Bachelor of Science in Radiologic Sciences (B.S.R.S.) Core Curriculum

Sponsored by the American Society of Radiologic Technologists, 15000 Central Ave. SE, Albuquerque, NM 87123-3909.

Introduction

The ASRT recognizes the baccalaureate degree as the professional level of radiologic science education. The need for sophisticated imaging management and leadership to respond to the clinical, organizational and fiscal demands facing the health care industry supports the creation of advanced educational and skill development opportunities for imaging and therapeutic practitioners.

Baccalaureate degree programs in radiography currently exist. These programs take on varying models, and content within this document is applicable to any of these program models.

This B.S.R.S. core curriculum is an expression of content that elevates entry-level education and supports multiple post-primary specialty certifications as well as a transition to education in advanced clinical practice. The core content areas should be seen as the essential foundation of any B.S.R.S. program. Sponsors of B.S.R.S. degrees are encouraged to create a favorable environment for graduates of associate degree and certificate programs to transfer into the B.S.R.S. degree track.

The curriculum document consists of three sections: foundations, core content and optional. The foundations section represents an inventory of pre-existing knowledge and skills gained through an entry-level radiography educational experience and reinforced through professional practice.

Elements making up the core should be viewed as the minimum necessary; expansion or addition of areas is encouraged in developing an overall curriculum plan. Items within the core may be modified for regional, state or institutional variations. The descriptions and objectives are general in nature and not all inclusive. Instructors may modify the descriptions and objectives to reflect personal knowledge and experience. Curriculum content in outline form is intended to provide the general aspects that should be covered in the curriculum, while allowing instructor latitude in choosing specific content to make up individual courses. Program faculty should decide whether to combine topics in a single course or divide the information in one content area into separate courses.

The proposed B.S.R.S. core curriculum continues to expand areas found in the entry-level radiography curriculum, such as critical thinking, human diversity, research and communication skills. Students at the B.S.R.S. level engage these topics with more depth and breadth, resulting in a broader knowledge base and skill set than the entry-level radiographer.

Table of Contents

Foundations

This foundations section represents an inventory of pre-existing knowledge and skills gained through an entry-level radiography educational experience and reinforced through professional practice. The content in this section is intended to aid technologists in career planning and program managers in the development of preassessment tools for candidate selection.

Clinical Practice
Content and clinical practice experiences should be designed to sequentially develop, apply, critically analyze, integrate, synthesize and evaluate concepts and theories in the performance of radiologic procedures. Through structured, sequential, competency-based clinical assignments, concepts of team practice, patient-centered clinical practice and professional development are discussed, examined and evaluated.

Clinical practice experiences should be designed to provide patient care and assessment, competent performance of radiologic imaging and total quality management. Levels of competency and outcomes measurement ensure the well-being of the patient preparatory to, during and following the radiologic procedure.

Digital Image Acquisition and Display
Content imparts an understanding of the components, principles and operation of digital imaging systems found in diagnostic radiology. Factors that impact image acquisition, display, archiving and retrieval are discussed. Principles of digital system quality assurance and maintenance are presented.

Ethics and Law in the Radiologic Sciences
Content provides a foundation in ethics and law related to the practice of medical imaging. An introduction to terminology, concepts and principles will be presented. Students will examine a variety of ethical and legal issues found in clinical practice.

Human Structure and Function
Content establishes a knowledge base in anatomy and physiology. Components of the cells, tissues, organs and systems are described and discussed. The fundamentals of sectional anatomy relative to routine radiography are addressed.

Introduction to Computed Tomography
Content is designed to provide entry-level radiography students with an introduction to and basic understanding of the operation of a computed tomography (CT) device. Content is not intended to result in clinical competency.

Medical Terminology
Content provides an introduction to the origins of medical terminology. A word-building system is introduced and abbreviations and symbols are discussed. Also introduced is an orientation to understanding radiographic orders and diagnostic report interpretation. Related terminology is addressed.

Pathophysiology
Content is designed to introduce concepts related to the disease process. An emphasis on etiological considerations, neoplasia and associated diseases in the radiation therapy patient should be presented.

Patient Care in Radiologic Sciences
Content provides the concepts of optimal patient care, including consideration for the physical and psychological needs of the patient and family. Routine and emergency patient care procedures are described, as well as infection control procedures using standard precautions. The role of the radiographer in patient education is identified.

Pharmacology and Venipuncture
Content provides basic concepts of pharmacology, venipuncture and administration of diagnostic contrast agents and intravenous medications. The appropriate delivery of patient care during these procedures is emphasized.

Radiation Biology
Content provides an overview of the principles of the interaction of radiation with living systems. Radiation effects on molecules, cells, tissues and the body as a whole are presented. Factors affecting biological response are presented, including acute and chronic effects of radiation.

Radiation Physics
Content is designed to establish a basic knowledge of physics pertinent to developing an understanding of radiations used in the clinical setting. Fundamental physical units, measurements, principles, atomic structure and types of radiation are emphasized. Also presented are the fundamentals of x-ray generating equipment, x-ray production and its interaction with matter.

Radiation Protection
Content presents an overview of the principles of radiation protection, including the responsibilities of the radiographer for patients, personnel and the public. Radiation health and safety requirements of federal and state regulatory agencies, accreditation agencies and health care organizations are incorporated.

Sectional Anatomy
Content will introduce students to medical imaging methods currently used in the field of radiation therapy. Students will identify normal anatomical structures via a variety of imaging formats. Basic anatomical relationships will be compared using topographical and cross-sectional images.

Refer to Appendix for a detailed list of objectives for each content area.

Core Content

The B.S.R.S. requires specific knowledge and skills generally not obtained in basic educational programs in radiography. The core content section represents curriculum elements considered essential in educating students in a broader knowledge base and skill set than the entry-level radiographer.

Advanced Patient Care

Description

As the role of the medical imaging professional continues to expand, more knowledge is needed in all areas. Patient care is no exception. Advanced patient care skills are essential elements of providing high-quality patient care. This course focuses on patient education, assessment, communication, preprocedural and postprocedural care and proper charting and documentation. Technologists' responsibilities and intervention in cases of critical patient need also is discussed.

Objectives

1. Describe the areas required for patient education in medical imaging.
2. Contribute to treatment plan based on patient assessment.
3. Describe the procedure for and importance of obtaining a complete patient clinical history.
4. Perform proper charting and documentation using manual or electronic formats.
5. Analyze a situation requiring drug dispensing to determine the proper drug amount and route of administration.
6. List the parameters used in the current American Heart Association (AHA) Advanced Cardiac Life Support Guidelines.
7. Recognize normal and abnormal cardiac rhythms.

Content

I. Patient Education

A. Preprocedure

B. Postprocedure

II. Assessment of Physiological Parameters of Recommended Vitals

A. Introduction to basic patient assessment
   1. Subjective, objective, assessment, plan (SOAP format)
   2. Chief complaint, history, assessment, rendered treatment, transport/transfer (CHART format)

B. Patient history
   1. Setting of the interview
   2. Structure of the interview
   3. Taking the history

C. Patient assessment
   1. Pulse oximetry
   2. Level of consciousness
   3. Signs of patient distress
   4. Assessment of pain level before, during and after exam

D. Components of the cardiac cycle
   1. Electrocardiogram (ECG)
      a. Normal
      b. Dysrhythmia

E. Visual inspections
   1. Skin
   2. Eyes
   3. Nails

III. Charting and Documentation

A. Recognizing proper documentation

B. Manual vs. electronic

C. Ethical and legal aspects

IV. Procedure Specific Patient Care

A. Preprocedural

B. Postprocedural

V. Drug Dispensing

A. Routine and emergency situations
   1. Types of drugs to use
   2. When to use the drugs

B. Drug actions
   1. Therapeutic
   2. Adverse effects
      a. Minor
      b. Moderate
      c. Severe
   3. Interventions

VI. AHA Advanced Cardiac Life Support

A. Technologist role

B. Drugs

C. Cardiac rhythms

D. Life-support

Advanced Sectional Anatomy

Description

The ability to locate and identify structures in the axial (transverse), sagittal, coronal and orthogonal (oblique) planes is a necessary skill in many imaging and therapeutic modalities. Volumetric data sets and 3-D reconstruction of the body structures are increasingly important to the critical diagnosis and treatment of diseases. To enhance patient care and assist physicians with the prognosis, radiologic science professionals must understand cross-sectional anatomy.

Objectives

1. Distinguish normal anatomical structures in the transverse or axial, coronal, sagittal and orthogonal (oblique) cross-sectional imaging planes within the:
   a. Head
   b. Neck
   c. Thorax
   d. Abdomen
   e. Pelvis
   f. Body imaging
   g. Extremities – large joints
2. Distinguish common pathologies recorded on multiplanar images.

