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## Maternal Intuition of Fetal Gender

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<b>Purpose</b>	Fetal gender speculation is a preoccupation of many expecting parents, and pregnant women commonly profess to intuitively know the gender of their unborn babies. This study objectively compared pregnant mothers' perceptions of fetal gender to sonographically proven gender determinations. Also, success rates from previously published studies, noninvasive prenatal testing and a myriad of gender determination methods were observed and reported for context.
<b>Methods</b>	All pregnant women presenting for second-trimester screening ultrasound (at 17–23 weeks gestation) in the obstetrics department of a single health center were asked to participate. A medical sonographer described the ultrasound examination, obtained appropriate consent and medical history. Each mother was asked if she had any perception as to the fetal gender and her answer documented. Mothers who had foreknowledge of fetal gender were excluded. Frequencies of actual gender were compared with observed frequencies of the maternal prediction using chi-squared test.
<b>Results</b>	Approximately 40% (n=411) of our study population (N=1,026) indicated having an intuition or perception of fetal gender. These women correctly predicted the gender of their babies 51% of the time (P=0.6571). Women who expressed a “strong” degree of intuition (n=53) fared better, accurately predicting fetal gender at a rate of 62%, though the difference in this smaller subcohort also failed to demonstrate statistical significance (P=0.0741).
<b>Conclusions</b>	Intuition of fetal gender is professed by almost half of mothers though, when present, is no better at accurately predicting fetal gender than flipping a coin. ( <i>J Patient Cent Res Rev.</i> 2017;4:125-130.)
<b>Keywords</b>	maternal intuition, fetal gender, sonography, pregnancy, ultrasound

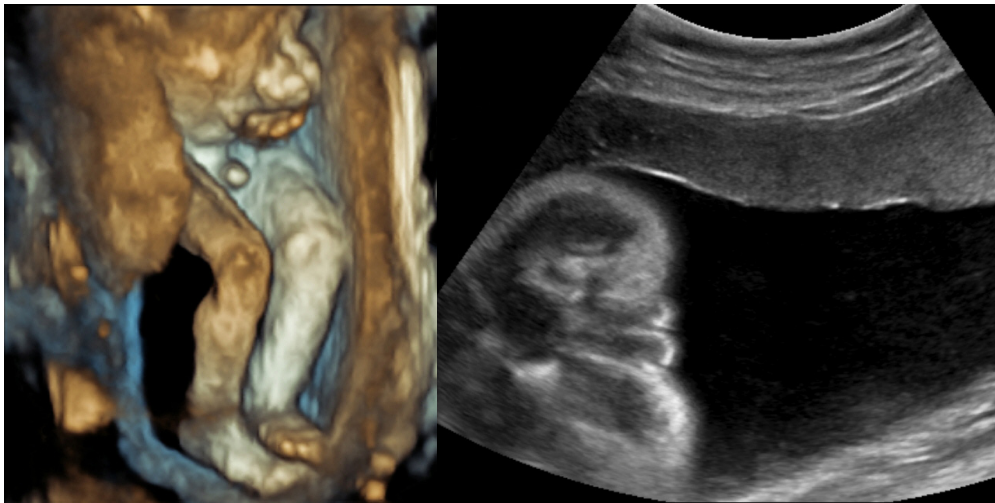
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Fetal gender speculation gets significant media attention and is a preoccupation of many expecting couples.<sup>1</sup> We have observed anecdotally that the vast majority of pregnant women presenting to our obstetrics clinic for second-trimester ultrasound screening request gender identification. At these visits, many mothers-to-be say they can perceive or “feel” the gender of the unborn baby. However, the scientific literature contains very few published articles on intuitive prediction of fetal gender,<sup>2-4</sup> and these studies did not necessarily test the success rate of predictions by intuition using rigid research protocols.

Evaluation of fetal anatomy, including gender, is an essential element of the standard second-trimester ultrasonography examination (Figure 1) according to a practice bulletin issued by the American College of Obstetricians and Gynecologists and American Institute of Ultrasound in Medicine.<sup>5</sup> A large prospective study from Nigeria on fetal gender determination reported 97.1% accuracy of second-trimester ultrasound, with an overall sensitivity of 98.1%.<sup>6</sup> Three smaller studies reported respective accuracy rates of 100%, 99%–100% (in those without malformed external genitalia), and 98.8% (for female identification) and 100% (for male identification).<sup>7-9</sup> Locally, our obstetricians verify gender accuracy of the second-trimester ultrasound report at every delivery, and the rate of ultrasound accuracy for babies both screened as fetuses and delivered at our institution from 2013 through 2016 was 100%

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**Figure 1.** Left panel: Three-dimensional ultrasound image revealing male gender with lower torso and extremities. Right panel: Two-dimensional ultrasound revealing female gender.

