VCUHS Perspective NPCR-MERP

CDC-NPCR

Facilitate & Guide Model Development

<u>Virginia</u> <u>Commonwealth University</u> <u>Health System (VCUHS)</u> Implement & Test Model

Virginia Cancer <u>Registry (VCR)</u> Monitor Model Development/ Pilot Central Registry Automation/

VCUHS Role in NPCR-MERP

- Serve as a site for Pilot Implementation of the Model
 - Implement the capture of electronic data from several commonly available data sources into the hospital cancer registry
 - Implement the model for automated electronic transfer of EMR data from the hospital to the central cancer registry

NPCR-MERP: How is it different?

- MERP focuses on automation initiated at the hospital level
- MERP includes attention to automated capture of key *required* elements beyond case finding
- MERP also includes capture of other data elements related to cancer surveillance
- MERP is based on the intellectual capital of the registrar for
 - building the registry function business model
 - and optimizing the system's efficiency

VCUHS Registry Focus

Case ascertainment

- Timeliness (4-6 month lag)
- Efficiency (personnel effort expended in downloading data, screening large volumes of data and reports, re-entry of electronic data, materials handling and disposal)
- Accuracy (transcription errors)

Initial Treatment

- Efficiency (review of multiple sources, data entry, transcription errors)
- Completeness/validity (initial planned versus received)

VCUHS Registry Focus

Follow Up

- Efficiency (man hours of data entry and logging into various multiple sources for follow up)
- Completeness (currently dependent on either death index, contact with MDs, claims-based utilization)
- Issues of HIPAA

Diagnostic Work Up

- Capture of clinical laboratory tests
- Improved information and potential to capture more complete and useful data
- Currently capture tests not results (i.e. PSA performed not PSA value)

VCUHS Registry Focus

- Quality Control/ Quality Improvement
 - Efficiency: Would allow registrars to be registrars!
 - Validity: Multiple sources could be compared and assessed for comparability of data.
 - Accuracy: Reduction in transcription and translation errors.
 - Quality: Increased ability to focus on assessing completeness and data quality in the registry.

How MERP might impact a registrar's daily function

Enhance CTR analytic function

Diminish clerical/paper work

 Increase opportunity for validation through automated integration of data from multiple sources How MERP might impact a registrar's daily function
Improve timeliness, completeness and validity of many data elements
Automate flow of case finding
Potential for real time case ascertainment

 Opportunity to capture additional important data elements without increasing the registrar's workload

- Follow up
- Clinical diagnostic parameters
- Subsequent therapy
- Recurrence

The MERP process is applicable to all hospitals even if the EMR is not fully integrated for all sources

 The primary data sources identified by MERP at the hospital level are currently being used in all hospitals

 The model is developed in segments that permit implementation in a stepwise fashion. Focus is on Common Electronic Data Sources available in a standard format • Claims: UB92 and CMS 1500

Surgical pathology synoptic &/or text reports

• Clinical laboratory reports

 Commercial vendor linkages to SSDI and other public sources

Focus is on Standardized Electronic Data Elements and Languages

Codes

 SNOMED CT
 ICD-9, CPT

 LOINC (translate clinical laboratory tests for standardized capture and upload)

Languages/protocols

 HL7 (standard protocol used for data review and upload into registry product)
 CAP Synoptic Reports (standardized information on histology and staging)

The association between the VCUHS EMR Components and NAACCR Standards

NAACCR STANDARD	MCC/60	Pathologo.	Redietion	Surger Charles	00000	Accumit	
Demographic	•	•					
Patient-Confidential	•	•					
Cancer Identification		•					
Stage/Prognostic Factors	•	•					
Text-Diagnosis		•					
Treatment - 1st Course	•		•	•	•		
Treatment - Subsequent & Other	•		•	•	•		
Text-Treatment			•	•	•		
Hospital-Specific	•		•	•	•		
Other-Confidential	•	•		•			
Hospital-Confidential	•						
Follow-up/Recurrence/Death	•					•	
Text-Miscellaneous							
Special Use							
Edit Overrides/Conversion							
History/System Admin							
Record ID							

VCUHS Registry Aims

 Develop HL7 protocol for translation and transmission of required data from hospital sources for capture and upload by registry software.

