Methicillin Resistant Staphylococcus Aureus Alert Implementation

Miley Cyrus, Kanye West and Lady Gaga

University of Ohio

Methicillin Resistant Staphylococcus Aureus Alert Implementation

**Formulation & Scope of Informatics Problem**

The implementation of electronic health records (EHR) in health care facilities nationwide has been an attempt to improve the quality of care and control health care costs (Barey, 2009). Electronic health records offer an array of benefits to improve patient care, however, the area of decision support is an aspect of the EHR that provides reminders and alerts to improve the diagnosis and care of a patient (Barey, 2009) and is the focus of this quality improvement project. Having the availability of alerts to notify health care providers regarding abnormal labs is a beneficial attribute of an EHR that promotes safe patient care. Furthermore, an alert system focused on identifying patients with a positive MRSA culture would permit enhanced monitoring and treatment interventions for patients who present to an outpatient clinic.

Historically, people infected with MRSA have acquired the bacteria from hospitals and nursing homes which are known as hospital-acquired MRSA (HA-MRSA) (Shareef, Stancilou, & Ahmed, 2007). However, in recent years a new strain has emerged known as community-acquired MRSA (CA-MRSA) that is defined as “the development of the infection by individuals in an outpatient setting or by inpatients discharged within 48 hours of hospital admission without prior history of MRSA (NeVille-Swensen & Clayton, 2011, p. 308). It has been suggested that CA-MRSA will eventually become the dominant MRSA strain in hospitals because of inappropriate treatment in the outpatient setting (NeVille-Swensen & Clayton, 2011). According to Mark (2007), improved community surveillance is a key control measure, making tracking infection rates and trends in the outpatient setting an important aspect of disease control.

With the utilization of the EHR as a mode for generating alerts, the surveillance of CA-MRSA infection trends can be more easily identified and monitored. If key elements are properly documented in the correct areas of the patient chart using standardized terminology, the facility would have a more accurate representation of disease rates and trends.

**Significance of Informatics Problem**

Accurate surveillance of CA-MRSA within the outpatient setting is an important factor to ensure patients are being properly treated and educated regarding the bacteria (Mark, 2007). Currently, the EHR system within this facility does not generate alerts to providers for patients with positive MRSA cultures, nor does the system prompt an independent provider to enter a diagnosis using standardized International Classification of Diseases, ninth revision, Clinical Modification [ICD-9-CM] codes for MRSA. Without proper selection of a standardized code, the diagnosis does not populate under the problem list. Therefore, this important data is not easily available. Additionally, the infection control department is unable to accurately mine data related to MRSA infections if it has not been correctly coded into the system.

It is impossible for the infection control department to query patients who have tested positive for MRSA but do not have an ICD-9-CM entered for the corresponding diagnosis. Additionally, the current process (Appendix A) for reporting MRSA positive culture results is dependent upon the nursing staff to record incidences in paper format which is then forwarded to infection control on a monthly basis. This process does not allow for real-time updates and may not be inclusive of all patients due to human error. As part of an ongoing initiative to control the rate of MRSA and provide education to patients, the infection control department is very concerned with patients who return to the clinic within three months with additional MRSA positive cultures. This raises suspicion that the patient may not have been properly treated the first time, or more education and further follow-up is needed with this patient. According to Mark (2007), increased community surveillance and bolstering infection control measures is needed to moderate the effect of CA-MRSA in outpatient communities.

**Environmental Risk Analysis**

From 1999 to 2006, CA-MRSA has increased seven-fold compared to HA-MRSA in outpatient settings (Klein, Smith, & Laxminarayan, 2009). This illustrates the importance of detection, treatment, and evaluation of MRSA in the outpatient setting. Our outpatient clinic is a combination of a wound clinic and an intravenous (IV) infusion clinic located in the same wing. The wound clinic occupies one large room with two treatment tables, two large supply cabinets, and a single sink. The IV infusion clinic is another large room with five infusion chairs and a curtain separator between each chair. A single medication room shared by both clinics is located next to the nurses’ station and contains an Omnicell medication dispenser. The nurses’ station is located centrally between treatment rooms and contains six computer workstations that all have access to the EHR, two printers, one fax machine, one computer station for scanning, and four multiline telephones.

The current process of tracking patient’s with positive MRSA cultures consists of recording patient data on a paper form located within the nurses’ station; the patient’s data is generally recorded at the initial visit to either the wound or infusion clinic. With the current process, use of a paper tracking record kept at the nurses’ station poses significant risks to patient privacy and confidentiality. As with any paper charting system, records always have the chance of becoming misplaced or taken by unauthorized personnel, “with the percentage varying according to the record processing and tracking procedures of different institutions” (Coiera, 2003, pp.115). Exposure of personal information and violated Health Insurance Portability and Accountability Act (HIPAA) guidelines are at risk.

Since paper documentation can only be used for one task at a time, data availability is problematic. The problem of tracking patient infection data on a designated form that is forwarded monthly to infection control does not allow for real-time updates. The process of manually recording infection data has proven ineffective and has the potential for error. According to Coiera (2003), the absence of any formal structure to guide documentation has an increased opportunity for error, which includes the omission of important or relevant data.

With the development of a MRSA alert feature, the ability to track infection rates and trends would reflect more accurate and timely data. This data would assist health care providers in determining whether more intensive educational interventions are necessary to aide in antibiotics compliance and reduction in community transmission. Furthermore, the alert feature will remind providers to take the necessary action to ensure infection data is captured in the system such as the date of culture results, history of the same infection in the previous three months, history of antibiotics prescribed, and duration of drug therapy. This data has the potential to help the medical team with future courses of treatment, thereby, reducing the reinfection and transmission of CA-MRSA.

