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Will Meaningful Use (MU) Improve Cancer Data Reporting?

Curtisha Manire
University of Tennessee Health Science Center

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Health Informatics and Information Management

University of Tennessee Health Science Center

Department of Health and Environment Control: South Carolina Central Cancer Registry

Abstract

The American Recover and Reinvestment Act directives supply the healthcare community with the improvement of technology across the nation through the Health Information Technology Economic and Clinical Health (HITECH) Act passed in 2009 by promoting healthcare technology. In order to reach the goal of an interoperability that supports reliable communication systems, certain individual technological objectives need to be addressed in particular, Meaningful Use (MU). Meaningful Use objectives contribute to interoperability, with potential outcomes that may increase accuracy and reduce time for reporting. This study will describe how cancer data reporting methods impacts data accuracy and turnaround time evolving around transitions supported by Meaningful Use . Data for this study will be collected and analyzed from the South Carolina Department of Health and Environmental Control Central Cancer Registry (SCCCR) 2013 reporting year for conventional methods (fax, mail, facility visits, facility's VPN access, and data imported to SCCCR server), electronic laboratory reporting (ELR) 2013 cases, and cases from March 2015 – October 2016 period via automatic electronic reporting method . The outcome of this research will display the differences and similarities of SCCCR cancer data reporting.

KEY WORDS: Cancer Reporting, Electronic Lab Reporting, Health Information Exchange, Health Technology, Meaningful Use, Interoperability

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Introduction

Health facilities' systems utilize classification systems, terminologies, vocabularies, and nomenclatures to capture health data need for specific health services. The American Recover and Reinvestment Act directives supply the healthcare community with the improvement of technology and standard sets for these coding systems across the nation through the Health Information Technology for Economic and Clinical Health (HITECH) Act that promotes healthcare technology for health information exchange utilizing Meaningful Use. Meaningful Use (MU) demonstrate health facilities are utilizing Electronic Health Record (EHR) systems specific to standards sets for certified systems that meet the Meaningful Use criteria. In order to reach the goal of interoperability individual Meaningful Use objectives need to be addressed that demonstrate compatibility, reliability, credibility, accuracy, accessibility, and completeness. An interoperability environment will have the potential to support true sharing which includes: share patient clinical information via electronic and or automatic reporting with health information exchange networks, widespread and comprehensive use of health data for patients' wellness, data warehousing, quality improvements, data mining techniques to capture health data, and public health surveillance to name a few benefits.

Facilities have the option to choose what type of data to captured concerning Meaningful Use depending on the health services provided by the facility; 3 out of 6 clinical quality measures (CQM) are required with Meaningful Use Stage 2 for systems' development/ design (CMS 2012). Some examples of clinical quality measures include data that represents populations, public health, patient safety, and effectiveness of clinical processes. Stage 2 Objective 10. Public Health & Clinical Data Registry Reporting Specialized Registries requires eligible providers (EP's) to report cancer data to South Carolina Central Cancer Registry

(SCCCR). SCCCR is recognized as a specialized registry that supports requirements to ensure the variations of health organizations health systems have the capabilities to exchange health data and provide a path for interoperability. The values of health information technology used for exchanging health data provide an opportunity for quality health data for improvements, best practices, knowledge base systems, monitoring, prevention, and management of public health, that contributes to patients' quality health.

The importance of health data and its many uses ignites mandated standard sets for health entities through MU to have the basics for health information exchange. Health data used by secondary entities have the potential of receiving a range between poor to quality health data that contributes to public health. Electronic reporting is one component required by meaningful use standards that have the potential to address areas of improvement involving accuracy, completeness, reliability, turnaround time, and accessibility of health data. The transition of moving from traditional methods to mandated methods for reporting creates a format of changes in operations within health organizations. Health information exchange among networks provides a path for time saving, accessible, and available for health data. Laboratories send HL7 pathology reports through PHIN MS to the cancer registry. The Public Health Information Network Messaging System (PHIN MS) is the CDC-provided software that fulfills this critical need for public health. PHIN MS can securely send and receive messages facilitating interoperability among public health information systems. Eligible Providers (EP's) send HL7 Clinical Document Architecture (CDA) Messages through PHINMS to the cancer registry as part of participating in MU stage 2 cancer reporting. A CDA can contain any type of clinical content which includes: discharge summary, imaging report, admission and physical, pathology report documents and many other health documentation. The most popular use is for this process is

health information exchange, such as the U.S. Health Information Exchange (HIE). The cancer registry uses an application provided by the Center for Disease Control (CDC) and the National Program of Cancer Registries (NPCR) called eMaRC Plus to import pathology reports and CDA messages. Electronic mapping, reporting, and coding concerning eMaRC Plus was initially developed to receive and process Health Level Seven (HL7) files from anatomic pathology laboratories. The eMaRC Plus Electronic Pathology (ePath) module imports HL7 narrative or synoptic reports directly from the Public Health Information Network Messaging System (PHIN MS) queue, makes sure the files contain the required data items, parses HL7 messages, maps HL7 data elements, and populates a cancer abstract for each path report.

With the mechanisms in place that successfully receive HL7 CDA messaging, EPs have potential to demonstrate Meaningful Use (MU) Stage 2 by sending a test message through their certified EHR system. Once the test message is sent by HL7, the message is imported into PHIN MS (sort of the same process with ELR) in queue, the message is exported to CDA Validation Plus and validated confirming the information in the message was received in the proper format. CDA Validation Plus is a software tool intended for testing only and validate CDA documents are in good standards to promote interoperability. After an EP have successfully sent a message provided by the standards, a message is sent back verifying the test message. The message is imported using eMaRC Plus to generate a record. In MU Stage 3, EPs can report cancer cases as part of the Public Health Registry Reporting measure. But, the question is will the transition provide an advantage or disadvantage compared to traditional methods used prior to mandated standards criteria of MU. This research compares traditional methods and innovational methods mandated for automatic reporting, and address areas of any improvements or disadvantages

concerning the accuracy, and turnaround time of data reported utilizing the stages of Meaningful Use.

Background

Missing, incomplete, and inaccurate health data, contributes to lack information for continuum of care and secondary health data that is used for several processes such as research, surveillance, quality, and risk management. Health organizations will experience difficulties with utilizing poor quality health data. Traditional methods for cancer data reporting provide information for statistical analytical purposes for prevention, monitoring, and maintaining public health. The beginning stages of health data improvement starts with interoperability to exchange cancer data. Meaningful Use is a key foundation to health data exchange.

The future of quality health data and health services is based on the establishment of facilities requirements to obtain a certified electronic health system in order to exchange health information which encourage improvements of privacy and security laws, quality health data, vendors' products, and standard health care. The practice of Meaningful Use demonstrated through certified EHR systems among health facilities are required to meet 3 Stages of Meaningful Use criteria. The Centers of Medicare and Medicaid (CMS) have established the objectives for meaningful use that eligible professionals (EPs), eligible hospitals, and critical access hospitals (CAHs) must meet (CMS 2014). Electronic Health Record systems certified for the year 2014 is an improvement for the criteria of the 2011 certification. The 2014 criteria supports "an electronic record of health-related information on an individual that: (1) includes patient demographic and clinical health information, (2) Has the capacity: (i) To provide clinical decision support; (ii) To support physician order entry; (iii) To capture and query information

relevant to health care quality; (iv) To exchange electronic health information with, and integrate such information from other sources; (v) To protect the confidentiality, integrity, and availability of health information stored and exchanged identified by CMS (ONC 2013). There are ten menu objectives suggested, and at least five of the ten needs to be reported, but at least one of the five objectives must be a public health objective to demonstrate Meaningful Use. The criteria set for Meaningful Use suggest an improvement for a foundation for public health departments to capture data through electronic reporting needed for populations' statistics.

Significance of Study

The significance of this study will identify the importance of data being collected through automatic reporting compared to traditional method, and recognize any changes with the transition from conventional reporting to automatic reporting cancer data demonstrating Meaningful Use (MU). The findings will provide evidence of which method supports quality data for cancer data reporting and provide opportunities for health entities to recognize the importance of implementing processes that capture accurate data that utilize mandated standards and regulations for the purpose of public health surveillance. The results have the potential to recognize the increase or reduction of data quality, or reveal areas of improvements of Meaningful Use for exchange health data for public health.

Research Questions

These statistics will address measurable data that involves the turnaround time, and accuracy of health data fields reported to the South Carolina Central Cancer Registry. The questions of the data capture will answer measuring queries which include: Is cancer health data

inputted manually more accurate, and/or have a quicker turnaround time than ELR, and/or automatic data received through the health information exchange; What is the volume of cases reported with the different methods concerning turnaround time; What is the percentage of accuracy of all methods; Which type of method is necessary for cases to be reported with accurate information? Are there any areas of improvement with the implementation of Meaningful Use? These research questions will reflect the implementation of automatic reporting compared to conventional methods along with any areas of improvement that may be address with utilizing Meaningful Use.

