Practice Analysis Report: Vascular 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 vascular interventional radiography conducted from June 2021 to May 2022. The project sought to identify tasks currently required of the typical vascular 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 six 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 five 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 153 questions asking current vascular 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*. 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
- Prepare equipment or trays with medications and supplies
- Ensure proper function and cleanliness of the automatic contrast injector
- Participate in pre-procedural time-out activity
- Set-up and operate the automatic contrast injector
- 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
- Position the patient and/or imaging equipment to achieve desired projections
- Select appropriate imaging protocols (e.g., frame rates, high/low level fluoro) 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)

The second section of the survey included 23 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 9,895 vascular interventional technologists from the ARRT database of certified and registered technologists. All sampled individuals listed vascular interventional as their primary discipline and were working in a hospital or clinic as a technologist (or other similar title). The sample was stratified for years of experience such that 594 had been practicing three or less years, 366 had been practicing for four to five years, and 240 had been practicing for six to ten years. The final sample consisted of a random sample of 800 registrants with a vascular interventional certification and a random sample of 400 of registrants without a vascular interventional certification for a total of 1,200 vascular interventional technologists.

ARRT's survey vendor mailed the survey in July 2021. A total of 297 recipients returned their survey by close in September 2021, for an absolute response rate of 25.1%. ARRT staff screened responses to ensure that the surveys were correctly filled out by the intended population, retaining 270 for an effective response rate of 22.5%.

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.

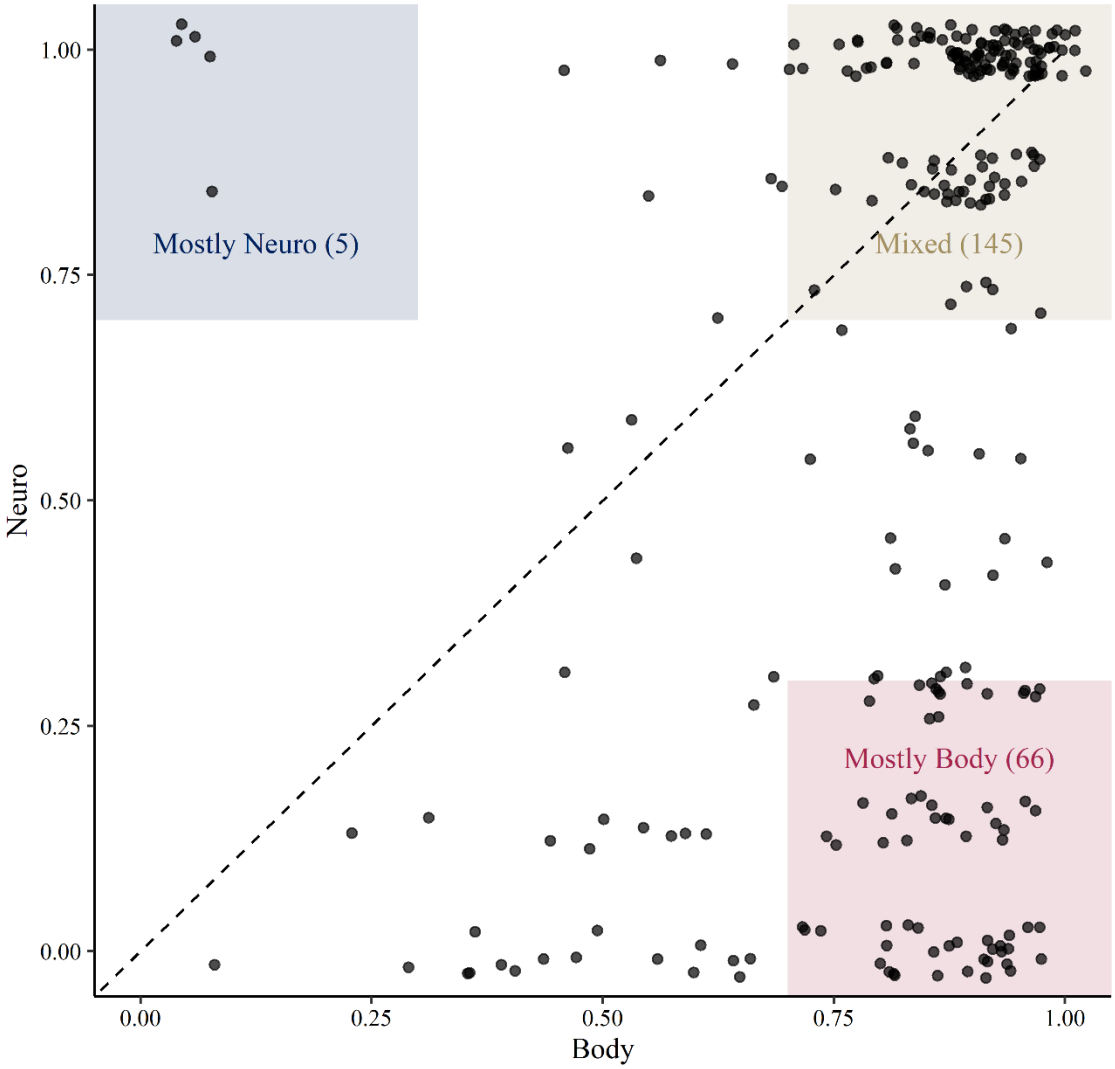
Psychometric staff next compared the percent of entry-level (0-5 years of experience) and experienced (6+ years) respondents performing each task to ensure that the tasks included on the inventory are relevant to entry-level practice. Table 2 provides a list of tasks that differed in a potentially meaningful way and staff presented these results to the committee for discussion.

