

CHAPTER 275: MAGNETIC RESONANCE IMAGING

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1 PURPOSE AND SCOPE

This document outlines space planning criteria for VA Handbook 7610 Chapter 275: Magnetic Resonance Imaging. It applies to all medical facilities at the Department of Veterans Affairs (VA).

2 DEFINITIONS

Accessible: A site, building, facility, or portion thereof that complies with provisions outlined in the Architectural Barriers Act of 1968 (ABA).

Architectural Barriers Act (ABA): A set of standards developed to insure that all buildings financed with federal funds are designed and constructed to be fully accessible to everyone. This law requires all construction, renovation, or leasing of sites, facilities, buildings, and other elements, financed with federal funds, to comply with the Architectural Barriers Act Accessibility Standards (ABAAS). The ABAAS replaces the Uniform Federal Accessibility Standards (UFAS).

Diagnostic Room: Designated room containing diagnostic equipment performing patient procedures such as MRI. It may also be referred to as Scanning Room, Procedure Room, or Gantry.

Functional Area: The grouping of rooms and spaces based on their function within a clinical service. Typical Functional Areas are Reception Areas, Patient Areas, Support Areas, Staff and Administrative Areas, and Residency Program.

Input Data Statement(s): A set of questions designed to elicit information about the healthcare project in order to create a Program for Design (PFD) based on the criteria parameters set forth in this document. Input Data Statements could be Mission related, based in the project's Concept of Operations; and Workload or Staffing related, based on projections and data provided by the VHA or the VISN about the estimated model of operation. This information is processed through mathematical and logical operations in VA-SEPS.

Magnetic Resonance Imaging (MRI): The technique utilizing magnetic and radio frequency fields to produce computer calculated images of human anatomy (body tissue) and monitor body chemistry. While immersed in a magnetic field, the portion of the body to be scanned is exposed to energy in the radio frequency range. When the radio frequency is stopped, the nuclei return to a normal state. The effects of this exposure on atomic nuclei position are read by the computerized system and converted into images. MRI reflects tissue density and body chemistry.

Picture Archiving and Communication System (PACS): The digital capture, transfer and storage of diagnostic images. A PACS system consists of workstations for interpretation, image/data producing modalities, a web server for distribution, printers for file records, image servers for information transfer and holding, and an archive of off-line information. A computer network is needed to support each of these devices.

Procedure / Suite Stop: A procedure / suite stop is one encounter of a patient with a healthcare provider. Per these criteria, the procedure / suite stop is the workload unit of measure for space planning. One individual patient can have multiple procedure / suite stops in a single visit or in one day.

Program for Design (PFD): A space program based on criteria set forth in this document and specific information about Concept of Operations, Workload projections and Staffing levels authorized.

Room Efficiency Factor: A factor that provides flexibility in the utilization of a room to account for patient delays, scheduling conflicts, and equipment maintenance. Common factors are in the 80 to 85% range. A room with 80% room efficiency provides a buffer to assume that this room would be available 20% of the time beyond the planned operational practices of the room. This factor may be adjusted based on the actual and/or anticipated operations and processes of the room / department.

SEPS (VA-SEPS): Acronym for Space and Equipment Planning System, a digital tool developed by the Department of Defense (DoD) and the Department of Veterans Affairs to generate a Program for Design (PFD) and an Equipment List for a VA healthcare project based on specific information entered in response to Input Data Statements. VA-SEPS incorporates the propositions set forth in this chapter as well as all chapters in VA's Handbook 7610. VA-SEPS has been designed to aid healthcare planners in creating a space plan based on a standardized set of criteria parameters.

Workload: Workload is the anticipated number of procedures or suite stops that is processed through a department/service area. The total workload applied to departmental operational assumptions will determine overall room requirements by modality.

