

**Department of Veterans Affairs
OI&T Innovations Program
Radiology Protocol Tool and Reporter
(RAPTOR)
Functional Requirements Document**

Initiative #292

Order #: VA118-11-RP-0173

Version 3.5

March 17, 2012

TABLE OF CONTENT

1	BACKGROUND	5
1.1	PROJECT SCOPE.....	5
2	REQUIREMENTS.....	8
2.1	NON-FUNCTIONAL (TECHNICAL, USABILITY) REQUIREMENTS	8
2.2	USERS	8
2.3	ACCESS ROLES.....	8
2.4	RAPTOR WORKFLOW STATUS	10
2.5	APPROVING A PROTOCOL.....	12
2.6	PROTOCOL WORKLIST	12
2.7	PROTOCOL LISTING.....	14
2.8	PATIENT BASED PROTOCOLING	15
2.9	CONSENT CONDITIONS FOR IV CONTRAST ADMINISTRATION	17
2.10	RAPTOR PRE-PROCEDURE NOTES	20
2.11	ORAL AND IV HYDRATION	21
2.12	CONTRAST	21
2.13	IV CONTRAST	22
2.14	ENTERIC CONTRAST.....	22
2.15	SEDATION	23
2.16	CLAUSTROPHOBIC.....	23
2.17	RAPTOR DATA ELEMENTS.....	24
2.18	RADIOLOGY ORDER DATA ELEMENTS	26
2.19	VITAL SIGNS TAB	27
2.20	NOTES TAB.....	28
2.21	PROBLEM LIST TAB	28
2.22	LAB RESULTS TAB	28
2.23	RADIATION DOSE.....	29
2.24	ALLERGIES TAB	30
2.25	MEDICATIONS	30
2.26	PATHOLOGY REPORTS	32
2.27	RADIOLOGY REPORTS.....	32
2.28	OTHER REPORTS (NON-RADIOLOGY, NON-PATHOLOGY)	32
2.29	RAPTOR COMMUNICATIONS	32
2.30	RECORD CONSCIOUS SEDATION.....	33
2.31	SYSTEM ADMINISTRATION.....	33
3	DASHBOARD ORGANIZATION.....	33
3.1	PROTOCOLLING.....	33
3.2	INTERPRETATION	39
3.3	PROTOCOL SUMMARY -.....	39
4	OTHER CONSIDERATIONS.....	39
4.1	ALTERNATIVES	39
4.2	ASSUMPTIONS	40
4.3	DEPENDENCIES	40

4.4	CONSTRAINTS	40
4.5	BUSINESS RISKS AND MITIGATION	40
4.6	REFERENCE.....	41
5	WORKLIST TAB (TO PROTOCOL).....	41
6	INTERPRETATION TAB.....	41
7	TECHNOLOGIST COMMENTS.....	42
8	PROTOCOL LIBRARY	42

Approved

TABLE 1 - ROLES OVERVIEW	9
TABLE 2 – ACTIONS BY ROLE	34

FIGURE 1 – RAPTOR FUNCTIONALITY IN RADIOLOGY WORKFLOW 1 OF 2.....	6
FIGURE 2 - RAPTOR FUNCTIONALITY IN RADIOLOGY WORKFLOW 2 OF 2	7
FIGURE 3 - WORKFLOW STATUS DIAGRAM.....	10

Approved

Version Table

Version .1	April 11, 2011
Version 1.0	May 14, 2011, Approved Draft
Version 1.5	August 3, 2011
Version 2.0	October 1, 2011
Version 2.5	November 9, 2011
Version 3.0	February 3, 2012
Version 3.5	March 17, 2012

1 Background

This project will demonstrate RAPTOR, the Radiology Protocol Tool and Reporter. RAPTOR is an electronic protocol workflow application that will utilize open-source open-standards web-based development platform and tools. This project will deliver a functional prototype that interoperates with VistA (MDWS).

Currently, VA Radiologists review all clinician orders for advanced diagnostic imaging (Computerized Tomography, Magnetic Resonance Imaging, and Nuclear Medicine tests) and assign specific protocol instructions directing how each examination must be performed so that the clinical questions are answered. This is standard practice and typically paper based.

VA Radiologists frequently do not receive sufficient information on exam requisitions to optimize the quality and safety of their protocol decisions. Efforts to augment the clinical detail provided by the ordering provider can be cumbersome and negatively impact Radiologist productivity and department efficiency.

- a) Paper – based processes are inefficient.
- b) Lost paperwork
- c) Duplication of paperwork (and effort)
- d) Potential for vague documentation of responsibility

1.1 Project Scope

The Radiology Protocol Tool and Reporter (known as RAPTOR) will:

- Leverage VHA information systems to maximize Radiologist advanced imaging protocoling effectiveness while preserving productivity

- Protocol decisions will occur within a tailored electronic environment displaying and coordinating functionality of all information and resources needed to make rapid, informed protocol decisions and actions
- Provide to Radiologists
 - Exam order
 - Access to all pertinent textual data (allergies, medications, provider notes, radiology reports, ionizing radiation exposure history, etc.)
 - Initially presented data will be filtered for relevance
 - Access to previous imaging reports
 - Protocol action space (to record protocol decision)
 - Non-urgent communication through notes, when necessary

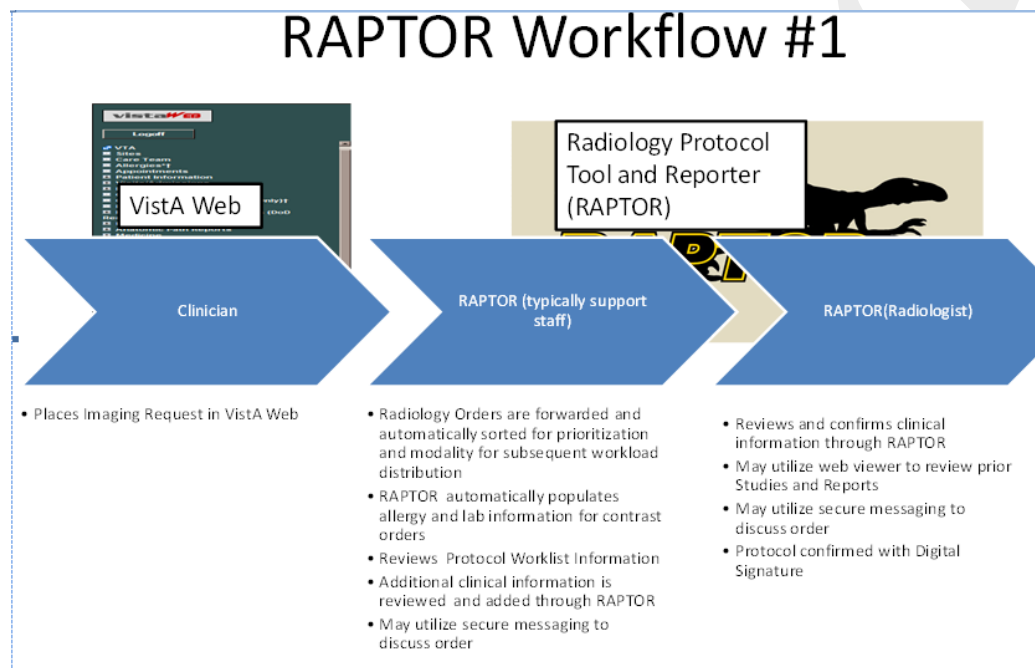


Figure 1 – RAPTOR Functionality in Radiology Workflow 1of 2

RAPTOR Workflow #2

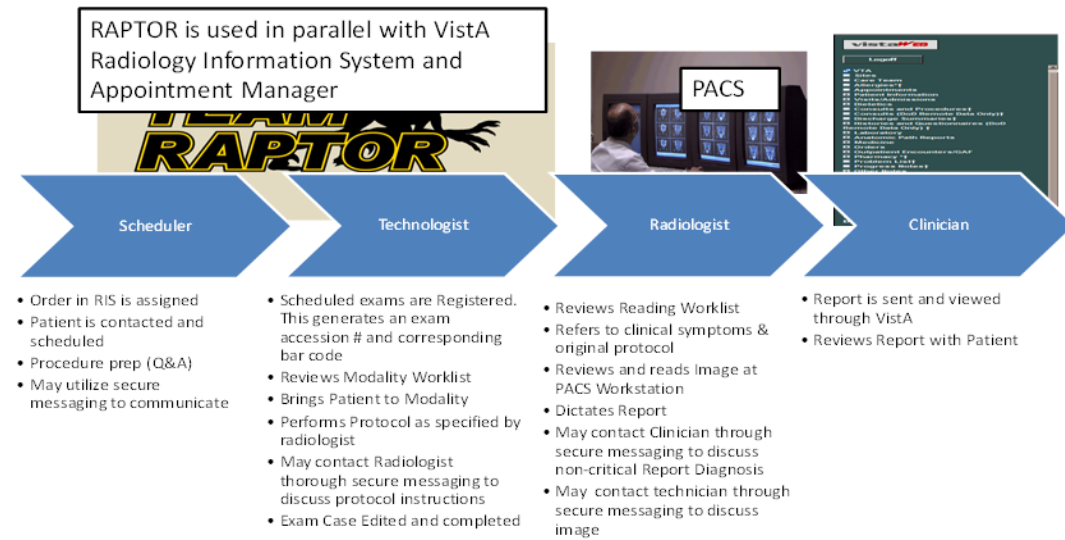


Figure 2 - RAPTOR Functionality in Radiology Workflow 2 of 2

2 Requirements

2.1 Non-Functional (Technical, Usability) Requirements

- 2.1.1** *The Operational Environment for the RAPTOR project is within the innovation sand box.*
- 2.1.2** *RAPTOR User Access will be defined by current user authentication. There will be no additional security or data access restrictions above what currently exists.*
- 2.1.3** *RAPTOR Precision or Accuracy Requirements will be defined by the current clinical data. There will be no additional data Precision or Accuracy requirements above what currently exists.*

2.2 Users

- 2.2.1** *RAPTOR will receive user name and contact information from Windows.*
- 2.2.2** *RAPTOR sites will have the ability to create, delete, and update users and their attributes.*

2.3 Access Roles

- 2.3.1** *RAPTOR users will be assigned an access role.*
- 2.3.2** *RAPTOR user access roles include:*
 - 2.3.2.1** *Radiologist*
 - 2.3.2.2** *Resident*
 - 2.3.2.3** *Technologist*
 - 2.3.2.4** *Scheduler*
 - 2.3.2.5** *System administrator*
- 2.3.3** *Any of the access roles can be configured by the system administrator. Only the system administrator can make system configurations and updates.*
- 2.3.4** *The radiologist and resident can approve the protocol.*
 - 2.3.4.1** *The resident will have all the same access as a radiologist with exception of “Approve” and “Abort”.*
 - 2.3.4.2** *The resident can directly approve by clicking “Resident Approval”. They will be presented with the following alert requiring action: [This represents a final approval of the protocol. Do you want to do this or “Request Approval” for review by radiologist*

instead? **Yes** – **Approve Now**, No – Request Approval, Cancel Action] The YES option is the default.