Review of Literature

The articles choose supply evidence of the comparison of conventional and electronic reporting. The research from the articles have proven that electronic reporting has improved the turnaround time, and the number of cases reported for information exchange, but just as effective or less effective as conventional methods for accurate health documentation. One constant area of improvement for ELR suggests addition resources of education and establishing qualified health staff for quality control for the electronic reporting methods.

In the study, "Completeness and Timeliness of Electronic vs. Conventional Laboratory Reporting for Communicable Disease Surveillance-Oklahoma Bradley (2011)" reviewed 18 laboratories in Oklahoma and compared completeness and timeliness reports from two laboratories utilize electronic laboratory reporting (ELR) with conventional reports from 16 other Oklahoma laboratories. In Oklahoma, laboratories with ≥400 positive tests/year for reportable diseases must use ELR. Of 18 laboratories reviewed, 2 have adopted ELR. The research retrospectively reviewed reportable disease cases for January 1–December 31, 2011, excluding

tuberculosis, hepatitis, sexually transmitted infections, diseases without laboratory diagnoses, and immediately reportable diseases. Probable reportable tickborne disease cases were included. Conventional reporting was defined as reports received by mail, fax, telephone, and Internet. We assessed data completeness based on eight demographic and two laboratory fields in each disease report and timeliness by percentage of cases reported in ≤1 business day. The results displayed 1,867 reports met the inclusion criteria; 24% of these reports had been submitted by ELR. Data completeness was 90% for ELR and 95% for conventional reporting. Patient addresses accounted for 97% of the missing data fields for ELR reports. Timeliness was 91% for ELR and 87% for conventional reports. Although early in the transition to ELR compliance in Oklahoma, ELR has already yielded improved timeliness for communicable disease surveillance. However, ELR did not yield more complete reports than conventional reporting. If required specific demographic data fields were captured in ELR, it can improve the completeness of ELR. One major limitation of this study included the sample size of laboratories with full ELR capabilities, whereas the assessment of conventional reporting was based on a greater number of laboratories.

In the study, "Automatic Electronic Laboratory Based Reporting of Notifiable infectious diseases Dixon (2002)" the improvements of utilizing ELR recognized minimizing the size of free text that will allow a higher percentage of completion. Electronic laboratory reporting was evaluated to determine if it could be integrated into the conventional paper-based reporting system. The study reviewed reports of 10 infectious diseases from 8 hospitals with HL7 messaging capabilities, compared all disease reports electronic and paper-based systems with dates of positive culture from January to November 26, 2000, for 10 infectious organisms: *Campylobacter*, *Cryptosporidium*, *Escherichia coli* O157:H7, *Giardia*, *Listeria, Legionella,Neisseria meningitidis*, *Salmonella*, *Shigella*, and *Yersinia*. To determine the

timeliness of the two surveillance systems, three time points were defined. The date/time when the laboratory result was obtained and entered into the laboratory computer. The date/time when the laboratory result was reported by the conventional paper-based system. The date/time the automatic electronic laboratory-based system notification was generated. The estimate total of reports was 144 that reported to the Allegheny County Health Department during January 1– November 26, 2000. Electronic reports were received a median of 4 days earlier than conventional reports. The completeness of reporting was 74% (95% confidence interval [CI] 66% to 81%) for the electronic laboratory-based reporting and 65% (95% CI 57% to 73%) for the conventional paper-based reporting system ($p>0.05$). Most reports (88%) missed by electronic laboratory based reporting were caused by using free text. ELR was more rapid and as complete as conventional reporting. Timeliness was calculated by using the 69 records common to both databases. Eleven data fields were common to both the electronic and paper-based databases. Of these, six fields were 100% complete in both. Of the remaining five, two were more complete in the electronic system (date of birth and age), whereas three were more complete in the paper-based system (address, zip code, report status. Using standardized coding and minimizing free text usage will increase the completeness of electronic laboratory-based reporting. Limitations of not maximizing free text may omit information that is not collected by codes.

The study, "Improvements In Timeliness Resulting From Implementation of Electronic Laboratory Reporting and an Electronic Disease Surveillance System (Fangman2013)" provided information on how electronic laboratory reporting (ELR) reduces the time between communicable disease diagnosis and case reporting to local health departments (LHDs) by

assessing how ELR affects the timeliness and accuracy of case report processing within public health agencies. Data from May–August 2010 and January–March 2012
calculated the time between receiving a case at the LHD and reporting the case to the state (first stage of reporting) and between submitting the report to the state and submitting it to the Centers for Disease Control and Prevention (second stage of reporting). Accuracy was define by calculating the proportion of cases returned to the LHD for changes or additional information. The results showed evidence that ELR had a higher accuracy and reduces time for reporting in both years. The overall impact of increased ELR is more efficient case processing at both local and state levels. Electronic laboratory reporting (ELR) has been shown to reduce the time interval between diagnosis of reportable communicable diseases and reporting these cases to public health agencies. Some data fields are more likely to be completed when reports are made via ELR. Increases in electronic data transfer would decrease the processing burden within public health agencies; automated reporting increases the total number of cases reported and can increase the number of reports not meeting reportable cases potentially increasing the time required for case processing for local health department (LHD) staff. This study provides evidence that ELR does not capture important case information, such as treatment details, which need to be added to case reports following investigation by local or state personnel. Two major limitations revealed factors that yields the outcome of this study. One limitation was that the data used for this study was collected from only two laboratory facilities that report all diseases in that state of North Carolina. The other major limitation with this study is that there is little published information on whether the increasing number of cases will require additional processing time and resources; therefore, it is difficult to predict the impact of increased ELR on the public health infrastructure.

The "Government Leadership in Addressing Public Health Priorities-Strides and Delays in Electronic Laboratory Reporting in the United States (Gluskin 2014)" study recognize barriers when switching from paper to electronic laboratory reports (ELRs) included workload, accuracy, and timeliness. The successes and challenges of electronic reporting is supported by peer-reviewed literature. Lessons learned from ELR systems will benefit efforts to standardize electronic medical records reporting to health departments. The research found that laboratories face challenges of transmitting a single test result message to several different entities. Each ELR facility may have its own semantic standards and reporting systems. These different systems complicate the mapping of test results for ELRs that were designed to work with previous, not current or future, technologies. If a laboratory implements a new system that generates results with a different laboratory test or outcome code, ELRs need to be reconfigured. Delay in the configuration of an ELR code could lead to missed cases or misclassification, and may not always be able to interpret the data sent from laboratories. Also, ELRs have the capability to changed the volume and work flow. Health departments report that the number one barrier to ELR use is that laboratories have other competing information technology priorities. ELRs to public health agencies accounts for only a small proportion of all outgoing reports and does not generate revenue for the laboratory, it may be a lower priority for the laboratory than improving its reporting to health care providers and patients. This is especially true in smaller clinical laboratories with limited resources. Variations in laboratory resources can lead to variations in the quality of reports sent to public health agencies. Many of the following issues existed in the era of paper laboratory reporting; ELR use has automated some data processes but complicated others by increasing the reporting volume. Massive amounts of data in varying formats can quickly become difficult for health departments to manage, altering both work flow

and load. Some ELRs may lack basic information and need follow-up, such as retrieving the patient's address or the specimen source. The health department staff have to retrieve missing information to complete a report, and continually monitor the data to ensure quality. This puts an additional burden on public health staff to keep up on ELR changes and errors at the laboratory. The backlog for this study was roughly 800 ELRs that could not be automatically sorted by the computer; instead the health department staff had to manually review each message to decide whether it was data needed to complete the case for reporting. This process of continuous ELR follow-up could interrupt and cause delays with traditional work flow. Increasing the data volume makes it harder to ensure data quality. Some health departments have found that receiving large amounts of laboratory data can lead to more false positives, which may be hard to distinguish from true positive cases that need to be acted on immediately. With information technology infrastructure upgrades and development health departments must secure additional data storage for sensitive health messages and maintain information systems of large amounts of data. ELR implementation has reduced reporting time and increased reporting volume with several obstacles. Although MU calls for the use of semantic standards, it is unclear whether the financial incentives from MU will reach the clinical laboratories to conclude an interoperability without costing laboratories to be in a financial hole. Developing tools for laboratories to efficiently adopt standards-based ELR may accelerate this transition.

Another study, "A Comparison of the Completeness and Timeliness of Automated Electronic Laboratory Reporting and spontaneous reporting of notifiable conditions Grannis (2008)" examined whether automated electronic laboratory reporting of notifiable-diseases results in information being delivered to public health departments more completely and quickly than is the case with paper-based reporting. The research compared traditional spontaneous

reporting to the health department with automated electronic laboratory reporting through the health information exchange. There were 4785 unique reports for 53 different conditions during the study period. Automated electronic laboratory reporting identified 4.4 times as many cases as traditional spontaneous, paper-based methods and identified those cases 7.9 days earlier than spontaneous reporting. The results revealed automated electronic laboratory reporting improves the completeness and timeliness of disease surveillance, which will enhance public health awareness and reporting efficiency.