3 OPERATING RATIONALE AND BASIS OF CRITERIA

- A. Workload projections or planned services / modalities for a specific VA medical center, hospital or satellite outpatient clinic project are provided by the VA Central Office (VACO) / VISN CARES Capacity Projection Model. Workload projections are generated by methodology based upon the expected veteran population in the respective market / service area. Health care planners working on projects for VA medical centers, hospitals or satellite outpatient clinics, shall utilize workload criteria set forth herein to determine room requirements and generate a space program for each project.
- B. Space planning criteria have been developed on the basis of an understanding of the activities involved in the functional areas of the Magnetic Resonance Imaging and their relationship with other services of a medical facility. These criteria are based on established and/or anticipated best practice standards, as adapted to provide environments supporting the highest quality health care for Veterans.
- C. These criteria are subject to modification relative to development in the equipment, medical practice, vendor requirements, and healthcare planning and design developments. The final selection of medical equipment for Magnetic Resonance Imaging is approved by VACO Radiology Service based upon Veterans Health Administration (VHA) anticipated medical needs.
- D. MRI Services, as used in these criteria, includes the diagnostic imaging modality of Magnetic Resonance Imaging (MRI).
- E. Room capacity per year should be based on:

$$\frac{\text{Operating days per year} \times \text{Hours of operation per day}}{\text{Minutes per procedure} / 60 \text{ minutes}} = \text{Number of annual procedures}$$

- 1. The general planning model for VA facilities assumes 250 Operating Days per Year and 8 Hours of Operation per Day. Room capacity will fluctuate as hours of operation are modified, i.e., additional capacity may be generated by extending the daily hours of operation within the same physical setting.

2. Base Room Efficiency Factor is 80%.
 - a. Modalities with routine, scheduled procedures and backup equipment (more than one piece of the same type of equipment in the department) should plan for an efficiency factor of 85%.

Example: Assume a modality room that averages 30 minute per procedure / suite stop:

$$\frac{250 \text{ operating days per year} \times 8 \text{ hours of operation per day}}{30 \text{ minutes per procedure} / 60 \text{ minutes}} = 4,000 \text{ annual procedures}$$

A maximum capacity of 4,000 procedures/suite stops per year, assuming 100% utilization. However, 100% utilization is not realistic to achieve, thus, it is not an accurate design standard. Apply Room Efficiency Factor:

$$4,000 \times 80\% = 3,200 \text{ annual procedures.}$$

TABLE 1: WORKLOAD PARAMETER CALCULATION

PROCEDURE	AVERAGE LENGTH OF PROCEDURE (minutes)	ANNUAL PROCEDURES PER ROOM (rounded)	MINIMUM WORKLOAD TO GENERATE ONE ROOM
MRI Scanning Room	30	3,200	960

The number of annual procedures per room will be used as a criteria parameter to calculate the number of procedure rooms in the Space Criteria section of this document. The minimum workload to generate one room is 30% of the calculated annual procedures per room.

4 INPUT DATA STATEMENTS

A. Mission Input Data Statements

1. Is Teaching Viewing / Consultation authorized? (M)
2. Is an MRI Residency Program authorized? (M)
 - a. How many MRI Resident / Intern positions are authorized? (S)
 - b. How many MRI Student positions are authorized? (S)
3. Is PACS authorized? (M)
4. Is a Resident Training Room for the Education Area authorized? (M)

B. Workload Input Data Statements

1. How many annual MRI procedures are projected? (W)

C. Staffing Input Data Statements

1. How many MRI Data Processing Employee FTE positions are authorized? (S)
2. How many MRI Physicist FTE positions are authorized? (S)
3. How many MRI Professional Non-Physician FTE positions are authorized? (S)
4. How many MRI Quality Assurance Specialist FTE positions are authorized? (S)
5. How many MRI Staff Radiologist FTE positions are authorized? (S)
6. How many MRI Scheduler FTE positions are authorized? (S)
7. How many MRI Transcriptionist FTE positions are authorized? (S)

D. Miscellaneous Input Data Statements

1. How many FTEs will work on peak shift? (Misc)
2. How many FTE positions are not authorized to have an office or work space? (Misc)

5 SPACE CRITERIA

A. FA1 Reception Area:

1. **Waiting (WTG04)**..... **100 NSF (9.3 NSM)**

Provide one if the projected number of MRI Scanning Room is one or two; provide WTG06 if the projected number of MRI Scanning Room is three; provide WTG08 if the projected number of MRI Scanning Room is four.

