The Integration of Home Collected Data into the Veterans Administration Health System

The Home Telehealth VistA Integration Project: The Sharing of Computable Data

George C. Blankenship, Jr.
Consultant to Home Telehealth IT PMO
Alexandria, Virginia
BlankenG@GWU.edu

Daniel L. Maloney
U. S. Department of Veterans Affairs
Home Telehealth IT PMO
Silver Spring, Maryland
Daniel.Maloney@VA.gov

Abstract—In 2004, the US Department of Veterans Affairs was confronted with the creation of an enterprise application based upon multiple triage systems supplied by vendors who had dramatically different levels of experience with system integration or with Health Level 7 International Standard. One objective of the application was to leverage the capabilities of the existing Electronic Medical Record and medical software wherever possible. In order to accomplish the objective a strong integration approach was required. The selected approach was the development of a reference engine that could be used to validate the communication between existing applications and newly procured triage systems. The approach also included the development of supplements that are specific to the usage of the international standards. The triage system validation is performed in three phases. The first two phases are directed by a set of functional validation objectives. The third phase is a limited deployment supporting actual patients to minimize risk to patient care during a national rollout. The objectives are the slaving of patient identity and demographics to the enterprise identity management, the collection of patient survey responses, and the placement of triage system generated progress notes and home collected vital signs in an enterprise database. A direct result of this integration is the automatic inclusion of the Home Telehealth program in the standard enterprise outcomes analysis and availability of the program data to whole clinical team. This paper describes the integration process and problems that were confronted during the first five years of the program. The paper represents the opinion of the authors and is not a statement of any official position of the Department of Veterans Affairs.

Keywords; telehealth; home telehealth; telemental health; HL7; CCOW; protocol validation; realtime HL7 transactions

I. VA INTEGRATION OF HOME BASED CARE

A. Background

The United States Department of Veterans Affairs (VA) [1] Home Telehealth program is clinically managed by the Office of Telehealth Services (OTS) [2]. The program is supported by the VA's Office of Information & Technology (OIT) [3] Home Telehealth Program Management Office. The program uses a telemedicine approach for the care of patients with a chronic illness such as diabetes, congestive heart failure or chronic obstructive pulmonary disease. Care is also provided for patients suffering from post-traumatic stress disorder. Equipment is placed in the patient's home to evaluate the health of the patient much as would be done during a home visit by a nurse. The data collected by the home equipment is sent to a triage system that analyzes the data and ranks the patient for attention by a nurse in a remote location.

The VA has an integrated health system based upon an Electronic Medical Record (EMR) that allows clinical personnel to access all patient data that has been collected at any VA medical facility in the US and abroad. A patient's data can be presented as an aggregation independent of the original visit location. The VA's approach to patient care is based upon the ability to access a patient's complete medical record from any VA location. The core component of the health system is the Veterans Health Information Systems and Technology Architecture (VistA) [4].

The objective of the Home Telehealth VistA Integration project is the integration of the Home Telehealth triage systems into the VA health system. This is a real time sharing of data between an individual triage system and the VA EMR. This integration approach starts with the establishment of a patient record in the triage system using VA identifiers and the synchronization of the patient identity using the VA identity management system. With a consistent identity, the triage system is able to send patient data collected at the home to VA systems in a computable form so that the data can be used in standard VA patient care analysis packages.

The approach is for the triage systems to present the collected information to VA systems such that it has the look and feel of data collected by any other VA medical facility. The data is then available to all VA medical personnel and all of the VA medical outcomes analysis processing engines. The home care component of the patient's medical program is no longer an isolated data island, but is a system integrated into the VA's approach to patient care.

