Implementation of Clinical Decision Support for the Prevention of Perinatal Group B Streptococcal Disease: A Quality Improvement Perspective

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Published In/Presented At

Bigelow, J., McLean, D. (2015, July 16). *Implementation of Clinical Decision Support for the Prevention of Perinatal Group B Streptococcal Disease: A Quality Improvement Perspective.* Poster presented at the Prologue II Presentation Day, Tampa, FL.

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Implementation of Clinical Decision Support for the Prevention of Perinatal Group B Streptococcal Disease: A Quality Improvement Perspective

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Introduction:

How does clinical decision support (CDS) improve quality of care? The goal of this project is to use the CDS recently implemented into the electronic health record at Lehigh Valley Health Network (LVHN) for the prevention of neonatal group B streptococcus disease as an example of clinical decision support and how it can improve the quality of a health system.

Quality clinical care is an essential measure of success of a healthcare system. One method of particular interest for improving quality of care is CDS, defined as the use of information and communication technologies to bring relevant knowledge to bear on the health care and well-being of a patient[2]. One cause of this interest in healthcare technology is U.S. legislation enacted in 2009, which incentivized the healthcare industry to adopt or improve electronic health record (EHR) systems and demonstrate their meaningful use. CDS plays an important role in fulfilling stage two and three EHR Meaningful Use criteria.

A simple but valuable CDS tool is data entry validation, for example, setting predefined limits in a computer-based provider order entry. This could inhibit a physician from accidently requesting ten times the intended medication dosage. More complex CDS tools include applications that aid in constructing a differential diagnosis or selecting an optimal treatment strategy. An example of one of these high level tools is the CDS involved in the prevention of neonatal Group B streptococcal disease, and it will be examined in detail.

Group B streptococcal (GBS) disease is the most common infectious cause of neonatal morbidity and mortality in the U.S. The Center for Disease Control and Prevention (CDC) developed a CDS tool based on their 2010 guideline for the prevention of neonatal GBS disease that assists providers in improving guideline compliance. This ensures pregnant patients in labor receive the proper standard of care, and neonatal GBS disease cases are prevented.

Despite significant promise, CDS continues to be underutilized, with only 34.4% of non-federal acute care hospitals using EHRs with advanced CDS features[1]. A cause for this underutilization is that many EHRs do not have the complex programming capabilities necessary for CDS application[4], but this deficit can be overcome by using external operating systems. Web-based development platforms along with vender-supported application programming interfaces have been shown to be feasible[7], but the CDS implemented at LVHN goes a step further with complete integration within the EHR.

Plan:

The GBS prevention tool was selected as a representative CDS because there is a well-documented, but complex guideline under which the CDS could be built, the CDS integration into the EHR at LVHN demonstrates the challenges of implementation, and room for improved outcomes for GBS disease still exist. A recent review of early-onset GBS cases, GBS disease in neonates less than seven days old, found that 25% of the cases contained at least one implementation error in the use of intrapartum prophylaxis when indicated[6].

The LVHN Department of Obstetrics and Gynecology is currently studying the clinical effectiveness of the implemented CDS in improving the delivery of guideline concordant GBS prophylaxis. The retrospective cohort study will compare how patients in labor were treated for the prevention GBS sepsis in the newborn following the implementation of the CDS for six months compared to a similar time period prior to the availability of the CDS system.

Characteristics of the GBS prevention tool that may have influenced its effectiveness will also be evaluated using literature review.

Study / Results:

Figure 1: EHR integrated GBS clinical decision support tool interface

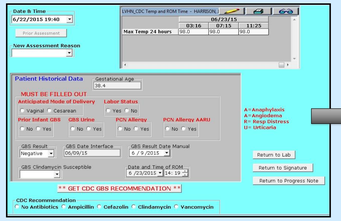


Figure 2: Indications and nonindications for intrapartum antibiotic prophylaxis to prevent early onset GBS disease

Intrapartum GBS prophylaxis indicated	Intrapartum GBS prophylaxis not indicated
• Previous infant with invasive GBS disease	• Colonization with GBS during a previous pregnancy (unless an indication for GBS prophylaxis is present for current pregnancy)
• GBS bacteriuria during any trimester of the current pregnancy*	• GBS bacteriuria during previous pregnancy (unless an indication for GBS prophylaxis is present for current pregnancy)
• Positive GBS vaginal-rectal screening culture in late gestation† during current pregnancy*	• Negative vaginal and rectal GBS screening culture in late gestation† during the current pregnancy, regardless of intrapartum risk factors
• Unknown GBS status at the onset of labor (culture not done, incomplete, or results unknown) and any of the following: – Delivery at <37 weeks' gestation§ – Amniotic membrane rupture ≥18 hours – Intrapartum temperature ≥100.4°F (≥38.0°C)¶ – Intrapartum NAAT** positive for GBS	• Cesarean delivery performed before onset of labor on a woman with intact amniotic membranes, regardless of GBS colonization status or gestational age

Figure 3: Recommended regimens for intrapartum antibiotic prophylaxis for prevention of early-onset GBS disease