In addition, Psychometric staff compared those with ARRT VI credentials and those without ARRT VI credentials to see how responsibilities of technologists vary based on credential status. Table 3 provides a list of tasks that differed in a potentially meaningful way and staff presented these results to the committee for discussion.

A few respondents mentioned that they believe neuro and body content should be placed on separate exams because departments are not cross-training. ARRT staff have heard this same comment in other contexts as well, so a final pair of plots were created to determine whether there is evidence that these anecdotes are representative of a larger trend. Survey tasks were split into body-only (n = 55) and neuro-only (n = 7) groups and the results were compared across persons.

If there are technologists who work in a department that only covers neuro or body VI, we should expect to find survey respondents who perform most of the tasks in one category but very few of the other. To that end, Figure 1 is a scatterplot of survey respondents with the Y axis indicating the proportion of neuro tasks performed while the X axis indicates the proportion of body tasks performed. A hypothetical technologist who works in a predominately neuro department could appear in the top left of the chart (highlighted in blue). A technologist who works in a predominately body department could appear in the bottom right (highlighted in red). Finally, a technologist who works in a mixed department that covers almost all body and neuro procedures could appear in the top right (highlighted in gold).

Figure 1. Proportion of Tasks Performed



Finally, ARRT staff summarized results for the 22 multiple choice items that covered the respondent's role and workplace (Tables 4 - 25). 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 for appropriate emergency supplies.	49.3%	35.8%
2	Prepare equipment for sterilization.	68.4%	58.7%
3	Clean and disinfect or sterilize facilities and equipment.	78.1%	74.7%
4	Evaluate sequencing of imaging procedures and inform physician of concerns (e.g., NPO status, contrast administration).	89.6%	85.8%
5	Address the patient's ability to tolerate the requested procedure (e.g., physical, sensory, or cognitive impairments).	84.0%	78.4%
6	Obtain pertinent medical history (e.g., clinical notes, labs, prior imaging, allergies).	88.1%	85.6%
7	Confirm the patient's preparation (e.g., diet restrictions, preparatory medications) prior to procedure.	71.9%	65.9%
8	Communicate with the patient, patient's family, or authorized representative regarding scheduling delays, exam duration, and additional imaging procedures.	72.2%	63.7%
9	Verify presence of appropriate signed informed procedural consent.	85.6%	81.1%
10	Recognize abnormal or missing lab values relative to the procedure ordered.	80.7%	74.1%
11	Prior to administration of a contrast agent or medication, determine if the patient is at risk for an adverse event.	95.6%	94.1%
12	Obtain baseline vital signs, monitor changes, and recognize abnormalities.	58.6%	52.2%
13	Record vital signs.	32.8%	26.9%
14	Observe ECG for changes and recognize abnormal rhythms.	55.2%	47.0%
15	Assess distal pulses pre- and post-procedure.	53.7%	43.3%
16	Prepare and drape the access site(s).	98.9%	97.8%
17	Explain the procedure instructions to patient, patient's family, or authorized representative (e.g., pre-procedure, post-procedure).	79.3%	74.1%
18	Prepare the patient for the examination to include physiological monitoring equipment.	79.1%	75.4%
19	In conjunction with physician, select the appropriate contrast agent:		
	a. ionic	50.6%	45.1%
	b. nonionic low osmolar	80.5%	74.7%
	c. nonionic iso-osmolar	62.2%	49.8%
	d. CO_2	82.8%	30.2%
	e. gadolinium	47.5%	16.7%

