ARDMS
An Inteleos Community

Pediatric Sonography

Practice Analysis Detailed Report (2021)

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 692 Pediatric Sonography registrants 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 and our partner Joy Lopez at JML Measurement.

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 Pediatric Sonography (PS) practice analysis collected information on the requisite knowledge, skills, and abilities essential to pediatric sonography professionals. The practice analysis kicked-off with a workshop held in June 2020. A survey of the task inventory developed by the workshop panel was sent to the 2001 registrants holding the RDMS credential with a PS specialty at that time. The practice analysis survey was administered May 20 – June 24, 2021. The analysis and discussion of results by the PS Assessment Committee led to the recommended content outline found in Appendix H. This report details the methodology, data collection, analysis, and the recommended updated test content outline for the PS 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 provide sonographers with an additional source of validation. This supports the veracity of the diagnostic medical sonography exams that these practitioners perform. The PS examination assesses the knowledge, skills and abilities in the areas of the head, spine, chest, hips/joints and the male and female genitourinary system of the pediatric patient.

METHODOLOGY

Practice Analysis Workshop Panel

The practice analysis workshop panel consisted of seven subject matter experts (SMEs). The seven panel members were volunteers, and some were members of the PS Assessment Committee (see Appendix A). The panel was chosen to be representative of the practice to the extent possible and all panel members were registrants holding a current PS specialty (see Appendix B).

DACUM Workshop

Inteleos used a consultant, Joy Mattews-Lopez (JML Measurement, LLC) to facilitate the DACUM workshop. Materials were sent out to panelists ahead of the workshop to orient the group to the process and gather initial feedback regarding tasks, behaviors, tools, knowledge, skills, future trends and acronyms that are necessary in the role of a pediatric sonographer (see Appendix C for the Pre-Workshop Activity). The facilitator combined all of the input from the meeting attendees for review at the workshop.

Panel members attended a remote DACUM workshop via Zoom on June 13th and June 20th, 2020. The agenda for the workshop can be found in Appendix D. DACUM is an acronym for developing a curriculum. The process provides a picture of what a practitioner does in terms of duties, tasks, knowledge, skills, and traits. Although originally designed to develop professional training and education, the DACUM process has been used successfully by certification organizations to provide the foundation for a practice analysis (Center on Education and Training for Employment, 2021).

The facilitator provided an orientation on the DACUM process. Next, the group reviewed some of the pre-workshop activity responses and drafted the major duties of the job. The facilitator worked with the group to develop a list of tasks that comprise the practice of Pediatric Sonographer. The group also identified knowledge, skills, abilities, behaviors, tools, future trends, concerns and acronyms that apply Pediatric Sonography. Appendix E contains the report compiled by the facilitator detailing the outcomes of the DACUM workshop.

Field Survey

Field Survey Development

Working with members of the PS Assessment Committee, Inteleos staff made minor edits to the preliminary task inventory developed at the DACUM workshop. The inventory was compared with the existing content outline to verify that no topics were inadvertently omitted. The final task inventory was approved by the PS Assessment Committee and used to build the practice analysis survey.

Field Survey Structure, Instructions and Scale

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 pediatric sonography responded to the survey: "*Do you currently perform and/or teach **Pediatric** ultrasound examinations?*" Participants who selected "No" were thanked for their time and their survey ended.

For the task inventory portion of the field survey, participants were asked to rate each task on an importance scale. The instructions for this section were:

> *In the next section of the survey, you will be examining tasks associated with being a **Pediatric** Sonographer, and consider the following question:*
>
> ***How important** is this task to the practice of Pediatric Sonography…*
>
> - *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 2,001 RDMS registrants who were certified in PS. The survey was open from May 20 – June 21, 2021. The survey was available to participants as a web-based survey through the survey platform Qualtrics®. All responses to the survey were kept confidential. 692 individuals completed the task inventory portion of the survey (35% response rate). Responses from participants who did not complete the task inventory were not used as part of the data analysis.

RESULTS

Data Analysis

Task Inventory Analysis

Each option for the 70 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 F). Tasks were assigned to three categories to assist in the discussion of importance scores. The following instructions were provided to the committee:

- **Green:** Any task with an importance score of four or above. The committee was instructed that 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. Seven tasks fell into the "yellow" category and there were no "red" category tasks.

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 Committee Call)

Domain	# Tasks	Sum Importance	Initial weightings
Anatomy and Physiology	14	61.86	20%
Congenital Variants Pathology and Physiology	35	151.98	49%
Data and Protocols	10	46.48	15%
Physics and Instrumentation	4	18.69	6%
Treatment and Emerging Technologies	7	31.32	10%
Total	*70*	*310.33*	*100%*

Demographic Analysis

Responses to demographic questions were also analyzed. Appendix G contains highlights from the demographic analysis. The analysis shows the survey respondents are representative across the dimensions of gender identification, location, age, and average years since earning original RDMS certification. The demographic analysis also provided information regarding years practice setting and years practicing pediatric ultrasound examinations.

Discussion of Results

A Zoom conference call was held on August 23, 2021 with five members of the PS Assessment Committee and members of Inteleos staff. Prior to the call, the results of the data analysis and initial content outline weightings were shared with the assessment committee. During the call, the attendees reviewed the tasks and mean importance score, focusing on the seven tasks with importance scores less than four. The committee recommended removing two tasks. The committee suggested some minor changes to the wording of tasks. All edits, comments, rationales, and decisions from the committee can be found in Appendix F.

The committee considered the importance weightings, the current content outline, and the item bank depth to arrive at a final recommendation for domain weightings (Table 2).

Table 2. Final Committee Recommended Domain Weightings

Domain	# Tasks	Committee Recommendations for Domain Weightings
Anatomy and Physiology	14	26%
Congenital Variants Pathology and Physiology	34	45%
Data and Protocols	10	19%
Physics and Instrumentation	3	5%
Treatment and Emerging Technologies	7	5%
Total	**68**	**100%**

FINAL CONTENT OUTLINE APPROVAL

Staff conducted a final review and added examples, clarified some language, and re-ordered one section (edits are recorded in Appendix F). The revised content outline was provided to the PS Assessment Committee for final review and approval. This report, including the final version of the content outline recommended by the Assessment Committee (Appendix H) will be sent to the ARDMS Council for approval. Upon approval of the content outline, this report will be amended to include the approval date.

