406-DL Clinical Decision Support Systems

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Assignment 2

EHR Meaningful Use Clinical Decision Support Rule
Pneumonia Core Measures

MEANINGFUL USE

The Centers for Medicare & Medicaid Services (CMS) finalized an EHR incentive, with the goal of demonstrating meaningful use of a certified EHR. The program, in concert with the HITECH act, focuses on quality measures reporting.

In order to qualify for Stage I awards, in the first round of Medicare and Medicaid EMR bonuses for 2011-12, physicians must meet ALL 15 CORE objectives and at least five of 10 "menu set" items. Among the CORE set of objectives, the requirement to implement at least ONE Clinical Decision Support Rule within an EHR is the basis for this paper. The selected CDS rule must be relevant to a high clinical priority condition and must include the ability to track compliance with the rule. However, tracking compliance is not part of the Stage I measure.

The incidence of community-acquired pneumonia (CAP) in the United States ranges from 4-5 million cases annually, with about 25% requiring hospitalization. It is the 6th leading cause of death among patients over the age of 65. The importance of measuring processes and outcomes of care for patients who present to the hospital with CAP is supported by literature that highlights increasing risks among an aging population, changing epidemiology, and spiraling healthcare costs. Evidence-based guidelines for management of CAP have been a major focus of collaboration between the Infectious Disease Society of America, the American Thoracic Society, The American Society of Emergency Room Physicians, and The Centers for Disease Control and Prevention. In May 2001, the Joint Commission announced that one of the four initial core measurement areas for hospitals was CAP, and hospitals began collecting data on these 5 measurements for CAP patient discharges beginning July 1, 2002. In 2004, CMS and the Joint Commission agreed to align their goals and create one common set of pneumonia measures, within a document called the Specifications Manual for National Hospital Quality Measures, which would be used by both organizations. However, the tracking and reporting of core measurement data is a tremendous unfunded burden to hospitals. To receive some reimbursement for this labor, our choice for implementing a clinical decision rule, is the Pneumonia Core Measure Set. This CDS rule will, specifically, address the medical management of adult patients presenting with symptoms, signs, and test results consistent with community-acquired pneumonia. It will not apply to nosocomial infections, neutropenic pneumonia, HIV infection, bioterrorism-related infections, or severe acute respiratory syndrome.

Implementing the Pneumonia Core Measure set as a clinical decision support rule will demonstrate "Meaningful Use" in the following ways:

- It relates to a high priority hospital condition
- It will improve the quality and safety of patient care, relating to the management of CAP, improve efficiency of care, and reduce health care disparities
- It will improve care coordination across the institution (i.e. ER, inpatient unit, ICU, outpatient setting)
- It is measurable
- Results are reportable
- It will improve population and public health

HOW PATIENT OUTCOMES WILL IMPROVE

The 2007 joint CMS/Joint Commission Community-Acquired Pneumonia Core Set is included in the Specifications Manual for National Hospital Quality Measures and referenced in Appendix A.

One of the measurements of the CAP core set focuses on the timely administration of antibiotics. Specifically, when antibiotics are administered within 4 hours of patient arrival to the hospital, mortality is reduced by 15%.[1] However, when the time frame for administering antibiotics is expanded from 4 hours to 6 hours from arrival, patients, who ultimately receive a different diagnosis later in the evaluation, may avoid unnecessary treatment, without compromising their outcomes.[2,]

Another measurement within the core set requires that blood cultures be performed before the administration of the first dose of antibiotics for suspected CAP. Forty percent of patients with severe pneumonia will have their antibiotic regimen adjusted as a result of final microbiological results. [3] [4]

Specific antibiotic regimens, focusing on severity of illness, associated risk factors, suspected pathogens, prior hospitalizations and/or institutionalization, and appropriate site of care (outpatient, inpatient, ICU), are included in the core measurement set for CAP. Guideline-recommended antibiotics can reduce the risk of death from pneumonia up to 30% compared with non–guideline-recommended antibiotics and are more likely to be given in a timely manner. [5]

Smoking status must be assessed and documented upon presentation of every patient with symptoms of CAP, since smokers are 2 to 3 times more likely to contract pneumonia and are at greater risk of more severe disease, compared to non-smokers.[6] Smoking cessation counseling must be provided and documented.