Item	Task	% Performing	% Daily/Weekly
20	Prepare or assist in administering the following types of injectable medications according to physician's orders:		
	a. analgesics	35.3%	31.0%
	b. anticoagulants	57.2%	48.5%
	c. thrombolytics	65.8%	44.2%
	d. vasoactives (constrictors, dilators)	60.2%	36.4%
	e. emergency medications	25.7%	8.8%
	f. moderate sedation medications	21.8%	11.7%
21	Recognize and communicate the need for prompt medical attention.	95.2%	70.7%
22	Recognize the need for and administer emergency care.	92.5%	55.4%
23	Monitor and maintain medical equipment (e.g., IVs, oxygen) used during the procedure.	63.3%	54.4%
24	Identify characteristics of interventional and diagnostic non-imaging equipment (e.g., balloons, wires, appropriate sizing)	99.6%	99.6%
25	Use sterile or aseptic technique when indicated.	100.0%	100.0%
26	Follow environmental protection standards for handling and disposing of bio-hazardous materials (e.g., sharps, blood, body fluids).	100.0%	100.0%
27	Handle, label, and submit laboratory specimens (e.g., body fluid, tissue samples).	89.2%	78.0%
28	Adjust and calibrate pressure transducers.	68.7%	41.4%
29	Scrub in to assist with procedure.	98.5%	95.9%
30	Position the patient and/or imaging equipment to achieve desired projections.	99.3%	98.9%
31	Employ image-enhancement techniques (e.g., magnification, filtration, collimation) during procedure to improve image quality.	99.6%	99.3%
32	Initiate the radiographic exposure.	99.6%	91.4%
33	Monitor procedure dose metrics against the significant dose reference level (NCRP report #168).	86.0%	79.5%
34	Operate interventional procedural equipment:		
	a. ultrasound unit	98.9%	97.0%
	b. CT scanner	34.5%	24.3%
	c. intravascular ultrasound (IVUS)	72.6%	33.1%
	d. cryo/microwave ablation	51.1%	10.5%
	e. thrombectomy	92.9%	64.6%
	f. thrombolysis	92.6%	53.5%
	g. atherectomy	65.9%	31.8%