**System Analysis**

The Model for Defining Information System Requirements (MDISR) was used as a guide for system analysis and selection for this project. Created by Carole Gassert, the MDISR model provides a guiding framework for deriving requirements for nursing information system (NIS) (Gassert, 1990). The MDISR consists of five elements: Users, Information Processing, Information Systems, Information, and System Goals (Gassert, 1996).

**Users**

User functions, information handling needs, and practice responsibilities are identified to obtain information functions (Gassert, 1996). The user functions consist of users identifying and treating patients that are or have had positive cultures for MRSA. The Information handling need of the system requires accurate and timely alerts of patients with MRSA to prompt established interventions. Practice responsibilities include appropriately responding to the alert and notifying the medical provider to enter the corresponding ICD-9-CM code for MRSA. The nursing information function is to record patients with MRSA on a paper log and medical provider’s information function is to enter the ICD-9-CM code for MRSA.

**Information Processing**

The information processing element combines the user’s informational functions and practice responsibilities to create an output of information processing requirements (IPR) (Gassert, 1996). The nurse and medical provider IPR are categorized by the lab results, history of same infection in the past 3 months, the use of antibiotics that were prescribed and length of time while under antibiotic treatment.

**Information systems**

The inputs include IPRs, computer system characteristics, and existing computer systems; the output comes in the form of systems output (SO) (Gassert, 1996). The computer system characteristics are used in order to track the MRSA positive patients and also in alerting nursing and/or medical staff; the infection control department is alerted once an ICD-9-CM diagnosis has been entered. The existing computer systems do not have this capability. The nursing system output would generate the initiation of reviewing patient labs, medication regiment, wound care, and a patient’s functional status. The medical providers SO are composed of isolation precautions, medication regiment, and updates on a wound’s status.

**Information**

The fourth element involves combining the nursing system outputs with available data to determine the nurse data requirements (NDR) (Gassert, 1996). The NDR is comprised of medical providers’ orders for antibiotics, wound care, isolation, and additional lab work, in addition to, functional status inquiries. The medical provider DR is composed from the lab results, and wound status.

**System Goals**

The final element considers the NDR, NSO, and nursing system goals to establish the nursing system benefits (Gassert, 1990). The nursing system goals relate to accurately and efficiently recording and tracking patient specific data related to MRSA infections to prevent the spread of CA-MRSA. Overall, the goal of this electronic alert system is to track, treat, and prevent further MRSA infection while still recording its compositional aspects with carefully implemented data entry. With the help of the MDISR, the new alert system is on track to continue its ongoing purpose.

**Feasibility of Solution**

The proposed solution to improve tracing of MRSA positive patients within the ambulatory wound clinic is to create an add-on alert system to the clinic’s existing Resource and Patient Management System (RPMS) software. The RPMS is an electronic health record (EHR) that is used in over 190 Indian Health Service (IHS) facilities nationwide (DHHS, 2011). An add-on would be cost effective, involves minimal additional training, and would improve the safety of patients and providers by guiding clinicians in decision-making.

The proposed solution to the current MRSA tracking systems would be a cost effective solution. Since the wound clinic has an existing EHR, costs would be related to maintenance. Implementation costs would have been covered at the initial establishment of the EHR in prior years. After implementing and utilizing RPMS EHR, the Community Health Network of West Virginia (2008) noticed dramatically lower costs compared to commercial vendors. Annually, the RPMS maintenance costs averaged $43,200 compared to commercial maintenance costs of $133, 632 (Community Health Network of West Virginia, 2008).

Training staff to utilize the new alert add-on feature would be minimal since the staff is already accustomed to using the RPMS EHR system. Educational sessions can be brief and even done online. The DHHS (2011) website has links to RPMS recorded web-based sessions, training pamphlets, and options to schedule training in specific areas.

Chen, Enberg, & O’Klein (2007), implemented a successful add-on feature to existing EHR systems in healthcare facilities throughout Sweden. The aim of Julius was to allow clinicians to define what data to record and share and design own layouts within a template (Chen, Enberg, & O’Klein, 2007). Clinician feedback was positive and empowered users in clinical decision-making. Furthermore, Julius did not change the workflow, eliminated repeated data recording, and permitted data collection from various units or facilities regardless of the EHR software used (Chen et al., 2007). As evidenced by Chen et al. (2007), an add-on feature is feasible and beneficial to users and patients. The above benefits are part of the goal for the proposed MRSA tracking system.

**Hardware/Software Selection**

The wound clinic is currently running the RPMS EHR software to manage patient data and will continue utilizing this software; a cost-effective add-on feature will simply be added to the formatting. Hardware including computer stations, network lines and server, fax machines, printers, a scanning machine, and telephones are readily available and accessible for users providing point of care services. The RPMS EHR system aims to have adaptive scalability in its hardware, limitless flexibility in its software applications, and unlimited connectivity in its network (DHHS, 2011). There are over 35 clinical, administrative, and infrastructure applications combined in the RPMS system that is readily available (DHHS, 2011). In addition, information captured during patient visits can be shared across applications eliminating duplication of data and charges for services (DHHS, 2011).