UPDATE: 10/4/2021

Resolution 21408: Pediatric Sonography (PS) Practice Analysis and Content Outline Update was approved by the ARDMS Council on September 30th, 2021. The resolution states: “The ARDMS Council approves the new content outline for the Pediatric Sonography Examination. The new content outline will be applied to the spring 2022 form build.”

Reference:

DACUM international Training Center. Center on Education and Training for Employment. (2021, September 13). Retrieved September 15, 2021, from https://cete.osu.edu/programs/dacum-international-training-center/.

Appendix A: Practice Workshop Attendees

Participants	
Sara Baker, Lead Sonographer University of Wisconsin Hospital and Clinics American Family Children's Hospital Madison, WI	Ashley Olguin, Sonographer CHOC Children's Hospital Orange, CA
Amanda Grice, Operations Manager for Ultrasound Boston Children's Hospital Boston, MA	Monique Riemann, Research Sonographer Phoenix Children's Hospital Phoenix, AZ
Helen Maplesden, Lead Sonographer Inova Children's Hospital Falls Church, VA	Maya Sanders, Lead Sonographer Children's Mercy Hospitals and Clinics Kansas City, MO
	Megan Tafavoti, Lead Sonographer The Children's Hospital at OU Medical Center Oklahoma City, OK

Facilitator
Joy L. Matthews-Lopez, PhD JML Measurement & Testing Services, LLC

Observers	
Sarah Pelter Director of Inteleos Psychometric Services	Benjamin Andrews, PhD Senior Psychometrician Inteleos
Christine Damar Exam Clinical Specialist, Inteleos	Xiaonan Zhang Data Analyst, Inteleos
Belinda Brunner Director of Testing, Inteleos	Liesel Tavenner, Sonographer Exam Program Manager, Inteleos

Appendix B: Practice Workshop Panel Demographics

Table 3. Gender Identification of Population and Panel

Gender	Percent in population	Panel	Percent of Panel
Female	91%	8	100%
Male	9%	0	0%
Total	**100%**	**8**	**100%**

Table 4. Geography Represented within in Population and Panel

Location	Percent in population	Panel	Percent of Panel
U.S. Midwest	25.4%	2	28.6%
Northeast	13.8%	1	14.3%
South	31.7%	3	42.9%
West	27.3%	1	14.3%
International/Other	1.8%	0	0.0%
Total	**100.0%**	**7**	**100.0%**

Appendix C: Pre-workshop Activity

Please complete all parts of this worksheet. When you are done and have saved your file, please email it Sarah Pelter (sarah.pelter@inteleos.org) **Monday, June 8, 2020.** This information will be used during the upcoming Pediatric Sonographer workshop.

Whole Job Brainstorming Exercise

The purpose of this exercise is to think about and articulate what you do on the job. There are tasks that you perform prior to working with a patient, during a patient encounter, as well as things to you after the patient leaves your care. In addition, there may be tasks that you perform on an on-going basis that don't involve direct care, such as engaging in professional development activities, staying current on evidence-based literature, or working to maintain your credentials.

Please think through what you do in a given day- a given week- a given month- a given year, or on an on-going basis. In the spaces provided below, please type 3-4 tasks that you perform in each category. If you can't think of anything to write in a particular category, it is OK to instead write an additional task in a different category.

If I were to follow you around and observe you at work, **what would I see you do**?

List 3-4 tasks that you perform on any given day.

1. Task 1:
2. Task 2:
3. Task 3:
4. Task 4:

List 3-4 tasks that you perform on a weekly basis.

1. Task 1:
2. Task 2:
3. Task 3:
4. Task 4:

List 3-4 tasks that you perform on a monthly basis.

1. Task 1:
2. Task 2:
3. Task 3:
4. Task 4:

List 3-4 tasks that you perform on an on-going basis.

1. Task 1:
2. Task 2:
3. Task 3:
4. Task 4:

Behaviors

What behaviors are reasonable to expect of a Pediatric Sonographer? Example of behaviors

may include being professional, courteous, accurate, self-disciplined, and sensitive. Please list 5 typical behaviors of a competent Pediatric Sonographer:

Tools, Equipment, Supplies, and Materials

Please list some tools, equipment, supplies, and/or materials that a Pediatric Sonographer needs to conduct their job or perform the tasks we have identified. Examples may include transducers, blood pressure cuff/kits, ultrasound video equipment, or an ultrasound monitor.
Please list some of the most important or commonly used tools/equipment/supplies/materials needed by a Pediatric Sonographer:

General Knowledge

Please list anything that a Pediatric Sonographer would need to KNOW in order to conduct their job or perform the tasks we have identified. For example, are there content areas that a Pediatric Sonographer needs to be knowledgeable in, such as laws of physics or techniques needed to diagnose or treat certain diseases or injuries? Functional knowledge of human anatomy? Knowledge of certain drugs or pharmaceuticals? Knowledge of medical codes or coding?
Please list 5-7 common or typical things that a Pediatric Sonographer should KNOW or know about:

Skills/Abilities

What skills must a Pediatric Sonographer possess? Example skills or abilities may include critical thinking, reading comprehension, oral communication, or time management.
Please list 5-7 common or typical skills/abilities that a Pediatric Sonographer should possess:

Future Trends and/or Concerns

What do you think the job of a Pediatric Sonographer will look like in 5 years? 10 years? Will different knowledge, skills or abilities be needed to conduct the job? Will different tools or equipment be needed?
Please list 5 trends or emerging issues that might affect how a Pediatric Sonographer conducts their job in the future.