Item	Task	% Performing	% Daily/Weekly
	h. laser	40.5%	9.7%
	i. lithotripsy (balloon or catheter)	44.0%	20.7%
35	Document and assess accuracy of dose metrics for patient exams per compliance regulations.	81.1%	74.4%
36	Post-process images (e.g., 3D reconstruction, annotation).	97.4%	92.6%
37	Assist with ultrasound guidance.	97.0%	95.2%
38	Assist in OR hybrid procedures.	69.9%	41.3%
39	Monitor and record all procedural data (e.g., injection data, physiologic data, administered medications, complications).	65.1%	60.6%
40	Evaluate individual occupational exposure reports to determine if values for the reporting period are within established limits.	61.9%	28.5%
41	Arterial access	94.8%	91.5%
42	Venous access	95.9%	93.7%
43	Vascular patency (e.g., ultrasound, Allen test)	88.8%	80.5%
44	Please mark 'Yearly'	NA	
45	Intracranial arteriography	72.2%	50.4%
46	Carotid/vertebral arteriography	81.0%	50.6%
47	Spinal arteriography	70.1%	11.9%
48	Thoracic aortography	84.4%	28.3%
49	Pulmonary arteriography	83.6%	24.2%
50	Bronchial arteriography	74.3%	13.1%
51	Abdominal aortography	94.4%	73.7%
52	Pelvic arteriography	95.5%	61.8%
53	Renal arteriography	95.5%	40.5%
54	Adrenal arteriography	76.0%	12.0%
55	Celiac arteriography	89.9%	51.1%
56	Superior mesenteric artery (SMA)	94.1%	53.2%
57	Inferior mesenteric artery (IMA)	92.9%	46.8%
58	Upper extremity arteriogram	94.1%	44.1%
59	Lower extremity arteriogram	92.2%	57.6%
60	Pelvic venography	90.5%	33.5%
61	Superior vena cavagram	95.1%	53.0%
62	Inferior vena cavagram	95.9%	60.6%
63	Renal venography	81.3%	17.2%

Item	Task	% Performing	% Daily/Weekly
64	Adrenal venography	66.8%	9.0%
65	Gonadal venography	70.7%	12.2%
66	Hepatic venography	83.6%	32.8%
67	Portal venography	84.3%	27.2%
68	Upper extremity venogram	93.7%	46.5%
69	Lower extremity venogram	89.6%	35.9%
70	Venous sampling	66.3%	8.1%
71	Hemodialysis graft/fistula study	92.2%	68.0%
72	Lymphangiography - general mapping	53.2%	6.3%
73	Physiological pressure measurement	74.8%	29.7%
74	Central venous device check (e.g., port, PICC, hemodialysis catheter)	95.9%	84.3%
75	Angioplasty:		
	a. neurologic	61.1%	29.6%
	b. body	95.6%	77.0%
76	Stent placement:		
	a. neurologic	61.7%	30.9%
	b. body	96.3%	61.1%
77	Embolization:		
	a. neurologic	58.6%	35.4%
	b. body	97.0%	67.7%
78	Thrombolysis:		
	a. neurologic	45.3%	22.5%
	b. body	92.9%	44.2%
79	Thrombectomy:		
	a. neurologic	58.4%	43.9%
	b. body	92.9%	48.7%
80	Atherectomy	68.3%	27.5%
81	Percutaneous thrombin injection	75.4%	9.7%
82	Distal protection device placement	81.9%	30.7%
83	Foreign body retrieval	88.8%	12.4%
84	Endograft placement	57.1%	21.8%
85	Caval filter placement	94.1%	55.4%
86	Caval filter removal	92.9%	34.7%

Item	Task	% Performing	% Daily/Weekly
87	Transjugular intrahepatic portosystemic shunt (TIPS) placement or revision	78.4%	16.7%
88	Transvenous biopsy	76.1%	19.4%
89	Chemoembolization	77.0%	26.7%
90	Radioembolization	56.4%	24.4%
91	Venous access		
	a. tunneled catheter	95.5%	90.7%
	b. non-tunneled catheter	93.3%	81.0%
	c. port placement	93.3%	84.4%
	d. port removal	91.4%	69.9%
	e. PICC line placement	89.3%	70.4%
92	Percutaneous fistula creation	21.3%	4.5%
93	Thoracic duct embolization	36.7%	1.5%
94	Nephrostomy	89.9%	81.7%
95	Whitaker test	27.7%	4.2%
96	Please mark "Weekly"		
97	Ureteral dilation/stents	87.7%	44.6%
98	Antegrade urography through an existing catheter	75.0%	44.4%
99	Percutaneous stone extraction (e.g., renal, biliary)	43.1%	8.9%
100	Suprapubic catheter placement	64.8%	18.4%
101	Percutaneous radiofrequency ablation (RFA)	54.1%	13.3%
102	Percutaneous thermal ablation	35.2%	6.4%
103	Percutaneous cryoablation	45.9%	9.0%
104	Percutaneous transhepatic cholangiogram	87.4%	43.3%
105	Biliary internal/external drainage	88.9%	49.6%
106	Cholecystostomy	84.8%	46.8%
107	Gastrostomy/gastrojejunostomy	86.3%	63.7%
108	Percutaneous, enteric tube evaluation (verification with contrast)	77.0%	48.3%
109	Vertebroplasty/kyphoplasty	85.0%	37.1%
110	Discography	37.3%	3.0%
111	Epidural steroid injection	56.0%	31.3%
112	Lumbar puncture	70.3%	37.5%
113	Myelogram	49.8%	20.6%
114	Chest tube/drain placement	80.0%	53.7%

