# Fetal Echocardiography

## Practice Analysis Detailed Report

Approved by the ARDMS Council on April 24, 2024

# Contents

# ACKNOWLEDGEMENTS

Thank you to the subject matter expert volunteers who spent many hours developing the task inventory, evaluating the survey and responses, and reviewing the final content outline. Also, thank you to the nearly 200 Registered Diagnostic Medical Sonographers (RDMSs) and Registered Diagnostic Cardiac Sonographers (RDCSs) certified in Fetal Echocardiography around the world who took the time to participate in the practice analysis survey. This study was completed through the efforts of many individuals at Inteleos who worked together with our expert volunteer panel to identify tasks, construct the survey, administer the survey, and analyze the data.

# EXECUTIVE SUMMARY

The American Registry for Diagnostic Medical Sonography (ARDMS), part of the Inteleos family of certifications, is the globally recognized standard of excellence in sonography. The ARDMS is responsible for the preparation of valid and reliable certification examinations in the field of sonography. Conducting practice analyses at the national and international levels allows the ARDMS to evaluate the current practice expectations and performance requirements within the field. The Fetal Echocardiography (FE) practice analysis collected information on the requisite FE knowledge, skills, and abilities essential to sonography professionals. The practice analysis was conducted in several stages:

1. *Review and Revise Existing Content Outline*
2. *Expert Panel Meeting*
3. *Field Survey and Analysis*
4. *Final Task and Domain Weighting*
5. *Knowledge, Skills, and Abilities (KSA) Development*

The result of these activities led to the FE Practice Analysis Panel recommending a new Content Outline and list of KSAs (see Appendix H). This report details the methodology, data collection, analysis, and the recommended updated test content outline for the FE examination based on the results of the practice analysis.

# BACKGROUND OF STUDY

The ARDMS recognizes that diagnostic medical sonography is a valuable tool in the healthcare industry. There are several healthcare professions that utilize sonography in practice to increase the efficacy of their patient care. Successful mastery and demonstration of the knowledge and skills required to hold ARDMS sonographer credentials will provide sonographers with an additional source of validation. This will support the veracity of the diagnostic sonography exams that these practitioners perform. The FE examination assesses the requisite fetal echocardiography knowledge, skills, and abilities essential to sonographer-level professionals.

# METHODOLOGY

## Selection and Profile of Subject Matter Experts

The FE Assessment Committee members reviewed and proposed changes to the existing content outline. An FE Practice Analysis Expert Panel was recruited and participated in all of the other stages of the practice analysis with the exception of the survey which was sent to a larger sample as described in the *Field Survey and Analysis* section of this report. The FE Practice Analysis Expert Panel was comprised of members of the FE Assessment Committee and additional experts who were selected from a pool of current RDMSs and RDCSs certified in FE who indicated an interest in volunteering. Efforts were made to select a panel which represented the population of RDMSs and RDCSs certified in FE on several demographic features. For a list of panelists, their involvement, and this demographic breakdown, see Appendix A.

## Review and Revise Existing Content Outline

On June 15, 2023, Cynthia Parshall, from Touchstone Consulting, facilitated a meeting with the FE Assessment Committee to collect feedback about the current FE content outline. The purpose of the meeting was to (a) learn what the committee members like and dislike about the outline, (b) identify outdated content, and (c) identify topics that may be missing from the outline. Prior to the meeting, Cynthia prepared a set of pre-reading materials that provided instructions to perform a critical review of the content outline. Inteleos sent the materials to the committee two weeks prior to the meeting for their review. See Appendix B for the agenda and Appendix C for the summary of this meeting. A revised content outline was prepared as a result of this meeting.

## Expert Panel Meeting

On September 15-16, 2023, the FE Practice Analysis Expert Panel met in person to review and edit the revised content outline. The meeting was facilitated by Cynthia Parshall from Touchstone Consulting. The meeting agenda can be found in Appendix D. This meeting resulted in an edited version of the content outline to be used to develop a list of tasks for the field survey. This included 56 tasks organized into four domains. The tasks can be found in Appendix E.

## Field Survey and Analysis

### Field Survey Structure and Instructions to Survey Participants

The field survey was divided into two parts: demographic items and the task inventory items. A screening item was used at the beginning of the survey to ensure only those actively practicing FE sonography responded to the survey: "*Do you currently perform and/or teach Fetal Echocardiography ultrasound examinations?*" Participants who selected "No" were thanked for their time and their survey was ended.

The tasks (grouped by domains) as developed by the practice analysis expert panel were presented to survey participants. The participants were asked to rate each task on an importance scale. The instructions for this section were:

> *In the next section of the survey, please examine the tasks associated with being a Fetal Echocardiography Sonographer, and consider the following question:*
>
> How important is this task to ***your*** practice of Fetal Echocardiography?
>
> - *Absolutely essential*
> - *Very important*
> - *Of average importance*
> - *Of little importance*
> - *Not important at all*

The rating scale and weighting calculations are described in the *Data Analysis* section below.

### Survey Administration Procedure and Response Rate

The survey was sent to a random sample of 1,500 RDCS Sonographer registrants who were, at the time, certified in FE. The survey was available from October 30, 2023, to November 12, 2023. The survey was administered to participants via the web-based survey platform Qualtrics®. All responses to the survey were kept confidential. The task inventory portion of the survey was completed by 195 individuals. Responses from participants who did not complete the task inventory were not used as part of the data analysis.

### Data Analysis

#### Task Inventory Analysis

Each option for the 56 task inventory items was assigned the following *importance score*:

- Absolutely essential = 5
- Very important = 4
- Of average importance = 3
- Of little importance = 2
- Not important at all = 1

The mean importance score was calculated for each task (see Appendix E). Tasks were assigned to three categories to assist in the discussion of importance scores.

- Green: Any task with an importance score of four or above. These tasks should only be removed from the outline if they are redundant or for some other extraordinary circumstance. A rationale must be provided if the task is recommended for removal.
- Yellow: Tasks with an importance score of less than four and greater than or equal to three. These tasks may be kept or removed. A rationale is required for any tasks that are removed.
- Red: Any task with an importance score lower than three. These tasks should be considered for removal. A rationale is required for any of these tasks that are kept.

Most of the tasks fell into the "green" category. Two tasks fell into the "yellow" category, and there were no tasks in the "red" category.

### Initial Domain Weightings

The mean importance scores for each task were summed within each domain. The sum of the mean importance score for each domain was divided by the total mean importance score to determine the initial domain weightings (Table 1).

Table 1. Initial Domain Weightings (Prior to Expert Panel Review)

| *Domain #* | *Domain Name* | *# Tasks* | *Importance Sum* | *% of Total* |
|---|---|---|---|---|
| 1 | Integrate Data | 4 | 18.77 | 7% |
| 2 | Anatomy and Physiology | 14 | 65.83 | 25% |
| 3 | Perform the Exam | 20 | 91.66 | 35% |
| 4 | Evaluate Pathology and Pathophysiology | 18 | 86.96 | 33% |
| | ***Total*** | ***56*** | ***263*** | ***100%*** |

### Demographic Analysis

Responses to demographic questions were also analyzed. Appendix F contains highlights from the demographic analysis. Data from the survey responses, the total population (currently registered RDMSs and RDCSs but excluding physicians), and from the 2016 FE practice analysis are included where available. Here are the key findings:

- The survey respondents are representative across the dimensions of gender identification, age, location, and primary job function.
- The international respondents to the 2023 survey are proportional to the current population, however they represent a slightly lower percentage than the international respondents to the 2016 survey.
- 75% of respondents to the 2023 survey said that the FE certification was a requirement for their job. 50% of respondents to the 2016 survey reported the FE certification was a requirement for their job.

## Final Task and Domain Weighting

The final tasks and domain weightings were determined by members of the FE Practice Analysis Expert Panel on a Zoom call held January 24, 2024. The panelists were provided the tasks and instructions one week prior to the call. See Appendix G for instructions provided to the panelists.

The FE Practice Analysis panel decided to remove one green task as it is now included on the SPI exam content outline. They kept the rest of the tasks. The panelists changed one of the names of the domains (Domain 1) and also made some minor edits to other tasks. The complete list of tasks with the importance ratings and the comments from the panel can be found in Appendix E.

The results from the meeting were sent back to the panel for confirmation as a draft of the content outline.

After the edits were made, the domain weightings shifted slightly (see Table 2).

Table 2. Final Domain Weightings (Panel Recommendations)

| *Domain #* | *Domain* | *# Tasks* | *Importance Sum* | *% of Total* |
|---|---|---|---|---|
| 1 | Gather pertinent medical history prior to the exam | 4 | 18.77 | 7% |
| 2 | Anatomy and Physiology | 14 | 65.83 | 25% |
| 3 | Perform the Exam | 19 | 87.06 | 34% |
| 4 | Evaluate Pathology and Pathophysiology | 18 | 86.96 | 34% |
| | **Total** | **55** | **258.62** | **100%** |

## KSA Development

While reviewing the draft content outline, the practice analysis panel was asked to identify knowledge, skills, and abilities (KSAs) that are required to accomplish the tasks laid out in the updated content outline. They were provided with brief training (video and word document) that explained how to write KSAs. After the panel submitted a list of KSAs, Inteleos staff, including an in-house SME, compiled the results, editing for clarity and removing redundancies. The draft KSAs were shared once again with the panel. The resulting KSAs are included at the end of Appendix H.

# FINAL CONTENT OUTLINE

The final version of the content outline with the KSAs can be found in Appendix H. This report, including the final version of the content outline recommended by the Practice Analysis Panel, will be presented to the ARDMS Council for approval. Upon approval of the content outline, this report will be amended to include the approval date.