It is important for a facility to be evaluated to ensure an effective technology environment can be supported and accessibility to hardware and software is feasible. The wound clinic meets the general hardware and network requirements listed on the IHS RPMS website (Appendix B) to successfully run the software. The RPMS EHR is currently installed on all user computers and does not require a separate server to run because it is an application (DHHS, 2011). Furthermore, a single library folder is stored on the RPMS server (or another central computer) of which updates for the application can be placed. Updates are automatically downloaded to user computers each time the application is launched (DHHS, 2011).

The RPMS software continually works to improve functionality to the EHR and embraces flexibility of hardware and software configurations, has numerous applications and compatibilities, and utilizes appropriate network communication (DHHS, 2011). These technological components provide comprehensive clinical, financial, and administrative solutions to improving health care. Therefore, this would be a benefit for the wound clinic.

**Implementation Plan**

In order to successfully implement the Continuous MRSA Tracking System, the project team will follow the designated timeline (Appendix C). Additionally, the implementation of the project will follow five phases adapted from the Project Management Institute (Reynolds, 2010) which include: initiation, planning, execution, monitoring, and closing.

**Initiation**

The initiation phase, which will include discussions related to improving the existing MRSA tracking system, is scheduled to begin December 1, 2011 and conclude January 1, 2012. According to Coiera (2003), the initiation phase will clarify the setting and evaluate the abilities and needs of the intended users; therefore, active participation from the users is imperative in identifying their specific needs. During the first week of the initiation phase, nursing staff, physicians, patient care technicians, infection control staff, and the laboratory manager will have the opportunity to discuss needs and ideas for improvement with the project manager. Discussions will include the health care staffs’ computer competencies, problems identified with the current MRSA tracking system, suggestions to improve the system and the staffs’ perception of an efficient and accurate system. In addition to this, a non-participatory method of evaluation will be used by viewing the service dates and notification of MRSA infection. As stated by Coiera (2003), many clinicians may not know what their needs are and using non-participatory methods will bring the advantage of evaluating “based on the realities of the clinical workplace” (p.129). With a combination of both the staffs’ needs and the statistical evidence of the current MRSA tracking, the needs of the system will be identified in order to meet the goal of improving accurate and timely identification of MRSA.

**Planning**

Beginning January 2, 2012 to February 2, 2012 the project manager and committee will discuss the proposed plan for the MRSA tracking project (Appendix D). The project committee will include information technology (IT) programmers, education team, nurse champion, physician champion, project facilitator, two nurse volunteers and two physician volunteers. From the ideas gathered during the initiation phase, the project manager and committee will discuss the feasibility of the alert feature, discuss the projected time needed to create the code, establish marketing strategies for the change, and develop an education plan and criteria to evaluate the new system. The project manager will be responsible for identifying individual skills of each committee member and appropriately allocate tasks (Blair, n.d.) (Appendix E); the projected timeframe for task completion and evaluation will be established with task allocation (Blair, n.d.).

**Execution**

The execution phase will begin February 3, 2012. The IT committee will have one month to create the alert feature within the EHR, and one week to test the alert. By February 17, 2012, the project facilitators will work with the physician and nurse champions to market the new technology and bring awareness of the upcoming change to the wound clinic. Project facilitators are those that will help enable the implementation of the MRSA tracking system. March 5th through the 10th, 2012 the initial testing of the alert system will begin by the nurse and physician volunteers. By March 12, 2012, the volunteers will meet with IT to discuss errors and ease of use. At this time the load test will also be evaluated to determine if the system can handle multiple uses during peak times (Coiera, 2003); based upon the feedback, information technology will have until March 25, 2012 to make necessary changes to the code. Between March 26, 2012 and March 30, 2012, hands-on and interactive education in the test mode will be provided to all staff responsible for responding to the MRSA alerts in preparation for the scheduled ‘go live’ on April 2, 2012. Between April 9th and 13th, 2012, initial system evaluations will be conducted with staff, followed by subsequent evaluations at three, six, and twelve months. Coiera (2003) discussed that systems should be evaluated during the course of implementation in order to capture errors during development. As the software matures, the costs for removing the errors significantly increase (Coiera, 2003).

**Monitoring**

Phases three and four will run simultaneously as illustrated in the task list [Appendix E] (Reynolds, 2011a). The project manager will monitor the user friendliness of the system and ensure user still understand the purpose of the alert feature. Human-technology interaction issues can occur when the technology is “not matched well with the users and the context of the care (Coiera, 2003, p. 65). The MRSA tracking system must be efficient in providing accurate data for MRSA infections as well as timely alerts for those that do not have a history noted or lack cultures for surveillance. The estimated final completion of this project is April 2013 and stakeholders will provide a sign-off on the closing document, which will formally state that the project is complete (Reynolds, 2011b).

**Education Plan**

Beginning March 26, 2012, all employees responsible for using the new MRSA alert system will attend one hour long sessions of interactive education and training to learn how to appropriately respond to alerts. The educational plan will utilize a variety of techniques and tools to promote optimal user education and literacy. According to Johnson, Johnson, & Zhang (2005), “This information is needed because different types of users require different types of interfaces”. Each session will begin with an overview of the importance of accurate documentation, followed by a review of the facilities mission and vision statements.

This initial overview will assist staff in accepting the implementation of a MRSA alert feature as an added benefit to improving patient care, clinical decision-making, and communication rather than additional workload (Mercer & Felt, 2010). The educational team will consist of clinical educators, IT programmers, the nurse and physician champions, and the program facilitator who will guide trainees through a test mode of the EHR system. The EHR training session will provide clinical case scenarios of various instances involving patients with both positive and negative MRSA cultures. By offering training sessions with realistic working situations the users have the ability to ask questions and address potential problems that may arise while using the new system (Mercer & Felt, 2010).

