
# Vascular Technology (VT)

## 2017-2018 Job Task Analysis Summary Report

May 2018

American Registry for Diagnostic Medical Sonography (ARDMS)

# Contents

# ACKNOWLEDGEMENTS

This study was completed through the work of many individuals at Inteleos, who worked together to construct the survey, administer the survey, and analyze the data. Eight subject matter experts also volunteered many hours to draft and review materials before and after the survey was administered. Thanks to the 1200+ ARDMS sonographer registrants around the nation and other countries who took the time and interest to participate in the job task survey.

# EXECUTIVE SUMMARY

The American Registry for Diagnostic Medical Sonography (ARDMS) is the globally recognized standard of excellence in sonography. ARDMS is responsible for the preparation of valid and reliable certification examinations in the field of sonography. Conducting job task analyses (JTAs) at the national and international levels facilitates ARDMS in evaluating the current practice expectations and performance requirements of the specialty. The 2017 Vascular Technology (VT) JTA was designed to collect information on the sonography-related work activities sonographer registrants perform in practice. The results of the JTA were used in updating the test content outline, which guides content distribution of the VT Examination. This report details the methodology, data collection and analysis, and survey results. It also includes the test content outline that resulted from the JTA.

# BACKGROUND OF STUDY

The American Registry for Diagnostic Medical Sonography (ARDMS) recognizes that diagnostic medical sonography is a valuable tool in the healthcare industry. There are several healthcare professions that are utilizing 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 medical sonography exams that these practitioners perform.

# METHODOLOGY

## Job Task Analysis Working Group

A JTA Working Group consisting of eight subject matter experts (SMEs) led this project. The eight JTA Working Group members were volunteers and some were members of the Assessment Committee.

## Survey Questionnaire Development

ARDMS contracted with *The Caviart Group*, a certification and testing consulting group, to facilitate a kick-off meeting. During this meeting that was conducted on June 22nd, 2017, the JTA Working Group developed the task list and demographic questions to include on the survey. Tasks and demographic questions from previous job task surveys were used as a starting point in this development. The JTA Working Group reached consensus on a list of 73 tasks to be used in the survey. The survey questionnaire was pilot-tested with the eight members from the JTA Working Group and six validation group members.

## Survey Process

### Survey Administration Procedure

The survey was made available to participants as a web-based survey through the survey platform Qualtrics®. An invitation to participate in the survey was sent via email to the prospective respondents.

ARDMS sent the JTA survey to 2,546 registrants credentialed since 2001. These registrants were selected randomly using a stratified sampling method so that the sample was representative of all ARDMS sonographer registrants in terms of specialty, gender, and geographic region. The survey was made available to the participants for two weeks between October 10th and October 24th, 2017. All responses made by the participants were kept confidential.

### Response Rates

A total of 1,350 (53% of those sampled) sonographers responded to the survey. Of these, 1,258 (93% of respondents) reported that they currently perform vascular technology sonography. The data analysis was based on the responses from the 1,258 sonographers currently performing vascular technology sonography.

### 2nd Mini JTA Survey

A second survey was sent out to participants through the survey platform Qualtrics® on February 9th, 2018 and remained open until February 23rd, 2018. The survey was sent to 390 individuals and consisted of two tasks that were not included in the original JTA survey. The ratings from these two tasks were aggregated with the original survey. Among the 186 surveys that were started (for a

response rate of 48%), 163 respondents stated that they currently performed Vascular Sonography, and of that group, 155 respondents rated both tasks that made up the body of the survey.

## Data Analysis

Respondents were asked the following questions for each task: 1) How frequently do newly certified vascular sonographers perform this task? and 2) How important is the task in affecting clinical decisions and patient outcomes? The frequency and importance rating scales were scored 1-5. The response options for the frequency scale were Never (1), Rarely (2), Occasionally (3), Often (4), and Always (5). The response options for the importance scale were Not Important (1), Somewhat Important (2), Important (3), Very Important (4), and Critically Important (5).

The frequency and importance rating scales were combined into a single measure of overall criticality (ranging from 0-16) using a hierarchical method in which values on the importance scale outweigh or outrank all values on the frequency scale, with the exception of 'Never' (see Table 1). Higher criticality values indicate the most critical tasks for a sonographer performing diagnostic medical sonography examinations. These criticality values were averaged for each task and rank ordered and reviewed by the JTA Working Group. In addition, the criticality values were summed within each domain. The sum of criticality for each domain is divided by the overall criticality score to determine the initial percentages of the examination content in each domain.

| Survey Response Options | | Overall Criticality Score |
|---|---|---|
| **Importance** | **Frequency** | |
| **Critically Important (5)** | Always (5) | 16 |
| | Often (4) | 15 |
| | Occasionally (3) | 14 |
| | Rarely (2) | 13 |
| **Very Important (4)** | Always (5) | 12 |
| | Often (4) | 11 |
| | Occasionally (3) | 10 |
| | Rarely (2) | 9 |
| **Important (3)** | Always (5) | 8 |
| | Often (4) | 7 |
| | Occasionally (3) | 6 |
| | Rarely (2) | 5 |
| **Somewhat Important (2)** | Always (5) | 4 |
| | Often (4) | 3 |
| | Occasionally (3) | 2 |
| | Rarely (2) | 1 |
| **Not Important (1)** | All options | 0 |
| **All options** | Never (1) | 0 |

Table 1: Construction of Overall Criticality Scale

# SURVEY RESULTS

## Demographics and Backgrounds of Participants

Of the 1,258 participants who were currently practicing vascular technology sonography, 1,095 completed the demographics portion of the JTA survey, and this section is based on those 1,095 participants.