Are you concerned about anything that may impact the current or future role of a Pediatric Sonographer? **If so, please indicate it here:**

Acronyms

List any acronyms that a Pediatric Sonographer would routinely use or need to know to safely and adequately conduct their job. Please write out what each acronym means. For example: ALERA = As Low As Reasonably Achievable

Appendix D: DACUM Workshop Agenda

DACUM Workshop Agenda: Pediatric Sonography (PS)

Virtual Meeting

June 13 and 20, 2020

DAY 1: Saturday, June 13

(All times are Eastern)	
10:00 a.m.	Welcome and Introductions
	Orientation to the DACUM Process
11:15	Brainstorming the Job*
	Develop Organizational Chart
12:00 p.m.	Identify the Major Duties
1:00	BREAK (2 hours)
3:00	Identify the Tasks
5:30	Adjourn

DAY 2: Saturday, June 20

(All times are Eastern)	
10:00 a.m.	Resume Identifying Tasks
1:00 p.m.	BREAK (2 hours)
3:00	Resume and Complete Identifying Tasks
4:30	Develop lists*: General Knowledge and Skills; Worker Behaviors; Tools, Equipment, Supplies and Materials; Future Trends and Concerns; Glossary of Acronyms
5:00	Conduct DACUM Chart Refinement and Sequencing
5:30	Conclusion of DACUM Workshop

*Refer to your pre-workshop assignments

Appendix E: DACUM Workshop Report

DACUM Research Chart for Pediatric Sonography (PS)

DACUM Panel

Sara Baker
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Helen Maplesden
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Ashley Olguin
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Monique Riemann
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Phoenix Children's Hospital
Phoenix, AZ

Maya Sanders
Lead Sonographer
Children's Mercy Hospitals and Clinics
Kansas City, MO

Megan Tafovoti
Lead Sonographer
The Children's Hospital at OU Medical Center
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Remote DACUM Workshop
June 13 & June 20, 2020

DACUM Facilitator
Joy L. Matthews-López, PhD

Observers
Sarah Pelter, Director of Inteleos Psychometric Services
Christine Demar, Exam Clinical Specialist, Inteleos
Liesel Tavenner, Exam Program Manager, Inteleos

DACUM Research Chart for

Duties	Tasks			
A Perform Pre- and Post-Scanning Activities	Verify appropriateness of ultrasound order	Communicate examination preparation requirements (e.g., fasting, bladder filling)	Review pertinent patient medical records (e.g., prior imaging, labs, report)	Select proper transducer
B Apply Clinical Standards and Protocols	Perform sonographic examinations	Modify imaging protocols based on clinical history and/or sonographic findings (e.g. premature, critically ill, or uncooperative patients)	Assess patient signs and symptoms for the designated examination	Utilize multiple patient positions to evaluate anatomy
C Evaluate Anatomy and Physiology	Evaluate anatomy of the brain and skull	Evaluate anatomy of the spine	Evaluate anatomy of the gastrointestinal systems (e.g., liver, spleen, pancreas, bowel)	Evaluate anatomy of the genitourinary system (e.g., scrotum, kidneys, adrenal gland, bladder, uterus, ovaries)
	Evaluate intracranial vascular anatomy	Evaluate transplants		
D Identify Congenital Variants, Pathology, & Pathophysiology	Identify congenital intracranial abnormalities	Identify neurocutaneous syndromes (e.g., tuberous sclerosis, Von Hippel-Lindau, Struge-Weber)	Identify hydrocephalus or ventriculomegaly	Identify findings of hypoxic-ischemic results in preterm and term infants
	Evaluate peritoneal cavity (e.g., ascites and abscess)	Evaluate retroperitoneum for masses (e.g., lymphadenopathy)	Evaluate for congenital renal abnormalities (e.g., horseshoe, duplication anomalies, cystic diseases)	Evaluate for acquired renal abnormalities (e.g., obstruction, infection, masses)
	Evaluate the glands and soft tissues (e.g., infection, lymph nodes, masses)	Evaluate superficial structures (e.g., foreign bodies, infections, masses)	Evaluate hernias	Evaluate the hip for developmental dysplasia
	Evaluate transplant complications (e.g., thrombus, stenosis)	Evaluate vessels and intravascular lines for abnormalities (e.g., thrombosis, stenosis, and pseudoaneurysm)	Identify abnormalities due to traumatic events	

June 13 & 20, 2020

Duties →

A	**Perform Pre- and Post-Scanning Activities**	Verify patient identifiers	Obtain pertinent clinical patient history	Communicate ultrasound examination process (e.g. pressure and position requirements, pediatric-specific language)	Communicate sonographic findings to radiologist	Perform low-level disinfection techniques	Perform high-level disinfection techniques (e.g., Trophon, Cidex)	
B	**Apply Clinical Standards and Protocols**	Utilize appropriate acoustic windows and scan planes	Obtain measurements of structures	Obtain Doppler velocities and measurements	Select appropriate examination techniques (e.g. M-mode, B-mode, Doppler, harmonic imaging)	Adjust console settings to optimize images	Provide ultrasound guidance during interventional procedures (e.g., sterile techniques)	Utilize emerging technologies (e.g., elastography, contrast)
C	**Evaluate Anatomy and Physiology**	Evaluate anatomy of the chest (e.g., pleural space, lung, thymus)	Evaluate anatomy of superficial structures	Evaluate anatomy of the neck	Evaluate musculoskeletal anatomy (e.g., hips and joints)	Identify normal age-specific changes	Evaluate peripheral vascular anatomy	Evaluate abdominal vascular anatomy
D	**Identify Congenital Variants, Pathology, & Pathophysiology**	Evaluate intracranial hemorrhage, infection, and masses	Identify spinal malformations	Evaluate for splenic abnormalities (e.g., polysplenia, infection, masses)	Evaluate for pancreatic abnormalities (e.g., cystic fibrosis, pancreatitis, and lesions)	Evaluate for stomach and intestinal abnormalities (e.g., appendicitis, pyloric stenosis)	Evaluate for hepatobiliary disease (e.g., infection, obstruction, disease, lesions)	Evaluate adrenal glands for masses and hemorrhage
		Evaluate for ureter and bladder abnormalities (e.g., ureterocele, urachal anomalies)	Evaluate male genital tract for abnormalities (e.g., hydroceles, cryptorchidism, torsion)	Evaluate female genital tract for abnormalities (e.g., hematometrocolpos, torsion, masses)	Evaluate chest abnormalities (e.g., pleural effusion and masses)	Evaluate diaphragmatic paralysis (M-mode) and congenital hernia	Evaluate the neck for abnormalities (e.g., vascular and nonvascular lesions)	Evaluate for thyroid abnormalities
		Evaluate joint effusion in hips or other joints	Evaluate tendons and synovium (e.g., tenosynovitis, synovial hypertrophy)	Evaluate for post-procedure changes	Identify findings related to sickle cell disease	Identify peripheral vascular malformations	Identify abdominal vascular malformations	Identify intracranial vascular malformations