Item	Task	% Performing	% Daily/Weekly
115	Thoracentesis	75.8%	45.7%
116	Percutaneous biopsy	81.3%	57.1%
117	Paracentesis	81.4%	55.3%
118	Tunneled drainage catheter placement:		
	a. thoracic	84.3%	40.8%
	b. abdominal	86.8%	42.1%
119	Percutaneous drainage with or without placement of catheter (excluding thoracentesis and paracentesis)	80.6%	48.1%
120	Removal of percutaneous drainage catheter (e.g., tunneled, non-tunneled)	86.6%	52.6%
121	Change of percutaneous tube or drainage catheter	88.8%	64.2%
122	Abscess, fistula, or sinus tract study	86.9%	53.9%
123	Vascular closure device placement:		
	a. permanent (e.g., Perclose ProGlide™, StarClose SE™)	76.2%	51.3%
	b. non-permanent (e.g., Angio-Seal®, MYNX CONTROL™)	89.6%	76.5%
124	Apply pressure to arterial or venous puncture site:		
	a. manual pressure	97.8%	75.4%
	b. external device (e.g., TR Band®, FemoStop™)	81.9%	41.9%
125	Apply dressing (e.g., surgical glue, hemostatic dressing, Steri-Strips™, external fixation).	98.1%	94.4%
126	Assist with access site complication management.	92.9%	72.5%

Table 2

Percent performing tasks for those with greater or fewer than 5 years of experience

Survey Item	Task	5 or fewer years	More than 5 years
20A	[administer injectable medication] analgesics	33.0%	40.8%
34H	[operate equipment] laser	39.2%	43.8%
102	Percutaneous thermal ablation	31.0%	45.0%

Note: No results were statistically significant. A portion of the results have been presented for committee consideration (i.e., Chi-square $p < .01$, where values are on either side of the 40% threshold, or where the difference in percent performing is greater than 20 percentage points.)

Table 3
Percent performing tasks for those with and without an R.T.(VI) credential

Survey Item	Task	With VI	Without VI
19E	[select a contrast agent] gadolinium	51.1%	37.7%
20D	[administer injectable medication] vasoactives (constrictors, dilators)	65.6%	44.9%
22	Recognize the need for and administer emergency care.	95.4%	84.3%
28	Adjust and calibrate pressure transducers.	75.0%	51.4%
34E	[operate equipment] thrombectomy	96.4%	83.1%
34F	[operate equipment] thrombolysis	96.0%	83.1%
34H	[operate equipment] laser	44.2%	30.6%
43	Vascular patency (e.g., ultrasound, Allen test)	92.9%	77.1%
45	Intracranial arteriography	77.8%	56.9%
47	Spinal arteriography	75.1%	56.3%
48	Thoracic aortography	89.3%	70.8%
49	Pulmonary arteriography	88.3%	70.8%
50*	Bronchial arteriography	80.6%	56.9%
51	Abdominal aortography	97.0%	87.5%
54*	Adrenal arteriography	82.2%	58.6%
55*	Celiac arteriography	96.5%	71.4%
56	Superior mesenteric artery (SMA)	97.0%	86.1%
57*	Inferior mesenteric artery (IMA)	97.0%	81.9%
60	Pelvic venography	93.8%	81.2%
64	Adrenal venography	71.9%	52.8%
65*	Gonadal venography	77.8%	51.4%
66	Hepatic venography	87.8%	71.8%
67*	Portal venography	90.3%	68.1%
73	Physiological pressure measurement	80.4%	59.7%
75A	[angioplasty] neurologic	66.2%	47.2%
78A	[thrombolysis] neurologic	49.5%	33.8%
79A	[thrombectomy] neurologic	63.5%	44.4%
82	Distal protection device placement	86.9%	68.1%
83*	Foreign body retrieval	94.4%	73.2%