Pneumococcal vaccination has a 40% overall efficacy in preventing pneumonia in high risk patients, as well as efficacy in attenuating the complications of pneumococcal pneumonia (i.e. bacteremia and meningitis), reducing the length of hospitalization, and reducing mortality from the disease. [7] Therefore, one of the measurements in the CAP core set is administering pneumonia vaccination to patients meeting criteria.

Similarly, there is a documented 50% reduction in the rate of pneumonia, hospitalization, and death in patients who have received influenza vaccination[8]. All patients meeting criteria must be administered influenza vaccination.

Performance measurements for CAP are part of the Hospital Inpatient Quality Measures of the Leapfrog Group (2010), CMS (2010), the Joint Commission (2010), Hospital Quality Alliance (2010), and National Quality Forum (2003). A powerful evidence-based clinical decision support system will empower local hospital CQI initiatives and ensure acceptable reimbursement.

THE CONCEPT - CDSS MODEL

In accordance with the Stage 1 EHR meaningful use final rule, we will implement a Clinical Decision Support System (CDSS) in our ED which will focus on effectively evaluating and treating patients with suspected CAP. Our goal is to provide our clinicians with a safe, standardized, cost-effective algorithm which will ensure that patients with CAP receive the most appropriate treatment at the earliest possible stage.

A CDSS tool, which recommends therapeutic options for pneumonia, as well as offer criteria for hospitalization, presents an opportunity to achieve the CAP core measure goals, while also establishing meaningful use of the EHR. Our process will address the CAP Pathway for patients entering through the Emergency Department (ED) and our CDSS will be focused on the successful completion of the Pneumonia Quality measure set as defined above. (see Appendix B)

CDSS KNOWLEDGE BASE & LOGIC

To illustrate a logical example of structure for the Pneumonia Core Measurements in our CDSS, we will look more closely at one of the performance measurements, i.e. **influenza vaccination (PN-7)**, and describe the knowledge base, inferencing method, and output to the practicing clinician.

The CDSS knowledge base for PN-7 will be derived from case studies and expert opinion. A retrospective study by Spaude et al. found that, in patients 18 years or older hospitalized with CAP, prior influenza vaccination, in the current or most recent influenza season, reduced the rate of all-cause in-hospital mortality. [9] With Level III (Strong Recommendation) evidence, the Infectious Disease Society of America/ American Thoracic Society proposes that, "during the fall and winter, influenza vaccine should be offered to all persons at hospital discharge or during outpatient treatment."[10]

The inferencing method for PN-7 will be data driven, as compared to a time driven method, which will be used for our PN-3a and PN-3b (timing of blood cultures) and PN-5c measurements (timing of antibiotic administration). We will model the rules and logic for influenza vaccination within our CDSS, against the appropriate order set within the ZyncHealth™ product, *ZyncOrder.* We have chosen *ZyncOrder*, because it is an industry standard that continually vets the literature and provides timely updates from experts. As our CDSS will span the patient's hospital course from the ED through admission to discharge, we will incorporate elements of many *ZyncOrde*r sets, including "the Adult CAP Emergency Department Treatment", "Adult CAP Admission to Med/Surg", and "Adult CAP discharge" sets. The ZyncHealth logic behind an order for influenza vaccination is referenced in Appendix C.

The action reminder for influenza vaccination will reappear on consecutive CAP order sets throughout the patient's hospitalization, up to, and including the discharge order set, until either Option #2 (i.e. order influenza vaccine) or Option #3 (document reason for not ordering influenza vaccine) is completed. Each order set reminder will include a tab displaying the level of evidence supporting the recommendation and a direct link to the relevant literature, so the ordering clinician(s) can make an informed decision regarding patient care.

IMPLEMENTING FOR SUCCESS

According to Osheroff et al., there are 'five rights' of an effective CDSS. The "CDS should be designed to provide the right information to the right person in the right format through the right channel at the right time (i.e., when the information is needed). [11] Additionally, Kawamoto et al., conducted a research literature review and concluded that the following four factors are associated with successful CDS deployment: [11]

1. Computer-based decision support is more effective than manual processes for decision support

2. CDS interventions that are presented automatically and fit into the workflows of the clinicians are more likely to be used.

3. CDS that recommends actions for the user to take are more effective than CDS that simply provides assessments.

4. CDS interventions that provide information at the time and place of decision making are more likely to have an impact.

