

Referral for fetal echocardiography is associated with increased maternal anxiety

Katherine B. Rosenberg, Catherine Monk, Julie S. Glickstein, Stephanie M. Levasseur, Lynn L. Simpson, Charles S. Kleinman & Ismee A. Williams

To cite this article: Katherine B. Rosenberg, Catherine Monk, Julie S. Glickstein, Stephanie M. Levasseur, Lynn L. Simpson, Charles S. Kleinman & Ismee A. Williams (2010) Referral for fetal echocardiography is associated with increased maternal anxiety, Journal of Psychosomatic Obstetrics & Gynecology, 31:2, 60-69, DOI: [10.3109/01674821003681472](https://doi.org/10.3109/01674821003681472)

To link to this article: <https://doi.org/10.3109/01674821003681472>



Published online: 05 May 2010.



Submit your article to this journal [↗](#)



Article views: 111



View related articles [↗](#)



Citing articles: 25 View citing articles [↗](#)

Referral for fetal echocardiography is associated with increased maternal anxiety

KATHERINE B. ROSENBERG¹, CATHERINE MONK², JULIE S. GLICKSTEIN¹,
STEPHANIE M. LEVASSEUR¹, LYNN L. SIMPSON³, CHARLES S. KLEINMAN¹, &
ISMEE A. WILLIAMS¹

¹Department of Pediatrics–Cardiology, Columbia University College of Physicians and Surgeons, Morgan Stanley Children’s Hospital, New York, NY 10032, USA, ²Department of Psychiatry/Behavioral Medicine, Columbia University Medical Center, New York, NY, USA, and ³Department of Obstetrics and Gynecology, Columbia University College of Physicians and Surgeons, Morgan Stanley Children’s Hospital, New York, NY 10032, USA

(Received 29 June 2009; revised 4 February 2010; accepted 5 February 2010)

Abstract

Background. Referral for fetal echocardiography (fECHO) is an acute stressor that may induce significant maternal anxiety. To promote good clinical management of expectant mothers in this situation, including adequate screening for possible psychiatric interventions, data are needed regarding the psychosocial functioning of women scheduled for fECHO procedures.

Objective. To investigate the association between fECHO and maternal anxiety.

Methods. Pregnant women answered two questionnaires before first fECHO. The Spielberger State-Trait Anxiety Inventory (STAI) assessed how subjects feel “now” (*state*) versus how they “usually feel” (*trait*). Separate *state* and *trait* anxiety scores were calculated; scores were compared between the study cohort and a gestational age-matched historical cohort of 31 pregnant women who did not undergo fECHO. A second questionnaire developed by the investigators ascertained pregnancy specific concerns and characteristics.

Results. Forty subjects were enrolled. The mean *state* score of the fECHO cohort (42.1 ± 15.1) differed from the historical cohort (32.8 ± 11.3 ; $p = 0.006$); however there was no difference between *trait* scores (34.7 ± 10.8 vs. 35.4 ± 12.8 ; $p = 0.8$). A multivariate linear regression model controlling for race and maternal age demonstrated that fECHO was a strong independent predictor of maternal *state* anxiety score ($p = 0.004$, $\beta = 10.4$).

Conclusions. Pregnant women presenting for fECHO report high anxiety levels compared with women not presenting for fECHO. Clinician awareness and sensitivity are recommended and further investigation of modifiers of anxiety in this high risk group should be explored.

Keywords: Echocardiography, congenital heart defects, maternal anxiety

Introduction

Recent advances in ultrasound technology enable detailed evaluation of fetal cardiac anatomy. Fetal echocardiography (fECHO) to evaluate for congenital heart disease (CHD) is now routinely indicated when there is a family history of CHD, maternal diabetes, or when the anatomic fetal survey is abnormal. Newer indications for referral, which include abnormal first trimester nuchal screening, the presence of multiple gestations, and a history of *in vitro* fertilization, have

led to an increase in the number of women referred for fECHO. While it has been shown that fECHO improves antenatal detection rates for CHD [1], the impact of additional fetal testing on the mother’s psychological state is not well described. Sklansky et al. reported that normal fECHO results led to qualitatively decreased anxiety and increased happiness while abnormal results led to increased anxiety and decreased happiness [2]. Bjorkem et al. reported that in women with a history of a prior child with

CHD, a normal fECHO in a following pregnancy decreased anxiety [3]. Neither of these papers quantitatively assessed maternal anxiety. Furthermore, neither study sought to characterize the anxiety level of the women before the fECHO appointment as women completed the questionnaires as retrospective reports long after the fECHO procedure. Finally, neither report investigated associations between different indications for referral to fECHO and anxiety levels.

