



**Practice Analysis Report:
Cardiac Interventional - Effective July 2023**

Introduction

The ARRT establishes the job relatedness of an examination via a practice analysis (also called a job analysis). Practice analyses document the role to be credentialed, the topics to be covered by the examination used in the credentialing decision, as well as the degree of emphasis that each topic receives. The rationale for practice analyses is outlined in *The Standards for Educational and Psychological Testing* (American Educational Research Association, American Psychological Association, National Council on Measurement in Education, 2014) and in the National Commission for Certifying Agencies (NCCA) *Standards for the Accreditation of Certification Programs* (NCCA, 2021). Legislation and legal precedent also stress the importance of practice analysis in the development and validation of certification exams. The ARRT conducts a practice analysis for each discipline approximately every five years. Regular updates are important for professions that continually evolve due to advances in technology because they help ensure that the content specifications and other certification requirements reflect current practice.

This report describes the practice analysis for Cardiac Interventional Radiography conducted from June 2021 to April 2022. The project sought to identify tasks currently required of the typical cardiac interventional technologists and to determine what knowledge and cognitive skills are required to effectively perform those tasks.

To accomplish this task, ARRT hosted several meetings with a committee of subject matter experts (SMEs) to develop a survey of job tasks; evaluate survey results; and revise the content specifications, content outline, and clinical experience requirements. ARRT selected seven SMEs for this committee from across the United States and from a range of practice settings (e.g., hospitals, clinics, educational programs). These SMEs represented a range of expertise including six certified and registered technologists and one radiologist.

All statistical analyses were performed by trained statisticians employed by ARRT and meetings were primarily conducted by ARRT’s Exam Development Coordinators with psychometric support provided by ARRT psychometric staff.

The ARRT Board of Trustees reviewed all changes to exam content and eligibility requirements before giving approval in July 2022. The first exam under the new content and eligibility requirements was administered in July 2023.



Task Inventory

Survey Development

ARRT begins the practice analysis process by revising the task inventory, which is a listing of clinical and supporting procedures related to practice. The committee reviewed the previous task inventory and content outline before creating an updated list of job tasks by adding, deleting, or rewording tasks as necessary to reflect changes in the profession.

The committee used the updated job task list to create a survey for distribution to individuals working in the profession. The first section of this survey consisted of 155 questions asking current cardiac interventional technologists how frequently they perform each task utilizing a six-point scale with the following options: *Never Perform, Yearly, Quarterly, Monthly, Weekly, and Daily* as well as two attention checks. Based on past research, ARRT uses a frequency scale with absolute anchors because data from scales like importance and criticality, which use subjective anchors, have inferior statistical properties (Babcock, Risk, & Wyse 2020). The data gathered by absolute anchor frequency scales also correspond well to medical imaging practice as defined by external data sources (Babcock & Yoes, 2013) and add value beyond advisory committee members' judgement without data (Wyse & Babcock, 2018).

To reduce the length and burden of the practice analysis survey, the committee identified tasks from the previous task inventory that they believed were so ubiquitous in practice that over 90% of respondents would report that they do perform the task. The following tasks were omitted from the survey and included in the new task inventory without further discussion:

- Verify package integrity and expiration date of sterile supplies.
- Verify the type, concentration, amount, and expiration date of medications.
- Ensure proper function and cleanliness of the automatic contrast injector.
- Verify presence of appropriate signed informed procedural consent.
- Participate in preprocedural time-out activity.
- Take appropriate precautions to minimize radiation exposure to the patient.
- Take appropriate precautions to minimize occupational radiation exposure.
- Advocate radiation safety and protection.
- Describe the potential risk of radiation exposure when asked.
- Wear a radiation monitoring device while on duty.
- Select appropriate imaging protocols (e.g., frame rates, high/low level fluoroscopy) to optimize image quality while minimizing dose.
- Employ image enhancement techniques (e.g., magnification, filtration, collimation) during procedure to improve image quality.
- Adjust digital images (e.g., roadmapping, subtraction, magnification).
- Monitor and record procedural data (e.g., injection data, physiologic data, administered medications, complications).

The second section of the survey included 22 questions regarding the respondent's role and workplace such as hours worked, primary job title, and department composition.