WTG04: Allocated space accommodates two standard chairs @ 9 NSF each, one bariatric chair @ 14 NSF, one accessible space @ 10 NSF, and circulation; total four people.

WTG06: Allocated space accommodates four standard chairs @ 9 NSF each, one bariatric chair @ 14 NSF, one accessible space @ 10 NSF, and circulation; total six people.

WTG08: Allocated space accommodates six standard chairs @ 9 NSF each, one bariatric chair @ 14 NSF, one accessible space @ 10 NSF, and circulation; total eight people.

2. **Reception (RCP02)** **260 NSF (24.2 NSM)**

Provide one for MRI Service.

Allocated NSF accommodates two Receptionist FTEs, patient privacy area, and circulation.

3. **Patient Education Kiosk / Alcove (CLSC1)**..... **30 NSF (2.8 NSM)**

Provide one for MRI Service.

4. **Toilet, Public (TNPG1)**..... **60 NSF (5.6 NSM)**

Provide two for MRI Service.

Allocated NSF accommodates one accessible toilet @ 25 NSF, one wall-hung lavatory @ 12 NSF, ABA clearances, and circulation. One for male and one for female.

B. FA 2: Patient Area:

1. **Sub-Waiting (WTMRI)** **80 NSF (7.5 NSM)**

Provide one if the projected number of MRI Scanning Rooms is one or two; provide an additional one if the projected number of MRI Scanning Rooms is three or four.

Allocated space accommodates one bariatric chair @ 14 NSF, one MRI Compatible Stretcher @ 36 NSF, and circulation; total two people. Locate near MRI Scanning Room.

2. **Scanning Room, MRI (XMRS1)**..... **500 NSF (46.5 NSM)**

Provide one for every increment of 3,200; annual MRI procedures projected; minimum annual workload projected to provide a room is 960 (see Table 1).

Excludes control room. This room contains the high strength magnet, patient table and related supporting hardware. The patient reclines on the table that fits in the "bore" or the central, cylindrical part of the magnet. The MRI Scanning Room requires radio frequency shielding to protect the scanning operation against the effects of common sources of radio frequency interference waves emanating from external transmitters. Magnetic shielding may be required to control, shape and/or reduce the magnetic field of the scanner equipment. All equipment in this area should be made from non-magnetic material.

3. **Control Room (XMRC1)**120 NSF (11.2 NSM)

Provide one per each MRI Scanning Room.

This room contains an operator console which consists of a computer terminal and image display monitors. The viewing window provides the operator with an unobstructed view of the patient within the scanner. The operator requires direct access to both MRI Scanning Room and to the System Component Room from the control room. The operator controls the scanner operations and image manipulation such as acquisition, reconstruction, display of the images for various studies, and produces hard copy images through a multi-format camera. Provide audio and closed circuit TV systems to communicate with the patient for closed-type MRI systems.

4. **System Component Room (XMRC2)**200 NSF (18.6 NSM)

Provide one per each MRI Scanning Room.

This room contains the computer and most of the supporting electronic and electrical equipment. Typical hardware may include computer cabinets, power distribution unit, gradient cabinet, system control cabinet, radio frequency signal cabinet, shim and magnet power supply cabinets, radio frequency penetration cabinets, power conditioner, and other system hardware. The room space allows access for maintenance on two sides of the equipment and should be adjacent to the control and MRI Scanning room.

5. **Viewing Room (XMRV1)**.....120 NSF (11.2 NSM)

Provide one per each MRI Scanning Room.

A remote physician console provides the physician with the capability of independently viewing and manipulating images separate from the operator console. It may also contain standard X-Ray illuminators. Requires authorization by VACO Radiology Service.