2.3.4.3 When a resident determines they wish to “Request Approval,” they have an opportunity to assign it to a particular radiologist.

2.3.5 The technologist will have all the access of a resident with the exception of “Resident Approval” authority.

2.3.6 Technologist will provide the actual volume, type and rate of contrast administered. If the contrast values are missing, RAPTOR prompts for completion.

2.3.7 Technologist will confirm that the examination complete.

Table 1 - Roles Overview

Role	Ability to Approve Protocol	Ability to edit “Examination Notes” box and confirm “Examination Completed”	Comment
Radiologist	Yes	Yes	Nuc Med, Radiology, Neuro, Body, Thorax, Musculoskeletal
Resident	Conditionally, Yes	Yes	See 2.3.4.2
Technologist	No	Yes	
Scheduler	No	No	
System Administrator	No	No	Administers the system configuration

2.3.8 All roles can view the assigned protocol in the work list.

2.3.9 Technologist can edit “Examination Notes” box and confirm “Examination Completed”

2.4 RAPTOR Workflow Status

When an advanced radiology order is entered into VistA MDWS, RAPTOR workflow is at the accepting state. RAPTOR’s workflow statuses include inactive, active, review, collaborative, approved, protocol acknowledged and exam complete. Inactive or Exam complete is the final state. The transactions of statuses between accepting and final state is shown in the figure below.

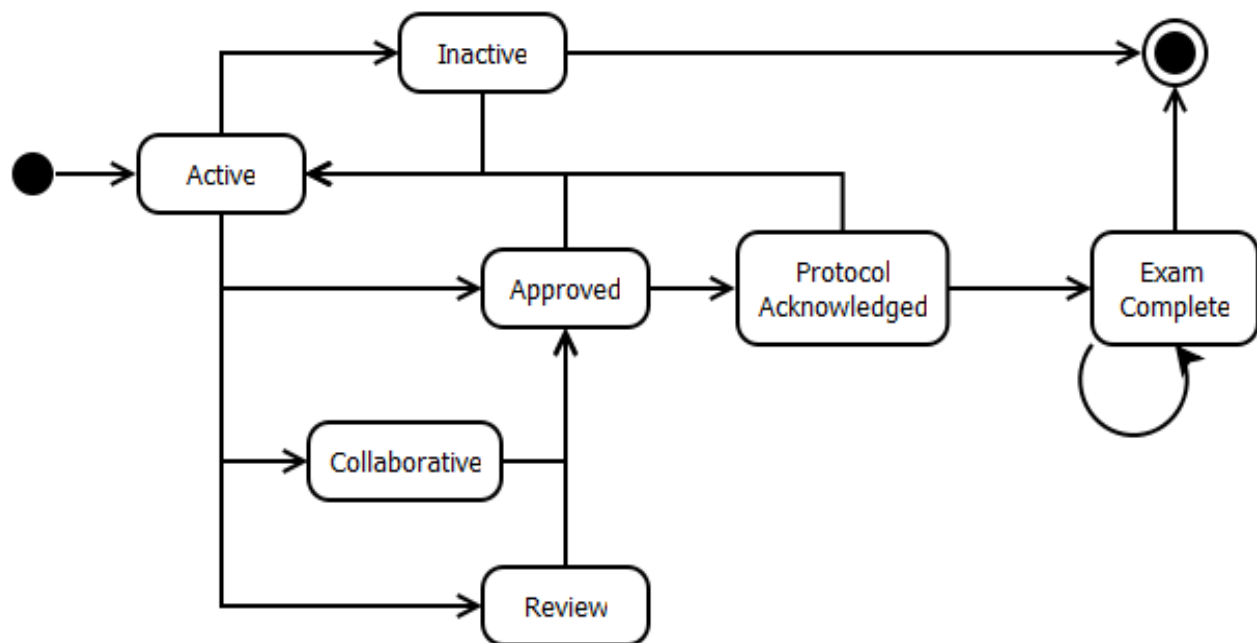


Figure 3 - Workflow Status Diagram

2.4.1 An **inactive** status does not appear on the RAPTOR worklist. An inactive status will not be protocolled. This includes a protocol that has been aborted (i.e. canceled) when the wrong study was ordered.

2.4.1.1 An administrator role can move an **inactive** protocol back into **active** status.

2.4.2 A **complete** status does not appear on the RAPTOR worklist. A complete protocol has been both approved and examination completed.

2.4.2.1 When the assignment filter is set to “interpretation” the worklist displays protocols with a “complete” status.

- 2.4.3 An **active** order is on the RAPTOR worklist and clinical information can be added to it. It can be signed by the radiologist user.
- 2.4.4 A **review** status is an active status state. As an active status, it appears on the RAPTOR worklist. The user who selects and progresses the protocol is not authorized to approve. The non-authorized user can suggest a protocol and place the order in the review status for approval by an authorized user (resident, radiologist).
- 2.4.5 The **collaborative** status is a special case of an active status. As an active protocol, it appears on the RAPTOR worklist. The user places the protocol in the collaborative status when the user wants another user to assist with the protocol process. An example is when waiting for the input of a subspecialist. Collaborative is a different status than review status in that the original user who places the protocol in the collaborative status can approve the protocol.
- 2.4.6 When a resident or radiologist role digitally signs off on a protocol, it advances to an **approved** status.
- 2.4.7 An approved protocol will be **protocol acknowledged** by the modality operator (technologist) prior to performing the imaging examination. They will be presented with the following alert requiring action: [Have you confirmed correct patient identity, protocol ordered, and completion of any required pre-procedure preparations (i.e. hydration, sedation, informed consent) **Yes – proceed with exam**, No – Not yet.
- 2.4.7.1 Selecting “No – not yet” maintains state at current state (approved)
- 2.4.7.2 Selecting “Yes – proceed with exam” ascends state to protocol acknowledged.
- 2.4.8 Ticket Attributes**
- 2.4.8.1 Any “Active”, “Review” or “Collabrative” ticket that has been in that set of states for more than site configurable number of days is considered **STALE**.
- 2.4.8.1.1 A STALE ticket will appear at a higher priority in the worklist than other tickets.**
- 2.4.8.2 A protocol that is marked by the system as being edited for more than a site configurable number of minutes without activity from the user will automatically be returned back to the worklist.
- 2.4.8.3 The user will have a 10 minute warning prior to the ticket being returned to the worklist during which time they can interrupt that process. If returned, the user edits will **NOT** be saved with the ticket. The alert will have the following text: [All changes to current protocol will be lost. If you wish to save them, click OK and select “Collaborate” to save your settings.] Only option is OK.
- 2.4.8.3.1 If the user does not click OK in time, the current ticket is returned to the worklist and the screen makes very clear that the information was not saved and the ticket was returned to the worklist.**

- 2.4.8.3.2** If the user made changes and selected “Release ticket back to worklist” they will be prompted with a warning that they will lose their changes.

2.5 Approving a Protocol

Depending on the role assigned, a user can perform a number of different actions to approve a protocol.

2.5.1 A protocol can be edited prior to approval status.

2.5.1.1 A technologist, resident or radiologist role can unapprove either an approved or acknowledged protocol back to an active status.

2.5.2 If the user does not sign or does not put the protocol in a suspended state, the status message “Unsigned Protocol is overdue for signature” is displayed at the bottom of the page.

2.5.3 Based on the filtering criteria set on the protocol worklist, the next protocol can be automatically displayed.

2.6 Protocol Worklist

Radiologists often prescribe an acquisition protocol for complex procedures such as CT’s and MRI’s. Procedure protocoling is the responsibility of the radiologist, with the support of technicians and schedulers providing accurate and timely information. This worklist provides an opportunity for the user to select a pending order tied to a specific patient so they can work that ticket through the RAPTOR workflow statuses.

2.6.1 Assignment Filter

Assignment filter can be configured by an administrator to set criteria for sorting. The information displayed in the protocoling work list can be customized by the assignment filter to a user, a group role, a modality or to weighted keyword. .

2.6.1.1 The weighted keywords are scored with the first group having the most weight and each subsequent group having less weight up to five scoring groups. .

2.6.2 Duplicate Order Check

RAPTOR will check active, approved, acknowledged and completed orders for duplications by patient name and number. If there a potential match, RAPTOR will provide a user configurable message, default message: “potential duplicate order”. This message does not need to be acknowledged.

