PARCA Certified PACS Associate (CPAS2014) Requirements

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This document contains the detailed requirements for the certification of a CPAS2014 or Certified PACS Associate. The focus is on general technical and clinical understanding. CPAS2014 is an update to the original CPAS requirements published in 2005 to include new technologies and developments. The requirements are split up in two sections: A) Technical (IT) and B) Clinical.

A. Technical (IT) requirements

1. Computer basics (20%)

1.1 Hardware: A computer has hardware components, i.e. CPU, memory, Disk, removable media, display card and display and data entry devices (aka peripherals) such as keyboard and mouse and others. There are several standard interfaces, such as serial and parallel ports, FireWire and several choices of disk and network interfaces. – Know how to distinguish between these components and interfaces and the function and characteristics of each of them.

1.2 CPU and Memory: The CPU and memory determine to a high degree the performance of the computer. – Know impact of the number of parallel processors, their speed and I/O path width (in bits) of the different processor types, the impact of dedicated processing boards and performance impact of memory speed and capacity.

1.3 Disk technology: Disk performance is typically determined by type and access (I/O channel, or network). Other parameters are speed, reliability, redundancy, impact of formatting, capacity, and technology (optical vs. magnetic, RAID vs. single drives). - Know impact of disk parameters on performance.

1.4 IP / MAC Addresses: Computers communicate via networks, which mean that there is an addressing scheme needed so others can access them. – Know function of IP, IPV4 vs. IPV6, MAC address, port numbers and host names and how to manage these.

1.5 Exchange media: Exchange media are MOD, DVD, CD, tape, and removable memory cards. – Know how the characteristics, differences and when to use either one of these devices to address these media on a computer, and to distinguish between Read- Only and Read/Write functionality.

2. Operating system basics (20%)

2.1 Software: Software can be divided into operating system, drivers to deal with specific hardware features, utilities such as database and word processing and application software. There are different software architectures, i.e. client-server, thin and thick clients, as well as zero footprint applications, cloud applications and virtual machines. - Know how to distinguish these, the advantages and their function.

2.2 Unix: Unix, or derivatives (LINUX) is often used for high availability computers

such as servers. – Know basic UNIX/LINUX prompts, difference between the UNIX shell, kernel and file system.

2.3 Windows: Windows is a common operating system used for desktop and client computers. – Know basic windows concepts, such as directory structures, windows task manager, control panel features, settings and network configurations, and how to change basic settings, including for security.

2.4 DOS prompts: DOS prompts are used for basic hardware and low level features. – Know how to get to the DOS prompt and to execute basic network management commands.

2.5 Mobile Applications: Tablets and mobile devices have their own platform using easily downloadable applications. – Know differences and characteristics of the different mobile platforms.

3. Core Architecture (20%)

3.1 Databases: Image Managers or databases provide the capability for storing and retrieving key record information. A database can be based on a flat file system, or have hierarchical, relational, or object relationships. MUMPS is its own database language. – Know the difference between, and characteristics of different database types.

3.2 Basic SQL knowledge: The ANSI SQL language is the most common command language used for database access and allows for direct access for troubleshooting, maintenance, and special reporting. – Know basic SQL commands to access data from a relational database.

3.3 Archiving architecture: Images and/or other related patient information are archived on media which can be accessed directly through the computer bus (DAS) or through a network connection (NAS, SAN, Cloud). – Know the differences between the various archive architectures and their advantages.

3.4 Archive implementations: Multiple archives can be clustered, one can use an enterprise archive or VNA, or the archiving can be outsourced as a service (SSP). – Know the advantages and disadvantages of these implementations.

3.5 Core Interfaces: Information such as images, reports and other related information is exchanged with the core using specific protocols and formats (DICOM, HL7 and IHE). – Know the basic protocol and file format differences and how IHE plays a role.

4. Data representations (10%)

4.1 Binary data format: Information is stored in computer memory as zero's and ones, i.e. in a binary format. For numbers, each position in a data field can represent a power of two. – Convert a binary representation to a numeric value.