In addition to the interactive training, convenient instructional pamphlets will be provided to all attendees to serve as a quick reference guide. A brief question and answer session will be offered at the end of each session where EHR developers will be available for further elaboration. Following the completion of the course, each employee will complete a proficiency checklist and sign a form verifying their active participation in the class and acknowledge the requirement to adhere to the new process for MRSA reporting. At the completion of each session, all attendees will have the opportunity to provide feedback about the course via an evaluation form (Mercer & Felt, 2010). The comments will be shared with the educational team, and improvement made as needed.

In addition to the in class session, the employees will be provided with an online learning management system which provides additional case scenarios. The user will be asked a series of multiple choice questions related to real-life situations. Users must obtain a minimum score of 85% to be awarded credit for the module. If a user fails to achieve a score of at least 85%, they may review the educational material and repeat the modules. These online modules will be an annual requirement for all employees to complete.

**Evaluation Plan**

According to McGowan, Cusack & Poon (2008) the underlying push towards the implementation for an EHR is to promote a healthier population. In addition to this, the use of technology allows for data, information and knowledge to be both accessible and easily manipulated by a number of individuals (McGonigle & Mastrian, 2009). The goal presented in this paper is to bring ease and accuracy to tracking MRSA infections and prevent unnecessary spread within the wound clinic and among the community. The system would also provide the ability to acknowledge recurring trends and deliver educational interventions appropriately. In order to determine if these goals are met, continuous evaluation is necessary during the course of implementation. As discussed in the implementation plan, periodic evaluation through user satisfaction tests as well as clinical outcomes will help capture errors and prevent failure of the MRSA tracking system (Coiera, 2003).

After one week of implementation and two weeks following the education of the employees, a feedback questionnaire will be distributed for completion by April 13, 2012 (Appendix F). This questionnaire will provide an opportunity for users to provide feedback to the project committee to determine if needs are being met with the alert feature, or if adjustments are need. According to McGonigle and Mastrian (2009), it is important that all members of the team “feel a sense of ownership in order to make the implementation a success” (pp.226). If a user-centered design is not implemented, the technology has the potential to be underutilized and fail to be seen as beneficial (McGonigle & Mastrian, 2009).

Three months after implementing the MRSA alert system, the feedback questionnaire will be redistributed to the users. During this time, MRSA infection statistics will be generated and compared to rates prior to the implementation of the alert feature. This will provide data to evaluate whether there is more documented MRSA infection with the alert system compared to paper documentation. A noted increase in rates would indicate that MRSA infections are being captured in the EHR system with the ICD-9-CM codes and populating in the problem list. As stated by McGowan, Cusack & Poon (2008) in order to determine if the implementation is successful, specific success criteria must be chosen. As stated above, success will be determined if the MRSA tracking rates are increased.

The evaluation process will be repeated at three, six, and twelve months of use of the new system. Each evaluation will be compared to the previous evaluation to determine if the system is truly beneficial to the surveillance of MRSA infections in the wound clinic. These evaluations as described by McGonigle & Mastrian (2009) will help identify design flaws and errors that can improve the transparency of the technology prior to the full implementation.

**Cost-Benefit Analysis**

Based on a combination of benefits from previous implementations of MRSA surveillance and costs associated with implementing an EHR, the potential cost-benefit analysis for the MRSA alert system was created; the cost-benefit analysis was adapted from Community Health Network of West Virginia (2008), Wang, et. al. (2003) and Chaix, Durand-Zaleski, Alberti, & Brun-Buisson (1999).

According to Plowman (2011), monetary costs are the costs that will be incurred in order to implement the system from beginning to end. Based on the needs of the MRSA tracking system, costs would include implementation which includes redesign of the workflow and training (Wang, et. al., 2003), in addition to ongoing maintenance and support. Since the wound clinic has an existing EHR, the software, hardware and product licenses will have already been absorbed. Non-monetary costs are those that will be absorbed during the implementation of the system (Plowman, 2011) and include productivity loss and potential risks of the system. These costs should be temporary and will decrease as the providers become more experienced with the system. From Wang et. al.’s (2003) estimation of cost for an EHR, a list of costs was generated for the proposed process, which were adjusted for the present standard of living (Table 1).

The proposed alert feature will allow timely notification of MRSA positive cultures, as well as, prevent duplicate data and billing charges. Electronic health records allow data to be transmitted among various applications and promote increased productivity resulting in physicians being able to see two additional patients per day averaging $60,000 of revenue per year per provider (DHHS, 2011). Productivity is predicted to initially be decreased until alerts are adapted in to the workflow; however, future predictions indicate an increase. Furthermore, the adjustment to the EHR will help the wound clinic meet eligibility requirements for the American Recovery and Reinvestment Act (ARRA) incentives for adapting electronic medical records which is predicted to be $12,000 at the completion of the project (Protech Networks, n.d.). If the MRSA surveillance is able to accurately track and prevent the spread of MRSA infection to the community, the overall organization will be able to save approximately $12,560 per patient (adapted from Chaix, Durand-Zaleski, Alberti & Brun-Buisson, 1999), which is the approximate cost for treating MRSA positive patients. This cost-benefit analysis confirms the benefits of the system outweigh the costs of the implementation; specifically, indicating an estimated profit of $60,000 per provider per year (Table 1).