Content

I. Head and Brain

A. Surface anatomy of the brain
   1. Fissures (sulci)
      a. Longitudinal cerebral
      b. Lateral (Sylvian)
      c. Central (of Rolando)
   2. Convolutions (gyri)
      a. Precentral
      b. Postcentral

B. Sinuses
   1. Frontal
   2. Maxillary
   3. Ethmoid
   4. Sphenoid

C. Facial bones
   1. Mandible
   2. Maxillae
   3. Zygomas
   4. Nasal bones
   5. Inferior nasal conchae
   6. Lacrimal
   7. Palatine
   8. Vomer

D. Cranial bones
   1. Frontal
   2. Ethmoid
      a. Nasal conchae (turbinates)
      b. Nasal septum
   3. Parietal
   4. Sphenoid
      a. Lesser wings
         1) Tuberculum sellae
         2) Sella turcica
         3) Dorsum sellae
         4) Anterior and posterior clinoid process
         5) Optic canals
      b. Greater wings
   5. Occipital
      a. Foramen magnum
      b. Internal and external occipital protuberance
      c. Jugular foramen

6. Temporal
    a. Zygomatic process
    b. External auditory meatus (EAM)
    c. Internal auditory canal
    d. Mastoid process
    e. Petrous portion or ridge

E. Lobes of the brain and midline cerebral hemisphere structures
    1. Frontal
    2. Parietal
    3. Occipital
    4. Temporal
    5. Insula (island of Reil)
    6. Cerebellum
    7. Corpus callosum (genu, rostrum, body and splenium)
    8. Septum pellucidum

F. Cranial nerves
    1. Olfactory
    2. Optic
    3. Oculomotor
    4. Trochlear
    5. Trigeminal
    6. Abducens
    7. Facial
    8. Vestibulocochlear
    9. Glossopharyngeal
    10. Vagus
    11. Accessory
    12. Hypoglossal

G. Brainstem
    1. Diencephalon
        a. Thalamus
        b. Hypothalamus
        c. Optic chiasm
        d. Optic tracts
        e. Infundibulum (pituitary stalk)
        f. Pituitary gland
        g. Mammillary bodies
        h. Pineal gland
    2. Midbrain
    3. Pons
    4. Medulla oblongata
        a. Spinal cord

H. Arteries of the head and neck (Circle of Willis)
    1. Vertebral
    2. Basilar
    3. Internal carotid
    4. Anterior and posterior communicating
    5. Anterior and posterior cerebral
    6. Middle cerebral

I. Veins
    1. Venous sinuses
        a. Superior sagittal sinus
        b. Vein of Galen
        c. Straight sinus
        d. Confluence of sinuses (torcular herophili)
        e. Transverse sinus
        f. Sigmoid sinus
    2. Internal jugular

J. Ventricular system
    1. Lateral ventricles (anterior, body, posterior, inferior or temporal, and trigone or antrium)
    2. Interventricular foramen (of Monro)
    3. Third ventricle
    4. Cerebral aqueduct (of Sylvius)
    5. Fourth ventricle
    6. Foramen of Luschka
    7. Foramen of Magendie
    8. Choroid plexus

K. Meninges
    1. Dura mater
        a. Extensions of the dura mater
            1) Falx cerebri
            2) Falx cerebelli
            3) Tentorium cerebelli
            4) Diaphragma sellae
        b. Spaces
            1) Epidural
            2) Subdural
            3) Subarachnoid
    2. Arachnoid
    3. Pia mater

L. Basal ganglia
    1. Caudate nucleus
    2. Putamen

3. Globus pallidus
4. Claustrum
5. Internal capsule
6. External capsule
7. Extreme capsule

M. Orbit
1. Globe
2. Lens
3. Optic nerve
4. Lacrimal gland
5. Lateral rectus muscle
6. Medial rectus muscle
7. Superior rectus muscle
8. Inferior rectus muscle
9. Superior oblique muscle
10. Inferior oblique muscle
11. Orbital fat
12. Ophthalmic artery
13. Retinal vein

N. Anatomical structures of brain
1. Diploe
2. Subcutaneous soft tissue
3. Superior sagittal sinus (anterior and posterior)
4. Central sulcus
5. Interhemispheric fissure
6. Falx cerebri
7. Centrum semiovale
8. Corpus callosum (genu, rostrum, body and splenium)
9. Septum pellucidum
10. Fornix
11. Sylvian fissure
12. Insula
13. Lentiform nucleus (putamen and globus pallidus)
14. Caudate nucleus (head)
15. Internal capsule (anterior, body and posterior sections)
16. External capsule
17. Claustrum
18. Hippocampus
19. Tentorium cerebelli
20. Petrous portion or ridge
21. Cerebellar tonsil
22. Internal auditory canal (IAC)
23. Nasal septum
24. EAM

25. Clivus
26. Mastoid air cells

II. Neck

A. Bones
1. Cervical vertebrae
   a. Bony structures
   b. Intervertebral disks
   c. Spinal cord and nerves
   d. Spinal ligaments

B. Organs
1. Pharynx
2. Larynx
3. Esophagus
4. Trachea
5. Salivary glands
6. Thyroid gland
7. Parathyroid glands
8. Lymph nodes

C. Vasculature and neurovasculature
1. Carotid arteries
2. Vertebral arteries
3. Jugular veins
4. Carotid sheath

D. Musculature
1. Anterior triangle
2. Posterior triangle

III. Chest and Mediastinum

A. Bony thorax
1. Thoracic vertebrae
   a. Bony structures
   b. Intervertebral disks
   c. Spinal cord and nerves
   d. Spinal ligaments
2. Sternum
3. Ribs
4. Costal cartilages
5. Scapulae
6. Clavicles

B. Pulmonary
1. Apices (lung)

2. Diaphragm
3. Angles
4. Hilum
5. Lobes (lungs)
6. Trachea
7. Carina
8. Primary (mainstem) bronchi
9. Secondary bronchi

C. Mediastinum
1. Thymus gland
2. Heart
   a. Coronary vessels and valves
   b. Musculature and septal walls
   c. Chambers
   d. Pulmonary vessels
3. Ascending aorta
4. Aortic arch
5. Branches of the aortic arch
6. Descending (thoracic) aorta
7. Inferior vena cava
8. Esophagus
9. Trachea
10. Thoracic duct
11. Lymph nodes
12. Azygos vein
13. Hemiazygos vein

D. Breasts

E. Musculature

IV. Abdomen

A. Bones
1. Lumbar vertebrae
   a. Bony structures
   b. Intervertebral disks
   c. Spinal cord and nerves
   d. Spinal ligaments

B. Diaphragm and openings

C. Branches of the abdominal aorta
1. Anterior visceral branches
   a. Celiac axis
      1) Left gastric

2) Splenic
3) Hepatic

2. Superior mesenteric artery
   a. Jejunal and ileal
   b. Inferior pancreaticoduodenal
   c. Middle colic
   d. Right colic
   e. Ileocolic
3. Inferior mesenteric artery
   a. Left colic
   b. Sigmoid
   c. Superior rectal
4. Lateral visceral branches artery
   a. Suprarenal
   b. Renal
   c. Testicular or ovarian
5. Parietal branches artery
   a. Inferior phrenics
   b. Lumbars
   c. Middle sacral
6. Terminal branches
   a. Common iliacs

D. Tributaries of the vena cava
1. Anterior visceral
   a. Hepatic
2. Lateral visceral
   a. Right suprarenal
   b. Renal veins
   c. Right testicular or ovarian
3. Tributaries of origin
   a. Common iliacs
   b. Median sacral

E. Tributaries of the portal vein
1. Splenic
2. Inferior mesenteric
3. Superior mesenteric
   a. Left gastric
   b. Right gastric
   c. Cystic

F. Abdominal organs and structures
1. Abdominal cavity
   a. Peritoneum
   b. Peritoneal space

c. Retroperitoneum
d. Retroperitoneal space
2. Liver
3. Gallbladder and biliary system
4. Pancreas and pancreatic ducts
5. Spleen
6. Adrenal glands
7. Urinary system and tract
a. Kidneys
b. Ureters
8. Stomach
9. Small intestine
10. Colon
11. Musculature

V. Pelvis

A. Bony structures
1. Proximal femur
2. Ilium
3. Ischium
4. Pubis
5. Sacrum
6. Coccyx

B. Pelvic vasculature
1. Arterial
a. Common iliacs
b. Internal iliacs
c. External iliacs
d. Ovarian/testicular
2. Venous
a. External iliacs
b. Internal iliacs
c. Common iliacs
d. Ovarian/testicular

C. Pelvic organs
1. Urinary bladder
a. Ureter
b. Urethra
2. Small intestine
a. Terminal ilium and ileocecal valve
3. Colon
a. Ascending
b. Descending
c. Sigmoid

d. Rectum
e. Vermiform appendix

4. Female reproductive organs
   a. Vagina
   b. Cervix
   c. Uterus
   d. Fallopian tubes
   e. Ovaries
5. Male reproductive organs
   a. Testes/scrotum
   b. Prostate gland
   c. Seminal vesicles
   d. External to pelvis
      1) Penis

VI. Extremities

A. Joints and associated soft-tissue structures
   1. Shoulder
   2. Elbow
   3. Wrist
   4. Hip
   5. Knee
   6. Ankle

Communication

Description
Communication is important because radiologic technologists need to effectively relate and communicate with patients and other health care professionals. Communication with the patient is well established in the entry-level curricula. Therefore, this content focuses on expanding the knowledge base and skills necessary for interpersonal, internal, external and written communications. Human diversity and respect is emphasized.

