1 EHR Infrastructure Functions

Business Focus: Health Record/PHI Management

1.1 EHR Patient (Person) Registry

Master Patient (Person) Index

1.1.1 PHI

1.1.2 Patient Dataset

1.1.2.1 Identifiers
1.1.2.2 Name, alias(es) and demographics
1.1.2.3 Location and contact information
1.1.2.4 Next of kin
1.1.2.5 Usual practitioners
1.1.2.6 Health plan, insurance, billing details
1.1.2.7 ...

1.1.3 Patient Registry Functions

1.1.3.1 Create patient record
1.1.3.2 Assign patient ID
1.1.3.3 Amend patient record(s)
1.1.3.4 Merge duplicate patients
1.1.3.5 Unmerge patients (previously merged in error)
1.1.3.6 Transmit patient record(s) to external system or entity
1.1.3.7 Receive patient record(s) from external system or entity
1.1.3.8 Archive patient record(s)
1.1.3.9 De-identify or alias patient record(s)
1.1.3.10 Re-identify patient records (from alias)
1.1.3.11 Purge/delete patient record(s)

1.2 EHR Practitioner (Person) Registry

1.2.1 Not PHI

1.2.2 Practitioner Dataset

1.2.2.1 Identifiers
1.2.2.2 Name, alias(es) and demographics
1.2.2.3 Practitioner roles
1.2.2.4 Location and contact information
1.2.2.5 Credentials, licenses
1.2.2.6 Assignment parameters: location, department, service or specialty, practice group and individual
1.2.2.7 Notification, reminder and alert parameters
1.2.2.8 Personal order sets: group and individual
1.2.2.9 User-based security access clearance(s) - User and Role Based, controlling access to
1.2.2.9.1 Access to EHR/PHI functions
1.2.2.9.2 Access to EHR/PHI content
1.2.2.10 Password, access details

1.2.3 Practitioner Registry Functions

1.2.3.1 Create practitioner record
1.2.3.2 Create practitioner ID
1.2.3.3 Amend practitioner record
ALL Level EHR Functional Hierarchy and Decomposition

1.2.3.4 Activate, inactivate practitioner
1.2.3.5 Purge/delete practitioner record(s)

1.3 EHR Role Registry
1.3.1 Not PHI
1.3.2 Role Dataset
1.3.2.1 Role
1.3.2.2 Role-based security access clearance(s), controlling access to
   1.3.2.2.1 EHR/PHI functions
   1.3.2.2.2 EHR/PHI content
1.3.3 Role Registry Functions
   1.3.3.1 Create role record
   1.3.3.2 Amend role record
   1.3.3.3 Delete role record(s)

1.4 EHR Entity Registry
1.4.1 Not PHI
1.4.2 Entities
   1.4.2.1 Organizations
   1.4.2.2 Business Units
   1.4.2.3 Persons (as above): patients, practitioners
   1.4.2.4 Devices: e.g., instruments, monitors
   1.4.2.5 Software: e.g., applications, interface engines, hubs, routers
1.4.3 Entity Dataset
   1.4.3.1 Entity identifiers
   1.4.3.2 Name, description
   1.4.3.3 Location(s) and demographics
1.4.4 Entity Registry Functions
   1.4.4.1 Create entity record
   1.4.4.2 Assign entity ID
   1.4.4.3 Amend entity record
   1.4.4.4 Delete entity record

1.5 EHR Location Registry
1.5.1 Not PHI
1.5.2 Locations, where
   1.5.2.1 Health(care) delivery takes place: healthcare services are performed
   1.5.2.2 EHR records are created, accessed/used
1.5.3 Location examples
   1.5.3.1 Facilities, areas, rooms, beds
   1.5.3.2 Business units: departments, services, specialties
1.5.4 Location Dataset
   1.5.4.1 Location Identifiers
   1.5.4.2 Demographics
   1.5.4.3 Business unit(s): departments, services, specialties
1.5.5 Location Registry Functions
   1.5.5.1 Create location record
   1.5.5.2 Update location ID
   1.5.5.3 Amend location record
1.5.5.4 Delete location record

1.6 EHR - Multiple Person Linkage
1.6.1 Parts PHI
1.6.2 Linkages, e.g.,
   1.6.2.1 Patient to practitioner(s)
   1.6.2.2 Patient to other person/entity: e.g., family member, guarantor, insured, employer

1.6.3 Person Linkage Functions
   1.6.3.1 Create linkage between persons
   1.6.3.2 Activate, deactivate linkage between persons

1.7 EHR Chronology (Chronicle of)

Health Service Acts, Health Record Acts
1.7.1 PHI
1.7.2 Chronicle of
   1.7.2.1 Health status
   1.7.2.2 Health service acts, actions
   1.7.2.3 Health record acts, actions

1.7.3 Health service acts, actions
   [See Care Delivery Functions]
1.7.4 Health record acts, actions
   >Typically trigger audit events
      1.7.4.1 Enable/show record authorship, origination
      1.7.4.2 Enable/show record amendment
      1.7.4.3 Enable/show record verification
      1.7.4.4 Enable/show record access/use
      1.7.4.5 Enable/show record translation
      1.7.4.6 Enable/show record transmittal, including authorized PHI disclosure
      1.7.4.7 Enable/show record receipt, including externally sourced PHI
      1.7.4.8 Enable/show record re-identification, aliasing, re-identification
      1.7.4.9 Enable/show record archival
      1.7.4.10 Enable/show record destruction or loss
      1.7.4.11 Enable/show physical record check-out/check-in: paper, film, tracings
      1.7.4.12 Enable/show record queries and responses

1.7.5 Health record acts -
   Interchange events (in/out-bound interface triggers)
      1.7.5.1 Enable/show record transmittal, including authorized PHI disclosure
      1.7.5.2 Enable/show record receipt, including externally sourced PHI

1.8 EHR Timeline Perspectives
1.8.1 PHI
1.8.2 Prospective - future
   1.8.2.1 Enable/show health services (care delivery)
      >Planned/scheduled - not yet underway
   1.8.2.2 Include wellness checks and preventative care
1.8.3 Concurrent - now
  1.8.3.1 Enable/show health services (care delivery)
    >In progress - but not yet complete

1.8.4 Retrospective, historical
  1.8.4.1 Enable/show health services (care delivery)
    >Completed (cancelled, resolved or other terminus state)

1.9 EHR/PHI Record Management
1.9.1 Including PHI
1.9.2 Rules and guidelines
  1.9.2.1 Enable EHR/PHI record management based on
    1.9.2.1.1 Regulatory, statutory guidelines
    1.9.2.1.2 Accreditation standards
    1.9.2.1.3 Professional and best practice guidelines
    1.9.2.1.4 Local or regional conventions

1.9.3 Record retention, persistence
  >For duration of legal requirement
  1.9.3.1 Retain patient records
  1.9.3.2 Retain supporting records and registries (persons, entities, locations...)

1.9.4 Record indelibility
  1.9.4.1 Ensure and retain record instance as originated, and
  1.9.4.2 Ensure and retain record instance for each successive amendment

1.9.5 Record creation, amendment
  >Per creation or amendment act/action
  1.9.5.1 Capture/input record: e.g., by keyboard/pointer entry, with formatted input screens
  1.9.5.2 Authenticate record/data source (entity)
  1.9.5.3 Review and approve content: e.g., user display and accept
  1.9.5.4 Audit origination or amendment: who, what created/amended, when, where

1.9.6 Record verification
  >Per verification act/action
  1.9.6.1 Review, verify and approve record content: e.g., user display and accept
  1.9.6.2 Authenticate verifying entity
  1.9.6.3 Audit verification: who, what verified, when, where

1.9.7 Record translation
  >Per translation act
  1.9.7.1 Enable record/data translation: e.g., language, code sets
  1.9.7.2 Authenticate translating entity: e.g., interface mediator (interface engine)
  1.9.7.3 Retain original data value + translated value
  1.9.7.4 Audit translation: who (translation entity), what content translated or amended, when, where

1.9.8 Record access/use/view
  >Per patient record accessed
1.9.8.1 Access/use/view record/PHI: e.g., user display
1.9.8.2 Authenticate accessing entity (user)
1.9.8.3 Audit access: who, what accessed, when, where

1.9.9 Record transmittal
>Per transmittal
1.9.9.1 [See EHR/PHI Outbound Record Transmittal]
1.9.9.2 Audit record transmittal: who, what, when, where

1.9.10 Record receipt
>Per receipt
1.9.10.1 [See EHR/PHI Inbound Record Receipt]
1.9.10.2 Audit record receipt: who, what, when, where

1.9.11 Record archival
>Retention according to Legal Requirement
1.9.11.1 Archive record(s): e.g., to external entity or offline storage medium
1.9.11.2 Enable/show archive log, index for retrieval
1.9.11.3 Audit archival: who, what archived, when, where

1.9.12 Record purge/deletion
>Intentional, meeting legal requirements
1.9.12.1 Purge/delete electronic record
1.9.12.2 Audit purge/deletion: who, what purged, when, where
1.9.12.3 Enable/show purge record log, for later review

1.9.13 Record destruction or loss
>Typically unintentional
1.9.13.1 Notate record destruction or loss
1.9.13.2 Audit destruction/loss: who, what, when, where

1.9.14 Record de-identification, aliasing
1.9.14.1 De-identify record: e.g., per HIPAA
1.9.14.2 Alias record
1.9.14.3 Audit de-identification: who, what, when, where