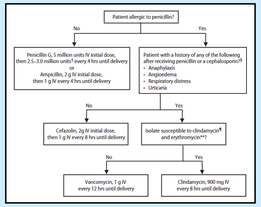


Figure 4: CDC GBS antibiotic prophylaxis recommendation

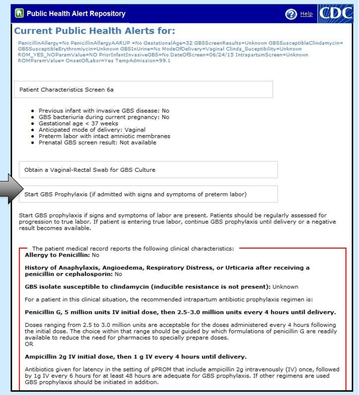
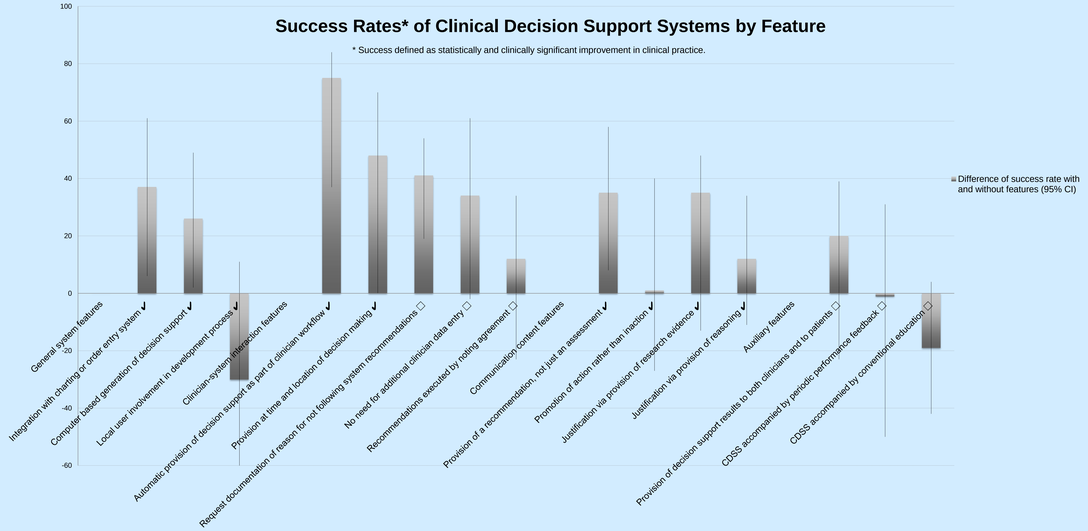


Figure 1 displays the provider interface of the CDS at LVHN. The CDS extracts information from different sources within the EHR or requires the provider to input the information. The information is then transferred to the CDC headquarters in Atlanta, GA, where the algorithm program processes the data.

Figures 2 and 3, taken from the 2010 CDC guideline, depict two parts of the GBS prevention algorithm: under what circumstance antibiotic prophylaxis is indicated, and which antibiotic to administer, including dosing regimen. These rules are the basis for the algorithm program.

The CDC recommendation then appears to the LVHN provider, and example of which is shown in Figure 4.



A literature search of clinical decision support, computer-interpretable guideline, and quality was performed, and a large systematic review of CDS tools and their affect on clinical practice[3] was selected as a measure. This systematic review included 77 studies, and the differences in success rates of the CDS systems with and without 15 potentially important features are depicted in the graph above. Features present in the GBS CDS are indicated with a checkmark. The GBS prevention CDS contains three of the four features found to be statistically and clinically significant in this systematic review.

Act / Conclusions:

CDS systems will almost certainly continue to be important aspects of EHR systems, and their development, integration and clinical significance will play essential roles in their ability to improve quality of care.

The GBS CDS utilizes two clinically significant general system features correlated with CDS success based on systematic review: integration into the charting or order entry system and computer-based generation of decision support. Benefits of creating a highly integrated CDS, that is, an interface integrated within an EHR, are that it is easily accessible and visible to the provider, and that it provides the platform for efficient data extraction and information output.

The third clinically significant feature of the GBS tool is its ability to automatically provide decision support as a part of clinician workflow. This feature applies to the GBS CDS because the clinician has access to pertinent information through the EHR, they are prompted to use the CDS at the appropriate time, and they receive the results immediately. Because this project does not include an encompassing analysis of workflow[5], the evaluation of how well this CDS fits into clinician workflow is a potential oversimplification.

The only clinically significant provision the GBS CDS does not follow is request for documentation of reason for not following system recommendations. The probable cause being that the CDS requires all information for guideline adherence; there would not likely be a defendable reason to challenge the recommendation. Though there certainly are circumstances that lead to non-adherence such as incorrect CDS input information, or a patient delivering before recommendations are carried out, these types of cases are outside the scope of this project.

At this point, external algorithm processing is necessary to overcome deficiencies in available EHRs, but an additional benefit of the model used for this CDS is that the same organization that created the guideline also built the CDS used to follow it. This attribute enforces usage of the guideline in the manner the CDC intended it, and facilitates keeping the CDS up-to-date in conjuncture with updated guidelines. One final benefit of the unique implementation of the GBS tool at LVHN is that the CDC receives the data in real-time, which they are able to use in population based studies. The model used for the GBS CDS at LVHN has the potential for broad application with the end goal of improving the delivery of quality healthcare and ensuring patient safety.

Limitations of this study include utilization of only one systematic review[3], which examined varying types of CDS. The features necessary for success of these CDS tools may be different from more complex, treatment strategy recommendations or computerized guideline support. Another limitation is the research examining the effectiveness of the GBS CDS is not yet complete. Demonstrated effectiveness of this CDS tool will strongly support the recommendation that this tool is useful and its implementation was effective. Next steps include examining the results of the research assessing effectiveness of the CDS, monitoring the status of the CDS as LVHN transitions to the EHR Epic, and continuing to monitor provider utilization of the CDS.

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Acknowledgments:

We would like to acknowledge LVHN Department of Obstetrics and Gynecology for their support in our project.