### Gender

Approximately 84% of the respondents were female and 16% were male (Figure 1). One (1) respondent selected 'Other' and seven (7) declined to answer (see Figure 1).

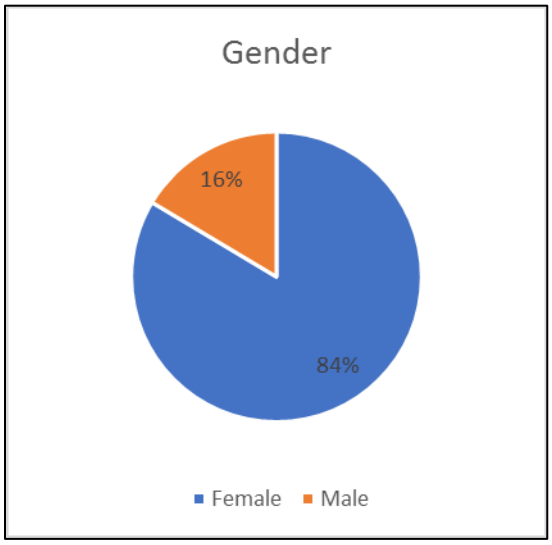


Figure 1

### Race and Ethnicity

Approximately 74% of respondents were white or Caucasian, 11% of respondents were Asian, 4% black or African American, 7% Hispanic or Latino, and 1% American Indian. Additionally, 3% of respondents marked "other" (see Figure 2). Less than 1% of respondents selected Native Hawaiian or Other Pacific Islander (not shown), and 2% of respondents selected more than one race/ethnicity.

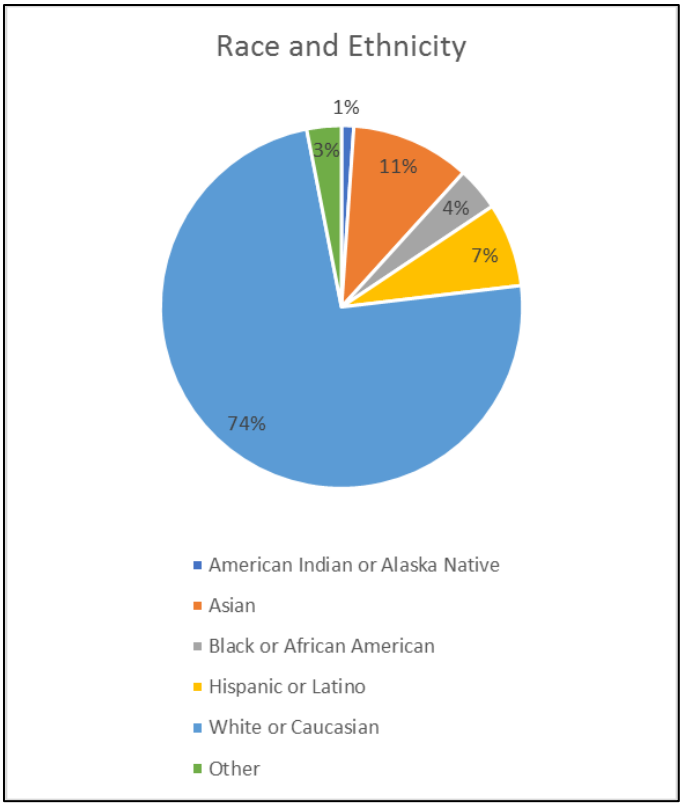


Figure 2

### Location of Practice

Of the respondents who reported the country in which they practice, 94% reported practicing in the United States and 3% in Canada, with the other 3% of respondents practicing in 19 other countries (see Table 2).

Table 2: Location of Practice

| Location of Practice | Count | Percent |
|---|---|---|
| United States of America | 1031 | 94% |
| Canada | 38 | 3% |
| Other | 30 | 3% |

Among US residents who provided the US state they practice in, over a third (37%) practiced in the southern region of the United States (as defined by the US Census Bureau), followed by the Midwest where 26% of US residents practiced (see Figure 3).

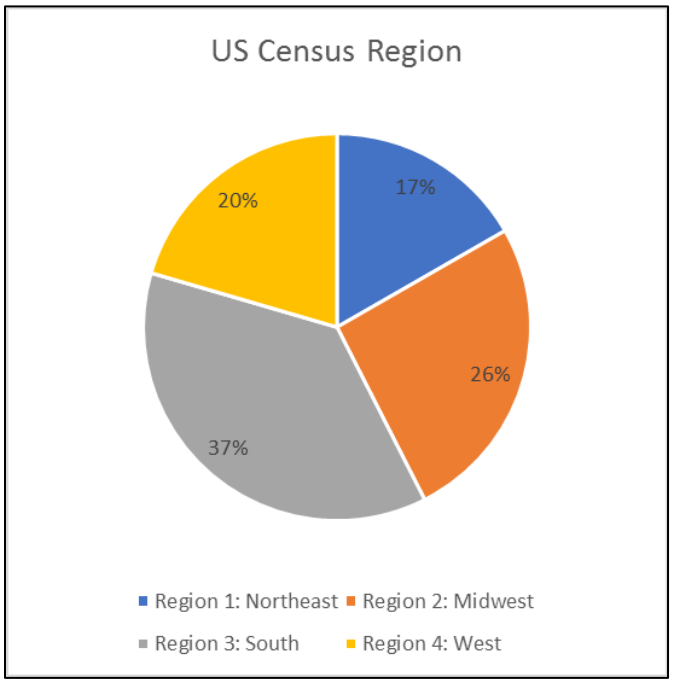


Figure 3

## Education

Approximately 41% of respondents had a Bachelor's degree and 41% had an Associate's degree as their highest level of education (see Figure 4). Within sonography-specific education, 45% of respondents had an Associate's degree and 32% of respondents had a certificate program as their highest level of education (see Figure 5).