4.2 Bits, bytes: Each zero/one in a data field is called a "bit" multiple of 8 bits are called Bytes. – Know actual number of bits represented by KB, MB, GB, TB, PB.

4.3 Data Representations: Information can be represented as hexadecimal, integers, floating point, and negative numbers (two's complement). – Know these representations so as to interpret type definitions, e.g. from image header definitions and data dumps.

4.4 Monochrome, color: A data field could represent a certain grayscale value (Black/White) or a value in a color mapping, for example, RGB. Other color mappings are possible as well (YBR, color by plane and pixel). – Know how to interpret grayscale and color values and encoding.

4.5 Image representations: Images consist of a matrix of pixels and/or voxels which are encoded and represented by a specific bit depth. They can also possibly consist of multiple frames representing a dimension in time. - Know the difference between the spatial, contrast and time resolution and how they are encoded in images.

5. Networking technology (20%)

5.1 OSI model: A network connection can be thought of using different peer-to-peer layers using their own protocols. – Know function and features of each 7 layers of the OSI (Open Systems Interconnection) model and how they apply to the common health care interface standards.

5.2 LAN/WAN: Network technology is used to either access a local or wide area network (LAN, WAN) using a specific access bandwidth (OC-xx with each their MBit/s) using an access path such as a high speed T1 line, or using DSL technology. LAN's typically use switched Ethernet. Wireless connections have their own protocols. – Know different terminology and technologies for networks and access connections including packet and circuit switching.

5.3 Internet: Internet access using internet protocols such as http, udp, ftp and others is commonly used for e-mail and to exchange information with other internet users using TCP/IP. – Know function of domains and how to identify them with a url as well as function of www and http. Know function of RFC's and structure of Internet governance.

5.4 Throughput, bandwidth, level of service parameters: Network access is determined by several critical parameters used for planning and forecasting the required network topology. – Know meaning and how to characterize these parameters

5.5 Network components: Networks consists of several physical devices with their own addressing. – Know function of hubs, bridges, routers, gateways and different cable types as well as addressing (ports, IP and MAC addresses, network masks and host names) and exchange modes (full, half duplex).

6. Basic Security Concepts (10%)

6.1 System security in general: Security is typically characterized as authentication, authorization, confidentiality and integrity. – Know how to characterize and identify each of the security components.

6.2 Authentication: First item typically done when accessing data is authenticating of entity that is doing the access. – Know of authentication methods including certificates.

6.3 Authorization: Authorization is typically done at application level based on certain roles. – Know authorization functionality and how it fits in the overall security scheme.

6.4 Confidentiality and integrity: Confidentiality is mostly implemented using encryption. Data integrity can be implemented with digital signatures, checksums, etc. – Know strengths of different algorithms and impact of key length as well as symmetric- asymmetric and public/private key function and how digital signatures work, including the function of hashing and keys.

6.5 Secure connections: When connecting devices through a public network, one needs to use encryption. In addition, one needs to address the different security threats such as viruses and malware. – Know function and set-up of VPN's, use of https and SSL/TLS, IDS, firewalls, and DMZ's.

B. Clinical requirements

1. Basic medical terminology (20%)

1.1 History and background: The medical profession is constantly changing. - Understand its history, the common source of clinical errors and legal terms and concepts.

1.2 Coding: Most medical terms are coded such as procedures, body parts, measurements, diagnosis and diseases. - Know of the most common coding schemes, vocabularies and how they relate to data models, and how they are used.

1.3 Medical terms: The medical profession uses certain terms that appear in orders, such as in the diagnosis or pre-condition. – Be familiar with the most common medical terms.

1.4 Clinical terms: Most terms are based on using standards pre and suffixes. – Know and understand the most common pre and suffixes in the context of diseases, tests, etc.

2. Basic human anatomy (20%)

2.1 Nervous system: Imaging is typically done of certain body parts, organs. – Know the function and parts of the nervous system so that images can be related back to these components.

2.2 Chest/abdomen: The chest/abdomen contains the respiratory and digestive system. – Know the main organs and function of the respiratory and digestive system, corresponding terminology and used imaging technologies.