1.9.15 Record re-identification
1.9.15.1 Re-identify record: e.g., for previously aliased records
1.9.15.2 Audit re-identification: who, what, when, where

1.9.16 Physical record check out/in
>Tracking the movement of various physical media
>Including paper, film
1.9.16.1 Check-out physical record media
1.9.16.2 Audit checkout: who, what, when, where
1.9.16.3 Check-in physical record media
1.9.16.4 Audit checkin: who, what, when, where

1.9.17 Record query/response
1.9.17.1 Query record
1.9.17.2 Respond to record query
1.9.17.3 Audit queries, if PHI: who, what, when, where

1.9.18 Record accuracy, consistency
1.9.18.1 Check algorithmically for record/data accuracy, consistency
1.9.18.2 Show checks performed, per record instance
1.9.19 Record completeness
   1.9.19.1 Check record completeness
       1.9.19.1.1 Per encounter or episode of care
       1.9.19.1.2 Per record instance
   1.9.19.2 Check record completeness, as a function of the completeness of health(care) delivery
       1.9.19.2.1 Per encounter or episode of care, per set of corresponding health service acts/actions - complete or not
       1.9.19.2.2 Per record instance, per corresponding health service acts/action(s) - complete or not

1.9.20 Record audit
   1.9.20.1 [See EHR/PHI Chronology - Health Record Acts]
   1.9.20.2 Create/maintain record acts/action audit trails
   1.9.20.3 Provide audit event review tools
   1.9.20.4 Show audit event exceptions, per criteria

1.9.21 Record secure physical storage
   1.9.21.1 Enable physical security controls of EHR/PHI systems, databases, networks and media: e.g., per HIPAA IN/OUT of scope?

1.10 EHR/PHI - Inbound Record Capture/Receipt
   1.10.1 Including PHI
   1.10.2 Inbound records, including receipt from:
       1.10.2.1 Entities: organizations, business units, individuals
       1.10.2.2 Software systems, devices
   1.10.3 Inbound interchange mediation
       1.10.3.1 Inbound interchange often via interface mediators (engines)
   1.10.4 If homogeneous record source, assume
       1.10.4.1 Identical record content
       1.10.4.2 Identical context and data relationships
       1.10.4.3 Identical function: “real world” event triggers, communication triggers, HL7 trigger events
       1.10.4.4 Identical data types
       1.10.4.5 No special mapping or translation required
   1.10.5 If heterogeneous record source, assume
       1.10.5.1 Disparities (source to receiver) in record content, context, function and data types
       1.10.5.2 Content, per record element: identical, translated, unmappable
       1.10.5.3 Context, per record or acts/action: identical, translated, unmappable
       1.10.5.4 Function, per trigger: identical, translated, unmappable
       1.10.5.5 Data type, per record element: identical, translated, unmappable
       1.10.5.6 If identical: 1:1 mapping, no translation required
       1.10.5.7 If translated (source to receiver representation): single (original value) becomes duple (original + translation)
1.10.5.8 If unmappable, record element has no source=receiver equivalent

1.10.5.9 DATA INTEGRITY: impact of unmapped content, context, function or data type
1.10.5.10 CLINICAL INTEGRITY: patient care/safety impact of unmapped content, context, function or data type

1.10.6 Interface standards
>Per interface instance
  1.10.6.1 Use applicable industry standards for inbound messages, including HL7 v2/CDA, DICOM, MIB, X12N, NCPDP

1.10.7 Transmission source authentication
>Per connection, session, record or message
  1.10.7.1 Authenticate source (entity): e.g., software system, device, network, interface mediator

1.10.8 Transmission encryption, decryption
> If PHI or otherwise confidential
> If transmitted over untrusted or public network
>Per connection, session, record or message
  1.10.8.1 Decrypt inbound record receipt

1.10.9 Transmission (message) authentication
>Per connection, session, record or message
  1.10.9.1 Ensure record/message content integrity: record received equals record sent
  1.10.9.2 Ensure record/message sequence integrity
    1.10.9.2.1 Source to receiver sequence
    1.10.9.2.2 Source to interface mediator to receiver sequence

1.10.10 Record origination evidence
> Evidence of record source, origin and/or authorship
> As represented by record source/transmitter to record receiver
>Per record instance
  1.10.10.1 Show record source, origin and/or authorship: who, what, when, where

1.10.11 Record verification evidence
> Evidence of record verification
> As represented by record source/transmitter to record receiver
>Per record instance
  1.10.11.1 Show record verification: who, what, when, where

1.10.12 Record content translation evidence
> Evidence of record content translation
> As represented by record source/transmitter to record receiver
>Per record instance, per record element translated
  1.10.12.1 Show record translation: who, what, when, where
  1.10.12.2 Show translated content: as originated, as translated

1.10.13 Record amendment evidence, history
> Evidence of record content, as originated and as amended
As represented by record source/transmitter to record receiver
Per record instance
  1.10.13.1 Show record, as originated
  1.10.13.2 Show record, per each subsequent amendment
  1.10.13.3 Show record audit trail: who, what, when, where

1.10.14 Inbound record re-identification
Per record, per record instance
  1.10.14.1 Re-identify inbound records, i.e., invert previous outbound aliasing
  1.10.14.2 Audit re-identification: who, what, when, where

1.10.15 Inbound record audit
Per connection, session, record or message received
  1.10.15.1 Log record/message as received, unaltered
  1.10.15.2 Audit inbound record receipt: from whom, what, when, where

1.11 EHR/PHI - Outbound record transmittal
  1.11.1 Including PHI
  1.11.2 Outbound records, including transmittal to:
    1.11.2.1 Entities: organizations, business units, individuals
    1.11.2.2 Software systems, devices
    1.11.2.3 Hardcopy output: e.g., print, fax
    1.11.2.4 Softcopy output: e.g., email, pager, PDA
    1.11.2.5 Media output: e.g., magnetic, optical, microfiche
  1.11.3 Outbound interchange mediation
    1.11.3.1 Outbound interchange often via interface mediators (engines)
  1.11.4 If homogeneous record receiver, assume
    1.11.4.1 Identical record content
    1.11.4.2 Identical context and data relationships
    1.11.4.3 Identical function: "real world" event triggers, communication triggers, HL7 trigger events
    1.11.4.4 Identical data types
    1.11.4.5 No special mapping or translation required
  1.11.5 If heterogeneous record receiver, assume
    1.11.5.1 Disparities (source to receiver) in record content, context, function and data types
      1.11.5.2 Content, per record element: identical, translated, unmappable
      1.11.5.3 Context, per record or act/action: identical, translated, unmappable
      1.11.5.4 Function, per trigger: identical, translated, unmappable
      1.11.5.5 Data type, per record element: identical, translated, unmappable
      1.11.5.6 If identical: 1:1 mapping, no translation required
      1.11.5.7 If translated (source to receiver representation): single (original value) becomes duple (original + translation)
1.11.5.8 If unmappable, record element has no source=receiver equivalent

1.11.5.9 DATA INTEGRITY: impact of unmapped content, context, function or data type
1.11.5.10 CLINICAL INTEGRITY: patient care/safety impact of unmapped content, context, function or data type

1.11.6 If unmappable
>Due to unresolved disparities between source and receiver
1.11.6.1 From external source entity (e.g., software system), receive record not fully mapped (and so identified by mapping agent)
1.11.6.2 Enable/show record status as not fully mapped: e.g., display status to user when accessing record

1.11.7 Interface standards
>Per interface instance
1.11.7.1 Use applicable industry standards for outbound messages, including HL7 v2/CDA, DICOM, MIB, X12N, NCPDP

1.11.8 Transmission receiver authentication
>Per connection, session, record or message
1.11.8.1 Authenticate receiver (entity): e.g., software system, device, network, interface mediator

1.11.9 Transmission content (message) authentication
>Per connection, session, record or message
1.11.9.1 Ensure record/message content integrity: record received equals record sent
1.11.9.2 Ensure record/message sequence integrity
   1.11.9.2.1 Source to receiver sequence
   1.11.9.2.2 Source to interface mediator to receiver sequence

1.11.10 Transmission encryption
>If PHI or otherwise confidential
>If transmitted over untrusted or public network
>Per connection, session, record or message
1.11.10.1 Encrypt outbound record(s)

1.11.11 Record origination evidence
>Evidence of record source, origin and/or authorship
>As represented by record source/transmitter to record receiver
>Per record instance
   1.11.11.1 Show record source, origin and/or authorship: who, what, when, where

1.11.12 Record verification evidence
>Evidence of record verification
>As represented by record source/transmitter to record receiver
>Per record instance
   1.11.12.1 Show record verification: who, what, when, where

1.11.13 Record content translation evidence
>Evidence of record content translation
ALL Level EHR Functional Hierarchy and Decomposition

>As represented by record source/transmitter to record receiver
>Per record instance, per record element translated
  1.11.13.1 Show record translation: who, what, when, where
  1.11.13.2 Show translated content: as originated, as translated

1.11.14 Record amendment history
>Evidence of record content, as originated and as amended
>As represented by transmitter to receiver
>Per record instance, per record element
  1.11.14.1 Show record, as originated
  1.11.14.2 Show record, per each subsequent amendment
  1.11.14.3 Show record audit trail: who, what, when, where

1.11.15 Outbound record de-identification, aliasing
>Per record, per record instance
  1.11.15.1 De-identify outbound records: e.g., per HIPAA
  1.11.15.2 Alias outbound records
  1.11.15.3 Audit record re-identification: who, when, where