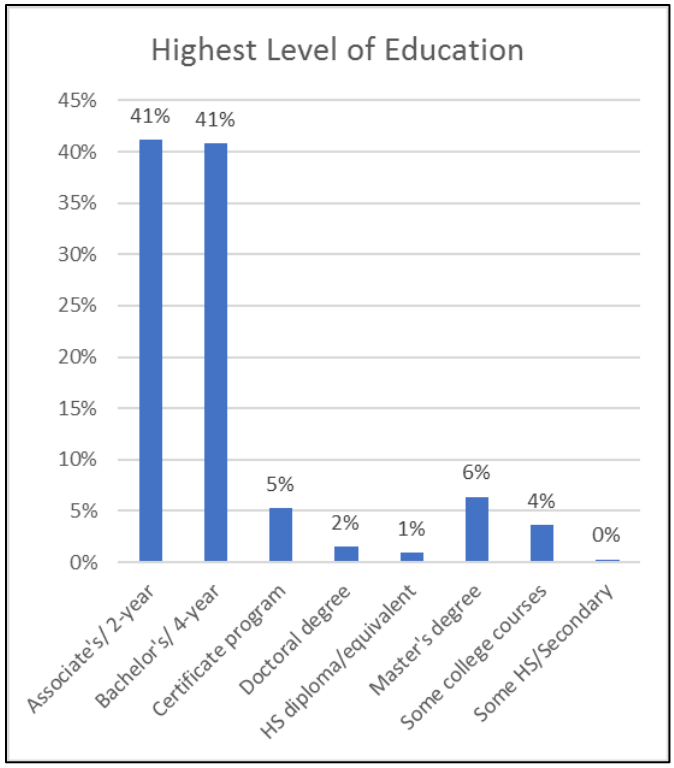


Figure 4

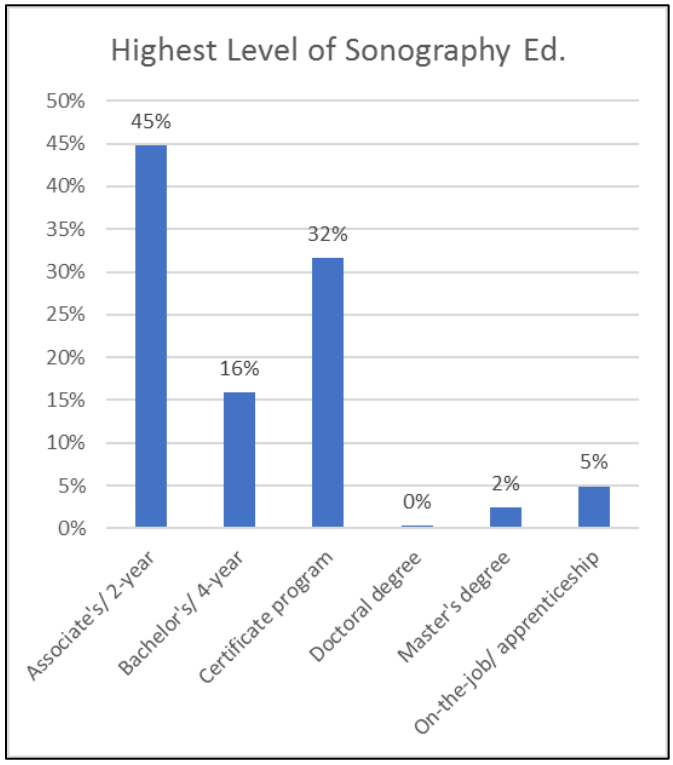


Figure 5

Almost all (94%) of respondents received the majority of their education in the United States, 3% in Canada, and the remaining 3% of respondents were educated in 17 other countries around the world (see Table 3).

**Table 3: Location of Education**

| Location of Education | Count | Percent |
|---|---|---|
| United States of America | 1030 | 94% |
| Canada | 38 | 3% |
| Other | 30 | 3% |

A little over half of respondents (55%) had opportunities to continue their education provided by their employers (see Figure 6).

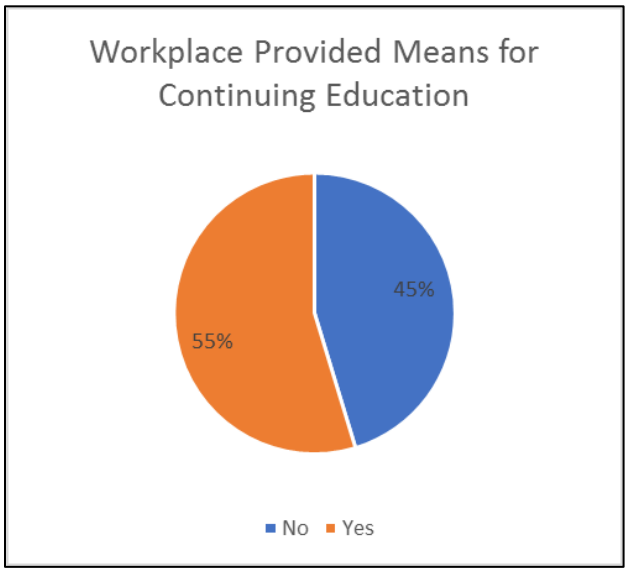


**Figure 6**

## Work Experience

Approximately 39% of respondents had been practicing sonography for 5 years or less, and 37% had been practicing for 6 to 10 years (see Figure 7).