6. **Consult Room (OFDC2)**120 NSF (11.2 NSM)

Provide two for MRI Service.

7. **Dressing Room / Cubicle (DR001)**35 NSF (3.3 NSM)

Provide two per each MRI Scanning Room.

Room is to have convenient access to Patient Toilet, Waiting and MRI Scanning Room. Personal property lockers provided in this space.

8. **Holding Bay, Patient Stretcher (WRL01)**80 NSF (7.5 NSM)

Provide one per each MRI Scanning Room.

Provides space for staging/observation of patient pre/post procedure. Patient scheduling should be managed so that not more than two stretcher patients are present in the MRI suite at a given time. Also, this area is used for storage of non-ferrous transport devices for transferring patients into the MRI Scanning room. This area should be adjacent to reception area where technicians can see the patients because patients transported by mobile conveyances may require closer supervision.

9. **Toilet, Patient (TPG01)**60 NSF (5.6 NSM)

Minimum one; provide an additional one for every increment of two MRI Scanning Rooms greater than two.

Allocated NSF accommodates one accessible toilet @ 25 NSF, one accessible wall-hung lavatory @ 13 NSF, ABA clearances, and circulation. This must be accessible from the Dressing Room / Cubicle and Waiting.

- 10. **Alcove, Crash Cart (RCA01)** **20 NSF (1.9 NSM)**
Provide one for MRI Service.

C. FA3: Support Area:

- 1. **Storage, Gas / Cryogen (SRGC2)** **60 NSF (5.6 NSM)**
Provide one for MRI Service.

This room contains the portable stainless steel dewars and cylinders containing liquid helium and liquid nitrogen. This refrigerant is used to produce low temperatures in cooling the magnet to approximately four degrees Kelvin. The dewars handling equipment; siphons, cables, hoses and special connectors are also stored in this room. Due to the weight and difficulty of moving the dewars during delivery and replenishment, access to the Gas / Cryogen Storage Room should be direct and without stairs. Empty dewars and cylinders are kept in this room until removed for refilling. This room needs a door opening that will allow passage of dewars with diameter of up to 48" and a height of approximately 72". Venting to the outside is required for this room. The Gas / Cryogen Storage Room should be located close to the MRI Scanning Room.

- 2. **PACS: Digital Quality Control (XVC01)**..... **100 NSF (9.3 NSM)**
Provide one if PACS is authorized.

- 3. **PACS: Digital Archival Storage (XFDS1)**..... **80 NSF (7.5 NSM)**
Provide one if PACS is authorized.

This room is utilized for the archiving of digital media. Shelving and a computer terminal without a printer may be located in this room.

- 4. **Film Processing Room (XFP01)** **80 NSF (7.5 NSM)**
Provide one if PACS is not authorized.

This space is for developing, film sorting, identification, tagging, film interpretation, and film image quality check. Room should be isolated from the main traffic circulation pattern. Silver recovery tank and facilities for cleaning the processor and its rollers will be located in this area. Film processing capabilities may not be required if adequate capacity is available for this function from another Service.

- 5. **Storage, Equipment (XMRE1)**..... **120 NSF (11.2 NSM)**
Provide one for MRI Service.

This room is for the storage of specialized equipment required for imaging procedures and should be located near the MRI Scanning Room. Items for storage include: surface coils and coil holders, patient positioning accessories, and the calibration phantom kit.

- 6. **Storage, Stretcher / Wheelchair (SRLW1)** **40 NSF (3.8 NSM)**
Provide one for MRI Service.

- 7. **Alcove, Linen (LCCL3)** **20 NSF (1.9 NSM)**
Provide one per each MRI Scanning Room.

- 8. **Utility Room, Clean (UCCL1)** **100 NSF (9.3 NSM)**
Provide one for MRI Service.

9. **Utility Room, Soiled (USCL1)**80 NSF (7.5 NSM)
Provide one for MRI Service.

