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# The Pregnancy Project: Impact of Ultrasound Use During Pregnancy Care

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# **The Pregnancy Project: Impact of Ultrasound Use During Pregnancy Care**

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**Abstract**      *Use of ultrasounds during pregnancy continues to increase and there is much debate as to what the best practice is regarding their use, for what types of patients, at what volume level<sup>2</sup>. Current evidence suggests, the extended routine use of ultrasound technology should be for all women that present complications to screen for structural anomalies during pregnancy<sup>2</sup>. However, others have suggested that excessive ultrasound use may be both unnecessary, costly and potentially harmful<sup>13</sup>. Evidence further suggests that mothers find the use of technology to be security enhancing during pregnancy and through the process of care, and that ultrasound use is important for bonding with their unborn baby<sup>4-5</sup>. Here, I examine the impact of ultrasound use on care satisfaction in a panel of women who have given birth in the northeast through a retrospective survey. Findings suggest that ultrasound use is not a driver of care satisfaction overall, however physicians may be acting on this differently with the coming implications of health care reform<sup>9</sup>.*

## **Background**

Patient satisfaction is a common component of health care quality measurement<sup>10</sup>. Health care providers are interested in how satisfied patients are, as the perceived satisfaction of patients allows for improvements in the delivery of care and is becoming an important factor relative to health care reimbursement.

Authors have characterized the domains of patient satisfaction as: general satisfaction, technical quality, interpersonal manners, communication, finances, time spent with doctor, and accessibility and convenience<sup>8</sup>.

And some suggest that, technology may specifically have a significant impact on the perceived satisfaction of patients. Wang discusses that the increased use of technology has the ability to contribute to the increased quality of care delivered<sup>12</sup>. At a time when technology in the health care fields continue to grow, and satisfaction is becoming an integral part of quality assessments, some tied to reimbursement<sup>3,9</sup>.

One commonly used type of technology, ultrasounds, are also becoming more advanced. Used during pregnancy, ultrasounds generate high frequency and low intensity sound waves that pass through the abdomen and cervix to produce an image of the fetus. This technology has been used for over 50 years on pregnant women all over the world<sup>7</sup>. Ultrasound technology now allows women to see clear 3-and 4D images of their fetus. According to the American Pregnancy Association, there is no recommended number of ultrasounds a woman should receive<sup>11</sup>.

Ultrasounds are not, however, without risks. Evidence suggests that there are significant psychological impacts on pregnant women before, during and after an ultrasound procedure such as anxiety, attachment, stress, and attitudes towards

pregnancy<sup>2</sup>. However, despite the anxiety that is experienced before and during the ultrasound, after the ultrasound has taken place the women tend to feel free of anxiety and stress. For most women, the ultrasound is the only visual contact they will have with their child throughout their entire pregnancy. As such, pregnant mothers have expressed wanting the ultrasound to be accurate, and special<sup>4</sup>. They further report that after the ultrasound takes place, the women become much more connected with their unborn baby<sup>4</sup>. This reduction in anxiety, and increased bonding experience increases the positive perception of the ultrasound<sup>4</sup>. However, technology use is only one dimension of perceived satisfaction. Many pregnancies result in complications, which can independently impact the perceived satisfaction with care. Research has shown, that individuals who have a positive self-perceived health status will have a positive perception of satisfaction with the medical care provided<sup>13</sup>.

The evidence as to the risk of excessive technology use on the patient remains mixed. Also unclear is the link between use of ultrasound technology and satisfaction with the pregnancy and birthing experience. Here I examine the health care experiences of women along the domains of patient satisfaction to assess the relative impact of ultrasound use on overall satisfaction. I hypothesize that increased ultrasound use will lead to greater levels of satisfaction, but that the presence of complications during pregnancy will mitigate the strength of that relationship.

## **Methods**

The sampling frame used for this study was women 18 years of age or older who had given birth to a child in the past year in the Northeast United States.