(unpublished data). Clearly, the reliability of ultrasound in this regard is well established. Still, sonographers frequently encounter mothers who insist they know the fetal gender by various intuitive methods alone.

There were two impetuses to perform this study. First, there is a paucity of research on the efficacy of maternal intuition of fetal gender in current literature, including professional journals and lay media outlets. Second, many mothers express extreme confidence in predicting gender based on feelings or other unscientific methods, making the success rate of such frequently issued predictions worthy of investigation. Our sonography laboratory initially started tracking fetal gender predictions by mothers anecdotally, then designed and performed this study to obtain more concrete evidence.

## METHODS

The study was approved by the local institutional review board. The source population came from an obstetrics clinic in Sheboygan, Wisconsin, that performs approximately 1,000 deliveries annually. During a 14-month period from February 2015 to April 2016, patients were recruited when they presented to the obstetrics clinic for a routine second-trimester ultrasound exam. All patients were between 17 and 23 weeks pregnant. A medical sonographer described the ultrasound exam and obtained appropriate consent. Patients with foreknowledge of fetal gender were excluded from the study. Twin pregnancy patients were included in the late stages of data collection. Triplets were excluded. A total of 1,026 mothers agreed to participate in the study.

## Survey

Prior to performing ultrasound, the sonographer initiated a verbal survey and documented the results. Each participant was asked if she had any perception of her baby's gender; if affirmative, she was then asked, "Do you have strong feelings or perception as to your baby's gender?" Mothers who expressed not having any perception of fetal gender were excluded from further analysis. Gender predictions from participants who expressed having a perception of fetal gender were obtained. Predictions made by participants who indicated having "strong" intuition of fetal gender were included in the overall study cohort and also analyzed as a separate subcohort.

## Statistical Analysis

Actual fetal gender was determined by ultrasound results, as second-trimester sonographic identification of fetal gender, when external genitalia are visible, has a clinically proven track record.<sup>6-8</sup> The frequencies of the actual gender of the fetus were compared with observed frequencies of the maternal prediction of the gender using chi-squared test. For all statistical tests, an alpha of 0.05 was used as level of significance. All statistical analyses were done using SAS 9.4 (SAS Institute Inc, Cary, NC).

## RESULTS

The average age of the surveyed population (N=1,026) was 28.14 years, with average gravida of 2.64 and para of 1.21. Racial makeup was predominately white (84.5%), with 9.4% Asian, 2.7% black and 3.4% other or unknown. Of 1,026 mothers queried, 60%

(n=615) expressed having no perception or intuition of fetal gender. The remaining 40% of our surveyed population professed having intuition of fetal gender, and the intuitive predictions from this cohort (n=411) were further analyzed.

Intuitive participants were more likely to perceive gender to be female versus male by a 53% to 47% ratio. Three of the four mothers of dichorionic/diamniotic twins predicted a boy/girl combination; only one accurately predicted both genders out of the four sets (25%). Overall, participants accurately predicted fetal gender by intuition in 210 cases (51%) (P=0.6571).

Of the 411 intuitive women, 53 indicated having a strong intuition of fetal gender and underwent analysis as a subcohort. Of these 53, 33 accurately predicted gender, a higher rate (62%) than the overall cohort. However, even this higher rate did not reach statistical significance (P=0.0741).

## DISCUSSION

Fetal gender speculation is a popular preoccupation of many expecting parents. Many women proclaim assured certainty of the gender of their unborn baby. This led the authors to search the literature for reports measuring maternal intuition of fetal gender; few studies were performed in a scientific manner and employed rigid data collection methods. Our attempt to test maternal intuition of gender resulted in a 51% success rate, an indication that predicting in this fashion amounts to guessing.