General Knowledge	Abilities and Skills
Anatomical changes due to surgery	Ability to accept constructive criticism
Common lab values (benchmarks)	Ability to distract or calm a pediatric patient and/or parent/guardian
Common pediatric anomalies and variants	Ability to empathize (with patients and parents/guardians)
Common pediatric conditions (e.g., Beckwith Wiedermann, hemihypertrophy)	Ability to focus
Common pediatric malignancies (e.g., Wilm's, neuroblastoma)	Ability to interpret images
Examination preparation requirements (e.g., fasting, bladder filling)	Ability to know limitations
Human anatomy	Ability to multi-task
Imaging protocols in the premature or critically ill patient	Ability to read body language
Knowledge of current protocols and measurements	Ability to read demeaner
Pathology of the human body	Ability to take charge of a room or situation
Pathophysiology of the human body	Ability to work efficiently
Physics of ultrasound	Ability to work with both hands
Physiology of the human body	Ability to advocate for patients
Positioning protocols	Critical thinking skills
	Eye-hand coordination skills
	Reading comprehension skills
	Strong attention to detail
	Time management skills
	Verbal communication skills

Behaviors

Accurate
Adaptable
Agreeable
Ambidextrous
Calm
Compassionate
Confident
Conscientious
Creative
Curious
Patient
Detail-oriented
Diligent
Driven
Efficient
Empathetic
Flexible
Focused
Good bedside manner
Honest
Humble
Inquisitive
Kind
Knowledgeable
Open-minded
Organized
Perfectionist
Professional
Prudent
Self-aware
Sensitive
Tolerant

Tools, Equipment, Supplies and Materials

Acoustic gel
Additional staff (e.g., helping hands)
Bed/furniture
Biopsy supplies
Books (for patients)
Child Life Services
Disinfectant wipes
Distraction toys (e.g., spinners, crib soothers)
Electrolyte solutions
Electronics (e.g., iPad, DVD player with movies, TV with cartoon channels)
Hand sanitizer
Linens
PACS system
Patient chart
Personal protective equipment (PPE)
Probe covers
Snooz-ellen (light projector)
Sterile gel (e.g., for open wounds)
Sweet-ease & pacifiers
Thick gel (e.g., for cranial examinations)
Transducers
Ultrasound machine
Warm blankets

Future Trends and Concerns

Emerging technology (e.g., elastography, contrast)
Fast growth rate of ultrasound profession
Healthcare reform
Increased use of musculoskeletal ultrasound
Increasing trend to use ultrasound in pediatric patients
Infection prevention methods for neonates
Legal/Privacy issues (e.g., chaperone for testicular or breast exams)
Level of education for entry into the profession (e.g., BS requirement)
Maintaining privacy in the era of social media
Methods to reduce work-related musculoskeletal injuries (e.g., ergonomics)
Pandemic readiness
Shortage of qualified pediatric sonographers (and radiologists)
State licensure
Using simulations for training or professional development

Acronyms

AAA	Abdominal aortic aneurysm
Abx	Antibiotics
ACA	Anterior cerebral artery
ALARA	As low as reasonably achievable
AO	Aorta
Beta hCG	Beta human chorionic gonadotropin
BMT	Bone marrow transplant
Bx	Biopsy
CBD	Common bile duct
CC	Corpus callosum
CCA	Common carotid artery
C-DIFF	Clostridium difficile colitis
CEUS	Contrast-enhanced ultrasound
CHD	Congenital heart defect
CKD	Chronic kidney disease
CM	Centimeter
CRL	Crown rump length
CSP	Cavum septum pellucidum
CT	Computerized tomography
CVA	Costovertebral angle
CVA	Cerebrovascular accident
DDx	Differential diagnosis
DOB	Date of birth
DVT	Deep venous thrombosis
DWM	Dandy-Walker malformation
ECA	External carotid artery
ECMO	Extracorporeal membrane oxygenation
ED	Emergency department
EDV	End diastolic velocity
F/U	Follow up
FF	Free fluid
FHR	Fetal heart rate
FN	From nipple
FNA	Fine needle aspiration
FNH	Focal nodular hyperplasia
GA	Gestational age
GB	Gallbladder
GBS	Group B streptococcus
GSD	Gestational sac diameter
H/O	History of
Hct	Hematocrit
Hgb	Hemoglobin
HLD	High-level disinfection
HPS	Hypertrophic pyloric stenosis
HV	Hepatic vein
ICA	Internal carotid artery
IFTT	Isolated fallopian tube torsion
IMA	Inferior mesenteric artery
IUD	Intrauterine contraceptive device
IV	Intravenous (e.g., in reference to a line)
IVC	Inferior vena cava
IVH	Intraventricular hemorrhage
IVUS	Intravascular ultrasound
LFTs	Liver function tests
LHA	Left hepatic artery
LLD	Left lateral decubitus
LLD	Low-level disinfection
LLQ	Left lower quadrant
LMP	Last menstrual period
LN	Lymph node
LRA	Left renal artery
LUQ	Left upper quadrant
MCA	Middle cerebral artery
MCDK	Multicystic dysplastic kidney
MDR	Multi-drug resistant
ML	Midline
MM	Millimeter
MRI	Magnetic resonance imaging
MRSA	Methicillin-resistant staphylococcus aureus
MVP	Main portal vein
NEC	Necrotizing enterocolitis
OV	Ovary
PCA	Posterior cerebral artery
PCKD	Polycystic kidney disease
PCOS	Polycystic ovarian syndrome
PE	Pleural effusion
PE	Pulmonary embolism
PHA	Proper hepatic artery
PID	Pelvic inflammatory disease
Plt	Platelet count
PMA	Post-menstrual age
PMH	Past medical history
PMT	Point of maximal tenderness
POD	Post-operative day
PPE	Personal protective equipment
PSV	Peak systolic velocity
PUI	Person under investigation
PUV	Posterior urethral valves
R/O	Rule out
RAS	Renal artery stenosis
RHA	Right hepatic artery
RLD	Right lateral decubitus
RLQ	Right lower quadrant
RRA	Right renal artery
RUQ	Right upper quadrant