Objectives
1. Establish effective communication within the professional environment.
2. Apply communication strategies for conflict management.
3. Create and deliver professional presentations.
4. Integrate the values and beliefs of the profession and organization in daily communications.
5. Compose professional communications in a variety of electronic and written formats.
6. Demonstrate active listening skills.

Content

I. Interpersonal Communications

A. Health care interactions
   1. Professional – patient
   2. Professional – professionals
   3. Professional – family
   4. Patient – family

B. Listening and feedback
   1. Hearing vs. listening
   2. Active vs. inactive listening
   3. Reflecting
   4. Feedback

C. Building rapport
   1. Self-disclosure
   2. Trust
   3. Respectful social interactions
   4. Respect for human diversity
   5. Barriers to communication

D. Negotiation and conflict management
   1. Avoidance
   2. Accommodating
   3. Competitive
   4. Cooperation
   5. Compromising

E. Interview skills

II. Intrapersonal Communication

A. Perception
   1. Role
   2. Past roles and experiences
   3. Personality traits
   4. Culture
   5. Feelings and circumstances
   6. Self image

B. Perceptual errors
   1. Stereotyping
   2. First impressions

C. Defense mechanisms

III. Internal and External Communication

A. Groups
    1. Group types
    2. Roles and responsibilities
    3. Factors affecting group performance

B. Business communication
    1. Message types and structure
    2. Electronic communication
    3. Channels or hierarchy
    4. Telephone/conference calls

IV. Oral Communication

A. Speaker preparation
    1. Topic identification
    2. Audience analysis
    3. Environment
    4. Approach

B. Speech creation and delivery
    1. Topic selection
    2. Narrowing a topic
    3. Source materials
    4. Parts of a speech
    5. Informative speech patterns
    6. Persuasive speech patterns
    7. Supporting materials for clarification
    8. Speech delivery
        a. Appropriate and legal use of media

V. Communication Tools

A. Presentation tools

B. Multimedia

C. Mass media

Ethics and Diversity

Description

Ethics and diversity are important because all health care providers work in a global community that is increasingly diverse and complex. Health care providers must interact with individuals from a variety of backgrounds both ethically and with respect for their beliefs and values. This content builds on ethical and diverse issues that affect the radiologic technologist as an individual and interactions with patients, coworkers and the community.

Objectives

1. Assess situations to determine how a radiologic technologist would perform ethically based on personal, societal and professional standards within the United States.
2. Examine situations to determine if the radiologic technologist interacts appropriately and respectfully with a diverse population.

Content

I. Values and Ethics

A. Professional
   1. Standards
   2. Examples
   3. Resources for assistance

B. Medical
   1. Standards
   2. Examples
   3. Resources for assistance

C. Research
   1. Standards
   2. Examples
   3. Resources for assistance

II. Diversity

A. Socioeconomic

B. Ethnicity

C. Gender

D. Sexual orientation

E. Age

F. Family structure

G. Religion

H. Effects of lifestyle choices and behaviors

I. Mentally and physically challenged

J. Medical conditions

Health Care Delivery

Description
It is important for the radiologic technologist to understand the various methods of health care delivery to remain knowledgeable in the changing face of technology. The political context of health care organization and delivery, with specific focus on the mechanisms for policy formulation and implementation, is discussed.

Objectives
1. Debate historical perspectives and technological advances as they relate to the delivery of health care.
2. Discriminate between various policy formation and implementation mechanisms and the impact of each on direct patient care.
3. Analyze the various influences of policy on direct patient care.
4. Compare and contrast the different types of health care delivery systems.
5. Differentiate between the components of the U.S. health care delivery system.
6. Explain factors influencing health care delivery.
7. Characterize the sources of research and monitoring in health care delivery.
8. Examine the impact of imaging technology on health care delivery.

Content

I. Evolution of the U.S. Health Care System

A. Historical perspective

B. Evolution of national standards

C. Evolution of state standards

D. Landmark events

II. Health Policy Formulation and Implementation

A. National policy-making process

B. State policy-making process

C. Policy implementation

III. Policy Influences on Direct Patient Care

A. National

B. State

C. Local

D. Institutional
   1. For profit
   2. Not for profit

IV. U.S. Health Care Delivery System

A. Philosophy/mission

B. Organizational structure

C. Recipients of care

D. Health care providers

V. Components of the Health Care Delivery System

A. Financing

B. Insurance

C. Delivery

D. Payment

VI. Sources of Research and Monitoring Health Care Delivery

A. International agencies

B. National agencies

C. State (academic health centers)

D. Professional organizations/societies

VII. Factors Influencing U.S. Health Care Delivery

A. Definition of health

B. Determinates of health

C. Cultural beliefs and values

D. Strategies to improve health wellness

VIII. The Impact of Imaging Technology on Health Care Delivery

A. Telecommunication systems

B. Fusion technologies

C. Patient information/education resources

D. Rapid development of technology

Health Care Law and Compliance

Description

Health care law and compliance is important because of its impact on technologists, patients and health care facilities. This content is geared toward legal and compliance issues that affect the employee and employer directly regarding accreditation and compliance issues. In addition this content gives guidance on quality management techniques, including reporting, that can help mitigate noncompliance.

Objectives

1. Analyze various scenarios involving roles and responsibilities of radiologic technologists to determine if they are working within the scope of practice and using appropriate practice standards.
2. Evaluate an existing quality management plan to determine if it complies with effective quality management principles.
3. Determine implications of civil and criminal law upon professional licensing/certification and accreditation.
4. Outline civil procedures followed when a complaint is filed.
5. Analyze a situation to determine the type of patient consent granted.
6. Identify strategies to assure that patient's rights are maintained.
7. Differentiate between the employer's and employee's legal responsibilities.
8. Identify the accreditation and compliance issues relevant to health care facilities.

Content

I. Scope of Practice and Practice Standards

A. Scope of practice
   1. State laws and regulations
      a. Body of laws
   2. National certification
   3. Institutional authority
   4. National organizations
      a. Persuasive authority

B. Practice standards
   1. Development and maintenance
   2. Use and applications
   3. Clinical performance standards
   4. Quality performance standards
   5. Professional performance standards
   6. Advisory opinion statements

II. Components of a Quality Improvement Management Program

A. Decision making as an outcome of quality improvement analysis

B. Planning to improve quality and safety
   1. Present and future actions

C. Quality management team
   1. Involvement of other departments/agents
   2. Application of policy and procedures
   3. Assignments
   4. Monitoring
   5. Assessment
   6. Education
   7. Outcomes

III. Legal Issues

A. Civil

B. Criminal law

C. Administrative law

IV. Civil Procedures

A. Pleadings

B. Summons and complaint

C. Discovery

D. Motions

E. Trial procedure

F. Evidence

G. Verdict

H. Appeals

V. Burden of proof

A. *Res Ipsa Loquitur*

B. *Respondeat Superior*

VI. Patient Consent

A. Implied

B. Informed

C. Uninformed

D. Research (Institutional Review Board, or IRB)

VII. Advanced Directives

A. Living wills

B. Do-not-resuscitate orders (DNR)

C. Power of attorney

VIII. Employer and Employee Responsibilities

A. Labor laws

B. Unions

C. Discrimination laws

D. Workplace harassment

E. Conditions of employment
   1. Position descriptions
   2. Drug screening
   3. Background checks
   4. Misrepresentation

F. Liability coverage
   1. Employer
   2. Personal

G. Equipment safety regulations

H. Occupational safety and training

I. Whistleblower protection

IX. Accreditation and Compliance Issues

A. Purpose of accreditation

B. Health care facility accreditation
   1. Federal
   2. State
   3. Private

C. Health care professional credentialing
   1. Certification
   2. Licensure
   3. Registration

D. Credentialing agencies
   1. National organizations
   2. State agencies

E. Regulatory agencies
   1. Federal
   2. State

F. Advisory agencies
   1. International
   2. National

Leadership and Teambuilding

Description
Leadership and teambuilding are vital components of all health care organizations. To promote an effective team, the radiologic technologist must be able to lead and exercise the ability to function within an interdisciplinary team. It is highly recommended for this information to be applied throughout the curriculum to ensure adequate understanding based on various situations.

Objectives
1. Evaluate the characteristics of a team as they relate to the effectiveness of the team.
2. Compare and contrast the advantages and disadvantages of a team.
3. Discuss the role of the leader in building effective teams.
4. Identify the skills necessary to be an effective team leader.