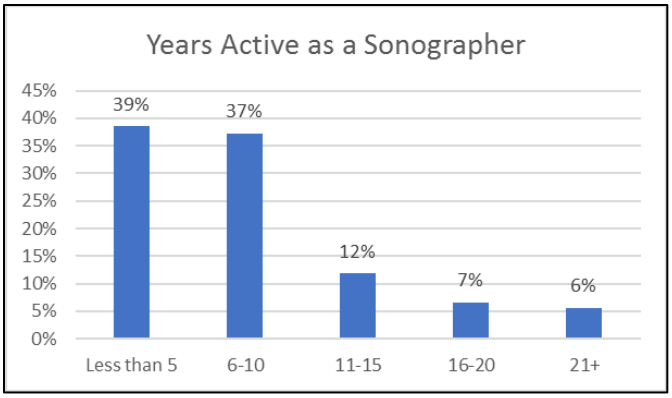


**Figure 7**

Around a third (31%) of respondents performed between 26 and 50 vascular exams each month, and about a quarter (24%) performed more than 100 vascular exams a month (see Figure 8).

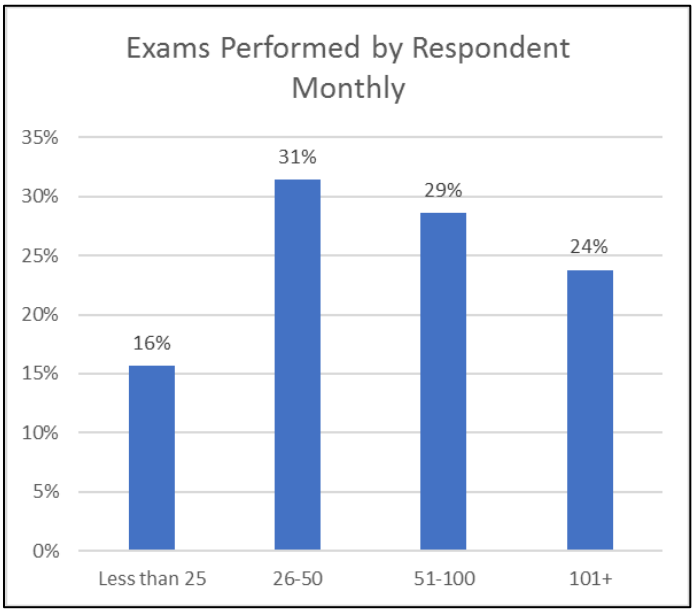


**Figure 8**

Seventeen percent (17%) of respondents reported that they were sonography educators (see Figure 9).

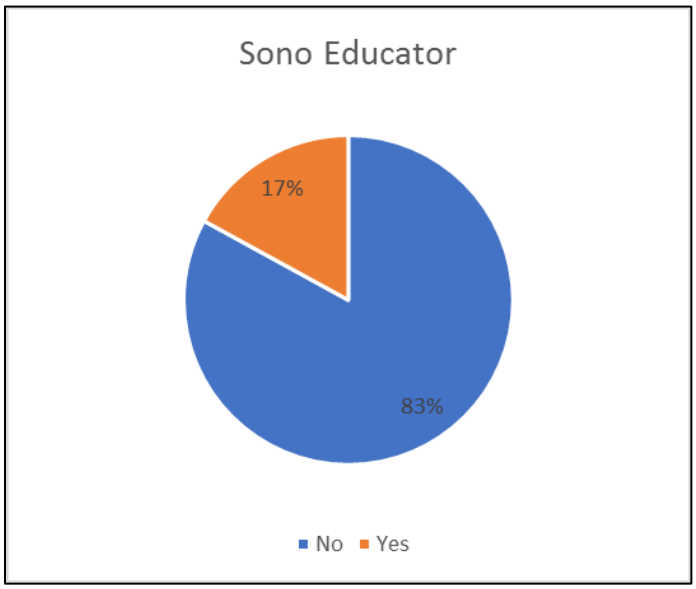


Figure 9

## Work Environment

The respondents were asked to indicate the type of environment in which they perform most of their sonographic examinations. The most common response (36%) was a non-university hospital (see Figure 10).

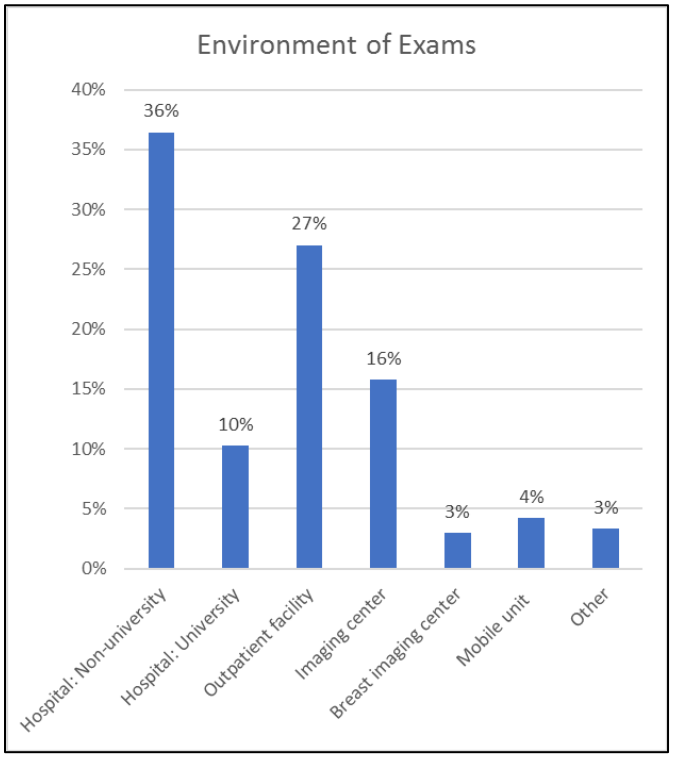


Figure 10

The most common number of sonographers in respondents' labs was less than 5 (42%) followed by 6 to 10 (31%) (see Figure 11).