1.11.16 Outbound record audit
>Per connection, session, record or message received
  1.11.16.1 Log record/message as transmitted
  1.11.16.2 Audit outbound record transmittal: to whom, when, where

1.12 EHR/PHI Lifecycle "Chain of Trust"
Trusted End-to-End Record Flow
  1.12.1 [See Draft ISO 21089]
  1.12.2 Health record lifecycle and flow
    1.12.2.1 Evidence/show health record lifecycle and flow, at points of:
      1.12.2.1.1 Authorship, origination
      1.12.2.1.2 Amendment
      1.12.2.1.3 Verification
      1.12.2.1.4 Access/use
      1.12.2.1.5 Translation
      1.12.2.1.6 Transmittal, including PHI disclosure
      1.12.2.1.7 Receipt
      1.12.2.1.8 De-identification, aliasing
      1.12.2.1.9 Re-identification
      1.12.2.1.10 Archival
      1.12.2.1.11 Destruction or loss
      1.12.2.1.12 Purge/deletion
      1.12.2.1.13 Physical record check-out/check-in

1.13 EHR Historical Snapshot
>Historical context, basis for clinical decision making
  1.13.1 Snapshot of historical "moment in time"
ALL Level EHR Functional Hierarchy and Decomposition

1.13.1.1 Enable/show state of record for historical point in time
   1.13.1.1.1 Based on state of health record at given point in time
   1.13.1.1.2 Based on state of health(care) delivery and corresponding health service acts/actions at given point in time

1.14 Multi-media EHR
>Text, graphics/waveforms, images, audio...
   1.14.1 Local storage
      1.14.1.1 Capture
      1.14.1.2 Retain
      1.14.1.3 Render and display
   1.14.2 Networked multi-media server
      1.14.2.1 Enable live and reference-able link to multi-media server
      1.14.2.2 Render and display

1.15 EHR Controlled Vocabulary
   1.15.1 Controlled Vocabulary
      1.15.1.1 Enable uniform and common classification schemes and code sets
         >For record elements
            1.15.1.1.1 Industry standard: e.g., ICD, CPT, NDC, LOINC, SNOMED
            1.15.1.1.2 Localized

1.16 EHR/PHI Privacy
   1.16.1 Continuous privacy protection/assurance
      1.16.1.1 Ensure continuous privacy protection/assurance: e.g., per HIPAA
         1.16.1.1.1 Records "at rest" (retained in datastore)
         1.16.1.1.2 Records "in transit" (during interchange)

1.17 EHR/PHI Privacy - HIPAA
   1.17.1 "Need to know" and "minimum necessary"
      >See EHR Security - Access Control
         1.17.1.1 Limit access to "need to know" and "minimum necessary"
            1.17.1.1.1 Per user, per role, per work assignment
            1.17.1.1.2 Per use/purpose of access
     1.17.2 Record de-identification
        >See EHR Record Management - Record de-identification
          1.17.2.1 Enable record de-identification
     1.17.3 Notice of Privacy Practices
      1.17.3.1 Capture, retain and display notice
      1.17.3.2 Notate patient receipt of notice
     1.17.4 Authorization for specific disclosure/use
        >Beyond routine use - HIPAA TPO (treatment, payment and healthcare operations)
          1.17.4.1 Capture, retain and display authorization, including
             1.17.4.1.1 Purpose and scope of record access/use
             1.17.4.1.2 By whom
1.17.4.1.3 For how long

1.17.5 Right to inspect or copy EHR content
>Exclusion for psychotherapy notes
  1.17.5.1 Notate patient's request to inspect or copy EHR content
  1.17.5.2 Notate request disposition

1.17.6 Right to request amendment
  1.17.6.1 Notate amendment request
  1.17.6.2 Notate request disposition
  1.17.6.3 If request accepted, amend record according to request
  1.17.6.4 As appropriate, retransmit amended record to previous recipients

1.18 EHR Security

1.18.1 Continuous security protection/assurance
  1.18.1.1 Ensure continuous security protection/assurance: e.g., per HIPAA
    1.18.1.1.1 Records "at rest" (retained in database)
    1.18.1.1.2 Records "in transit" (during interchange)

1.18.2 EHR Security Administration
  1.18.2.1 Enable single point security administration/control
    >Typical within homogeneous environments
  1.18.2.2 Enable multi-point security administration/control
    >Typical across heterogeneous environments
  1.18.2.3 Configure security and audit controls
  1.18.2.4 Enable/show audit review and monitoring
    1.18.2.4.1 Routine and exceptional audit event monitoring

1.18.3 EHR Security Policy Domains
  1.18.3.1 Enable security policy domains as discrete functional units requiring a unique security policy implementation, e.g.
    1.18.3.1.1 Per organization
    1.18.3.1.2 Per business unit: e.g., department, service, specialty
    1.18.3.1.3 Per location or facility
    1.18.3.1.4 Per record subset: e.g., psychotherapy, SDT results, drug and alcohol abuse records

1.18.4 EHR Security - Access Classifications (Locks)
  >EHR Record Access, Amendment and Processing
  >EHR Function Access
  1.18.4.1 Enable EHR record access classifications
    1.18.4.1.1 Per record domain
    1.18.4.1.2 Per record type
    1.18.4.1.3 Per record element
  1.18.4.2 Enable EHR function access classifications
    1.18.4.2.1 Per EHR function or sub-function

1.18.5 EHR Security - Access Clearances (Keys)
  Authorizations, Privileges
  1.18.5.1 Enable user-based access clearances
    1.18.5.1.1 Per authorized user
  1.18.5.2 Enable role-based access clearances
1.18.5.2.1 Per authorized role

1.18.6 EHR Security - Access Control

> EHR/PHI record access control
> EHR/PHI function access control

1.18.6.1 Enable access types
   1.18.6.1.1 User-based
   1.18.6.1.2 Role-based
   1.18.6.1.3 Context-based

1.18.6.2 Audit access
   > Per user, per session

1.18.6.3 Enable session management
   > Per user, per session

   1.18.6.3.1 Signon: e.g., ID, physical token, password
   1.18.6.3.2 Enable user authentication
   1.18.6.3.3 Log excess signon attempts
   1.18.6.3.4 Enable automatic session timeout, signoff

1.18.7 EHR Security - ID and Password Management

   1.18.7.1 Enable ID management
   1.18.7.2 Enable token management: e.g., ID cards, buttons, keys
   1.18.7.3 Enable password management
      1.18.7.3.1 Encrypted passwords

1.18.8 EHR Security - Entity Authentication

> User, software system, device, network, address...

1.18.8.1 Authenticate entities:

1.18.9 EHR Security - Audit

> Who, what, when, where

   1.18.9.1 Audit health record acts
   [See EHR Chronology - Health Record Acts]
   1.18.9.2 Audit health record data states
      1.18.9.2.1 As originated
      1.18.9.2.2 Per successive amendment
   1.18.9.3 Audit health service acts
   [See EHR Chronology - Health Service Acts]
   1.18.9.4 Audit EHR system events
      1.18.9.4.1 Routine and exception
      1.18.9.4.2 Hardware, software, database, network...

1.18.10 EHR Security - Communications

   1.18.10.1 Authenticate sender/receiver entities: e.g., software systems
   1.18.10.2 Enable secure session management
   1.18.10.3 Encrypt/decrypt EHR/PHI and other confidential communications
      1.18.10.3.1 Over public or untrusted networks
   1.18.10.4 Audit communications events
      1.18.10.4.1 Routine and exception
      1.18.10.4.2 Session start/end

1.19 EHR Database Management

1.19.1 Database backup

   1.19.1.1 Backup database
      1.19.1.1.1 Full backup
      1.19.1.1.2 Incremental, since last backup
1.19.1.2 Backup database, hot backup
  1.19.1.2.1 With minimal (elapsed time) system freeze at final update pass

1.19.2 Database restore
  1.19.2.1 Restore database, from previous backup

1.19.3 Database integrity
  1.19.3.1 Check database integrity: e.g., periodic integrity checking and reporting

1.20 **EHR Database Transaction Management**

1.20.1 Logical and physical transactions
  1.20.1.1 Enable logical and physical transactions

1.20.2 Arbitrarily large transactions
  1.20.2.1 Enable arbitrarily large transactions: e.g., order entry with multiple orders, acts/action scheduling, notifications in single transaction

1.20.3 Rapid transaction processing
  >Appropriate to scale/scalability requirements of stakeholder domain
  1.20.3.1 Enable rapid transaction processing (transaction volume per unit time)

1.20.4 Multi-phase database commits
  1.20.4.1 Enable multi-phase commits: bid, lock, update, unlock

1.20.5 Multi-node concurrent locks
  1.20.5.1 Enable multi-node concurrent locks

1.20.6 Transaction journaling
  1.20.6.1 Enable transaction journaling
    1.20.6.1.1 Robust roll-back and forward

1.21 **EHR Availability**

1.21.1 Availability, uptime
  >Appropriate to stakeholder domain served
  >e.g., 24 x 7 x 365 for acute inpatient
  1.21.1.1 Ensure 99.9% uptime

1.21.2 Minimal downtime
  1.21.2.1 Ensure minimal down-time for periodic version rollovers
  1.21.2.2 Ensure minimal downtime for routine system maintenance