With these recommendations as guidelines, we will implement our CDSS using an Internet-based, commercially available product, which will be integrated into our EHR. The knowledge used in our CDSS will be stored in a central repository and accessed and incorporated into our local EHR, as needed.

Some of the factors that influenced our choice are financial constraints, and how well the product will interface with the clinical system we already have in place. Other important criteria for selecting our CDSS are: the system must be able to improve the efficiency of our ED staff, assist in providing accurate diagnosis and protocol based treatment, as well as provide non-intrusive support to our clinicians throughout various stages of the ED encounter. We believe our CDSS will be most effective if nurses and prescribers receive the information automatically at the point of care. Clinicians will ultimately have the opportunity to accept or reject the suggested course of action.

For our influenza CDS, we will follow the example presented by Osheroff et al., which suggests that an effective CDS approach is to design standing orders for the nurse as part of the discharge process. [11]

There will be some workflow changes in the ED which we believe will enhance the current process. For example, we will need to assign dedicated triage nurse(s) to the ED who is/are trained to rapidly identify suspected cases of pneumonia; determine acceptable turnaround time from registration to triage to nursing assessment to being evaluated by a prescriber; a guideline regarding x-ray result turnaround time also needs to be established.

COST AND TIME ESTIMATES

Determining design, implementation and maintenance cost will occur during our CDS development phase. Post-implementation evaluation of how the CDS has addressed the core CAP measures will help us to determine the relevancy and effectiveness of the CDS. To accomplish this, we will look at factors such as evidence of alert fatigue and the number of times clinicians ignore the suggested recommendations.

Our CDSS should reduce health care cost by reducing the number of patients who present to our institution with morbidity related to CAP and increase the number of patients who benefit from preventive care. Cost can be measured in the amount of dollars spent treating CAP, reduced length of hospital stays related to CAP, medication cost and cost of hiring additional ED staff and providing training . Additional cost to consider involves the cost of IT and project management personnel, programmers and clinician time spent on review of the CDSS content. We estimate that our development cost will be minimal as the product we have chosen uses an existing database. Prior to our CDS deployment, we will conduct testing and validation, during which time we will also utilize key ED nursing and prescriber staff.

How well we are able to integrate the product into our clinicians' workflows will be a key indicator of how successful the implementation has been. To evaluate the effectiveness of the CDS product, we will routinely assess the impact it has on the clinicians who use the system, the impact the system has on patient outcome and the overall impact it has on our organization.

TRAINING CONSIDERATIONS

Training will be conducted in such a way as to increase user acceptance by demonstrating the system's ease of use, its reliability, and how it facilitates workflow processes. We will utilize a variety of training methods personalized to the needs and computer proficiency of our users i.e., classroom and computer-based training with associated post-training assessment scoring and one-on-one training for our staff members who are not computer savvy or request individualized training. Nursing training will include rapid identification of suspected pneumonia, and use of CAP order set via the EHR. Prescribers will be provided with training related to use of the CDSS and the Pneumonia Severity Index calculator.

THE NEXT STEPS

Recently, 24 individuals were "tasked with prioritizing quality measures for Stage 2 meaningful use and analyzing gaps in the current criteria"[12]. While there is some concern that specialists are not noted among this committee, there are opportunities to ensure the committee has a chance to acknowledge recommendations to cover the broad spectrum that is Stage 2 of Meaningful Use. Some recommendations, as relates to pneumonia core measures, include:

- Track institutional compliance with CAP core measurement for influenza vaccination, as a result of implementing CDSS: Goal of 90% of patients diagnosed with CAP, who meet criteria for influenza vaccination, receive vaccine prior to discharge.
- Use real-time epidemiologic data to encourage compliance with the CDSS: including incidence, morbidity, and mortality of influenza disease in the surrounding community and neighboring hospitals, # of confirmed cases of influenza A and B seen in the ER and/or admitted to the hospital during current influenza season, # of ICU admissions and hospital deaths relating to known influenza disease, etc.