Individuals were recruited to participate in an online survey through snowball sampling using Facebook and word-of-mouth. A Facebook group was formed in order to have a central location on Facebook that would allow women to gain access to the survey. This Facebook group further allowed individuals on Facebook to invite women they knew who had a child at home under 12 months.

Because Facebook utilized a rolling screen, status updates were created to get people's attention and to promote recruitment. These updates contained the link to the survey. The Facebook status updated stated the criteria of who could participate clearly. A second recruitment strategy was to target mother's groups on Facebook. A post was added to the Facebook wall of multiple mother's groups containing a brief summary of where the study originated, who was gathering the data, who was eligible to participate, and the link to the survey. This allowed all mothers who are members of the group to see the Facebook post and participate in the study if eligible. These posts were added to the walls of mother's groups at least once a week.

*Survey Tool* Here I used an online survey hosted by the University of New Hampshire survey center. The survey was divided into three primary sections. The first was related to the overall care experiences and outcomes of the respondent including age, the number of ultrasounds and doctors visits they had during their pregnancy, how many children they were pregnant with, as well as if any complications were experienced during their pregnancy.

The next set of questions discussed the mothers' satisfaction with their pregnancy care and was derived from using the Patient Satisfaction Questionnaire, PSQ-18 scale<sup>8</sup>.

This scale is broken down into the seven dimensions of satisfaction with medical care; general satisfaction, technical quality, interpersonal manner, communication, financial aspects, time spent with doctor, and accessibility and convenience<sup>8</sup>.

The remaining four questions in the survey touched on demographic information including ethnicity, marital status, education level and current employment. All participants viewed an informed consent page prior to agreeing to participate. All study protocols were approved by the University of New Hampshire Institutional Review Board.

*Measures* A series of 18 questions are asked in the PSQ-18 scale. In this study, only 16 of the questions were used, as the remaining two questions were not applicable to prenatal care.

Prior to analysis of the data, each of the variables was properly coded to meet the PSQ-18 form requirements. This required some of the questions to be reverse coded so that the satisfaction was consistently recorded from lowest to highest for those questions that ask about the least satisfying experiences rather than the most. The PSQ-18 specifically stated which questions were reverse coded and which ones were not.

Questions are grouped together according to each of the seven different measures of satisfaction. In order to confirm the internal reliability of these scales, Chronbach Alpha's were run on each scale prior to any analysis. The Chronbach Alpha results were as follows: general satisfaction .589, technical quality .507, interpersonal manner .478, communication .271, financially .672, time spent with doctor .755, and accessibility and

convenience .537. Only the value for communication fell below the recommended values previously associated with the tool.

Summary measures were then created for each dimension using combined averages. The summary measures were then dichotomized into highly satisfied and satisfied groups using the top quartile, as is suggested when performing this analysis on satisfaction data<sup>6</sup>. A total of 195 participants were collected. Sixty-two were dropped due to missing data or they did not fit the study criteria, leaving 133 valid responses.

## **Analysis**

Analyses were conducted in SPSS version 19. Univariate analyses were calculated and used to describe the sample population. Bivariate analyses, included t-test and chi square tests were used to examine the relationship of predictor variables and demographic factors according to satisfied or not satisfied. Multi-variate analyses used logistic regression to examine the impact of the main predictor variables, number of ultrasounds and presence of complications, on domains of satisfaction.

## **Results**

*Univariate Analysis* Of the final sample size is (n=133), 97% were white. The average age of the population was 28.5 years, ranging from 19 years old to 40 years old. The majority was also married (89.5%) or were members of a unmarried couple (6.8%). Educationally, the majority had at least some college (65.4%), and almost 1/3<sup>rd</sup> had advanced degrees. In addition, 91% of the population had private health insurance.

Respondents reported having about 5 ultrasounds on average (4.77) ultrasounds, ranging from 1 to 40 ultrasounds.

*Bivariate Analysis* Tables 1-3 show demographic and predictor variables by satisfaction domains. Overall, all but one of the relationships is not statistically significant. The only relationship that shows a statistically significant difference is the relationship between education and the financial satisfaction scale.