Protocols by procedure

RAPTOR provides the ability to protocol by procedure. Site Configurable key words for radiology subspecialties:

- 2.6.2.1.1.1 Body: abdomen, pelvis, kub, ivp, liver, hepatic, spleen, pancreas, adrenal, kidney, renal, abdominal, bowel, colon, enterography, colonography
- 2.6.2.1.1.2 Chest/Thorax: chest, thorax, thoracic, heart, cardiac, coronary, pulmonary, lung
- 2.6.2.1.1.3 Musculoskeletal/MSK: extremity, lower extremity, upper extremity, shoulder, elbow, wrist, hand, finger, digit, sacroiliac, hip, knee, ankle, foot, toe, leg, arm, thigh, joint
- 2.6.2.1.1.4 Neuroimaging/Neuro: spine, brain, head, neck, cervical, thoracic, lumbar, maxillofacial, orbit, sinus, auditory, sella, nerve, jaw, temporomandibular, TMJ, larynx, laryngeal, neurogram
- 2.6.2.1.1.5 CT, US and MR guided procedures: biopsy, needle, guidance, guided, ablation, drainage, percutaneous,

- 2.6.2.1.2 Interpretative by procedure
- 2.6.2.1.3 Interpretative by group name

2.6.3 *RAPTOR worklists can be filtered and sorted based on the following criteria*

2.6.3.1 *Patient Name*

2.6.3.2 *Date Desired*

2.6.3.3 *Date Ordered*

2.6.3.4 *Study*

2.6.3.5 *Urgency*

2.6.3.6 *Patient Category/Location*

2.6.3.7 *Anatomy/ Imaging subspecialty*

2.6.3.8 *Workflow Status*

2.6.3.9 *Assignment*

2.6.3.10 *A protocol worklist order can be assigned to a specific user. This assignment is a request to collaborate on a specific order.*

2.6.3.11 *The worklist action for all users except scheduler is either edit or view. The action for scheduler is view only.*

2.6.4 *Assigned users choose which work order from the worklist they wish to assign a protocol. This will “lock out” any other user from performing a similar action on the particular ticket.*

2.6.5 *The user can directly identify a specific set of tickets to “add into a personal cycle queue” functionality. (That way a user can select, for example, a stat as **well as a block of routines that may have intervening entries that they don’t want to work on at the time.**)*

2.6.5.1 *Although a user has identified the tickets to their cycle list, the worklist item are still available for other users to work on.*

2.6.6 *When jumping between protocol and tabs, the users protocoling entries persist.*

2.7 Protocol Listing

Each VA facility has a book of standard protocols available to the technologist. The book is composed by the radiologists and approved by the service chief. Any procedure that requires IV contrast must be approved individually by the radiologist (or else the contrast must be dispensed by the Pharmacy service). Technologists can check lab values and report them back to the radiologist. Radiologists preview the requisitions each day. Technologists should not be working without a radiologist available to answer questions.

2.7.1 The administrator has the ability to add or delete a protocol name from the institution's list of standard protocols.

2.7.2 RAPTOR can suggest a protocol based on institution's listing entered by the administrator. For example, for a CT HEAD order, RAPTOR will display all the protocols that include CT HEAD at the top of the list of standard protocols. Below that, RAPTOR will include other listings.

2.7.3 Protocol Library

RAPTOR provides a site-configurable listing of standard protocols that have been entered by the administrator. By clicking on the listing, the user can view the details of the protocol.

For the RAPTOR Innovation Project, the VA PSHCS protocols provided are listed in the appendix:

2.8 Patient based Protocols

When an authorized user selects a non-inactive procedure to view or edit within the protocols worklist, RAPTOR displays an electronic version of the VA form 519. This electronic form consists of both VistA MDWS data (i.e. relevant patient and study data) and a selection of data to be completed by the RAPTOR user(s).

- 2.8.1** *The RAPTOR user name and patient name is displayed to assist with context.*
- 2.8.2** *When defining a protocol for a certain procedure, a selection can be made from the list of predefined protocols. This predefined protocol can be updated by an administrator if required.*
- 2.8.3** *As a default, RAPTOR provides predefined suggested protocol(s). RAPTOR also has the ability to show all protocols in the notebook, in addition to the default predefined suggested protocol(s).*
- 2.8.4** *Protocol notes can be added to each procedure protocolled. The notes are free text. The radiologist can capture a note to the technologist and scheduler.*
- 2.8.5** *Procedure notes can be added to each procedure protocolled. The notes are free text. The technologist can add the actual amount of contrast used & QA codes*
- 2.8.6** *Post-Procedure notes are grayed out in protocol filter. The notes are free text. In the interpretation filter, post-procedure notes can be used while interpreting the image, to track radiation exposure.*
- 2.8.7** *In the Interpretive phase, the radiologist has the ability to capture post-exam QA observations.*
- 2.8.8** *From the protocoling work list, RAPTOR displays (in limited number of characters):*
- 2.8.8.1** *Requestor*
 - 2.8.8.2** *Requestor Contact #*
 - 2.8.8.3** *Current Attending Physician*
 - 2.8.8.4** *Current Attending Physician #*
 - 2.8.8.5** *Primary Care Physician*
 - 2.8.8.6** *Primary Care Physician #*
 - 2.8.8.7** *Clinical History*
 - 2.8.8.8** *Reason for Study*
 - 2.8.8.9** *Medication Alerts (at-risk if applicable)*
 - 2.8.8.10** *Vitals*
 - 2.8.8.11** *Allergies*
 - 2.8.8.12** *Labs*

2.8.8.13 Radiology

2.9 Consent Conditions for IV contrast administration

The RAPTOR administrator has the ability to configure values of the following contrast contraindication rules. These rules are applied and messages are presented to the user at every key RAPTOR workflow state.

2.9.1 2 types of patients may require consent prior to contrast enhanced advanced medical imaging: allergy & impaired renal function

2.9.2 Renal function impairment contraindication -

2.9.2.1 *Risk for permanent or reversible renal injury secondary to receiving imaging IV contrast agents increases with decreasing renal function. RAPTOR will identify patients with renal function impairment that may require consent prior to contrast enhanced advanced medical imaging.*

2.9.2.2 *If MDWS does not return eGFR value(s), RAPTOR calculated values should be used*

2.9.2.2.1 Calculated eGFR formula is administrator configurable. Default formula:

$$\text{eGFR (mL/min/1.73 m}^2\text{)} = 186 * [\text{Serum Creat (mg/dL)}]^{-1.154} * [\text{Age (years)}]^{-0.203} * F * (1.212 \text{ if African American})$$

[F = 1 if male, F = 0.742 if female]

2.9.2.3 *Time criteria for valid laboratory assessment of renal function (i.e. serum creatinine/eGFR) for inpatients and outpatients are administrator configurable.*

- 2.9.2.3.1 Inpatient. If eGFR measurement is not within 48 hours, then RAPTOR notifies the user with a configurable message. Default message: "Laboratory renal function required within 48 hours for inpatients. Please assure blood draw is ordered."
- 2.9.2.3.2 At Risk Outpatient – eGFR must be measured within 14 days of procedure. If this measurement is not within 14 days, then RAPTOR notifies the user with the a configurable message. Default message: "Laboratory renal function required within 14 days for at risk outpatients. Please assure blood draw is ordered."
- 2.9.2.3.3 Non-Risk Outpatient – eGFR must be measured within 30 days of procedure. If this measurement is not within 30 days, then RAPTOR notifies the user with the a configurable message. Default message: "Laboratory renal function required within 30 days for routine outpatients. Please assure blood draw is ordered."
- 2.9.2.3.4 These messages do not need to be acknowledged.
- 2.9.2.3.5 Whether a laboratory assessment of renal function is valid or invalid based on site configurable date, RAPTOR will analyze renal function lab values against rules for informed consent (listed below)

2.9.2.4 *RAPTOR will flag with user configurable message that consent is required for patients meeting the following user configurable requirements:*

- 2.9.2.4.1 All **stage V and IV renal impairment patients**, configurably defined as $\text{eGFR} < 30$ (mL/min/1.73 m²)
- 2.9.2.4.2 **Acute stage III renal impairment patients**, configurably defined as patients who had eGFR value(s) $\Rightarrow 60$ (mL/min/1.73 m²) at a configurable unit of time, default >60 days, ago whose more recent serum eGFR value(s) are now within the $30 \leq \text{eGFR} < 60$ (mL/min/1.73 m²) range
- 2.9.2.4.3 If RAPTOR cannot identify sufficient data to fulfill the time and eGFR values above, then patients with most recent eGFR value(s) $30 \leq \text{eGFR} < 60$ (mL/min/1.73 m²) will be assumed to be (handled as) acute stage III renal impairment
- 2.9.2.4.4 Default configurable message = "Consent for IV contrast required, impaired renal function"
 - 2.9.2.4.4.1 This flag must be acknowledged by user
 - 2.9.2.4.4.2 User can acknowledge and still elect to proceed without consent required radio button checked and has option to indicate a reason in the protocol notes free text area
- 2.9.2.4.5 If flag for consent data conditions are true, RAPTOR then also displays the following configurable default message text
 - 2.9.2.4.5.1 "Impaired renal function, consider non-contrast study or alternative imaging modality"
 - 2.9.2.4.5.2 "Impaired renal function, consider pre and post-exam hydration for renal protection if IV contrast will be administered"
 - 2.9.2.4.5.3 "Impaired renal function, consider reduced dose of IV contrast if IV contrast will be administered"
- 2.9.2.4.6 User does not have to acknowledge these messages
- 2.9.2.5 *RAPTOR will flag with user configurable message that consent is optional for patients meeting the following user configurable requirement:*
 - 2.9.2.5.1 Chronic stage III renal impairment patients, configurably defined as patients who presently and historically have had eGFR value(s) within the $30 \leq \text{eGFR} < 60$ (mL/min/1.73 m²) range. Historically is defined as configurable unit of time, default > 60 days
 - 2.9.2.5.1.1 Default configurable message = "Consent for IV contrast is optional, chronic stage III renal impairment"
 - 2.9.2.5.1.2 User does not have to acknowledge this message
 - 2.9.2.5.2 If flag for optional consent data conditions are true, RAPTOR then also displays the following configurable default message text
 - 2.9.2.5.2.1 "Impaired renal function, consider non-contrast study or alternative imaging modality"
 - 2.9.2.5.2.2 "Impaired renal function, consider pre and post-exam hydration for renal protection if IV contrast will be administered"