- Protocols will provide optimal transportability and generalizability.
 - Will require modest modification (data mapping) for use in other hospital systems.

 Implement registry software (CNExT and CAS) with capacity for automated screening and upload of standardized data elements

VCUHS Registry Aims

Work with vendor (CNET Solutions) to broaden range of data elements captured to include:

- Treatment (surgery, chemotherapy and radiation therapy)
- Direct upload of follow up information and updated demographic and contact data
- Additional data elements
 - Clinical laboratory data
 - Comorbidity

VCUHS Registry Aims

 Develop secure HL7 protocol for transfer of data from hospital to the central registry (VCR)

- Protocol will be PHIN-compliant, generalizable and transportable
- Schedule for data transfer may be variable

Data Flow Diagram: Current VCUHS Registry Data Collection Procedures and Sources



Future VCUHS Data Collection Procedures and Sources



Current Status of VCUHS in MERP

- HL7 Messages for capture of claims data (ADT) and pathology text (ORU) for case finding successfully implemented and functioning with CNExT and the CAS
- Sequence diagram and Class diagram for model of registry function at VCU completed and available online for comment
- Developing tables for use in capture of treatment from claims data and discharge summary text data
- Developing protocol and HL7 message for selected clinical laboratory results

Simplification by Automation



MSH|/~\&|CASCommunicator|VCU|CAS|CNET|20050406090923||ADT/A08|||2.3|00000001| EVN||54816216842||||PID|001|||1354652A1^M11^CASCommunicator^MRAVCU|DOE^JOHNAR^^^^AL||19700829|M||W|123 DG1|001||174.94MALIGN NEOPL BREAST NOSAICD9444 00000000 NON STAFF PHYSICIAN, NON S DG1 002 174.94MALIGN NEOPL BREAST NOSAICD9444 00000000 DOCTOR NAME HERE DG1|003||V58.81^FIT/ADJ VASCULAR CATHETR^ICD9^^^|00000000 DG1|004||V10.3^HX OF BREAST MALIGNANCY^ICD9^^^|00000000|| ||DOCTOR NAME HERE| DOCTOR NAME HERE 174.94MALIGN NEOPL BREAST NOSAICD9444 00000000 DOCTOR NAME HERE DG1 005 DG1 006 174.94MALIGN NEOPL BREAST NOSAICD9444 00000000 DOCTOR NAME HERE DG1|007||174.94MALIGN NEOPL BREAST NOSAICD9444|00000000 DOCTOR NAME HERE DOCTOR NAME HERE DG1 009 174.84MALIGN NEOPL BREAST NECAICD9444 00000000 DOCTOR NAME HERE DG1 010 174.94MALIGN NEOPL BREAST NOSAICD9444 00000000 DOCTOR NAME HERE DGI 011 | 174.94MALIGN NEOPL BREAST NOSATCO94A4 00000000 DGI 012 | V10.34HX OF BREAST MALIGNANCYAICO94A4 00000000 DGI 013 | 174.94MALIGN NEOPL BREAST NOSATCO94A4 00000000 DOCTOR NAME HERE DOCTOR NAME HERE DOCTOR NAME HERE DG1 014 174.84MALIGN NEOPL BREAST NECAICD9444 00000000 DOCTOR NAME HERE DG1 015 | 611.724LUMP OR MASS IN BREASTAICD9444 00000000 DG1 016 | 174.94MALIGN NEOPL BREAST NOSAICD9444 000000000 DOCTOR NAME HERE DOCTOR NAME HERE DG1 017 174.94MALIGN NEOPL BREAST NOSAICD9444 00000000 DOCTOR NAME HERE DG1 018 174.94MALIGN NEOPL BREAST NOSAICD9444 00000000 DOCTOR NAME HERE PRI 001|85.41APRIAUNILAT SIMPLE MASTECTOWYAAA|20000728|P|||||DOCTOR NAME HERE PRI 002|36533LACPTANU]7AAA|00000000|P|||||DOCTOR NAME HERE|| PRI 003|86.07APRIAINSERT VASC ACCESS DEVAAA|20000825|P|||||DOCTOR NAME HERE|| DOCTOR NAME HERE! PR1 004 | 19120RACPTANu] AAA | 00000000 P | | | | DOCTOR NAME HERE | | PRI 005] 35537/CPT/REMOVAL OF ACCESS PORTAAN [00000000] PILII DOCTOR NAME HERE] PRI 006[85.21/PRI/LOCAL EXCIS BREAST LESAAA [20010216]PILII DOCTOR NAME HERE] PRI 007] 86.054P01/SKIN INCIS & FB REMOVALAAA [20010216]PILII DOCTOR NAME HERE]