Routine obstetric ultrasound testing in general has been shown to be a positive and very much anticipated experience for most patients [4]. However, prior studies have demonstrated that abnormal fetal testing is associated with increased maternal anxiety, irrespective of whether the findings are from screening or definitive diagnostic tests. Structural variants, so called soft markers, on fetal ultrasound are routinely encountered; however, the clinical significance of many of these findings beyond the link to increased risk for chromosomal anomalies remains controversial [5]. Hoskovek et al. reported that women referred for further genetic counseling because of a soft ultrasound marker have significantly higher levels of anxiety than do those referred due to advanced maternal age alone [6]. Cristofalo et al. found that the detection of a benign structural variant of the brain, the choroid plexus cyst, during routine ultrasounds led to intense negative maternal emotions, despite reassurance from providers [7]. Similarly, Ohman et al. demonstrated that women who were told their child might have trisomy 21 based on ultrasound findings were intensely anxious in the interim between the ultrasound and the conclusive amniocentesis [8].

From a clinical perspective, discovery of a potential fetal anomaly either by screening tests or by history, would likely lead to a referral to a specialist and in the pursuit of fetal diagnostics, the mother's psychosocial and emotional well-being may be overlooked. While it is to be expected that reference to a potential fetal anomaly would likely increase maternal anxiety, the specific effect of referral for additional testing such as fECHO on maternal anxiety levels has not been clearly defined. The purpose of this study was to investigate if maternal anxiety levels are elevated prior to a fECHO, to characterize the level of anxiety, and to investigate if certain indications for referral are more likely to be associated with elevated anxiety. We hypothesized that women presenting for a fECHO would experience heightened levels of anxiety and we

further hypothesized that the indication for fECHO would be associated with the level of anxiety.

Methods

An institutional review board-approved cross-sectional study of pregnant women presenting for fECHO was conducted at the Morgan Stanley Children's Hospital of New York from May 2007 to November 2008. Figure 1 demonstrates the study design. Women presenting for a first time fECHO were eligible. Women unable to read English or carrying multiple gestations were excluded. Anxiety was assessed using the Spielberger State-Trait Anxiety Inventory Form Y (STAI) which consists of 40 items: 20 designed to assess *state* anxiety, and 20 aimed at evaluating *trait* anxiety. The STAI is a validated measure that is designed to differentiate anxiety related to the personality of the individual (*trait*) from anxiety that is related to an external experience (*state*). Scores for both the *state* and *trait* measures range from 20 to 80, where higher scores indicate greater anxiety. Average scores for non pregnant women are reported to be 36.2 ± 10.96 for *state* and 36.2 ± 9.5 for *trait* among women 19–39 years old [9]. Field et al. surveyed 166 pregnant women and concluded that a *trait* score higher than 38 was considered to be 'highly anxious' [10].

Investigators developed the pregnancy stress scale (PSS) to assess pregnancy specific anxiety triggers (Appendix). The PSS recorded self-reported demographic variables as well as perceptions of anxiety related to fetal testing in general and fECHO specifically. Women were asked to rank their level of worry for pregnancy specific factors based on a five-point Likert scale with five indicating extremely worried and one indicating no worry. Example questions included: 'On a scale of 1 to 5 how worried are you about this ultrasound?' and, 'on a scale of 1 to 5, how worried are you about: weight gain, labor and delivery, quality of life of the child, and how your life will change after the birth of the child?'

A research assistant administered the STAI to all consenting subjects using a standardized interview technique. STAI scores were not shared with subjects. Rather, all subjects received information on how to contact a clinical psychologist specializing in pregnancy related issues at the start of the study. Upon completion of the STAI, subjects filled out the PSS.

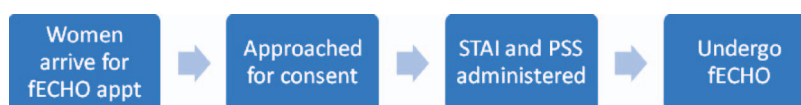


Figure 1. Flow chart of study design. fECHO, fetal echocardiogram; STAI, Spielberger state-trait inventory; PSS, pregnancy stress scale.