Content

I. Nature of Teams

A. Philosophy and guiding principles of a team
   1. Vision
   2. Mission
   3. Goals

II. Team Utilization

A. Advantages

B. Disadvantages

C. Limitations

D. Continuous quality improvement

III. Leadership

A. Leadership role
   1. Facilitator
   2. Power
   3. Effectiveness
   4. Conflict management and resolution
   5. Mentoring

B. Leadership styles
   1. Coaching
   2. Motivating
   3. Empowering
   4. Situational leadership

C. Effective communication skills
   1. Guide the team through change
   2. Successfully achieve a common goal

IV. Characteristics of a Productive Team

A. Interdependence

B. Trust

C. Communication

D. Diversity

Pathophysiology

Description
Content focuses on the characteristics and manifestations of diseases caused by alterations or injury to the structure or function of the body. Concepts basic to pathophysiology as well as common disease conditions are studied and serve in understanding alterations that occur in the major body systems. Emphasis is placed on the image correlation with these pathologies. The in-depth study of pathophysiology allows the professional to communicate better with other health care professionals, including physicians and scientists, as well as with the patient, for the history and physical assessment.

Objectives
1. Define terminology used in the study of disease.
2. Describe the general principles and mechanisms of disease.
3. Describe the physiological response in inflammation and cell injury due to pathological insult.
4. Differentiate between the processes of various types of cellular and tissue injury and adaptive mechanisms.
5. Describe the disorders of fluid and electrolyte balance.
6. Differentiate between the mechanisms of tissue repair and healing.
7. Identify common tests used to diagnose disease or injury.
8. Examine the role of nutrition and genetics in disorders.
9. Describe the common etiology, signs and symptoms, diagnostic tests, typical course and management of common diseases and disorders of body systems.
10. Discuss the common effects of aging on each of the body systems.

Content

I. Concepts of Health and Disease Defined

A. Definition of health

B. Disease terminology

C. Influences on health and the development of disease

II. Alterations in Cell Function and Growth

A. Cell and tissue characteristics

B. Cellular adaptation and injury

C. Genetic and congenital disorders

D. Alterations in cell differentiation: neoplasia

E. Tissue repair and wound healing

III. Alterations in Body Defenses

A. Stress and adaption

B. Alterations in temperature regulation

C. Infectious processes

D. Inflammation and repair

E. The immune response

F. Alterations in the immune response

G. Acquired immunodeficiency syndrome (AIDS)

H. White blood cell and lymphoproliferative disorders

I. Alterations in hemostasis and blood coagulation

IV. Alterations in Oxygenation of Tissues

A. Composition of blood and blood formation

B. The red blood cell and alterations in oxygen transport

C. The circulatory system and control of blood flow

D. Alterations in blood flow

E. Control of arterial blood pressure

F. Alterations in blood pressure

G. Control of cardiac function

H. Alterations in cardiac function
   1. Disorders of the pericardium
   2. Coronary artery disease
   3. Dysrhythmias and conduction disorders
   4. Disorders of the endocardium
   5. Valvular disease
   6. Cardiomyopathies
   7. Congenital heart disease
   8. Diagnosis and treatment

I. Heart failure

J. Circulatory shock

K. Control of respiratory function

V. Alterations in Respiratory Function

A. Respiratory infections

B. Disorders of the pleura

C. Obstructive lung disorders

D. Interstitial lung disorders

E. Pulmonary vascular disorders

F. Cancer of the lung

G. Ventilation disorders

H. Respiratory failure

I. Diagnosis and treatment

VI. Alterations in Body Fluids

A. Alterations in body fluids and electrolytes

B. Alterations in the distribution of body fluids

C. Alterations in acid-base balance

D. Control of renal function

E. Alterations in renal function
   1. Congenital disorders
   2. Urinary tract infections and pyelonephritis
   3. Obstructive disorders
   4. Disorders of the nephron and glomerulus
   5. Neoplasms
   6. Renal failure
   7. Diagnosis and treatment

VII. Alterations in Reproductive Function

A. Structure and function of the reproductive system

B. Alterations in the structure and function of the reproductive system
   1. Disorders of the testes and prostate
   2. Disorders of the uterus, ovaries and breasts

C. Diagnosis and treatment

VIII. Alterations in Endocrine Function, Metabolism

A. Mechanism of endocrine control

B. Control of metabolism

C. Alterations in endocrine control of growth and metabolism

D. Control of diabetes

E. Diagnosis and treatment

IX. Alterations in GI Function

A. Control of gastrointestinal function

B. Alterations of GI function
   1. Manifestations of GI tract disorders
   2. Disorders of the esophagus
   3. Disorders of the stomach
   4. Disorders of the small and large bowel
   5. Disorders of the peritoneum
   6. Malabsorption

C. Alterations in function of the hepatobiliary system and pancreas

D. Diagnosis and treatment

X. Alterations in Neuromuscular Function

A. Properties of the nervous tissue

B. Control of neuromuscular and autonomic nervous system function

C. Development and segmental organization of the nervous system

D. Disorders of cerebral function
   1. Increased cranial pressure
   2. Infections
   3. Seizures
   4. Consciousness and unconsciousness
   5. Organic brain syndrome

E. Alterations in motor function
   1. Control of motor function
   2. Alterations in cerebral circulation
   3. Disorders of the myelin
   4. Spinal cord injury
   5. Alterations in neuromuscular function

F. Pain
   1. Pain mechanisms and response
   2. Pain disorders
   3. Treatment for pain

G. Diagnosis and treatment

XI. Alterations in Skeletal Support and Movement

A. Structure and function of the skeletal system

B. Alterations in skeletal function: trauma and infection
   1. Injury and trauma of musculoskeletal structures
   2. Bone infections

C. Alterations in skeletal function
   1. Arthritis
   2. Congenital disorders
   3. Metabolic bone disease
   4. Neoplasms

D. Diagnosis and treatment

XII. Alterations in Skin Function and Integrity

XIII. Alterations in Structure and Function Related to Aging

A. Physiologic changes of aging

B. Functional considerations of aging
   1. Incontinence
   2. Instability and falls
   3. Sensory and cognitive impairment
   4. Depression
   5. Dementia
   6. Delirium

Patient Information Management

Description
Patient information management is important because of the integral role the radiologic technologist has within the health care team. It is essential for the radiologic technologist to provide all members of the team with a thorough patient record to ensure quality patient care.

Objectives:
1. Describe The Joint Commission standards and Health Insurance Portability and Accountability Act (HIPAA) regulations regarding the accountability and protection of patient information.
2. Evaluate the patient record to ensure The Joint Commission standards and HIPAA regulations are satisfied.
3. Explain the process by which imaging departments develop and revise policies and procedures to maintain compliance regarding patient information
4. Analyze the potential abuses in maintaining confidential patient information.

Content

I. The Joint Commission Standards

A. Accountability for protecting patient information
   1. Information collection
   2. Information maintenance
   3. Use of personally identifiable health information
   4. Contractual agreements
   5. Demonstrating and monitoring compliance

B. Consents
   1. Informed
      a. Patient and provider elements
   2. Release of information
      a. Purposes
      b. Types of information released
      c. Recipients of information

C. Education regarding policies, rights and responsibilities
   1. Patient education
   2. Provider education

II. Health Insurance Portability and Accountability Act (HIPAA)

A. Evolution of HIPAA

B. Impact on health care providers and personnel

C. Disclosure

D. State laws and regulations affecting the use of disclosure of health information

E. Health Information Technology for Economic and Clinical Health (HITECH) Act

III. Protected Health Information

A. Information systems
   1. Hospital information system (HIS)
   2. Radiology information system (RIS)
   3. Picture archiving and communications system (PACS)

B. Standards
   1. Digital imaging and communication in medicine (DICOM)
   2. Health level standards (HL7)

C. Health information exchanges (HIE)

D. Methods of obtaining patient health information
   1. Coding and standardization

E. Physical or electronic health record content
    1. Elements of proper charting and documentation
    2. Legal ramifications of improper charting and documentation

IV. Compliance

A. Accreditation

B. Federal and state regulations

C. Protected health information (PHI)

D. Non-compliance issue

Pharmacology

Description
An exploration of pharmacology is necessary to provide the student with comprehensive knowledge concerning drugs and their applications in medical imaging. Drug regulations, types of drugs and drug administration are included. Discussions integrate the selection of drugs with their appropriate use and possible effects.

Objectives
1. Outline consumer safety and drug regulations.
2. Differentiate among various types of drugs and their proper application.
3. Administer drugs commonly used for medical imaging.
4. Assess various types of responses following drug administration.