2.9.2.5.2.3 "Impaired renal function, consider reduced dose of IV contrast if IV contrast will be administered"

2.9.2.5.2.4 User does not have to acknowledge these messages

2.9.3 *A patient is considered “At Risk” if any one of the following risk factors apply (these factors do not generate contraindication messages or acknowledgements):*

2.9.3.1 *60+ years old*

2.9.3.2 *Insulin-dependent diabetes >2 yrs*

2.9.3.3 *Non-insulin-dependent diabetes >5 yrs*

2.9.3.4 *A history of kidney disease (including kidney tumors, solitary kidney, renal transplantation, recurrent UTI, etc.)*

2.9.3.5 *Family history of kidney failure*

2.9.3.6 *A history of vascular surgery for atherosclerosis*

2.9.3.7 *Myeloma or Sickle Cell disease (risks for dehydration)*

2.9.3.8 *Liver txp work-up*

2.9.3.9 *Gout*

2.9.3.10 *Systemic Lupus Erythematosus*

2.9.3.11 *On nephrotoxic drugs*

2.9.4 *Non-Risk Outpatient –Must be measured within 30 days of procedure. If this measurement is not within 30 days, then RAPTOR notifies the user with the following message: “Laboratory renal function required within 30 days for outpatient. Please assure blood draw is ordered.”*

2.10 RAPTOR pre-procedure notes

RAPTOR can prepopulate patient pre-scan procedure notes with site configurable boiler-plate text that the RAPTOR user has selected.

2.10.1 Premedication Menu options include:

2.10.1.1 Methylprednisolone 32 mg PO @ 12 hr and 2 hr before scan

2.10.1.2 Prednisone 50 mg PO @ 13 hr, 7 hr and 1 hr before scan

2.10.1.3 Diphenhydramine 25 mg PO 1 hr before scan for either protocol above

2.10.1.4 Emergency protocol – Hydrocortisone 200 mg IV 6 hr before scan, 0 hr before scan, and 4-6 hr after scan + diphenhydramine 50 mg PO or IM or IV 1 hr before scan

2.11 Oral and IV Hydration

Hydration is accessed under the protocol tab. It can be recommended by a radiologist to reduce risk of contrast induced nephropathy. Hydration can be assigned as either “None required”, “Oral” or “IV”.

2.11.1 Oral hydration

The following are default oral hydration directions/ values. The list is configurable by site.

2.11.1.1 500 cc water during 2 hr before scan + 500 cc water during 2 hrs after scan

2.11.1.2 Other (allow any value)

2.11.2 IV

The following are default IV hydration directions/ values. The list is configurable by site.

2.11.2.1 Outpatients – Normal saline 1-2 mL/kg/hour for 3-6 hours before and after scan

2.11.2.2 Inpatients – Normal saline 1-2 mL/kg/hour for 12 hours before and after scan

2.11.2.3 Other (see “Protocol Notes”)

2.12 Contrast

Contrast can be assigned as either None, Enteric or IV. More than one contrast agent can be selected at the same time.

2.13 IV Contrast

2.13.1 CT – list is configurable by site

The following are default IV contrast values:

2.13.1.1 Ultravist 300 (default setting)

2.13.1.2 Visipaque 320

2.13.2 MR – list is configurable by site

2.13.2.1 ProHance (default setting)

2.13.2.2 MultiHance

2.13.2.3 MultiHance ½ dose

2.13.2.4 Eovist

2.13.2.5 Ablavar

2.14 Enteric Contrast

2.14.1 The list of enteric contrast is configurable by site.

2.14.1.1 CT: RediCat (450 cc) during 1 – 2 hour before scan (default setting)

2.14.1.2 CT: Volumen (1350 cc) protocol

2.14.1.3 CT: Volumen (900 cc) protocol

2.14.1.4 CT: Water (450 cc) during 20 min before scan + 150 cc on table

2.14.1.5 CT: GastroView

2.14.1.6 CT: Rectal

2.14.1.7 CT: Other

2.14.2 Body & Musculoskeletal Imaging

2.14.2.1 The list of contrast agents is configurable by site.

2.14.2.2 For abdomen and pelvis exams rectal contrast (PR) option is needed.

2.14.3 Neuro Imaging

2.14.3.1 The list of contrast agents is configurable by site

2.14.4 Image – guided procedures

2.14.4.1 The list of contrast agents is configurable by site

2.14.4.2 There are two types of image guided procedures: US guided & CT guided

2.15 Sedation

2.15.1 RAPTOR has the option for No, Oral, or IV stipulate “Conscious Sedation required”

2.15.1.1 The default option is “None” for all diagnostic and procedural exams, but the user has the ability to update.

2.15.1.2 If Sedation is selected, the user has the ability to enter the sedation orders. This is configurable by site text.

2.15.1.3 The default oral sedation order is blank.

2.15.1.4 Site configurable oral sedation order include Valium 10 mg PO 20 min before scan & other

2.15.1.5 The default IV sedation order is blank

2.15.1.6 Site configurable IV sedation order includes conscious sedation and other.

2.16 Claustrophobic

RAPTOR will capture whether the patient is Claustrophobic or unknown.

2.17 RAPTOR Data Elements

2.17.1 *RAPTOR receives and displays patient and order information from VistA (MDWS) consistent with the Form 519.*

2.17.2 *In the Protocol Tab, the following patient demographics and order information is displayed:*

- Patient Name
- Patient ID
- Patient DOB
- Patient Age
- Patient Sex
- Patient race/ethnicity
- Phone
- Request Urgency
- Transport Required
- Current Patient Location
- Requested Procedure
- Request Status
- Requesting Physician Name
- Requesting Physician Office Phone
- Requesting Physician Cell Phone
- Requesting Physician Pager
- Current Attending Physician Name
- Attending Physician Contact Information
- Primary Physician Name
- Primary Physician Contact Information

- Date and Time of Order Request
- Desired Date of Order Fulfillment
- Clinical History & Reason for exam fields

2.17.3 Thumbnails Displays are dashboards of information also found under the tabs

2.17.3.1 Vital Signs “thumbnail” display is Date/Time of most recent value for: Temp, HR, BP, Ht, Wt, BMI.

2.17.3.2 Lab “thumbnail” Summary should provide two tables as follows:

2.17.3.2.1 “Renal Function” titled table of three most recent Datetime, Serum Creatinine, eGFR values

2.17.3.2.1.1 If eGFR is not returned with its serum creatine pair, then calculate and display eGFR calculated value. (Notify user that eGFR has been calculated rather than fetched from the lab report.) Formula for calculated eGFR should be facility/administrator configurable.

2.17.3.2.1.2 The Default eGFR formula is:

$$eGFR (mL/min/1.73 m^2) = 186 * [Serum Creat (mg/dL)]^{-1.154} * [Age (years)]^{-0.203} * F * (1.212 \text{ if African American}) \quad [F = 1 \text{ if male, } F = 0.742 \text{ if female}]$$

2.17.3.2.1.3 Color code the eGFR cells 3 color renal function table. Lab “thumbnail” display is “stoplight” diagnostic eGFR<strike>]. Green is greater than or equal to 60. Yellow is between 30 and 60. Red is below 30. Ranges for color coding should be facility/administrator configurable.

2.17.3.2.2 “Coagulation Panel” titled table of most recent coagulation entries

2.17.3.2.2.1 Datetime, Protime (PT), Prothrombin time (PTT), INR (international normalized ratio), Hematocrit (HCT)

2.17.3.3 Flag/asterix values out of reference range

2.17.3.4 If feasible within RAPTOR prototype, allow coagulation panel table to collapse/expand with default presentation being collapsed (i.e. user could then click the table title to expand and see table of data).

2.17.3.5 Lab summary should provide a hyperlink to access the Lab Tab

2.17.4 Radiology “Thumbnail” Summary

2.17.4.1 “Completed Radiology Exams” table will list 5 most recent DateTime, ExamNames.

2.17.4.2 Radiology Summary should provide a hyperlink to access the Radiology Reports Tab

2.18 Radiology Order Data Elements

Radiology Data Elements displayed by RAPTOR include:

- Current Primary Provider:
- Current Attending Physician:
- Requested by:
- Patient ID:
- Patient Name:
- Anatomy/Imaging Specialty:
- Patient Location:
- Current Status:
- Order:
- Study:
- Category:
- Due Date:
- Mode of Transport:
- Urgency:
- Age (DOB):
- Ethnicity:

2.19 Vital Signs tab

2.19.1 *The default presentation is a: 1) presentation of most recent height, weight and body mass index (BMI), with datetime stamp. English and metric measures displayed for height and weight; and 2) reverse chronological full table of vital sign parameters, including the Patient Name, Time Date, Temperature, height, weight, BMI, HR and Blood Pressure, respiratory rate, pain score, pulse oximetry (Pox), central venous pressure (CVP), and blood glucose (finger stick BG). Number of row entries can be configurable with default number corresponding to what can be conveniently displayed on one page. If a value for a specific datetime row does not exist, field in table will display blank.*

2.19.2 *By clicking on an entry from the list of vital signs, the following details can be displayed*

2.19.2.1 *Recent trend of the reverse chronological listing of a configurable number of date entries*

2.19.2.2 *The temperature pulse is displayed both in a listing and in a graph.*

2.19.2.3 *In the column headings, the units of vital signs date entries are displayed.*

2.20 Notes tab

2.20.1 *The default presentation divides notes into Selected Notes and Rest of Notes. This listing is a reverse chronological listing showing the following columns, Type, Date, Details*

2.20.2 *Within any Notes Tab listing display, the user can elect to view additional note details.*

2.21 Problem List Tab

2.21.1 *The default presentation is a reverse chronological showing the following columns Title, Onset Date, Details.*

2.21.2 *By clicking on an entry from the problem list, its details can be displayed.*

2.22 Lab Results Tab

2.22.1 *The default presentation is a 30 day reverse chronological listing of laboratory data including the Patient Name, Time Date, the value, and the reference range. Flag/asterix values out of reference range. If feasible within RAPTOR prototype, allow searching of lab term names. Number of days of lab data presentation should be facility/administrator configurable.*

2.22.2 *For serum creatinine values, pair its corresponding eGFR value with it. First check for eGFR in CPRS. If there is an entry, display with an integer value. If there is not an entry, then calculate with the following formula and provide origin of value.*

2.22.2.1 *The eGFR Formula used in calculation is:*

$$\text{eGFR (mL/min/1.73 m}^2\text{)} = 186 * [\text{Serum Creat (mg/dL)}]^{-1.154} * [\text{Age (years)}]^{-0.203} * F * (1.212 \text{ if African American})$$

[F = 1 if male, F = 0.742 if female]

2.22.3 By clicking on a serum creatinine or eGFR value from the list of lab results, the following configurable list vs. graph details can be displayed

2.22.3.1 Graphie Trend of last 5 entries for that test with reference range. Flag/asterisk out of range values.

2.22.3.2 Hovering mouse over a data point yields the actual value

2.23 Radiation Dose

2.23.1 Modality Operator (i.e. CT technologist) will enter the modality reported radiation dose data into the RAPTOR exams results area. CT data entered includes either the Computed Tomography Dose Index volume (CTDIvol) or the Dose Length Product (DLP) or both and total exam DLP, if available.