2.3 Bony system: The skeleton and joints provide the body structure and strength. – Know main parts of the skeleton and used imaging technologies.

2.4 Circulatory system: Vessels, arteries and its core, i.e. the heart, are responsible for circulating oxygen and other essential elements to every body part. – Know the parts of the circulatory system and used imaging technologies, especially for angiography and cardiology.

2.5 The Endocrine/reproductive system: Glands, hormones, reproductive organs.- Know the main functions of the endocrine/reproductive system components and how they are imaged.

3. Medical Imaging basics (20%)

3.1 Principles of different modalities (CR, DR, XR, XA, RF, US, MR, NM, CT, MG, CT/PET, MR/PET): Each modality has different characteristics based on how the images are generated, i.e. using X-ray, electro-magnetic energy, radiation, etc. - Need to know the principle of how the energy is captured and imaged including typical exam types and applications.

3.2 Basic operational procedural knowledge of imaging equipment: Each exam requires different handling and operation by a technologist, and has a specific length and characteristics. – Need to know typical examination procedures and technologist handling.

3.3 Image characteristics for each modality: Each image has specific characteristics regarding noise, resolution, size of image and relationship with others (CINE loops, functional imaging). – Recognize typical image parameters for each modality.

3.4 Positioning and viewing techniques and terminology: A patient is positioned in a certain way (e.g. L/R; PA/LAT) with regard to the imaging equipment. Images are identified as such. – Know most important viewing and positioning techniques.

3.5 Other specialties: In addition to radiology, other specialties are generating and using imaging as well. – Know the modalities and their characteristics used in cardiology, dentistry, pathology, radiation therapy, and ophthalmology.

4. CR/DR: Computed and Digital Radiography (20%)

4.1 The majority of the procedures are typically created using CR or DR, i.e. Computerized and/or Digital Radiography. – Know the X-Ray basics, its characteristics and the impact of exposure and patient characteristics on the image quality.

4.2 Collimation versus shuttering: Proper collimation is critical to achieve optimal image quality. – Know about the use of shutters, grids, and the impact it might have on images.

4.3CR/DR basics: CR and DR have a different workflow as use different technologies (fixed vs. removable detector plates). – Understand the differences in technology and impact on workflow.

4.4 Special CR/DR applications: There are special CR/DR systems for specific body parts and specialties such as digital mammography including tomosynthesis, dentistry, and radiation therapy. – Know the characteristics and workflow of special CR/DR modalities.

4.5QA/QC: CR/DR requires dedicated QA/QC programs which include reject analysis and the use of test plates and phantoms. – Know the components of a CR/DR QA program.

5. Typical process flow (20%)

5.1 Physician order: Orders should contain all pertinent information to perform an imaging procedure. – Know what typical orders information consist of, and what is critical for certain procedures (e.g. allergy, pregnancy status, lab values, weight, history)

5.2 Performance of exam: Exams are sometimes scheduled, depending on the procedure

or urgency. Each exam type has a different series of steps to perform. – Know a typical workflow for each modality.

5.3 Results reporting (dictation & speech recognition): The technologist does a "hands-off" to a physician who performs a diagnosis using a dictation system or speech recognition. – Know the workflow for the radiologist using a worklist, potentially sharing this list with peers, till the report is signed off and approved. This includes critical results and discrepancy reporting.

5.4 Remote system access for image viewing: In many cases, the images with the requisition are sent to a remote location, e.g. for reading images at night, or are shared with other locations for consultation and/or viewing by a primary care provider. – Know the workflow and architectures for remote access.

5.5Outside studies: Prior exams might have to be fetched, either as film or, if digital, potentially from an off-line media, read from a CD or from the cloud or storage service provider. In some cases, the images might have to be digitized. – Know the digitization workflow, including potential issues with conflicting identifiers in the case the films are brought in from another institution. Also know the appropriate workflow and identify common issues with importing CD's such as the availability of proprietary data, embedded viewers, and identifiers that could give potential conflicts.