Automated Capture Of Electronic Cancer Surveillance Data Via HL7 Message

After

Before

Next Steps at VCU for MERP

 Integrate additional data sources into HL7 message (discharge summary, clinical pathology, follow up information)

 Continue collaboration with CNET to permit automation of capture of treatment, follow up, and laboratory data

 Begin development of secure HL7 transfer protocol to VCR

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Extra slides

Present VCUHS Registry Data Collection Procedures and Sources

- Utilization of electronic sources (claims, clinical and surgical pathology and other sources) for case ascertainment, treatment reporting and follow up.
- Lack of compatibility with registry software requires printing or download and manual data entry
- Inefficiencies (manual review of large numbers of path reports, manual data entry and risk of transcription errors)

Simplification by Automation

Data Via HL7 Message

Abstraction



After

Before

Future VCUHS Registry Data Collection Procedures and Sources

- Automate the process of obtaining data from these electronic sources and upload directly into the registry
- Will continue to have manual review by registrar prior to acceptance of most data
- Frees CTR for case ascertainment of complex cases, perform validation and quality improvement studies.
- The MERP will build on the intellectual capitol of the registrar in building the business model for registry function and in optimizing the efficiency and effectiveness of the system



Figure 1: Block Diagram of the Proposed State

MSH	٨~\&	CASCommunicator/VCU/CAS/CNET/20050406090923//ADT^A08///2.3/00000001/
EVN	548	16216842 PID 001 1354652/1/M11/CASCommunicator/MR/VCU D0E/JOHN/R////L 19700829 M W 123
GREE	EN ST	AABIG CITYAVAA145190000AUSAAAA041AA 041 (123)555-1234 M 123456789
PV1	001	A
DG1	001	174.94MALIGN NEOPL BREAST NOSAICD94440000000000000000000000000000000000
DG1	002	174.94MALIGN NEOPL BREAST NOS4ICD94440000000000000000000000000000000000
DG1	003	V58.81AFIT/ADJ VASCULAR CATHETRAICD9AAA 00000000 DOCTOR NAME HERE
DG1	004	V10.34HX OF BREAST MALIGNANCY/ICD9///0000000000000000000000000000000000
DG1	005	174.94MALIGN NEOPL BREAST NOS4ICD94440000000000000000000000000000000000
DG1	006	174.94MALIGN NEOPL BREAST NOS4ICD94440000000000000000000000000000000000
DG1	007	174.94MALIGN NEOPL BREAST NOSAICD94440000000000000000000000000000000000
DG1	008	244.9AHYPOTHYROIDISM NOSAICD9AAA0000000000000000000000000000000000
DG1	009	174.84MALIGN NEOPL BREAST NECAICD9444 0000000000000000000000000000000000
DG1	010	174.94MALIGN NEOPL BREAST NOSAICD94440000000000000000000000000000000000
DG1	011	174.94MALIGN NEOPL BREAST NOSAICD9444 0000000000000000000000000000000000
DG1	012	V10.34HX OF BREAST MALIGNANCYAICD94440000000000000000000000000000000000
DG1	013	174.94MALIGN NEOPL BREAST NOSAICD9444 0000000000000000000000000000000000
DG1	014	174.84MALIGN NEOPL BREAST NECAICD9444 0000000000000000000000000000000000
DG1	015	611.72/LUMP OR MASS IN BREAST/ICD9////000000000000000000000000000000000
DG1	016	174.94MALIGN NEOPL BREAST NOSAICD9444 0000000000000000000000000000000000
DG1	017	174.94MALIGN NEOPL BREAST NOSAICD9444 0000000000000000000000000000000000
DG1	018	174.94MALIGN NEOPL BREAST NOSAICD9444 0000000000000000000000000000000000
PR1	001	85.41^PR1^UNILAT SIMPLE MASTECTOMY^^^ 20000728 P DOCTOR NAME HERE
PR1	002	36533LACPTANu11AAA 00000000 P DOCTOR_NAME_HERE
PR1	003	86.074PR14INSERT_VASC_ACCESS_DEV444 20000825 P DOCTOR_NAME_HERE
PR1	004	[19120RACPTANu1]AAA 00000000 P DOCTOR_NAME_HERE
PR1	005	36535ACPTAREMOVAL OF ACCESS PORTAAA 00000000 P DOCTOR NAME HERE
PR1	006	85.214PR14LOCAL EXCIS BREAST LES444 20010216 P DOCTOR NAME HERE
PR1	007	86.05^P01^SKIN INCIS & FB REMOVAL^^^ 20010216 P DOCTOR NAME HERE