# Appendix A: Practice Analysis Participants

Table 3. Full List of Participants and Meetings Attended

| *Full Name and Certifications* | *Review and Revise Existing Content Outline (Remote)* | *Expert Panel Meeting (In Person)* | *Final Task and Domain Weighting/KSA (Remote)* |
|---|---|---|---|
| Giulia Kingston, RDMS, RDCS | X | X | X |
| Sue Gomien, RDMS | X | | X |
| Joan Mastrobattista, MD | X | | X |
| Bob Egerman, MD, RDMS | X | | X |
| Diana Strickland, RDMS, RDCS | X | X | X |
| Elizabeth Medeiros, RDMS | | X | X |
| Jamie Fitzsimmons, RDMS, RVT | | X | X |
| Vladimir Lemaire, RDMS | | X | X |
| Julisa Litvinskas, RDMS, RDCS, RVT | | X | X |
| Tiffany Chen, RDMS | | X | X |
| Valerie Isaacks, RDMS, RDCS | | X | X |
| Emily Chen, RDMS, RDCS, RVT | | X | X |
| Jaime Taylor-Fujikawa, RDMS, RDCS | | | X |

Table 8. Gender Identification of Population and Participants

| *Gender* | *Percent in Population* | *Participants* | *Percent of Participants* |
|---|---|---|---|
| Female | 94 % | 11 | 88% |
| Male | 6 % | 2 | 12 % |

Table 9. U.S. Region or Country of Population and Participants

| *Region* | *Percent in Population* | *Participants* | *Percent of Participants* |
|---|---|---|---|
| Mid-Atlantic | 15% | 0 | 0% |
| Midwest | 19% | 2 | 15% |
| Northeast | 4% | 2 | 15% |
| Northwest | 3% | 1 | 8% |
| Southeast | 22% | 3 | 23% |
| Southwest | 17% | 2 | 15% |
| West | 16% | 2 | 15% |
| International | 3% | 1 | 8% |

Table 8. Certification Identification of Population and Participants

| *Certification* | *Percent in Population* | *Participants* | *Percent of Participants* |
|---|---|---|---|
| RDMS | 62% | 8 | 67% |
| RDCS | 38% | 4 | 33% |

# Appendix B: Review and Revise Existing Content Outline Meeting Agenda

**Fetal Echocardiography Assessment Committee Content Outline Review**
Thursday, June 15, 2023, 7:00 PM, ET

**Join Zoom Meeting**
https://inteleos.zoom.us/j/92291469219?pwd=dEZpL1AyRjVUOThYT1NPbUwwdU5NQT09
**Meeting ID:** 922 9146 9219
**Passcode:** 787263

I. Welcome and Introductions – Kathy Kelly, Chief Assessment Officer
II. Review of Practice Analysis process – Kathy Kelly

III. Review of Content Outline and discussion – Cynthia Parshall, PhD, Touchstone Consulting and Panel

IV. Next Steps – Kathy Kelly

## Appendix C: Review and Revise Existing Content Outline Meeting Summary

On June 15, 2023, the FE Assessment Committee members met to review the existing content outline. The purpose of the meeting was to (a) learn what the committee members like and dislike about the outline, (b) identify outdated content, and (c) identify topics that may be missing from the outline. Two weeks prior to the meeting, a set of pre-reading materials that provided instructions on performing a critical review of the content outline were prepared and sent to the committee.

The committee members identified overlap within Domain 1: *Assess Anatomy and Physiology* and Domain 4: *Perform the Exam*. The committee clarified that Domain 1 is about evaluating and assessing the need for imaging across the normal anatomy while the focus of Domain 4 is to obtain the various views. The Committee suggested a few wording changes and some combining of tasks across the outline. Overall, the suggested changes were minor.

# Appendix D: Expert Panel Meeting

## FE Practice Analysis
September 15 – 16, 2023
Seattle, WA

**Friday, September 15th**

| Topics | Description | Facilitator | Time |
|---|---|---|---|
| Breakfast | | | 8:00-9:00 AM |
| Introductions/Ice Breaker | Welcome<br>Introductions<br>Agenda Review<br>Opening Presentation<br>Individual Task List Review | Cynthia Parshall<br>Alison Schachtschneider | 9:00-10:30 AM |
| Break | | | 10:30 - 10:45 AM |
| Group Activity | Review and discuss Domains 1 and 2 | Cynthia Parshall<br>Alison Schachtschneider | 10:45-12:30 PM |
| Lunch | | | 12:30-1:30 PM |
| Group Activity | Review and discuss Domains 3 and 4 | Cynthia Parshall<br>Alison Schachtschneider | 1:30-3:00 PM |
| Break | | | 3:00-3:15 PM |
| Group Activity | Finalize recommendations | Cynthia Parshall | 3:15-5:00 PM |
| Dinner | | | 6:00-8:00 PM |

**Saturday, September 16th**

| Topics | Description | Facilitator | Time |
|---|---|---|---|
| Breakfast | | | 8:00-9:00 AM |
| Group Activity | Review updated task statements | Cynthia Parshall<br>Alison Schachtschneider | 9:00-10:30 AM |

## Appendix E: Task Importance Score and Committee Decision

The tasks below were developed by the practice analysis and were included on the survey for respondents to provide an importance rating. Cells in column C contain the mean importance rating for each task and are colored green, yellow, or red. Tasks in the "Green" category have a mean importance score of four or greater. Tasks in the "Yellow" category have a mean importance score of greater than or equal to three and less than four. Tasks in the "Red" category have a mean importance score of less than three (there are no "Red" tasks). The panel's decisions are recorded in column D. Column E contains comments from the panel.

| A. Content Code | B. Domain & Task | C. Imp. | D. Panel Decision | Comment |
|---|---|---|---|---|
| **1** | **Integrate Data** | | | Change the title to Gather pertinent medical history prior to the exam |
| **1.A** | **Gather pertinent medical history prior to the exam** | | | |
| 1.A.1 | Review referral information and clarify pertinent data and indications for exam (e.g., review genetic testing results, prior sonographic studies, risk factors) | 4.73 | Keep | |
| 1.A.2 | Correlate known genetic syndromes and chromosomal anomalies with expected exam findings | 4.70 | Keep | |
| 1.A.3 | Correlate history of maternal disease and drug exposure with expected exam findings (e.g., maternal congenital heart disease, lupus, diabetes, indomethacin use) | 4.71 | Keep | |
| 1.A.4 | Correlate extracardiac anomalies with expected exam findings (e.g., CHARGE, VACTERL syndromes) | 4.63 | Keep | |
| **2** | **Anatomy and Physiology** | | | |
| **2.A** | **Identify normal anatomy and physiology** | | | |
| 2.A.1 | Understand normal embryologic development (e.g., early chamber development, normal septal formation) | 3.94 | Keep | |
| 2.A.2 | Identify fetal anatomic structures related to the abdomen/pelvis (e.g., inferior vena cava, ductus venosus, hepatic veins, stomach, bladder, spleen) | 4.96 | Keep | |
| 2.A.3 | Identify fetal anatomic structures related to the chest/thorax (e.g., lungs, esophagus, trachea, thymus, diaphragm) | 4.90 | Keep | |
| 2.A.4 | Understand anatomy of the tissues composing the heart (e.g., pericardium, myocardium) | 4.74 | Keep | Replace Understand with Distinguish |
| 2.A.5 | Identify normal cardiac chamber morphology and position | 4.71 | Keep | |
| 2.A.6 | Identify septa (e.g., atrial, ventricular, and arterial septa) | 4.12 | Keep | |
| 2.A.7 | Identify normal atrioventricular and semilunar valve morphology | 4.75 | Keep | |

| | | | | |
|---|---|---|---|---|
| 2.A.8 | Identify systemic veins, arteries, and outflows | 4.71 | Keep | Cross-out outflows and add another task, "Identify Outflows" |
| 2.A.9 | Identify pulmonary veins and arteries | 4.32 | Keep | |
| 2.A.10 | Identify aortic arch | 4.96 | Keep | |
| 2.A.11 | Identify ductus arteriosus | 4.97 | Keep | |
| 2.A.12 | Identify ductus venosus | 4.85 | Keep | |
| 2.A.13 | Identify umbilical vein and arteries | 4.95 | Keep | |
| 2.A.14 | Understand anatomy of the fetal cardiac electrical conduction system (e.g., SA node, AV node) | 4.93 | Keep | Take out the words "anatomy of" |
| **3** | **Perform the Exam** | | | |
| **3.A** | **Clinical care and safety** | | | |
| 3.A.1 | Practice universal infection control precautions | 4.61 | Remove | It has been covered in SPI |
| 3.A.2 | Recognize and inform the supervising physician of fetal critical findings (e.g., sustained bradycardia/tachycardia, fetal demise, hydrops, anhydramnios) | 4.90 | Keep | |
| 3.A.3 | Modify imaging protocols based on maternal clinical safety (e.g., supine hypotensive disorder, seizures, preeclampsia, anxiety) | 4.38 | Keep | Change the wording to "Monitor and adjust exam based on maternal clinical symptoms (e.g. supine hypotensive disorder, severe headache, unrelenting vomiting)" |
| **3.B** | **Exam techniques & measurements** | | | |
| 3.B.1 | Select transducer and console settings appropriate for the exam | 4.67 | Keep | |
| 3.B.2 | Evaluate multiple gestations and associated cardiac complications (e.g., fetal position, number; twin-to-twin transfusion syndrome) | 4.42 | Keep | |
| 3.B.3 | Determine visceral-atrial situs (e.g., Cordes method) | 4.77 | Keep | Add "Cordes and other methods" |
| 3.B.4 | Evaluate and obtain various cardiac views (e.g., bicaval, four-chamber, short axis, left and right ventricular outflow tract, three-vessel-trachea) | 4.76 | Keep | Replace "various" with "standard". Get rid of the examples |
| 3.B.5 | Evaluate and obtain various views of great vessels (e.g., branch pulmonary arteries, systemic veins, pulmonary veins, aortic and ductal arches) | 4.94 | Keep | Replace "various" with "standard". |
| 3.B.6 | Determine orientation and relationship of the great vessels using various cardiac views | 4.94 | Keep | Replace "various" with "standard". |
| 3.B.7 | Perform measurements of chamber size using two-dimensional and M-mode techniques | 4.95 | Keep | |

| | | | | |
|---|---|---|---|---|
| 3.B.8 | Perform measurements of cardiac valves and great vessels | 4.23 | Keep | |
| 3.B.9 | Perform measurement of cardiothoracic (CT) ratio | 4.54 | Keep | |
| 3.B.10 | Perform fetal biometric measurements (e.g., biparietal diameter [BPD], head circumference [HC], abdominal circumference [AC], femur length [FL]) | 4.30 | Keep | |
| **3.C** | **Assess fetal cardiac function and hemodynamics** | | | |
| 3.C.1 | Assess ventricular function (e.g., myocardial performance index) | 3.90 | Keep | Remove the example |
| 3.C.2 | Assess function of atrioventricular and semilunar valves using color and spectral Doppler (e.g., regurgitation, stenosis) | 4.73 | Keep | |
| 3.C.3 | Assess fetal heart rate and rhythm using Doppler and M-mode | 4.83 | Keep | |
| 3.C.4 | Use spectral and color Doppler to assess middle cerebral artery (MCA), umbilical arteries, umbilical vein, and ductus venosus | 4.42 | Keep | |
| 3.C.5 | Use spectral and color Doppler to assess pulmonary and systemic veins | 4.64 | Keep | |
| 3.C.6 | Use spectral and color Doppler to assess pulmonary and systemic arteries | 4.63 | Keep | |
| 3.C.7 | Assess mechanical PR intervals | 4.11 | Keep | |
| **4** | **Evaluate Pathology and Pathophysiology** | | | |
| **4.A** | **Assess abnormal physiology and perfusion** | | | |
| 4.A.1 | Recognize signs of fetal distress (e.g., abnormal fluid collections, cardiomegaly, hemodynamics) | 4.90 | Keep | |
| 4.A.2 | Evaluate for the presence of fetal cardiomyopathies | 4.84 | Keep | |
| 4.A.3 | Evaluate for the presence of fetal dysrhythmias | 4.85 | Keep | |
| **4.B** | **Identify and assess congenital anomalies** | | | |
| 4.B.1 | Evaluate for abnormalities related to genetic syndromes (e.g., trisomy 21, Noonan, monosomy X, 22q11 deletion) | 4.78 | Keep | |
| 4.B.2 | Evaluate for cardiac malpositioning | 4.89 | Keep | |
| 4.B.3 | Identify and assess heterotaxy syndromes | 4.78 | Keep | |
| 4.B.4 | Identify and assess cardiac septal defects | 4.61 | Keep | |
| 4.B.5 | Identify and assess left-sided cardiac anomalies | 4.83 | Keep | |
| 4.B.6 | Identify and assess right-sided cardiac anomalies | 4.75 | Keep | |
| 4.B.7 | Identify and assess conotruncal anomalies | 4.84 | Keep | |
| 4.B.8 | Identify and assess systemic venous anomalies | 4.88 | Keep | |
| 4.B.9 | Identify and assess pulmonary venous anomalies | 4.84 | Keep | |
| 4.B.10 | Identify and assess aortic arch anomalies | 4.87 | Keep | |
| 4.B.11 | Identify and assess ductus arteriosus abnormalities | 4.88 | Keep | |
| 4.B.12 | Identify and assess ductus venosus anomalies | 4.90 | Keep | |
| 4.B.13 | Identify and assess congenital cardiac masses | 4.91 | Keep | |
| 4.B.14 | Identify and assess cardiac changes with thoracic anomalies | 4.80 | Keep | |