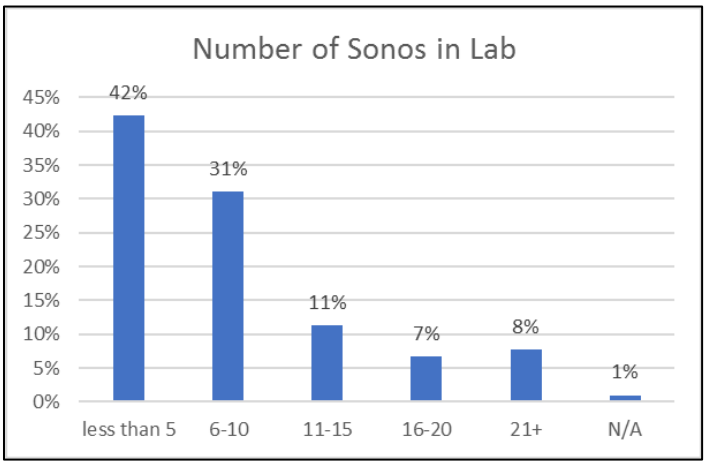


Figure 11

Respondents were asked how many vascular exams their lab performed each month, and 46% of respondents reported that their lab performed over 200 vascular exams per month (see Figure 12).

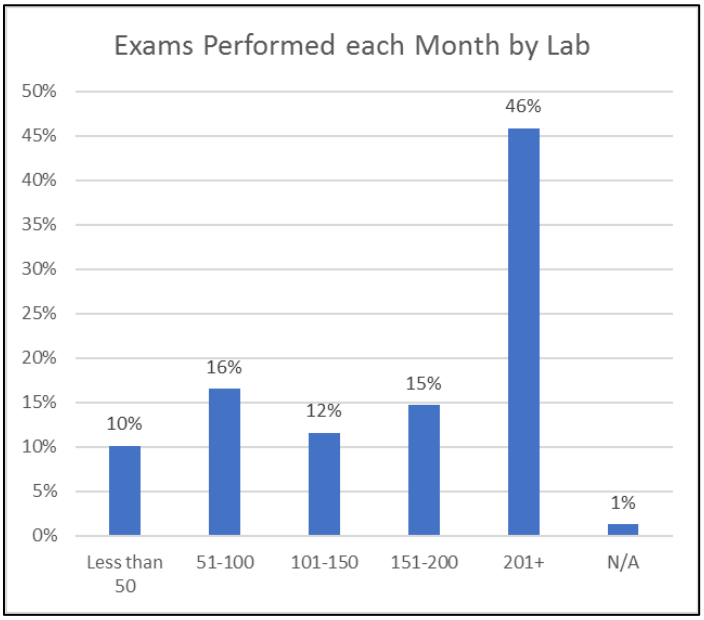


Figure 12

## Breakdown of Time

Respondents were asked to elaborate how their professional time is spent. A significant portion (195) responded that they spent 50% (±5%) of their time performing vascular ultrasound, and 154 respondents reported that they spent exactly 100% of their time performing vascular ultrasound. The mean percentage of time that respondents spent performing vascular ultrasound was 61%. 1027 respondents answered this question (Figure 13).

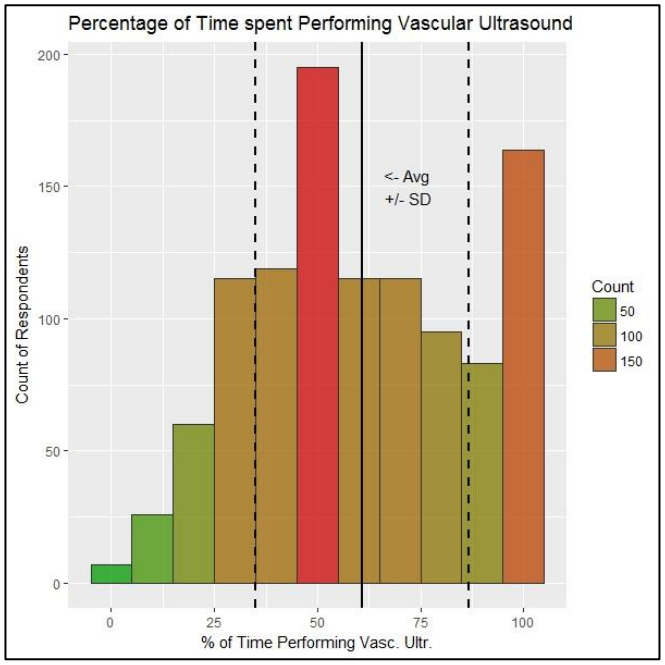


Figure 13

Respondents who reported that they were sonography educators were asked what percentage of time they spent as a sonography educator, and the most common response was 30% (±5%) with 41 respondents. The mean percentage of time respondents who were sonography educators spent as a sonography educator was 43%. 156 respondents answered this question and were only asked if they reported that they were a sonography educator (Figure 14)