Example ADT A08 (HL7) Message

NPCR-MERP: How is it different? The majority of current e-registry projects have

The majority of current e-registry projects have focused on automated reporting from clinical pathology labs and data capture at the central registry level

MERP focuses on automation initiated at the hospital level

- Improving timeliness, accuracy, and efficiency of hospital reporting will impact the central registry
- Automated electronic reporting from the hospital provides the opportunity to meet changing registry standards
- Offering extensibility of data collected as new information becomes relevant (comorbidity, genetic data, recurrence, subsequent Rx, values for diagnostic markers longitudinally)

NPCR-MERP: How is it different? The majority of e-registry projects to date

have focused on case finding/ascertainment

MERP includes attention to automated capture of key required elements beyond case finding including:

- Histopathology
- Staging
- Initial treatment
- Follow up (vital status)

NPCR-MERP: How is it different?

MERP also includes capture of other data elements related to cancer surveillance

- Improving accuracy and efficiency of data on initial & subsequent treatment (specific doses)
- Improved capture of follow up data (recurrence)

 Values for selected diagnostic and prognostic markers

CASCommunicator HL7Message CASQ : MSMQ Field Component Other HL7 MMNotifier.exe myACKMessage : string -mvComponentValue : string Messages.. myEventType : string -myListOfComponents : ArrayList myACKMRN : string mySubComponentList : ArrayList -myListOfComponentListIndex : ArrayList mvClientThread ' Thread mySegmentType : string myNumberOfComponents : int omponentDelimiter : string = " 1 -mvFailFlag : bool -myFieldDelimieter : string = | -subComponentDelimiter ; string = & #myMessageIDList : MessageID MMWorker -mvIPAddress : string -subCompSepEscapeChar : string = \T\ MessageManager #mylsEmptyFlag : bool -myFieldRepeatDelimiter : string = myCASComm : CASCommunicator -myLastMessageSent : string -repetitionSepEscapeChar : string = \R\ numberOfHL7Messages : int +Field(in comValue : string, in cleanIt : bool) myCASPortNumber : int wMRNList : SolDataReader -myNetworkStream : NetworkStream -componentSepEscapeChar : string = \S\ +HL7Message() +getNumberOfRepetitions() myIPAddressOfCAS : string nessageNumber ; int myMRN : int -startHighlighting : string = \H\ +addSegment() +insertAt() myIsPollingFlag : bool << creates >> mvACKMesage : string endHighlighting : string = \N\ myNumberRejected : int +ToString() +isEmpty() myLogMessagesFlag : bool myHL7Message : string myNumberSent ; int escapeCharacter : string = \E\ +isEmpty() +ToString() myMSMQ : MSMQ mvMessageSource : string -fieldSepEscapeChar : string = \F\ 1..* -myPortNumber : int 1 myMSMQMessage : string Δ Δ nvNumOfErrors : int myTCPClient : TCPClient hexData : string = \Xdddd myMSMQThread : Thread mvStopFlag : bool 1.11 -myTimeLimit : int = 5 locallyDefinedEscapeSeq : string = \Zdddd 1 myUseGUIFlag : bool isBufferLocked : bool +CASCommunicator() +Component(in theValue : string, in cleanIt : bool) +MessageManager() +numOfWorkerThreads : int +addSubComponent() +close() +isPolling() MMWorker() +connect() +getComponentValue() +pollMSMQ() markMessageAsSent() +getNumberOfSubComponents() ADTMessage +didMessageFail() -pollThread() 1.