### Noninterventional Means of Determining Gender

Researchers from the Birth and Women's Health Center (Tucson, AZ) reported that 70% of women accurately predicted gender using intuition.<sup>2</sup> According to that 2-year study, 34 of 48 pregnant women claiming to have intuition about the gender of their child made the correct choice.<sup>10</sup> These findings differed greatly from our study results, which may be explained by the Arizona study's much smaller overall cohort (N=100) and unclear data collection/participant selection methods. Of note, many participants in the Arizona study had prenatal ultrasound examinations done before they were surveyed. In contrast our study contained significantly more participants (N=1,026),

and every mother who presented for second-trimester ultrasound at our institution during the data collection period was invited to participate. Albeit a small proportion of the total study population, the success rate of our subcohort professing strong maternal intuition in predicting gender (62%) was more similar to that reported in the Arizona study; whether this rate would achieve statistical significance with a larger cohort remains to be seen.

Outside of "having a feeling," one of the most commonly cited techniques on which women base intuition is use of fetal heart rate to predict gender. A popular gender speculation method for decades, it's generally stated that fetal heart rates fall in the 120–140 bpm range for boys and the 140–160 bpm range for girls. What many laypersons may not realize is that fetal heart rate changes as a baby grows and also fluctuates based on the baby's activity (eg, slowing when the baby sleeps). Early pregnancy heart rates range from 100 to 120 bpm before increasing rapidly in the later stages of the first trimester and gradually slowing thereafter. According to a study by von Steinburg et al, the "normal" fetal heart rate ranges from 120 to 160 bpm.<sup>11</sup> Such variability would seem to make fetal heart rate a poor gender identification technique, no more reliable than maternal intuition. Indeed, McKenna et al reported no significant differences between male and female heart rates during the first trimester; average female rate was 151.7 bpm versus male rate of 154.9 bpm (P=0.13).<sup>12</sup> Likewise, Ogueh et al reported no gender differences in fetal heart rate measured in the third trimester (135.57 female vs 135.55 male, P=0.626) nor in other fetal heart rate characteristics.<sup>13</sup>

A pregnant woman's weight gain may be useful in predicting gender. According to a 2014 study by endocrinologist Kristen Navara that retrospectively evaluated more than 69 million births of various races, low gestational weight gain in mothers skews gender toward female.<sup>14</sup> In that study, mothers experienced more gestational weight gain in male births compared to female births. A lower proportion of males were produced by women who gained less weight. Based on this positive correlation, gestational weight gain is likely to be a better predictor of gender than maternal intuition, although further research would be necessary to determine its exact strength.

Many pregnant parents believe in more culturally traditional sex determination techniques often opined by family and friends. Some of these techniques were shared anecdotally with our sonography team during the study and are shown in Table 1. These stories demonstrate that many people enjoy speculating on fetal sex and also how easily unproven means of determining sex can be passed down generationally and/or spread to other families and friends. The results of our study remind us that these beliefs usually lack supporting scientific evidence.

### Open-Market Gender Determination Products

Society's infatuation with fetal gender is also evident

by a robust online presence of gender determination methods and products, with dozens of websites (eg, FortuneBaby.com, BabyCenter.com) claiming predictive abilities. One such site, The Gender Experts, employs the "Ramzi Method" — using placenta/chorionic location as a marker for fetal gender determination<sup>15</sup> — to guess a baby's gender at 6–10 weeks from ultrasound images provided to them by the mother.<sup>16</sup> The Gender Experts correctly picked the gender on the one 7-week embryo case submitted by the authors at a cost of \$9.95. Of course, similar to all methods of gender prediction, including maternal intuition, it is worth noting The Gender Experts stands a 50% chance of correctly predicting gender in any single case.