These articles provided evidence of how electronic reporting impact workflow operations by improving, delaying, or showing no significance at all for reporting compared to traditional methods. The significance of these comparisons between conventional and electronic reporting methods displayed an increase with the volume of cases reported, and a quicker turnaround time for reported cases. However the findings revealed a backlogs, additional health data investigation, and a transition of work flows due to missing health data elements with electronic reporting. The review of articles provided evidence that electronic reporting is just as effective or less effective as conventional methods for accuracy, but having additional resources and improvements for quality control for the electronic reporting methods have the potential for accurate and reliable reporting**.**

Table 1. Comparison of Literature Review

Table 1: Comparison of Literature Review			
(Year) Author(s)	**Participants/ Survey Method**	**Variables**	**Results**

(2014) Rebecca Tave Gluskin, Maushumi Mavinkurve, and Jay K. Varma	New York City Department of Health and Mental Hygiene (DOHMH)/ Systematic Review	All method reports from a clinical laboratory to a NY Public Health Department.	We found evidence from multiple sources that ELR implementation has reduced reporting time and increased reporting volume, but that many obstacles remain. ELR use can affect the workload and work flow of public health practice. Information system investments alone cannot solve ELR issues. Government agencies should endeavor to retain skilled staff and redirect information technology resources to handle the flood of data sent from clinical laboratories

(2013) Erika Samoff, Mary T. Fangman, Aaron T. Fleischauer, Anna E. Waller, and Pia D.M. MacDonald	North Carolinas' local health departments (LHDs) / A retrospective review	Timeliness and accuracy for ELR and non-ELR cases	The overall impact of ELR is more efficient case processing at both local and state levels. Electronic laboratory reporting (ELR) has been shown to reduce the time interval between diagnosis of reportable communicable diseases and reporting these cases to public health agencies.
(2011) Matthew G Johnson, Jean Williams, Anthony Lee, Kristy K Bradley	Oklahoma laboratories/ A retrospective review	Compared ELR with conventional reporting (i.e., mail, fax, telephone, and Internet)	Overall, Data completeness was 90% for ELR and 95% for conventional reporting. Patient addresses accounted for 97% of the missing data fields for ELR reports. Timeliness was 91%

			for ELR and 87% for conventional reports. Although early in the transition to ELR compliance in Oklahoma, ELR has already yielded improved timeliness for communicable disease surveillance. However, ELR did not yield more complete reports than conventional reporting. Requiring specific demographic data fields for ELR reports can improve the completeness of ELR.
(2008) J. Marc Overhage, MD, PhD, Shaun Grannis, MD, MS, and Clement J. McDonald, MD	Marion County population notifiable disease potential cases/ A retrospective review	Traditional spontaneous reporting and automated electronic laboratory reporting through the	Automated electronic laboratory reporting improves the completeness and timeliness of disease

		health information exchange.	surveillance, which will enhance public health awareness and reporting efficiency.
(2002) Anil A. Panackal, Nkuchia M. M'ikanatha, Fu-Chiang Tsui, Joan McMahon, Michael M. Wagner, Bruce W. Dixon, Juan Zubieta, Maureen Phelan, Sara Mirza, Juliette Morgan, Daniel Jernigan, A. William Pasculle, James T. Rankin, Jr., Rana A. Hajjeh, and Lee H. Harrison	8 University of Pittsburgh Medical Centers (UPMC) Health System that reported to the Allegheny County Health Department in southwestern Pennsylvania / comparison evaluation	Electronic laboratory-based reporting and conventional paper-based reporting	The overall completeness of reporting was 74% for the UPMC electronic system and 65% for paper-based system, showing no significant difference in completeness of reporting between the electronic and paper-based systems.

Methodology

In this section the information provided will describe the methodology used to conduct this study. This section describes the investigation tools used to collect information which includes systems and procedures used to gather information to research, compare, and to provide an answer to research questions.

Method

The method includes an observation of accumulation of cancer data that details data for reporting through conventional methods and automatic electronic reporting methods involving human manipulation and non-human manipulation for cancer data reporting. The components that will be examined include accuracy and turnaround time of patient data entered into SCCCR database. Accuracy is defined as completed cases with the correct value(s) in the correct fields without blanks or unknowns of the date of diagnosis, topography (primary site), morphology (histology and behavior), and stage of tumor that reflects the free narrative text. Example: a Ductal Cell Carcinoma text will be inaccurate to a coded primary skin site that is a Melanoma; since there is no ductal cells in epithelial tissue, and the text doesn't reflect the text which demonstrate an error. Turnaround time is the time it takes for data to be entered in SCCCR database captured by the date case reported exported, data of completion, and date case initiate.

Among the different methods, proportion of accuracy among the groups, the date of case initiated compared to the date case completed { (determine the timeliness of case reported completion) and the date case exported (determines the time a case is reported to the facility's database prior to the time the report is transmitted in the caner registry database) using

(difference between the date – the mean date Xi – X)} will be compared to reveal any significance among the different types of cancer data reporting.

Variables

The reporting methods that will be studied consist of cancer health data collected using conventional methods (full human manipulation), ELR (hybrid manipulation), and collected automatically (non human manipulation). Conventional methods consist of data that is manually inputted with human interface (fax, mail, VPN access, imported files into server to be completed not excluding electronic devices and technology software). Automatic electronic methods consist of data directly inputted into the database without human interface. Hybrid methods consist of data that is directly inputted into the database through ELR with human manipulation for completion. The different practices of data collection composes of a sample of specific fields (date case reported exported, date of diagnosis, data of completion, data of completion-coc, date case initiate, primary site, histology, behavior, and derived summary stage of the tumor 2000) that will be reviewed for the accuracy and turnaround time of reported cases.

Research Design

The aim of this research is to conclude the effectiveness of three method sets to capture cancer data for reliable reporting. A retrospective study of cancer data fields reported for cases in the year of 2013 reporting year for conventional methods (fax, mail, facility visits, facility's VPN access, and data imported to SCCCR server), electronic laboratory reporting (ELR) 2013 cases, and cases from March 2015 – October 2016 period via automatic electronic reporting method will be compared. Accuracy will measure correct value(s) in the correct fields against

narrative text, blanks, and unknowns of five of the variables that reflects the date of diagnosis, primary site, histology, behavior of the tumor, and stage of the tumor; and turnaround time will measure the time data was completed and entered in SCCCR database captured by the date of case exported, case completion, and the date case initiated. These categories of specific fields would be sorted by the path of completion in the database through conventional reporting methods (human manipulation), ELR (hybrid manipulation) , and automatic electronic reporting (non human manipulation). Each group will be analyzed into the for accuracy, and turnaround time of the cases submitted based on specific fields for measures. The outcome of this study will recognize benefits and area of improvements of implementing Meaningful Use criteria stages for health data exchange for cancer data reporting.

Population and Sample Studied

The population of health facilities in the state of South Carolina is in the transition of preparing and establishing Meaningful Use (MU) processes since announcement of mandate standards. Meaningful Use (MU) Stage 2 incentives requires validation of exchange of health information in the calendar year of 2016. Currently in 2016, there are nineteen laboratories reporting E-PATH to SCCCR, a random selection of 30 cases processed using ELR of the nineteen laboratories reporting and would be used to represent electronic laboratory reporting, a random selection of 30 cases processed by abstracters would represent conventional reporting (human manipulation), and a random selection of 20 cases from the Meaningful Use reporting system would represent reporting without human interface using HL7 messaging while continuing to report traditionally with human interface. Each interface will be use to determine the outcome of this research. The specific fields created by the CDC abstract formulation will be

examine for specific coded data fields used to calculate the accuracy and the turnaround time for reporting.

Timeline

In order to examine the reporting methods involving the implementation of automatic reporting from conventional methods, the timeline will include a review of health data submitted to South Carolina State Cancer Registry in 2013 reporting year for conventional methods (fax, mail, facility visits, facility's VPN access, and data imported to SCCCR server), electronic laboratory reporting (ELR) 2013 cases, and cases from March 2015 – October 2016 period via automatic electronic reporting method.

Findings

Results

All data fields reviewed for MU were missing 24% of data; after QC corrections 13% of data remain non reliable. It was a 100% accuracy for 4/5 data fields reviewed for both conventional reporting and ELR. 1/5 data fields slightly decreased the total accuracy proportions "Derived SS2000" ELR 90% & Conventional 97%, and MU days in between Mean 45.15 a reduced rate from both ELR and Conventional reporting; but have a abstract over 325 days. ELR table displayed a trend of missing dates for timeliness evaluation due to dates not captured through the ELR system. The MU process lacked site codes, incorrect histology codes and narrative text, lack of dates imported, and limited length fields. Each method reviewed involved human manipulation in to form a complete record.