For purposes of statistical analysis, a number of questions on the PSS were recoded to better assess general trends. The question, 'Do you consider yourself to be a worrier' (1 = No, 5 = Yes, a lot) was recoded so that anyone who self-reported >3 was recoded a 'worrier,' and anyone ≤ 3 was 'not a worrier'. The question, 'Do you think there is a problem with the fetus' heart' (1 = No, 3 = Maybe, 5 = Yes, definitely, 6 = Don't know) was recoded to 'probably not' (answers 1, 2), or yes (answers 4,5); coding for 'maybe' or 'don't know' remained the same.

A gestational age-matched historical cohort of pregnant women who were not presenting for fECHO served as controls. These subjects were recruited as non-depressed controls for a study of maternal antenatal depression; depression was assessed by a licensed mental health practitioner using the Structured Clinical Interview for DSM-IV. Subjects were given the STAI using the same standardized interview technique used in the current study. The PSS was not administered to this group.

Statistical analysis

Basic descriptive characteristics were calculated and reported using means and standard deviations after assessing distributions for normality. Baseline differences between the control and the case cohorts were assessed using a Student's *t*-test and two by two tables with the Chi Square test statistic or the Fisher's Exact test statistic when appropriate. To evaluate associations between fECHO and anxiety, an independent Student's *t*-test comparing the STAI *state* and *trait* scores of cases and controls was conducted. Student's *t*-tests and ANOVA were used to ascertain STAI score differences attributable to other subject characteristics including advanced maternal age, first pregnancy, a history of miscarriage, and the presence of fetal anomalies. Using multivariate regression analysis we evaluated the difference in STAI *state* scores among pregnant women presenting for fECHO and pregnant women not presenting for fECHO while controlling for potential confounding variables. Entry criterion for the multivariable analysis was set at 0.1. All other α values were set at 0.05. Given our sample size of 40 cases and 31 controls, *post hoc* analysis revealed a power of 0.971 to see a 10-point difference in anxiety score and 83% power to see an 8-point difference anxiety score ($\alpha = 0.05$, $\sigma = 11.3$).

The Cronbach's alpha model was used to measure internal consistency within a five question worry scale created by the investigators from the PSS. All statistics are based on subject self-reported information.

Results

Subject characteristics

Of the 75 eligible women screened for the study, 40 successfully completed both the STAI and PSS questionnaires. No women refused participation in the study; 21 were missed due to scheduling conflicts, 14 because English was not their first language. STAI scores of 31 subjects from the prior study were evaluated as controls. Table I summarizes basic descriptive characteristics of the study population. Among the cases, mean maternal age was 30.7 ± 6.9 years, mean gestational age was 23.4 ± 5.1 weeks, 30 (75%) had a prior pregnancy, 17 (43%) had a history of miscarriage, and 15 (38%) reported seeing a therapist in the past. Compared with controls, cases tended to be older (mean age controls 26.3 ± 5.8 years, $p = 0.006$). There was no significant difference in race and gestational age between cases and controls.

Table II summarizes self-reported indications for referral to fECHO. Abnormality on prior ultrasound was the most common indication ($N = 24$, 60%), followed by family history ($N = 10$, 25%), maternal medical indication ($N = 6$, 15%), abnormal karyotype ($N = 3$, 7.5%) and abnormal serum screening ($N = 1$, 2.5%). Reason for referral was unknown in four subjects (10%) and six subjects (15%) reported more than one reason for referral. Of note, physician-reported indication for fECHO referral did not always match the subject's self-reported indication.

State and trait scores for subjects presenting for fECHO

There was a statistically significant difference between the mean *state* and *trait* scores of women presenting for fECHO (*state* 42.1 ± 15.1 vs. *trait* 34.7 ± 10.8 ; $p < 0.001$). Neither *state* nor *trait* scores were associated with subject characteristics including advanced maternal age, parity, or history of miscarriage or psychotherapy (Table II). Self-reported indications for fECHO consisting of family history of CHD, abnormal serum screening, abnormal blood test or maternal medical condition also were not associated with *state* or *trait* anxiety scores. However, subjects who reported they did not know why they were referred for fECHO had significantly higher *state* and *trait* scores than those who did know (*state* 58.0 ± 19.7 vs. 40.3 ± 13.8 , $p = 0.025$; *trait* 46.5 ± 19.6 vs. 33.4 ± 8.9 , $p = 0.019$).