**Table 1.** Popular Gender Determination Traditions

<b>Tactic</b>	<b>Anecdotal evidence from study patients</b>
Chinese calendar charts gender using mother's age at time of conception.	Chinese calendar was correct on two previous pregnancies, but wrong on this one.
Dangle a ring, preferably a wedding band, on a string over the mother's tummy. If it moves in a circle, it's a girl; back and forth, it's a boy.	One husband performed the test 40 times and a girl was indicated every time. The baby was a boy.
Watch fetal movement. A baby moving on the right side = boy; left side = girl.	A Filipino woman, raised on a remote Pacific island, correctly predicted her baby's gender this way.
Dreams drive gender outlook.	One mother had dreams that accurately predicted gender in her three previous pregnancies. She dreamt girl and was correct again. One patient was astonished when her dream did not pick the correct gender.
Reference physical conditions during prior pregnancy.	One mother had three girls and felt the same during the current pregnancy so she correctly predicted girl. Another said she felt completely different from her first pregnancy and incorrectly predicted girl. Another correctly predicted a girl because "I get morning sickness with my all my boys." "I carry my girls like a ball and my boys like a torpedo" — this torpedo was correctly a boy. "It feels like a girl, but I've been wrong on every pregnancy so far" — this mom was wrong again.
Rely on family commonalities.	One woman who had three daughters, four great granddaughters and three great-great granddaughters correctly predicted another girl joining the family. Another woman cited a remarkable familial sequence of girl, boy, girl. The mom already had girl, boy, and correctly predicted her current pregnancy as a girl.
Carrying high versus low? If high, it's a girl (and vice versa).	Several patients had minimal success with this technique.
Mix Drano with the mother's urine. If it turns brown it's a girl, blue means boy.	None provided by the study population.

Over-the-counter gender prediction testing is available online and at retail outlets for \$30 to \$70. One of the most popular is a urine test made by IntelliGender® (Plano, TX). No accuracy statistics are provided on the product's website, but the FAQ page notes that "IntelliGender does not recommend making any financial, emotional or family planning decisions based on the test results."<sup>17</sup>

Noninvasive prenatal testing (NIPT) uses cell-free fetal DNA sampling technique that predicts gender with 98.9% sensitivity and 99.6% specificity.<sup>18</sup> NIPT is ordered after 10 weeks gestation to diagnose chromosomal abnormalities when a mother has specific risk factors. Our institution uses the MaterniT® 21 PLUS test (Sequenom, San Diego, CA), which screens for trisomy 21 (Down syndrome), trisomy 18 (Edwards syndrome) and trisomy 13 (Patau syndrome), among other genetic disorders.<sup>19</sup> NIPT and previously reported rates for second-trimester ultrasound<sup>5-8</sup> have comparable accuracy for gender determination; and both are far superior to maternal intuition. Using NIPT for gender determination does have practical limitations in that it requires venipuncture and additional expense, whereas ultrasound screening is recognized as standard of care regardless of whether gender identification takes place.

### **Fetal Gender-Related Social Trends**

Interestingly, a growing trend in fetal gender speculation is the "gender reveal party." We recently questioned 180 mothers-to-be regarding any intended plans for revealing the child's gender and observed that 17, or nearly 10%, were participating in such a prearranged party at which gender is revealed for the first time to families, friends and often the couple themselves. The sonographer or physician facilitates the reveal by writing down the gender in a sealed envelope. We also have observed instances of "premature revelation," in which the parent(s) open the envelope before leaving our facility's parking lot.

### **Study Limitations**

Ultrasound results were used to confirm actual fetal gender rather than confirmation at birth. While gender determination by ultrasound was retrospectively 100% accurate within our institution throughout the study period, it is possible study participants who

subsequently gave birth at another institution received inaccurate second-trimester gender diagnoses.

Although the strong intuition subcohort demonstrated greater success in predicting gender than the study population as a whole, these participants self-selected themselves as possessing strong intuition and did not rate their degree of intuition on a Likert or similar scale. Most participants were accompanied at their ultrasound by family and/or friends, which could have biased respective responses.

Lastly, interest in gender determination may fall within socioeconomic divisions, as it was anecdotally apparent that many affluent mothers didn't want to know their baby's gender. However, this hypothesis was not analyzed and requires further study.

## **CONCLUSIONS**

There are many gender determination techniques available to the public. The most applicable is a second- or third-trimester ultrasound, with accuracy rates approaching 100%, followed by noninvasive prenatal testing. The majority of women (60%) in our study expressed no maternal intuition of fetal gender whatsoever. Those who strongly feel a maternal intuition of gender had better success predicting gender than those with more mild expressions of intuition, but not to a statistically significant degree. Our study indicates that maternal intuition of fetal gender accurately predicts gender in 51% of cases, virtually the same as a flip of a coin.

### **Patient-Friendly Recap**

- Pregnant women often claim they can perceive the sex of children in the womb.
- The authors asked women who expressed such maternal intuition to go on record predicting fetal sex at their routine second-trimester ultrasound examination.
- The study revealed that maternal intuition successfully predicted fetal sex 51% of the time, the equivalent of flipping a coin, and was far less accurate than the well-documented diagnostic ability of midpregnancy ultrasound.

## Conflicts of Interest

None.

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