2.23.1.1 The value of CTDIvol (in units of mGy) or of DLP (in units of mGy·cm) is set by the operating institution.

2.23.2 For previous historical procedures, RAPTOR will check on the dose data (DLP and CTDIvol) in the Radiology Reports text and notify the user if there is a match.

2.23.2.1 In addition to notifying the user, RAPTOR will give the user the opportunity to edit/update the patient dose history by affirming the values found

2.23.3 For previous historical procedures for which dose data was not provided in the dictated report, RAPTOR will estimate a range based on historical tables. Table will be site configurable.

2.23.4 These estimated dose numbers will also include an exam count over a time range.

2.23.5 The radiation dose estimate tab display includes a notice that this collected information is an first level estimate only.

2.23.6 RAPTOR will maintain and present a summary of a patient's previous radiation dose estimates from prior advanced imaging studies available in its database.

2.23.7 Modality Operator (i.e. NM technologist) will enter the pertinent radiation dose data into the RAPTOR exams results area. NM data entered includes [xxx], if available.

2.23.8 RAPTOR will maintain a table of site-configurable recorded dose values for each imaging exam name in its facility protocol library. In addition to administrator reporting utility and other utilities, RAPTOR can use these tables to derive dose estimate of an exam for which dose data was not captured, as well as provide "average

dose for ‘x’ exam” over a date range reporting. Dose table data will be exportable by an administrator.

2.24 Allergies Tab

2.24.1 *The default presentation is a list of allergies*

2.24.2 *By clicking on an entry from the list of both food and drug allergies, the following details can be displayed*

- Causative agent
- Signs/Symptoms
- Drug classes
- Originator
- Date
- Item
- Verified Date
- Observed/Historical

2.25 Medications

2.25.1 *On the protocol page, RAPTOR shall display an “at-risk” medications alert or no alerts. Link for more takes the user to the medications tab.*

2.25.2 *On the medication tab, RAPTOR shall display a list of all active medications, “at-risk” alerts (prioritized) and what was checked for “at-risk”.*

2.25.3 *“at-risk” Medications is defined as medications that the patient is currently taking that will generate a RAPTOR alert. This list is configurable by an administrator.*

The following are the default exam/medication combinations trigger RAPTOR “at-risk” alerts:

- Diagnostic exams: Metformin, Avandamet, Glucophage, Glucovance, Metaglys, Aldesleukin, Proleukin
- Image-guided procedures: Coumadin, warfarin, Aspirin, clopidogrel, Plavix, heparin, low molecular weight heparin, enoxaparin, Lovenox), dalteparin, Fragmin
- Nuclear medicine exams/procedures: not provided

- 2.25.4 The list of medications shall indicate a list of “at-risk” medications identified within the patient’s active medication list.*
- 2.25.5 When no “at-risk” medications are identified, a status message is displayed. A list of what was searched for can be displayed.*
- 2.25.6 By clicking on an entry from the list of medications, its details can be displayed.*
- 2.25.7 There is also an ability to have access to a larger listing of medications*
- 2.25.8 Metformin (including the following brand names: Avandamet, Glucophage, Glucovance, Metaglys, Actoplus Met, pioglitazone, Avandamet, rosiglitazone, Fortamet, Glucophage FM, Glucovance, glyburide, Glumetza, Glycon, Janumet, Sitagliptin, Kombiglyze XR, saxagliptin, Metaglip, glipizide, Prandimet, repaglinide, Riomet)*
- 2.25.9 If RAPTOR finds, should display a configurable message: “Metformin post-scan precaution protocol should be considered” (user can override)*
- 2.25.10 Aldesleukin (brand name Proleukin)*
- 2.25.11 RAPTOR flags if found and provides a message that blood creatinine within 48 hours recommended*

2.26 Pathology Reports

2.26.1 The default presentation is a list of pathology reports and their Time Date Stamp.

2.26.2 The number of reports is configurable by an administrator.

2.26.3 By clicking on an entry from the list of pathology reports, the report contents can be displayed.

2.26.4 There is also an ability to have access to a larger listing of pathology reports.

2.27 Radiology Reports

2.27.1 The default presentation is a list of most recent Radiology reports and their Time Date Stamp.

2.27.1.1 By clicking on an entry from the list of Radiology reports, the report contents can be displayed.

2.28.1.2 By clicking (a different kind of click than to see report contents) on an entry from the list of Radiology reports, a filtered display of the 5 most recent Radiology reports of that exam name is returned.

2.27.2 The number of reports is configurable by an administrator.

2.28 Other Reports (Non-Radiology, Non-Pathology)

Other Reports are defined in RAPTOR as Non-Radiology, Non-Pathology. These include, but are not limited to GI, Pulmonary, Neurology, Ear-Nose-Throat, Microbiology, endoscopic esophagoduodenography (EGD), endoscopic retrograde cholangiopancreatography (ERCP), colonoscopy, bronchoscopy, echocardiography, and ENT scope.

2.28.1 The default presentation is a list of the most recent other reports and their Time Date Stamp.

2.28.2 By clicking on an entry from the list of other reports, the report contents can be displayed. By performing a different kind of click on an entry, a filtered display of the 5 most recent reports of that report name will be returned.

2.28.3 The number of reports is configurable by an administrator.

2.29 RAPTOR Communications

2.29.1 RAPTOR sends secure messaging through VA secure messaging infrastructure

2.29.2 RAPTOR populates secure messages with the following destination options

- Requesting Physician
- Attending Physician

- Primary Physician
- All registered RAPTOR users

2.29.3 *RAPTOR can prepopulate subject line and the message area with site configurable boiler-plate text that the RAPTOR user has selected.*

2.30 Record conscious sedation

The user can track the review and approval of image guided biopsy requests. RAPTOR displays the authorized approval and when procedure is scheduled.

2.31 System Administration

RAPTOR's system administrator will have access to an Administration Screen. This screen provides a list of non-patient specific, non-order specific action options for system administrators.

2.31.1.1 Application Context Area

For an Application Administrator, the list of action options might be something like this:

2.31.1.2 Add New User

2.31.1.3 Edit Existing User Profile

2.31.1.4 Disable Existing User

2.31.1.5 Customize Workflow

2.31.1.6 Customize Labels

3 Dashboard Organization

3.1 Protocolling

RAPTOR optimizes the protocolling process as described here.

3.1.1 *Once the RAPTOR user selects a ticket from the worklist, they are presented with the following organization of relevant information and input areas.*

- Protocols – This is the only tab where user can enter data
- Medications
- Vitals
- Allergies
- Labs
- Clin Rpts

- Problem List
- Rad Rpts
- Notes
- Library

3.1.1.1 Protocol

3.1.1.1.1 Summary of the following information is displayed here:

- Medications
- Vitals
- Allergies
- Labs
- Clin Rpts
- Rad Rpts
- Notes

3.1.1.1.2 Authorized RAPTOR user can take the following actions depending on ROLE and STATE

Table 2 – Actions by Role

Role	State	Description
Radiologist	Inactive	No actions available
Radiologist	Active	<ul style="list-style-type: none"> • Select protocol settings • Provide protocol notes • Release ticket back to worklist • Send secure message • Move ticket to INACTIVE state • Move ticket to APPROVED state • Move ticket to REVIEW state • Move ticket to COLLABORATE state

Role	State	Description
Radiologist	Collaborative	<ul style="list-style-type: none"> • Select protocol settings • Provide protocol notes • Release ticket back to worklist • Send secure message • Move ticket to INACTIVE state • Move ticket to APPROVED state • Move ticket to COLLABORATE state • Move ticket to REVIEW state
Radiologist	Review	<ul style="list-style-type: none"> • Select protocol settings • Provide protocol notes • Release ticket back to worklist • Send secure message • Move ticket to INACTIVE state • Move ticket to APPROVED state • Move ticket to COLLABORATE state • Move ticket to REVIEW state
Radiologist	Approved	<ul style="list-style-type: none"> • Send secure message • Move ticket to INACTIVE state • Move ticket to ACTIVE state • Move ticket to PROTOCOL ACKNOWLEDGED state
Radiologist	Protocol Acknowledged	<ul style="list-style-type: none"> • Send secure message • Provide exam notes • Move ticket to INACTIVE state • Move ticket to ACTIVE state • Move ticket to EXAM COMPLETED state
Radiologist	Exam Complete	<ul style="list-style-type: none"> • Provide Post-Exam Notes • Send secure message • Move ticket to EXAM COMPLETED state
Resident	Inactive	No actions available