84	Endograft placement	63.4%	40.3%
89	Chemoembolization	81.3%	65.3%
93	Thoracic duct embolization	40.0%	27.8%
99	Percutaneous stone extraction (e.g., renal, biliary)	47.2%	31.9%
103	Percutaneous cryoablation	49.2%	36.6%
104	Percutaneous transhepatic cholangiogram	91.9%	75.0%
106	Cholecystostomy	88.8%	73.6%
107	Gastrostomy/gastrojejunostomy	89.9%	76.4%
110	Discography	41.8%	25.0%
118A	[tunneled catheter placement] thoracic	88.7%	72.2%
118B	[tunneled catheter placement] abdominal	90.7%	76.4%

Note: Statistically significant differences are marked by an asterisk in column 1. A portion of the non-significant results have been presented for committee consideration (i.e., Chi-square $p < .01$, where values are on either side of the 40% threshold, or where the difference in percent performing is greater than 20 percentage points.)

Table 4

Is VI radiography your primary discipline of employment?

Response	Count	Percentage
Yes	269	99.6
No	0	0.0

Table 5

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

Response	Count	Percentage
R.T.(VI)	198	73.3
R.T.(CI)	7	2.6
R.T.(CV)	1	0.4
R.T.(R)	228	84.4
RCIS	2	0.7
RCES	0	0.0
RN	0	0.0
LPN	0	0.0

Table 6

How many years have you worked as a VI radiographer?

Response	Count	Percentage
Less than 1 year	5	1.9
1 - 3 years	89	33.0
4 - 5 years	96	35.6
6 - 10 years	63	23.3
More than 10 years	17	6.3

Table 7

What is your primary job title

Response	Count	Percentage
Staff radiographer	219	81.1
Lead or chief radiographer	37	13.7
Educator	0	0.0
Administrator or manager	0	0.0
Other	13	4.8

Table 8

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

Response	Count	Percentage
Less than 20 hours	7	2.6
20 - 30 hours	26	9.6
More than 30 hours	237	87.8

Table 9

How many hours per week do you typically perform cardiac interventional procedures?

Response	Count	Percentage
Not applicable	229	84.8
Less than 20 hours	28	10.4
20 - 30 hours	7	2.6
More than 30 hours	6	2.2

Table 10

Please select the specialists that you currently support. (select all that apply)

Response	Count	Percentage
Cardiologist	39	14.4
Cardiothoracic surgeon	30	11.1
Neurologist/Neurosurgeon	127	47.0
Interventional nephrologist	72	26.7
Radiologist	235	87.0
Vascular Surgeon	151	55.9
Other	36	13.3

Table 11

Please select the environments that you currently work in: (select all that apply)

Response	Count	Percentage
OR	65	24.1
Hybrid OR	113	41.9
IR lab	249	92.2
Cath lab	37	13.7
EP lab	9	3.3
Other	18	6.7

Table 12

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

Response	Count	Percentage
Informal, on the job training	230	85.2
Structured on the job training, including didactic and supervised clinical instruction	117	43.3
Formal coursework provided by a college or university	35	13.0
Self-guided learning (journal and textbook reading, etc.)	184	68.1
In-hours (on-site) trainings sponsored by equipment vendors	157	58.1
Off-site training sponsored by equipment vendor	90	33.3
Seminar given by CE vendor	82	30.4
Self-funded, off-site training	29	10.7

Table 13

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

Response	Count	Percentage
Academic/university hospital	91	33.7
Community hospital	148	54.8
Government (e.g., military/VA) hospital	8	3.0
Outpatient imaging center	6	2.2
Free-standing vascular clinic	7	2.6
Mobile unit	0	0.0
Other	8	3.0

Table 14

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

Response	Count	Percentage
Not applicable	13	4.8
Less than 50	4	1.5
50-100	10	3.7
101-250	49	18.1
251-500	105	38.9
More than 500	87	32.2

Table 15

How many radiographers are employed in the VI department where you work?