| | | | | |
|---|---|---|---|---|
| 4.B.15 | Assess abnormal blood flow across cardiac valves and vessels | 4.82 | Keep | |

# Appendix F: Demographic Analysis

*Figure 1: 2023 Age in population and survey responses*

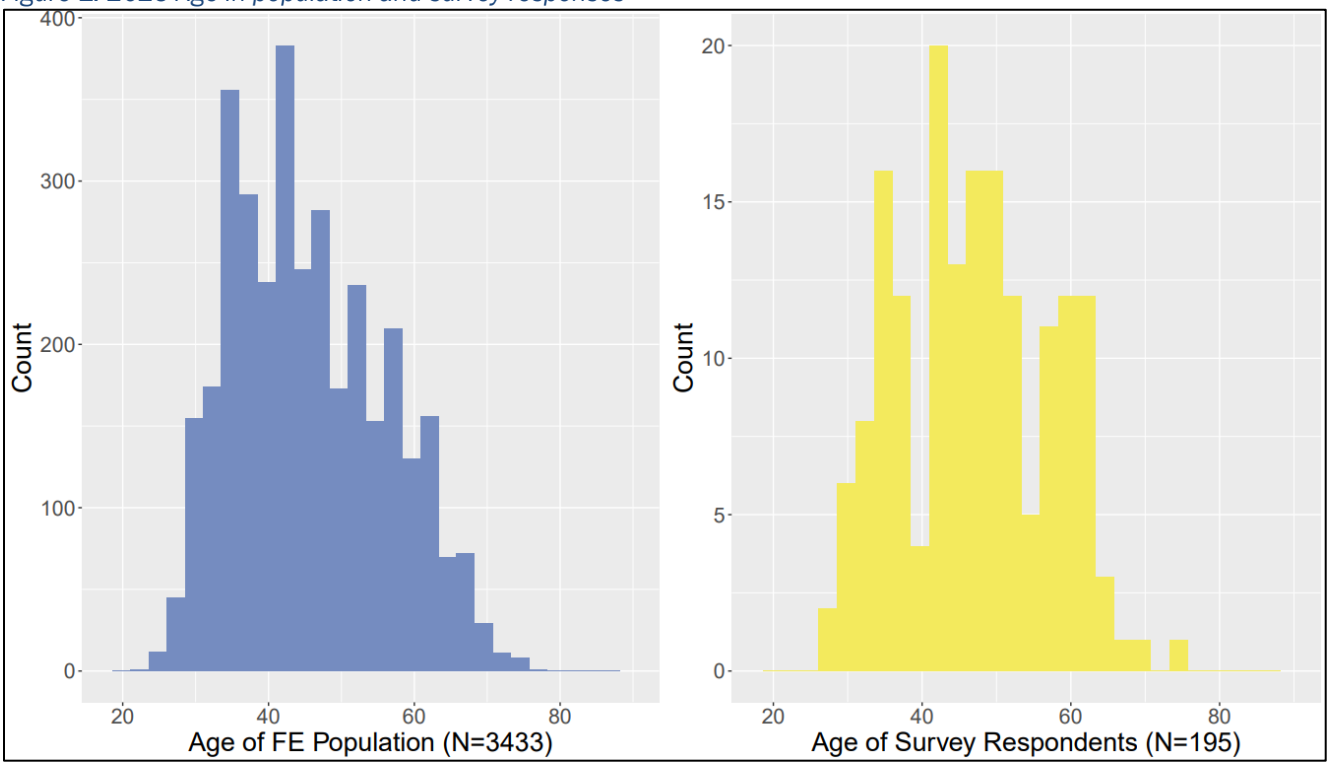



*Figure 2: Gender in 2023 population and 2023 survey responses*

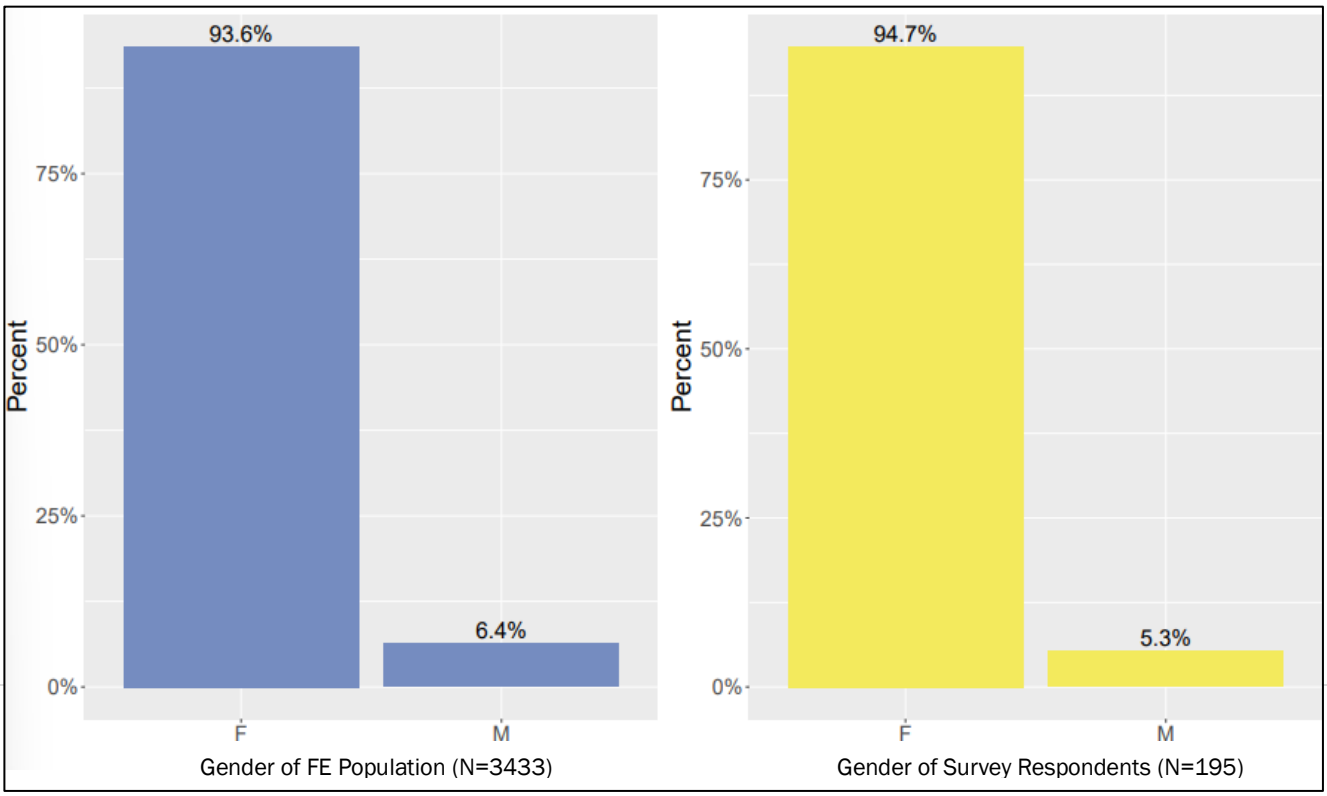


*Figure 3: Country of Residence in 2023 population and 2023 survey responses*