Survey Sample

ARRT staff identified an initial population of 8,952 cardiac interventional technologists from the ARRT database of certified and registered technologists. All sampled individuals listed cardiac interventional as their primary discipline and were working in a hospital or clinic as a



technologist (or other similar title). Of these 8,952 cardiac interventional technologists, 807 possessed a cardiac interventional certification and the remaining 8,145 did not. One thousand and two-hundred RTs were randomly selected from the final population, stratified by years working as an RT (50% 0-3 years, 30% 4-5 years, 20% 6-10 years). The final sample consisted of all 322 registrants with a cardiac interventional certification and a random sample of 878 of registrants without a cardiac interventional certification for a total of 1,200 cardiac interventional technologists.

ARRT's survey vendor mailed the survey in July 2021. A total of 286 recipients returned their survey by close in September 2021, for an absolute response rate of 24.0%. ARRT staff screened responses to ensure that the surveys were correctly filled out by the intended population, retaining 278 for an effective response rate of 23.2%.

Analysis

ARRT psychometric staff first calculated the percentage of respondents who report performing the task and the percent who report performing the task daily or weekly (Table 1). ARRT allows tasks performed by 40% or more of respondents to be included on the task inventory without further discussion so that committees may focus on discussions most likely to impact task inclusion. However, committees still review all survey results and may choose to include tasks below the threshold or reject tasks above the threshold as they see fit based on their joint expertise.

Finally, ARRT staff summarized results for the 21 multiple choice items that covered the respondent's role and workplace (Tables 2 - 22). Note that percentages may not add up to 100% because some individuals did not answer some items.



Table 1
Percent of technologists performing tasks

Item	Task	% Performing	% Daily/Weekly
1	Check emergency cart to ensure appropriate emergency supplies.	68%	62%
2	Prepare equipment or trays with medications and supplies.	95%	95%
3	Prepare equipment for sterilization.	72%	65%
4	Clean and disinfect or sterilize facilities and equipment.	77%	75%
5	Evaluate sequencing of imaging procedures and inform physician of concerns (e.g., NPO status, contrast material).	85%	82%
6	Address the patient's ability to tolerate the requested procedure (e.g., physical, sensory, or cognitive impairments).	82%	78%
7	Obtain pertinent medical history (e.g., clinical notes, labs, prior imaging, allergies).	87%	86%
8	Confirm the patient's preparation (e.g., diet restrictions, preparatory medications) prior to procedure.	68%	64%
9	Communicate with the patient, patient's family, or authorized representative regarding scheduling delays, exam duration, and additional imaging procedures.	74%	66%
10	Recognize abnormal or missing lab values relative to the procedure ordered.	81%	78%
11	Prior to administration of a contrast agent or medication, determine if the patient is at risk for an adverse event.	93%	91%
12	Obtain baseline vital signs, monitor changes, record, and recognize abnormalities.	95%	94%
13	Record vital signs.	91%	90%
14	Observe ECG for changes and recognize abnormal rhythms.	100%	100%
15	Assess distal pulses pre and post procedure.	84%	78%
16	Prepare and drape the access site(s).	98%	98%
17	Explain the procedure instructions to patient, or patient's family, or authorized representative (e.g., pre-procedure, post-procedure).	91%	88%
18	Prepare the patient for the examination to include physiological monitoring equipment.	95%	95%
In conjunction with physician, select the appropriate contrast agent:			
19	nonionic low-osmolar	61%	57%
20	nonionic iso-osmolar	72%	68%
21	CO ₂	52%	20%
22	Ionic	33%	30%