Shown in Tables 4 and 5, are the dependent variables, or measures of satisfaction, in relationship to the mean ultrasound use among groups that are satisfied or highly satisfied. The table shows all seven scales of patient satisfaction that are used in this analysis. There is no statistically significant difference between the mean number of ultrasounds received by women who are satisfied when compared to those who are highly satisfied.

Another important factor to be considered is whether these women had complications or not, and if their mean ultrasound use differed. Table 6 shows the mean number of ultrasounds women with complications received compared to those without complications is significantly higher at 6.62 as opposed to 3.25 ultrasounds without complications. Despite this significantly higher ultrasound use, the women with complications did not experience a statistically higher level of satisfaction than those women without complications (Table 7).

*Multivariate Analysis* Logistic regressions were run on both general satisfaction and technological satisfaction in relation to ultrasound use and whether an individual had complications or not. Neither of the logistic regressions revealed significant findings.



Therefore, neither ultrasound use or pregnancy complications have an impact on general satisfaction or technological satisfaction.

## **Discussion**

Although research has shown that higher ultrasound use may lead to increased patient satisfaction in pregnant mothers, this analysis suggests differently. Here we show that the number of ultrasounds a woman receives during her prenatal care does not impact her perceived satisfaction.

This becomes especially important given provisions in the Affordable Care Act, which uses patient satisfaction as a component of measurable quality. According to the law, the reimbursement providers receive will be based on the perceived satisfaction delivered to the patient for certain procedures<sup>9</sup>. And while ultrasound use and pregnancy are not among those procedures currently, providers generally assess satisfaction unilaterally. In doing so, health care providers may have the perception that increased technology use may lead to increased satisfaction with care, resulting in the tendency to provide more ultrasounds. These increased ultrasounds would certainly lead to higher costs, and evidence is unclear as to the physical impacts of providing the tests<sup>11</sup>. Thus, this study provides evidence that promoting technology use is not an important consideration when promoting satisfaction among birthing patients.

This analysis further shows that women who experience complications during their pregnancy receive a significantly higher number of ultrasounds than women that do not experience complications. Such increased ultrasound use is often called for when the pregnancy is determined high risk<sup>7</sup>.

## **Limitations and Future Research**

This study recruited through Facebook. While Facebook is multi-national, it is not open access, meaning that recognition has to occur through referral. Because this study emanated in the Northeast, women tended to be from a small geographic area, highly educated and privately insured. However, as mentioned above, this group is of interest as care volume tends to be higher in privately insured patients. All data was also gathered on a retrospective basis and there is the potential for recall error.

For future research, diversifying the sampling frame could result in a more diverse response rate in regards to the descriptive data that was collected. Further, it is unclear if the use of technology is similarly unrelated to satisfaction in patients with other disorders, especially technologically intensive ones. In addition, the role of technology in patient care is often important and warranted. Only in cases where its effectiveness is unclear should the link between use and satisfaction be of interest.