Response	Count	Percentage
1 - 3	41	15.2
4 - 6	90	33.3
7 - 9	52	19.3
10 - 19	71	26.3
20 or more	16	5.9

Table 16

What functions are preformed by R.T.s in your vascular department?

Response	Count	Percentage
Scrub	262	97.0
Monitor	88	32.6
Circulate	257	95.2
Radiographic/fluoroscopic imaging	250	92.6
Administer medications (excluding contrast and heparinized saline)	42	15.6
Other	15	5.6

Table 17

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

Response	Count	Percentage
Yes	17	6.3
Yes, but may attain advanced certification after hire.	102	37.8
No	149	55.2

Table 18

If you answered yes to item 14, what certifications would meet the advanced requirement? (select all that apply)

Response	Count	Percentage
Not applicable	55	20.4
R.T.(VI)	123	45.6
R.T.(CI)	17	6.3
R.T.(CV)	24	8.9
RCIS	6	2.2
Other	2	0.7

Table 19

Does your employer require ACLS certification

Response	Count	Percentage
Yes	78	28.9
No	192	71.1

Table 20

Does your employer require PALS certification

Response	Count	Percentage
Yes	8	3.0
No	262	97.0

Table 21

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

Response	Count	Percentage
No change	151	55.9
Increased	97	35.9
Decreased	21	7.8

Table 22

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

Response	Count	Percentage
No change	128	47.4
Increased	69	25.6
Decreased	72	26.7

Table 23

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

Response	Count	Percentage
No change	94	34.8
Increased	128	47.4
Decreased	47	17.4

Table 24

How long did this survey take to complete?

Response	Count	Percentage
Less than 10 minutes	11	4.1
10 - 19 minutes	102	37.8
20 - 29 minutes	107	39.6
30 - 39 minutes	38	14.1
40 - 49 minutes	6	2.2
50 - 59 minutes	1	0.4
More than 60 minutes	4	1.5

Table 25

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

Response	Count	Percentage
Yes	184	68.1
No	79	29.3

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:

- Record vital signs
- Prepare or assist in administering the following types of medications according to physician's orders: Analgesics
- Percutaneous stone extraction (e.g., renal, biliary)
- Discography

The following tasks were added or significantly revised:

- Check emergency cart to ensure appropriate emergency supplies
- 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 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
- Prior to administration of a contrast agent or medication, determine if the patient is at risk for an adverse event
- Observe ECG for changes and recognize abnormal rhythms
- Recognize and communicate the need for prompt medical attention
- Identify characteristics of interventional and diagnostic non-imaging equipment (e.g., balloons, wires, appropriate sizing)
- Assist in OR hybrid procedures
- Handle, label, and submit laboratory specimens (e.g., body fluid, tissue samples).
- Operate interventional procedural equipment:
    - ultrasound units
    - intra-vascular ultrasound (IVUS)
    - cryo/microwave ablation
    - thrombectomy
    - thrombolysis
    - atherectomy
    - laser
    - lithotripsy (balloon or catheter)
- Assist with the following procedures:
    - vascular diagnostic procedures - lymphangiography – general mapping
    - vascular interventional procedures:
        - thrombectomy:
            - neurologic

        - body
    - percutaneous thrombin injection
    - venous access:
        - port removal
        - PICC line placement
    - nonvascular procedures:
        - antegrade urography through an existing catheter
        - suprapubic catheter placement
        - percutaneous ablation
            - thermal ablation
            - cryoablation
            - radiofrequency ablation (RFA)
        - percutaneous, enteric tube evaluation (verification with contrast)
        - epidural steroid injection
        - lumbar puncture
        - myelogram
    - percutaneous drainage with or without placement of catheter (excluding thoracentesis and paracentesis)
    - removal of percutaneous drainage catheter (e.g., tunneled, non-tunneled)
    - change of percutaneous tube or drainage catheter
    - abscess, fistula, or sinus tract study
    - post-procedure patient care:
        - vascular closure device placement:
        - permanent
        - non-permanent
        - apply pressure to arterial or venous puncture site:
            - manual pressure
            - external device
        - assist with access site complication management