Item	Task	% Performing	% Daily/Weekly
Set-up and operate the automatic contrast delivery system:			
23	power injector	86%	78%
24	Acist™	51%	48%
25	Dyevert™	8%	5%
26	Set-up and operate the manifold.	94%	79%
Prepare or assist in administering the following types of injectable medications according to physician's orders:			
27	analgesics	31%	30%
28	anticoagulants	48%	45%
29	thrombolytics	44%	29%
30	vasoactives (constrictors, dilators)	61%	57%
31	emergency medicines	34%	18%
32	moderate sedation medications	11%	8%
33	antibiotics	25%	18%
34	antiemetics	10%	7%
35	antihypertensives	16%	11%
36	antiarrhythmics	20%	14%
37	antiplatelet	21%	18%
38	Recognize and communicate the need for prompt medical attention.	97%	92%
39	Recognize the need for and administer emergency care.	100%	89%
40	Monitor and maintain medical equipment (e.g., IVs, oxygen) used during the procedure.	82%	77%
41	Use sterile or aseptic technique when indicated.	100%	100%
42	Follow environmental protection standards for handling and disposing of bio-hazardous materials (e.g., sharps, blood, body fluids).	100%	99%
43	Handle, label, and submit laboratory specimens (e.g., body fluid, tissue samples).	84%	58%
44	Identify characteristics of interventional and diagnostic non-imaging equipment (e.g., balloons, wires, appropriate sizing)	99%	99%
45	Adjust and calibrate pressure transducers.	96%	96%
46	Scrub in for the procedure.	96%	94%
47	Position the patient and/or imaging equipment to achieve desired projections.	100%	98%
48	Initiate the radiographic exposure.	96%	87%
49	Monitor procedure dose metrics against the significant dose reference level (NCRP report #168).	85%	79%
50	Document and assess accuracy of dose metrics for patient exams per compliance regulations.	82%	75%
51	Postprocess images: (e.g., 3D reconstruction, annotation).	73%	54%



Item	Task	% Performing	% Daily/Weekly
52	Assist with ultrasound guidance.	95%	88%
53	Assist in OR hybrid suite.	63%	44%
54	Use interventional and diagnostic non-imaging equipment (e.g., balloons, wires, appropriate sizing).	96%	94%
55	Please mark 'Yearly'.	99%	1%
Operate interventional procedural equipment:			
56	ultrasound unit	86%	82%
57	CT scanner	9%	4%
58	intravascular ultrasound (IVUS)	94%	79%
59	optical coherence tomography (OCT)	41%	23%
60	fractional flow reserve (FFR)/ instantaneous wave-free ratio (IFR)	95%	84%
61	resting full cycle ratio (RFR)	33%	25%
62	cryo/microwave ablation	41%	21%
63	intracardiac echocardiography (ICE)	62%	31%
64	thrombectomy	94%	53%
65	thrombolysis	79%	35%
66	atherectomy	90%	56%
67	intra-aortic balloon pump (IABP)	96%	32%
68	catheter based ventricular assist device (e.g., Impella®)	84%	23%
69	extracorporeal membrane oxygenation (ECMO)	32%	4%
70	laser	56%	17%
71	lithotripsy (balloon or catheter)	52%	19%
72	Evaluate individual occupational exposure reports to determine if values for the reporting period are within established limits.	73%	20%
Assist with the following procedures:			
Vascular Access Assessment			
73	Femoral angiography	99%	96%
74	Radial angiography	95%	87%
75	Brachial angiography	84%	39%
76	Axillary angiography	61%	22%
77	Subclavian angiography	86%	43%
78	Jugular angiography	70%	34%
79	Vascular patency (e.g., Allen test, Barbeau test)	83%	76%



Item	Task	% Performing	% Daily/Weekly
80	Carotid angiography	62%	22%
81	Ulnar angiography	55%	12%
Vascular Diagnostic Procedures			
82	Pulmonary angiography	71%	24%
83	Pulmonary pressure measurement	89%	69%
84	Aortography	97%	75%
85	Great vessel angiography	85%	53%
86	Coronary angiography	99%	96%
87	Renal angiography	89%	25%
88	Femoral angiography	96%	91%
89	Internal mammary angiography	92%	75%
90	Carotid angiography	73%	29%
91	Ventriculography	91%	77%
92	Coronary bypass graft angiography	96%	88%
93	Intravascular ultrasound (IVUS)	94%	78%
94	Optical coherence tomography (OCT)	42%	24%
95	Cardiac output calculations and measurement	93%	78%
96	Point of care blood sampling (e.g., ACT, ABG)	88%	80%
97	Biopsies (e.g., transvenous endomyocardial biopsy)	45%	16%
98	Intracardiac echocardiography (ICE)	64%	32%
99	Right heart catheterization	99%	84%
100	Fractional flow reserve (FFR)	94%	78%
101	Shunt detection	65%	24%
102	Ventricular volume measurement (ejection fraction)	89%	75%
103	Cardiac valve area calculations and measurements	86%	58%
104	Electrophysiology studies	64%	41%
Interventional Procedures			
105	Coronary angioplasty	95%	94%
106	Peripheral angioplasty	91%	73%