State and trait scores for subjects presenting for fECHO versus controls

The mean *state* anxiety score of the fECHO subjects was significantly higher than that of the non-fECHO historical control subjects (42.1 ± 15.1 fECHO group vs. 32.8 ± 11.3 control group, $p = 0.006$);

Table I. Baseline subject characteristics.

Variable	Cases (N=40)		Controls (N=31)		p
	N (%)	Mean ± SD	N (%)	Mean ± SD	
Age		30.7 ± 6.9		26.3 ± 5.8	0.006
Gestational age		23.4 ± 5.1		23.1 ± 4.0	0.785
Race					0.053
Caucasian	26 (65.0)		8 (25.5)		
Hispanic	7 (17.5)		15 (48.4)		
African-American	3 (7.5)		4 (12.9)		
Other	4 (10.0)		4 (12.9)		
Number of pregnancies*		2.9 ± 1.7			
Primigravid	10 (25.6)				
Multiporous pregnancy	30 (75.9)				
Previous miscarriage					
Yes	17 (42.5)				
No	23 (57.5)				
Maternal medical problems					
Yes	12 (30.0)				
No	28 (70.0)				
Previous therapist*					
Yes	15 (38.5)				
No	24 (61.5)				

*One subject did not respond.

however, there was no significant difference between *trait* anxiety scores (34.7 ± 10.8 fECHO *vs.* 35.4 ± 12.8 controls, $p=0.798$) (Table III). A multivariate linear regression model controlling for race, gestational age, and maternal age demonstrated that presentation for a fECHO was a strong independent predictor of maternal *state* anxiety ($p=0.009$) (Table IV) and is responsible for a 9.7 point increase in *state* score.

Pregnancy stress scale

All 40 enrolled subjects presenting for fECHO completed the PSS, although not all questions were answered by all subjects. The average response to, ‘are you a worrier’ was 2.7 ± 1.2 ($N=38$). Both the mean *state* and *trait* scores of women who considered themselves ‘worriers’ was significantly different from those of women who did not consider themselves ‘worriers’ (*state* 57.3 ± 7.5 *vs.* 39.5 ± 12.0 , $p=0.003$; *trait* 48.3 ± 11.9 *vs.* 32.0 ± 8.2 , $p < 0.001$).

To further assess if anticipation of a fetal cardiac anomaly was associated with anxiety level, subjects were asked if they thought there was a problem with the fetus’ heart. The majority of women ($N=23$) responded ‘probably not’, three subjects responded ‘maybe’, seven responded ‘yes’, and seven subjects did not know. There was a difference in *state* scores between those who did not think there was a problem with the fetus’ heart and those who thought there was a problem (37.5 ± 10.0 *vs.* 51.4 ± 17.3 , $p=0.009$). However, there was no difference in the *state* scores of those who did not think there was a problem with the fetus’ heart and those who didn’t know

(37.5 ± 10.0 *vs.* 49.7 ± 22.8 , $p=0.213$), nor between those anticipating a problem and those who didn’t know (51.4 ± 17.3 *vs.* 49.7 ± 22.8 , $p=0.877$). There was no significant difference in mean *trait* scores between subjects who did not think there was a problem with the fetus’ heart, those who thought there was a problem, and those who didn’t know (32.1 ± 8.0 *vs.* 39.7 ± 14.9 *vs.* 39.4 ± 13.5 , $p=0.108$).

To assess the source of subjects’ pregnancy related anxiety, women were asked to report on a 5-point Likert Scale how much they worry about the following: (1) weight gain, (2) labor and delivery, (3) if the child will be healthy, (4) how the child will change your life, and (5) something going wrong (Table V). Subjects were most worried about the health of the child (mean worry score 4.35 ± 0.98) and least worried about weight gain (mean worry score 2.43 ± 1.17). Subjects tended to rank their level of worry similarly across all five questions as demonstrated by the Cronbach’s Alpha coefficient of 0.709, a measure of reliability or internal consistency of subjects’ responses to these five items.