B. Veterans Health Administration Home Telehealth Environment

The Veterans Health Administration (VHA) [5] is home to the largest integrated health care system in the United States consisting of 152 medical centers in addition to almost 1,400 community-based outpatient clinics, community living centers, Vet Centers and Domiciliary. The health care system is divided into 23 geographical regions; each region

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is called a Veterans Integrated Service Network (VISN). Together these health care facilities provide comprehensive care to over 8.3 million Veterans based upon data from FY2010. In 2000, VHA started two Home Telehealth pilots in two VISNs. In 2003, the number of pilots increased to seven. In 2004, the number of pilots increased to eight. In 2005, the Home Telehealth moved from a set of pilots to a nationally supported program. In 2012 the program is supporting over 70,000 patients across the United States and its territories.

The national program replaced the pilots with standardized systems and a standardized design. The program from its inception included the federally mandated security approach with a strong disaster resiliency and the integration with the VistA. This process started in 2005 with the installation of new Home Telehealth triage systems from each supplier in one VA data center. All the patients in the pilots were migrated to the new systems. Each supplier added a resilient system in a second VA data center. Each supplier was required to replicate their databases between the centers and alternate the active system between the data centers as part of the Home Telehealth program Continuity of Operations Plan (COOP). Once each supplier was supporting patients in the new data centers, they started preparing for VistA Integration.

C. Telemedicine

Telemedicine is the use of technology to bridge geography in order to provide patient care. One, or more, of the care providers (doctors) are not co-located with the patient. The original telemedicine model was consultation via a telephone. Telemedicine has now progressed to the collection of patient information via the collaboration of multiple systems across a wide geography. This use of technology promises to reduce the cost of patient care while actually improving the care. [6] Among the key attributes of telemedicine that make it attractive are:

1. Ability to provide the right care cost effectively,
2. Agility to respond to a sizable space of conditions, and
3. Ability to adapt to integration with other care systems.

D. The Triage System

The program is built around a set of triage systems procured from vendors experienced in providing remote home health care. Prior to the integration, patient identity and demographics information was manually entered into the triage system. The manual creation of the patient identity is impacted by the keystroke errors and the copying of information from other system displays. The unreliable data entry creates a problem when a care nurse wishes to correlate data in the triage system with data in the VA EMR. Vigilant manual correction of patient information is required to create effective reports on care.

The each triage system vendor supplies a device that is placed in the patient's home. The intent of the device is to mimic the actions of a visiting nurse. The patient interacts with the device according to a treatment plan implemented in a Disease Management Protocol (DMP). The DMP defines a set of questions to be presented to the patient by the home unit over a period of days and answered using the home unit. The DMP may also require the collection of vital signs. The DMP is constructed to discover the patient's condition through answers to the questions and the collection of vital signs. The patient interacts with the home unit on a scheduled basis. The data collected by the home unit is sent to the triage system for analysis. The triage system displays the results of the analysis on the clinical desktop used by the care nurse. The analysis ranks each patient under the nurse's care for attention. The average nurse in the VA Home Telehealth program manages around 200 patients.

E. VistA Integration

The VistA Integration plan uses messages defined by Health Messaging Level 7 International Standard [7] (HL7) to communicate with VA medical systems and HL7 Clinical Context Object Workgroup [8] (CCOW) defined application context control to integrate the triage system clinical desktop with the standard VA desktop applications. The VA has an extremely mature HL7 environment. The first challenge of the integration was the verification that each triage system has an HL7 engine implementation that would allow the integration. A special set of tools had to be developed to perform the verification. The second challenge was the implementation of a CCOW environment for the triage system clinical desktop. Each triage system has a complex clinical desktop that requires an extensive validation testing. The solution of these two challenges allowed the program to start the piloting of VistA Integration in 2005 for a limited number of patients out of the rapidly growing population of Home Telehealth patients.

F. Shared Data Implications

The triage system receives data from multiple sources within the home. The use of this data requires that the triage system maintains an appropriate data quality inspection. The triage systems are time synchronized with the VA systems and all patient data is displayed in the time zone of the patient. The home units are synchronized with servicing triage system. However, some of the home equipment can be used in a disconnected mode with internal power and a manual configuration. The disconnected operation allows for the device to loose time synchronization with the home unit. Every submission of each such device must be evaluated for potential time errors along with other data errors.

