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The Power of Daily Prognostication of Outcome in the Pediatric Intensive Care Unit

Introduction/Background

Critically ill children in the Pediatric Intensive Care Unit (PICU) require complex, prolonged, and invasive care. Pediatric intensivists are often asked to predict the outcome of patients to parents make informed decisions about continuing, withholding, or withdrawing treatment in the best interest of their child. However, research on the accuracy of these prognostications, particularly in the PICU, is limited. (Gillis 2011) Studies in the Neonatal and the Medical Intensive Care Units reveal that 2/3 of infants and slightly over 1/2 of adult patients predicted to "die before discharge" actually died, respectively. (Meadow et al., 2002, et al., 2011)

Work to date in the PICU has focused on the accuracy and confidence of predictions of mortality with an understanding that delivery of care and family counseling may be influenced by assessment of mortality risk. (Marcin et al., 2004) However, information regarding risk of morbidity in addition to risk of mortality may influence decision-making by the family. Ideally, physicians are able to outline treatment options with careful attention to the risks and benefits of each alternative. While we have evidence regarding the effectiveness of invasive treatments and procedures in treating specific medical problems, we have a more limited understanding of how well physicians predict overall patient outcome in the initial days of critical illness. Just as a physician's degree of experience with a particular medical condition may be of reassurance, an understanding of the overall accuracy of clinician prognostication may provide families with some guidance during complex decision-making in stressful and otherwise uncertain situations (Gillis 2011). With a better understanding of our current prognostic accuracy, we could begin to address this aspect of the patient-doctor relationship.

The objective of this study was to determine the accuracy of clinician intuition regarding morbidity and mortality for children under their care in the PICU. We hypothesized that serial predictions, obtained daily from clinicians (attending physicians, fellows, residents, nurse practioners, and bedside nurses) would have limited positive predictive value for distinguishing survivors versus nonsurvivors and would be a function of clinical severity. We expected the positive predictive value of clinician prognostication to increase with level of experience, clinician confidence in his/her prediction, concordance among the clinician care team (an attending physician, a fellow, a resident or nurse practioner, and a bedside nurse), and if the outcome measure was not restricted to mortality alone but included severe functional morbidity.

Methods

This prospective cohort study was conducted at The University of Chicago Medicine Comer Children's Hospital PICU. The study was approved by the Institutional Review Board.

Data were collected starting June, 2012. All patients aged 18 years or younger admitted to the PICU were included. Patients were excluded if they were wards of the state or if their parents/guardians could not provide consent in English. Patient data included age, gender, PICU length of stay, PICU and hospital outcome (survival or death), diagnosis, and reason for admission. Data were also collected from clinicians (attending physicians, fellows, residents/nurse practioner, and bedside nurses) about their intuition regarding the likely survival or death of children in their care for each day of the patient's PICU stay. If survival was predicted, the clinician was asked to rate his or her confidence in this binary prediction as low, medium, or high. If survival was predicted, the clinician was also asked about his or her intuition regarding the patient's functional morbidity. Again, the clinician was asked to rate his or her confidence in this prediction as low, medium, or high. The single nurse practioner's predictions were combined with all residents (pediatric, surgery, anesthesia, and emergency medicine) for the purpose of maintaining confidentiality of the data and for analysis.

Patient outcomes were determined during the hospitalization. At 1 month and 6 months after discharge, we contacted patient families to assess the patient's functional performance status. Specifically, parents were asked questions related to mental status, sensory functioning, communication, motor functioning, feeding, and respiratory status in order to determine a pediatric functional status score using a validated measure. (Pollack et al., 2009)

Results: Outcomes, Metrics, and Deliverables

We screened 176 patients for inclusion into the study; 33 patients did not meet inclusion criteria or refused consent. 143 patients have been enrolled to date. We anticipate that this number may continue to increase as we are still consenting patients who were admitted during the enrollment period. We are currently in the process of conducting 6-month follow-up phone calls for consented patients to assess their functional morbidity. We collected 3266 clinician intuitions over 978 patient days during the enrollment period.