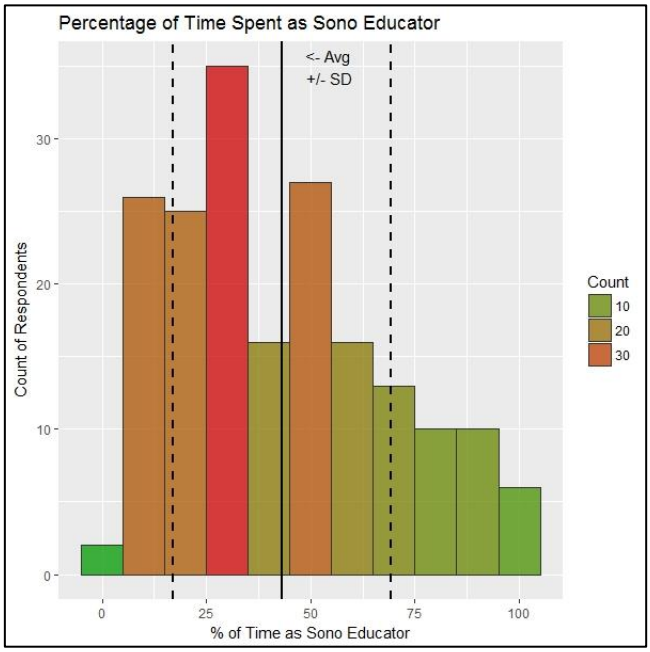


Figure 14

Respondents were asked the percentage of time they spent performing research, and the most common response was 0% with 205 respondents. More than half of the respondents (289 respondents) reported spending between 0% and 5% of their time performing research. The mean response was 14%. 552 respondents answered this question (Figure 14).

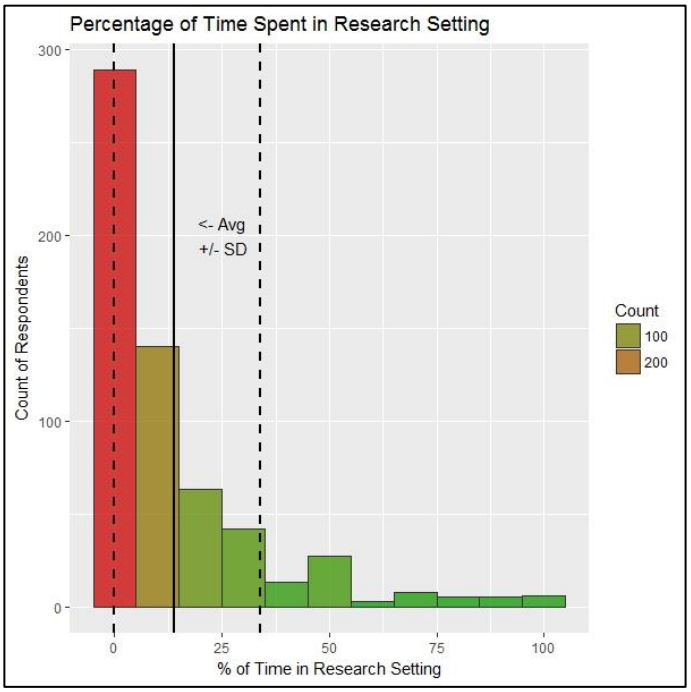

Figure 14

# Conclusion

When the survey concluded, Inteleos staff analyzed the results to determine criticality ratings of each of the task statements. These results were used to develop an initial list of tasks and domain weightings. This list was shared with the JTA Working Group via a Qualtrics® survey to allow JTA Working Group members to review and provide feedback prior to the "Discussion of Results" call.

## Discussion of Results

A call was held March 20, 2018 to discuss the survey results with the JTA Working Group. Seven of the eight members of the JTA Working Group and seven Inteleos staff members were in attendance. The call was facilitated by *The Caviart Group*. The overall frequency, importance, and criticality statistics were presented in rank order of criticality by domain and subdomain based on the survey data. Each task was reevaluated for inclusion in the final list based on the JTA Working Group's opinion and criticality scoring from the survey participants. The JTA Working Group decided to lower the number of tasks from 75 to 47, discarding tasks with low criticality ratings or other content issues and reducing redundant tasks.

The JTA Working Group also reviewed the preliminary content outline based on the data and the outline based on their task removals/combinations to decide what percentage of the examination should be in each domain. The JTA Working Group could deviate ±10% in each domain from the preliminary content outline based on the 47 tasks. Table 3 shows this process and the resulting domain weightings.

**Table 4: Content domain breakdown after the JTA Working Group review of survey results**

| Order | Domain | # Tasks | Criticality Sum | % of Total | Acceptable Range | Committee Recommendation |
|---|---|---|---|---|---|---|
| 1 | Normal Anatomy, Perfusion and Function | 12 | 95.13 | 20.39% | 18%-22% | 21 |
| 2 | Pathology, Perfusion and Function | 14 | 147.58 | 31.63% | 28%-35% | 32 |
| 3 | Surgically Altered Anatomy and Pathology | 3 | 29.44 | 6.31% | 6%-7% | 6 |
| 4 | Physiologic exams | 5 | 55.89 | 11.98% | 11%-13% | 12 |
| 5 | Ultrasound-guided Procedures/Intraoperative Assessment | 4 | 33.12 | 7.10% | 6%-8% | 7 |
| 6 | Physical Principles, Instrumentation, Quality Assurance, and Safety | 6 | 66.41 | 14.24% | 13%-16% | 14 |
| 7 | Preparation, Documentation and Communication | 3 | 38.96 | 8.35% | 8%-9% | 8 |
| | *Total* | *47* | *467* | *100%* | 100% | 100 |

## Final Approval by JTA Working Group

After the call, the JTA Working Group completed an approval survey (administered April 18-April 25, 2018). Some questions were raised, and minor edits proposed through the survey. The proposed edits were reviewed, clarified and minor edits were made. There were no changes made to the final tasks and domain weightings. The Chair of the JTA Working Group approved these changes on a call held on April 27, 2018. The ARDMS council voted and approved this content outline on June 24, 2018..