1.22 **EHR Fault Tolerance, Redundancy**

1.22.1 Fault tolerant architecture
  1.22.1.1 Enable fault tolerant architecture
    1.22.1.1.1 Software: OS and application
    1.22.1.1.2 Database
    1.22.1.1.3 Processors
    1.22.1.1.4 Networks
  1.22.1.2 Enable/show dynamic failure bypass to ensure continuous operation
  1.22.1.3 Enable/show real-time monitors of component status and availability

1.22.2 Redundancy of datastores
1.22.2.1 Enable dual fully redundant physical datastores
   1.22.2.1.1 Networked together but physically separate
   1.22.2.1.2 If appropriate, in physically separate facilities

1.23 EHR Responsiveness, User Response Time
   1.23.1 System Responsiveness
   >Appropriate to stakeholder domain served
   1.23.1.1 Ensure immediate response to user commands
   1.23.1.2 Ensure immediate display of next page

1.24 EHR Time (Clock) Synchrony
   1.24.1 Time (Clock) Synchrony
   1.24.1.1 Enable robust time (clock) synchrony services across multiple systems
      1.24.1.1.1 Homogeneous: common architecture
      1.24.1.1.2 Heterogeneous: disparate architecture(s)

1.25 EHR Record Synchrony
   1.25.1 Record synchrony
   1.25.1.1 Enable robust record synchrony services across multiple systems
      1.25.1.1.1 Homogeneous: common architecture
      1.25.1.1.2 Heterogeneous: disparate architecture(s)

1.26 EHR Localization, Local Authority
   Configuration, Configuration Management and Control
   1.26.1 Localization
      1.26.1.1 Enable parameters for localization
      1.26.1.1.1 Per use setting
      1.26.1.1.2 Per use instance

1.27 EHR User/Use Environments
   >Per EHR implementation
   1.27.1 EHR production environment
      1.27.1.1 Live EHR, Live PHI
      1.27.1.2 Enable EHR production environment
   1.27.2 EHR test, development environment
      1.27.2.1 Typically not PHI
      1.27.2.2 Enable test, development environment: e.g., for pre-production configuration and testing
   1.27.3 EHR training environment
      1.27.3.1 Typically not PHI
      1.27.3.2 Enable EHR training environment: e.g., for user training and education

1.28 EHR Version Management
   1.28.1 Version management
      1.28.1.1 Enable software version management, control
      1.28.1.1.1 OS
      1.28.1.1.2 Application
      1.28.1.1.3 Interface mediator (e.g., interface engine)
      1.28.1.1.4 Device
      1.28.1.1.5 Network, communication
      1.28.1.2 Enable version management/control for vocabulary files
         1.28.1.2.1 Vocabulary, coding and classification schemes
1.28.1.3 Retain historical vocabulary files for ongoing reference
1.28.1.4 Enable version management/control for master configuration and definition files
1.28.1.5 Enable version management/control for messaging standards: e.g., HL7 v2/CDA, DICOM, IEEE, X12N, NCPDP

1.29 EHR Scalability, Change Scale
1.29.1 Scalability
1.29.1.1 Enable progressive (upward) scalability as capacity requirements expand
   1.29.1.1.1 Database
   1.29.1.1.2 Concurrent users, sessions

1.30 EHR OLTP
On-Line Transaction Processing
1.30.1 OLTP
>Appropriate to stakeholder domain served
>Sufficient to support immediate, real-time care delivery in all venues
   1.30.1.1 Enable high performance real-time transaction throughput
      1.30.1.1.1 Large transaction payloads
      1.30.1.1.2 High transaction volumes
   1.30.1.2 Ensure upward scalability of transaction capacity

1.31 EHR OLAP
On-Line Analytical Processing
1.31.1 OLAP
>Appropriate to stakeholder domain served
   1.31.1.1 Enable retrospective record/data analysis without impacting real-time OLTP performance
      1.31.1.1.1 Clinical
      1.31.1.1.2 Administrative, operational
2 EHR Care Delivery Functions
Business Focus: Health(care) Delivery

2.1 Encounter Management

2.1.1 PHI

2.1.2 Business and clinical practice rules
  2.1.2.1 Enable encounter management based on
  2.1.2.1.1 Business and clinical practice rules
  2.1.2.1.2 Re-imbursement guidelines

2.1.3 Encounter types
  2.1.3.1 Enable standard encounter types
    2.1.3.1.1 Acute inpatient
    2.1.3.1.2 Emergent
    2.1.3.1.3 Ambulatory, including
      2.1.3.1.3.1 Physician office
      2.1.3.1.3.2 Public health clinic
      2.1.3.1.3.3 Same day surgery
      2.1.3.1.3.4 Dental office
    2.1.3.1.4 Long-term inpatient care, including
      2.1.3.1.4.1 Skilled nursing facility, nursing home
      2.1.3.1.4.2 Inpatient hospice
    2.1.3.1.5 Home care, including
      2.1.3.1.5.1 Practitioner provided home services
      2.1.3.1.5.2 Home based hospice
      2.1.3.1.5.3 Patient self care
    2.1.3.1.6 Care "in the community", including
      2.1.3.1.6.1 Paramedic
      2.1.3.1.6.2 School
      2.1.3.1.6.3 Health education, including first aid and
      2.1.3.1.6.4 CPR
      2.1.3.1.6.5 Wellness and prevention programs
      2.1.3.1.6.6 Health fairs, immunization clinics

2.1.4 Encounter dataset
  2.1.4.1 Capture and retain encounter data, including
    2.1.4.1.1 Diagnosis, symptoms
    2.1.4.1.2 Encounter date(s), time(s): e.g., admit/discharge dates
    2.1.4.1.3 Encounter type
    2.1.4.1.4 Encounter location, site of care
    2.1.4.1.5 Practitioner(s)
      2.1.4.1.5.1 Admitting, attending, consultant, referred to/from
    2.1.4.1.6 Discharge type and disposition
    2.1.4.1.7 Insurance coverage, subscriber and guarantor

2.1.5 Encounter type conversion
  2.1.5.1 Convert encounter types: e.g., emergent to acute inpatient

2.1.6 Encounter "leave of absence"
  2.1.6.1 Enable/show encounter leave of absence

2.2 Episode, Problem Management

> Problem oriented
2.2.1 Business and clinical practice rules
   2.2.1.1 Enable episode/problem management based on
      2.2.1.1.1 Business and clinical practice rules
      2.2.1.1.2 Professional and best practice guidelines
      2.2.1.1.3 Local and regional conventions

2.2.2 Problem list
   2.2.2.1 Capture and retain problem list, per patient
   2.2.2.2 Track/show problem list, active and resolved problems
   2.2.2.3 Track related problem onset, milestones and resolution(s)
   2.2.2.4 Show related diagnosis(es), symptoms
   2.2.2.5 Track/enable/show problem management across
      2.2.2.5.1 Encounters
      2.2.2.5.2 Locations, sites of care
      2.2.2.5.3 Departments, services, specialties
      2.2.2.5.4 Multiple practitioners, inter-disciplinary care
   2.2.2.6 Include goals, objectives
   2.2.2.7 Include/link related care plans, critical paths, protocols
   2.2.2.8 Include/link related orders, results

2.3 Point of Service, Point of Care
   2.3.1 Immediate point of service/care
      2.3.1.1 Enable health(care) delivery at the point of service, point of care

   2.3.2 Immediate, interactive clinical decision support
      2.3.2.1 Enable immediate, interactive clinical decision support and real-time decision agents

   2.3.3 Immediate information source
      2.3.3.1 Provide a immediate information source to inform and guide the practitioner
         >Per patient
            2.3.3.1.1 Patient status
            2.3.3.1.2 Outstanding abnormal or panic result values
            2.3.3.1.3 Current and pending orders and status
            2.3.3.1.4 Current and pending acts/actions, status and assignment
            2.3.3.1.5 Care plan and status
            2.3.3.1.6 Problem list and status
            2.3.3.1.7 Medication administration record
            2.3.3.1.8 Immediate and recent results and trends
            2.3.3.1.9 Allergies, precautions
            2.3.3.1.10 Demographics
            2.3.3.1.11 Immunizations
            2.3.3.1.12 Family history
            2.3.3.1.13 Surgical/procedure history

   2.3.4 Immediate data capture
      2.3.4.1 Enable immediate, real-time data capture during the course of health(care) delivery

   2.3.5 Immediate access to knowledge bases, medical literature
2.3.5.1 Enable immediate, real-time access to knowledge bases and medical literature

2.4 Orders, Order Management

>For the provision of health(care) services
>Care, diagnostics, therapies, medications, self care, followup...