The Soiled Utility Room provides an area for cleanup of equipment, utensils and for disposal of waste material.
10. **Housekeeping Aides Closet (HAC) (JANC1)**.....60 NSF (5.6 NSM)
Provide one for MRI Service.
11. **Viewing / Consultation Room: Non-teaching (XVC01)**.....120 NSF (11.2 NSM)
Provide one for MRI Service.
12. **Viewing / Consultation Room: Teaching (XVC01)**.....240 NSF (22.3 NSM)
Provide one if a Teaching Viewing and Consultation Room is authorized.

The Viewing and Consultation Room is the focal point of activity where staff and residents will review patient results. Activities also include training, film viewing, and reading.
13. **Work Area, Staff (WRCH1)**.....80 NSF (7.5 NSM)
Provide one for MRI Service.

D. FA 4: Staff and Administrative Area:

1. **Workstation, Chief Technician (OFA07)**.....56 NSF (5.3 NSM)
Provide one for MRI Service.
2. **Workstation, Staff Radiologist (OFA07)**56 NSF (5.3 NSM)
Provide one per each Staff Radiologist FTE position authorized.
3. **Workstation, Professional Non Physician (OFA07)**56 NSF (5.3 NSM)
Provide one per each Professional Non-Physician FTE position authorized.
4. **Workstation, PACS Administrator (OFA07)**56 NSF (5.3 NSM)
Provide one if PACS is authorized.
5. **Workstation, Physicist (OFA07)**.....56 NSF (5.3 NSM)
Provide one per each Physicist FTE position authorized.
6. **Workstation, Quality Assurance (OFA07)**56 NSF (5.3 NSM)
Provide one per each Quality Assurance FTE position authorized.
7. **Workstation, Administration (OFA07)**56 NSF (5.3 NSM)
Provide one for MRI Service.
8. **Workstation, Data Processing (OFA07)**56 NSF (5.3 NSM)
Provide one per each Data Processing FTE position authorized.
9. **Workstation, Scheduler (OFA07)**56 NSF (5.3 NSM)
Provide one per each Scheduler FTE position authorized.
10. **Workstation, Transcriptionist (OFA07)**56 NSF (5.3 NSM)
Provide one per each Transcriptionist FTE position authorized.
11. **Copier Room (RPR01)**.....100 NSF (9.3 NSM)
Provide one for MRI Service.
12. **Lounge, Staff (SL001)**80 NSF (7.5 NSM)
Minimum NSF; provide an additional 15 NSF per each MRI FTE position working on peak shift greater than five; maximum 210 NSF.

13. Locker Room, Staff (LR001)..... 80 NSF (7.5 NSM)

Minimum NSF if total number of MRI FTE positions not authorized to have office or work space is between five and thirteen; provide an additional 6 NSF per each MRI FTE position not authorized to have office or work space is greater than thirteen.

Provide locker space only for those FTEs without assigned office or work space. For less than five FTE combine Locker Room facilities with adjacent department or sum in chapter 410.

14. Toilet, Staff (TNP1)..... 60 NSF (5.6 NSM)

Minimum one; provide an additional one for every increment of fifteen MRI FTE positions working on peak shift greater than fifteen.

Allocated NSF accommodates one accessible toilet @ 25 NSF, one wall-hung lavatory @ 12 NSF, ABA clearances, and circulation.

E. FA 5: Education Area:

The methodology below provides programming of educational facilities at department/service/chapter level. Alternatively, sum all departments / services / chapters data for educational facilities and program space in Chapter 402-Educational Facilities. *Either/or – do not duplicate space in both this Chapter and Chapter 402.*

Resident spaces should be grouped in one area close to the Viewing and Consultation Room.

1. Workstation, Resident / Intern (OFA07)..... 56 NSF (5.3 NSM)

Provide one per each Resident / Intern FTE position authorized.

2. Workstation, Student (OFA07)..... 56 NSF (5.3 NSM)

Provide one for every increment of two Student FTE positions authorized.