Role	State	Description
Resident	Active	<ul style="list-style-type: none"> • Select protocol settings • Provide protocol notes • Release ticket back to worklist • Send secure message • Move ticket to INACTIVE state • Move ticket to APPROVED state • Move ticket to REVIEW state • Move ticket to COLLABORATE state
Resident	Collaborative	<ul style="list-style-type: none"> • Select protocol settings • Provide protocol notes • Release ticket back to worklist • Send secure message • Move ticket to INACTIVE state • Move ticket to APPROVED state • Move ticket to COLLABORATE state • Move ticket to REVIEW state
Resident	Review	<ul style="list-style-type: none"> • Select protocol settings • Provide protocol notes • Release ticket back to worklist • Send secure message • Move ticket to INACTIVE state • Move ticket to APPROVED state • Move ticket to COLLABORATE state • Move ticket to REVIEW state
Resident	Approved	<ul style="list-style-type: none"> • Send secure message • Move ticket to INACTIVE state • Move ticket to ACTIVE state • Move ticket to PROTOCOL ACKNOWLEDGED state
Resident	Protocol Acknowledged	<ul style="list-style-type: none"> • Send secure message • Move ticket to INACTIVE state • Move ticket to ACTIVE state • Move ticket to EXAM COMPLETED state

Role	State	Description
Resident	Exam Complete	<ul style="list-style-type: none"> • Provide Post-Exam Notes • Send secure message • Move ticket to EXAM COMPLETED state
Technologist	Inactive	No actions available
Technologist	Active	<ul style="list-style-type: none"> • Select protocol settings • Provide protocol notes • Release ticket back to worklist • Send secure message • Move ticket to INACTIVE state • Move ticket to REVIEW state • Move ticket to COLLABORATE state
Technologist	Collaborative	<ul style="list-style-type: none"> • Select protocol settings • Provide protocol notes • Release ticket back to worklist • Send secure message • Move ticket to INACTIVE state • Move ticket to COLLABORATE state • Move ticket to REVIEW state
Technologist	Review	<ul style="list-style-type: none"> • Select protocol settings • Provide protocol notes • Release ticket back to worklist • Send secure message • Move ticket to INACTIVE state • Move ticket to COLLABORATE state • Move ticket to REVIEW state
Technologist	Approved	<ul style="list-style-type: none"> • Send secure message • Move ticket to INACTIVE state • Move ticket to ACTIVE state • Move ticket to PROTOCOL ACKNOWLEDGED state
Technologist	Protocol Acknowledged	<ul style="list-style-type: none"> • Send secure message • Move ticket to INACTIVE state • Move ticket to ACTIVE state • Move ticket to EXAM COMPLETED state

Role	State	Description
Technologist	Exam Complete	<ul style="list-style-type: none"> • Provide Post-Exam Notes • Send secure message • Move ticket to EXAM COMPLETED state
Scheduler	Inactive	No actions available
Scheduler	Active	<ul style="list-style-type: none"> • Read information • No state changes allowed
Scheduler	Collaborative	<ul style="list-style-type: none"> • Read information • No state changes allowed
Scheduler	Review	<ul style="list-style-type: none"> • Read information • No state changes allowed
Scheduler	Approved	<ul style="list-style-type: none"> • Read information • No state changes allowed
Scheduler	Protocol Acknowledged	<ul style="list-style-type: none"> • Read information • No state changes allowed
Scheduler	Exam Complete	<ul style="list-style-type: none"> • Read information • No state changes allowed
Administrator	Inactive	<ul style="list-style-type: none"> • Restore back to Active state

3.1.1.2 Medications

3.1.1.3 Vitals

3.1.1.4 Allergies

3.1.1.5 Labs

3.1.1.6 Clin Rpts

3.1.1.7 Rad Rpts

3.1.1.8 Notes

3.2 Interpretation

RAPTOR facilitates the interpretation process as described here.

3.2.1 *Once the RAPTOR user selects an “exam completed” ticket from the interpretation list, they are presented with the following organization of relevant information.*

- Protocols - This is the only tab where user can enter data
- Medications
- Vitals
- Allergies
- Labs
- Clin Rpts
- Rad Rpts
- Notes

3.2.1.1 Protocol

1. Displays all data captured using RAPTOR during protocol processing.
2. Authorized user can update the Post-Exam Notes text area of the tab.
3. Authorized user can save their notes by selecting the “Save Notes”

3.2.1.2 Medications

3.2.1.3 Vitals

3.2.1.4 Allergies

3.2.1.5 Labs

3.2.1.6 Clin Rpts

3.2.1.7 Rad Rpts

3.2.1.8 Notes

3.3 Protocol Summary -

4 Other Considerations

4.1 Alternatives

There is a great difference between different sites protocol workflow. Functional alternatives identified and studied for their requirements include:

- the VISN 20 (Seattle) and VISN 23 (Des Moines) current paper based process
- the VISN 1 (Manchester), VISN 10 (Cleveland) and VISN 16 (Houston) Class III electronic solutions
- Technical alternatives that shape the design of the prototype will be addressed in a subsequent white paper task and deliverable.

4.2 Assumptions

- It is assumed that the requested functionality can be developed within the existing VistA (MDWS) paradigm. VA owned components include VistA and the Medical Domain Web Services (MDWS).
- RAPTOR assumes that all MDWS clinical data is used and spelled correctly. RAPTOR assumes that MDWS has semantic integrity. RAPTOR displays existing MDWS clinical data, but doesn't check for integrity issues.
- Interfaces to other applications (both GOTS and COTS) and common services could be developed in future phases and scoped separately.
- RAPTOR displays existing MDWS clinical data, but doesn't have the ability to correct for incorrect MDWS data. There is no ability to overwrite or update existing MDWS data.
- If user overrides contraindication, they will be required to provide an explanation prior to system accepting change of status to APPROVED.
- RAPTOR has no data retention settings. Data retention is a local policy issue.
- Some features cannot be implemented in the VA INOVATIONS SANDBOX environment. The application will attempt to emulate the relevant behaviors in those situations.

4.3 Dependencies

- Dependencies include the availability of funds, technical resources, and human resources.

4.4 Constraints

- RAPTOR will be developed as a web based system within the VistA (MDWS) environment. It will conform to VistA Style and Medical Domain Web Services (MDWS).

4.5 Business Risks and Mitigation

- Due to the compressed time frames used to elicit and document the requirements, there is the inherent risk that the requirements do not capture the full scope of the protocol workflow. This has been mitigated by meeting with many additional sites.

- Workflow varies greatly between sites. The ability to configure RAPTOR is an important attribute.

4.6 Reference

Attribute of keywords associated with Sub specialty terms. Words and groupings are configurable by site. (keywords that appear in titles)

5 Worklist Tab (to protocol)

- Default filter
 - List all tickets with ACTIVE Current Status
- Default sort (weighed in this order)
 - If STAT, then show at the top
 - If URGENT, then show next
 - If STALE days, then show
 - Assigned to logged in user
 - Keywords matching in title (specialty matching)
 - All reset on date due
 - All else alphabetical on title
- Support search
 - Patient MRN
 - Patient Name
 - Subspecialty
- Support customized user cycle list

6 Interpretation Tab

- Default filter
 - List all orders at Current Status of "Exam Complete"
- Default sorting
 - Alphabetical on patient last name
- Support search
 - Patient MRN
 - Patient Name

7 Technologist Comments

- Box on the protocol page with facility/administrator configurable boilerplate text already there.
- Box for them to key in the amount of contrast and dropdown of contrast used.
- Box for hydration and kind used.
- They also have an **Examination Complete** button.

If user overrides contraindication, they will be required to provide an explanation prior to system accepting change of status to APPROVED

Some features cannot be implemented in the VA INOVATIONS SANDBOX environment. The application will attempt to emulate the relevant behaviors in those situations.

If user overrides contraindication, they will be required to provide an explanation prior to system accepting change of status to APPROVED.

8 Protocol Library

For the RAPTOR Innovation Project, the following VA PSHCS protocols were provided:

#ID|Label|Modality|Weighted Keywords group1;group2; etc with commas in group | CTDI | DLP| Radiotracer Dose (mCi) +/-10% | Est. Eff. Dose (mSv)

[CT::diagnostic]

RPID18|CT Chest with IV contrast |CT|Chest; |#SPACER#| 484

RPID16|CT Chest without IV contrast (normal, low dose) |CT|Chest; |#SPACER#| 390

WAV004|CT High Resolution Spiral Chest (supine or prone) |CT|Spiral;Chest; |#SPACER# | #SPACER#

RPID249|CT Chest, abdomen and pelvis with IV and oral contrast |CT|Chest,Abdomen;pelvis; |#SPACER#| #SPACER#

RPID145|CT Abdomen and pelvis with IV and oral contrast |CT|Abdomen,pelvis |#SPACER#| #SPACER#

WAV007|CT Chest, Abdomen and pelvis with oral contrast only |CT|Chest,Abdomen,pelvis |#SPACER#| #SPACER#

WAV008|CT Abdomen and pelvis with oral contrast only
|CT|Abdomen;pelvis |#SPACER# |#SPACER#

RPID144|CT Abdomen and pelvis with no oral or IV contrast
|CT|Abdomen;pelvis |#SPACER# |#SPACER#

WAV010|CT Four-phase liver |CT|liver;body
|#SPACER# |#SPACER#

WAV011|CT Three-phase liver |CT|liver;body
|#SPACER# |#SPACER#

WAV012|CT KUB (normal, low dose)
|CT|#SPACER#;genitourinary;body |#SPACER# | 557

WAV013|CT IVP
|CT|#SPACER#;genitourinary;body |#SPACER# |#SPACER#

WAV014|CT renal mass protocol
|CT|#SPACER#;genitourinary;body |#SPACER# |#SPACER#

WAV015|CT adrenal mass protocol
|CT|#SPACER#;genitourinary;body |#SPACER# |#SPACER#

WAV016|CT pancreas mass protocol |CT|pancreas;body
|#SPACER# |#SPACER#

WAV017|CT aortic dissection protocol
|CT|Chest;Thoracic;Vascular |#SPACER# |#SPACER#