Item	Task	% Performing	% Daily/Weekly
	<i>Coronary atherectomy:</i>		
107	directional	58%	35%
108	rotational	78%	46%
109	laser	51%	22%
110	orbital (e.g., CSI)	65%	33%
	<i>Peripheral atherectomy:</i>		
111	directional	61%	28%
112	rotational	62%	28%
113	laser	41%	17%
114	orbital (e.g., CSI)	65%	30%
115	Intravascular lithotripsy (e.g., shockwave)	55%	16%
116	Pulmonary thrombectomy	53%	18%
117	Coronary stent placement	94%	92%
118	Peripheral stent placement	90%	60%
	<i>Coronary thrombectomy:</i>		
119	mechanical	90%	52%
120	pharmacological	71%	38%
121	Arrhythmia ablation	47%	31%
122	Atrial fibrillation	62%	40%
123	Atrial flutter	64%	38%
124	Ventricular tachycardia	67%	30%
125	Cardioversion	73%	42%
	<i>Pacemaker:</i>		
126	temporary	98%	56%
127	permanent	86%	68%
128	leadless	57%	20%
129	Pericardiocentesis	90%	17%
130	Defibrillator implantation	77%	52%
131	Lead extraction	53%	6%
132	Patent foramen ovale/atrial septal defect closure	58%	12%
133	Ventricular septal defect closure	40%	6%
134	Alcohol septal ablation	26%	3%



Item	Task	% Performing	% Daily/Weekly
	<i>Ventricular assist device implantation:</i>		
135	left ventricle	62%	23%
136	right ventricle	40%	9%
137	Intra-aortic balloon counterpulsation	81%	27%
138	Distal protection device placement/retrieval	72%	22%
139	Foreign body removal	52%	4%
	<i>Vascular closure device placement:</i>		
140	permanent (e.g., Perclose ProGlide™, StarClose SE™)	90%	74%
141	non-permanent (e.g., Angio-Seal®, MYNX CONTROL™)	98%	89%
142	IVC filter placement/retrieval	73%	21%
143	Please mark 'Weekly'.	99%	99%
144	Transcatheter aortic valve implantation/replacement	54%	39%
145	Pulmonic valve repair	15%	3%
146	Tricuspid valve repair	19%	4%
147	Transcatheter mitral valve repair (MitraClip™)	38%	17%
148	Atrial appendage closure device implantation (e.g., WATCHMAN®)	41%	20%
149	Extracorporeal membrane oxygenation system placement (ECMO)	31%	3%
150	Septostomy	12%	2%
151	Valvuloplasty	51%	16%
152	Cooling catheters (therapeutic hypothermia)	28%	3%
153	Perivalvular leak repair (vascular plugs, embolization)	35%	6%
Post-Procedure Patient Care			
	<i>Apply pressure to arterial or venous puncture site:</i>		
154	manual pressure	98%	89%
155	external device (e.g., TR Band®, FemoStop™)	95%	87%
156	Apply dressing (e.g., surgical glue, hemostatic, dressing, Steri-Strip™, external fixation).	97%	88%
157	Assist with access site complication management.	97%	81%



Table 2
Is CI radiography your primary discipline of employment?

Response	Count	Percentage
Yes	265	96%
No	10	4%

Table 3
Which of the following certifications do you currently hold? (select all that apply)

Response	Count	Percentage
R.T.(CI)	113	41%
R.T.(VI)	25	9%
R.T.(CV)	2	1%
R.T.(R)	243	87%
RCIS	24	9%
RCES	2	1%
RN	1	0%
LPN	0	0%

Table 4
How many years have you worked as a CI radiographer?

Response	Count	Percentage
Less than 1 year	9	3%
1-3 years	83	30%
4-5 years	72	26%
6-10 years	100	36%
More than 10 years	13	5%

Table 5
What is your primary job title?

