IMPORTANT NOTICE

Interim policy announced for post-primary structured education requirement

Interim policy 'relaxes' exam content outline requirement

(November 12, 2015) — The ARRT announces an interim policy that modifies the post-primary certification and registration structured education requirement effective January 1, 2016.

In 2010, ARRT announced an additional requirement for individuals seeking post-primary credentials. Sixteen hours of structured education reflecting the content of the examination content outline with at least one credit from each major content category of the outline would be required beginning this January 1, 2016.

The structured education requirement will enhance post-primary certification and registration by providing additional documentation that candidates have mastered the knowledge determined through the practice analysis process to be part of being qualified.

"Relaxed" interim requirement takes effect

In November 2015, ARRT announced a two-year interim phase-in period for the requirement. During the phase-in candidates must report 16 structured education credits from activities whose content "pertains to the discipline" rather than the stricter criterion of "reflecting the content of the examination content outline." The provision that candidates earn at least one credit from each of the exam content outline's major categories will not be enforced during the 2-year period. The activities must still meet the same criteria as activities reported for compliance with ARRT's biennial CE requirements (i.e., must be approved by a RCEEM, RCEEM+ or must meet ARRT's definition of an Approved Academic Course as described in the *ARRT Continuing Education Requirements).*

Interim policy effective January 1, 2016, through December 31, 2017

The two-year interim policy will allow CE sponsors additional time to create more activity options and better align existing activities with the subject matter of the post-primary exam content outlines. This will increase access for candidates to the education necessary to comply with the requirement.

The interim policy will apply to activities completed prior to January 1, 2018.

Activities completed January 1, 2018 and thereafter must meet the full structured education requirement as originally announced.

Magnetic Resonance Imaging

The purpose of structured education is to provide the opportunity for individuals to develop mastery of discipline-specific knowledge that, when coupled with selected clinical experiences, helps to document qualifications.

Candidates for Magnetic Resonance Imaging Certification and Registration must document at least 16 hours of structured education. Structured education activities may be academic courses from an institution accredited by a mechanism recognized by the ARRT[1], CE opportunities approved by a RCEEM or RCEEM+, or a combination of the two.

Structured education documentation must include at least one CE credit or its equivalent in each content area listed below (i.e., Patient Care, Safety, Image Production, and Procedures). The remaining hours may be earned from any one or more of the content areas.

Content Areas *	**Minimum Credits**
Patient Care (includes) 1. Patient Interactions and Management	1
Safety (includes) 1. MRI Screening and Safety	1
Image Production (includes) 1. Physical Principles of Imaging Formation 2. Sequence Parameters and Options 3. Data Acquisition and Processing	1
Procedures (includes) 1. Neuro 2. Body 3. Musculoskeletal	1
Total	16

Acceptable Examples:

Example 1	Example 2	Example 3
Patient Care – 3 hours Safety – 2 hours Image Production – 4 hours Procedures – 7 hours	Patient Care – 1 hour Safety – 1 hour Image Production – 1 hour Procedures – 13 hours	Patient Care – 1 hour Safety – 5 hours Image Production – 5 hours Procedures – 5 hours
TOTAL – 16 hours	TOTAL – 16 hours	TOTAL – 16 hours

* The number of questions and organization of content for the Magnetic Resonance Imaging Examination are located in the *Magnetic Resonance Imaging Examination Content Specifications* document.

[1] Activities meeting the definition of an approved academic course will be awarded credit at the rate of 12 CE credits for each academic **quarter** credit or 16 CE credits for each academic **semester** credit. See the ARRT *Continuing Education Requirements* document for additional information.

Patient Care

1. Patient Interactions and Management

A. Legal and Ethical Principles (4)
1. confirmation of exam requisition
   a. verification of patient identification
   b. comparison of request to clinical indications
2. legal issues
   a. common terminology (e.g.,* negligence, malpractice)
   b. legal doctrines (e.g., respondeat superior, res ipsa loquitur)
3. patient's rights
   a. informed consent (written, oral, implied)
   b. confidentiality (HIPAA)
   c. Patient's Bill of Rights (e.g., privacy, access to information, health care proxy, research participation)
4. ARRT Standards of Ethics

B. Infection Control (3)
1. terminology and basic concepts
   a. types of asepsis
   b. sterile technique
   c. pathogens (e.g., fomites, vehicles, vectors)
   d. hospital acquired infections
2. cycle of infection
   a. pathogen
   b. source or reservoir of infection
   c. susceptible host
   d. method of transmission (contact, droplet, airborne, common vehicle, vector-borne)
3. CDC Standard Precautions (general patient contact)
   a. handwashing
   b. gloves, gowns
   c. masks
   d. medical asepsis/disinfection
4. additional or transmission-based precautions (e.g., hepatitis B, HIV, tuberculosis)
   a. airborne (e.g., negative ventilation)
   b. droplet (e.g., mask)
   c. contact (e.g., gloves, gown)
5. safe cleaning of equipment and disposal of contaminated materials
   a. linens
   b. needles
   c. patient supplies
   d. scanner, bore, coils, ancillary equipment

(Patient Care continues on the following page.)