**Potential Issues**

The implementation of digital technology within patient care environments is a process that has many obstacles and potential risks to the facility and patients. No system is flawless but the goal is to minimize the risks as much as possible. Security and privacy are potentially the most significant problem with electronic records because there is always a possibility that private information could end up in the wrong hands (Torrey, 2009). A large numbers of health care employees have access to personal patient information within the EHR system. In an attempt to decrease the probability of security and privacy breaches, all users are provided with individual access codes and passwords to enter the EHR. Individual user login credential will allow IT to monitor and control access to the EHR system form unauthorized users. In addition, each employee is required to undergo annual HIPPA training to ensure patient privacy and confidentiality is at the forefront of all operations.

Social and cultural aspect may be influenced with the implementation of an alert system specific to MRSA. According to Winkelstein (n.d., para 1) “advice produced by decision support systems must be understood and acted upon in the context of the overall goals and values of health care.” In addition, “data mining may impact confidentiality or lead to discrimination by identifying subgroups” (Winkelstein, n.d., para. 1). In order to minimize these negative impacts the four principle of bioethics developed by Beauchamp and Childress will be emphasized, and they include: autonomy, beneficence, nonmaleficence, and justice (Winkelstein, n.d.)

Economic costs are a potential issue because EHR systems are costly to implement and maintain. The wound clinic is located in a rural, underserved community which can be beneficial when seeking funding. According to the Rural Assistance Center (2011), facilities that serve and underserved population, provide comprehensive services, offer a sliding fee scale, have a governing board, and have an ongoing quality assurance program meet the requirements for a Federally qualified health center, which allows enhanced Medicaid and Medicare reimbursement. By implementing the MRSA alert system to allow enhanced surveillance of MRSA infections, this qualifies as an on ongoing quality assurance program.

References

Acker, B., Bronnert, J., Brown, T., Clark, J. S., Dunagan, B., Elmer, T., Tegen, A. L. (2011). Problem list guidance in the EHR. *Journal of AHIMA / American Health Information Management Association, 82*(9), 52-58.

Ash, J.S., Berg, M., & Coiera, E. (2004). Some unintended consequences of information technology in health care: The nature of patient care information system-related errors. *Journal of the American Medical Informatics Association, 11(2),* 104-112.

Barey, E. (2009). The electronic health record and clinical informatics. In D. McGonigle & K. Mastrian (Eds.), *Nursing informatics and the foundation of knowledge* (219-237). Sudbury, MA: Jones and Bartlett.

Blair, G.M. (n.d.) Planning project. Retrieved from http://www.ee.ed.ac.uk/~gerard/Management/art8.html

Boston-Fleischhaur, C. (2008). Enhancing Healthcare Process Design With

Human Factors Engineering and Reliability Science, Part 2: Applying the

Knowledge to Clinical Documentation Systems. *The Journal of Nursing*

*Administration 38(2), pp. 84-89.*

Centers for Disease Control and Prevention [CDC], 2011. International classification of disease, ninth revision, clinical modification (ICD-9-CM). Retrieved from http://www.cdc.gov/nchs/icd/icd9cm.htm

Chaix, C., Durand-Zaleski, I., Alberti, C., & Brun-Buisson, C. (1999). Control of endemic methicillin-resistant Staphylococcus aureus: A cost-benefit analysis in an intensive care unit. *The Journal of the American Medical Association, 282*(18), 1745-51. doi: 10.1001/jama.282.18.1745

Chen, R., Engberg, G., & O’Klein, G. (2007). Julius-a template based supplementary electronic health record system. *BMC Medical Informatics and Decision Making, 7(*10)*,* 1-11.

Coiera, E. (2003). *Guide to health informatics.* London, England: Hodder EducationCommunity

Health Network of West Virginia. (2008). RPMS-EHR. Retrieved from, http://www.chnwv.org/Solutions/RPMSEHR/Investment/tabid/117/Default.aspx

Gassert, A. (1996). A model for defining information requirements. In M.E. Mills, C.A. Romano, & B.R. Heller (Eds.)*, Information Management in Nursing and Healthcare* (pp. 7-15). Springhouse, PA: Springhouse Corporation.

Gassert, A. (1990). Structured analysis: methodology for developing a model for defining nursing information system requirements. *Advance Nursing Science, 13*(2), 53-62.

Holden, R.J. (2011). What stands in the way of technology-mediated patient safety improvements? A study of facilitators and barriers to physicians’ use of electronic health records. *Journal of Patient Safety, 4(*4), 193-203.

Johnson, C. M., Johnson, T. R., Zhang, J. (2005). A user-centered framework for

redesigning health care interfaces. *Journal of Biomedical Informatics 38, pp.*

*75-87.*

NeVille-Swensen, M., & Clayton, M. (2011). Outpatient management of community-associated methicillin-resistant staphylococcus aureus skin and soft tissue infection. *Journal of Pediatric Health Care: Official Publication of National Association of Pediatric Nurse Associates & Practitioners, 25*(5), 308-315. doi:10.1016/j.pedhc.2010.05.005

Mark, D. (2007). Community-associated MRSA: disparities and implications for AI/AN communities. *The IHS Primary Care Provider, 32*(12), 361-365.

McGonigle, D., Mastrain, K. (2009). *Nursing informatics and the foundation of*

*knowledge*. Sudbury, Massachusetts: Jones and Bartlett Publishers, LLC.