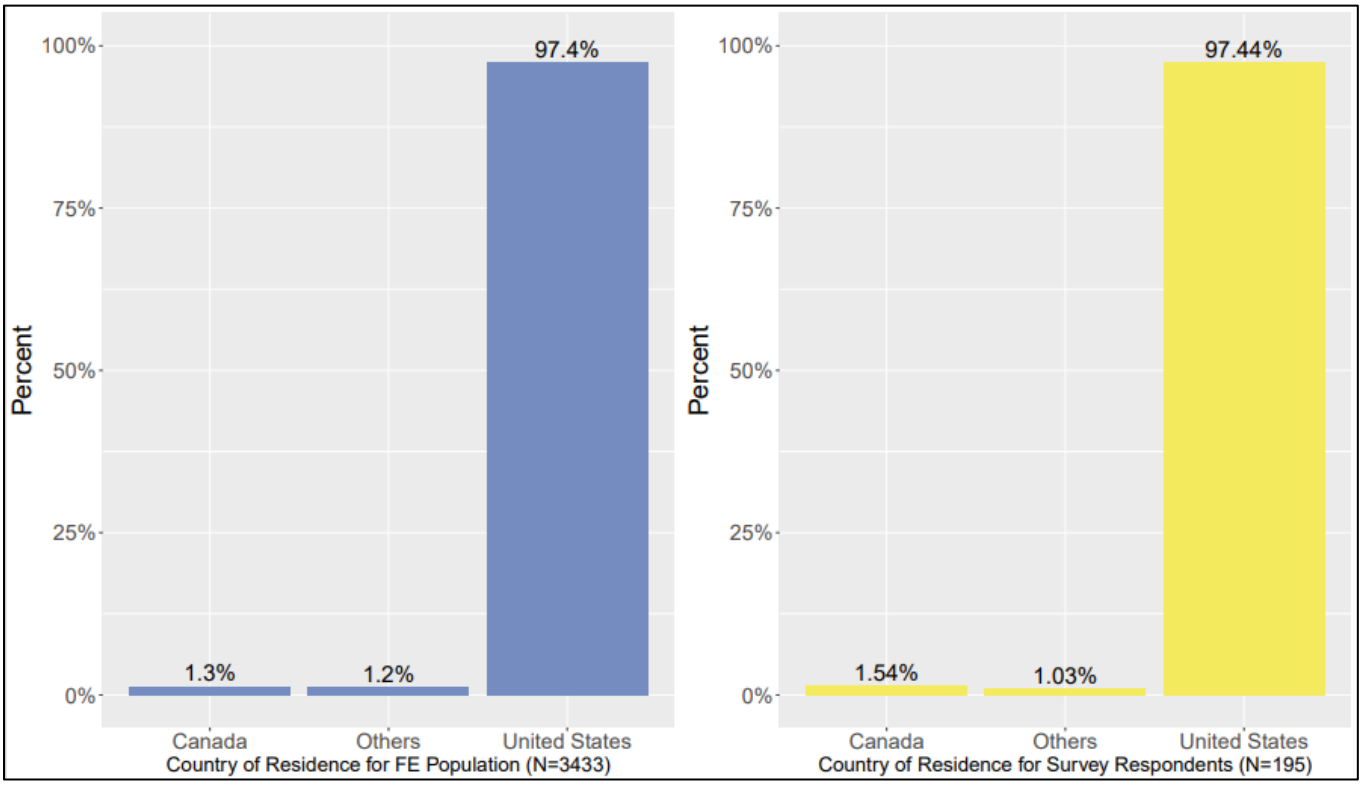



*Figure 4: Country of Practice in 2016 survey responses*

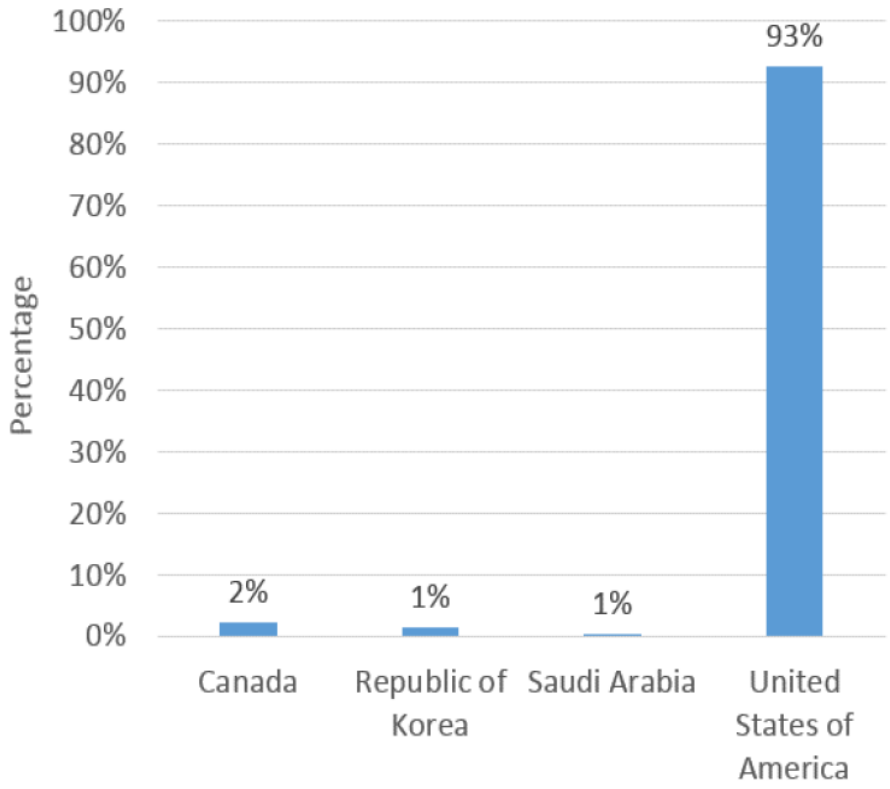


*Figure 5: U.S. Census Region in 2023 population and 2023 survey responses*

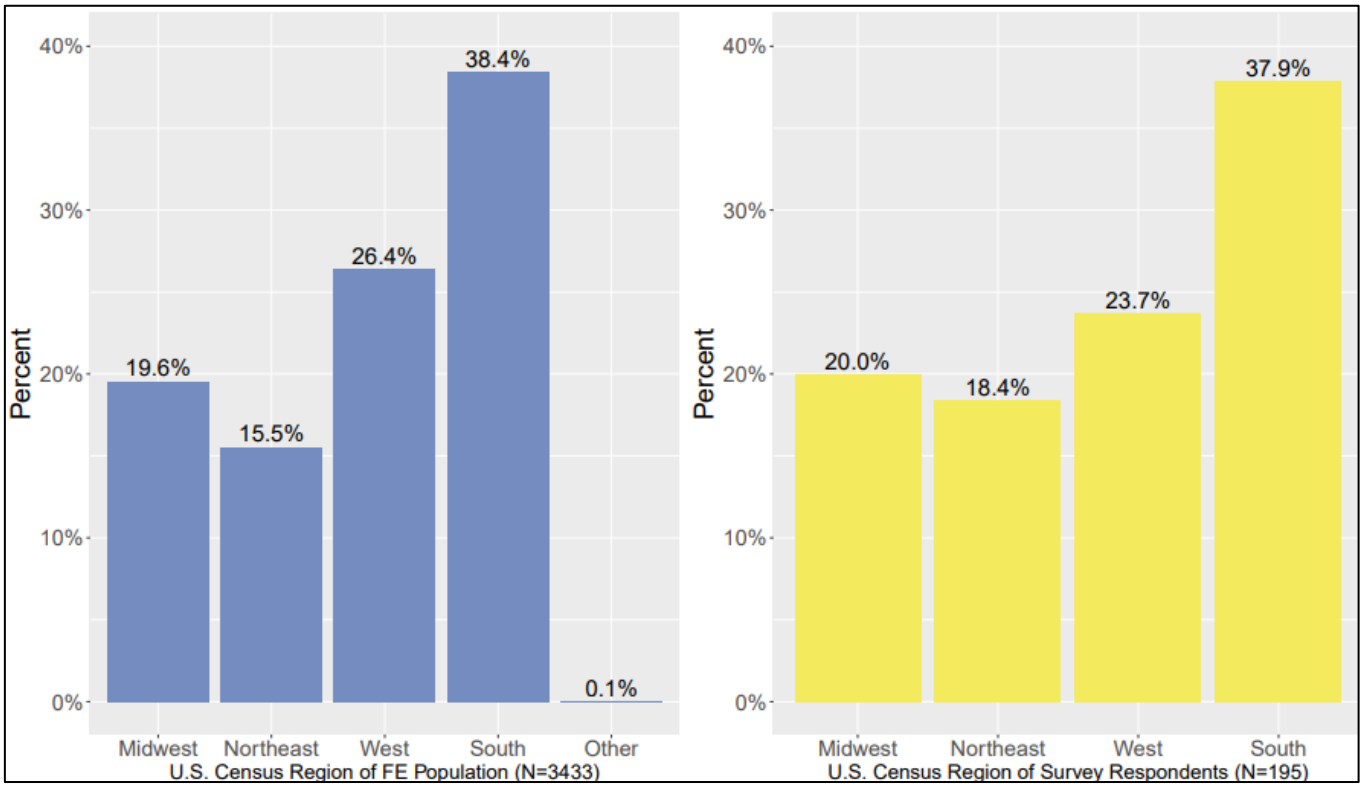



*Figure 6: U.S geographic region in 2016 survey responses*

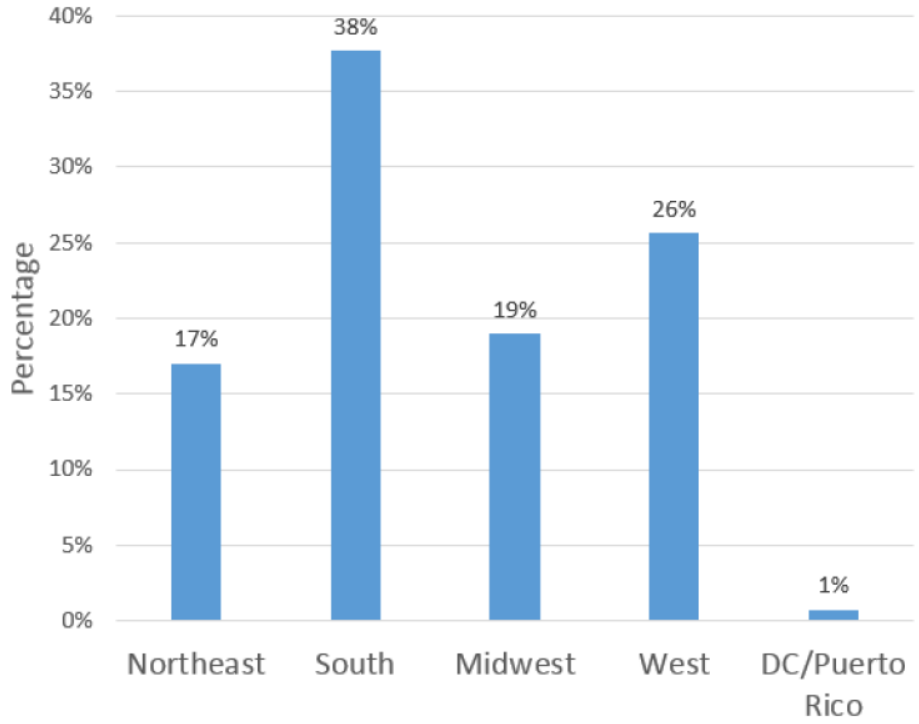