Content

I. Consumer Safety and Drug Regulations

A. Federal drug laws
   1. 1906 Pure Food and Drug Act
   2. 1938 Federal Food, Drug and Cosmetic Act
   3. 1970 Controlled Substances Act

B. State drug laws

C. The Food and Drug Administration

D. Drug Enforcement Administration

E. Proper disposal procedures

II. Abbreviations and Systems of Measurement

III. Drug Nomenclature and References

A. Classifications

B. Identifying names
   1. Generic name
   2. Chemical name
   3. Trade name
   4. Official name (as it appears in the United States Pharmacopoeia - USP/National Formulary - NF)

C. Legal terms referring to drugs
   1. Over-the-counter
   2. Legend (or prescription) drug
   3. Controlled substance

D. Terms indicating drug actions
   1. Indications
   2. Actions
   3. Contraindications
   4. Cautions
   5. Side effects
   6. Adverse reactions
   7. Interactions

E. Drug references
   1. *Physicians' Desk Reference*
   2. *United States Pharmacopoeia dispensing information*
   3. *American Hospital Formulary Service*
   4. *Compendium of Drug Therapy*

5. *Facts and Comparisons*
6. *American Hospital Formulary Service Drug Information*
7. *Mosby's GenRx*

IV. Biopharmaceutics

A. Dosage forms
1. Tablets
2. Capsules
3. Lozenges
4. Compressed suppositories or inserts
5. Injectables

B. Pharmacokinetics
1. Disintegration and dissolution
2. Absorption
3. Distribution
4. Metabolism
5. Excretion

C. Other variables
1. Age
   a. Pediatric considerations
   b. Geriatric considerations
2. Weight
3. Sex
4. Psychological state
5. Drug interactions
6. Dosage
7. Route

D. Unexpected responses to drugs
1. Teratogenic effect
2. Tolerance
3. Dependence
4. Hypersensitivity
5. Anaphylactic reaction

V. Pharmacodynamics

A. Mechanisms of action
1. Drug-receptor interactions
2. Drug-enzyme interactions
3. Nonspecific response relationships
4. Drug response relationships

B. Half-life
1. Duration of drug effect

C. Therapeutic index

D. Adverse effects

E. Drug-drug interactions

VI. Safe Dosage Preparation

A. Calculation guidelines

B. Age-appropriate dosage

VII. Responsibilities and Principles of Drug Administration

A. Responsible drug administration
   1. Informed consent
   2. Preprocedural/postprocedural assessment
   3. Evaluation of laboratory values

B. Medication error avoidance

VIII. Administration Routes and Techniques

A. Gastrointestinal (GI)
   1. Oral
   2. Nasogastric tube
   3. Gastric tube
   4. Rectal

B. Parenteral
   1. Buccal
   2. Transcutaneous
   3. Inhalation therapy
   4. Injections
   5. Topical
   6. Application to mucous membranes

C. Appropriate documentation of administration and patient outcomes
   1. Dose
   4. Time
   5. Route
   6. Location of injections
   7. Sign or initial record
   8. Documentation involving narcotics and any medications

IX. Frequently Used Drug Categories

A. Basic drug categories relevant to radiography as described in the Radiography Curriculum Guidelines

B. Drug categories relevant to patient care that go beyond radiography applications
   1. Adrenergic blocking agents
   2. Antimicrobials
   3. Antifungals
   4. Antivirals
   5. Anticholinergics
   6. Anticonvulsants
   7. Antiperistaltics
   8. Antipsychotics
   9. Antipyretics
   10. Antitussives
   11. Barbiturates
   12. Cardiac depressants/stimulants
   13. Emetics
   14. Hypoglycemics
   15. Opioids/opioid antagonists
   16. Radiopharmaceuticals
   17. Musculoskeletal relaxants
   18. Stimulants/tranquilizers

X. Contrast Media

A. Routes of administration
   1. Parenteral (intravascular)
   2. Enteral

B. Pharmacology of parenteral contrast media
   1. Categories
      a. Ionic
      b. Non-ionic
      c. Low osmolar
      d. Paramagnetic
      e. Echogenic
   2. Distribution
   3. Excretion

C. Adverse pharmacodynamics of parenteral contrast media
   1. Osmolality
   2. Chelation
   3. Anticoagulation
   4. Autoimmune response
   5. Nephrotoxicity
   6. Neurotoxicity
   7. Thyrotoxicity
   8. Drug interactions

D. Administration and dosage

E. Pharmacology of enteral contrast agents
   1. Barium sulfate
   2. Water-soluble iodinated
   3. Methylcellulose
   4. MR contrast agents

F. Postprocedure instructions

XI. Adverse Reactions

A. Patient assessment
   1. Screening
   2. Monitoring

B. Patient treatment
   1. Department protocol for each pharmacologic agent
   2. Technologist responsibilities
   3. Symptoms and recommended response
      a. Minor reaction
      b. Moderate reaction
      c. Severe reaction
      d. Extravasation/infiltration

Quality Management

Description
Quality management (QM) is important to ensure the proper functioning of equipment and compliance with government and accreditation standards. Thus, technologists should have an understanding of the activities and their role in the QM process. This content is designed to expand the QM skills of the technologist to include digital imaging systems and the application of QM principles in an imaging department.

Objectives
1. Differentiate between quality management (QM), quality assurance (QA) and quality control (QC).
2. Apply QM principles to a given scenario.
3. Analyze collected QM data and make appropriate recommendations.
4. Analyze the benefits of a QM program to the patient and to the department.
5. Develop a QM plan to collect data for digital imaging equipment.

Content

I. Definitions

A. Quality management (QM)

B. Quality assurance (QA)

C. Quality control (QC)

II. Concepts and Principles of QM

A. Philosophical basis

B. QM problem-solving strategies

C. Tools for problem identification and analysis

III. Collection and Analysis of QA Data

A. Development of indicators

B. Data collection methods

C. Assessment of outcomes

D. Standards for quality

IV. Benefits

A. Internal customers

B. External customers

V. QM Requirements for Computed Radiography/Digital Radiography/PACS

A. Initial acceptance testing

B. System reader preventive maintenance (PM)

C. Plate maintenance

D. Uniformity of processing codes

E. System detectors

F. Image quality

G. Image output

H. Repeat/reject analysis

Research Methods and Information Literacy

Description

Research methods and information literacy are important because the health care profession is continually changing, which requires the radiologic technologist to possess new knowledge to function competently. The radiologic technologist should contribute to the body of knowledge and be able to effectively analyze resources to promote growth in the profession. The attitude of life-long learning enables the radiologic technologist to stay in step with the current health care environment and be prepared to help foster the future and increase awareness of the profession in the global community. This content is geared to increase and disseminate intellectual inquiry, information literacy and the use of scholarly research methods.

Objectives

1. Analyze research articles to determine the accuracy and validity of findings.
2. Integrate information literacy concepts into a research project.
3. Critique research projects to determine appropriateness and usefulness to the profession.

Content

I. Analysis of Research Articles

A. Assessing appropriateness of article for source material
   1. Scholarly (peer-reviewed) publications
   2. News magazines, other non-peer-reviewed

B. Assessing quality of information
   1. Research design
   2. Research bias
   3. Study validity

C. Assessing value of article
   1. Application for future research and recommendations
   2. Implications for professional practice

II. Information Literacy Concepts

A. Research quality
   1. Technical accuracy
   2. Reader comprehension
   3. Scholarly
   4. Relevance to professional practice
   5. Effectiveness of writing style
   6. Appropriateness of form and style

B. Systematic literature analysis
   1. Determining sources of information
   2. Using information search strategies
   3. Assessing value and appropriateness of source material

C. Paper organization
   1. Appropriate title
   2. Title page
   3. Abstract
   4. Introduction
   5. Definition of terms
   6. Literature review
   7. Research design or methodology
   8. Hypothesis or purpose of research
   9. Results or analysis
   10. Conclusions, discussions and recommendations

III. Types of Research Projects

A. Literature review

B. Survey

C. Descriptive/technical

D. Case studies

E. Posters

F. Qualitative (observation or interview)

IV. Preparing a Research Project

A. Topic selection
   1. Analysis of current literature on topic
   2. Identification of clinical practice issues

B. Information search strategies
   1. Identifying information sources
   2. Types of searches (manual, electronic – Ovid, PubMed, etc.)

C. Ethical principles and legal consideration

D. Review of the literature
   1. Analysis of source material
   2. Integration of material into project

E. Research design and data collection
   1. Qualitative
   2. Quantitative
   3. Mixed methods

F. Data Analysis
   1. Terms (sensitivity, specificity, predictor values, false-positive, false-negative, etc.)
   2. Statistical methods – determine significance of data
   3. Qualitative methods
   4. Triangulation of multiple data sources

G. Dissemination of findings
   1. Format
      a. Abstract
      b. Article
      c. Poster
      d. PowerPoint presentation
      e. Others
   2. Reference formats, (e.g. American Medical Association or AMA, American Psychological Association or APA, etc.)
   3. Illustrations (images, charts, etc.)

H. Preparation of draft and revisions of project

I. Submission for publication
    1. Peer-reviewed
    2. Other (editorial, columns, etc.)

Optional Content

Content in this section will assist program planners wishing to enhance the curriculum with select topics of instruction intended to satisfy the mission of a given program and/or local employment market.

Educational Principles for Technologists

Description
Content is designed to impart an understanding of strategies and techniques for developing skills as an effective facilitator of learning in the clinical setting.