When asked to rate their level of worry about the upcoming fECHO (1 = Not worried, 5 = Worried a lot), 7 women reported they were “worried a lot”, 8 women were fairly worried, 12 women were “somewhat” worried, 8 were “a little worried”, and 5 were “not worried”. When asked whether tests of the pregnancy and fetus provoke worry (1 = No, 3 = Somewhat, and 5 = Yes, definitely) the mean response was 2.9 ± 1.41 ($N=40$). When asked whether tests of the pregnancy and fetus are reassuring, the mean response was 3.5 ± 1.2 ($N=40$).

Table II. Effect of subject characteristics and self-reported indications on *state* and *trait* scores among cases ($N=40$).

Variable	N (%)	State score		Trait score	
		Mean \pm SD	p	Mean \pm SD	p
Subject characteristics					
Advanced maternal age (≥ 35)					
Yes	13 (32.5)	42.6 \pm 17.3	0.88	35.4 \pm 11.9	0.78
No	27 (67.5)	41.9 \pm 14.4		34.4 \pm 10.4	
Parity					
Primigravid	10 (25)	42.0 \pm 11.0	0.98	33.2 \pm 6.4	0.62
Multiparous	30 (75)	42.1 \pm 16.5		35.2 \pm 11.9	
History of miscarriage					
Yes	17 (42.5)	45.1 \pm 14.3	0.28	37.9 \pm 12.3	0.10
No	23 (57.5)	39.9 \pm 15.7		32.3 \pm 9.0	
History of psychotherapy					
Yes	15 (37.5)	45.5 \pm 13.7	0.17	36.9 \pm 8.4	0.08
No	24 (60)	38.8 \pm 15.0		31.8 \pm 9.2	
Self-reported indication for fECHO					
Abnormality on ultrasound					
Yes	24 (60)	40.8 \pm 12.8	0.51	33.0 \pm 7.1	0.29
No	16 (40)	44.1 \pm 18.4		37.3 \pm 15.5	
Family history of CHD					
Yes	10 (25)	37.3 \pm 16.5	0.29	33.9 \pm 8.7	0.76
No	30 (75)	43.7 \pm 14.6		35.0 \pm 11.5	
Abnormal serum screen					
Yes	1 (2.5)	56.0 \pm n/a	0.36	31.0 \pm n/a	0.73
No	39 (97.5)	41.7 \pm 15.2		34.8 \pm 10.9	
Abnormal amniocentesis					
Yes	3 (7.5)	29.3 \pm 11.9	0.13	27.3 \pm 2.5	0.22
No	37 (92.5)	43.1 \pm 15.0		35.3 \pm 11.0	
Maternal medical problem					
Yes	6 (15.0)	45.3 \pm 10.3	0.58	39.2 \pm 13.5	0.28
No	34 (85.0)	41.5 \pm 16.0		33.9 \pm 10.2	
Don't know					
Yes	4 (10)	58 \pm 19.7	0.03	46.5 \pm 19.6	0.02
No	36 (90)	40.3 \pm 13.8		33.4 \pm 8.9	

Table III. Univariate analysis comparing *state* and *trait* anxiety scores between women presenting for fECHO and historical controls (maximum score = 80).

	Cases (presenting for fECHO), $N=40$	Controls (no fECHO), $N=31$	p
	Mean \pm SD	Mean \pm SD	
State score	42.1 \pm 15.1	32.8 \pm 11.3	0.006
Trait score	34.7 \pm 10.8	35.4 \pm 12.8	0.798

Table IV. Multivariate regression analysis comparing *state* and *trait* anxiety scores among women presenting for fECHO and historical controls while accounting for maternal age, gestational age, and race (maximum score = 80).

	Cases (presenting for fECHO), $N=40$	Controls (no fECHO), $N=31$	β	p
	Mean \pm SD	Mean \pm SD		
State score	42.1 \pm 15.1	32.8 \pm 11.3	9.7	0.009
Trait score	34.7 \pm 10.8	35.4 \pm 12.8	0.7	0.83

Subjects were asked if the questionnaire itself increased pregnancy worry; most subjects responded that it did not (mean worry level of 1.4) and 30 subjects indicated that the questionnaire did not influence their worry about this pregnancy at all.