*Figure 7: Primary job function in 2023 population*

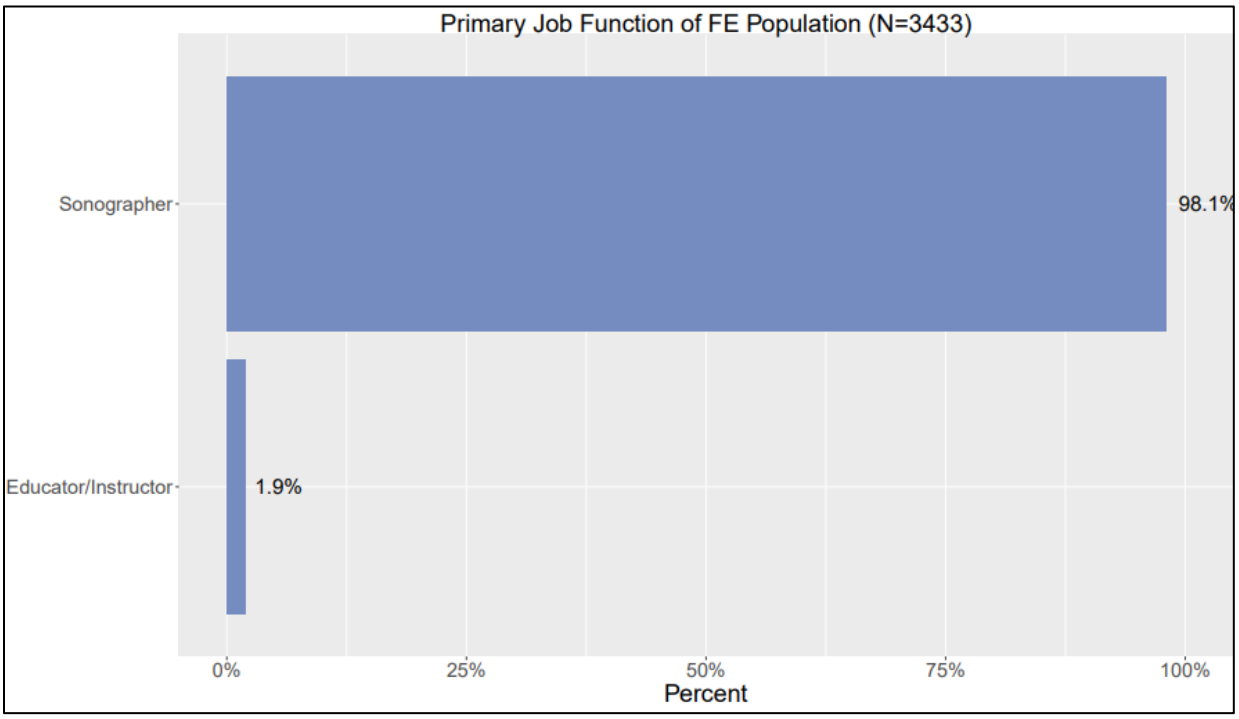



*Figure 8: Primary job function in 2023 survey responses*

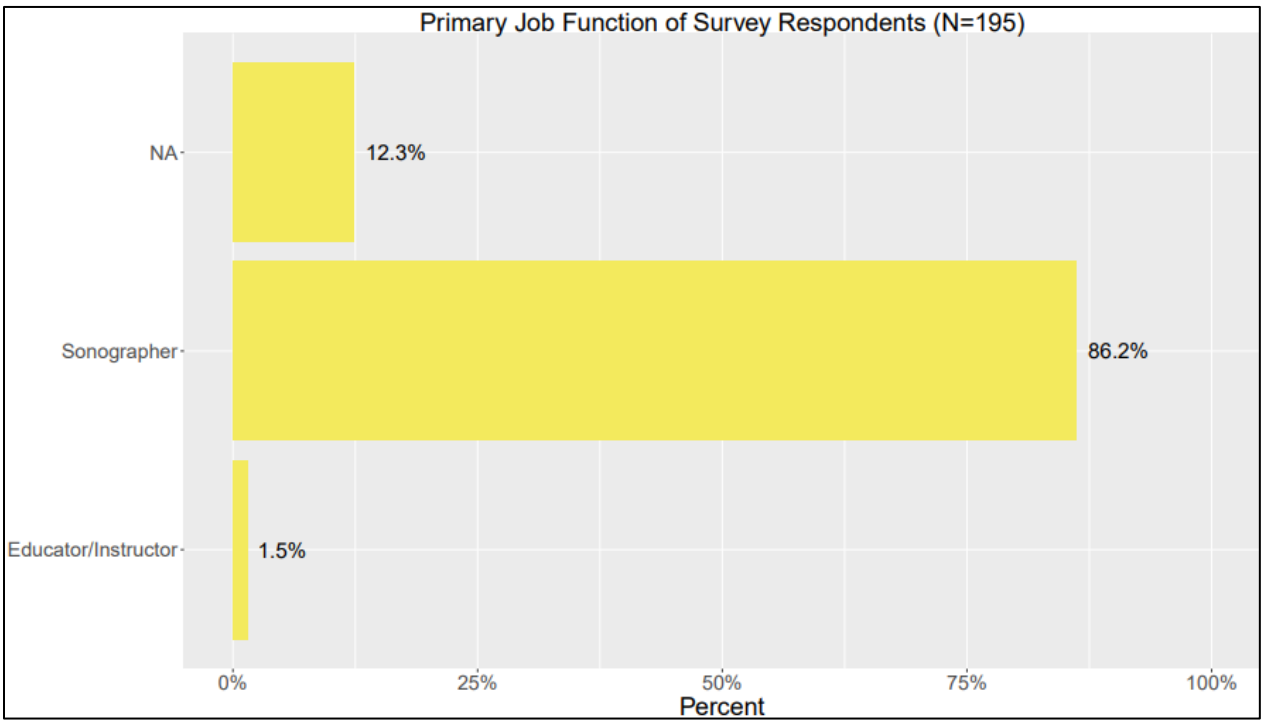


*Figure 9: Education level in 2023 survey responses*

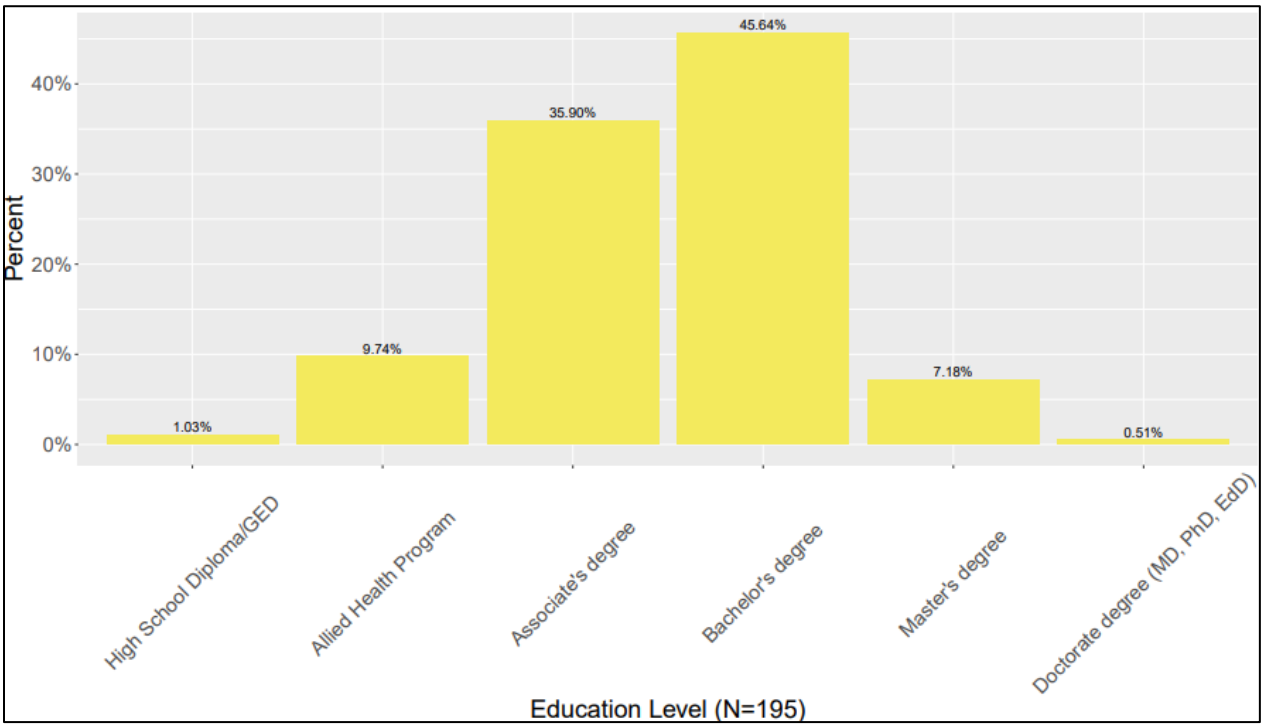



*Figure 10: Education level in 2016 survey responses*

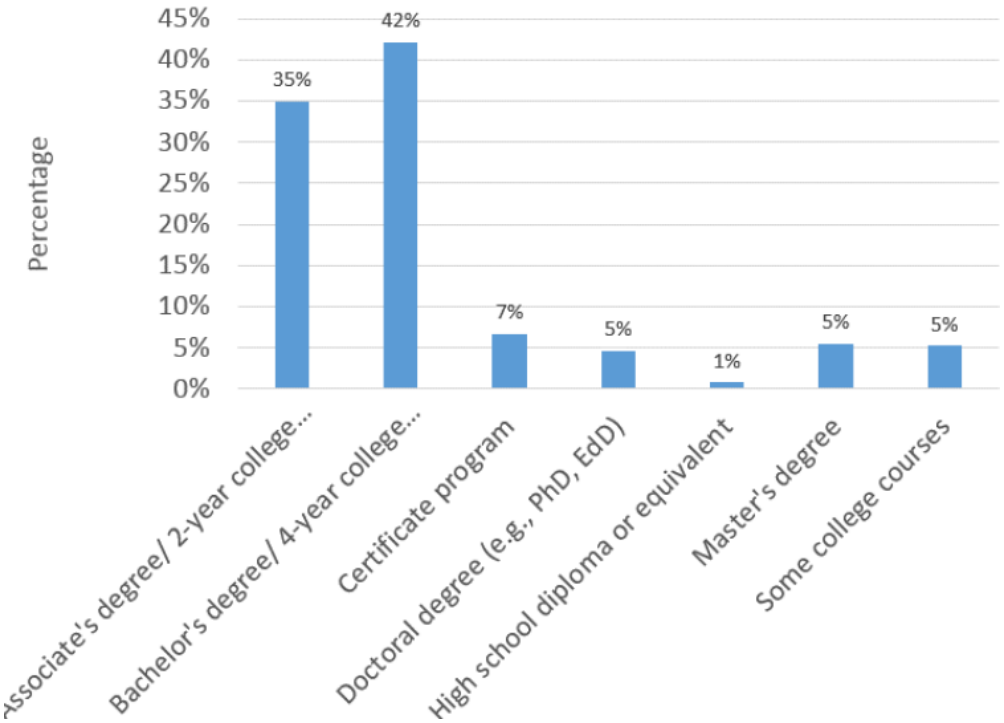


*Figure 11: FE ultrasound exams performed per month in 2023 survey responses*