# Approved VT Content Outline

**(Outline Summary)**

| # | Domain | Subdomain | Percentage |
|---|---|---|---|
| **1** | **Normal Anatomy, Perfusion, and Function** | Evaluate normal anatomy, perfusion, function | **21%** |
| **2** | **Pathology, Perfusion, and Function** | Evaluate pathology, perfusion, and function | **32%** |
| **3** | **Surgically Altered Anatomy and Pathology** | Evaluate surgically altered anatomy and pathology | **6%** |
| **4** | **Physiologic Exams** | Perform physiologic arterial examinations<br>Perform physiologic venous examinations | **12%** |
| **5** | **Ultrasound-guided Procedures/Intraoperative Assessment** | Participate in ultrasound-guided procedures/intraoperative assessment | **7%** |
| **6** | **Quality Assurance, Safety, and Physical Principles** | Participate in quality assurance activities and monitor safety<br>Apply physical principles | **14%** |
| **7** | **Preparation, Documentation, and Communication** | Prepare for examination<br>Document and communicate findings | **8%** |

**(Detailed Outline)**

| 1. | Normal Anatomy, Perfusion, and Function | Knowledge and/or skill related to normal anatomy, perfusion, and function |
|---|---|---|
| **1.A.** | **Evaluate normal anatomy, perfusion, and function** | |
| 1.A.1. | Aortoiliac vasculature | Ability to assess vasculature<br>Ability to assess organs related to vasculature (liver, kidney, spleen, pancreas, gallbladder, thyroid, etc.)<br>Ability to recognize and apply proper scan technique in obtaining and documenting diagnostic images<br>Ability to recognize, evaluate, and document congenital anomalies<br>Ability to recognize and document normal vascular flow patterns using spectral, color, and power Doppler<br>Knowledge of hemodynamics as it relates to normal anatomy<br>Knowledge of sonographic appearance of anatomy, landmarks, and vascular structures |
| 1.A.2. | Upper extremity veins | |
| 1.A.3. | Lower extremity veins | |
| 1.A.4. | Native upper extremity arteries | |
| 1.A.5. | Native lower extremity arteries | |
| 1.A.6. | Mesenteric vasculature | |
| 1.A.7. | Renal vasculature | |
| 1.A.8. | Hepatoportal system | |
| 1.A.9. | Inferior vena cava and/or iliac veins | |
| 1.A.10. | Extracranial cerebrovascular system | |
| 1.A.11. | Intracranial cerebrovascular exams (transcranial Doppler (TCD) and transcranial imaging (TCI)) | |
| 1.A.12. | Vein mapping | |

| 2. | Pathology, Perfusion, and Function | Knowledge and/or skill related to pathology, perfusion, and function |
|---|---|---|
| **2.A.** | **Evaluate pathology, perfusion, and function** | |
| 2.A.1. | Aortoiliac disease (atherosclerosis, aneurysm, dissection, etc.) | Ability to assess abnormal vasculature<br>Ability to assess organs related to abnormal vasculature (liver, kidney, spleen, pancreas, gallbladder, thyroid, etc.)<br>Ability to identify pathology<br>Ability to identify anatomic variants<br>Ability to identify and communicate critical findings<br>Ability to recognize and document abnormal vascular flow patterns using spectral, color, and power Doppler<br>Ability to recognize and apply proper scan technique in evaluating and documenting pathology<br>Ability to identify and document incidental findings<br>Knowledge of pathophysiology of vascular disease<br>Knowledge of hemodynamics as it relates to pathology<br>Knowledge of sonographic appearance of abnormal anatomy and vascular structures |
| 2.A.2. | Venous insufficiency | |
| 2.A.3. | Upper extremity venous disease (thrombosis, thoracic outlet syndrome, extrinsic compression, etc.) | |
| 2.A.4. | Lower extremity venous disease (thrombosis, extrinsic compression, etc.) | |
| 2.A.5. | Native upper extremity artery disease (atherosclerosis, aneurysm, dissection, thoracic outlet syndrome, etc.) | |
| 2.A.6. | Native lower extremity artery disease (atherosclerosis, aneurysm, dissection, extrinsic compression, etc.) | |
| 2.A.7. | Mesenteric vasculature disease (atherosclerosis, aneurysm, dissection, thrombosis, extrinsic compression, etc.) | |
| 2.A.8. | Renal vasculature disease (atherosclerosis, aneurysm, dissection, thrombosis, extrinsic compression, fibromuscular dysplasia, etc.) | |
| 2.A.9. | Hepatoportal system disease (thrombosis, Budd-Chiari syndrome, portal hypertension, etc.) | |
| 2.A.10. | Inferior vena cava and/or iliac vein disease (thrombosis, extrinsic compression, etc.) | |
| 2.A.11. | Extracranial cerebrovascular disease | |
| 2.A.12. | Intracranial cerebrovascular disease (TCD and TCI) (for stroke, for vasospasm, agitated saline for patent foramen ovale (PFO), for intraoperative emboli monitoring, etc.) | |
| 2.A.13. | Incidental findings (thyroid mass, Baker cyst, carotid body tumor, etc.) | |
| 2.A.14. | Critical findings (aneurysm, acute deep vein thrombosis, critical stenosis, etc.) | |
| **3.** | **Surgically Altered Anatomy and Pathology** | **Knowledge and/or skill related to surgically altered anatomy and pathology** |
| **3.A.** | **Evaluate surgically altered anatomy and pathology** | |
| 3.A.1. | Dialysis access | |