WAV018|CT thoracic aortic aneurysm protocol
|CT|Chest;Thoracic;Vascular |#SPACER# |#SPACER#

WAV019|CT pre-stent evaluation (or R/O AAA leak)
|CT|#SPACER#;vascular;body |#SPACER# |#SPACER#

WAV020|CT Three-phase post-stent evaluation
|CT|#SPACER#;vascular;body |#SPACER# |#SPACER#

WAV021|CT Two-phase post-stent evaluation
|CT|#SPACER#;vascular;body |#SPACER# |#SPACER#

WAV022|CT CERVICAL SPINE TRAUMA DETAILED Non-Contrast (helical)
|CT|#SPACER#;cervical;spinal |#SPACER# |#SPACER#

WAV023|CT CERVICAL SPINE TRAUMA SCREEN Non-Contrast (helical)
|CT|#SPACER#;cervical;spinal |#SPACER# |#SPACER#

RPID21|CT CERVICAL SPINE without CONTRAST
|CT|#SPACER#;cervical;spinal|#SPACER#|1289

WAV025|CT Chest Pulmonary Angiogram
|CT|#SPACER#;chest;pulmonary;lung|#SPACER#|#SPACER#

WAV026|CT FACIAL TRAUMA - CORONAL REFORMAT Non-Contrast (helical)
|CT|#SPACER#;face;head|#SPACER#|#SPACER#

RPID22|CT HEAD Non-Contrast (axial)
|CT|#SPACER#;head;neural|#SPACER#|801

RPID96|CT HEAD PERFUSION with Contrast (axial)
|CT|#SPACER#;head;neural|#SPACER#|#SPACER#

RPID160|CT HEAD- POSTERIOR FOSSA (3mm) Non-Contrast (axial)
|CT|#SPACER#;head;neural|#SPACER#|#SPACER#

RPID159|CT HEAD- POSTERIOR FOSSA (3mm) with Contrast (axial)
|CT|#SPACER#;head;neural|#SPACER#|#SPACER#

RPID24|CT HEAD with Contrast (axial)
|CT|#SPACER#;head;neural|#SPACER#|1221

RPID23|CT HEAD without and with Contrast (axial)
|CT|#SPACER#;head;neural|#SPACER#|1524

WAV033|CT HEAD ANGIOGRAPHY (CTA) D ANEURYSM with and without Contrast (axial & helical)
|CT|#SPACER#;head;neural|#SPACER#|#SPACER#

WAV034|CT HEAD-RADIATION TREATMENT PLANNING with Contrast (helical)
|CT|#SPACER#;head;neural|#SPACER#|#SPACER#

WAV035|CT HEAD-STEALTH STEREOTACTIC with Contrast (helical)
|CT|#SPACER#;head|#SPACER#|#SPACER#

WAV036|CT HEAD-STEREOTACTIC THALAMOTOMY Non-Contrast (helical)
|CT|#SPACER#;head|#SPACER#|#SPACER#

WAV037|CT LARYNX TUMOR with Contrast (helical and angled axial)
|CT|#SPACER#;throat;neck;larynx|#SPACER#|#SPACER#

WAV038|CT LUMBAR SPINE DEGENERATIVE Non-Contrast (helical)
|CT|#SPACER#;spinal;neural|#SPACER#|#SPACER#

RPID33|CT LUMBAR SPINE with Contrast (helical)
|CT|#SPACER#;spinal;neural|#SPACER#|824

RPID31|CT LUMBAR SPINE without CONTRAST
|CT|#SPACER#;spinal;neural|#SPACER# | 690

RPID66|CT NECK ANGIOGRAPHY (CTA) (helical) only
|CT|#SPACER#;neck|#SPACER# | #SPACER#

WAV042|CT NECK ANGIOGRAPHY (CTA) (helical), plus HEAD with and without Contrast (axial) |CT|#SPACER#;neck|#SPACER# | #SPACER#

RPID39|CT NECK with Contrast (helical)
|CT|#SPACER#;neck|#SPACER# | #SPACER#

WAV044|CT NECK, ORAL, CAVITY, LARYNX, THYROID, without & with CONTRAST
|CT|#SPACER#;neck;oral;larynx;throat;thyroid;cavity|#SPACER# | #SPACER#

WAV045|CT ODONTOID TRAUMA Non-Contrast (helical)
|CT|#SPACER#;cervical;vertebrae|#SPACER# | #SPACER#

WAV046|CT ORBIT SCREEN PRE-MRI (helical)
|CT|#SPACER#;orbital;head|#SPACER# | #SPACER#

WAV047|CT ORBIT with Contrast (axial) with CORONAL SAGITTAL REFORMATS
|CT|#SPACER#;orbital;head|#SPACER# | #SPACER#

RPID42|CT ORBIT without & with CONTRAST
|CT|#SPACER#;orbital;head|#SPACER# | #SPACER#

WAV049|CT PITUITARY (helical) and HEAD CT with Contrast (axial)
|CT|#SPACER#;pituitary;head;neural|#SPACER# | #SPACER#

WAV050|CT SINUSITIS - CORONAL REFORMAT PRE-OP (helical)
|CT|#SPACER#;sinus;head;face|#SPACER# | #SPACER#

WAV051|CT SINUSITIS AXIAL SCREEN (In-Patient/Elderly) (axial)
|CT|#SPACER#;sinus;head;face|#SPACER# | #SPACER#

WAV052|CT SINUSITIS DIRECT CORONAL DETAILED PRE-OP (axial)
|CT|#SPACER#;sinus;head;face|#SPACER# | #SPACER#

WAV053|CT TEMPORAL BONE (High Res) (axial) & SPIRAL Non-Contrast (helical)
|CT|#SPACER#;temporal;head;neural|#SPACER# | #SPACER#

WAV054|CT TEMPORAL BONE (High Res) (axial) & CORONAL Non-Contrast (axial)
|CT|#SPACER#;temporal;head;neural|#SPACER# | #SPACER#

[MR::diagnostic]

WAV055|MR knee (left, right)

|MR|Knee;Musculoskeletal;Body |#SPACER# | #SPACER#

WAV056|MR shoulder (left, right)

|MR|shoulder;Musculoskeletal;Body |#SPACER# | #SPACER#

WAV057|MR shoulder arthrogram (left, right)

|MR|shoulder;Musculoskeletal;Body |#SPACER# | #SPACER#

WAV058|MR ankle (left, right)

|MR|ankle;Musculoskeletal;Body |#SPACER# | #SPACER#

WAV059|MR hip (left, right)

|MR|hip;Musculoskeletal;Body |#SPACER# | #SPACER#

WAV060|MR hip arthrogram (left, right)

|MR|hip;Musculoskeletal;Body |#SPACER# | #SPACER#

WAV061|MR wrist (left, right)

|MR|wrist;Musculoskeletal;Body|#SPACER# | #SPACER#

WAV062|MR wrist arthrogram (left, right)

|MR|wrist;Musculoskeletal;Body|#SPACER# | #SPACER#

WAV063|MR elbow (left, right)

|MR|elbow;Musculoskeletal;Body |#SPACER# | #SPACER#

WAV064|MR run-off

|MR|#SPACER#;Vascular;Body |#SPACER# | #SPACER#

WAV065|MR Renal

|MR|#SPACER#;Vascular;Genitourinary;Body |#SPACER# | #SPACER#

WAV066|MR thoracic aortogram

|MR|aortogram;thoracic;chest |#SPACER# | #SPACER#

WAV067|MR liver

#SPACER#

|MR|liver;body |#SPACER# |

WAV068|MR CP

#SPACER#

|MR|liver;body |#SPACER# |

WAV069|MR renal mass protocol

|MR|renal;genitourinary;body |#SPACER# | #SPACER#

WAV070|MR adrenal mass protocol
|MR|adrenal;genitourinary;body |#SPACER# | #SPACER

WAV071|MR urogram
|MR|urogram;genitourinary;body |#SPACER# | #SPACER

WAV072|MR gynecologic study
|MR|gynecologic;genitourinary;body |#SPACER# | #SPACER

WAV073|MR pelvic venogram
|MR|pelvic;vascular;body |#SPACER# | #SPACER

WAV074|MR ankle arthrogram (right)
|MR|ankle;Musculoskeletal;Body |#SPACER# | #SPACER

WAV075|MR ankle arthrogram (left)
|MR|ankle;Musculoskeletal;Body |#SPACER# | #SPACER

WAV076|MR hip AVN/Fracture screen
|MR|hip;Musculoskeletal;Body |#SPACER# | #SPACER

WAV077|MR elbow arthrogram (right)
|MR|elbow;Musculoskeletal;Body |#SPACER# | #SPACER

WAV078|MR elbow arthrogram (left)
|MR|elbow;Musculoskeletal;Body |#SPACER# | #SPACER

WAV079|MR foot (right)
|MR|foot;Musculoskeletal;Body |#SPACER# | #SPACER

WAV080|MR foot (left)
|MR|foot;Musculoskeletal;Body |#SPACER# | #SPACER

WAV081|MR foot OSTEO/Mass with Contrast (right)
|MR|foot;Musculoskeletal;Body |#SPACER# | #SPACER

WAV082|MR foot OSTEO/Mass with Contrast (left)
|MR|foot;Musculoskeletal;Body |#SPACER# | #SPACER

WAV083|MR Pelvis OSTEO with Contrast
|MR|Pelvis;Musculoskeletal;Body |#SPACER# | #SPACER

WAV084|MR Thighs Myosittis without Contrast
|MR|Thighs;Musculoskeletal;Body |#SPACER# | #SPACER

WAV085|MR Subcutaneous Lipoma
|MR|#SPACER#;Musculoskeletal;Body |#SPACER# | #SPACER

WAV086|MR Soft Tissue Mass with Contrast
 |MR|#SPACER#;Musculoskeletal;Body|#SPACER#|#SPACER