PNEUMONIA NATIONAL HOSPITAL INPATIENT QUALITY MEASURES Set Measure ID #	Measure Short Name
PN-2	Pneumococcal Vaccination
PN-3a	Blood Cultures Performed Within 24 Hours Prior to or 24 Hours After Hospital Arrival for Patients Who Were Transferred or Admitted to the ICU Within 24 Hours of Hospital Arrival
PN-3b	Blood Cultures Performed in the Emergency Department Prior to Initial Antibiotic Received in Hospital
PN-4	Adult Smoking Cessation Advice/Counseling
PN-5₁	Antibiotic Timing (Median)
PN-5c	Initial Antibiotic Received Within 6 Hours of Hospital Arrival
PN-6₂	Initial Antibiotic Selection for CAP in Immunocompetent Patient
PN-6a₁	Initial Antibiotic Selection for CAP in Immunocompetent – ICU Patient
PN-6b₁	Initial Antibiotic Selection for CAP Immunocompetent – Non ICU Patient
PN-7	Influenza Vaccination

APPENDIX B

The ZyncHealth™ logic behind an order for influenza vaccination is as follows: [13]

Purpose: When an adult patient with the diagnosis of community-acquired pneumonia (CAP) is being seen in an inpatient setting, a reminder that no influenza immunization has been documented for the current influenza season will be displayed to the user if certain criteria are met, upon signing of an adult CAP order set.

Evoke: The "Adult CAP Emergency Department Treatment" OR "Adult CAP Admission to Med/Surg" or "Adult CAP Discharge" order set is signed.

Logic: [The patient is > 18 years of age] AND [the date is October 1 to February 29] AND [the patient is not allergic to eggs or influenza vaccine] AND [the patient has not received an influenza vaccine in the last 5 months] AND [an influenza vaccine has not been ordered on the "Adult CAP Emergency Department Treatment" OR "Adult CAP Admission to Med/Surg" OR "Adult CAP Step-down Transfer" OR "Adult CAP Discharge" order sets] AND [an influenza vaccine is not preselected on the customized "Adult CAP Emergency Department Treatment" OR "Adult CAP Admission to Med/Surg" OR "Adult CAP Step-down Transfer" OR "Adult CAP Discharge" order sets defined by the hospital] AND [an "influenza immunization exclusion form" has not been completed during this encounter] AND [(the patient is age > 50 years) OR (the patient lives in a nursing home) OR (the patient's active problem list OR primary admitting diagnosis OR secondary admitting diagnosis includes "chronic obstructive pulmonary disease" OR "COPD" OR "emphysema" OR "chronic bronchitis" OR "asthma" OR "cystic fibrosis" OR "CF" OR "congenital lung disease" OR "congestive heart failure" OR "heart failure" OR "CHF" OR "congenital heart disease" OR "diabetes mellitus" OR "chronic renal failure" OR "hemoglobinopathy"

OR "sickle cell disease" OR "HIV infection") OR (the patient is receiving chemotherapy OR systemic corticosteroids) OR (the patient is in her second or third trimester of pregnancy) OR (the patient is employed as a healthcare worker)]

Action: A reminder is presented that states: "No influenza immunization has been documented for the current influenza season."
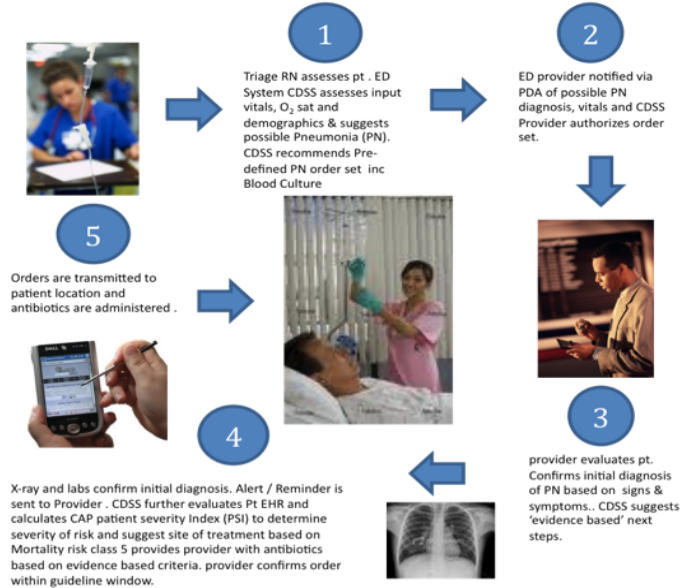
> *Option#1- Dismiss reminder,*
>
> *Option #2- Order influenza vaccine,*
>
> *Option #3-Document reason for not ordering vaccine"*