Limitations

Some limitations recognized include the input of incorrect data from primary source, not having primary records to review patient health information, vital unknown health data fields, not having enough certified health systems tested for HL7 for significant evidence, the number of systems ready to go live, cost, and the lack of training for end users that used the software to capture cancer data for reporting. The sample size chosen limited the research outcome. These variables may affect the outcome of the study.

Discussion

The evidence from multiple sources of ELR implementation has reduced reporting time and increased reporting volume, but many obstacles remain. ELR use can affect the workload and work flow of public health practice. Information system investments alone cannot solve ELR issues. Government agencies should consider skilled staff and redirect information technology resources to handle the flood of data sent from clinical laboratories (Gluskin et al). The overall impact of ELR is more efficient case processing at both local and state levels which has been shown to reduce the time interval between diagnoses of reportable communicable diseases and reporting cases to public health agencies (Samoff et al). The data from the research collected in Oklahoma demonstrated completeness was 90% for ELR and 95% for conventional reporting. Patient addresses accounted for 97% of the missing data fields for ELR reports. Timeliness was 91% for ELR and 87% for conventional reports**,** ELR did not yield more complete reports than conventional reporting (Johnson et al). However, another article describes opposite findings of how electronic laboratory reporting improves the completeness and timeliness of disease

surveillance, which will enhance public health awareness and reporting efficiency (Overhage et al). While, the earliest article shown an overall completeness of reporting was 74% for electronic system and 65% for paper-based system, showing no significant difference in completeness of reporting between the electronic and paper-based systems (Panackal et al). The vision of improvements for reporting has imprinted several trails and errors due to factors concerning accuracy, reliability, and accessibility. The ELR has the potential of a complete and quicker reporting system when the areas of improvement of capturing all data is address. The timeliness of ELR and automatic electronic reporting is tainted by the additional time it may take to complete a record divided by a quicker turnaround of retrieving reportable cases. This process will have to be considered when calculating the time to process complete reports in the different format of reporting cancer data. Observations recognized workflow transitions concerning the addition time needed to investigate and complete cases of missing information reported through the ELR system. The volume is greater with a quicker turnaround time, but causing a backlog of records to investigate with potential of being a reported case. One of the limitations of the research conducted to see if meaningful use will improve cancer data includes the obstacle of cost needed for implementation of electronic reporting. Only nineteen laboratories in the state of South Carolina, since March 2016, have the capabilities of ELR, and a selected few EPs test successful with full potential of MU practices for health information exchange. Experiences with collecting data from different facilities involve a complex in EHR systems that required additional software for reporting to health departments. The research revealed how cost factored the facilities outcomes of interoperability and the response to why few facilities are reporting electronically. Some vendors did not incorporate a path for public health reporting (Objective 10 in Stage 2 of Meaningful Use (MU) for a deemed certified EHR system for a EP required to

report cancer data. This is an obstacle EP's encounter when implementing technology systems, and is pinned to spend additional cost for health technology for demonstrating MU. Most financial incentives may not reach smaller facilities laboratories in this case SCCCR will support and assist with electronic reporting to ensure data collection.

Conclusion

There are many areas of improvement involving a reliable MU reporting which includes, but not limited to: interoperability among EHR's in order for all reportable cases to be exported into the cancer database, reliable health data, record completeness, additional QC, and additional resources. The evidence from multiple sources of ELR implementation has reduced reporting time and increased reporting volume, but many obstacles remain. ELR use can affect the workload and work flow of public health practice. Information system investments alone cannot solve ELR issues; one major issue being missing data. The vision of improvements for reporting has imprinted several trails and errors due to factors concerning accuracy, reliability, and accessibility. Until processes using automatic systems are improve to match the confidence level of conventional reporting, human manipulation of the process are necessary to have reliable reporting.

Definition of Terms

Electronic Laboratory Reporting (ELR) *- an automated exchange of laboratory data from one entity to another using an electronic system*

Health data *- Information related to health conditions*

Health Information System *- any system that supports the capture, management, storage, and exchange of health data*

HITECH Act *-The Health Information Technology for Economic and Clinical Health (HITECH) Act, is part of the American Recovery and Reinvestment Act of 2009, which promoted Meaningful Use (MU) of health information data, systems, and technology.*

Health-Level 7 (HL7) *a set of international standards and formats for establishing health information exchange*

Health Technology *- a variety of electronic devices including the design, development, creation, use and maintenance of information systems that are used to diagnosis, monitor, and maintain health conditions or services.*

Human Interaction *– the use of computer technology between people (users) and computers, computer technology, and/ or devices*

International Classification of Disease for Oncology (ICD-O) *- classification system used for coding neoplasms.*

Interoperability *- the ability for technology systems to exchange information and utilize the information being exchange*

Meaningful Use (MU) *- demonstrate health facilities are utilizing Electronic Health Record (EHR) systems specific to standards sets for certified systems that meet*

compatibility, reliability, credibility, accuracy, accessibility, and completeness for interoperability.

Morphology - *The study of cell types (histology) of anatomy microscopic structure of tissues which is represented by a five-digit code ranging from M-8000/0 to M-9989/3 and the slash one digit behavior code that indicates malignant, benign, in situ, or uncertain.*

Quality *- The process of looking at how well a medical service is provided. The process may include formally reviewing health care given to a person, or group of persons, locating the problem, correcting the problem, and then checking to see if what you did worked.*

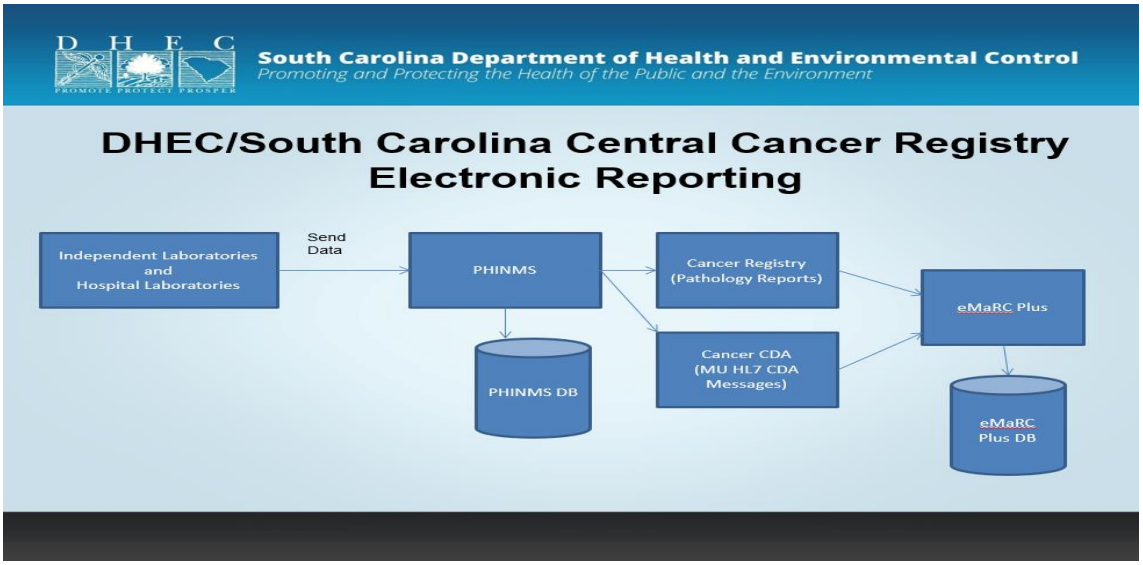
Stage *– Indication of the spread of cancer throughout the anatomy*