WAV087|MR HEAD VENOGRAM (MRV) without & with CONTRAST
 |MR|#SPACER#;head|#SPACER#|#SPACER

WAV088|MR CERVICAL SPINE- (MULTIPLE SCLEROSIS) with CONTRAST ONLY
 |MR|#SPACER#;cervical;neural|#SPACER#|#SPACER

WAV089|MR ELBOW NEUROGRAM (MRN) without & with CONTRAST
 |MR|#SPACER#;elbow;Body|#SPACER#|#SPACER

WAV090|MR HEAD & COW MRA without CONTRAST
 |MR|#SPACER#;head|#SPACER#|#SPACER

WAV091|MR HEAD- (MULTIPLE SCLEROSIS) without & with CONTRAST
 |MR|#SPACER#;head|#SPACER#|#SPACER

WAV092|MR HEAD, NECK, & ARCH MRA without & with CONTRAST
 |MR|#SPACER#;head;neck|#SPACER#|#SPACER

WAV093|MR IAC & HEAD without & with CONTRAST
 |MR|#SPACER#;head|#SPACER#|#SPACER

WAV094|MR KNEE NEUROGRAM (MRN) without & with CONTRAST
 |MR|#SPACER#;knee;body|#SPACER#|#SPACER

WAV095|MR PITUITARY & HEAD without & with CONTRAST
 |MR|#SPACER#;head;pituitary|#SPACER#|#SPACER

WAV096|MR POST-OP LUMBAR SPINE without & with CONTRAST
 |MR|#SPACER#;spinal;neural|#SPACER#|#SPACER

WAV097|MR SACRAL PLEXUS without & with CONTRAST
 |MR|#SPACER#;spinal;neural|#SPACER#|#SPACER

WAV098|MR SINUS TUMOR without & with CONTRAST
 |MR|#SPACER#;neoplasm;sinus|#SPACER#|#SPACER

WAV099|MR gynecologic study
 |MR|#SPACER#;reproductive;gynecologic|#SPACER#|#SPACER

WAV100|MR PITUITARY (helical) and HEAD CT with Contrast (axial)
 |MR|#SPACER#;pituitary;head|#SPACER#|#SPACER

WAV101|MR PITUITARY & HEAD without & with CONTRAST
 |MR|#SPACER#;head;pituitary|#SPACER#|#SPACER

WAV102|MR SKULL BASE & PAROTID without & with CONTRAST
 |MR|#SPACER#;spinal;neural|#SPACER#|#SPACER

WAV103|MR THORACIC SPINE- (MULTIPLE SCLEROSIS) with CONTRAST ONLY
 |MR|#SPACER#;spinal;neural|#SPACER#|#SPACER

WAV104|MR THORACIC SPINE without CONTRAST
 |MR|#SPACER#;spinal;neural|#SPACER#|#SPACER

WAV105|MR TOTAL CORD SCREEN (C & T-Sp) for MULTIPLE SCLEROSIS without &
 with CONTRAST |MR|#SPACER#;spinal;neural|#SPACER#|#SPACER

WAV106|MR TOTAL SPINE SCREEN without & with CONTRAST
 |MR|#SPACER#;spinal;neural|#SPACER#|#SPACER

WAV107|MR TRIGEMINAL NEURALGIA (TIC DOLOREUX) without & with
 CONTRAST |MR|#SPACER#;neural|#SPACER#|#SPACER

WAV108|MR WRIST NEUROGRAM (MRN) without & with CONTRAST
 |MR|#SPACER#;wrist;neural|#SPACER#|#SPACER

WAV109|MR BRACHIAL PLEXUS without & with CONTRAST
 |MR|#SPACER#;spinal;neural;thorax|#SPACER#|#SPACER

WAV110|MR HEAD- (SEIZURE) without & with CONTRAST
 |MR|#SPACER#;head;neural|#SPACER#|#SPACER

[NM::diagnostic]

WAV111|NM Bone Marrow
 |NM|#SPACER#;Musculoskeletal;Body|#SPACER#|#SPACER|25|#SPACER#

WAV112|NM Bone Scan
 |NM|#SPACER#;Musculoskeletal;Body|#SPACER#|#SPACER|30|#SPACER#

WAV113|NM Brain Imaging
 |NM|neural;head;Body|#SPACER#|#SPACER|0.7|#SPACER#

WAV114|NM Cisternogram
 |NM|#SPACER#;Musculoskeletal;Body|#SPACER#|#SPACER|0.5|#SPACER#

WAV115|NM CSF Shunt Eval
 |NM|spinal;neural;Body|#SPACER#|#SPACER|0.5|#SPACER

WAV116|NM Dacrocystogram
 |NM|orbital;lacrimal;Body|#SPACER#|#SPACER|0.05/eye|#SPACER

WAV117|NM Gallium Scan
 |NM|#SPACER#;neoplasm;Body |#SPACER# |#SPACER| 10 |#SPACER

WAV118|NM Gastric Emptying
 |NM|gastrointestinal |#SPACER# |#SPACER| 0.5 |#SPACER

WAV119|NM GI Bleed Loc.
 |NM|#SPACER#;gastrointestinal;hematological;Body |#SPACER# |#SPACER| 30 |
 #SPACER

WAV120|NM Hepatobiliary
 |NM|#SPACER#;liver;biliary;gallbladder;Body |#SPACER# |#SPACER| 6 |#SPACER

WAV121|NM Liver Blood Pool
 |NM|liver;hematological;Body |#SPACER# |#SPACER| 30 |#SPACER

WAV122|NM Liver/ Spleen
 |NM|liver;spleen;Body |#SPACER# |#SPACER| 6 |#SPACER

WAV123|NM Lung Perfusion
 |NM|lung;Body |#SPACER# |#SPACER| 5 |#SPACER

WAV124|NM Lung Ventilation
 |NM|lung;Body |#SPACER# |#SPACER| 1 |#SPACER

WAV125|NM Lymph Node Map
 |NM|lymphatic;Body |#SPACER# |#SPACER| 1 |#SPACER

WAV126|NM Meckles
 |NM|#SPACER#;Body |#SPACER# |#SPACER| 5 |#SPACER

WAV127|NM MIBG
 |NM|spinal;neural;Body |#SPACER# |#SPACER| 10 |#SPACER

WAV128|NM Myocardial Perfusion Resting Dual or Stress with proto
 |NM|#SPACER#;cardiac;Body |#SPACER# |#SPACER| 4 |#SPACER

WAV129|NM Myocardial Perfusion Resting high/high (two day) with proto 240# - 280#
 |NM|#SPACER#;cardiac;Body |#SPACER# |#SPACER| 45 |#SPACER

WAV130|NM Myocardial Perfusion Resting high/high (two day) with proto over 280#
 |NM|#SPACER#;cardiac;Body |#SPACER# |#SPACER| 50 |#SPACER

WAV131|NM Myocardial Perfusion Resting high/high (two day) with proto up to 240#
 |NM|#SPACER#;cardiac;Body |#SPACER# |#SPACER| 40 |#SPACER

WAV132|NM Myocardial Perfusion Resting low/high (one day) with proto
 |NM|#SPACER#;cardiac;Body |#SPACER# |#SPACER| 12 |#SPACER

WAV133|NM Myocardial Perfusion Stress one or two day proto 240# - 280#
 |NM|#SPACER#;cardiac;Body |#SPACER# |#SPACER| 45 |#SPACER

WAV134|NM Myocardial Perfusion Stress one or two day proto over 280#
 |NM|#SPACER#;cardiac;Body |#SPACER# |#SPACER| 50 |#SPACER

WAV135|NM Myocardial Perfusion Stress one or two day proto up to 240#
 |NM|#SPACER#;cardiac;Body |#SPACER# |#SPACER| 40 |#SPACER

WAV136|NM Myocardial Perfusion Viability
 |NM|#SPACER#;cardiac;Body |#SPACER# |#SPACER| 4 |#SPACER

WAV137|NM Octreotide Scan
 |NM|neoplasm;Body |#SPACER# |#SPACER| 6 |#SPACER

WAV138|NM Parathyroid
 |NM|#SPACER#;parathyroid;Body |#SPACER# |#SPACER| 30 |#SPACER

WAV139|NM Platelet
 |NM|#SPACER#;platelet;hematology;Body |#SPACER# |#SPACER| 0.5 |#SPACER

WAV140|NM Renal Scan with GFR
 |NM|renal;Body |#SPACER# |#SPACER| 5 |#SPACER

WAV141|NM Renal Scan
 |NM|renal;Body |#SPACER# |#SPACER| 10 |#SPACER

WAV142|NM RNVG (EF, MUGA)
 |NM|cardiac;Body |#SPACER# |#SPACER| 30 |#SPACER

WAV143|NM Testicular Scan
 |NM|reproductive;testes;Body |#SPACER# |#SPACER| 20 |#SPACER

WAV144|NM Thyroid Scan
 |NM|thyroid;endocrine;Body |#SPACER# |#SPACER| 5 |#SPACER

WAV145|NM Thyroid Uptake
 |NM|thyroid;endocrine;Body |#SPACER# |#SPACER| 0.01 |#SPACER

WAV146|NM Thyroid Uptake and Scan
 |NM|thyroid;endocrine;Body |#SPACER# |#SPACER| 0.4 |#SPACER

WAV147|NM Thyroid Whole Body Scan by rTSH stimulation
 |NM|thyroid;endocrine;Body |#SPACER# |#SPACER| 5 |#SPACER

WAV148|NM Thyroid Whole Body Scan by withdrawal
 |NM|thyroid;endocrine;Body |#SPACER# |#SPACER| 3 |#SPACER

WAV149|NM White Blood Cell Scan with IN-111 Oxine
 |NM|hematology;Body |#SPACER# |#SPACER| 1 |#SPACER

WAV150|NM White Blood Cell Scan with 99mTc-HMPAO
|NM|hematology;Body |#SPACER# |#SPACER| 20 |#SPACER

[ANY]

WAV999|Other (See notes

Approved