2.4.1 Business and clinical practice rules

2.4.1.1 Enable orders, order management based on business and clinical practice rules
2.4.1.2 Enable orders, order management based on best practice (standard of practice) guidelines
   2.4.1.2.1 Accreditation, regulatory guidance
   2.4.1.2.2 Professional society guidelines
   2.4.1.2.3 Local and regional conventions
2.4.1.3 Enable rules for
   2.4.1.3.1 Order entry, verification, amendment, discontinuation and cancellation
   2.4.1.3.2 Order scope of authority
   2.4.1.3.3 Protocol orders
   2.4.1.3.4 Order alerts and reminders
   2.4.1.3.5 Order spawned acts/actions
   2.4.1.3.6 Order-based practitioner assignment
   2.4.1.3.7 Order notification and routing
   2.4.1.3.8 Quality and performance measures
   2.4.1.3.9 Cost measures

2.4.2 Order management

2.4.2.1 Capture and retain patient orders and order details

2.4.3 Order entry

2.4.3.1 Enable order entry at point of service/care or at other points of convenience for practitioner
2.4.3.2 Check order content for accuracy and consistency
2.4.3.3 Check order content for completeness
2.4.3.4 Authenticate/identify
   2.4.3.4.1 Order author
   2.4.3.4.2 Order scribe (if any)
2.4.3.5 Audit order: who, what, when, where
2.4.3.6 Authenticate order

2.4.4 Order scope of authority

2.4.4.1 Define scope of authority for orders, within and across:
   2.4.4.1.1 Encounter types
      2.4.4.1.1.1 Inpatient
      2.4.4.1.1.2 Emergent
      2.4.4.1.1.3 Ambulatory
      2.4.4.1.1.4 Long-term care
      2.4.4.1.1.5 Home care
   2.4.4.1.2 Locations and Facilities
   2.4.4.1.3 Disciplines and Business Units
      2.4.4.1.3.1 Departments
      2.4.4.1.3.2 Services
      2.4.4.1.3.3 Specialties

2.4.5 Order verification
2.4.5.1 Verify order, e.g.,
>Prior to scheduling corresponding health(care) services
  2.4.5.1.1 Practitioner review of order entered by scribe
  2.4.5.1.2 Review of student, intern or resident by proctor or preceptor
  2.4.5.1.3 Review of employee work by supervisor
2.4.5.2 Audit order verification: who, what, when, where
2.4.5.3 Authenticate order verification
2.4.5.4 Retain content of original order, and all subsequent amendments
2.4.5.5 Invoke decision agent

2.4.6 Order amendment
  2.4.6.1 Amend order
  2.4.6.2 Cancel and/or reschedule spawned acts/actions
    2.4.6.2.1 Based on new order parameters
  2.4.6.3 Audit order amendment: who, what, when, where
  2.4.6.4 Authenticate order amendment
  2.4.6.5 Retain content of original order, and all subsequent amendments
  2.4.6.6 Invoke decision agent

2.4.7 Order renewal
  2.4.7.1 Renew order
  2.4.7.2 Schedule spawned acts/actions
  2.4.7.3 Audit order renewal: who, what, when, where
  2.4.7.4 Authenticate order renewal
  2.4.7.5 Retain content of original order, and all subsequent amendments/renewals
  2.4.7.6 Invoke decision agent

2.4.8 Order discontinuation, cancellation
  2.4.8.1 Discontinue or cancel order
  2.4.8.2 Cancel spawned acts/actions
  2.4.8.3 Audit order discontinuation/cancellation: who, what, when, where
  2.4.8.4 Authenticate order discontinuation/cancellation
  2.4.8.5 Retain content of original order, and all subsequent amendments
  2.4.8.6 Invoke decision agent

2.4.9 Single order
>Per patient, per service ordered
  2.4.9.1 Enable single order to be entered and authenticated:

2.4.10 Block Order
>Per patient
  2.4.10.1 Enable multiple orders to be entered in a single session and authenticated once

2.4.11 Order sets
  2.4.11.1 Enable custom order sets, specific to
    2.4.11.1.1 Individual practitioner
    2.4.11.1.2 Group practice
    2.4.11.1.3 Business unit: department, service, specialty
    2.4.11.1.4 Diagnosis, symptoms
2.4.11.2 Invoke order set by practitioner selection
2.4.11.3 Invoke order set by real-time decision agent

2.4.12 Protocol based orders
2.4.12.1 Enable protocol orders based on diagnosis, symptoms
2.4.12.2 Enable protocol orders based on planned regime (care plan) for
   2.4.12.2.1 Care services
   2.4.12.2.2 Diagnostic services
   2.4.12.2.3 Therapeutic services
   2.4.12.2.4 Diet
   2.4.12.2.5 ...
2.4.12.3 Link protocols to pre-defined order sets
2.4.12.4 Invoke protocol by practitioner selection
2.4.12.5 Invoke protocol by real-time decision agent

2.4.13 Order alerts and reminders
2.4.13.1 Invoke real-time decision agents for immediate alerts and reminders to practitioner during order session, e.g.,
   2.4.13.1.1 Possible allergic reaction
   2.4.13.1.2 Possible interaction or incompatibility, e.g.,
      2.4.13.1.2.1 Drug/drug
      2.4.13.1.2.2 Drug/lab
      2.4.13.1.2.3 Drug/food
      2.4.13.1.2.4 Drug/disease
      2.4.13.1.2.5 Procedure/procedure
   2.4.13.1.3 Possible drug dosage incompatibility: e.g., weight based dosing formulas
   2.4.13.1.4 Possible side effects
   2.4.13.1.5 Possibly ineffective or unnecessary
   2.4.13.1.6 Possible alternatives which may be
      2.4.13.1.6.1 Less costly
      2.4.13.1.6.2 More effective
   2.4.13.1.7 Possible duplication of current or recent services, medications...
2.4.13.2 Invoke real-time decision agents to
   2.4.13.2.1 Compute cost of services ordered or proposed to be ordered
   2.4.13.2.2 Suggest alternative services, when appropriate

2.4.14 Order spawned acts/actions
2.4.14.1 Schedule health(care) service acts/actions, per order parameters, within and across:
   2.4.14.1.1 Encounter types
      2.4.14.1.1.1 Inpatient
      2.4.14.1.1.2 Emergent
      2.4.14.1.1.3 Ambulatory
      2.4.14.1.1.4 Long-term care
      2.4.14.1.1.5 Home care
   2.4.14.1.2 Locations, Facilities and Sites of Care
   2.4.14.1.3 Disciplines and Business Units
      2.4.14.1.3.1 Departments
      2.4.14.1.3.2 Services
      2.4.14.1.3.3 Specialties
   2.4.14.2 Ensure order and spawned health(care) service acts/actions retain continuous linkage, as parent to child
      2.4.14.2.1 One order to one act/action
      2.4.14.2.2 One order to many acts/actions
2.4.15 Order-based practitioner assignment
   2.4.15.1 Enable practitioner assignment based on business and clinical practice rules
   2.4.15.2 Enable practitioner work assignments based on order-spawned acts/actions
       2.4.15.2.1 Per individual practitioner
       2.4.15.2.2 Per work group or group practice

2.4.16 Order notification and routing
   2.4.16.1 Enable order notification and routing based on business/clinical practice rules
   2.4.16.2 Notify/route order(s) based on order status or change in status, e.g.,
       2.4.16.2.1 Order creation
       2.4.16.2.2 Order amendment
       2.4.16.2.3 Order D/C
   2.4.16.3 Notify/route order(s) via
       2.4.16.3.1 Hardcopy: e.g., printer, fax
       2.4.16.3.2 Softcopy: e.g., secure email
       2.4.16.3.3 Outbound interface
   2.4.16.4 Notify/route order(s) to work or review queue/list, per
       2.4.16.4.1 Individual practitioner
       2.4.16.4.2 Work group or group practice
       2.4.16.4.3 Facility or location
       2.4.16.4.4 Business unit: department, services, specialties
   2.4.16.5 Receive and process order(s), e.g.,

2.4.17 Order lifecycle
[Placeholder]

2.4.18 Order status, state transitions
[Placeholder]

2.5 Results, Result Management

Result = Act/Action Result

2.5.1 Results, e.g.,
   2.5.1.1 Clinical observations
   2.5.1.2 Evaluations, exams, history and physical
   2.5.1.3 Interventions and care activities
   2.5.1.4 Diagnostic (test) parameters and findings
   2.5.1.5 Assessments, SOAP
   2.5.1.6 MDS
   2.5.1.7 Consultations
   2.5.1.8 Medication administrations
   2.5.1.9 Input and output (fluid) measures
   2.5.1.10 Quality measures
   2.5.1.11 Costs: e.g., projected vs. actual

2.5.2 Business and clinical practice rules
   2.5.2.1 Enable results, result management based on business and clinical practice rules
   2.5.2.2 Enable results, result management based on best practice (standard of practice) guidelines
       2.5.2.2.1 Accreditation, regulatory guidance
       2.5.2.2.2 Professional society guidelines
2.5.2.2.3 Local and regional conventions

2.5.2.3 Enable rules for
   2.5.2.3.1 Result entry, verification, amendment, completion, cancellation
   2.5.2.3.2 Order fulfillment, as a function of result completion
   2.5.2.3.3 Result alerts and reminders
   2.5.2.3.4 Result notification and routing

2.5.3 Result management
   2.5.3.1 Capture and retain acts/action results and result details

2.5.4 Result entry
   2.5.4.1 Enable result entry at point of service/care or at point of convenience for practitioner
   2.5.4.2 Include result values and normal ranges
   2.5.4.3 Check result content for accuracy and consistency
   2.5.4.4 Check result content for completeness
   2.5.4.5 Authenticate/identify
      2.5.4.5.1 Result author
      2.5.4.5.2 Result scribe (if any)
   2.5.4.6 Audit result: who, what, when, where
   2.5.4.7 Authenticate result
   2.5.4.8 Invoke decision agent

2.5.5 Result verification
   2.5.5.1 Verify result, e.g.,
      2.5.5.1.1 Practitioner review of result(s) sourced by device: e.g., instrument or monitor
      2.5.5.1.2 Practitioner review of result(s) entered by scribe
      2.5.5.1.3 Review of student, intern or resident by proctor or preceptor
      2.5.5.1.4 Review of employee work by supervisor
   2.5.5.2 Authenticate/identify result verifier
   2.5.5.3 Audit result verification: who, what, when, where
   2.5.5.4 Authenticate result verification
   2.5.5.5 Retain content of original result, and all subsequent amendments
   2.5.5.6 Invoke decision agent