Response	Count	Percentage
Staff technologist	201	74%
Lead or chief technologist	52	19%
Educator	0	0%
Administrator or manager	1	1%
Other	18	7%

Table 6
How many hours per week do you typically perform CI procedures?

Response	Count	Percentage
Less than 20 hours	11	4%
20-30 hours	57	21%
More than 30 hours	209	75%



Table 7

How many hours per week do you typically perform VI procedures?

Response	Count	Percentage
Not applicable	65	24%
Less than 20 hours	139	51%
20-30 hours	45	16%
More than 30 hours	26	9%

Table 8

What specialties do you currently support? (select all that apply)

Response	Count	Percentage
Diagnostic catheterization	268	97%
Electrophysiology	152	55%
Interventional catheterization	267	96%
Pediatric	22	8%
Structural heart	132	48%
Other	41	15%

Table 9

What type of training or education specific to CI radiography have you had? (select all that apply)

Response	Count	Percentage
Informal, on the job training	245	88%
Structured on the job training, including didactic and supervised clinical instruction	140	51%
Formal coursework provided by a college or university	37	13%
Self-guided learning (journal and textbook reading, etc.)	201	73%
In-house (on-site) trainings sponsored by equipment vendors	202	73%
Off-site training sponsored by equipment vendor	116	42%
Seminar given by CE provider	101	36%
Self-funded, off-site training	48	17%

Table 10

Which of the following best describes your primary place of employment?

Response	Count	Percentage
Academic/university hospital	52	20%
Community hospital	211	79%
Government (e.g., military/VA) hospital	1	1%
Outpatient imaging center	0	0%
Free-standing vascular clinic	3	1%
Mobile unit	0	0%
Other	5	2%



Table 11

If you work in a hospital/medical center providing inpatient care, what is the approximate size (number of beds)?

Response	Count	Percentage
Not applicable	4	1%
Less than 50	3	1%
50-100	30	11%
101-250	96	35%
251-500	85	31%
More than 500	57	21%

Table 12

How many radiographers are employed in the CI department where you work? (include yourself)

Response	Count	Percentage
1-3	50	18%
4-6	100	36%
7-9	55	20%
10-19	45	16%
20 or more	26	9%

Table 13

What functions are performed by R.T.s in your vascular department? (select all that apply)

Response	Count	Percentage
Scrub	268	97%
Monitor	243	88%
Circulate	179	65%
Radiographic/fluoroscopic imaging	247	89%
Administer medications (excluding contrast and heparinized saline)	50	18%
Other	14	5%

Table 14

Does your employer require advanced certification to work in the CI radiography department?

Response	Count	Percentage
Yes	13	5%
No, but must attain advanced certification in a certain time frame	64	23%
No	201	72%



Table 15

If yes, what certifications would meet the advanced requirement? (select all that apply)

Response	Count	Percentage
Not applicable	94	67%
R.T.(CI)	34	24%
R.T.(VI)	19	13%
R.T.(CV)	17	12%
RCIS	34	24%
Other	6	4%

Table 16

Does your employer require BLS certification?

Response	Count	Percentage
Yes	273	99%
No	4	1%

Table 17

Does your employer require ACLS certification?

Response	Count	Percentage
Yes	226	81%
No	52	19%

Table 18

Does your employer require PALS certification?

Response	Count	Percentage
Yes	14	5%
No	264	95%

Table 19

In the last year, has the number of approved full-time positions for CI radiographers at your facility changed?

Response	Count	Percentage
No change	172	62%
Increased	86	31%
Decreased	20	7%



Table 20

In the last year, has the number of employed full-time CI radiographers at your facility changed?

Response	Count	Percentage
No change	126	45%
Increased	66	24%
Decreased	86	31%

Table 21

When comparing to 2019 (prior to the COVID pandemic declaration) to the present, has your department experienced a change in CI radiography volume?

Response	Count	Percentage
Increased volume	97	35%
Decreased volume	106	38%
No change in volume	75	27%

Table 22

When comparing 2019 (prior to the COVID pandemic declaration) to the present, have the types of exams changed significantly?