Acronyms, continued

SMA	Superior mesenteric artery
SMV	Superior mesenteric vein
TX	Transplant
UA	Urinalysis
US	Ultrasound
UT	Uterus
VACTERL	Vertebral defects, Anal atresia, Cardiac defects, Tracheoesophageal fistula, Renal anomalies, and Limb abnormalities
VATER	Vertebral defects, Anal atresia, Tracheoesophageal fistula, and Renal anomalies
VCUG	Voiding cystourethrogram
VP shunt	Ventricular peritoneal shunt
VRE	Vancomycin-resistant enterococcus
VUR	Vesico urethral reflux
WBC	White blood cell count
WNL	Within normal limits
YS	Yolk sac

Appendix F: Task Inventory, Importance Score and Committee Decision

The mean importance rating for each task can be found in Column B. 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 tasks that fall into this category). In general, all "green" tasks are kept, and "red" tasks are removed. The committee's decisions to keep or remove the task are recorded in Column D. The rationale for removing tasks are recorded in Column E.

Red text indicates changes made after final call with committee. The Exam Clinical Specialist also suggested re-ordering the Congenital Variants Pathology & Pathophysiology Domain. The final outline (Appendix H) represents that structure. The committee reviewed and approved these final edits via e-mail.

Task Text	Importance	Committee Decision (Keep?)	Notes
Anatomy and Physiology			
Normal Anatomy			
Evaluate anatomy of the neonatal brain and skull	4.88	Yes	
Evaluate anatomy of the neck and head (e.g., parotid glands, submandibular glands, thyroid)	4.21	Yes	
Evaluate anatomy of the chest (e.g., pleural space, lung, thymus, diaphragm)	3.99	Yes	
Evaluate anatomy of the gastrointestinal tract (e.g., esophagus, pylorus, stomach, bowel, appendix)	4.86	Yes	
Evaluate anatomy of abdominal organs (e.g., liver, gallbladder, biliary tract, adrenal glands, pancreas, spleen)	4.77	Yes	
Evaluate anatomy of genitourinary system (e.g., kidneys, ~~adrenal gland~~, bladder, uterus, ovaries, scrotum)	4.84	Yes	
Evaluate musculoskeletal anatomy (e.g., hips and joints)	4.23	Yes	
Evaluate anatomy of superficial structures (e.g., ~~thyroid~~, breast, abdominal wall, soft tissue)	4.05	Yes	
Evaluate anatomy of the neonatal spine	4.70	Yes	
Developmental changes			
Identify normal age-specific changes	4.48	Yes	
Perfusion and function			
Evaluate peripheral vascular anatomy	3.92	Yes	
Evaluate abdominal vascular anatomy	4.35	Yes	
Evaluate intracranial vascular anatomy	4.22	Yes	
Evaluate transplants	4.37	Yes	
Congenital Variants Pathology & Pathophysiology			
Neonatal Brain			

Evaluate for congenital intracranial abnormalities (e.g., Dandy-Walker malformation, holoprosencephaly, callosal agenesis)	4.66	Yes	
Evaluate for neurocutaneous syndromes (e.g., tuberous sclerosis, Von Hippel-Lindau, Sturge-Weber)	4.14	Yes	
Evaluate for hydrocephalus/ventriculomegaly	4.83	Yes	
Evaluate for findings of hypoxic-ischemic insults in preterm and term infants	4.67	Yes	
Evaluate for intracranial hemorrhage, infection, and masses	4.87	Yes	
Evaluate for findings related to sickle cell disease	4.15	Yes	
Head and Neck			
Evaluate for neck abnormalities ~~(e.g., vascular and nonvascular lesions)~~ (e.g., thyroglossal duct cyst, brachial cleft cyst, fibromatosis colli)	4.12	Yes	
Evaluate for thyroid abnormalities ~~(e.g., Hashimotos, Graves disease, etc.)~~ (e.g., goiter, nodules, masses, enlargement)	3.89	Yes	
Chest			
Evaluate for chest abnormalities (e.g., pleural effusion, sequestration, congenital pulmonary airway malformation, masses)	4.07	Yes	
Evaluate for congenital diaphragmatic hernia and diaphragmatic paralysis (M-mode)	4.09	Yes	
Hepatobiliary			
Evaluate for hepatobiliary disease (e.g., infection, obstruction, parenchymal liver disease, ~~benign and malignant lesions~~ biliary atresia, hepatoblastoma)	4.64	Yes	
Spleen and Peritoneal Cavity			
Evaluate for splenic abnormalities (e.g., polysplenia, infection, masses)	4.23	Yes	
Evaluate for peritoneal cavity abnomalities (e.g., ascites and abscess)	4.30	Yes	
Gastrointestinal			
Evaluate for ~~stomach and intestinal~~ gastrointestinal abnormalities (e.g., appendicitis, volvulus, pyloric stenosis, necrotizing enterocolitis, intussusception, masses)	4.88	Yes	
Genitourinary System			
Evaluate for congenital renal abnormalities (e.g., horseshoe, duplication anomalies, cystic diseases)	4.66	Yes	
Evaluate for acquired renal abnormalities (e.g., obstruction, infection, masses)	4.68	Yes	
Evaluate for ureter and bladder abnormalities (e.g., infection, ureterocele, urachal anomalies, obstruction, vesicoureteral reflux, masses)	4.65	Yes	
Evaluate female genital tract for abnormalities (e.g., hematometrocolpos, torsion, masses)	4.69	Yes	
Evaluate male genital tract for abnormalities (e.g., hydroceles, cryptorchidism, torsion)	4.75	Yes	
Adrenal Glands, ~~and~~ Pancreas, and Retroperitoneum			