McGowan, J. J., Cusack, C.M., & Poon, E.G. (2008). Formative evaluation: A critical component in HER implementation. *Journal of Informatics in health and biomedicine,* 15, 297-301. doi:10.1197/jamia.M2584

Mercer, L., Felt, P. (2010). Designing your EMR training program. Retrieved from http://www.divurgent.com/images/EMRTrainingProgram.pdf

O'Brien, J., Greenhouse, P. K., Schafer, J. J., Wheeler, C. A., Titus, A., Pontzer, R. E., Wolf, D. (2008). Implementing and improving the efficiency of a methicillin-resistant staphylococcus aureus active surveillance program using information technology. *American Journal of Infection Control, 36*(3), S62-6.

Plowman, N. (2011). Writing a cost benefit analysis. Retrieved from http://www.brighthub.com/office/project-management/articles/58181.aspx.

Protech Networks. (n.d.). Understanding AARA EMR incentives and ROI. Retrieved from http://www.blackbookrankings.com/pdf/Understanding-the-ARRA-EMR-Incentive.pdf

Randle, J., & Bellamy, E. (2011). Infection control nurses’ perceptions of managing MRSA in the community. *Journal of Infection Prevention, 12*(4), 142-145. doi:10.1177/1757177411407535

Reynolds, D. (2010). The initiation stage in project management. Retrieved from

http://www.brighthub.com/office/project-management/articles/1672.aspx

Reynolds, D. (2011a). Looking at project monitor and control. Retrieved from http://www.brighthub.com/office/project-management/articles/1675.aspx

Reynolds, D. (2011b). Looking at project monitor and control. Retrieved from http://www.brighthub.com/office/project-management/articles/1676.aspx

Rural Assistance Center.(2011). Federally Qualified Health Centers. Retrieved on December 2, 2011 from http://www.raconline.org/info\_guides/clinics/fqhc.php

Torrey, T. (2008, February 10). Limitations of electronic patient record keeping: lack of

standardization. [ Online forum]. Retrieved from http://patients.about.com/od/electronicpatientrecords/a/limit-standards.htm

Torrey, T. (2009, February 19). Limitations of electronic patient record keeping:

privacy and security issues [Online forum]. Retrieved from

http://patients.about.com/od/electronicpatientrecords/a/privacysecurity.htm

U.S. Department of Health and Human Services, The Indian Health Service (2011). *Resource and patient management system (RPMS).* Retrieved from, http://www.rpms.ihs.gov

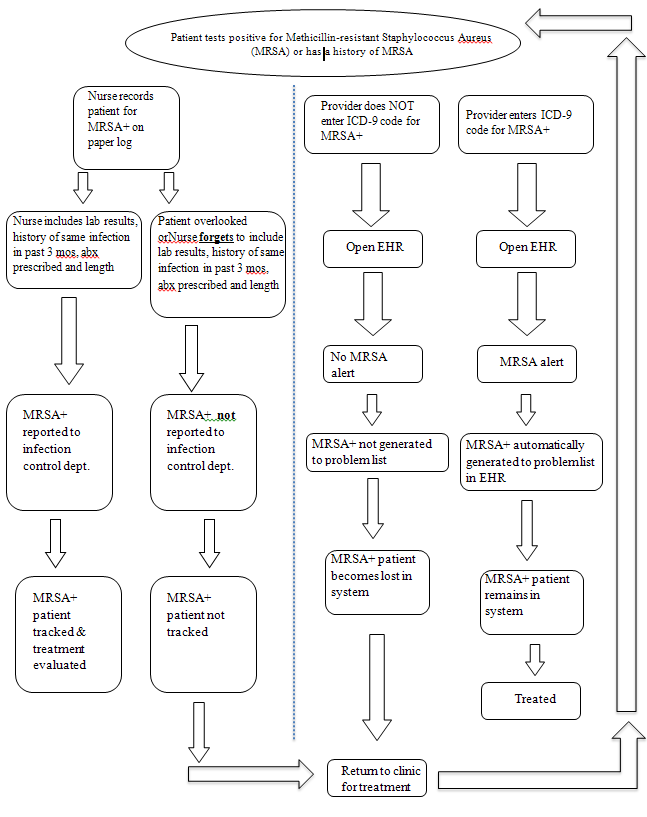
U.S. Department of Health and Human Services, The Indian Health Service (2011). *Resource and patient management system: A busy day in an Indian health clinic.* Washington, D.C.: Government Printing Office

Wang, S. J., Middleton, B., Prosser, L. A., Bardon, C. G., Spurr, C. D., Carchidi, P. J., Bates, D. W. (2003). A cost-benefit analysis of electronic medical records in primary care. *American Journal of Medicine, 114*(5), 397-403.

Winkelstein, P. (n.d.) Ethical and social challenges of electronic health information. Retrieved December 2, 2011 from http://ai.arizona.edu/mis596a/book\_chapters/medinfo/Chapter\_05.pdf

Appendix A

Current Process Flow Sheet

****

Appendix B

RPMS EHR Software Requirements\*

* File 200 must be current
* Fileman 22/Kernel 8 with latest patches
* Caché operating system
* Pharmacy v4.5 Suite
* Patient Information Management System (PIMS) version 5.3 (this includes Admit/Transfer/Discharge (ADT), Scheduling, and Sensitive Patient Tracking)
* Three additional VHA applications that are required to run in the background:
* Lexicon v2.0
* Visit Tracking v2.0
* VA Health Summary v2.7

RPMS and VHA Software Compatibility\*

* Text Integration Utility (TIU) v1.0 (a template-based notes authoring application)
* Laboratory v5.2
* Women's Health v2.0
* Immunization v8.0
* Radiology v5.0
* Pharmacy Inpatient v5.0
* Pharmacy Outpatient v7.0
* Order Entry/Results Reporting (OE/RR) v3.0
* VistA Imaging version 3.0 (a separate project is underway to make VistA Imaging available to I/T/U facilities)

\*Department of Health and Human Services website (2011).