* e.g., This is used here and in the remainder of this document to indicate examples of the topics covered, but not a complete list.

Patient Care (continued)

C. Interpersonal Communications (3)
1. modes of communication
   a. verbal, written
   b. nonverbal
      (e.g., eye contact, touching)
2. challenges in communication
   a. patient characteristics
      (e.g., cultural factors, physical or emotional status)
   b. strategies to improve understanding
3. patient education
   a. explanation of procedure
      (e.g., risks, benefits)
   b. communication with patient during procedure
   c. follow-up instructions
   d. referral to other services
4. medical terminology

D. Patient Assessment, Monitoring and Management (7)
1. routine monitoring
   a. vital signs
   b. physical signs and symptoms
   c. sedated patients
   d. claustrophobic patients
2. emergency response
   a. reactions to contrast
   b. other allergic reactions (e.g., latex)
   c. cardiac/respiratory arrest (CPR)
   d. physical injury, trauma or RF burn
   e. other medical disorders (e.g., seizures, diabetic reactions)
   f. life-threatening situations
      (e.g., quench, projectiles)
3. patient transfer and body mechanics
4. assisting patients with medical equipment
   a. implantable devices (e.g., infusion catheters, pumps, pacemakers)
   b. oxygen delivery systems
   c. other (e.g., nasogastric tubes, urinary catheters)

E. Contrast Administration
1. type of agent (FDA approved)
2. contraindications
3. dose calculation
4. administration route
5. effects on image

Safety

1. MRI Screening and Safety

A. Screening and Education (patients, personnel, non-personnel)
   1. biomedical implants
      a. identify and document device, year, make, model
      b. research and verify device labeling (MRI safe, MRI conditional, MRI unsafe)
      c. identify device specific parameters
   2. ferrous foreign bodies
   3. medical conditions (e.g., renal function, pregnancy)
   4. prior diagnostic or surgical procedures
   5. topical or externally applied items (e.g., tattoos, medication patches, body piercing jewelry, monitoring devices)
   6. level 1 and level 2 MRI personnel

B. Equipment Safety
   1. placement of conductors (e.g., ECG leads, coils, cables)
   2. cryogen safety
   3. ancillary equipment in proximity (MRI safe, conditional, unsafe)
   4. emergency procedures (e.g., quench, fire)

C. Environment
   1. climate control (temperature, humidity)
   2. designated safety zones
   3. gauss lines
   4. magnetic shielding
   5. RF shielding

D. Biological Considerations
   1. RF field
      a. specific absorption rate (SAR)
      b. biological effects
      c. FDA guidelines
   2. static and gradient magnetic fields
      a. biological effects
      b. FDA guidelines
   3. acoustic noise

Image Production

1. Physical Principles of Image Formation

A. Instrumentation
   1. electromagnetism
      a. Faraday's law
      b. types of magnets (superconductive, permanent, resistive)
      c. magnetic field strength
   2. radiofrequency system
      a. coil configuration
      b. transmit and receive coils
      c. transmit and receive bandwidth
      d. pulse profile
      e. phased array
   3. gradient system
      a. coil configuration
      b. slew rate
      c. rise time
      d. duty cycle

B. Fundamentals
   1. nuclear magnetism
      a. Larmor equation
      b. precession
      c. gyromagnetic ratio
      d. resonance
      e. RF pulse
      f. equilibrium magnetization
      g. energy state transitions
      h. phase coherence
      i. free induction decay (FID)
   2. tissue characteristics
      a. T1 relaxation
      b. T2 relaxation
      c. T2* (susceptibility)
      d. proton (spin) density
      e. flow
      f. diffusion
      g. perfusion
   3. spatial localization
      a. vectors
      b. X, Y, Z coordinate system
      c. physical gradient
      d. slice select gradient
      e. phase-encoding gradient
      f. frequency (readout) gradient
      g. k-space (raw data)

C. Artifacts
   1. cause and appearance of artifacts
      a. aliasing
      b. Gibbs, truncation
      c. chemical shift
      d. magnetic susceptibility
      e. radiofrequency, zipper
      f. motion and flow
      g. partial volume averaging
      h. crosstalk
      i. cross excitation
      j. Moiré pattern
      k. parallel imaging artifacts
   2. compensation for artifacts

D. Quality Control
   1. slice thickness
   2. spatial resolution
   3. contrast resolution
   4. signal to noise
   5. center frequency
   6. transmit gain
   7. geometric accuracy
   8. equipment handling and inspection (e.g., coils, cables, door seals)

(Image Production continues on the following page.)