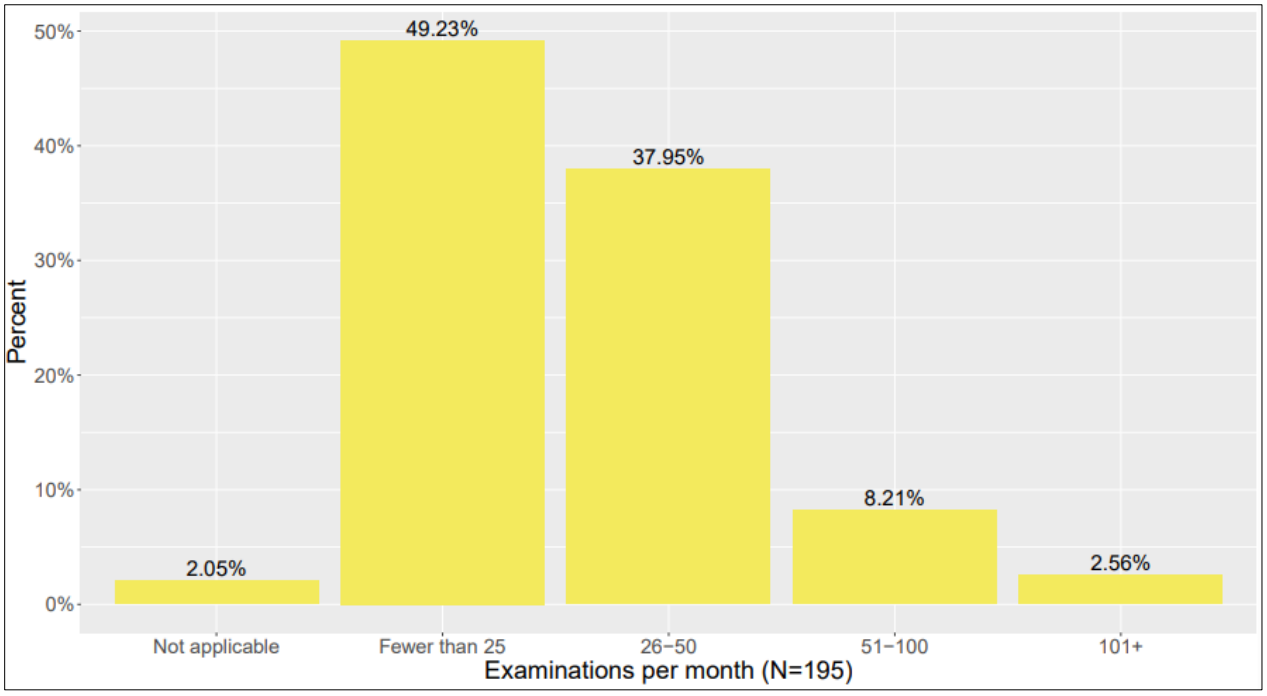



*Figure 12: FE ultrasound exams performed per month in 2016 survey responses*

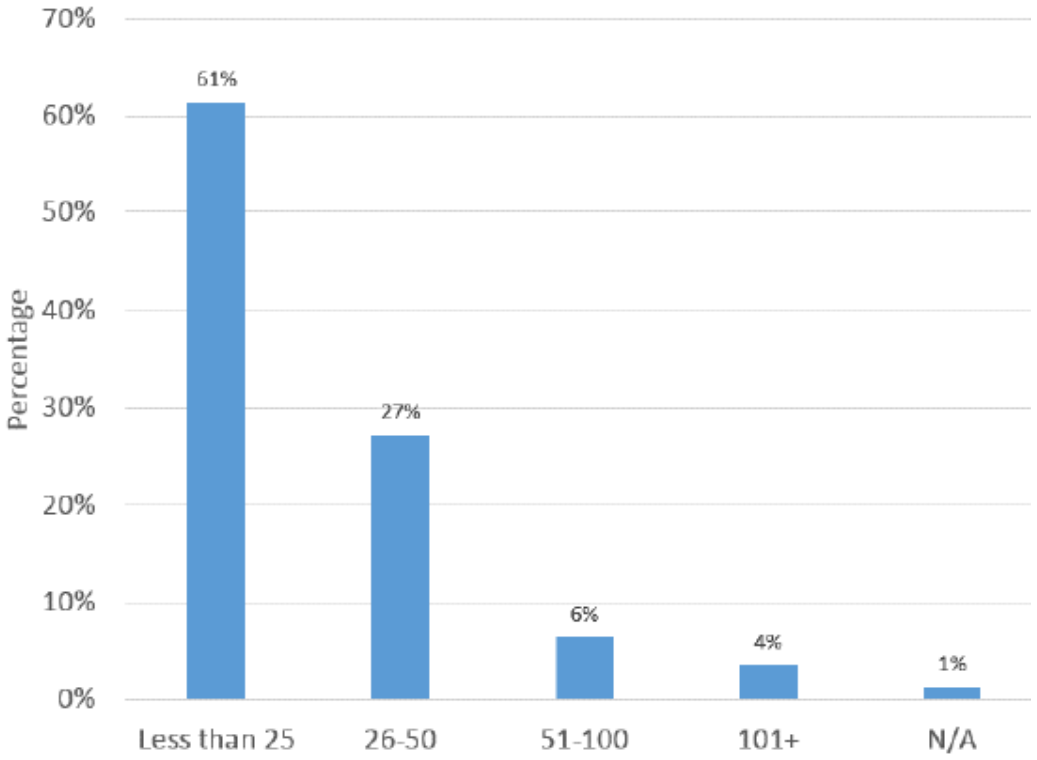


*Figure 13: Percent the FE credential is required to work in the 2023 survey responses*

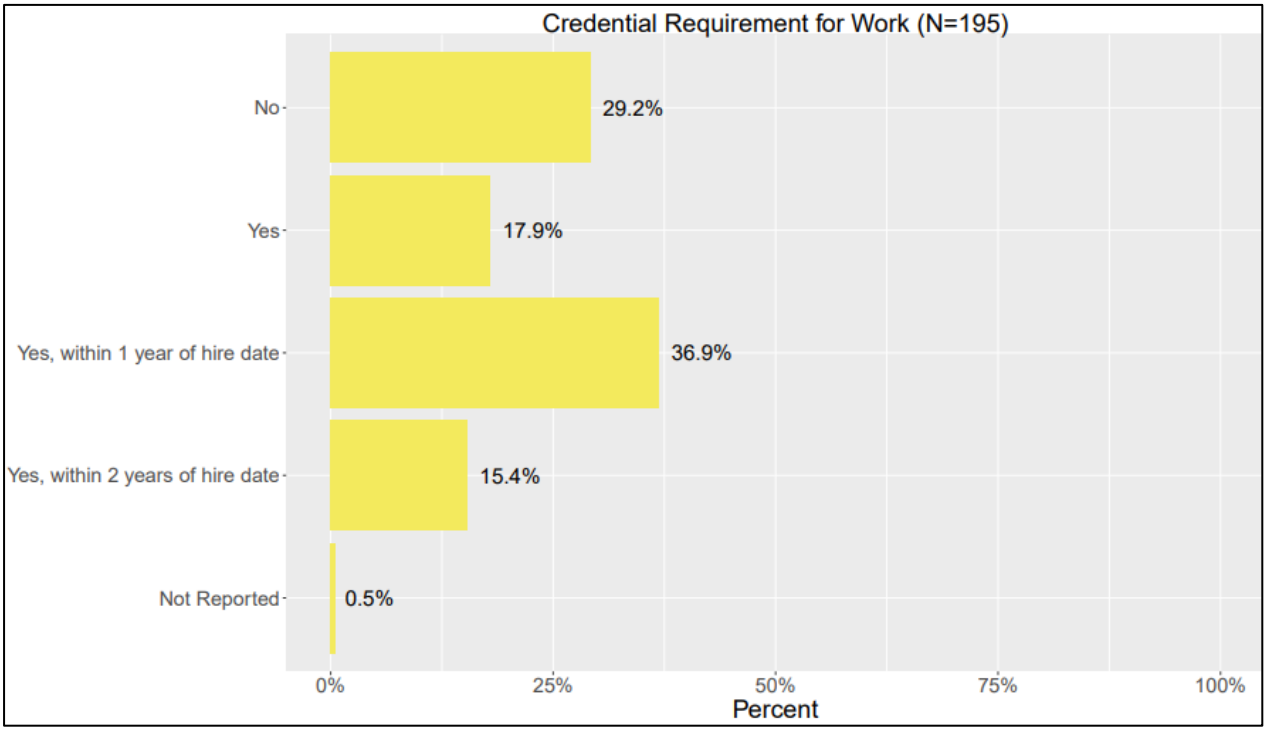



*Figure 14: Percent the FE credential is required to work in the 2016 survey responses*