Appendix C

Proposed Timeline December 1, 2012 – April 2013

1. December 1, 2012- December 8, 2012- *Open Forum between Project Manager, Stakeholders and Users*
2. January 1, 2012- ***Initiation Phase*** *complete- Project Manager and Stakeholders*
3. January 2, 2012-January 6, 2012 ***Begin Planning Phase****- Project Manager and Committees*
   1. Discuss individual skills
   2. Brainstorm ideas
4. January 9, 2012-*Project Manager to begin developing formal list of tasks, order and time frame* (Project committees will provide feedback and suggestions as necessary)
5. February 2, 2012- *Project Manager will assign tasks and post timeline for project committee and stakeholders.*
6. February 3, 2012- ***Begin execution phase***
   1. February 3, 2012-March 3, 2012- Information technology (IT) committee
      1. Create code for MRSA tracking system
   2. February 17, 2012- Project Facilitators and Champions
      1. Market new MRSA tracking system
   3. March 5- March 10, 2012- IT committee, Champions, Volunteers
      1. Load test- March 5 & 6
      2. MRSA tracking system unit test
   4. March 12, 2012- IT committee, Champions
      1. Discuss errors and user needs
      2. Evaluate load test
   5. March 12-March 25, 2012- IT committee
      1. Create changes to code
   6. March 26-March 30, 2012- Project facilitator, Champions, Education Team, Users
      1. Educate users on program
      2. Users to be checked off for competencies
      3. Sign agreement
      4. Users to complete online education
   7. April 2, 2012- Project facilitator, champions, IT, users
      1. System ‘goes live’
      2. Facilitator, champions, IT, Education team to provide users with help as necessary
7. ***Evaluation***- IT, Project Manager, users- April 9, 2012- April 13, 2012
   1. Questionnaires- User satisfaction studies
   2. Summative evaluation- review clinical outcomes, economic analyses
   3. To occur again three months (July 2012), six months (December, 2012) and one year (April 2013).
8. ***Closing-*** Project Manager and Stakeholders- April 5, 2013
   1. Complete closing document

Appendix D

Proposed Process Flow Sheet

Proposed Process Flow Sheet

No cultures/ provider selects no

Order cultures

Yes: Generate to problem list and generate ICD 9 code

Known MRSA (provider must select yes/no)

Alert provider of positive culture. Generate to problem list and generate ICD-9code

Generate alert for need of cultures.

Generate alert for need of cultures

Alert generates to health care provider.

Patient chart open

Methicillin-resistant Staphylococcus Aureus Surveillance System

Stop

Internally capture date of culture. Is this within last three months?

Internally capture date of positive culture. Is this within last three months?

Positive, ICD-9 code

Negative

**SEARCH history, microbiology labs** for “CUES”- MRSA positive, MRSA negative, ICD-9 code

No cues

Stop

Yes

Yes

No

No

**Opened today**

Appendix E

Proposed Tasks

|  |  |  |
| --- | --- | --- |
| Task | Assigned to | To be completed |
| Review user needs, system environment, user capabilities to brainstorm ideas for MRSA tracking system | Information technology (IT) committee | February 10, 2012 |
| Develop posters and education materials regarding MRSA infections. | Project Facilitators | February 16, 2012 |
| Create graphs for current MRSA tracking. | Project Facilitators | February 16, 2012 |
| Send formal email regarding the upcoming change to MRSA tracking system to nurses, physicians and patient care technicians. Post education materials and poster in staff break room | Nurse Champion | February 17, 2012 |
| Develop code for MRSA tracking system | IT | March 3, 2012 |
| Educate nurse and physician volunteers and education team on MRSA tracking system | IT | March 4, 2012 |
| Load test | Nurse & Physician volunteers | March 5-6, 2012 |
| System test | Nurse & Physician volunteers | March 5-10, 2012 |
| Edit code based on tests | IT | March 25, 2012 |
| Develop educational materials for MRSA tracking system for physicians, nurses and patient care technicians | Project facilitators | March 25, 2012 |
| Develop online education for physicians, nurses and patient care technicians | IT | March 25, 2012 |
| Develop user questionnaires | Nurse Champion | April 8, 2012 |
| Distribute user questionnaires | Nurse and Physician Champion | April 9, 2012 |
| Gather questionnaires | Project Facilitator | April 13, 2012 |
| Evaluate questionnaires and develop needed changes | Project Manager and IT | May 1, 2012 |
| Distribute user questionnaires | Nurse and Physician Champion | July 9, 2012 |
| Gather questionnaires | Project Facilitator | July 13, 2012 |
| Evaluate questionnaires and clinical outcomes. Create cost-benefit analysis and develop needed changes | Project Manager and IT | August 1, 2012 |
| Distribute user questionnaires | Nurse and Physician Champion | December 9, 2012 |
| Gather questionnaires | Project Facilitator | December 13, 2012 |
| Evaluate questionnaires and clinical outcomes. Create cost-benefit analysis and develop needed changes | Project Manager and IT | January 1, 2012 |
| Distribute user questionnaires | Nurse and Physician Champion | March 9, 2012 |
| Gather questionnaires | Project Facilitator | March13, 2012 |
| Evaluate questionnaires and clinical outcomes. Create cost-benefit analysis and develop needed changes | Project Manager and IT | April 2, 2012 |
| Sign-off document complete | Project Manager and Stakeholders | April 5, 2012 |