Discussion

Women presenting for fECHO evidence heightened anxiety. Our results show a statistically significant difference between *state* and *trait* scores for these

Table V. Women (N = 40) were asked whether they worry about the following variables on a scale of 1–5 (1 = No, 3 = Somewhat, 5 = Yes, a lot).

Variable, Mean \pm SD	
How much do your worry about...	
If the child will be healthy	4.35 \pm 0.98
Something going wrong	3.7 \pm 1.44
Labor and delivery	2.93 \pm 1.38
How the child will change your life	2.9 \pm 1.6
Weight gain	2.43 \pm 1.17

women, indicating that the experience itself of awaiting fECHO provokes increases in anxiety beyond what pregnant women typically experience. Additionally, the statistical difference in *state* scores, while controlling for age, race, and gestational age, between pregnant women presenting for fECHO and pregnant women not presenting for fECHO indicate that referral for fECHO is independently associated with increased anxiety. Neither indication for fECHO nor maternal factors such as parity or history of miscarriage were associated with anxiety levels. While health care providers typically view the ability to offer additional specialized testing as advantageous, our findings indicate that referral for advanced prenatal diagnostic testing may carry some unintentional negative effects. Our results do not suggest that referral for fECHO should be discouraged, however. The important clinical benefits of prenatal diagnosis of CHD to both the parents and the child have been widely reported and must be emphasized [11–13]. Rather, these results suggest that increased provider awareness and patient support are needed.

Findings from our study also suggest that patient understanding of the reasons for fECHO is inadequate. Some subjects reported that they did not know why they were referred for fECHO, while for others the physician-reported reason for fECHO was inconsistent with what the patient described. Of the three patients who reported they did not know the indication for fECHO referral, two had a fetal cardiac anomaly previously detected on ultrasound and one was referred to rule out a cardiac defect. Additionally, one woman who self-reported an abnormality on a previous ultrasound was referred because of an inability to visualize the fetus due to maternal body habitus. This is not the first report to suggest that physician–patient communication about obstetric ultrasound is suboptimal. A 2002 review of women’s views of obstetric ultrasound reported that it is common for women to lack information about the reason for an obstetric ultrasound [14]. The authors stated that inadequate awareness of the scan’s purpose makes the patient particularly vulnerable to distress if an abnormality is detected. Providing additional information about ultrasound testing to

patients has been shown to improve knowledge [15]. However, it has also been shown that even with extensive and accurate counseling, communication from the healthcare provider may not be understood by the patient [7]. Furthermore, whether improved doctor–patient communication decreases anxiety levels remains unclear. Our finding that women who did not know the reason for fECHO referral had increased anxiety would support that hypothesis, although our study was not designed to address this question. It may be that highly anxious individuals are less able to attend to the physician’s explanation for referral. As added information is unlikely to carry significant risk, methods to foster improved physician–patient communication should be supported.

Despite findings of high anxiety levels while awaiting fECHO, subjects self-reported that tests of the pregnancy and the fetus are reassuring and do not provoke worry. The positive association that patients feel towards obstetric ultrasound, as offering the opportunity for the family to be reassured and to “visit” with the fetus has been previously reported. Eurenus et al. reported that although 89% of women presenting for a routine level II obstetric ultrasound were concerned about the possible detection of fetal anomalies, anxiety levels were low [4]. This group reported that anxiety levels were higher among women who had a prior abnormal ultrasound. One explanation for the finding seen in our study wherein women reported that tests of the pregnancy do not increase worry, however the women scored high on the STAI while awaiting fECHO, could be that women may not be aware of how anxious they really are. Alternatively, subjects may perceive the fECHO as different from other pregnancy tests. Typically only patients with a higher risk of having a fetus with CHD are referred for this detailed examination and different reasons for fECHO referral carry different probabilities of detecting a fetal anomaly. Our analysis of the indications for fECHO referral was an attempt to investigate these factors. In spite of this, we did not find that the specific indication for fECHO was associated with maternal anxiety level; however, women who did not know why they were receiving a fECHO were significantly more anxious, indicating that a lack of understanding contributes to increased levels of anxiety.