Image Production (continued)

2. Sequence Parameters and Options

A. Imaging Parameters
1. TR
2. TE
3. TI
4. number of signal averages (NSA)
5. flip angle (Ernst angle)
6. FOV
7. matrix
8. number of slices
9. slice thickness and gap
10. phase and frequency
11. echo train length
12. effective TE
13. bandwidth (transmit, receive)
14. concatenations (number of acquisitions per TR)

B. Imaging Options
1. 2D/3D
2. slice order (sequential, interleaving)
3. spatial saturation pulse
4. gradient moment nulling
5. suppression techniques (e.g., fat, water)
6. physiologic gating and triggering
7. in-phase/out-of-phase
8. rectangular FOV
9. anti-aliasing
10. parallel imaging
11. motion correction imaging technique
12. filtering

FOCUS OF QUESTIONS:

Questions will address the interdependence of the imaging parameters and options listed on the left, and how those parameters and options affect image quality and contrast.

1. Image Quality
- contrast to noise (C/N)
- signal to noise (S/N)
- spatial resolution
- acquisition time

2. Contrast
- T1 weighted
- T2 weighted
- proton (spin) density
- T2* weighted

(Image Production continues on the following page.)

Image Production (continued)

3. Data Acquisition and Processing

A. Pulse Sequences
- 1. spin echo
  - a. conventional spin echo
  - b. fast spin echo (FSE)
- 2. inversion recovery
  - a. STIR
  - b. FLAIR
- 3. gradient recall echo (GRE)
  - a. conventional gradient echo
  - b. spoiled gradient echo
  - c. coherent gradient echo
  - d. steady state free precession
  - e. fast gradient echo
- 4. echo planar imaging (EPI)

B. Data Manipulation
- 1. k-space mapping and filling (e.g., centric, spiral, keyhole)
- 2. fast fourier transformation (FFT)
- 3. post processing
  - a. maximum intensity projection (MIP)
  - b. multiplanar reconstruction (MPR)
  - c. subtraction
  - d. apparent diffusion coefficient (ADC) mapping

C. Special Procedures
- 1. MRA/MRV
  - a. flow dynamics
  - b. time-of-flight
  - c. phase contrast
  - d. contrast enhanced
- 2. functional techniques
  - a. diffusion
  - b. perfusion
  - c. spectroscopy
- 3. dynamic imaging
- 4. contrast bolus detection
  - a. fluoro-triggering
  - b. timing bolus
  - c. automatic bolus detection

Procedures

1. Neuro

A. Head and Neck
1. brain
2. head trauma
3. brain for stroke
4. brain for MS
5. brain for seizure
6. brain for CSF flow
7. pediatric brain
8. IAC
9. pituitary
10. orbit
11. soft tissue neck (e.g., parotids, thyroid)
12. angiography
13. spectroscopy

B. Spine
1. cervical
2. thoracic
3. lumbar
4. sacrum/coccyx
5. brachial plexus

2. Body

A. Thorax
1. chest
2. breast
3. angiography

B. Abdomen
1. liver, spleen
2. pancreas
3. kidneys
4. adrenals
5. MRCP
6. angiography
7. enterography

C. Pelvis
1. soft tissue pelvis (bladder, rectum, anus)
2. female pelvis (uterus/cervix, ovaries, vagina)
3. male pelvis (prostate, testes)
4. angiography (iliac and run-off)

FOCUS OF QUESTIONS:

Questions about each of the studies listed on the left may focus on any of the following factors:

1. Anatomy and Physiology
- imaging planes
- pathological considerations
- protocol considerations
- patient considerations (e.g., pediatric, geriatric, bariatric)

2. Patient Set Up
- patient data input
- coil selection and position
- patient orientation
- landmarking
- physiologic gating and triggering

(Procedures continue on the following page.)

Procedures (continued)

3. Musculoskeletal

A. Temporomandibular Joint
B. Shoulder
C. Elbow
D. Wrist
E. Hand/Fingers
F. Thumb
G. Hip
H. Ankle
I. Knee
J. Fore Foot and Hind Foot
K. Long Bones (humerus, forearm, femur, lower leg)
L. Arthrography
M. Angiography
N. SI Joints
O. SC Joints
P. Sternum
Q. Bony Pelvis

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