* sendMessages() +disconnect() +insertSubComponentAt() sendStopMessage() setCASCommunicator() +getACKMessage() +insertSubComponenetAt() +stopPolling() ogMessage() +ADTMessage(in aPatient : Patient, in eventDate : string) +getLastMsgSent() +setComponenetValue() << creates >> buildADTMRNList() -parseDiagnoses() -parseProcedures() +createMod11CheckDigit() +getNumberRejected() sendBufferedMessages() +getNumberSent() +ToString() +sendORUMessages() Patient +parseACK() +lookForDegree() updateMessage() +lookForMiddileInitial() +receive() myADTMessage : ADTMessage +getMRNList() +runClient() +lookForSuffix() myORUMessage : ORUMessage +run() +isBufferEmpty() +toDataTypeCS() +send() -myDiagnosisDR : SqlDataReader ORUMessage +sendToCAS(in aPatient : Patient) +clean() -myHospDemoDR : SqlDataReader +parseMessage() +wasMessageSent() +toDataTypeDT() -myProcedureDR : SqlDataReader +toDataTypeTM() -myPathReport : SqlDataReader +ORUMessage(in aPatient : Patient, in eventDate : string) +toDataTypeTS() << Retrieves HL7 Message >> myMRN : int 1..* +toDataTypeXAD() myMessageIDList : MessageID +toDataTypeXPN() -myORUMessage : ORUMessage 1..* MessageID +toDataTypeXTN() myFirstName : string nyDXCode CASServer myLastName : short YCPAN CAS.exe Othe -myMessageTypeID : int myAcknowledgementCode Segment WRN Segments.. +Patient(in MRN : int) myNetworkStream nyTableSouce myPortNumber -buildDiagnosisDR() 1...* myType #myFieldList : Field -myServerThread -buildProcedureDR() prevSegmentID : int myVisDate -mySocket -buildHosDemDR() -segmentNumber : int +MessageID() +getMRN() +getDXCode() +Segment(in numFields : int, in charSegmentID : string) +getHospdemDR() Eclose() +getCPAN() +setMySegmentID() +createHL7ACK() +getProcedureDR() +getMRN() +ToString() +getDiagnosisDR() +parseMessageNumber() +getTableSource() Δ +getMessageList() : ArrayList +runServer() +getVisDate() +setMessageIDList() +hasNewData() buildORUMessage() buildADTMessage() uildPathReport() 1 PID EVN PV1 DG1 PR1 -myExpireDate : string myDateOfEvent : string myPatientClass : string Sequence of Events myIsAliveFlag : string +EVN(in dateOfEvent : string) +PV1(in patientClass : string) +PR1() 1) The Message Manager continuously polls the MSMQ for a message from the MMNotifier.exe myMRN : int createEVNSegment() -myExpireCode : string = 20.0 2) The Message Manager finds a Claims message in the MSMQ +PID() 3) An MMWorker object is created on it's own thread to process this task +setAddress() 4) The MMWorker creates it's own CAS Communicator object. 5) Unsent messages from the previous task are sent MSH OBX OBR 6) A list of MRNs is built from the Claims database -myEventType : string myMessageType : string 7) A Patient object is created based on the first/next MRN +OBX() +OBR() +MSH(in msgType : string, in eventType : string) 8) The Patient object creates an ADT Message object -createSegment() 9) The CAS Communicator pulls the ADT Message out of the Patient object 10) The CAS Communicator sends this message to the CAS.exe