We conducted an interim analysis of the first 110 patients included in the study, with follow-up for 28 patients at one month after hospital discharge. Analysis of the 1491 clinician prognostications of morbidity and mortality for these 110 patients over 428 patient days revealed that the positive predictive value of a prediction of death from any clinician was 0.5 and the sensitivity was 0.83. Predictive power increased with number of predictions of death (both serial predictions by one clinician and with concordance across the clinician care team). Greater than 2 days of predictions of death increased the positive predictive value of a prediction of death to 0.67 but decreased sensitivity to 0.33. If more than one clinician predicted death on a given day, the positive predictive value of a prediction of death increased to 0.75. Unanimous prediction of death on a given day increased the positive predictive value of a prediction of death to 1.00.

For initial 28 patients completing follow-up assessments, functional status as reported by parent/guardian at one month after discharge (n= 26) were compared with the attending physician's final prediction of six-month functional outcome. 61.5% of these children had no functional impairment per parent assessment compared to 42.9% predicted by attending physicians to have no functional impairment. 7.7% had mild functional impairment per parent assessment compared to 28.6% by attending physician prediction. 23% of these children had moderate functional impairment per parent assessment compared to 17.9% by attending

physician prediction. 7.7% of these children had severe functional impairment at one month per parent assessment compared to 10.7% by attending physician prediction. Functional Status Scores (FSS) based on parent response to specific questions were also determined for each patient. Less than half of these patients (n=11) had complete concordance between functional status score, parent assessment of functional status, and attending prediction of functional status. Attending prediction agreed with FSS in 54% of patients and with parent assessment in 46% of patients. Attending prediction was not consistently more or less severe than parent assessment but tended to be more severe than FSS. We also found that 36% patients had no objective impairment by FSS but were predicted by physicians or assessed by parents to have impairments.

Upon completion of the 6-month follow-up phone calls, we will again correlate clinician intuition to actual outcome for all consented patients. Clinician intuition will be correlated to survival, length of stay, readmission rates, and functional status scores at discharge and at 6-month follow-up. Positive predictive value of clinician intuition will be determined. Covariates, including patient demographics, admission diagnosis, severity of illness, and co-morbidities, will be analyzed to adjust for potential confounding. We will also determine whether the positive predictive value of clinician intuition differs according to type of clinician/level of training, confidence level of the prediction, or concordance among the clinician care team. We plan on using this pilot study as preliminary data for future grant applications on physician-patient communication regarding outcomes of critically ill children admitted to the PICU.

Discussion

Our preliminary analysis revealed that a prediction of death by any member of the clinician care team was not predictive of hospital mortality. The positive predictive value of predictions of death before hospital discharge increased when agreement existed across the clinician care team, with serial predictions of death over time, and with clinician level of training or experience. Our data are thus consistent with data from the neonatal and medical intensive care units: a prediction of death from any member of the clinician care team has no greater predictive value than chance, but increases with serial predictions of death over time and with concordance across the clinician care team. (Meadow et al., 2002, et al., 2008, et al., 2011, Lagatta et al., 2011)

Regarding functional outcomes, there was limited concordance between attendings, parents, and the FSS. Attending predictions tended to be more severe than FSS and concordant parent assessment and FSS but were did not have a consistent directionality when compared to a discordant parent assessment. Over 1/3 of patients with no objective impairment were predicted or perceived to have impairments highlighting the subjective nature of dysfunction.

Our preliminary analysis revealed some limitations regarding sample size and a relatively low overall mortality rate in the PICU, limiting our power. However, we anticipate that with our larger sample (143 consented patients to date vs. 110 in the preliminary analysis), our larger number of intuitions (3266 vs. 1491), and ongoing 6-month follow-up data collection for these 143 patients (vs. 28 at 1-month), we anticipate new results. We expect that the concordance between FSS, attending predictions, and parent assessment of functional status may be different at our 6 month follow-up due to recovery and rehabilitation in the longer interval from discharge.