Objectives

- Identify common learning opportunities in the direct patient care clinical setting.
- Identify typical situations in the clinical setting in which technologists assume the role of a facilitator of learning.
- Differentiate training events from educational events in the clinical setting.
- Describe how the information processing theory influences the planning of an instructional event.
- List typical characteristics of adult learners.
- Employ an instructional design model in the development of an instructional event.
- Employ Gagne's nine events of instruction in the delivery of an instructional experience.

Content

I. Learning Events in the Clinical Setting

A. Formal vs. informal

B. Synchronous vs. asynchronous

II. Training vs. Education

A. Task oriented

B. Personal and professional growth oriented

III. Technologist in the Role of Facilitator of Learning

A. Formal and informal

B. Patient interactions

C. Peer instruction

D. Interactions with other agents within the clinical setting

E. Community service

IV. Information Processing Theory

A. Basic principles

B. Applications in instruction

V. Adult Learners

A. Knowles' andragogy

B. Characteristics
   1. Want to be treated with respect
   2. Have immediate learning needs
   3. Have a low tolerance for busy work
   4. Have useful past experience
   5. Seek activities that build on prior skills and knowledge
   6. Are intrinsically motivated
   7. Appreciate active/lively learning events

VI. Principles of Instructional Design

A. ADDIE Model
   1. Analyze
   2. Design
   3. Develop
   4. Implement
   5. Evaluation

B. Alternative Models
    1. Dick and Carey Model
    2. Problem-based Learning

C. Application in the clinical setting

VII. Events of Instruction

A. Gagne's Nine Events of Instruction
    1. Gain attention
    2. Activating motivation
    3. Stimulating recall of prerequisite learning
    4. Presenting stimulus material
    5. Providing learning guidance
    6. Eliciting the performance
    7. Providing feedback
    8. Assessing the learner's performance
    9. Promoting retention and transfer

B. Application in the clinical setting

C. Value of personal assessment and reflection following an instructional event

Health Care Informatics

Description

Medical informatics is an important part of the medical environment; therefore, health care providers must have an understanding of how computers are used in health care delivery. This content is designed to provide an exploration of information technology as it applies to health care and health care organizations. An overview of how information is captured, converted, stored and ultimately used within the health care system is provided.

Objectives

- Describe the role of technology in health care.
- Explain the ethical concerns related to health care informatics.
- Examine the impact of regulations, laws and standards related to informatics on health care delivery.
- Evaluate decision-making strategies used in informatics.
- Compare and contrast different informatics applications in health care.

Content

I. Health Care Informatics

A. Definition

B. History

C. Theories

D. Databases

E. Ethics

II. Regulations, Laws and Standards

A. Licensure/certification

B. Accreditation

C. National and international standards

D. Federal laws

III. Decision-making

A. Administrative

B. Clinical

C. Evidence-based medicine

IV. Healthcare Informatics Applications

A. Electronic health records

B. Patient care systems

C. Patient monitoring systems

D. Radiology imaging systems

V. Future Trends

Appendix

This section represents an inventory of pre-existing knowledge and skills gained through an entry-level radiography educational experience and reinforced through professional practice. The content in this section is intended to aid technologists in career planning and program managers in the development of preassessment tools for candidate selection.

Clinical Practice

Description

Content and clinical practice experiences should be designed to sequentially develop, apply, critically analyze, integrate, synthesize and evaluate concepts and theories in the performance of radiologic procedures. Through structured, sequential, competency-based clinical assignments, concepts of team practice, patient-centered clinical practice and professional development are discussed, examined and evaluated.

Clinical practice experiences should be designed to provide patient care and assessment, competent performance of radiologic imaging and total quality management. Levels of competency and outcomes measurement ensure the well-being of the patient preparatory to, during and following the radiologic procedure.

Objectives

- Exercise the priorities required in daily clinical practice.
- Execute medical imaging procedures under the appropriate level of supervision.
- Adhere to team practice concepts that focus on organizational theories, roles of team members and conflict resolution.
- Adapt to changes and varying clinical situations.
- Describe the role of health care team members in responding/reacting to a local or national emergency.
- Provide patient-centered clinically effective care for all patients regardless of age, gender, disability, special needs, ethnicity or culture.
- Integrate the use of appropriate and effective written, oral and nonverbal communication with patients, the public and members of the health care team in the clinical setting.
- Integrate appropriate personal and professional values into clinical practice.
- Recognize the influence of professional values on patient care.
- Explain how a person's cultural beliefs toward illness and health affect his or her health status.
- Use patient and family education strategies appropriate to the comprehension level of the patient/family.
- Provide desired psychosocial support to the patient and family.
- Demonstrate competent assessment skills through effective management of the patient's physical and mental status.
- Respond appropriately to medical emergencies.
- Examine demographic factors that influence patient compliance with medical care.
- Adapt procedures to meet age-specific, disease-specific and cultural needs of patients.
- Assess the patient and record clinical history.
- Demonstrate basic life support procedures.
- Use appropriate charting methods.
- Recognize life-threatening electrocardiogram (ECG) tracing.
- Apply standard and transmission-based precautions.
- Apply the appropriate medical asepsis and sterile technique.

- Demonstrate competency in the principles of radiation protection standards.
- Apply the principles of total quality management.
- Report equipment malfunctions.
- Examine procedure orders for accuracy and make corrective actions when applicable.
- Demonstrate safe, ethical and legal practices.
- Integrate the radiographer's practice standards into clinical practice setting.
- Maintain patient confidentiality standards and meet HIPAA requirements.
- Demonstrate the principles of transferring, positioning and immobilizing patients.
- Comply with departmental and institutional response to emergencies, disasters and accidents.
- Differentiate between emergency and non-emergency procedures.
- Adhere to national, institutional and departmental standards, policies and procedures regarding care of patients, providing radiologic procedures and reducing medical errors.
- Select technical factors to produce quality diagnostic images with the lowest radiation exposure possible.
- Critique images for appropriate anatomy, image quality and patient identification.
- Determine corrective measures to improve inadequate images.

Digital Image Acquisition and Display

Description
Content imparts an understanding of the components, principles and operation of digital imaging systems found in diagnostic radiology. Factors that impact image acquisition, display, archiving and retrieval are discussed. Principles of digital system quality assurance and maintenance are presented.

Special Note: Digital imaging is a rapidly evolving technology. Every effort has been made to provide a curriculum outline that reflects, as accurately as possible, the state of the art of this discipline as of publication. Educators are encouraged to modify this outline with up-to-date information as it becomes available from vendors, clinical sites, textbooks, and technical representatives.

Objectives
- Define terminology associated with digital imaging systems.
- Describe the various types of digital receptors.
- Describe the response of digital detectors to exposure variations.
- Compare the advantages and limits of each receptor type.
- Evaluate the spatial resolution and dose effectiveness for digital radiography detectors.
- Describe the histogram and the process or histogram analysis as it relates to automatic rescaling and determining an exposure indicator.
- Relate the receptor exposure indicator values to technical factors, system calibration, part/beam/plate alignment and patient exposure.
- Describe the response of PSP systems to background and scatter radiation.
- Use appropriate means of scatter control.
- Avoid grid use errors associated with grid cutoff and Moiré effect.
- Identify common limitations and technical problems encountered when using PSP systems.
- Employ appropriate beam/part/receptor alignment to avoid histogram analysis errors.
- Associate impact of image processing parameters to the image appearance.
- Apply the fundamental principles to digital detectors.
- Evaluate the effect of a given exposure change on histogram shape, data width and image appearance.
- Describe the conditions that cause quantum mottle in a digital image.
- Formulate a procedure or process to minimize histogram analysis and rescaling errors.
- Examine the potential impact of digital radiographic systems on patient exposure and methods of practicing the as low as reasonably achievable (ALARA) concept with digital systems.
- Describe picture archival and communications system (PACS) and its function.
- Identify components of a PACS.
- Define digital imaging and communications in medicine (DICOM).
- Describe HIPAA concerns with electronic information.
- Identify common problems associated with retrieving/viewing images within a PACS.

Ethics and Law in the Radiologic Sciences

Description
Content provides a foundation in ethics and law related to the practice of medical imaging. An introduction to terminology, concepts and principles will be presented. Students will examine a variety of ethical and legal issues found in clinical practice.

Objectives
- Discuss the origins of medical ethics.
- Apply medical/professional ethics in the context of a broader societal ethic.
- Explain the role of ethical behavior in health care delivery.
- Explain concepts of personal honesty, integrity, accountability, competence and compassion as ethical imperatives in health care.
- Identify legal and professional standards and relate each to practice in health professions.
- Identify specific situations and conditions that give rise to ethical dilemmas in health care.
- Explain select concepts embodied in the principles of patients' rights, the doctrine of informed (patient) consent and other issues related to patients' rights.
- Explain the legal implications of professional liability, malpractice, professional negligence and other legal doctrines applicable to professional practice.
- Describe the importance of accurate, complete and correct methods of documentation as a legal/ethical imperative.
- Explore theoretical situations and questions relating to the ethics of care and health care delivery.
- Explain legal terms, principles, doctrines and laws specific to the radiologic sciences.
- Outline the conditions necessary for a valid malpractice claim.
- Describe institutional and professional liability protection typically available to the radiographer.
- Describe the components and implications of informed consent.
- Identify standards for disclosure relative to informed consent.
- Describe how consent forms are used relative to specific radiographic procedures.
- Differentiate between civil and criminal liability.
- Define tort and explain the differences between intentional and unintentional torts.