Topography*- details the anatomical site of origin of cancerous tissue*

APPENDIX

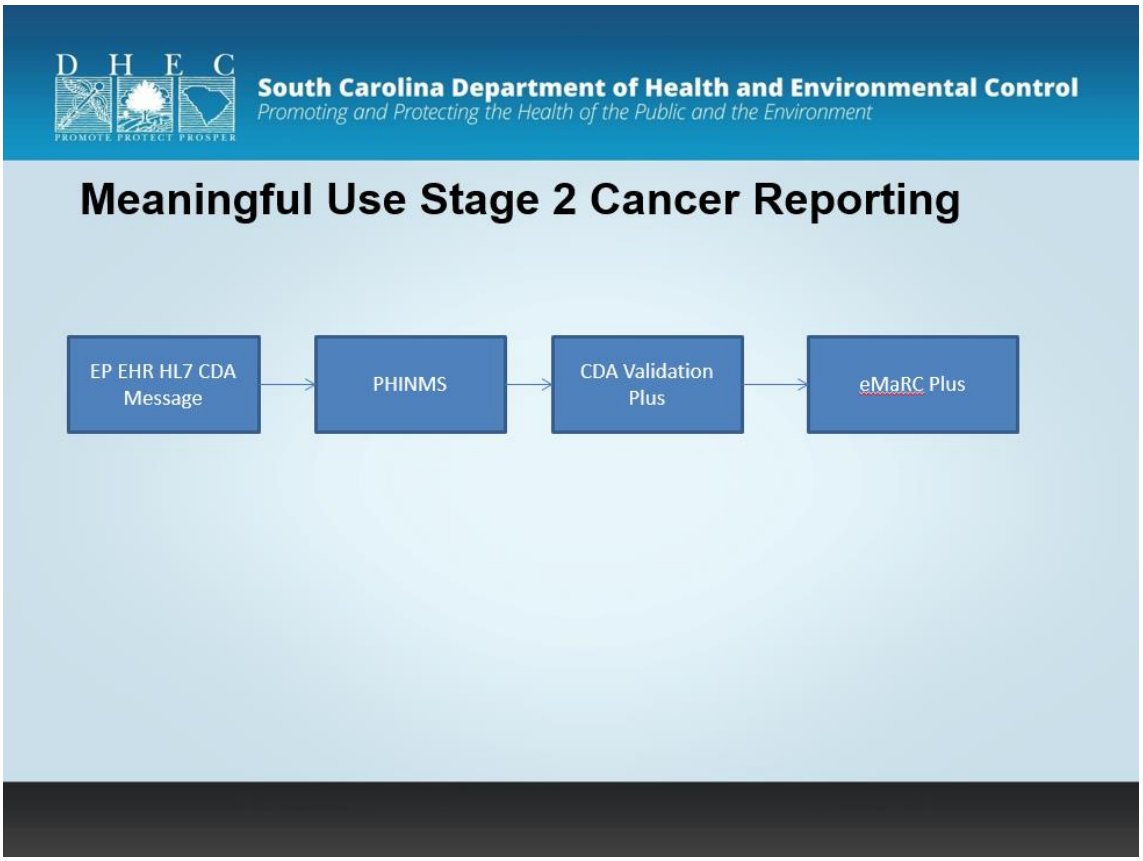
ELR

MODEL 1



AUTOMATIC ELETRONIC REPORTING

MODEL 2



DATA COLLECTION FIELDS

TABLE 2

BEHAVIOR CODE ICD-O-3

Alternate Name	Item #	Length	Source of Standard	Year Implemented	Version Implemented	Year Retired	Version Retired	Column #
Behavior Code (CoC) ICD-O-3 Behaviour (CCCR)	523	1	SEER/CoC	2001	9			554 - 554

Description
Code for the behavior of the tumor being reported using ICD-O-3. NAACCR adopted ICD-O-3 as the standard coding system for tumors diagnosed beginning January 1, 2001, and later recommended that prior cases be converted from ICD-O-2. See Behavior (92-00) ICD-O-2 [430], for ICD-O-2 codes.

Juvenile astrocytoma is coded as borderline in ICD-O-3; North American registries report as 9421/3.

Clarification of Required Status
Behavior is required by all standard-setting organizations for tumors diagnosed on or after January 1, 2001, and recommended (by conversion from ICD-O-2 codes) for tumors diagnosed before 2001.

When the histologic type is coded according to the ICD-O-3, the histology code must be reported in Histologic Type ICD-O-3 [522], with behavior coded in Behavior Code ICD-O-3 [523].

For information on required status for related data items for histologic type and behavior when coded according to ICD-O-2, see Histology (92-00) ICD-O-2 [420] and Behavior (92-00) ICD-O-2 [430].

Codes

Valid codes are 0-3. See ICD-O-3,[14] page 66, for behavior codes and definitions.

DATE CASE COMPLETED

Alternate Name	Item #	Length	Source of Standard	Year Implemented	Version Implemented	Year Retired	Version Retired	Column #
	2090	8	NAACCR					1959 - 1966

Description
The date that: (1) the abstractor decided that the tumor report was complete and (2) the case passed all edits that were applied. Definitions may vary among registries and software providers. This field is locally used by central registries. See Chapter X for date format. Standard edits check that no dates are later than the current date. These specifications will not necessarily be the same as those used for Date Case Completed--CoC [2092].

DATE CASE COMPLETED--COC

Alternate Name	Item #	Length	Source of Standard	Year Implemented	Version Implemented	Year Retired	Version Retired	Column #
	2092	8	CoC	2010	12			1967 - 1974

Description
Identifies the date that specified items are completed, based on the Class of Case, where those items pass the relevant edits. Follow-up information, including delayed treatment received elsewhere, may be coded after the Date Case Completed--CoC. See the current *FORDS* for details. This item should be autocoded by the registry software; specifications may be obtained from NCDB. The CoC specifications will not necessarily be the same as those used for Date Case Completed [2090]. See Chapter X for date format.

DATE CASE INITIATED

Alternate Name	Item #	Length	Source of Standard	Year Implemented	Version Implemented	Year Retired	Version Retired	Column #
	2085	8	NAACCR	2010	12			1951 - 1958

Description
Date the electronic abstract is initiated in the reporting facility's cancer registry database. See Chapter X for date format. Standard edits check that no dates are later than the current date or the date completed.

Rationale
This item is used to assess and monitor the timeliness of reporting. Timeliness of abstracting (and reporting) is a concern for all standard-setting organizations and consequently, timeliness standards have been established. Examples of use are as follows:

- This item can be used with the Date of 1st Contact [580] to measure timeliness of abstracting by individual reporting facilities
- This item can be used with Date Case Report Exported [2110] to determine the "residency time" of a case report within a reporting facility's database prior to data transmission to a central cancer registry
- This item can be used with Date Case Report Received [2111] to monitor central registry timeliness in entering case reports (for case reports abstracted in-house from hardcopy provided by a reporting facility)
- This item can be used with Date Case Completed [2090] to monitor timeliness of case report completion

DATE CASE REPORT EXPORTED

Alternate Name	Item #	Length	Source of Standard	Year Implemented	Version Implemented	Year Retired	Version Retired	Column #
Date Case Transmitted (pre-98 NAACCR)	2110	8	NPCR					1983 - 1990

Description
Date the reporting facility exports the electronic abstract to a file for transmission to the central registry. See Chapter X for date format. Standard edits check that no dates are later than the current date. Definitions may vary among registries and software providers.

DATE OF DIAGNOSIS

Alternate Name	Item #	Length	Source of Standard	Year Implemented	Version Implemented	Year Retired	Version Retired	Column #
Date of Initial Diagnosis (CoC)	390	8	SEER/CoC					530 - 537

Description
Date of initial diagnosis by a recognized medical practitioner for the tumor being reported whether clinically or microscopically confirmed. See Chapter X for date format.

For more discussion on determining date of diagnosis, consult the *SEER Program Coding and Staging Manual* or CoC *FORDS* manual.

DERIVED SS2000

Alternate Name	Item #	Length	Source of Standard	Year Implemented	Version Implemented	Year Retired	Version Retired	Column #
Derived SEER Summary Stage 2000	3020	1	AJCC	2003	10			1156 - 1156

Description
This item is the derived "SEER Summary Stage 2000" from the CS algorithm (or EOD codes) effective with 2004 diagnosis.

Rationale
The Collaborative Stage Data Collection System was designed by a joint task force including representatives from SEER, ACoS, CDC, NAACCR, NCRA, CCCR, CPAC, and AJCC, to provide a single uniform set of codes and rules for coding extent of disease (EOD) and stage information to meet the needs of all of the participating standard setters. When CS data items are coded, a computer algorithm provides the derivation of T, N, M, and stage-based on AJCC Cancer Staging Manual 6th & 7th Editions, SEER Summary Stage 1977, and SEER Summary Stage 2000. There are separate derived CS fields in the NAACCR record based on AJCC 6th Edition for 2004+ cases and AJCC 7th Edition for 2010+ cases.

HISTOLOGIC TYPE ICD-O-3

Alternate Name	Item #	Length	Source of Standard	Year Implemented	Version Implemented	Year Retired	Version Retired	Column #
ICD-O-3 Histology (CCCR)	522	4	SEER/CoC	2001	9			550 - 553

Description
Codes for the histologic type of the tumor being reported using ICD-O-3. NAACCR adopted ICD-O-3 as the standard coding system for tumors diagnosed in 2001 and later, and recommended that prior tumors be converted from ICD-O-2. Effective with 2010 diagnoses, this item also includes histology codes as per the 2008 WHO Hematopoietic/Lymphoid publication[39], which are listed on pages 3-5 of the NAACCR 2010 Implementation Guidelines. http://www.naaccr.org/StandardsandRegistryOperations/ImplementationGuidelines.aspx.

Note: See Histology (92-00) ICD-O-2 [420] for ICD-O-2 codes. Effective with 2010 diagnoses, this item also includes histology codes as per the 2008 WHO Hematopoietic/Lymphoid publication [39], which are listed on pages 3-5 of the NAACCR 2010 Implementation Guidelines. http://www.naaccr.org/LinkClick.aspx?fileticket=U-3o31G2Lik%3d&tabid=126&mid=466

Codes
See ICD-O-3,[14] Morphology Section and the SEER Hematopoietic database.