3. Training Room, Resident (CFR01) 240 NSF (22.3 NSM)

Provide one if a Resident Training Room for the Education Area is authorized.

Allocated NSF accommodates six conference chairs @ 7.5 NSF each, two 5'-0" x 2'-0" tables at 10 NSF each, one credenza @ 8 NSF, and circulation; total six people.

6. PLANNING AND DESIGN CONSIDERATIONS

- A. Net-to-department gross factor (NTDG) for Nuclear Medicine is **1.60**. This number, when multiplied by the programmed net square foot (NSF) area, determines the departmental gross square feet (DGSF).
- B. Centralized staff administration and support should be considered to maximize staff and space efficiency.
- C. PACS reading stations maybe located centrally or remotely (in offices); coordination is required to avoid duplication of locations. It should be noted that for general viewing by physicians outside of MRI, a typical flat screen monitor will suffice for reading of images. A high-end monitor system should be provided in areas where physician viewing / diagnosis occur within the Radiology Department or remotely.
- D. Provide separate outpatient intake and processing areas from inpatient circulation and holding areas when both patient types utilize the same department and/or procedure rooms.

- E. Verify room sizes and equipment layouts with imaging equipment vendors prior to finalizing room layouts.
- F. The MRI suite should be functionally organized to separate staff and patient circulation as much as possible. Diagnostic rooms, processing functions, staff workstations, and staff support space should be organized contiguous to a centralized hub element for staff circulation. Patient waiting and public areas should be organized in conjunction with a patient circulation element, which provides separate access to diagnostic rooms and dressing rooms.
- G. Corridors should be designed to a minimum of 8 feet clear width, to accommodate passage of equipment or beds and two stretchers and/or wheelchairs. In non-patient areas, corridors may be 6 feet in clear width.
- H. Locate all film file spaces to facilitate alternative use upon total implementation of PACS.
- I. MRI Scanning Room(s), Control Room(s) and System Component Room(s) should have an emergency power supply to complete in-process procedures and permit safe egress of patients.
- J. Locate MRI units in an area with minimal potential electrical interference, even though most MRI units today are self-shielded.
- K. A critical point in the quality of the images obtained from the MRI system is to maintain a constant, homogeneous magnetic field in the center of the magnet. This requirement for a homogeneous magnetic field could impose limitations on the location, construction and surroundings of the MRI suite. The homogeneity of the magnetic field can be distorted when large stationary ferromagnetic material (i.e., steel frames, ferrous ductwork, etc.) are present in the vicinity of the MRI suite. Also, large moving ferrous masses of magnetic material like carts, elevators, stretchers, etc. can produce magnetic field fluctuations. The degree of distortion caused by these ferromagnetic material depends on the magnetic field strength as well as on the mass, orientation, permeability and saturation of the surrounding material.
- L. Refer to Department of Veterans Affairs (VA) Office of Facilities Management Handbooks, Standards, Standard Details, and Design Guides for technical criteria.

7. FUNCTIONAL RELATIONSHIP

Relationship of Magnetic Resonance Imaging to Services Listed Below:

TABLE 2: FUNCTIONAL RELATIONSHIP MATRIX

RELATIONSHIP	SERVICES	REASONS
2	Ambulatory Care (including ER)	G,H
2	Radiology Service	G,H
3	Cardiovascular Laboratories	H
3	Digestive Diseases Service	H
3	Intensive Care Nursing Units	H
3	Medical Research & Development	A
3	MS&N Nursing Units	H
3	Nuclear Medicine Service	G,H
3	Pulmonary Medicine	H
3	Radiation Therapy Service	G,H
3	Phys. Med and Rehabilitation Service	H
3	Spinal Cord Injury Center (SCI)	H
3	Surgical Service	H
4	Audiology and Speech Pathology Service	K
4	Canteen Service / Dining Facilities	D,E,K

Legend:

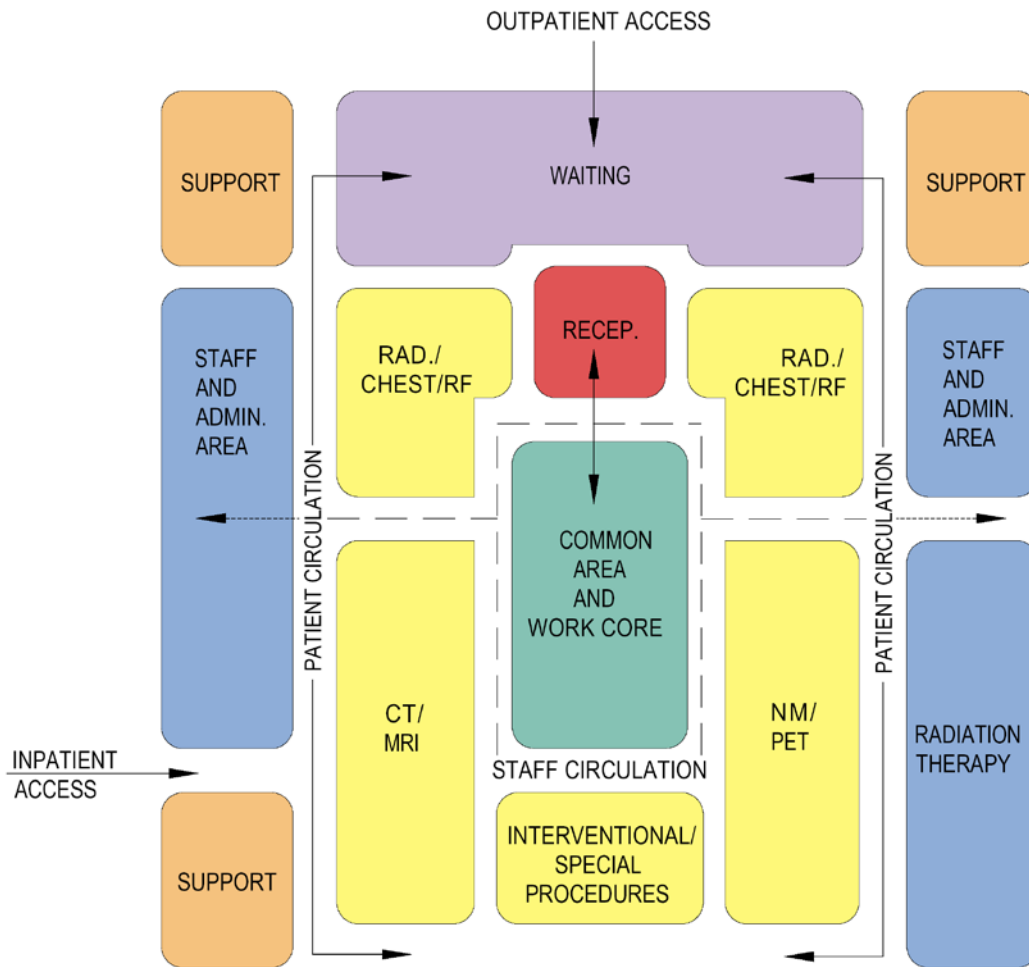
Relationship:

1. Adjacent
2. Close / Same Floor
3. Close / Different Floor Acceptable
4. Limited Traffic
5. Separation Desirable

Reasons:

- A. Common use of resources
- B. Accessibility of supplies
- C. Urgency of contact
- D. Noise or vibration
- E. Presence of odors or fumes
- F. Contamination hazard
- G. Sequence of work
- H. Patient convenience
- I. Frequent contact
- J. Need for security
- K. Closeness inappropriate

8. FUNCTIONAL DIAGRAM 1: MRI WITHIN RADIOLOGY SERVICE AREA RELATIONSHIP



9. FUNCTIONAL DIAGRAM 2: MRI AREA RELATIONSHIP