Evaluate adrenal glands for abnormalities (e.g., neuroblastoma, hyperplasia, hemorrhage, etc.)	4.37	Yes	
Evaluate for pancreatic abnormalities (e.g., cystic fibrosis, pancreatitis, ~~traumatic injury,~~ congenital anomalies, fatty replacement)	4.06	Yes	
Evaluate retroperitoneum for masses (e.g., lymphadenopathy)	4.19	Yes	
Musculoskeletal, Superficial Structures and Hernias			
Evaluate the hip for developmental dysplasia	4.64	Yes	
Evaluate for joint effusion in hips or other joints	4.41	Yes	
Evaluate tendons and synovium for abnormalities (e.g., tenosynovitis, synovial hypertrophy)	3.51	Yes	
Evaluate superficial structures for abnormalities (e.g., foreign bodies, infections, and masses)	4.08	Yes	
Evaluate glands and soft tissues for abnormalities (e.g., infection, lymph nodes, masses)	4.23	Yes	
Evaluate for hernias (e.g., direct, indirect, inguinal)	4.10	Yes	
Neonatal Spine			
Evaluate for spinal malformations (e.g., tethered cord, myelomeningocele, caudal regression)	4.72	Yes	
Vascular and Transplants			
Evaluate for peripheral vascular malformations	3.93	Yes	
Evaluate for abdominal vascular malformations	4.14	Yes	
Evaluate for intracranial vascular malformations	4.27	Yes	
Evaluate vessels and intravascular lines for abnormalities (i.e., thrombosis, pseudoaneurysm, and stenosis)	4.24	Yes	
Evaluate transjugular intrahepatic portosystemic shunt (TIPS)	3.77	No	AC felt that TIPS is rarely performed with Children
Evaluate transplant complications (e.g., thrombus, stenosis)	4.33	Yes	
Data and Protocols			
Outside data (Clinical assessment, history and physical [H&P], lab values)			
Verify appropriateness of the order and obtain pertinent clinical history from the patient and/ or medical records (including previous imaging)	4.79	Yes	
Assess relevant patient signs and symptoms for examination being performed	4.66	Yes	
Explain examination requirements to patient (positioning, gel application, transducer pressure)	4.64	Yes	
Clinical Standards and guidelines			
Communicate examination preparation requirements (e.g., fasting, bladder filling)	4.58	Yes	
Modify imaging protocols based on clinical history and/or sonographic findings (e.g., premature, critically ill, or uncooperative patients)	4.64	Yes	
Utilize multiple patient positions	4.55	Yes	
Utilize appropriate acoustic windows and scanning planes	4.69	Yes	

Communicate ultrasound findings and relevant patient information to ~~interpreting pratctioner~~ healthcare provider	4.52	Yes	
Measurement techniques			
Obtain appropriate measurements	4.78	Yes	
Obtain Doppler velocities and measurements	4.62	Yes	
Physics and Instrumentation			
Imaging instruments			
Select appropriate examination techniques (e.g., M-mode, B-mode, Doppler, harmonic imaging)	4.67	Yes	
Select proper transducer	4.79	No	AC felt this task is covered sufficiently in SPI and not necessary for Pediatric exam
Adjust console settings to optimize images (e.g., depth settings, artifact recognition, artifact correction when appropriate)	4.71	Yes	
Apply ALARA principle (e.g., thermal index, mechanical index)	4.51	Yes	
Treatment and Emerging Technology			
Managing medical emergencies and traumatic injury			
Recognize findings that require immediate attention	4.92	Yes	
Evaluate for abnormalities due to traumatic events	4.68	Yes	
Interventional procedures			
Assist/support ultrasound guidance during interventional procedures	4.15	Yes	
Evaluate for post-procedure changes	4.34	Yes	
Disinfection			
Maintain infection control (e.g., low-level disinfection techniques, high-level disinfection techniques, sterile techniques)	4.76	Yes	
~~Perform high-level disinfection techniques (e.g., Trophon, Cidex, etc.)~~	~~4.62~~	~~Yes~~	Remove. AC decided (after call) that this task was subsumed under "Maintain infection control"
Emerging Technology			
Recognize emerging technology applications (e.g., elastography, contrast, etc.)	3.86	Yes	

Appendix G: Demographics of Survey Respondents

Table 5. Gender Identification in Population and Survey Participants

Gender	Percent in population	Percent of Survey Participants
Female	91%	92%
Male	9%	8%
Total	**100%**	**100%**

Table 6. Average and Average Years of Experience* in Population and Survey Participants

Column1	Population	Survey Participants
Average Age	40	41.2
Average Years of Experience	11	12.2

* Average Years of Experience refers to the number of years since they first earned their RDMS Certification (any specialty)

Table 7. Geography Represented within in Population and Survey Participants

Location	Percent in population	Percent of Survey Participants
U.S. Midwest	25.4%	26%
Northeast	13.8%	16%
South	31.7%	32%
West	27.3%	23%
International/Other	1.8%	3%
Total	**100.0%**	**100.0%**