Clarification of Required Status
This data item is required by all standard-setting organizations for tumors diagnosed on or after January 1, 2001, and recommended (by conversion from ICD-O-2 codes when conversion algorithms and tables are available) for tumors diagnosed before 2001.

When the histologic type is coded according to ICD-O-3, the histology code must be reported in Histologic Type ICD-O-3 [522], with behavior coded in Behavior Code ICD-O-3 [523].

For information on required status for related data items for histologic type and behavior when coded according to ICD-O-2, see Histology (92-00) ICD-O-2 [420] and Behavior (92-00) ICD-O-2 [430].

PRIMARY SITE

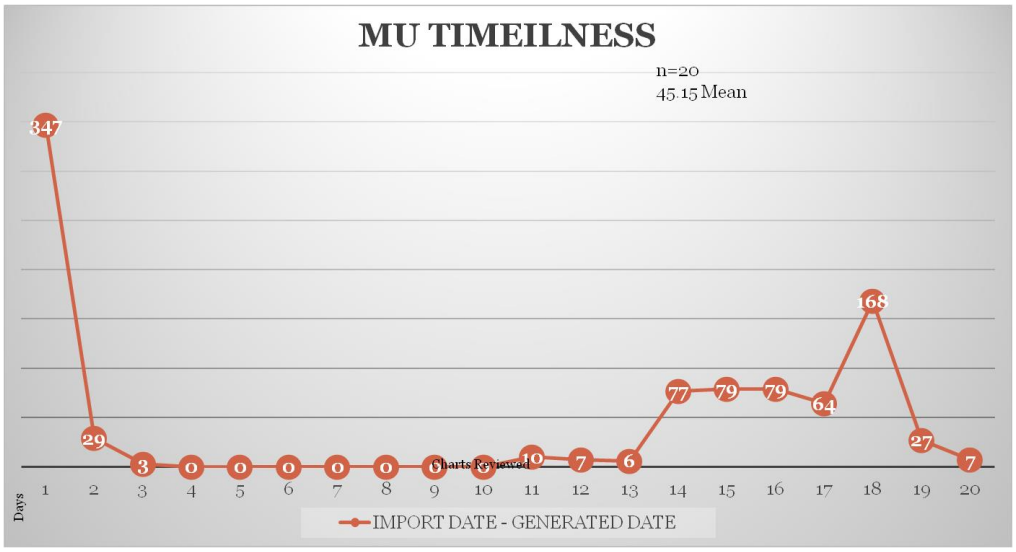
Alternate Name	Item #	Length	Source of Standard	Year Implemented	Version Implemented	Year Retired	Version Retired	Column #
IDC-O-2/3 Topography (CCCR)	400	4	SEER/CoC					540 - 543

Description
Code for the primary site of the tumor being reported using either ICD-O-2 or ICD-O-3. NAACCR adopted ICD-O-2 as the standard coding systen for tumors diagnosed beginning January 1, 1992. In addition, NAACCR recommended that tumors diagnosed prior to 1992 be converted to ICD-O 2. The topography (primary site) codes did not change between ICD-O-2 and ICD-O-3.

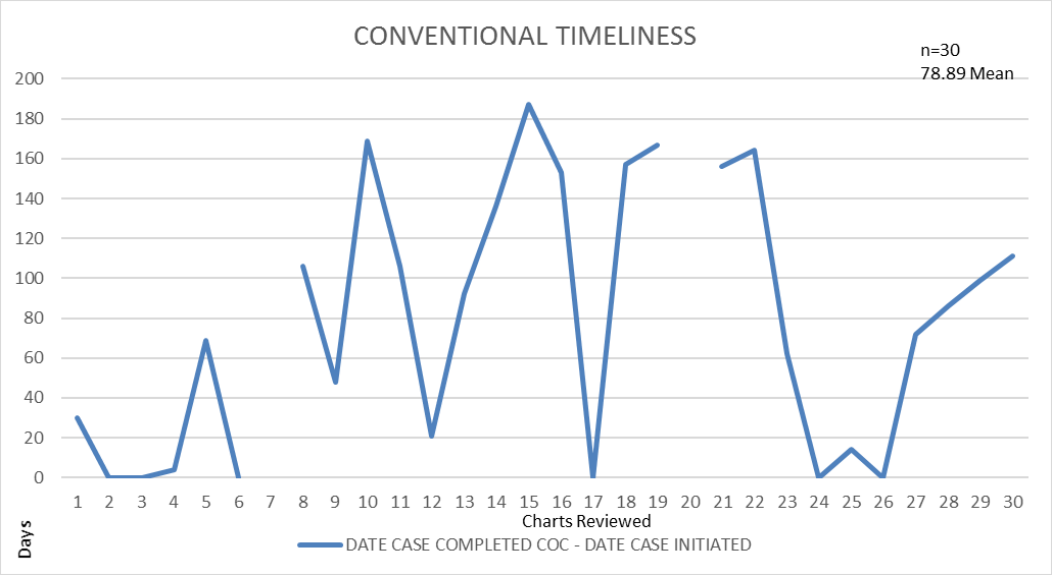
Codes
See ICD-O-2,[14] or ICD-O-3,[13] Topography Section, for the codes for primary site.

Note: See data item Site (73-91) ICD-O-1 [1960] for ICD-O-1 cases.