II. INTEGRATION STRATEGY

In 2004, the VA was confronted with the integration of multiple triage systems developed by vendors with a varied amount of integration experience or HL7 experience. The VA objective of the integration was to leverage the capabilities of the existing VA EMR and medical software wherever possible. In order to accomplish the objective a strong integration approach was required.

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The fundamental components of the selected approach was based upon the development of a document [9] that defines all the transactions used by the Home Telehealth program and a reference engine that implements all the transactions and processing rules defined in the document. The document supplements the HL7 and CCOW standards with the specific to the VA encoding definitions and processing rules. The reference engine emulates a triage system to existing VA systems in order to validate the transactions and encoding definitions. The reference engine also emulates VA systems to the triage system in order to validate the conformance and operation of the triage system's HL7 engine and transaction processing. This use of a reference engine presents a reliable base for the integration of the triage systems into the mature VA integrated environment. The triage system validation was performed in three phases. The first two phases were directed by a set of functional validation objectives in two different testing laboratories. The third phase was a limited deployment supporting actual patients to minimize risk to patient care.

The experience gained since the program's inception in 2005 is that successful real time processing of transactions requires a reliable, predictable and consistent performance of the HL7 engine. These required characteristics are achieved by the proper handling of exceptional conditions that occur during transmission and other events that occur during normal system operation. The objective of the first laboratory testing was to verify that each target system is capable of the real time processing requirements required for VistA Integration.

The second phase was performed in the VA Integration Test Laboratory (ITL). The ITL contains a full environment of the VA systems and software that would peer with a triage system. In the ITL, the triage system was evaluated while supporting test patients. VA clinicians evaluated the triage system clinical desktop; VA IT staff evaluated the system logs for proper system performance.

The third phase was a limited national release of a production version using a slow start approach. The production system was first brought into use at a single VA facility for Home Telehealth patient care for a five week evaluation period. A second and the third facility were added to the environment at weeks three and four as the testing progresses. The operation was evaluated at the end of each week. At the end of evaluation period, national use was authorized.

III. INITIAL FUNCTIONALITY

The initial function set design started in the fall of 2004. The first triage system validation started in the fall of 2005. The initial functionality included the transactions for patient synchronization between the triage system and the VA, the automatic generation of patient progress notes, the collection of patient survey responses, the collection of the weekly patient census, and the collection of patient vital signs. Each of these transactions is carried by an HL7 message.

A. Patient Synchronization with the VA

Fundamental to the synchronization of patient information between the VA and the triage system is the addition of the Integrated Control Number (ICN) to the patient record in the triage system. The ICN is a VA defined globally unique number assigned to each patient and part of the registration for health care within the VA. Patients can be established in a triage system either manually via the triage system clinical desktop or via an HL7 transaction from VistA. A patient established manually is considered a legacy patient; that is, a patient that has not been VistA Integrated. A legacy patient becomes VistA Integrated via an HL7 transaction from VistA. All communication between a triage system and a VA system uses HL7 messaging. As part of the VistA Integration process, the Master Patient Index (MPI) is notified by the triage server that it is a treating facility for the patient. Systems registered with the MPI receive identity and demographics updates from the MPI for each patient registered. Processing applications are able to query the MPI for those facilities that have patient data (treating facilities). This allows VA applications to aggregate patient data from all facilities that have serviced the patient.

A side effect of VistA Integration is that the triage system is able to participate in a CCOW patient context on each clinical workstation. VHA requires all clinical applications support CCOW patient context. With patient context, all clinical applications on a workstation display data for the same patient; those applications that do not have access to records of the patient in the context do not display data for any patient. This is a critical patient safety feature in a heterogeneous world where data from multiple databases could be displayed on a single workstation used by a clinician or multiple clinicians. This feature protects clinicians from the confusion that might arise due to the necessary use of multiple clinical applications in the management of patient care. The primary clinical desktop for the VA EMR is the Computerized Patient Record System (CPRS). Patient progress is usually documented in progress notes built using CPRS. Since the Home Telehealth triage systems are accessible only by a Home Telehealth care nurse, the nurse must manually create patient progress notes for the care provider. The "copy and paste" operation is the primary tool used to move data from the triage system clinical desktop to the CPRS progress note editing panel. Without CCOW, there is a significant risk that the information in a manually created progress note contains erroneous information (for example, information from the wrong patient or multiple patients).