| | | |
|---|---|---|
| 3.A.2. | Post intervention (endovascular aneurysm repair (EVAR), inferior vena cava (IVC) filter, venous ablation, bypass grafts, transjugular intrahepatic portosystemic shunt (TIPS), stents, etc.) | Ability to evaluate post-procedural vasculature (after EVAR, IVC filter, venous ablation, bypass grafts, TIPS, stents, etc.)<br>Knowledge of sonographic appearance of surgically altered anatomy/vasculature |
| 3.A.3. | Transplanted organs | Knowledge of hemodynamics as it related to surgically altered anatomy and pathology<br>Knowledge of common causes of failure/rejection of surgically altered anatomy/vasculature<br>Knowledge of surgical procedures related to dialysis access, bypass grafts, stents, organ transplants, venous ablation, etc.<br>Ability to understand an operative report and its impact on sonographic appearance and technique |
| **4.** | **Physiologic Examinations** | **Knowledge and/or skill related to physiologic examinations** |
| **4.A.** | **Perform physiologic arterial examinations** | |
| 4.A.1. | Manually calculate pressure indices (ankle-brachial index (ABI), segmental pressures, etc.) | Ability to evaluate effects of limb size and cuff diameter<br>Knowledge of provocative/exercise maneuvers and their effect on circulation |
| 4.A.2. | Obtain appropriate diagnostic waveforms/pressures with and without provocative/exercise maneuvers | |
| 4.A.3. | Select the appropriate instrumentation (photoplethysmography (PPG) sensors, cuffs, presets, protocols, etc.) | |
| **4.B.** | **Perform physiologic venous examinations** | |
| 4.B.1. | Obtain appropriate venous photoplethysmography (PPG) diagnostic waveforms (with and without tourniquets; plantar flexion and dorsiflexion) | Ability to optimize recordings<br>Ability to evaluate effects of tourniquet on hemodynamics<br>Knowledge of placement of venous PPG sensors and tourniquets<br>Knowledge of effects of tourniquet on hemodynamics |
| 4.B.2. | Select the appropriate venous photoplethysmography (PPG) instrumentation (sensors, presets, protocols, etc.) | |
| **5.** | **Ultrasound-guided Procedures/Intraoperative Assessment** | **Knowledge and/or skill related to ultrasound-guided procedures/intraoperative assessment** |
| **5.A.** | **Participate in ultrasound-guided procedures/intraoperative assessment** | |
| 5.A.1. | Participate in manual compression of pseudoaneurysms | Ability to provide guidance during a procedure<br>Knowledge of appropriate procedural imaging: pre-procedure, during procedure, and post-procedure<br>Knowledge of contraindications to a procedure<br>Knowledge of expected post-procedural findings/potential complications<br>Knowledge of instrumentation and its appropriate use<br>Knowledge of sonographer's role during procedure<br>Knowledge of procedure protocol and required resources |
| 5.A.2. | Provide guidance for thrombin injections of pseudoaneurysms | |
| 5.A.3. | Provide guidance for venous ablation procedures | |
| 5.A.4. | Obtain appropriate post-procedural diagnostic images | |

| 6. | Quality Assurance, Safety, and Physical Principles | Knowledge and/or skill related to quality assurance, safety, and physical principles |
|---|---|---|
| **6.A.** | **Participate in quality assurance activities and monitor safety** | |
| 6.A.1. | Assess the appropriateness of the exam (per indications, by applying Appropriate Use Criteria, etc.) | Ability to provide appropriate patient care<br>Ability to apply Appropriate Use Criteria<br>Ability to correlate vascular exam findings with other imaging modalities<br>Ability to utilize appropriate exam protocols<br>Knowledge of exam protocols<br>Knowledge of implications of various laboratory values<br>Knowledge of other imaging modalities (MRI, CT, conventional angiography, etc.)<br>Knowledge of scanning techniques and patient/sonographer positioning<br>Knowledge of contraindications to a vascular exam |
| 6.A.2. | Compare exam findings to correlative studies | |
| 6.A.3. | Collaborate regarding exam protocols (including discussions, optional images, modifications, timing, and diagnostic criteria) | |
| 6.A.4. | Monitor patient condition (including safety and comfort) | |
| **6.B.** | **Apply physical principles** | |
| 6.B.1. | Identify artifacts related to vascular imaging, and document and/or modify the exam as needed | Ability to adjust study to minimize artifacts<br>Knowledge of artifacts, their causes, and their implications on the study |
| 6.B.2. | Calculate, perform, and analyze resistive indices and acceleration times | |
| **7.** | **Preparation, Documentation, and Communication** | **Knowledge and/or skill related to preparation, documentation, and communication** |
| **7.A.** | **Prepare for examination** | |
| 7.A.1. | Adapt the exam to clinical setting and patient condition (patient position, physical environment, medications, etc.) | Ability to obtain and evaluate patient history<br>Ability to correlate information from various types of imaging studies<br>Ability to establish rapport and interview patient<br>Ability to interpret and follow patient identification protocols<br>Ability to synthesize information from various sources in the patient's medical history<br>Ability to select correct instrumentation based on protocol and patient body habitus<br>Ability to modify exam based on patient condition and body habitus<br>Knowledge of appropriate preparations for the test<br>Knowledge of implications of patient position, physical environment, and patient condition on vascular exams (hydrostatic pressure, etc.)<br>Knowledge of signs and symptoms pertaining to the vascular exam<br>Knowledge of potential effects of patient medications on exam<br>Knowledge of appropriate indications and contraindications for vascular exams |
| 7.A.2. | Review and confirm patient information (patient identity, clinical history, previous imaging studies, lab findings, interventions, etc.), and communicate exam process to patient | |
| **7.B.** | **Document and communicate findings** | |

| | | |
|---|---|---|
| 7.B.1. | Document preliminary impression/findings and technical limitations, and verify images are appropriately archived for interpretation | Ability to utilize resources, such as physicians, literature, or peers<br>Ability to modify exam based on real-time findings<br>Ability to communicate professionally with patient and provider<br>Ability to document preliminary impression/findings and technical limitations<br>Ability to verify that exam is properly archived<br>Knowledge of technical limitations of vascular exams<br>Knowledge of protocol for critical findings notification |