Study limitations

This study had certain limitations. The sample size limited our ability to detect multiple associations. Non-English speaking patients were excluded from participation, limiting the generalizability of these findings. Additionally, a number of eligible subjects were missed; however, this was due to the random availability of the research coordinator and time available prior to fECHO and is unlikely to result in

significant selection bias. We were unable to obtain significant demographic data from the historical cohort, including primigravid status or history of miscarriage, which may have influenced the comparability of the two groups. Use of a historical control group, *versus* one that is concurrently collected, introduces a potential cohort effect; however, the samples were comparable on most demographic variables, and were receiving medical care at the same institution. The finding that 38% of the cases reported a history of being seen by a therapist is interesting, and while we did not find an association between history of therapy and maternal anxiety scores, further implications of this finding are unknown. Finally, potential confounding variables that may be associated with anxiety levels, including education levels and income, were not collected. Despite these limitations, our study is a representative sample of the population at our institution and provides valuable and innovative insight into the association of specialized prenatal testing, specifically fetal echocardiogram, and anxiety in the expectant mother.

Conclusion

Women presenting for fECHO report heightened levels of anxiety, regardless of the indication for the fECHO. In line with current goals to provide integrated medical care to treat the “whole” unique patient, as well as decades of research demonstrating that women’s psychosocial health strongly influences child, as well as fetal, development, these data suggest that attention should be paid to women’s psychological well being during times of fECHO procedures. Further investigation to assess potential modifiers of maternal anxiety in this clinical situation is warranted. Furthermore, whether anxiety levels decrease following the fECHO and physician counseling should be investigated.

Acknowledgments

The authors thank their subjects for participating in this study as well as the clinic support staff who helped coordinate visits and interviews.

Declaration of interest: I.A. Williams received support from Grant No. KL2 RR024157 from the National Center for Research Resources, a component of the National Institutes of Health and the National Institutes of Health Roadmap for Medical Research. The contents herein are solely the responsibility of the authors and do not necessarily represent

the official view of National Centre for Research Resources or National Institutes of Health. Information on National Centre for Research Resources is available at <http://www.ncrr.nih.gov/>. Information on Re-engineering the Clinical Research Enterprise can be obtained from [www. http://nihroadmap.nih.gov/clinicalresearch/overview-translational.asp](http://nihroadmap.nih.gov/clinicalresearch/overview-translational.asp).

References

1. Stümpflen I, Stümpflen A, Wimmer M, Bernaschek G. Effect of detailed fetal echocardiography as part of routine prenatal ultrasonographic screening on detection of congenital heart disease. *Lancet* 1996;348:854–857.
2. Sklansky M, Tang A, Levy D, Grossfeld P, Kashani I, Shaughnessy R, Rothman A. Maternal psychological impact of fetal echocardiography. *J Am Soc Echocardiogr* 2002;15:159–166.
3. Björkhem G, Jörgensen C, Hanséus K. Parental reactions to fetal echocardiography. *J Matern Fetal Med* 1997;6:87–92.
4. Eurenus K, Axelsson O, Gällstedt-Fransson I, Sjöden PO. Perception of information, expectations and experiences among women and their partners attending a second-trimester routine ultrasound scan. *Ultrasound Obstet Gynecol* 1997;9:86–90.
5. Coco C, Jeanty P. Karyotyping of fetuses with isolated choroid plexus cysts is not justified in an unselected population. *J Ultrasound Med* 2004;23:899–906.
6. Hoskovec J, Mastrobattista JM, Johnston D, Kerrigan A, Robbins-Furman P, Wicklund CA. Anxiety and prenatal testing: do women with soft ultrasound findings have increased anxiety compared to women with other indications for testing? *Prenat Diagn* 2007;28:135–140.
7. Cristofalo EA, Dipietro JA, Costigan KA, Nelson P, Crino J. Women’s response to fetal choroid plexus cysts detected by prenatal ultrasound. *J Perinatol* 2006;26:215–233.
8. Ohman SG, Saltvedt S, Waldenström U, Grunewald C, Olin-Lauritzen S. Pregnant women’s response to information about an increased risk of carrying a baby with Down syndrome. *Birth* 2006;33:64–73.
9. Spielberger, CD. Manual for the state-trait anxiety inventory STAI (Form Y). Palo Alto, CA: Consulting Psychologists Press Inc.; 1990.
10. Field T, Diego M, Hernandez-Reif M, Schanberg S, Kuhn C, Yando R, Bendell D. Pregnancy anxiety and comorbid depression and anger: effects on the fetus and neonate. *Depress Anxiety* 2003;17:140–151.
11. Mahle WT, Clancy RR, McGaurn SP, Goin JE, Clark BJ. Impact of prenatal diagnosis on survival and early neurologic morbidity in neonates with the hypoplastic left heart syndrome. *Pediatrics* 2001;107:1277–1282.
12. Tworetzky W, McElhinney DB, Reddy VM, Brook MM, Hanley FL, Silverman NH. Improved surgical outcome after fetal diagnosis of hypoplastic left heart syndrome. *Circulation* 2001;103:1269–1273.
13. Williams IA, Shaw R, Kleinman CS, Gersony WM, Prakash A, Levasseur SM, Glickstein JS. Parental understanding of neonatal congenital heart disease. *Pediatr Cardiol* 2008;29:1059–1065.
14. Garcia J, Bricker L, Henderson J, Martin MA, Mugford M, Nielson J, Roberts T. Women’s views of pregnancy ultrasound: a systematic review. *Birth* 2002;29:225–250.
15. Dixon AM. The need for greater patient awareness in routine antenatal ultrasound. *Radiography Today* 1994;60:9–11.