B. Progress Notes

The Home Telehealth triage system creates a data island. Patient progress notes created by the triage system are not available to the VA medical staff except via an external method such as the creation of a printed copy. The reports generated by the triage system are not part of the official VA medical record.

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The VistA Text Integration Utility (TIU) allows external systems to create a progress note via an HL7 message. The note is placed in the patient's VA EMR for processing by a clinician. The clinician is able to edit the note using CPRS. After reviewing the note, the clinician either deletes the note from the system or electronically signs the note making it an official entry in the patient's medical record. The signed notes are available to the patient's care provider and other clinicians. Through the use of the VistA TIU application, a Home Telehealth triage system is able to create a report that is placed in the patient's VA EMR as a progress note. This process creates a note with all of the proper metadata so that the standard VA analysis routines are able to collect information on the existence of patient progress notes. A major use of the progress note analysis applications is accounting and care tracking.

C. Weekly Patient Census

Each triage system sends a weekly report of patients and equipment to the Home Telehealth Census system. The census includes information about each patient being serviced. Of primary importance is the date of the start of service, the date of end of service, the servicing VistA facility, the equipment in patient's home, the DMP directing the patient care, and the patient's compliance with the care plan. The Home Telehealth Census system supplies the VHA Support Service Center (VSSC) with a list of the patients in the Home Telehealth program along with their service periods, the VA facilities performing the service and the triage system that is monitoring each patient. The VSSC uses this information along with other data collected from VA systems to perform an outcomes analysis of all patients in the Home Telehealth program as it does for all VA other programs. The VA clinicians have access to these reports via the standard VSSC reporting application.

D. Patient Surveys

Each patient is given two evaluation surveys every 90 days on a staggered schedule. The Patient Satisfaction survey is aimed gathering data on the patient's satisfaction with the program and the provided care. The VR-12 ADL (Activities of Daily Living) survey gathers data on the patient's perspective of their medical state. These surveys are sent by the triage system to the patient's home unit. The surveys are presented as part of the DMP with the results returned to the triage system as part of the daily collection. The results collected by the triage system are sent to the Home Telehealth Survey system. Various reports are generated on the survey responses so that a realistic view of the patient's perspective is always available.

E. Patient Vitals

The DMP that directs the patient's care program may require that the patient supply vital signs. Each vital sign may be collected by a device that is directly connected to the home unit or manually entered by the patient into the home unit. Each collected reading is annotated with the date and time of collection. The readings are sent to the triage system. The triage system analyzes the readings and displays the readings along with other data collected as part of the patient's daily session with the home unit on the clinical desktop. The Home Telehealth nurse uses the information collected by the home unit and the triage system analysis to evaluate the patient's condition. The Home Telehealth program currently supports the collection of pulse, pulse oximetry, blood glucose, blood pressure, temperature, weight and pain. As part of the analysis provided by the triage system, the nurse is able to see a trend analysis report for each vital sign collected and other data. The triage system also sends the vital sign collections to the VA's Health Data Repository (HDR). The patient's care provider and other VA clinical team members are able to view all of the patient's data stored in the HDR using the standard VA applications such CPRS and VistA Web. The Home Telehealth data is displayed as part of an aggregation collected from all sources within the VA; each data value source can be easily identified in either a table or trend graph presentation. Home Telehealth data is also tagged with identity of the device that collected the measurement or tagged as self-entered.

IV. INITIAL RELEASE ACCOMODATIONS

The National Rollout of the initial release started in August of 2005. During the first three years of the rollout the program was confronted with a number of conditions that required adjustments to various components of the program.