2.5.6 Result amendment
   2.5.6.1 Amend result
   2.5.6.2 Check amended result content for accuracy and consistency
   2.5.6.3 Check amended result content for completeness
   2.5.6.4 Authenticate/identify
      2.5.6.4.1 Result amendment author
      2.5.6.4.2 Result amendment scribe (if any)
   2.5.6.5 Audit result amendment: who, what, when, where
   2.5.6.6 Authenticate result amendment
   2.5.6.7 Retain content of original result, and all subsequent amendments
   2.5.6.8 Invoke decision agent

2.5.7 Result completion
   2.5.7.1 Complete order
2.5.7.2 Authenticate/identify
   2.5.7.2.1 Result completion verifier
2.5.7.3 Audit result completion: who, what, when, where
2.5.7.4 Authenticate result completion
2.5.7.5 Retain content of original result, and all subsequent amendments
2.5.7.6 Invoke decision agent

2.5.8 Result cancellation
   2.5.8.1 Cancel result
   2.5.8.2 Authenticate/identify
      2.5.8.2.1 Result cancellation verifier
   2.5.8.3 Audit result cancellation: who, what, when, where, why
   2.5.8.4 Authenticate result cancellation
   2.5.8.5 Invoke decision agent

2.5.9 Order fulfillment
   2.5.9.1 Track result progression/completion against original order

2.5.10 Result alerts and reminders
   2.5.10.1 Enable result alerts and reminders based on
      2.5.10.1.1 Business and clinical practice rules
      2.5.10.1.2 Best practice guidelines

2.5.11 Result notification and routing
   2.5.11.1 Notify/route result(s) based on result status or change in status, e.g.,
      2.5.11.1.1 Result creation
      2.5.11.1.2 Result amendment
   2.5.11.2 Notify/route result(s) via
      2.5.11.2.1 Hardcopy: e.g., printer, fax
      2.5.11.2.2 Softcopy: e.g., secure email
      2.5.11.2.3 Outbound interface
   2.5.11.3 Notify/route result(s) to work or review queue/list, per
      2.5.11.3.1 Individual practitioner
      2.5.11.3.2 Work group or group practice
      2.5.11.3.3 Facility or location
      2.5.11.3.4 Department, service, specialty
   2.5.11.4 Receive and process result(s)

2.5.12 Result review
   2.5.12.1 Audit result review

2.6 Care Planning, Critical Paths, Protocols
   2.6.1 Business and clinical practice rules
      2.6.1.1 Enable care planning, critical paths and protocols
         based on
         2.6.1.1.1 Business and clinical practice rules
         2.6.1.1.2 Best practice guidelines
   2.6.2 Care plans, critical paths, protocols
      2.6.2.1 Enable care plans, critical paths and protocols, per patient, based on
         2.6.2.1.1 Diagnosis, symptoms
         2.6.2.1.2 Problem or disease state
ALL Level EHR Functional Hierarchy and Decomposition

2.6.2.2 Enable care plans, critical paths and protocols, per patient, for
   2.6.2.2.1 Department, service, specialty
   2.6.2.2.2 Facility, location or site of care
   2.6.2.2.3 Group or individual practice
   2.6.2.2.4 Across any combination of above

2.6.2.3 Link care plan/critical path/protocol to relevant order sets

2.6.2.4 Link care plan/critical path/protocol to corresponding orders and results, per patient

2.6.2.5 Enable/show care plan/critical path/protocol progression and current status

2.6.2.6 Enable/show variance from care plan/critical path or protocol

2.7 Clinical Decision Support, Knowledge Management

   2.7.1 Business and clinical practice rules
       2.7.1.1 Enable clinical decision support algorithms based on
           2.7.1.1.1 Business and clinical practice rules
           2.7.1.1.2 Best practice guidelines
           2.7.1.1.3 Care plans, critical paths, protocols
           2.7.1.1.4 Quality indicators
           2.7.1.1.5 Performance and accountability measures
           2.7.1.1.6 Cost parameters

   2.7.2 Decision agents
       2.7.2.1 Enable real-time concurrent decision agents
           2.7.2.1.1 At user front-end, real-time during user sessions
           2.7.2.1.2 At order entry, verification, amendment, renewal, discontinuation or cancellation
           2.7.2.1.3 At result entry, verification, amendment completion or cancellation
           2.7.2.1.4 At designated points in health(care) delivery process

       2.7.2.2 Enable retrospective decision support: e.g., OLAP based

       2.7.2.3 Enable prescribed actions (if decision algorithm evaluated as true)
           2.7.2.3.1 Alerts, reminders, notifications
           2.7.2.3.2 Start, hold, DC or cancel care plan
           2.7.2.3.3 Start, hold, DC or cancel orders
           2.7.2.3.4 Schedule, hold, resume or cancel acts/actions

   2.7.3 Decision acts/actions
       2.7.3.1 Capture and retain decision acts/actions and related detail
           2.7.3.1.1 Per patient
           2.7.3.1.2 Per decision
       2.7.3.2 Include clinical context
       2.7.3.3 Include rationale for decision

   2.7.4 On-line medical literature references
       2.7.4.1 Access/show medical literature references

   2.7.5 On-line policies and procedure references
       2.7.5.1 Access/show organizational policies and procedures
2.7.5.2 Access/show clinical practice guidelines, standards of care

2.8 Scheduling

2.8.1 Business and clinical practice rules

2.8.1.1 Enable scheduling based on business and clinical practice rules

2.8.2 Resource based scheduling

2.8.2.1 Schedule act/action against available resources

2.8.2.1.1 Resources: practitioners/staff, facilities, equipment, supplies, time blocks

2.8.3 Patient schedule

2.8.3.1 Schedule acts/actions based on active orders and care plans

2.8.3.2 Schedule acts/actions ad hoc

2.8.3.3 Track/show acts/actions;

2.8.3.3.1 Prospective (future): acts/actions planned, not yet underway

2.8.3.3.2 Concurrent (now): acts/actions in progress, not yet complete

2.8.3.3.3 Retrospective (historical): acts/actions completed or cancelled

2.8.3.4 Enable/show integrated patient schedule, integrated across

2.8.3.4.1 Encounter types

2.8.3.4.2 Locations, sites of care

2.8.3.4.3 Departments, services, specialties

2.8.4 Act/action timing and inter-dependencies

2.8.4.1 Schedule health(care) service acts/actions with closely coordinated sequence, timing, precedents, staging and transportation requirements

2.8.4.2 Schedule acts/actions according to relative priority

2.8.5 Non-clinical and indirect patient activities

2.8.5.1 Schedule non-clinical acts/actions: e.g., housekeeping, infection control surveillance

2.8.5.2 Schedule indirect patient acts/actions: e.g., utilization review, quality reviews

2.9 Integral Work Flow to Health(care) Delivery Management

2.9.1 Business and clinical practice rules

2.9.1.1 Enable integral work flow based on business and clinical practice rules

2.9.2 Immediate record of health(care) delivery

2.9.2.1 Enable/show record as immediate co-product (byproduct?) of health(care) delivery and discrete acts/actions

2.9.2.1.1 Facts: clinical, operational, administrative, financial

2.9.2.1.2 Measures: quality, performance, outcomes, cost, utilization

2.9.3 Timeline based
2.9.3.1 Enable/show integral work flow along act/action timeline
  2.9.3.1.1 Per patient

2.9.4 Work tasks \(= \text{acts} = \text{actions}\)
  2.9.4.1 Schedule acts/actions based on orders, care plans, operational protocols
  2.9.4.2 Schedule acts/actions as needed, ad hoc

2.9.5 Assignment
  [See Work Lists]
  2.9.5.1 Invoke decision agent to assign acts/actions to
    2.9.5.1.1 Individual practitioners
    2.9.5.1.2 Work groups and group practices
    2.9.5.1.3 Departments, services, specialties
  2.9.5.2 Enable/show work lists

2.9.6 Staging, sequencing, routing
  2.9.6.1 Invoke decision agent to stage, sequence and route acts/actions

2.9.7 Conditionals and Inter-dependencies
  2.9.7.1 Invoke decision agent to schedule work tasks based on predicate acts/actions being complete or conditions true

2.9.8 Allocation, deployment and coordination
  2.9.8.1 Invoke decision agent to allocate, deploy and coordinate needed resources to point of service/care, at appropriate time
    2.9.8.1.1 Resources: practitioners/staff, facilities, equipment, supplies, time blocks

2.9.9 Completeness of work
  2.9.9.1 Ensure/show accountability for work performance and completion
  2.9.9.2 Invoke decision agent to measure completeness of work, against known and scheduled acts/actions
    2.9.9.2.1 Per patient
    2.9.9.2.2 Per patient encounter
    2.9.9.2.3 Per practitioner
  2.9.9.3 Show incomplete acts with responsible practitioners

2.9.10 Quality indicators
  2.9.10.1 Capture and retain quality indicators as a function of integral work flow

2.9.11 Performance and utilization measures
  2.9.11.1 Capture and retain performance and utilization measures as a function of integral work flow

2.9.12 Cost projections
  2.9.12.1 Invoke decision agent to measure costs of health(care) delivery
    2.9.12.1.1 Projected vs. actual