During this pregnancy, do you worry about:

How much weight you will gain?	1 (No)	2	3 (somewhat)	4	5 (Yes, a lot)
The labor and delivery?	1 (No)	2	3 (somewhat)	4	5 (Yes, a lot)
If the child will be healthy?	1 (No)	2	3 (somewhat)	4	5 (Yes, a lot)
How the child will change your life?	1 (No)	2	3 (somewhat)	4	5 (Yes, a lot)
Something going wrong?	1 (No)	2	3 (somewhat)	4	5 (Yes, a lot)

If the fetus had a major problem, would you want to know about it before birth?

1 (No) 2 3 (Maybe) 4 5 (Yes, definitely)

Do you think it would be helpful to have an early test (less than 4 month of pregnancy) that would tell you if the fetus has a major problem?

1 (No) 2 3 (Maybe) 4 5 (Yes, definitely)

If a major problem were diagnosed early in pregnancy (less than 4 months), would you continue the pregnancy?

1 (No) 2 3 (Maybe) 4 5 (Yes, definitely) Don't know

If a major problem were diagnosed later in pregnancy (more than 4 months), would you continue the pregnancy?

1 (No) 2 3 (Maybe) 4 5 (Yes, definitely) Don't know

On a scale of 1 to 5, how worried are you about the ultrasound of the fetus' heart?

1 (Not worried) 2 3 4 5 (Worried a lot)

Did you have an amniocentesis? Y or N

If yes, on a scale of 1 to 5, how much did you worry about the amniocentesis before you had it done?

1 (Did not worry) 2 3 4 5 (Worried a lot)

In general, do tests of the pregnancy and fetus make you worry more?

1 (No) 2 3 (Somewhat) 4 5 (Yes, definitely)

In general, do tests of the pregnancy and fetus make you worry less (do they reassure you)?

1 (No) 2 3 (Somewhat) 4 5 (Yes, definitely)

Why were you referred for today's ultrasound? (circle all that apply)

Family history of heart problem

I have a medical problem that could affect the heart of the fetus

Abnormality on blood test

Abnormality on amniocentesis

Abnormality on prior ultrasound

Don't know

Do you think there is a problem with the fetus' heart?

1 (No) 2 3 (Maybe) 4 5 (Yes, definitely) Don't know

Would the results of today's ultrasound influence your decision to continue the pregnancy?

1 (No) 2 3 (Maybe) 4 5 (Yes, definitely) Don't know

What do you expect to gain from the results of today's ultrasound test? (circle all that apply)

Reassurance that everything is OK

Information to help me decide if I need another test, like an amniocentesis

Information to help me decide whether to continue the pregnancy

Information to help me plan for the birth and the care of the baby after birth

Other: _____

What factors would influence your decision whether or not to continue the pregnancy?

(circle all that apply and rank by level of importance with #1 being the most important)

Religion

Family values/Morales

What I think

What my partner thinks

Risk to my health

Quality of life of the child after birth

Ability to care for the child after birth

Other: _____

Did this questionnaire make you more worried about the pregnancy?

1 (No) 2 3 (Somewhat) 4 5 (Yes, definitely)