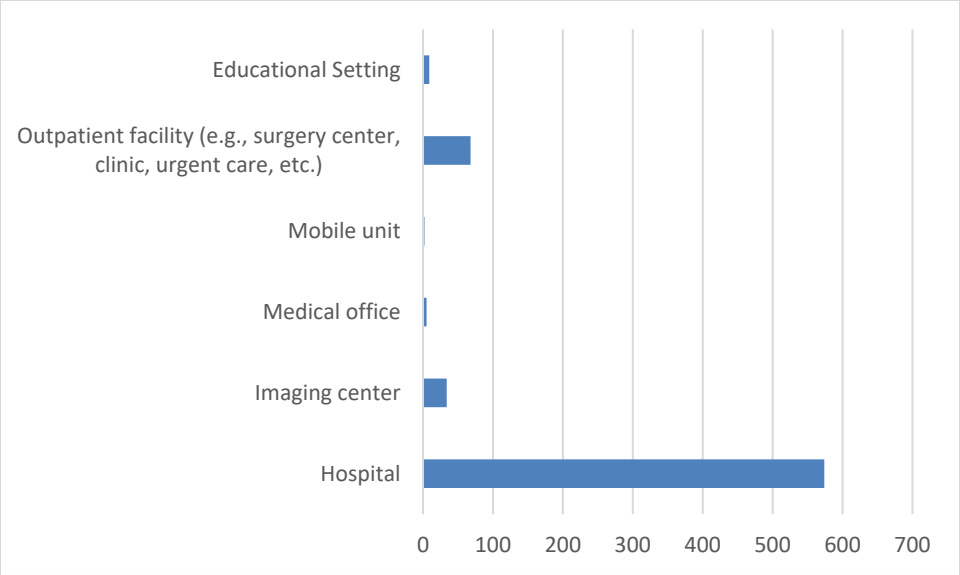

Figure 1. Survey Participant Results - In which type of facility do you perform most of your Pediatric ultrasound examinations?

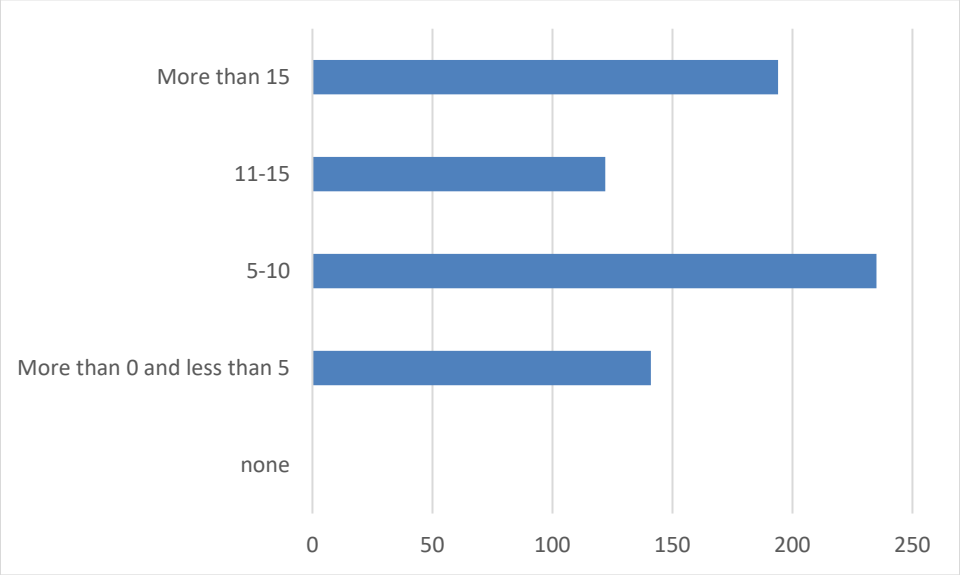

Figure 2. Survey Participant Results - How many years have you been performing Pediatric ultrasound examinations?

Appendix H: Content Outline

Pediatric Sonography Examination Content Outline
(Outline Summary)

#	Domain	Subdomain	Percentage
1	**Anatomy and Physiology**	Normal Anatomy Developmental Changes Perfusion and Function	**26%**
2	**Congenital Variants, Pathology, and Pathophysiology**	Neonatal Brain | Head and Neck | Chest Gastrointestinal | Hepatobiliary Adrenal Glands, Pancreas, and Retroperitoneum Spleen and Peritoneal Cavity | Genitourinary System Musculoskeletal, Superficial Structures, and Hernias Neonatal Spine | Vascular and Transplants	**45%**
3	**Data and Protocols**	Outside Data (clinical assessment, history and physical [H&P], lab values) Clinical Standards and Guidelines Measurement Techniques	**19%**
4	**Physics and Instrumentation**	Imaging Instruments	**5%**
5	**Treatment and Emerging Technologies**	Managing Medical Emergencies and Traumatic Injury Interventional Procedures Disinfection Emerging Technology	**5%**

(Detailed Outline)

1.	**Anatomy and Physiology 26%**
1.A.	***Normal Anatomy***
1.A.1.	Evaluate anatomy of the neonatal brain and skull
1.A.2.	Evaluate anatomy of the neck and head (e.g., parotid glands, submandibular glands, thyroid)
1.A.3.	Evaluate anatomy of the chest (e.g., pleural space, lung, thymus, diaphragm)
1.A.4.	Evaluate anatomy of the gastrointestinal tract (e.g., esophagus, pylorus, stomach, bowel, appendix)
1.A.5.	Evaluate anatomy of abdominal organs (e.g., liver, gallbladder, biliary tract, adrenal glands, pancreas, spleen)
1.A.6.	Evaluate anatomy of genitourinary system (e.g., kidneys, bladder, uterus, ovaries, scrotum)
1.A.7.	Evaluate musculoskeletal anatomy (e.g., hips, joints)
1.A.8.	Evaluate anatomy of superficial structures (e.g., breast, abdominal wall, soft tissue)
1.A.9.	Evaluate anatomy of the neonatal spine
1.B.	***Developmental Changes***
1.B.1.	Identify normal age-specific changes
1.C.	***Perfusion and Function***
1.C.1.	Evaluate peripheral vascular anatomy
1.C.2.	Evaluate abdominal vascular anatomy
1.C.3.	Evaluate intracranial vascular anatomy
1.C.4.	Evaluate transplants
2.	**Congenital Variants Pathology & Pathophysiology 45%**
2.A.	***Neonatal Brain***
2.A.1.	Evaluate for congenital intracranial abnormalities (e.g., Dandy-Walker malformation, holoprosencephaly, callosal agenesis)
2.A.2.	Evaluate for neurocutaneous syndromes (e.g., tuberous sclerosis, Von Hippel-Lindau, Sturge-Weber)
2.A.3.	Evaluate for hydrocephalus/ventriculomegaly
2.A.4.	Evaluate for findings of hypoxic-ischemic insults in preterm and term infants
2.A.5.	Evaluate for intracranial hemorrhage, infection, and masses
2.A.6.	Evaluate for findings related to sickle cell disease
2.B.	***Head and Neck***
2.B.1.	Evaluate for neck abnormalities (e.g., thyroglossal duct cyst, brachial cleft cyst, fibromatosis colli)
2.B.2.	Evaluate for thyroid abnormalities (e.g., goiter, nodules, masses, enlargement)
2.C.	***Chest***
2.C.1.	Evaluate for chest abnormalities (e.g., pleural effusion, sequestration, congenital pulmonary