Human Structure and Function

Description
Content establishes a knowledge base in anatomy and physiology. Components of the cells, tissues, organs and systems are described and discussed. The fundamentals of sectional anatomy relative to routine radiography are addressed.

Objectives
- Discuss the basics of anatomical nomenclature.
- Describe the chemical composition of the human body.
- Identify cell structure and elements of genetic control.
- Explain the essentials of human metabolism.
- Describe the types and functions of human tissues.
- Classify tissue types, describe the functional characteristics of each and give examples of their location within the human body.
- Describe the composition and characteristics of bone.
- Identify and locate the bones of the human skeleton.
- Identify bony processes and depressions found on the human skeleton.
- Describe articulations of the axial and appendicular skeleton.
- Differentiate the primary and secondary curves of the spine.
- Summarize the functions of the skeletal system.
- Label different types of articulations.
- Compare the types, locations and movements permitted by the different types of articulations.
- Examine how muscle is organized at the gross and microscopic levels.
- Differentiate between the structures of each type of muscle tissue.
- State the function of each type of muscle tissue.
- Name and locate the major muscles of the skeleton.
- Differentiate between the structure and function of different types of nerve cells.
- State the structure of the brain and the relationship of its component parts.
- Describe brain functions.
- List the meninges and describe the function of each.
- Outline how cerebrospinal fluid forms, circulates and functions.
- Describe the structure and function of the spinal cord.
- Determine the distribution and function of cranial and spinal nerves.
- Summarize the structure and function of components that comprise the autonomic nervous system.
- Describe the structures and functions of the components that comprise the human eye and ear.
- List the component body parts involved in the senses of smell and taste.
- List the somatic senses.
- Define endocrine.

- Describe the characteristics and functions of the components that comprise the endocrine system.
- Describe the hard and soft palates.
- Describe the structure and function of the tongue.
- Identify the structure, function and locations of the salivary glands.
- Describe the composition and characteristics of the primary organs of the digestive system.
- Describe the function(s) of each primary organ of the digestive system.
- Differentiate between the layers of tissue that comprise the esophagus, stomach, small intestine, large intestine and rectum.
- Differentiate between peritoneum, omentum and mesentery.
- List and label the accessory organs of the digestive system and describe their function.
- Identify the secretions and function of each accessory organ of the digestive system.
- Explain the purpose of digestion.
- List the digestive processes that occur in the body.
- Describe the composition and characteristics of blood.
- List the types of blood cells and state their functions.
- Differentiate between blood plasma and serum.
- Outline the clotting mechanism.
- List the blood types.
- Explain the term Rh factor.
- Explain the antigen/antibody relationship and its use in blood typing.
- Label the parts of the human heart.
- Describe the flow of blood through the body and identify the main vessels.
- Describe the structure and function of arteries, veins and capillaries.
- Differentiate between arterial blood in systemic circulation and arterial blood in pulmonary circulation.
- Outline the major pathways of lymphatic circulation.
- Correlate cardiac electrophysiology to a normal ECG tracing.
- Differentiate between nonspecific defenses and specific immunity.
- Explain antibody production and function.
- List the different types and functions of T- and B-cells and explain their functions.
- Label the components of the respiratory system.
- Describe the physiology and regulation of respiration.
- Label the parts of the kidneys, ureters, bladder and urethra.
- Describe the function of each organ of the urinary system.
- Describe the composition and formation of urine.
- Explain micturition.
- Label the anatomy of the male and female reproductive organs.
- Analyze the function of each of the male and female reproductive organs.
- Identify major sectional anatomical structures found within the head/neck, thorax and abdomen.

Introduction to Computed Tomography

Description
Content is designed to provide entry-level radiography students with an introduction to and basic understanding of the operation of a computed tomography (CT) device. Content is not intended to result in clinical competency.

Objectives
- Describe the components of the CT imaging system.
- Explain the functions of collimators in CT.
- List the CT computer data processing steps.
- Define algorithm and explain its impact on image scan factors and reconstruction.
- Define raw data and image data.
- Describe the following terms in relation to the CT data acquisition process:
  - Pixel.
  - Matrix.
  - Voxel.
  - Linear attenuation coefficient.
  - CT/Hounsfield number.
  - Partial volume averaging.
  - Window width (ww) and window level (wl).
  - Spatial resolution.
  - Contrast resolution.
  - Noise.
  - Annotation.
  - Region of interest (ROI).
- Name the common controls found on CT operator consoles and describe how and why each is used.
- Identify the types and appearance of artifacts most commonly affecting CT images.
- Name the radiation protection devices that can be used to reduce patient dose in CT and describe the correct application of each.
- Describe the general purpose of commonly performed CT studies.
- Discuss general radiation safety and protection practices associated with examinations in CT.

Medical Terminology

Description
Content provides an introduction to the origins of medical terminology. A word-building system is introduced and abbreviations and symbols are discussed. Also introduced is an orientation to understanding radiographic orders and diagnostic report interpretation. Related terminology is addressed.

Objectives
- Apply the word-building process.
- Interpret medical abbreviations and symbols.
- Critique orders, requests and diagnostic reports.
- Define medical imaging and radiation oncology terms.
- Translate medical terms, abbreviations and symbols into common language from a medical report.

Pathophysiology

Description
Content is designed to introduce concepts related to the disease process. An emphasis on etiological considerations, neoplasia, and associated diseases in the radiation therapy patient should be presented.

Objectives
- Describe the physiological response in inflammation and cell injury due to pathological insult.
- Assess the predictive factors, including genetics, lifestyles, age and environment as they influence the development of cancer and associated diseases.
- Compare the body's response to hereditary, lifestyle, age and environmental factors.
- Given a specific oncologic-related disease, determine probable diagnostic, prognostic, staging, grading and the rationale for the appropriate therapeutic pathway.
- Given the histology of a neoplasm, determine the tumor characteristics.
- Given a common disease, anticipate the effects of the disease on the oncologic patient.

Patient Care in Radiologic Sciences

Description
Content is designed to provide the basic concepts of patient care, including consideration for the physical and psychological needs of the patient and family. Routine and emergency patient care procedures are described, as well as infection control procedures using standard precautions. The role of the radiographer in patient education is identified.

Objectives
- Identify the responsibilities of the health care facility and members of the health care team.
- List the general responsibilities of the radiographer.
- Describe the practice standards for the radiographer as defined by the ASRT and state licensure.
- Differentiate between culture and ethnicity.
- Explain how a person's cultural beliefs toward illness and health affect his or her health status.
- Explain perceptions of dying and death from the viewpoint of both patient and radiographer.
- Describe the characteristics of each stage of grief.
- Identify methods for determining the correct patient for a given procedure.
- Explain the use of various communication devices and systems.
- Explain specific aspects of a radiographic procedure to the patient.
- Demonstrate correct principles of body mechanics applicable to patient care.
- Demonstrate techniques for specific types of patient transfer.
- Demonstrate select procedures to turn patients with various health conditions.
- Describe select immobilization techniques for various types of procedures and patient conditions.
- Describe specific patient safety measures and concerns.
- Explain the purpose, legal considerations and procedures for incident reporting.
- Describe methods to evaluate patient physical status.
- List the information to be collected prior to a patient examination.
- Describe vital signs and lab values used to assess patient condition, including sites for assessment and normal values.
- Define terms related to infection control.
- Describe the importance of standard precautions and isolation procedures, including sources and modes of transmission of infection and disease and institutional control procedures.
- Identify symptoms related to specific emergency situations.
- Describe the institution's emergency medical code system and the role of the student during a medical emergency.
- Explain the age-specific considerations necessary when performing radiographic procedures.
- Describe appropriate procedures for management of various types of trauma situations.

- Describe the symptoms and medical interventions for a patient with a contrast agent reaction.
- Explain the role of the radiographer in patient education.
- Describe the patient preparation for contrast studies.
- Identify specific types of tubes, lines, catheters and collection devices.
- Outline the steps in the operation and maintenance of suction equipment.
- Outline the steps in the operation and maintenance of oxygen equipment and demonstrate proper use.
- Demonstrate competency in basic life support (BLS).
- Describe the steps in performing various mobile procedures.
- Describe the special problems faced in performing procedures on a patient with a tracheotomy and specific tubes, drains and catheters.
- Describe the procedure for producing diagnostic images in the surgical suite.
- Explain the appropriate radiation protection required when performing mobile/surgical radiography.