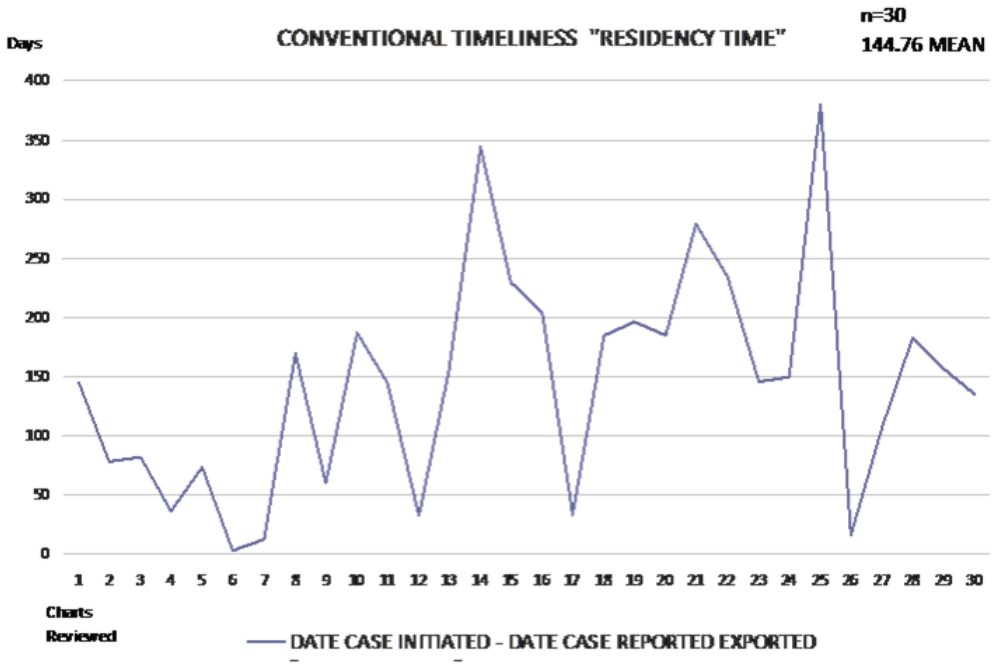
Graph 1. MU Timeliness



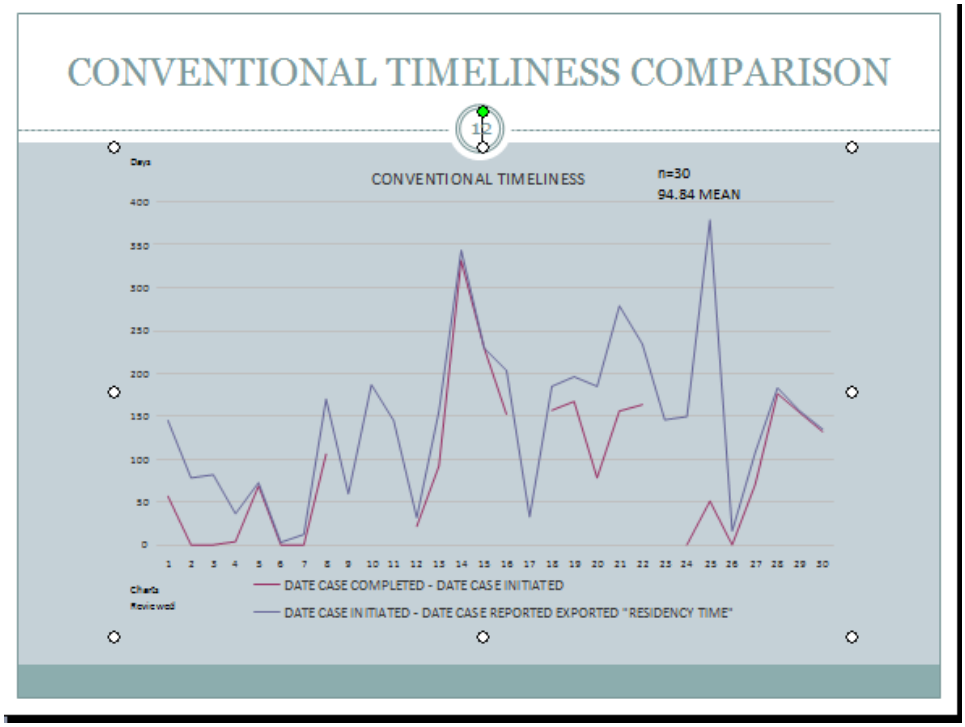
Graph 2. Conventional Timeliness



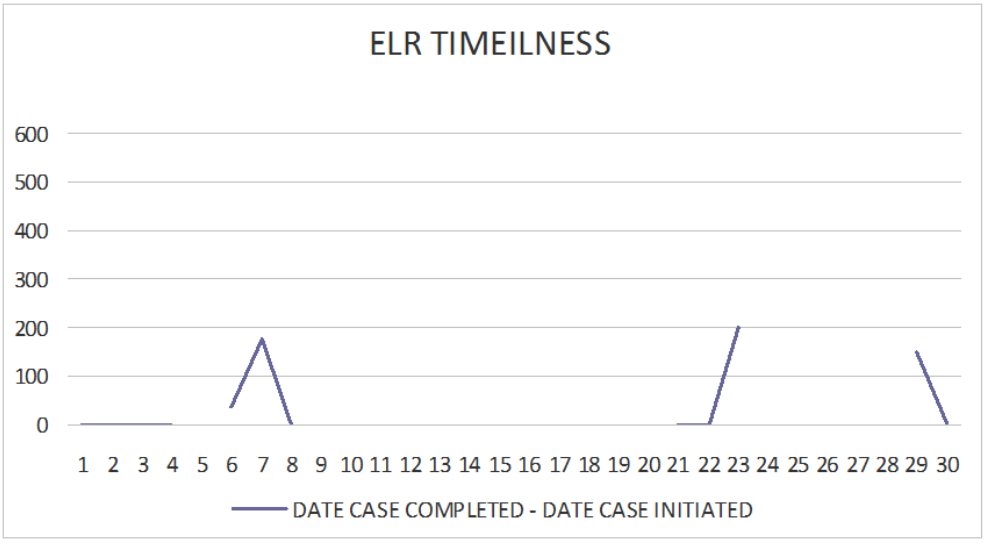
Graph 3. Conventional Timeliness "Residency Time"



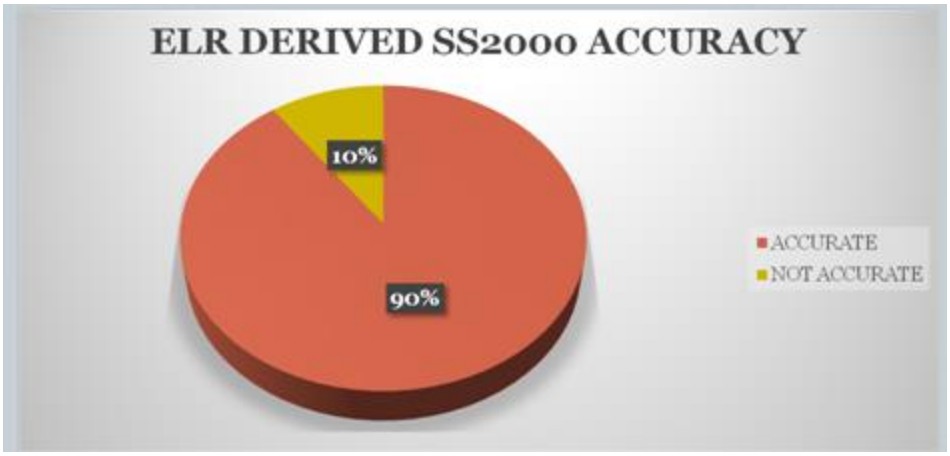
Graph 4. Conventional Timeliness Comparison