Sample Patient Severity Index (PSI) based ED Intervention Strategy

CDSS- CAP Risk Assessment Tool[1]

Enter "Y" or "N" in yellow highlighted table cells		Points	Patient
Demographic Factors			
Age	57	Age	57
Male/Female	F	0/-10	-10
Nursing home resident	N	+10	0
Coexisting Conditions			
Neoplastic disease	N	+30	0
Liver disease	N	+20	0
Congestive heart failure	N	+10	0
Cerebrovascular disease	N	+10	0
Renal disease	N	+10	0
Initial Physical Examination Findings			
Altered mental status (acute)	N	+20	0
Respiratory rate >= 30/min.	Y	+20	20
Systolic BP < 90 mm Hg	Y	+20	20
Temperature < 35 or >= 40 deg. C	Y	+15	15
Pulse >= 125/min.	Y	+10	10
Initial Diagnostic Test Findings			
pH < 7.35	N	+30	0
BUN >= 30 mg/dl	N	+20	0
Sodium < 130 mEg/L	N	+20	0
Glucose >= 250 mg/dl	N	+10	0
Hematocrit < 30%	N	+10	0
pO_2 < 60 mm Hg or O2 sat < 90% on room air or supplemental oxygen	Y	+10	10
Pleural effusion	Y	+10	10
Risk Class V			**132**
Mortality risk at 30 days = 27.0 - 29.2			
Recommended Site of Treatment: Inpatient			

1 Triage RN assesses pt . ED System CDSS assesses input vitals, O_2 sat and demographics & suggests possible Pneumonia (PN). CDSS recommends Pre-defined PN order set inc Blood Culture

2 ED provider notified via PDA of possible PN diagnosis, vitals and CDSS Provider authorizes order set.

3 provider evaluates pt. Confirms initial diagnosis of PN based on signs & symptoms.. CDSS suggests 'evidence based' next steps.

4 X-ray and labs confirm initial diagnosis. Alert / Reminder is sent to Provider . CDSS further evaluates Pt EHR and calculates CAP patient severity Index (PSI) to determine severity of risk and suggest site of treatment based on Mortality risk class 5 provides provider with antibiotics based on evidence based criteria. provider confirms order within guideline window.

5 Orders are transmitted to patient location and antibiotics are administered .

Rationale for Using the PSI [1]

- Most rigorously developed, widely tested, and broadly endorsed prediction rule for prognosis in CAP
- Classifies patients into risk classes based on 20 variables routinely available at presentation
- Identifies patients at low-risk (classes I-III) who are potential candidates for outpatient treatment

[1] CAP Risk Assessment tool Developed by VHA Reference: Aspinal, PharmD, **MSc Manual of Intervention Strategies to Improve the Initial Site of Treatment Decision for Patients with Community-Acquired Pneumonia**, VAHSR&D Service Quality Enhancement Research Initiative 2007

Registration	Pt registers in ED (age, gender, date/time captured in ADT system)		
Nursing	Pt triaged by RN (within 30 mins of arrival);	Nursing Assessment (documented in EHR); includes allergy, vital sign per ED protocol; cc, smoker?, ETOH abuse? Current medications	Protocol CAP order set (nurse initiates electronic order set - includes labs/chest xray; oxygenation assessment)
Prescriber	Prescriber evaluates pt	(documents in EHR signs/ symptoms/hx/risk factors. Prescriber receives x-ray result via EHR (x-ray result turnaround time captured)	Prescriber makes an assessment of pneumonia (ICD code documented)
CDSS	Pneumonia Dx triggers **Pneumonia Severity Index Tool**	**Low Risk (Outpatient Therapy)** a. Sputum Culture b. Recommended antibiotic based on allergy information, risk factors c. Reminders prior to discharge i. Pt screened/ vaccinated for pneumonia and influenza (Oct - Mar) ii. Smoking cessation education given, if appropriate	
		High Risk (Inpatient Therapy) a. Admission i. Blood culture prior to antibiotic administration ii. Recommended antibiotic based on allergy information, risk factors (within 24 hrs. of admission iii. Antibiotic administration on eMAR (date/time stamped)	
		Pre-Discharge a. Pt screened/ vaccinated for pneumonia and influenza (Oct - Mar) b. Smoking cessation education given, if appropriate	

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