Pharmacology and Venipuncture

Description
Content provides basic concepts of pharmacology, venipuncture and administration of diagnostic contrast agents and intravenous medications. The appropriate delivery of patient care during these procedures is emphasized.

Objectives
- Distinguish among the chemical, generic and trade names for drugs in general.
- Describe pharmacokinetic and pharmacodynamic principles of drugs.
- Explain the uses and impact of drug categories on the patient.
- Define the categories of contrast agents and give specific examples for each category.
- Explain the pharmacology of contrast agents.
- Describe methods and techniques for administering various types of contrast agents.
- Identify and describe the routes of drug administration.
- Demonstrate appropriate venipuncture technique.
- Differentiate between the two major sites of intravenous drug administration.
- Identify, describe and document complications associated with venipuncture and appropriate actions to resolve these complications.
- Discuss the various elements of initiating and discontinuing intravenous access.
- Differentiate and document dose calculations for adult and pediatric patients.
- Prepare for injection of contrast agents/intravenous medications using aseptic technique.
- Explain the current legal status and professional liability issues of the radiographer's role in contrast and/or drug administration.

Radiation Biology

Description
Content provides an overview of the principles of the interaction of radiation with living systems. Radiation effects on molecules, cells, tissues and the body as a whole are presented. Factors affecting biological response are presented, including acute and chronic effects of radiation.

Objectives
- Differentiate between ionic and covalent molecular bonds.
- Describe principles of cellular biology.
- Identify sources of electromagnetic and particulate ionizing radiations.
- Discriminate between direct and indirect ionizing radiation.
- Discriminate between the direct and indirect effects of radiation.
- Identify sources of radiation exposure.
- Describe radiation-induced chemical reactions and potential biologic damage.
- Evaluate factors influencing radiobiologic/biophysical events at the cellular and subcellular level.
- Identify methods to measure radiation response.
- Describe physical, chemical and biologic factors influencing radiation response of cells and tissues.
- Explain factors influencing radiosensitivity.
- Recognize the clinical significance of lethal dose (LD).
- Identify specific cells from most radiosensitive to least radiosensitive.
- Employ dose response curves to study the relationship between radiation dose levels and the degree of biologic response.
- Examine effects of limited vs. total body exposure.
- Relate short-term and long-term effects as a consequence of high and low radiation doses.
- Differentiate between somatic and genetic radiation effects and discuss specific diseases or syndromes associated with them.
- Discuss stochastic (probabilistic) and nonstochastic (deterministic) effects.
- Discuss embryo and fetal effects of radiation exposure.
- Discuss risk estimates for radiation-induced malignancies.
- Discuss acute radiation syndromes.

Radiation Physics

Description
Content is designed to establish a basic knowledge of physics pertinent to developing an understanding of radiations used in the clinical setting. Fundamental physical units, measurements, principles, atomic structure and types of radiation are emphasized. Also presented are the fundamentals of x-ray generating equipment, x-ray production and its interaction with matter.

Objectives
- Define the fundamental units of the English, metric and Système International d'Unites (SI) systems.
- Calculate various unit conversions.
- Demonstrate applications of the general principles that relate to inertia, work, energy and momentum.
- Describe Bohr's theory of atomic structure.
- Compare the characteristics and functions of a proton, neutron and electron.
- Discuss the energy levels of the atom.
- Define the terms relating to atomic nomenclature.
- Compare covalent bonding and ionic bonding.
- Describe the process of ionization.
- Differentiate between the characteristics of a mixture, substance and element.
- Classify the characteristics of an element using the periodic table.
- Compare the characteristics of a molecule and compound.
- Describe the nature of light.
- Explain the relationship between wavelength, frequency and velocity.
- Differentiate between the radiations of the electromagnetic (EM) spectrum.
- Explain the relationship of energy and frequency to Planck's constant.
- Distinguish between electrical charge and electrical field.
- Describe the methods of electrification.
- Explain the laws of electrostatics and their application.
- Describe the properties and laws of magnetism.
- Explain the electronic spin of an element to its potential magnetic properties.
- Describe the principle of magnetic induction.
- Define potential difference, current, resistance, circuit and electric power.
- Compare the characteristics of direct and alternating currents.
- Compare electrical measuring devices.
- Discuss electrical protective devices.
- Discuss the interaction between electric and magnetic fields.
- Describe the characteristics and functions of a cathode and rotating anode.
- Describe the construction and function of tube housing.
- Identify the parts of an x-ray tube.
- Determine heat units and cooling characteristics of x-ray tube housings.

- Propose methods to extend tube life.
- Discuss application and components of automatic exposure devices.
- State the principles of x-ray production.
- Compare the production of bremsstrahlung with the production of characteristic radiations.
- Compare various photon interactions in terms of description of interaction, relation to atomic number and applications.
- Discuss relationships of wavelength and frequency to beam characteristics.
- Define units of radiation measurement and provide an example of its application.

Radiation Protection

Description
Content is designed to present an overview of the principles of radiation protection, including the responsibilities of the radiographer for patients, personnel and the public. Radiation health and safety requirements of federal and state regulatory agencies, accreditation agencies and health care organizations are incorporated.

Objectives
- Identify and justify the need to minimize unnecessary radiation exposure of humans.
- Distinguish between somatic and genetic radiation effects.
- Differentiate between the stochastic (probabilistic) and nonstochastic (deterministic) effects of radiation exposure.
- Explain the objectives of a radiation protection program.
- Define radiation and radioactivity units of measurement.
- Identify effective dose limits (EDL) for occupational and nonoccupational radiation exposure.
- Describe the ALARA concept.
- Identify the basis for occupational exposure limits.
- Distinguish between perceived risk and comparable risk.
- Describe the concept of the negligible individual dose (NID).
- Identify ionizing radiation sources from natural and man-made sources.
- Comply with legal and ethical radiation protection responsibilities of radiation workers.
- Describe the relationship between irradiated area and effective dose.
- Describe the theory and operation of radiation detection devices.
- Identify appropriate applications and limitations for each radiation detection device.
- Describe how isoexposure curves are used for radiation protection.
- Identify performance standards for beam-limiting devices.
- Describe procedures used to verify performance standards for equipment and indicate the potential consequences if the performance standards fail.
- Describe the operation of various interlocking systems for equipment and indicate potential consequences of interlock system failure.
- Identify conditions and locations evaluated in an area survey for radiation protection.
- Distinguish between controlled and non-controlled areas and list acceptable exposure levels.
- Describe "Radiation Area" signs and identify appropriate placement sites.
- Describe the function of federal, state and local regulations governing radiation protection practices.
- Describe the requirements for and responsibilities of a radiation safety officer.
- Express the need and importance of personnel monitoring for radiation workers.
- Describe personnel monitoring devices, including applications, advantages and limitations for each device.
- Interpret personnel monitoring reports.

- Compare values for individual effective dose limits for occupational radiation exposures (annual and lifetime).
- Identify anatomical structures that are considered critical for potential late effects of whole body irradiation exposure.
- Identify effective dose limits for the embryo and fetus in occupationally exposed women.
- Distinguish between primary and secondary radiation barriers.
- Demonstrate how the operation of various x-ray and ancillary equipment influences radiation safety and describe the potential consequences of equipment failure.
- Perform calculations of exposure with varying time, distance and shielding.
- Discuss the relationship between workload, energy, half-value layer (HVL), tenth-value layer (TVL), use factor and shielding design.
- Identify emergency procedures to be followed during failures of x-ray equipment.
- Demonstrate how time, distance and shielding can be manipulated to keep radiation exposures to a minimum.
- Explain the relationship of beam-limiting devices to patient radiation protection.
- Discuss added and inherent filtration in terms of the effect on patient dosage.
- Explain the purpose and importance of patient shielding.
- Identify various types of patient shielding and state the advantages and disadvantages of each type.
- Use the appropriate method of shielding for a given radiographic procedure.
- Explain the relationship of exposure factors to patient dosage.
- Explain how patient position affects dose to radiosensitive organs.
- Identify the appropriate image receptor that will result in an optimum diagnostic image with the minimum radiation exposure to the patient.
- Select the immobilization techniques used to eliminate voluntary motion.
- Describe the minimum source-to-tabletop distances for fixed and mobile fluoroscopic devices.
- Apply safety factors for the patient, health care personnel and family members in the room during radiographic procedures.

Sectional Anatomy

Description
Content will introduce students to medical imaging methods currently used in the field of radiation therapy. Students will identify normal anatomical structures via a variety of imaging formats. Basic anatomical relationships will be compared using topographical and cross-sectional images.

Objectives
- Relate the importance of imaging with computed tomography, magnetic resonance and PET-CT in radiation therapy.
- Differentiate between sagittal, coronal and axial planes of the body.
- Review the principles of imaging for imaging modalities using relevant terminology.
- Compare the imaging modalities for application to radiation therapy.
- Identify normal anatomical structures on sectional images.
- Identify topographic anatomy used to locate underlying internal structures.

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