Newborn Hyperbilirubinemia Web-based Learning Tool

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Background

Hyperbilirubinemia

Hyperbilirubinemia is a common occurrence in newborns that can rapidly lead to significant morbidity and mortality. Residents in family medicine and pediatrics must learn to evaluate infants with hyperbilirubinemia, risk stratify them, and plan workup and treatment using national guidelines. The AAP guideline on management of hyperbilirubinemia in the neonate has objective standards for management, including how to risk stratify based on risk factors and bilirubin measurements.

Webpages

The internet and its wide accessibility and powerful programming tools can provide physicians with new means of learning about medicine and managing patients, and it has yet to reach its potential.

Purpose and Hypothesis

The **primary objective** of this study was to evaluate the utility of a web-based tool as a learning tool and aid in decision-making in managing hyperbilirubinemia in the neonate.

The **secondary objective** of the study was to discover ways to improve this webpage to make it more user-friendly, and a better teaching aid.

Methods and Materials

A **web-based tool** was developed with the following specifications:

- User enters information about neonate that is readily available.
- Displays the graphs by Bhutani of phototherapy treatment cutoffs and risk nomogram, their interpretation, and recommendations for plan of care based on AAP guideline.
- Programming code that maximizes
  - Compatibility with multiple browsers,
  - Accessibility through internet security measures,
  - Reliability

A **survey** was created to test the webpage in areas of reliability, utility, accuracy, and ease-of-use. Questions involving most of the commonly encountered scenarios in the newborn nursery were phrased into the survey, including:
early jaundice (ABO, bruising), late jaundice/breastfeeding infant, premature infant, term infant, starting and stopping phototherapy, NICU referral, septic infant, crossing risk categories, major risk factors, minor risk factors, follow-up, and normal infant.

Materials and Methods

Webpage Algorithm:

Data flow is from user input to the webpage again via the html "GET" method. Data is manipulated using javascript, and display is by HTML with CSS script.

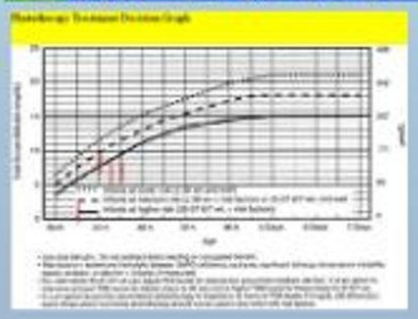
The program is structured by an initial reference to a main javascript routine at loading of the webpage. The main javascript routine then calls out subroutines to collect data from the url and process it. The recommendations are developed via an algorithm based on the AAP Guideline, my own personal reading and training.

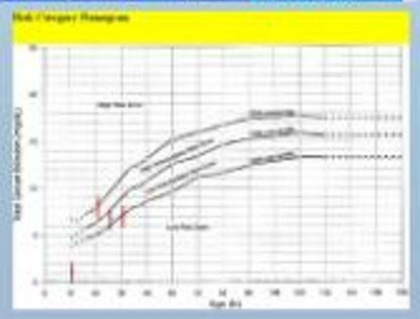
The interpretation of the phototherapy decision graph is accomplished by comparing bilirubin values to an approximation of the graph from Bhutani. Since the data for the Bhutani graph is not available, the approximation was developed by visually selecting values from the original graph, and using a least squares approximation of a parabolic equation.

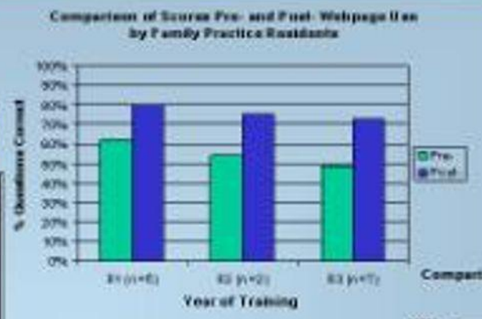
The risk nomogram interpretation was again accomplished by comparing bilirubin values to an approximation of the graph from Bhutani. Discrete data points were available, only as visualized from his graph, again, however, so comparisons were made using interpolation.

The graphs were reprinted on the webpage to lend a sense of familiarity. Data was plotted on the graphs and visually verified to be accurately placed.











Results

Residents showed on average an improvement of 21 percentage points when answering the survey with the aid of the bilirubin webpage as compared to answering the survey on their own. Residents in earlier years of training scored better than more senior residents before using the webpage, but all scored equally well after using the webpage.

Conclusions and Next Steps

The webpage made a significant difference in the residents' ability to answer questions related to managing hyperbilirubinemia.

Weaknesses in the study include that the survey questions were not validated, and the number of responders to the survery was low.

Strengths in the study include that the test questions covered the breadth of commonly occurring scenarios encountered by physicians in the newborn nursery.

Next Steps:

- Make webpage more user-friendly
- Include in more detailed recommendations on workup
- Possibly make webpage available in the future as a widely accessible protocol for managing hyperbilirubinemia in community hospitals.

References and Credits

VK Bhutani, Predictive Ability of a Predischarge Hour-specific Serum Bilirubin for Subsequent Significant Hyperbilirubinemia in Healthy Term and Near-term Newborns
AAP Guideline: Management of Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation
Rubaiselli, Transcutaneous Bilirubin Measurement: A Multicenter Evaluation of a New Device
www.bilinol.org for original idea and model for this website.