Appendix F

User Satisfaction

On a scale of 1-5, with 5 indicating you strongly agree and 1 indicating you strongly disagree, please rate the following statements related to the MRSA alert system.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | 1 | 2 | 3 | 4 | 5 |
| 1. The alerts allow me to provide the necessary education to patients in need. |  |  |  |  |  |
| 1. I am able to understand the alerts generated by the electronic health record and respond accordingly. |  |  |  |  |  |
| 1. The alerts are easily manipulated and do not disrupt my workflow. |  |  |  |  |  |
| 1. I believe the alerts are necessary in improving MRSA tracking. |  |  |  |  |  |
| 1. I believe the alerts generated by the electronic health records for MRSA positive patients needs improvement. |  |  |  |  |  |

If you agree with statement 5, please provide specific improvements.

Additional comments:

Appendix G

Executive Summary

**Background**

Recently, the outpatient wound clinic has seen an increasing population infected with methicillin-resistant Staphylococcus aureus (MRSA) infections. In an effort to monitor and effectively treat these patients, an electronic alert and protocol system within the electronic health record (EHR) has been proposed. The process would be incorporated into the current practice, thus allowing the capability of tracking MRSA positive patients more efficiently. This system is focused on identifying patients with positive MRSA cultures, which will provide enhanced monitoring, treatment, and teaching interventions for patients who present to an outpatient setting.

**Summary of Assessment Findings**

The current process for reporting a MRSA positive culture result is dependent upon the nursing staff to record incidences in paper format, which is then forwarded to infection control on a monthly basis. This process is not up-to-date and may not be inclusive of all patients due to human error. As part of an ongoing initiative to control the rate of MRSA and provide education to patients, the infection control department is very concerned with patients who return to the clinic within three months with additional MRSA positive cultures.

The EHR system within the clinic currently does not alert providers of patients with positive MRSA cultures. The system does display microbiology results in the lab section but does not prompt an independent provider to enter an ICD-9-CM diagnosis codes for MRSA. Without proper selection of a standardized code, the diagnosis for MRSA does not populate under the problem list; therefore, this vital data pertinent to all providers treating the patient is not easily noticeable under patient history.

Patients with positive MRSA cultures that do not have the correct ICD-9-CM code entered for the corresponding diagnosis pose a problem for infection control. Without coded, standardized diagnoses the infection control department is unable to accurately mine data related to MRSA incidence and prevalence during routine surveys. This inability to accurately monitor infection rates interferes with the success of an ongoing quality assurance program.

**Goal**

The goal of the proposal is to develop a comprehensive electronic decision support system to provide automated alert and protocol reminders for patients with positive MRSA cultures in an outpatient ambulatory setting. This system will assist health care providers in effectively and accurately documenting and tracking MRSA positive patients, thereby decreasing the transmission of the bacteria and providing accurate results to infection control.

**Description of Proposed Change/Innovation**

1. Present proposal to the Director of Nursing (DON) and the Director of

Administration

1. DON present the proposal and get the approval from the Board of Directors at

Administration

1. Employ additional nurses that share the same values and mission in implementing a

MRSA tracking system

1. Orient and train nurses, and additional training for nurses who do not exhibit proficiency in using the new program experiences
2. After nurse orientation, provide feedback data to the project team in order to implement necessary changes to the proposal.

**Brief Proposed Timeline**

The implementation team will follow a timeline, which will include five phases adapted from the Project Management Institute (Reynolds, 2010) to include: initiation, planning, execution, monitoring, and closing. The project is scheduled to begin during the week of December 1, 2011 where the project manager, stakeholders, and users will hold open discussion. The planning phase will start January 2 and run through February 2, 2012, which will allow the project manager, stakeholders, and users to unveil any necessary changes to the plan. The execution phase will begin February 3, 2012 with initial load testing by running from March 5th through the 10th. From March 12 through March 30th the project manager, IT committee, users, volunteers make finalizations to program and undergo training in preparation for the April 2, 2012 ‘go live’. Monitoring and evaluation of the program will continue at period intervals during the first year of implementation. Final closing of the project is scheduled for April 5, 2013.

**Conclusion**

The increasing numbers of MRSA positive patients seen within the outpatient setting raises much concern for community safety. By establishing an electronic MRSA alert system we hope to have a better understanding of MRSA rates and infection trends in the community. The committee invites the staff to review our proposal, and disclose any questions or concerns with us in hopes that our plan will be successfully implemented and benefit all involved.

*Table 1. Costs for developing the Active MRSA Tracking System in US dollars (per provider, per year)*

|  |  |  |
| --- | --- | --- |
|  | Amount | Reference |
| Monetary costs |  |  |
| Support and maintenance (yearly) | 8,500 | \* |
| Implementation (training, redesign) | 4,400 | \*\* |
| Non-monetary costs |  |  |
| Productivity loss | 11,200 | \*\* |
| Benefits |  |  |
| Productivity gain | 60,000 | \*\*\* |
| AARA Incentive (2013) | 12,000 | \*\*\*\* |
| Decreased hospital costs (per patient) | 12,560 | \*\*\*\*\* |

Note. \*Data from Community Health Network of Virginia (2008)

\*\*Data from Wang, et. al. (2003)

\*\*\*Data from DHHS (2011)

\*\*\*\*Data from Protech Networks (n.d.)

\*\*\*\*\*Data from Chaix, Durand-Zaleski, Alberti, Brun-Buisson (1999)