	airway malformation, masses)
2.C.2.	Evaluate for congenital diaphragmatic hernia and diaphragmatic paralysis (M-mode)
2.D.	***Gastrointestinal***
2.D.1.	Evaluate for gastrointestinal abnormalities (e.g., appendicitis, volvulus, pyloric stenosis, necrotizing enterocolitis, intussusception, masses)
2.E.	***Hepatobiliary***
2.E.1.	Evaluate for hepatobiliary disease (e.g., infection, obstruction, parenchymal liver disease, biliary atresia, hepatoblastoma)
2.F.	***Adrenal Glands, Pancreas, and Retroperitoneum***
2.F.1.	Evaluate adrenal glands for abnormalities (e.g., neuroblastoma, hyperplasia, hemorrhage)
2.F.2.	Evaluate for pancreatic abnormalities (e.g., pancreatitis, cystic fibrosis, congenital anomalies, fatty replacement)
2.F.3.	Evaluate retroperitoneum for masses (e.g., lymphadenopathy)
2.G.	***Spleen and Peritoneal Cavity***
2.G.1.	Evaluate for splenic abnormalities (e.g., polysplenia, infection, masses)
2.G.2.	Evaluate for peritoneal cavity abnormalities (e.g., ascites, abscess)
2.H.	***Genitourinary System***
2.H.1.	Evaluate for congenital renal abnormalities (e.g., horseshoe, duplication anomalies, cystic diseases)
2.H.2.	Evaluate for acquired renal abnormalities (e.g., obstruction, infection, masses)
2.H.3.	Evaluate for ureter and bladder abnormalities (e.g., infection, ureterocele, urachal anomalies, obstruction, vesicoureteral reflux, masses)
2.H.4.	Evaluate female genital tract for abnormalities (e.g., hematometrocolpos, torsion, masses)
2.H.5.	Evaluate male genital tract for abnormalities (e.g., infection, hydroceles, cryptorchidism, torsion)
2.I.	***Musculoskeletal, Superficial Structures, and Hernias***
2.I.1.	Evaluate the hip for developmental dysplasia
2.I.2.	Evaluate for joint effusion in hips or other joints
2.I.3.	Evaluate tendons and synovium for abnormalities (e.g., tenosynovitis, synovial hypertrophy)
2.I.4.	Evaluate superficial structures for abnormalities (e.g., foreign bodies, infections, masses)
2.I.5.	Evaluate glands and soft tissues for abnormalities (e.g., infection, lymph nodes, masses)
2.I.6.	Evaluate for hernias (e.g., direct, indirect, inguinal)
2.J.	***Neonatal Spine***
2.J.1	Evaluate for spinal malformations (e.g., tethered cord, myelomeningocele, caudal regression)
2.K.	***Vascular and Transplants***
2.K.1.	Evaluate for peripheral vascular malformations
2.K.2.	Evaluate for abdominal vascular malformations
2.K.3.	Evaluate for intracranial vascular malformations

2.K.4.	Evaluate vessels and intravascular lines for abnormalities (e.g., thrombosis, pseudoaneurysm, and stenosis)
2.K.5.	Evaluate transplant complications (e.g., thrombus, stenosis)

3.	**Data and Protocols 19%**
3.A.	***Outside Data (clinical assessment, history and physical [H&P], lab values)***
3.A.1.	Verify appropriateness of the order and obtain pertinent clinical history from the patient and/ or medical records (including previous imaging)
3.A.2.	Assess relevant patient signs and symptoms for examination being performed
3.A.3.	Explain examination requirements to patient (positioning, gel application, transducer pressure)
3.B.	***Clinical Standards and Guidelines***
3.B.1.	Communicate examination preparation requirements (e.g., fasting, bladder filling)
3.B.2.	Modify imaging protocols based on clinical history and/or sonographic findings (e.g., premature, critically ill, uncooperative patients)
3.B.3.	Utilize multiple patient positions
3.B.4.	Utilize appropriate acoustic windows and scanning planes
3.B.5.	Communicate ultrasound findings and relevant patient information to interpreting healthcare provider
3.C.	***Measurement Techniques***
3.C.1.	Obtain appropriate measurements
3.C.2.	Obtain Doppler velocities and measurements
4.	**Physics and Instrumentation 5%**
4.A.	***Imaging Instruments***
4.A.1.	Select appropriate examination techniques (e.g., M-mode, B-mode, Doppler, harmonic imaging)
4.A.2.	Adjust console settings to optimize images (e.g., depth settings, artifact recognition, artifact correction when appropriate)
4.A.3.	Apply as low as reasonably achievable (ALARA) principle (e.g., thermal index, mechanical index)
5.	**Treatment and Emerging Technology 5%**
5.A.	***Managing Medical Emergencies and Traumatic Injury***
5.A.1.	Recognize findings that require immediate attention
5.A.2.	Evaluate for abnormalities due to traumatic events
5.B.	***Interventional Procedures***
5.B.1.	Assist/support ultrasound guidance during interventional procedures
5.B.2.	Evaluate for post-procedure changes
5.C.	***Disinfection***
5.C.1.	Maintain infection control (e.g., low-level disinfection techniques, high-level disinfection

	techniques, sterile techniques)
5.D.	***Emerging Technology***
5.D.1.	Recognize emerging technology applications (e.g., elastography, contrast)