Response	Count	Percentage
No significant change	180	67%
The following procedures have increased or decreased (please specify)	90	33%



Changes to Task Inventory

The practice analysis committee met in October 2021 to review the practice analysis survey data and determine whether any tasks should be dropped from or added to the task inventory. The committee also clarified the wording of several tasks.

The following tasks were removed:

- No tasks were removed.

The following tasks were added:

- Clean and disinfect or sterilize facilities and equipment
- Evaluate sequencing of imaging procedures and inform physician of concerns (e.g., NPO status, contrast administration)
- Address the patient's ability to tolerate the requested procedure (e.g., physical, sensory, or cognitive impairments)
- Obtain pertinent medical history (e.g., clinical notes, labs, prior imaging, allergies).
- Confirm the patient's preparation (e.g., diet restrictions, preparatory medications) prior to procedure
- Communicate with and update the patient, or the patient's family, or authorized representative regarding scheduling delays, exam duration, and additional imaging procedures
- Recognize abnormal or missing lab values relative to the procedure ordered.
- Record vital signs
- Observe ECG for changes and recognize abnormal rhythms
- Document required information in the patient's medical record (e.g., imaging procedure documentation).
- Explain the procedure instructions to patient, or patient's family, or authorized representative (e.g., pre-procedure, post-procedure)
- In conjunction with physician, select the appropriate contrast agent:
 - CO₂
- Set-up and operate the automatic contrast delivery system:
 - power injector
- Set-up and operate the manifold
- Handle, label, and submit laboratory specimens (e.g., body fluid, tissue samples).
- Prepare or assist in administering the following types of injectable medications according to physician's orders:
 - other (e.g., analgesics, antibiotics, antiemetics, antihypertensives, antiirhythmics, antiplatelets)
- Identify characteristics of interventional and diagnostic non-imaging equipment (e.g., balloons, wires, appropriate sizing).
- Assist in OR hybrid suite
- Use interventional and diagnostic non-imaging equipment (e.g., balloons, wires)
- Operate interventional procedural equipment
 - ultrasound unit
 - intravascular ultrasound (IVUS)
 - optical coherence tomography (OCT)
 - fractional flow reserve (FFR)/ instantaneous wave-free ratio (IFR)
 - cryo/microwave ablation



- intracardiac echocardiography (ICE)
- thrombectomy
- thrombolysis
- atherectomy
- intra-aortic balloon pump (IABP)
- catheter based ventricular assist device
- extracorporeal membrane oxygenation (ECMO)
- laser
- lithotripsy (balloon or catheter)

Assist with the following procedures:

- Vascular Access Assessment
 - carotid angiography
 - ulnar angiography
- Vascular Diagnostic Procedures:
 - great vessel angiography
- Interventional
 - coronary atherectomy
 - orbital (e.g., CSI)
 - directional
 - rotational
 - laser
 - peripheral atherectomy
 - laser
 - orbital (e.g., CSI)
 - intravascular lithotripsy (e.g., shockwave)
 - pacemaker: leadless
 - lead extraction
 - ventricular septal defect closure
 - ventricular assist device implantation
 - left ventricle
 - right ventricle
 - vascular closure device placement
 - permanent
 - non-permanent
 - transcatheter mitral valve repair
 - atrial appendage closure device implantation
 - extracorporeal membrane oxygenation system placement (ECMO)

Post Procedure Patient Care

- Assist with access site complication management.
- Apply pressure to arterial or venous puncture site
 - manual pressure
 - external devices

The Board of Trustees approved the final task inventory in January 2022. The final task inventory may be found on the ARRT website: <https://www.rrt.org/pages/rrt-reference-documents/by-document-type/task-inventories>



Content Specifications and Clinical Experience Requirements

Changes to Content Specifications

The practice analysis committee updated the content specifications based on changes to the task inventory and the field. The committee considered the knowledge and cognitive skills required to successfully perform the tasks in the final task inventory and verified that those topics were covered in the content specifications, adding additional content as necessary. The committee also removed any topics that could not be linked to the updated task inventory.

The updated content specifications were then made available for public comment in March 2022 and the committee met again in April 2022 to discuss the comments before making any final adjustments.