The major feature of the initial release was the synchronization of patient identity in the triage systems with the VA. This capability was the basis for the integration of data collected by the triage system with data collected by other VA systems and the participation of the triage system clinical desktop in a CCOW controlled patient context. In the seven years of use the synchronization of patient identity has provided the capabilities that were desired. The program is able to report on itself to level of detail that allows for a realistic evaluation of the provision of care.

However, some of the features of the initial release had to be adjusted to accommodate the local autonomy within the VA medical centers and VISNs, to accommodate the use of disconnected end devices in the home, to adapt to an infrastructure that does not normally move real-time transactions and to integrate a system that monitors the enterprise application environment.

A. Local Autonomy Accomodations

The VA EHR system is extremely complex with a number of components that are configured locally to meet the needs and objectives of the administration of an individual medical facility. Administration policy is defined at the national level (VA/VHA), the regional level (VISN) and at the local level (VAMC). The VA provides a significant amount of autonomy so that the regions and local facilities have the flexibility to meet the needs of a diverse set of patients. This autonomy gives the VA a unique agility for an organization of its size. This autonomy presents the VA with a challenge when developing national rules and tailoring systems to operate with a national frame of

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reference. Generally the approach is to give the local organization flexibility by pushing the creation of information tagging to the local system. In the case of Home Telehealth, there is no local system; Home Telehealth is a national application. The rules that define the tagging of information must be defined in a manner that a national system is able to meet the requirements. This set of objectives seems to be self-contradictory in a world that allows for local autonomy; however, the VA has positioned itself to confront these types of problems.

Accounting is one item of major importance in any organization. The organization uses accounting information to distribute funding, create staffing level, and other operational related items. Within the VA some of the accounting information is collected from clinics associated with progress notes. Since the Home Telehealth program is a national program, the clinic names must follow a national algorithm and with objectives that are set nationally. The original requirements collection team did not discover the wide variation of local collection requirements. The majority of the VA medical facilities wished to have accounting information collected at a central aggregation point (the VAMC level). A few of facilities wished to have the data collected at the servicing location level. An extremely small number wished to have the accounting information collected using the patient's DMP assignment or diagnosis. The original design had the requirement to collect the accounting information at the VAMC level. It was discovered that the servicing location could easily be accommodated with a minor modification; however, the collection of data based up DMP or diagnosis presented a problem. In January of 2010, the decision was made to start a study group to understand the requirements for accounting aggregation. During the study period the generation of progress notes by the triage systems has been suspended.

B. Vital Sign Date/Time Validation

The home unit follows a medical treatment program that will present questions to the patient and collect vital signs. The questions and the responses are presented and collected through integrated componentry of the home unit. While some of the vital signs could be collected via an integrated collection unit, some cannot. In some cases, the independent device can be connected to the home unit during the collection; otherwise the patient must either manually enter the data from the vital sign collection device or cause the device to transfer the vital sign to the home device at a later time using a stored collection time.

The use of an independent device introduces problems that have not been generally addressed by the manufacturer or a standards group. Some of the problems are intractable and seem insolvable. For example, the reading collected by the device might be from someone other than the patient. The use of the device by someone else in the home is not detectable by the home unit. While the use of the device by someone other than the patient can be precluded with the use of some sort of biometric control, the cost of such a sensor would be prohibitive and the evaluation of the readings can indicate that there is the possibility of a problem with an individual reading.

Other problems, such as incorrect readings can be addressed. There are many reasons for incorrect readings. The reasons range from device failure to a misreading of the device display. Every reading has two components, date/time of the reading (the date/time label for the reading value) and the reading value itself. A wrong date/time label for a reading value will position the value in the wrong place of a trend graph or hide the reading if the displayed date range does not cover the date/time label. Manually entered values use a date/time label assigned by the home unit. However, manually entered values cannot be verified automatically and are not desired by the care providers (doctors). Data collected by devices that are connected to the home unit are generally considered reliable by care providers, and thus preferred. Devices that are connected to the home unit at the time of the collection receive a date/time label from the home unit. Devices that can be used independently of the home unit use a stored collection time based upon an internal clock; thus, they can have an unreliable time. This set of problems was brought home to attention of the Home Telehealth program through the use of battery powered blood glucometers. These glucometers are able to perform a series of observations while disconnected from the home unit; each observation is tagged with distinct set of metadata such as date/time label. If there is a problem with the battery such as fading power, the internal clock may run erratically or the collection analysis may supply incorrect results. Battery replacement may lead to resetting the clock and the collection analysis components of the glucometer. Those devices that allow the internal clock set by the patient are inherently inaccurate.