## Tables

**Table 1: Satisfaction Scale by Demographics**

Women Characteristics	Total	General Satisfaction		Technical Quality	
		<i>Satisfied</i>	<i>Highly Satisfied</i>	<i>Satisfied</i>	<i>Highly Satisfied</i>
<b>Women Sample (n=133)</b>					
<b>Race/Ethnicity</b>					
American Indian or Alaska Native	1.50%	2.50%	0%	0%	3%
Asian or Asian American	0.80%	0%	1.90%	1.50%	0%
Hispanic or Latino	0.80%	1.30%	0%	1.50%	0%
White	97%	96.20%	98.10%	97%	97%
<b>Type of Insurance</b>					
Healthy Kids	3.80%	2.50%	5.60%	0%	7.60%
Self-Pay	0.80%	1.30%	0%	1.50%	0%
Medicaid	4.50%	6.30%	1.90%	6%	3%
Private Insurance	91%	89.90%	92.60%	92.50%	89.40%
<b>Marital Status</b>					
Divorced	0.80%	1.30%	0%	1.50%	0%
Married	89.50%	91.10%	87%	88.10%	90.90%
Member of Unmarried Couple	6.80%	3.80%	1.90%	6%	7.60%
Never Been Married	3%	3.80%	1.90%	4.50%	1.50%
<b>Education</b>					
Some High School	0.80%	0%	1.90%	0%	1.50%
High School Graduate	5.30%	6.30%	3.70%	3%	7.60%
Some College	23.30%	26.60%	18.50%	29.90%	16.70%
College Graduate	42.1%	38%	48.10%	37.30%	47%
Advanced Degree	28.60%	29.10%	27.80%	29.90%	27.30%
<b>Employment</b>					
Employed for Wages	62.40%	58.20%	68.50%	58.20%	66.70%
Homemaker	21.80%	25.30%	16.70%	25.40%	18.20%
Out of work for less than 1 year	6%	5.10%	7.40%	6%	6.10%
Out of work for more than 1 year	0.80%	1.30%	0%	1.50%	0%
Self-Employed	6.80%	7.60%	5.60%	7.50%	6.10%
Student	2.30%	2.50%	1.90%	1.50%	3%

**Table 2: Satisfaction Scale by Demographics**

Women Characteristics	Women Sample (n=133)				
	Total	Interpersonal Manner		Communication	
		<i>Satisfied</i>	<i>Highly Satisfied</i>	<i>Satisfied</i>	<i>Highly Satisfied</i>
<b>Race/Ethnicity</b>					
American Indian or Alaska Native	1.50%	1.80%	1.30%	1.70%	1.40%
Asian or Asian American	0.80%	0%	1.30%	0%	1.40%
Hispanic or Latino	0.80%	1.80%	0%	1.70%	0%
White	97%	96.40%	97.40%	96.60%	97.30%
<b>Type of Insurance</b>					
Healthy Kids	3.80%	3.60%	3.80%	3.40%	4.10%
Self-Pay	0.80%	1.80%	0%	1.70%	0%
Medicaid	4.50%	5.50%	3.80%	3.40%	5.40%
Private Insurance	91%	89.10%	92.30%	91.50%	90.50%
<b>Marital Status</b>					
Divorced	0.80%	1.80%	0%	1.70%	0%
Married	89.50%	90.90%	88.50%	91.50%	87.80%
Member of Unmarried Couple	6.80%	5.50%	7.70%	6.80%	6.80%
Never Been Married	3%	1.80%	3.80%	0%	5.40%
<b>Education</b>					
Some High School	0.80%	0%	1.30%	0%	1.40%
High School Graduate	5.30%	5.50%	5.10%	5.10%	5.40%
Some College	23.30%	23.60%	23.10%	16.90%	28.40%
College Graduate	42.1%	40%	43.60%	42.40%	41.90%
Advanced Degree	28.60%	30.90%	26.90%	35.60%	23%
<b>Employment</b>					
Employed for Wages	62.40%	60%	64.10%	62.70%	62.20%
Homemaker	21.80%	18.20%	24.40%	18.60%	24.30%
Out of work for less than 1 year	6%	5.50%	6.40%	6.80%	5.40%
Out of work for more than 1 year	0.80%	1.80%	0%	1.70%	0%
Self-Employed	6.80%	9.10%	5.10%	8.50%	5.40%
Student	2.30%	5.50%	0%	1.70%	2.70%