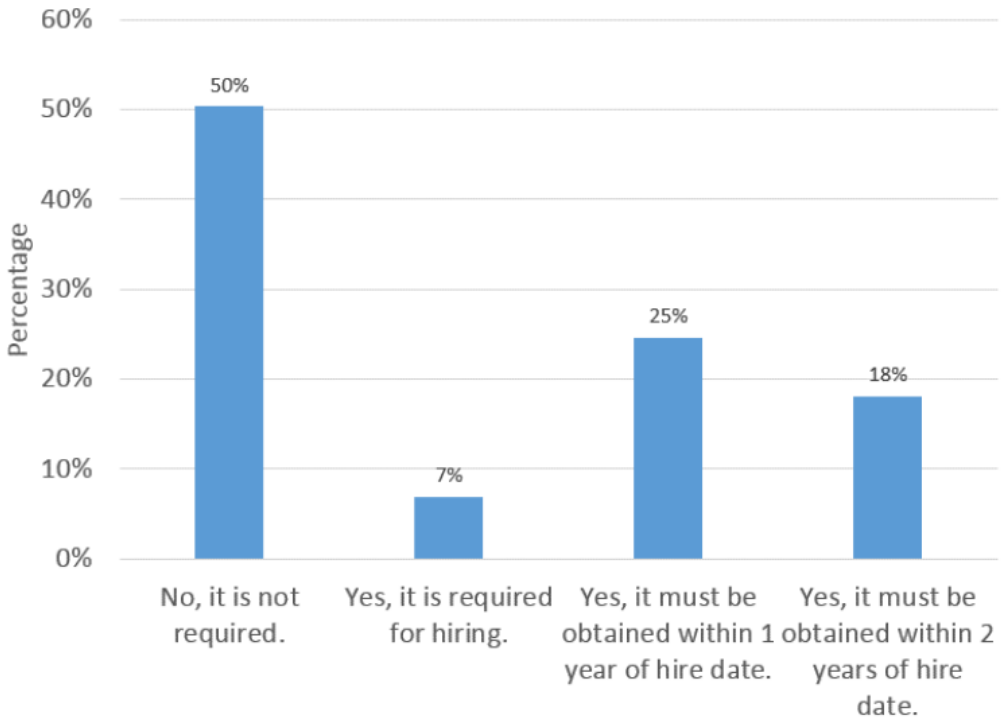


*Figure 15: Who performs FE ultrasounds according to the 2023 survey responses*

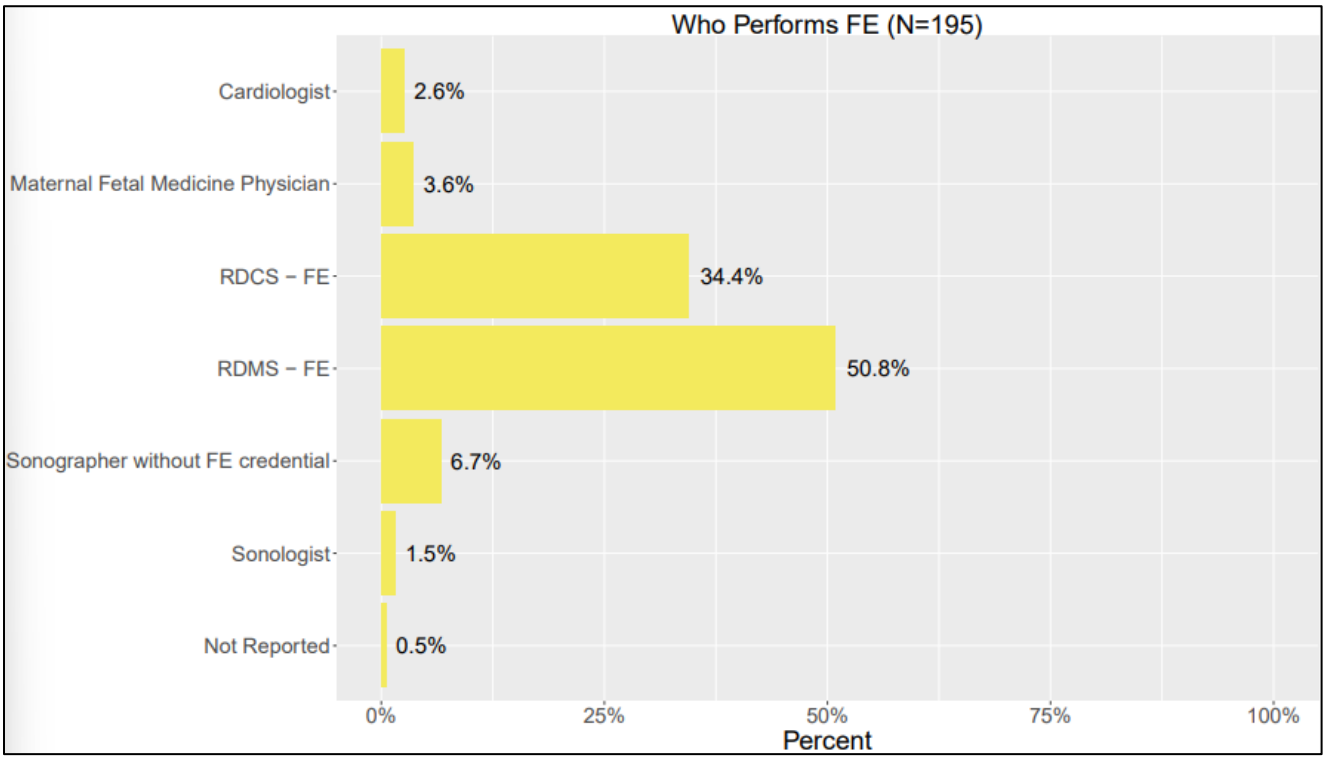



*Figure 16: Who reads FE ultrasounds according to the 2023 survey responses*

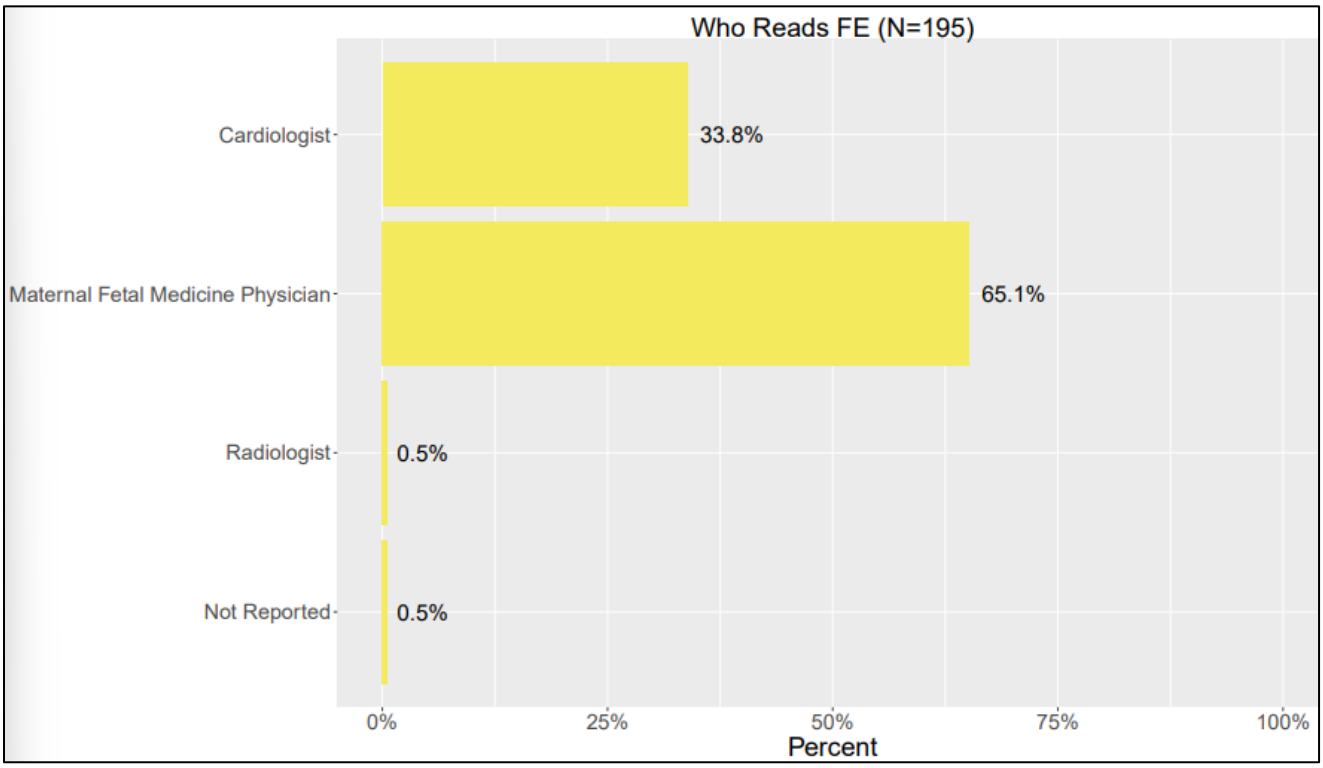


*Figure 17: Work setting of the 2023 survey respondents*

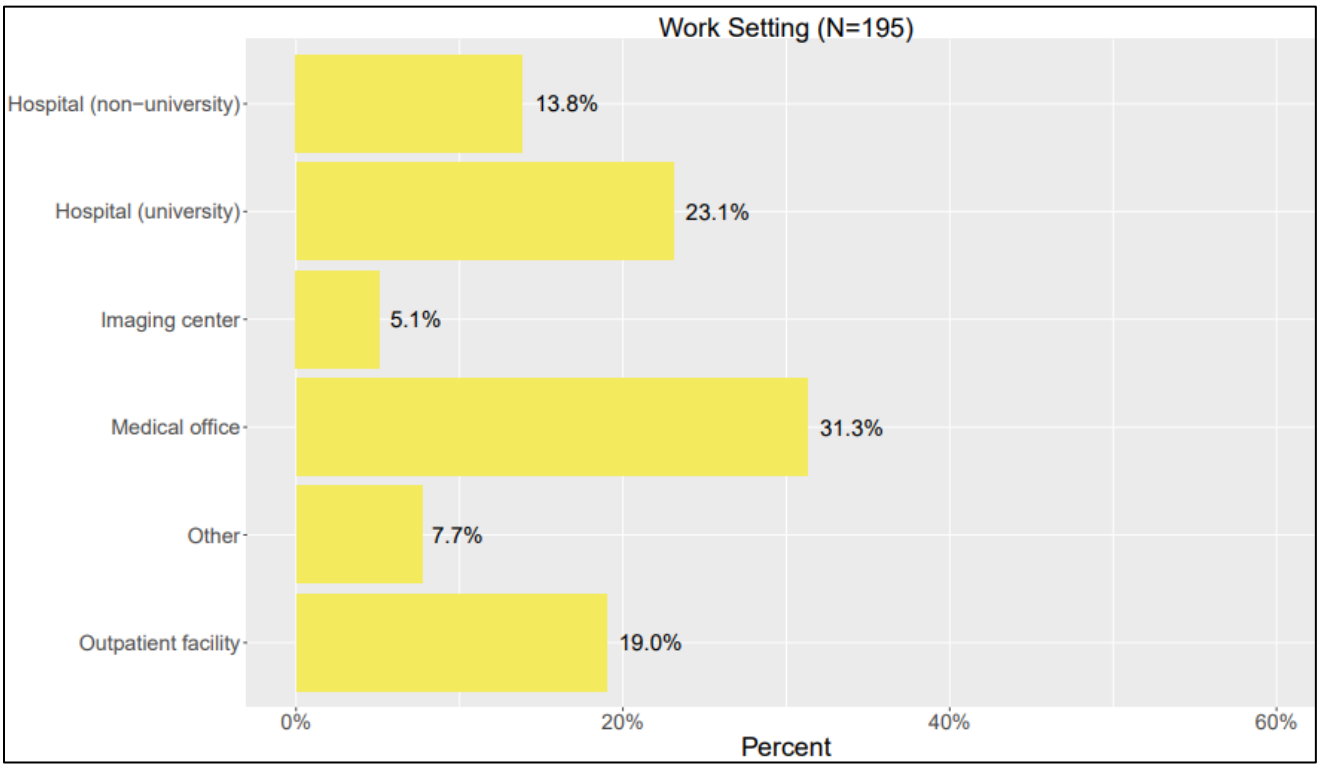
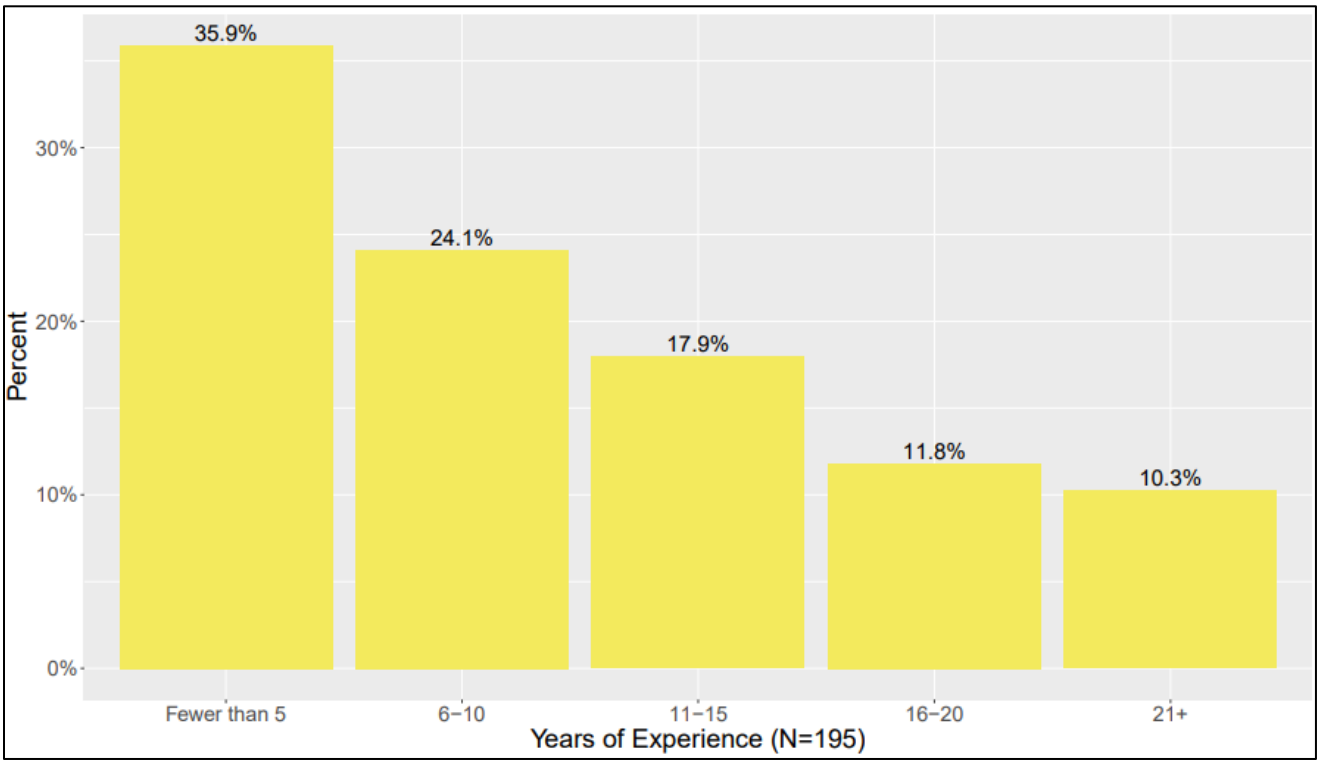