Class Diagram of HL7 Interface for Virginia Commonwealth University

Figure 2: Class Diagram

11) The Message Manager marks this message as sent

12) Repeat for the next MRN



Potential Vendor collaborations

- C/NET Registry Software's Case Ascertainment System (CAS)
 - Automation of screening HL7 messages for selected text and codes for case ascertainment
 - Upload into Registry Suspense file with opportunity to upload as case if approved by registrar
 - Matches with series of SNOMED CT and ICD-9 codes & other selected text

Potential Vendor collaborations

Accurint

- Searches multiple public and limited access databases for information on individuals
 Includes SSDI searches
- Provides updated data on demographics as well as vital status
- HIPAA Compliant methods of data sharing
- Advantage of searching US population databases for lost to follow up
- Opportunity to develop automated capture via electronic reporting file

VCUHS Registry Deliverables

- Develop protocols to translate required elements from a variety of electronic sources (SQL, flat files) into an HL7 message for capture & upload by registry software.
- Translation protocols will be developed to provide optimal transportability and generalizability.
 Will require modest modification for use in other hospital systems.
- Implement capture & translation of selected data elements from common data sources into standard messaging language (HL7) and vocabulary (LOINC/SNOMED CT).
- Develop PHIN-compliant protocol for "real-time"

MSH| ^~\&|CASCommunicator|VCU|CAS|CNET|20050510115923||ORU^R01|1234567_0510055923|P|2.3|0000002| OBR 001 123456789^^^^ OBX 001 TX 12345644444 SURGICAL PATHOLOGY GROSS DESCRIPTION The specimen is received fresh in a single container labeled "right breast tissue" and consists of a 1700 gram modified radical mastectomy specimen including an axillary tail. The specimen has overall dimensions of 40.0 x 20.0 x 7.5 cm. There is an elliptical brown-tan centrally located portion of skin which is 22.0 x 14.0 cm. and a centrally located raised nipple. The deep surgical margin is inked black and multiple serial sections through the breast parenchyma reveal a predominately fatty and fibrous breast parenchyma. Within the breast parenchyma are multifocal areas of both well-encapsulated masses. There is also a stellate griddy area of nodularity grossly suggestive of carcinoma. This stellate lesion is 1.8 x 1.5 x 1.5 cm. and 4.0 cm. from its closest (deep) surgical margin. Approximately it appears to be in the mid superior aspect of the mastectomy specimen. The well-encapsulated masses are scattered throughout the breast parenchyma and have a lobulated cut surface grossly suggestive of fibroadenomás. These nodules are scattered throughout the breast parenchyma and range from 2.0 to 0.4 cm. in their greatest dimensions. The remainder of the breast parenchyma is predominately fatty. There are no additional lesions, nodules or masses. Sectioning through the attached axillary dissection reveals multiple pink to red-tan lymph nodes ranging from 2.5 to 0.2 cm. in their greatest dimension. All lymph nodes are submitted. SURGICAL PATHOLOGY SUMMARY OF SECTIONS 1C-1E - sections of stellate lesion 1F - deep surgical margin closest to stellate lesion 1G-1J - representative sections of nodules within breast parénchyma from medial to lateral aspect 1K-1P - axillary lymph nodes SURGICAL PATHOLOGY MICROSCOPIC INTERPRETATION Carcinoma, infiltrating ductal type, modified Bloom-Richardson grade II of III, of right breast, mastectomy Multiple fibroadenomas of right breast. Proliferative fibrocystic change of right breast. Right axillary lymph nodes (13), no tumor identified.||||||F|||||

Example ORU R01 Message

Successful Transmission of ADT Messages to the Cancer Alert System (CAS)



Figure 3: Sequence Diagram

Focus is on Common Data Elements available in a standard format

ICD-9 Codes from claims data for:
 Case identification
 Follow up (vital status and recurrence)
 Initial Treatment Details
 Subsequent Treatment Details

Comorbidity

Focus is on Common Data Elements available in a standard format

CPT Codes from Claims data for:
 Initial Treatment Subsequent Treatment

SNOMED CT Codes from Surgical Pathology Reports and synoptic report data for:

- Case Identification
- Histopathology details