2.10 Work Lists
  2.10.1 Business and clinical practice rules
    2.10.1.1 Enable work lists based on business and clinical practice rules
  2.10.2 Assignments and work list
2.10.2.1 Track/show current assignments and work list
   2.10.2.1.1 Per individual practitioner
   2.10.2.1.2 Per practitioner role
   2.10.2.1.3 Per group coverage (multiple practitioner group)
   2.10.2.1.4 Per patient list, per individual patient
   2.10.2.1.5 Per individual health service (act) assigned

2.10.3 Incomplete work list
   2.10.3.1 Track/show incomplete work
   2.10.3.1.1 Per individual patient
   2.10.3.1.2 Per patient encounter
   2.10.3.1.3 Per practitioner
   2.10.3.1.4 Per practitioner role
   2.10.3.1.5 Per department, service, specialty

2.11 Medications, Medication Management

Prescriptions
   2.11.1 Business and clinical practice rules
      2.11.1.1 Enable medication management based on business and clinical practice
   2.11.2 Medication acts, medication lifecycle
      2.11.2.1 Order medication
         [See Orders, Order Management]
         2.11.2.1.1 Capture and retain medication order act and order details
      2.11.2.2 Invoke decision agent to check for drug allergies, interactions, duplications, appropriate dosing, less costly alternatives, more effective alternatives...
      2.11.2.3 Invoke decision agent to check for order completeness
      2.11.2.4 Invoke decision agent to check for order data accuracy and consistency
      2.11.2.5 Verify medication order, requestor
         >If transcribed order, By ordering practitioner
         >By supervisor, proctor, preceptor
         2.11.2.5.1 Capture and retain medication order verification act and details
      2.11.2.6 Verify medication order, pharmacy
         >By pharmacist
         2.11.2.6.1 Capture and retain medication order verification act and details
      2.11.2.7 Schedule medication administration acts
      2.11.2.8 Print medication label
         2.11.2.8.1 Product details, dosage form...
         2.11.2.8.2 Administration instructions
         2.11.2.8.3 Precautions, possible side effects
      2.11.2.9 Dispense medication
         2.11.2.9.1 Capture and retain medication dispensing act and details
      2.11.2.10 Fill medication cart or distribution conveyance
         2.11.2.10.1 Capture and retain medication cart fill act and details
      2.11.2.11 Administer medication
         2.11.2.11.1 Capture and retain medication administration act and related details
2.11.2.12 Audit each medication act (as above): who, what, when, where

2.11.3 IV lifecycle
[Variation of medication lifecycle]

2.11.4 Mediation Administration Record
2.11.4.1 Enable/show medication administration record, per patient
   2.11.4.1.1 Current
   2.11.4.1.2 Historical
2.11.4.2 Enable patient input of self administration acts

2.11.5 Inventory
2.11.5.1 Track pharmacy stock and formulary products

2.12 Specimen Collection, Specimen Management
2.12.1 Business and clinical practice rules
2.12.1.1 Enable specimen collection and management based on business and clinical practice rules

2.12.2 Specimen acts, specimen lifecycle
2.12.2.1 Schedule specimen collection, per order or care plan
2.12.2.2 Track/show specimens awaiting collection
2.12.2.3 Show specimen collection work lists
   2.12.2.3.1 Per patient
   2.12.2.3.2 Per scheduled time of collection
   2.12.2.3.3 Per location, site of care
   2.12.2.3.4 Per practitioner, per practitioner role
   2.12.2.3.5 Per department, service, specialty
2.12.2.4 Print specimen labels
2.12.2.5 Collect specimen, label specimen container
   2.12.2.5.1 Capture and retain specimen collection acts and related specimen details
2.12.2.6 Accession specimens: e.g., at receipt in laboratory
   2.12.2.6.1 Capture and retain specimen accessioning acts and related specimen details
2.12.2.7 Track specimens through analytical work flow
   2.12.2.7.1 Capture and retain specimen analysis acts and related specimen details
2.12.2.8 Recollect specimens, as necessary
   2.12.2.8.1 Capture and retain specimen re-collection acts and related specimen details
2.12.2.9 Audit each specimen act (as above): who, what, when, where

2.13 Practitioner/Patient Relationship
2.13.1 Business and clinical practice rules
2.13.1.1 Enable practitioner assignment based on business and clinical practice rules

2.13.2 Practitioner assignment
2.13.2.1 Assign practitioners to patients in their care
2.13.2.2 Enable/show active patient list
   2.13.2.2.1 Per practitioner
   2.13.2.2.2 Per group coverage (multiple practitioner group)
2.13.2.3 Enable patient to define access limitations to their record
2.14 Quality Indicators
2.14.1 Rules and Guidelines
2.14.1.1 Enable quality indicators based on
  2.14.1.1.1 Regulatory, statutory guidelines
  2.14.1.1.2 Accreditation standards
  2.14.1.1.3 Professional guidelines
  2.14.1.1.4 Best practice guidelines
  2.14.1.1.5 Local or regional conventions

2.14.2 Indicator capture
2.14.2.1 Capture and retain quality indicators as a function of
  2.14.2.1.1 Acts and act results
  2.14.2.1.2 Integral Work Flow
  2.14.2.2 As a function of retrospective analysis

2.15 Performance and Accountability Measures
2.15.1 Rules and Guidelines
2.15.1.1 Enable performance and accountability measures based on
  2.15.1.1.1 Regulatory, statutory guidelines
  2.15.1.1.2 Accreditation standards
  2.15.1.1.3 Professional guidelines
  2.15.1.1.4 Best practice guidelines
  2.15.1.1.5 Local or regional conventions

2.15.2 Measure capture
2.15.2.1 Capture and retain performance and accountability measures as a function of
  2.15.2.1.1 Acts and act results
  2.15.2.1.2 Integral Work Flow
  2.15.2.2 As a function of retrospective analysis

2.16 Epidemiological Surveillance
2.16.1 Rules and Guidelines
2.16.1.1 Enable epidemiological surveillance based on
  2.16.1.1.1 Regulatory, statutory guidelines
  2.16.1.1.2 Accreditation standards
  2.16.1.1.3 Professional guidelines
  2.16.1.1.4 Best practice guidelines
  2.16.1.1.5 Local or regional conventions

2.16.2 Surveillance
2.16.2.1 Invoke decision agents to scan
  2.16.2.1.1 New and amended orders
  2.16.2.1.2 New and amended results
  2.16.2.1.3 New and amended care plans, critical paths
  2.16.2.1.4 ...

2.16.2.2 Log pertinent findings

2.17 Preventative Care, Wellness
2.17.1 Rules and guidelines
2.17.1.1 Enable preventative care and wellness checks based on
  2.17.1.1.1 Business and clinical practice rules
2.17.1.2 Professional and best practice guidelines

2.17.2 Preventative, wellness acts/actions
   2.17.2.1 Schedule upcoming wellness checks and preventative care acts/actions

2.17.3 Notifications and reminders
   2.17.3.1 Notify/remind patients of:
   2.17.3.1.1 Upcoming appointments
   2.17.3.1.2 Check-ups and physicals
   2.17.3.1.3 Tests and exams
   2.17.3.1.4 Immunization
   2.17.3.1.5 Health education opportunities

2.18 Health Record Review
(Chart Review)

2.18.1 Rules and guidelines
   2.18.1.1 Enable health record review based on
      2.18.1.1.1 Business and clinical practice rules
      2.18.1.1.2 Professional and best practice guidelines

2.18.2 Longitudinal view
   2.18.2.1 Enable/show health record as longitudinal record of health status and health(care) services (acts/actions)

2.18.3 Record views
   2.18.3.1 Show health record within and across
      2.18.3.1.1 Encounter types
      2.18.3.1.1.1 Inpatient
      2.18.3.1.1.2 Emergent
      2.18.3.1.1.3 Ambulatory
      2.18.3.1.1.4 Long-term care
      2.18.3.1.1.5 Home care
      2.18.3.1.1.6 Care "in the community"
      2.18.3.1.2 Locations, Facilities and Sites of Care
      2.18.3.1.3 Disciplines and Business Units
      2.18.3.1.3.1 Departments
      2.18.3.1.3.2 Services
      2.18.3.1.3.3 Specialties

   2.18.3.2 Show health record content based on "need to know" and "minimum necessary"

   2.18.3.3 Customize health record display based on
      2.18.3.3.1 Individual practitioner
      2.18.3.3.2 Practitioner role
      2.18.3.3.3 Department, service, specialty

   2.18.3.4 Display multi-media record

   2.18.3.5 Highlight abnormal and critical values

   2.18.3.6 Highlight new and significant data, since last access: e.g., abnormal or critical results
      2.18.3.6.1 Per practitioner
      2.18.3.6.2 Per practitioner defined rules

   2.18.3.7 Compare data with graphing, trending and visualization tools

   2.18.3.8 Audit health record access/use: who, what, when, where

2.19 Practitioner Personal Use Profile

2.19.1 Personal use profile
   2.19.1.1 Set personal profile including
2.19.1.1 Personal (custom) health record displays
2.19.1.2 Personal (custom) trends and graphs
2.19.1.3 Personal order sets
2.19.1.4 Personal care plans, critical paths, protocols
2.19.1.5 Personal rules for notifications, alerts and reminders
2.19.1.6 Personal rules for alerts regarding abnormal and critical result values
2.19.1.7 Personal rules for recall of new and significant data, since last access