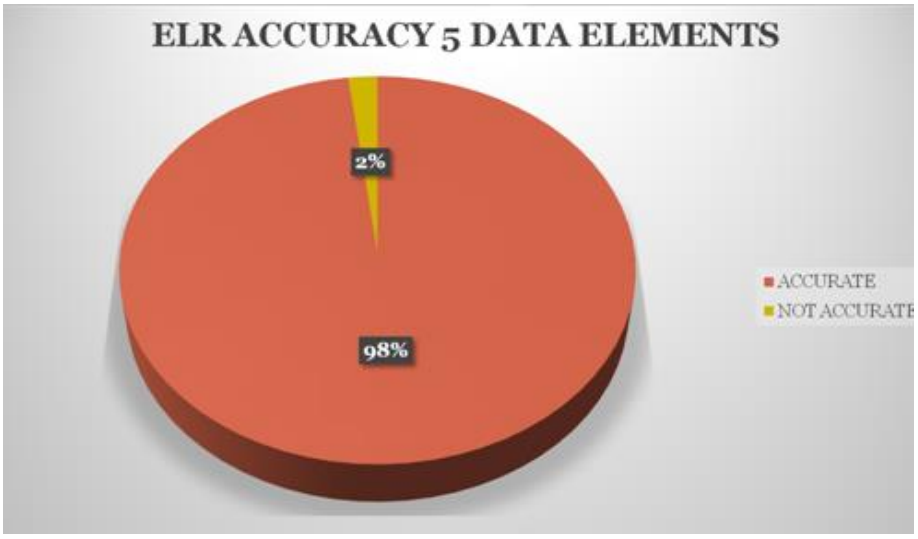
Graph 5. ELR Timeliness



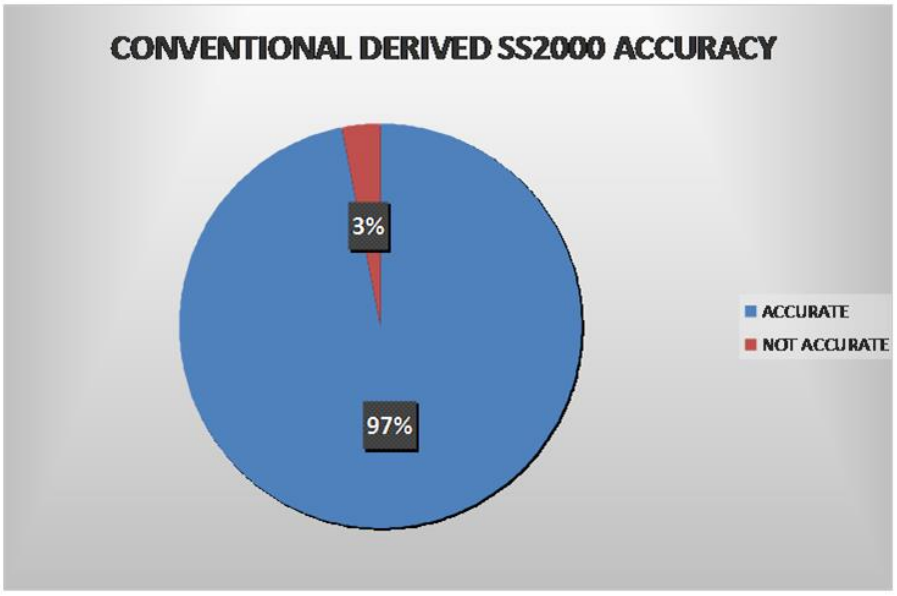
Graph 6. ELR Inaccuracy



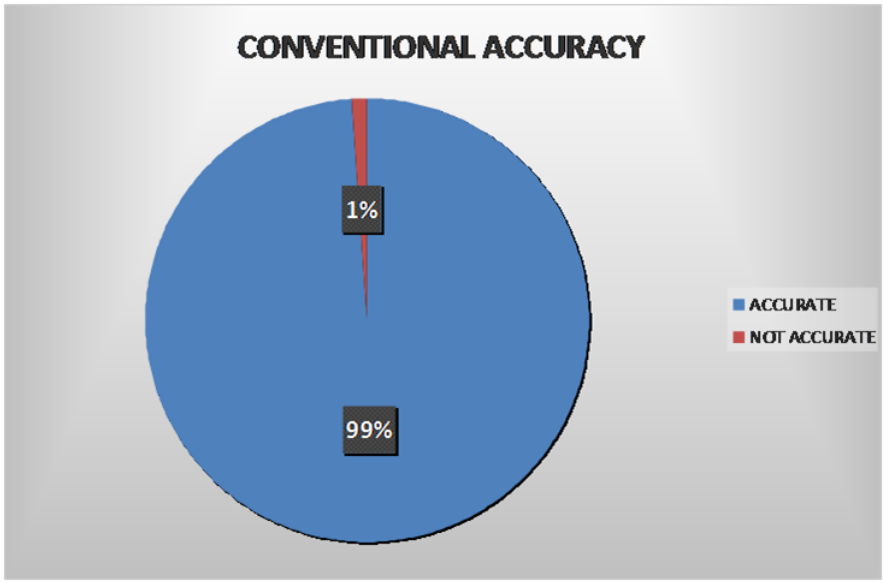
Graph 7. ELR Accuracy



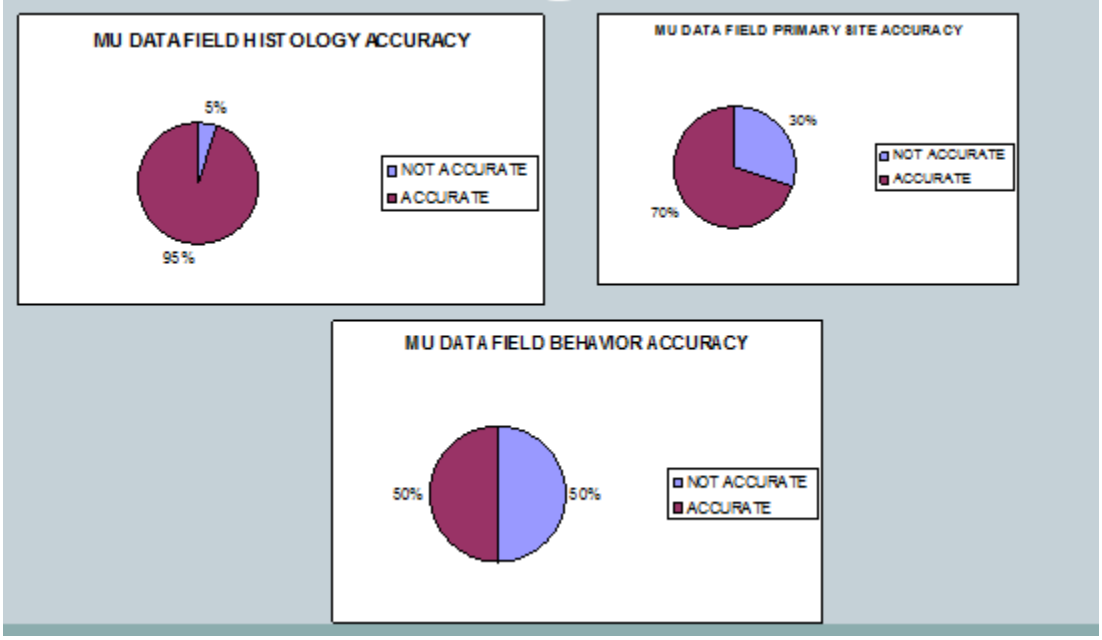
Graph 8. Conventional Inaccuracy



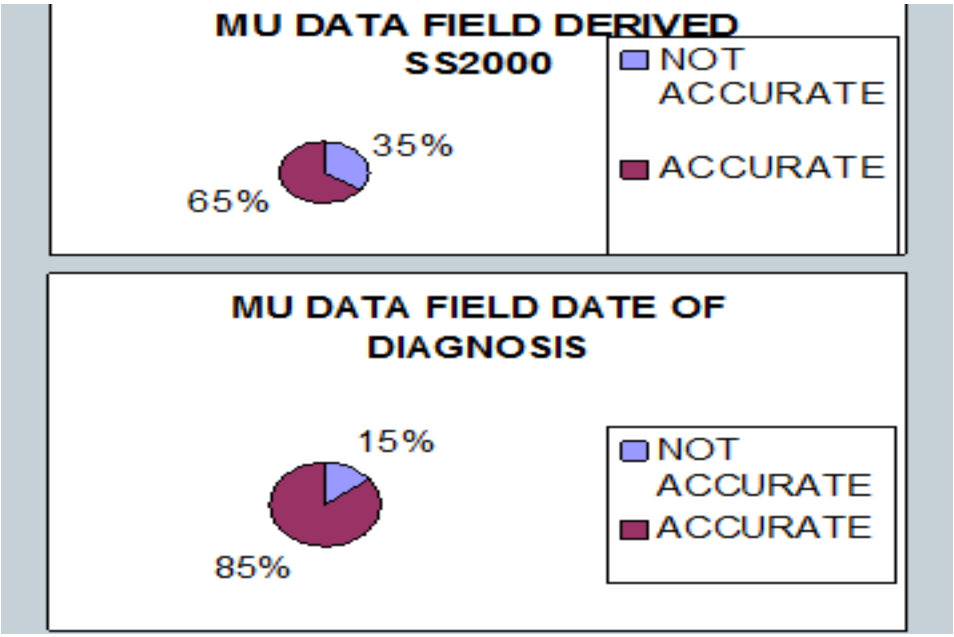
Graph 9. Conventional Accuracy



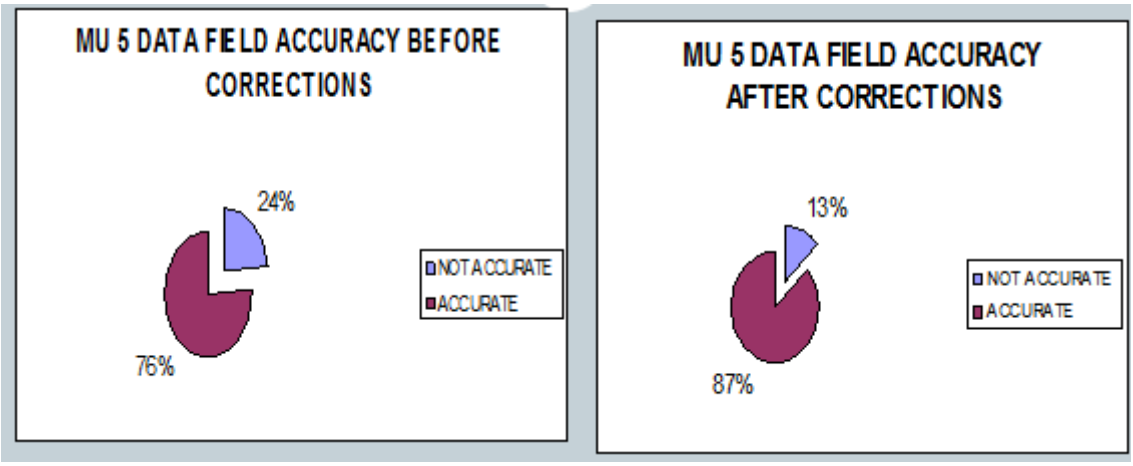
Graph 10. MU Data Items A



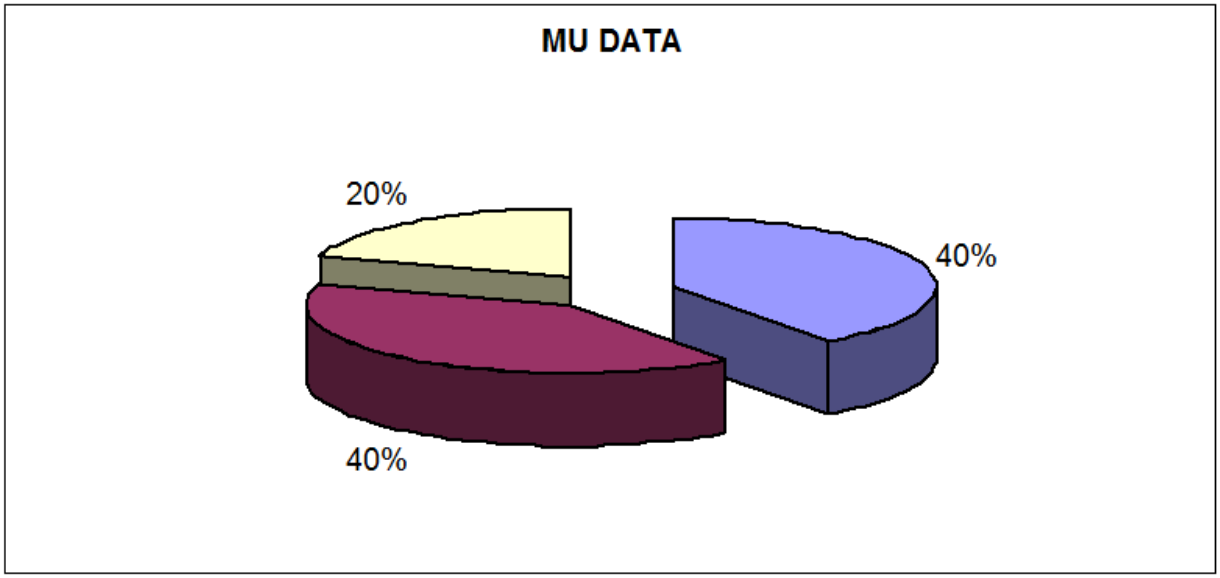
Graph 11. MU Data Items B



Graph 12. MU Comparison of Corrections



Graph 13. MU Data



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