The VA decided that the problems created by the use of independent devices required a study group. The transfer of patient vital signs from the home to the HDR was suspended until the study group published an acceptable set of business rules covering the use of the devices. The study group was convened in July of 2008; their recommendations were published in August of 2009. In June of 2010, the business rules were approved. The triage system vendors are currently updating their systems to use the approved date/time business rules and will be undergoing the validation during the first half of 2012.

C. Real-time Processing Implications

Historically, the use of HL7 has been to move transactions that do not have real-time processing requirements. HL7 transactions are forwarded (sent) on a publish/subscribe model and many transactions are sent only because they meet a subscription profile. Each application that receives transactions using this model is often flooded with transactions that are not really required. Selected transactions are deemed to be perishable; that is, the information content loses its significance over time. This approach has a tendency to weaken the requirement for a transaction delivery guarantee; that is, a significant number of transactions do not really need to be delivered. The

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publish/subscribe approach generally uses a manual action (alert), if a transaction cannot be delivered. If a transaction cannot be processed by an application, an alert is generated for a manual action. The injection of a manual component as the first recovery to exceptional conditions and transient errors leads to large impact on the transaction latency. The bound for transaction latency becomes the response time to an alert. The generation of the alert may be long after the exceptional condition due to an alert skid. The alert may be based upon a queue tolerance and not the lack of delivery of an individual transaction.

With respect to the Home Telehealth program, the mode of the transaction latencies is measured in seconds, generally less than 10 seconds; the median has the same shape. However, the average is impacted by the manual intervention approach. The Home Telehealth program has analyzed all of daily transactions since September 2005. The biweekly moving average latency until 2009 was generally multiple hours due to the response time of the data center and network staff to an alert. The assumption made at the design time of the network support team was that all HL7 transactions had overnight urgency. The response to an exceptional condition could be delayed for hours. The Home Telehealth program generally does not meet this model. The design criteria for the transaction latency bound in the Home Telehealth program is 10 minutes.

In order to achieve the biweekly moving average transaction latency target of 10 minutes, the program changed from an alert driven first recovery to an ordered exceptional condition recovery based upon automated first response. The fundamental problem that needed to be addressed had been clearly highlighted by the daily analysis of the Home Telehealth messages and transactions. The key problem was the delivery of acceptance of messages. The program mandated that all HL7 message delivery was to be keyed to the receipt of a message acceptance acknowledgement within a preset period. If a message did not receive an acceptance acknowledgement within the period, the message was to be resent. Only after the proscribed number of delivery attempts is exceeded is it permissible to base the response on an alert. This allows for the automatic recovery from transient problems and temporary system outages. As a result of this approach to message acceptance, each of the HL7 partners is required to detect duplicate messages and resend the acceptance acknowledgement message. The analysis also revealed that another delivery problem occurred when the HL7 infrastructure cleared a message due to stalled transmission queue. The clearing of messages occurred automatically as part of an assumption that the manual recovery would restart the messages. The program mandated that each HL7 transaction delivery was to be keyed to the receipt of an application acknowledgment within a preset period. If a transaction did not receive an application acknowledgement within the period, the transaction was to be resent. Only after the proscribed number of processing requests is exceeded is it permissible to base the response on an alert. This allows for the automatic recovery from the loss of a transaction in the HL7 infrastructure and system outages. As a result of this approach to transaction acknowledgement, each of the HL7 partners is required to detect duplicate transactions and resend the application acknowledgement. The Home Telehealth program implemented the automated response to exceptional conditions in 2008. The end result of these changes was a dramatic drop in the biweekly moving average transaction latency to the desired target value of 10 seconds.