**Table 3: Satisfaction Scale by Demographics**

Women Characteristics	Women Sample (n=133)						
	Total	Financial Aspects		Time Spent With Doctor		Accessibility and Convenience	
		<i>Satisfied</i>	<i>Highly Satisfied</i>	<i>Satisfied</i>	<i>Highly Satisfied</i>	<i>Satisfied</i>	<i>Highly Satisfied</i>
<b>Race/Ethnicity</b>							
American Indian or Alaska Native	1.50%	1.80%	1.30%	2.50%	0%	0%	2.90%
Asian or Asian American	0.80%	0%	1.30%	1.20%	0%	0%	1.40%
Hispanic or Latino	0.80%	1.80%	0%	1.20%	0%	1.60%	0%
White	97%	96.50%	97.40%	95.10%	100%	98.40%	95.70%
<b>Type of Insurance</b>							
Healthy Kids	3.80%	5.30%	2.60%	3.70%	3.80%	1.60%	5.70%
Self-Pay	0.80%	1.80%	0%	1.20%	0%	1.60%	0%
Medicaid	4.50%	3.50%	5.30%	6.20%	1.90%	3.20%	5.70%
Private Insurance	91%	89.50%	92.10%	88.90%	94.20%	93.70%	88.60%
<b>Marital Status</b>							
Divorced	0.80%	0%	1.30%	1.20%	0%	1.60%	0%
Married	89.50%	87.70%	90.80%	88.90%	90.40%	95.20%	84.30%
Member of Unmarried Couple	6.80%	8.80%	5.30%	4.90%	9.60%	3.20%	10%
Never Been Married	3%	3.50%	2.60%	4.90%	0%	0%	5.70%
<b>Education</b>							
Some High School	0.80%	1.80%	0% *	1.20%	0%	1.60%	0%
High School Graduate	5.30%	3.50%	6.60%	6.20%	3.80%	42.90%	41.40%
Some College	23.30%	36.80%	13.20%	24.70%	21.20%	25.40%	21.40%
College Graduate	42.1%	29.80%	51.30%	35.80%	51.90%	42.90%	41.40%
Advanced Degree	28.60%	28.10%	28.90%	32.10%	23.10%	28.60%	28.60%
<b>Employment</b>							
Employed for Wages	62.40%	59.60%	64.50%	61.70%	63.50%	60.30%	64.30%
Homemaker	21.80%	21.10%	22.40%	19.80%	25%	23.80%	20%
Out of work for less than 1 year	6%	5.30%	6.60%	7.40%	3.80%	6.30%	5.70%
Out of work for more than 1 year	0.80%	0%	1.30%	1.20%	0%	1.60%	0%
Self-Employed	6.80%	10.50%	3.90%	6.20%	7.70%	7.90%	5.70%
Student	2.30%	3.50%	1.30%	3.70%	0%	0%	4.30%

\* p&lt;.05

**Table 4: Mean Ultrasound Use by Satisfaction Scale**

	General Satisfaction		Technical Quality		Interpersonal Manner	
	<i>Satisfied</i>	<i>Highly Satisfied</i>	<i>Satisfied</i>	<i>Highly Satisfied</i>	<i>Satisfied</i>	<i>Highly Satisfied</i>
	Mean Number of Ultrasounds	5.24	4.07	5.09	4.44	5.45

**Table 5: Mean Ultrasound Use by Satisfaction Scale**

	Communication		Financial Aspects		Time Spent with Doctor		Accessibility and Convenience	
	<i>Satisfied</i>	<i>Highly Satisfied</i>	<i>Satisfied</i>	<i>Highly Satisfied</i>	<i>Satisfied</i>	<i>Highly Satisfied</i>	<i>Satisfied</i>	<i>Highly Satisfied</i>
	Mean Number of Ultrasounds	4.64	4.86	4.91	4.86	5.11	4.23	4.89

**Table 6: Mean Ultrasound Use by Pregnancy Complication**

Complication?	Mean Number of Ultrasounds	
<i>Yes</i>	6.62	*
<i>No</i>	3.25	

\* p<.05

**Table 7: General Satisfaction by Pregnancy Complication**

Complication?		
<i>Yes</i>	<i>Satisfied</i>	46.80%
	<i>Highly Satisfied</i>	42.60%
<i>No</i>	<i>Satisfied</i>	53.20%
	<i>Highly Satisfied</i>	57.40%

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