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.arrt.org/pages/arrt-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 February 2022 and the committee met again in May 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
    - Divided Patient Assessment and Preparation, and Patient Monitoring into separate sections with additional content
    - Added additional details to emergency care
    - Removed infection control section
- Image Production
    - Added a list of procedural equipment
    - Removed patient shielding
- Procedures
    - Added lymphangiography (general mapping) to vascular diagnostic procedures
    - Added vascular interventional procedures
        - percutaneous thrombin injection
        - port removal
        - PICC line placement
    - Split thrombectomy into separate neurologic and body sections
    - Added “interventional suite vs hybrid OR” to the focus of questions for Vascular Interventional Procedures
    - Added nonvascular procedures
        - Anterograde urography through an existing catheter
        - Suprapubic catheter placement
        - Percutaneous enteric tube evaluation (verification with contrast)
        - Epidural steroid injection
        - Lumbar puncture
        - Myelogram
        - Abscess, fistula, or sinus tract study
    - Split drainage procedures into four separate types of procedures
    - Added ultrasound guidance to the focus of questions for nonvascular procedures
    - Removed percutaneous stone extraction
    - Removed discography

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

Item weighting for the examination content specifications was adjusted. The total number of examination questions remains the same, but some areas increased or decreased. The number of pilots remains the same at 50.

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 26).

Table 26
Number of Items per Section

Content Area	Number of Scored Items
Patient Care	**22**
Patient Interactions and Management (22)	
Image Production	**26**
Image Acquisition and Equipment (26)	
Procedures	**112**
Vascular Diagnostic Procedures (41)	
Vascular Interventional Procedures (41)	
Nonvascular Procedures (30)	
Grand Total	**160**

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 February 2022 and the committee met again in May 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 listing of procedures was changed from anatomic and system areas (e.g., neurological, thoracic) to the three principal areas of vascular diagnostic, vascular interventional, and nonvascular.
- Added vascular diagnostic procedures
  - Intracranial arteriography
  - Bronchial arteriography
  - Celiac arteriography

        - Gonadal venography
        - Hepatic venography
        - Portal venography
        - Physiologic pressure measurements
        - Lymphangiography (general mapping)
    - Added vascular interventional procedures
        - Percutaneous thrombin injection
        - Distal protection device placement
        - Transvenous biopsy
    - Subdivided vascular interventional procedures into neurologic and body areas
        - Angioplasty stent placement
        - Thrombolysis
        - Thrombectomy
    - Added nonvascular procedures
        - urography through an existing catheter
        - suprapubic catheter placement
        - percutaneous enteric tube evaluation (verification with contrast)
        - vertebroplasty/kyphoplasty
        - epidural steroid injection
        - lumbar puncture
        - myelogram
        - percutaneous biopsy
        - abscess
        - fistula
        - sinus tract study
    - Removed nonvascular procedures
        - Discography
        - Percutaneous stone extraction
    - Subdivided drainage procedures into four separate procedural areas
    - The maximum number of times a procedure can be performed and counted decreased from 20 to 10 times. At least 50 exams must be from each area of vascular diagnostic, vascular interventional, and nonvascular. The remaining 50 exams can be from any of these areas
    - The maximum number procedures/entries that may be logged each day was increased from six to 10. For any given patient, only one diagnostic procedure and additional different interventional procedures (e.g., angioplasty, stent) can be logged per day

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.arrt.org/pages/arrt-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 vascular interventional radiography, and thanks to the efforts of all involved it assures that the ARRT Vascular Interventional Radiography exam program will continue to be an excellent assessment of vascular interventional technologists wishing to demonstrate their qualifications by seeking certification and registration.