*Figure 18: Years of Experience in FE of the 2023 survey respondents*



# Appendix G: Final Task and Domain Weighting Agenda

**On the call, we will:**

- Review demographic information from survey
- Review the panel's responses to the results of the survey and ask you to make final recommendations on the tasks and weightings for the content outline.

**The meeting will be:**
Wednesday, January 24, 7pm
Zoom Link: https://inteleos.zoom.us/j/92097499188?pwd=ejNiWDBiZW1mZ0k0UWUyRDI0Wngvdz09

**What to do before the meeting:**

- Review the two tabs of the attached spreadsheet:
    - Tasks to Review: This tab lists all of the tasks that were on the practice analysis survey.
        - Yellow highlighted tasks: There are two tasks that are highlighted. These came back lower in importance than the other tasks. Consider if they are worth keeping on the outline. Feel free to use the column labeled comments to write your thoughts out. We will discuss it on the call.
        - All tasks: Please review all the tasks one more time. We don't like to edit tasks too much after the survey, but if you see anything that needs to be edited, please also make a note and we will discuss it on the call.
    - Domain Weighting to Review: This tab shows the new domain weightings derived from analysis of the survey. We have also included the old domain weightings for your reference. These might change slightly if we remove tasks based on the conversation on the call.
- If all goes well, the final decisions for the tasks and the domain weightings will be made on the call, so we want as many panelists as possible to attend the call. If you cannot attend the call, please send your comments or questions to me prior to the call and we will make sure to include them in the discussion.

# Appendix H: Final Content Outline and KSAs

## Fetal Echocardiography Examination Content Outline
**(Outline Summary)**

| # | Domain | Subdomain | Percentage |
|---|---|---|---|
| **1.** | **Gather pertinent medical history prior to exam** | | **7%** |
| **2.** | **Anatomy and Physiology** | | **25%** |
| **3.** | **Perform the exam** | • Clinical care and safety<br>• Exam Techniques & measurements<br>• Assess fetal cardiac function and hemodynamics | **34%** |
| **4.** | **Evaluate pathology and pathophysiology** | • Assess abnormal physiology and perfusion<br>• Identify and assess congenital anomalies | **34%** |

**(Detailed Outline)**

| 1. | Gather pertinent medical history prior to exam 7% |
|---|---|
| 1.A.1. | Review referral information and clarify pertinent data and indications for exam (e.g., review genetic testing results, prior sonographic studies, risk factors) |
| 1.A.2. | Correlate known genetic syndromes and chromosomal anomalies with expected exam findings |
| 1.A.3. | Correlate history of maternal disease and drug exposure with expected exam findings (e.g., maternal congenital heart disease, lupus, diabetes, indomethacin use) |
| 1.A.4. | Correlate extracardiac anomalies with expected exam findings (e.g., CHARGE, VACTERL syndromes) |
| **2.** | **Anatomy and Physiology 25%** |
| 2.A.1. | Understand normal embryologic development (e.g., early chamber development, normal septal formation) |
| 2.A.2. | Identify fetal anatomic structures related to the abdomen/pelvis (e.g., inferior vena cava, ductus venosus, hepatic veins, stomach, bladder, spleen) |
| 2.A.3. | Identify fetal anatomic structures related to the chest/thorax (e.g., lungs, esophagus, trachea, thymus, diaphragm) |
| 2.A.4. | Distinguish anatomy of the tissues composing the heart (e.g., pericardium, myocardium) |
| 2.A.5. | Identify normal cardiac chamber morphology and position |
| 2.A.6. | Identify septa (e.g., atrial, ventricular, and arterial septa) |
| 2.A.7. | Identify normal atrioventricular and semilunar valve morphology |
| 2.A.8. | Identify systemic veins, and arteries |

| | |
|---|---|
| 2.A.9. | Identify outflows |
| 2.A.10. | Identify pulmonary veins and arteries |
| 2.A.11. | Identify aortic arch |
| 2.A.12. | Identify ductus arteriosus |
| 2.A.13. | Identify ductus venosus |
| 2.A.14. | Identify umbilical vein and arteries |
| 2.A.15. | Understand the fetal cardiac electrical conduction system (e.g., SA node, AV node) |
| **3.** | **Perform the exam** |
| **3.A.** | **Clinical care and safety** |
| 3.A.1 | Recognize and inform the supervising physician of fetal critical findings (e.g., sustained bradycardia/tachycardia, fetal demise, hydrops, anhydramnios) |
| 3.A.2 | Monitor and adjust exam based on maternal clinical symptoms (e.g. supine hypotensive disorder, severe headache, unrelenting vomiting) |
| **3.B** | **Exam Techniques & measurements** |
| 3.B.1 | Select transducer and console settings appropriate for the exam |
| 3.B.2 | Evaluate multiple gestations and associated cardiac complications (e.g., fetal position, number; twin-to-twin transfusion syndrome) |
| 3.B.3 | Determine visceral-atrial situs (e.g., Cordes and other methods) |
| 3.B.4 | Evaluate and obtain standard cardiac views |
| 3.B.5 | Evaluate and obtain standard views of great vessels (e.g., branch pulmonary arteries, systemic veins, pulmonary veins, aortic and ductal arches) |
| 3.B.6 | Determine orientation and relationship of the great vessels using standard cardiac views |
| 3.B.7 | Perform measurements of chamber size using two-dimensional and M-mode techniques |
| 3.B.8 | Perform measurements of cardiac valves and great vessels |
| 3.B.9 | Perform measurement of cardiothoracic (CT) ratio |
| 3.B.10 | Perform fetal biometric measurements (e.g., biparietal diameter [BPD], head circumference [HC], abdominal circumference [AC], femur length [FL]) |
| **3.C.** | **Assess fetal cardiac function and hemodynamics** |
| 3.C.1 | Assess ventricular function |
| 3.C.2 | Assess function of atrioventricular and semilunar valves using color and spectral Doppler (e.g., regurgitation, stenosis) |
| 3.C.3 | Assess fetal heart rate and rhythm using Doppler and M-mode |
| 3.C.4 | Use spectral and color Doppler to assess middle cerebral artery (MCA), umbilical arteries, umbilical vein, and ductus venosus |
| 3.C.5 | Use spectral and color Doppler to assess pulmonary and systemic veins |
| 3.C.6 | Use spectral and color Doppler to assess pulmonary and systemic arteries |
| 3.C.7 | Assess mechanical PR intervals |

| 4. | Evaluate pathology and pathophysiology 34% |
|---|---|
| **4.A.** | **Assess abnormal physiology and perfusion** |
| 4.A.1 | Recognize signs of fetal distress (e.g., abnormal fluid collections, cardiomegaly, hemodynamics) |
| 4.A.2 | Evaluate for the presence of fetal cardiomyopathies |
| 4.A.3 | Evaluate for the presence of fetal dysrhythmias |
| **4.B.** | **Identify and assess congenital anomalies** |
| 4.B.1 | Evaluate for abnormalities related to genetic syndromes (e.g., trisomy 21, Noonan, monosomy X, 22q11 deletion) |
| 4.B.2 | Evaluate for cardiac malpositioning |
| 4.B.3 | Identify and assess heterotaxy syndromes |
| 4.B.4 | Identify and assess cardiac septal defects |
| 4.B.5 | Identify and assess left-sided cardiac anomalies |
| 4.B.6 | Identify and assess right-sided cardiac anomalies |
| 4.B.7 | Identify and assess conotruncal anomalies |
| 4.B.8 | Identify and assess systemic venous anomalies |
| 4.B.9 | Identify and assess pulmonary venous anomalies |
| 4.B.10 | Identify and assess aortic arch anomalies |
| 4.B.11 | Identify and assess ductus arteriosus abnormalities |
| 4.B.12 | Identify and assess ductus venosus anomalies |
| 4.B.13 | Identify and assess congenital cardiac masses |
| 4.B.14 | Identify and assess cardiac changes with thoracic anomalies |
| 4.B.15 | Assess abnormal blood flow across cardiac valves and vessels |

| **Knowledge, Skills, and Abilities:**<br>*The following is a list of the foundational knowledge, skills, and abilities required to complete the tasks listed in the content outline.* |
|---|
| Ability to identify familial, maternal, and fetal risk factors prior to the exam and correlate with expected exam findings |
| Understand how to determine fetal position, situs, and cardiac axis |
| Knowledge of normal and abnormal fetal heart rate and rhythms and appropriate modalities to evaluate them |
| Knowledge of normal and abnormal waveforms across fetal cardiac valves and vessels |
| Understanding of fetal hemodynamics; knowledge of how abnormal hemodynamics affect the heart |
| Understanding of critical maternal and fetal clinical findings that require immediate attention during the performance of the exam |
| Knowledge of ultrasound system settings to optimize image quality and hemodynamic evaluation |
| Ability to identify and understand artifacts |
| Knowledge of genetic syndromes and chromosomal anomalies and their associated fetal cardiac findings |
| Knowledge of extracardiac anomalies and their associated cardiac findings |
| Ability to recognize and evaluate cardiac anomalies |
| Knowledge of how to obtain standard cardiac anatomic views and protocols for evaluating the fetal heart |
| Ability to perform standard measurements to determine normal vs abnormal cardiac structures and function |
| Knowledge of fetal embryology |
| Understand the fetal electrical conduction system |