The most notable changes from the previous version of the content specifications were:

- Patient Care
 - Added additional content to the patient assessment and preparation area and the patient monitoring area
 - Added more details to:
 - contrast administration
 - medications
 - handling and disposal of hazardous materials
 - the emergency care areas
 - Removed infection control and prevention section
 - Added asepsis and sterile technique
 - Added moderate sedation medication
- Image Production
 - Added additional details to data acquisition and processing
 - Updated the list of procedural equipment
 - Removed patient shielding
 - Added quality control of aprons
 - Added the role of dose calibration
- Procedures
 - Added intravascular imaging
 - Added additional peripheral angiography sites
 - Added temporary and leadless pacemaker
 - Added lead extraction
 - Added procedures in percutaneous intervention section
 - Added procedures in structural heart procedures section
 - Added under equipment and devices used:
 - types
 - indication for use
 - preparation, set up, and operation
 - Added puncture site pressure and dressing under closure devices
 - Moved ultrasound guidance to a separate heading
 - Moved interventional suite and hybrid OR to a separate heading

In addition, the committee edited all sections of the content specifications for clarity and updated terminology to reflect current practice.



The Board of Trustees approved the final content specifications in July 2022. The final content specifications may be found on the ARRT website: <https://www.arrt.org/pages/arrt-reference-documents/by-document-type/examination-content-specifications>

Content Weighting

The practice analysis committee determined the number of items that should be assigned to each section of the exam through a process known as content weighting. First, the committee performed a bottom-up exercise where members individually estimated the number of unique items that should be included in each section. Second, the committee performed a top-down exercise where members individually estimated the relative proportion of the exam that should be dedicated to each section. Finally, ARRT staff provided the committee with summary values from the two exercises and the committee held a discussion to finalize their recommendation for the number of items assigned to each section (Table 23).

Table 23
Number of Items per Section

Content Area	Number of Scored Items
Patient Care	40
Patient Interactions and Management (40)	
Image Production	20
Image Acquisition and Equipment (20)	
Procedures	85
Diagnostic and Electrophysiology Procedures (35)	
Interventional Procedures (50)	
Grand Total	145

Changes to Clinical Experience Requirements

ARRT created clinical experience requirements to verify that candidates have completed a subset of clinical procedures within a modality. Successful performance of these fundamental procedures, in combination with mastery of the cognitive knowledge and skills covered by the certification examination, provides the basis for the acquisition of the full range of clinical skills required in a variety of settings.

The practice analysis committee reviewed and updated the previous clinical experience requirements considering the final task inventory and content specifications. The updated clinical experience requirements were then made available for public comment in March 2022 and the committee met again in April 2022 to discuss the comments before making any final adjustments.

The most notable changes from the previous version of the clinical experience requirements were:

- The committee added a minimum of 10 Coronary Interventional Procedures to the list of mandatory procedures. Qualifying procedures are:
 - angioplasty
 - stent placement
 - atherectomy
 - thrombectomy



- The committee increased the minimum number of elective procedures from 80 to 100 procedures.
- Added the following elective procedures with no limit to repetitions:
 - ventricular septal defect closure
 - intravascular lithotripsy
 - transcatheter mitral valve repair
 - atrial appendage closure device implantation
 - extracorporeal membrane oxygenation system placement (ECMO)
- Added the following elective procedures with a limit of five repetitions per procedure:
 - coronary angiography
 - pacemaker leadless
- The number of peripheral (not in the heart) angiography procedures that may be counted was reduced to five total repetitions.
- A maximum of 8 repetitions may be logged for each day in the candidate's ARRT online tool.

The Board of Trustees approved the final clinical requirements in July 2022. The final clinical experience requirements may be found on the ARRT website: <https://www.rrt.org/pages/rrt-reference-documents/by-document-type/clinical-experience-requirements>



Conclusion

Numerous individuals contributed to this project, as committee members, document reviewers, or as survey respondents. Periodic practice analysis is a necessary step in the life cycle of an exam program to ensure that the content of the exam and the eligibility requirements remain relevant with current practice. This study noted significant changes to the field of cardiac interventional radiography, and thanks to the efforts of all involved it assures that the ARRT Cardiac Interventional Radiography exam program will continue to be an excellent assessment of cardiac interventional technologists wishing to demonstrate their qualifications by seeking certification and registration.