2.20 Analysis and Measures
2.20.1 Analysis and measures
2.20.1.1 Invoke concurrent real-time decision agents to automate measures, checks and analysis of key clinical and operational parameters, including
   2.20.1.1.1 Continuity and completeness of health record
   2.20.1.1.2 Continuity and completeness of health(care) delivery
   2.20.1.1.3 Measurement of completeness of workflow, acts/actions
   2.20.1.1.4 Compliance: e.g., with standards of care/practice
   2.20.1.1.5 Performance, effectiveness
   2.20.1.1.6 Outcomes
   2.20.1.1.7 Protocols, variances
   2.20.1.1.8 Allocations, deployments
   2.20.1.1.9 Assigned vs. actual practitioner acts/actions
   2.20.1.1.10 Resource utilization
   2.20.1.1.11 Costs: actual vs projected
   2.20.1.1.12 Productivity, work load
2.20.1.2 Invoke retrospective decision agents, per above
   [See OLAP]

2.21 Multiple Person Linkages
2.21.1 Person to person linkages
2.21.1.1 Link persons, based on known relationships, including
   2.21.1.1.1 Next of kin, family members
   2.21.1.1.2 Mother/child
   2.21.1.1.3 Donor/recipient
   2.21.1.1.4 Payment guarantor
   2.21.1.1.5 Insured, subscriber, health plan member
   2.21.1.1.6 Emergency contacts
   2.21.1.1.7 Employer, employee

2.22 Consents and Authorizations
2.22.1 Rules and guidelines
2.22.1.1 Enable patient consents and authorizations based on
   2.22.1.1.1 Regulatory, statutory guidelines
   2.22.1.1.2 Accreditation standards
   2.22.1.1.3 Professional or best practice guidelines
2.22.1.1.4 Local or regional conventions

2.22.2 Consents and authorizations

> For care, for procedures
> Including durable power of attorney for healthcare
> For disclosure of PHI, per HIPAA

2.22.2.1 Capture consents
2.22.2.2 Include scanned image of hardcopy consents/authorizations
2.22.2.3 Retain consents, for legal period
2.22.2.4 Show consents, per patient

2.23 Patient Locator

2.23.1 Rules and guidelines

2.23.1.1 Enable patient locator based on
   2.23.1.1.1 Regulatory, statutory guidelines
   2.23.1.1.2 Accreditation standards
   2.23.1.1.3 Professional or best practice guidelines
   2.23.1.1.4 Local or regional conventions

2.23.1.2 Enable patient locator based on "need to know"

2.23.2 Patient lookup

2.23.2.1 Lookup/show patients by
   2.23.2.1.1 Name, alias, including sounds-like
   2.23.2.1.2 Identifier
   2.23.2.1.3 Assigned practitioner
   2.23.2.1.4 Location or site of care

2.23.2.2 Lookup/show temporary leave of absences

2.23.3 Assigned location

2.23.3.1 Track/show patient location, e.g., assigned bed to assigned bed
   2.23.3.1.1 Admit to
   2.23.3.1.2 Transfer to
   2.23.3.1.3 Discharge from

2.24 Patient Transport

2.24.1 Concurrent patient movement tracking

2.24.1.1 Track patient movement throughout facility
2.24.1.2 Enable/show patient check-out/check-in at each location
2.24.1.3 Enable/show patient turnaround times

2.25 Remote Access

2.25.1 Rules and guidelines

2.25.1.1 Enable remote access based on regulatory and statutory guidelines: e.g., HIPAA
2.25.1.2 Enable remote access based on "need to know"

2.25.2 Access at points of convenience

2.25.2.1 Enable EHR access at points of convenience to the practitioner: e.g., remote ambulatory care clinic, home office
2.25.2.2 Authenticate remote user

2.25.3 Special protections for remote access

2.25.3.1 Ensure special protections for remote access
   2.25.3.1.1 Encrypted communications
   2.25.3.1.2 User authentication
   2.25.3.1.3 Device authentication
2.26  **Inter-Disciplinary Communication**

2.26.1  Immediate communication, inter-disciplinary

> Among and between departments, services, specialties
> To facilitate communication and close coordination of interdisciplinary care, delivered to each individual patient
> Within or across care settings
> To benefit each patient with well-informed practitioners and well-informed care

2.26.1.1  Enable immediate means of communication within, among and between health(care) disciplines

2.26.1.1.1  Common datasets, vocabulary
2.26.1.1.2  Common care plans, protocols
2.26.1.1.3  Closely coordinated work flow, acts/actions
2.26.1.1.4  Closely coordinated work assignments
2.26.1.1.5  Common work lists
2.26.1.1.6  Orders: notification, current fulfillment status, spawned acts/actions
2.26.1.1.7  Current and planned care, therapy and diagnostic acts/actions
2.26.1.1.8  Current results, medications, observations, notes
2.26.1.1.9  Allergies
2.26.1.1.10  Special notes and precautions
2.26.1.1.11  Reports

2.27  **Inter-Practitioner Communication**

2.27.1  Immediate communication, practitioner to practitioner

> To facilitate notification, consultation, referral
> To facilitate communication and close coordination of care, delivered to each individual patient

2.27.1.1  Enable immediate communication between practitioners

2.28  **Bed Management**

> Including Housekeeping

2.28.1  Bed management

2.28.1.1  Reserve beds
2.28.1.2  Place Hold on beds
2.28.1.3  Review occupancy
2.28.1.4  Assign Beds
2.28.1.5  Remove beds from service
2.28.1.6  Track usage

2.29  **Allergies**

2.29.1  Allergy management

2.29.1.1  Enable/show patient allergies
2.29.1.2  Enable/show severity of allergies and class of reaction

2.29.2  Allergy checking

2.29.2.1  [See Orders, Order Management for allergy checks]
2.30 Special Notes and Precautions
2.30.1 Special notes and precautions
  2.30.1.1 Capture and retain special patient notes and precautions, e.g.,
    2.30.1.1.1 Patient language preference
    2.30.1.1.2 Blind/deaf status
    2.30.1.1.3 Smoking status
    2.30.1.1.4 Prosthetics
    2.30.1.1.5 ...

2.31 Diet, Diet Management
2.31.1 Diet orders
  2.31.1.1 [See Orders, Order Management for diet/allergy checks]
  2.31.1.2 Enable/show dietary orders
2.31.2 Diet preferences
  2.31.2.1 Capture and retain patient diet preferences or requirements
2.31.3 Actual diet
  2.31.3.1 Capture and retain details on meals eaten

2.32 Practitioner Locator
2.32.1 Locator
  2.32.1.1 Lookup/show practitioners, including
    2.32.1.1.1 Name, title, identifiers
    2.32.1.1.2 Department, service, specialty
    2.32.1.1.3 Location
    2.32.1.1.4 Contact information

2.33 Physical Record Tracking, Check-out/in
2.33.1 Physical record check-out/in
  2.33.1.1 Enable physical record check-out
  2.33.1.2 Enable physical record check-in
2.33.2 Record locator
  2.33.2.1 Track/locate records apart from home location

2.34 Special Record Protections
>Mental health, psychotherapy notes, per HIPAA
>STD results, chemical dependency records
  2.34.1 Rules and guidelines
    2.34.1.1 Enable special record protections based on
      2.34.1.1.1 Regulatory, statutory guidelines
      2.34.1.1.2 Accreditation standards
  2.34.2 Special record protections
    2.34.2.1 Enable special protections for various record types

2.35 Donor, Blood Bank
  2.35.1 Rules and guidelines
    2.35.1.1 Enable donor and blood bank services based on
      2.35.1.1.1 Regulatory, statutory guidelines
      2.35.1.1.2 Accreditation standards
      2.35.1.1.3 Professional or best practice guidelines
  2.35.2 Blood, blood bank
    2.35.2.1 Enable/show patient blood type
    2.35.2.2 Track donor to recipient blood transfusion
2.35.3 Tissue/organ, bank
  2.35.3.1 Enable/show patient tissue type
  2.35.3.2 Track donor to recipient organ/tissue transplantation

2.36 Diagnosis and Procedure Coding
  2.36.1 Coding
    2.36.1.1 Use standard coding and classification schemes: e.g., ICD, CPT, SNOMED, LOINC
    2.36.1.2 Enable/show diagnosis coding
    2.36.1.3 Enable/show procedure coding
    2.36.1.4 Invoke decision agent to assist coding

2.37 Reports
  2.37.1 Including PHI
  2.37.2 Rules and guidelines
    2.37.2.1 Enable reports, reporting based on
      2.37.2.1.1 Regulatory, statutory guidelines
      2.37.2.1.2 Accreditation standards
      2.37.2.1.3 Professional or best practice guidelines
      2.37.2.1.4 Local or regional conventions
  2.37.3 Reports
    2.37.3.1 [See Outbound Record Transmittal]
    2.37.3.2 Enable reports
      2.37.3.2.1 Routine
      2.37.3.2.2 On demand
      2.37.3.2.3 By exception
      2.37.3.2.4 Query based
    2.37.3.3 Enable standard reports, including
      2.37.3.3.1 Admission, discharge, transfer
      2.37.3.3.2 Order notification
      2.37.3.3.3 Results
      2.37.3.3.4 Physical record tracking
      2.37.3.3.5 Record (chart) deficiencies
      2.37.3.3.6 Work list
      2.37.3.3.7 Incomplete work list
      2.37.3.3.8 ...

2.38 Charges, Charge Management
  2.38.1 Charges, Charge Management
    2.38.1.1 Enable/show charges for practitioner acts/actions (health service events)

2.39 Costs, Cost Management
  2.39.1 [TBD]

2.40 Localization, Local Authority
  Configuration, Configuration Management and Control
  [Specific to Local Use Setting]
  2.40.1 [TBD]