D. Application Monitoring

A major problem is the realm of enterprise distributed processing is the ability to detect off-line or overloaded dependent entities. All networks are built on the platform of a strong network management with a monitoring element. Trunk utilization is constantly monitored. Network nodes are monitored for throughput. When a network node or a trunk presents a problem a network map is updated indicating the problem area and an automatic recovery should already have been initiated.

Unfortunately the network monitor does not monitor the enterprise applications that really define a distributed collaborative processing system. The Home Telehealth program extends the network approach to the applications that define the Home Telehealth system. The applications are the triage servers with their clinical desktops and the applications that reside on the VA systems shown in Figure 1. The Home Telehealth Network Monitor probes each application element of the Home Telehealth enterprise environment. The results of the probes are displayed on a national map. Figure 1 is the status display for the system components that exchange HL7 transactions with the triage servers. The left hand column of the Network Monitor window changes the display to the results of other probe types. The monitor probes the VA WAN (the VA Intranet) for performance statistics, the Vendor Servers (triage systems) for clinical desktop latency, and the HL7 Servers (HL7 transactions partners). The HL7 transaction partners are probed for operational state and the latency of a test transaction.

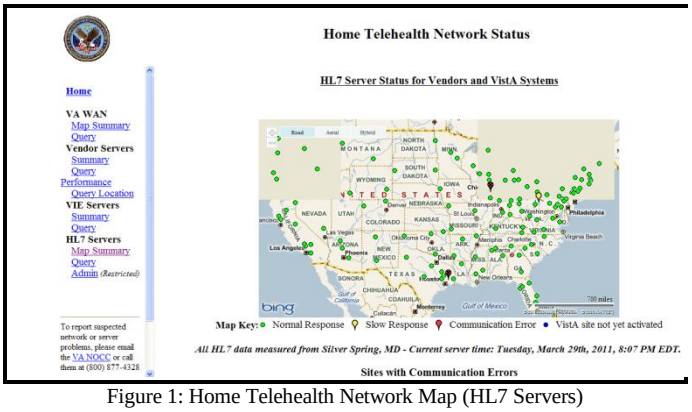

Figure 1: Home Telehealth Network Map (HL7 Servers)

V. FUTURE FUNCTIONALITY

The Home Telehealth program is currently completing its initial capability release and bringing on new triage system

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suppliers. The next releases will add automated tools to develop and manage DMPs, medical orders to configure the triage systems, the VistA Integration of a wound care application, and the tracking of home equipment from order to disposal, the mining of the Survey and DMP responses. The following sections give a short description of each of the future capabilities.

A. *Disease Management Protocol Standardizaton*

The current DMPs are a mix of triage system vendor supplied question sets and VA sets supplied to the triage system vendors in printed or printable documents. A future release will include a DMP development tool that will create a machine readable version. The triage system vendor will be able to generate the question set using automation rather than manually creating the question set.

B. *Medical Orders*

Each patient treatment plan is manually defined on the clinical desktop. The treatment plan includes the diagnosis, DMP, home device and sensors to collect the patient vital signs. A future release will include the definition of an HL7 transaction to perform this function.

C. *Wound Care*

Some of the triage systems include a wound care application. The basis of a wound care system is the analysis of pictures of the lesion. The triage system wound care applications will be required to connect to the standard VA image application (VistA Imaging) so that the wound care images can be made available to other VA staff.

D. *Equipment Inventory*

The home units are re-used as patients move in and out of the program. The application will be expanded to track the home units from order to decommissioning.

E. *Mining of Survey Responses*

At the current time the Patient Satisfaction and VR-12 ADL (activities of daily living) surveys are presented only in aggregation reports. The plan is to report at the patient level.

F. *Collection and Mining of DMP Responses*

At the current time the DMP responses are stored only in the triage system. Once the data is placed in the EMR, the DMP responses can be used in the outcomes analysis of the patient's treatment.

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