Smart Form Design and Functionality: Originally created in 2013 at Nationwide Children’s Hospital, the pre- and post-BMT Smart Forms (SFs) were designed by a collaborative team including members of the BMT Program, Information Services and Technology, Electronic Data Warehouse, and Research Information Solutions and Innovation (RISI). Specifically, the BMT SFs were designed using the Epic® platform to enable clinical and quality reporting and research data capture (Figure 1). In this regard, the SFs contain minimal free text fields to minimize data entry error and standard data elements (SDEs), which facilitate data mapping and routing. Once completed, the SFs can be transformed into clinical documentation for clinical management purposes. By design and through a data visualization platform (QlikView®), the BMT SFs also facilitate internal and external data reporting for transplant- and cell therapy-related agencies including the CIBMTR (Center of International Blood and Marrow Transplant Research), FACT (Federation for Accreditation of Cellular Therapy), and NMDP (National Marrow Donor Program). Clinical data entered into the BMT SFs route into a database with the capability for automated data transfer from within and outside NCH, thereby creating the potential for a combined, multi-institutional database through which data can be easily queried (Figure 2). Lastly, the database enables predictive analytic modeling for common transplant-related metrics (e.g., engraftment) and complications (e.g., infection). Reiterations of the BMT SFs have occurred over time, reflecting new technologies and approaches to transplant care as well as future steps for on-boarding additional transplant centers.

Pilot Study - Composite Risk Score for Pre-Transplant Risk Assessment in Patients Undergoing Allogeneic Hematopoietic Cell Transplantation
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Objective: An internal pre-transplant risk assessment tool or Risk Monitor was developed by the Baylor Blood & Marrow Transplant (BMT) Data Management and Analytics team to assist with optimization of patient selection. The tool assigns a total risk score for allogeneic transplants based on attributes such as disease status, disease risk index (DRI), patient age, Karnofsky performance status (KPS), hematopoietic cellular therapy co-morbidity index (HCT-CI), and CMV status, along with psychosocial factors such as caregiver support, coping skills or motivation, health literacy, medication compliance, socioeconomic viability, distance of residence from the transplant center, as well as others. A retrospective pilot study was conducted to predict which attributes have the highest correlation with the primary outcome variable, post-transplant patient mortality.

Method: The Risk Monitor was developed using Microsoft Access (Microsoft®, Redmond, WA). A score of 0 (no risk) or 1 (risk) was assigned for each variable and an aggregate score was calculated for each patient (Figure 1). The data was analyzed using Waikato Environment for Knowledge Analysis (Weka). Weka is an open-source data mining tool consisting of a collection of machine learning algorithms for data mining tasks. It contains tools for data preparation, classification, regression, clustering, association rules mining, and visualization.

Results: We evaluated the total risk score for 97 patients that had undergone an allogeneic stem cell transplant (SCT) at Baylor University Medical Center in 2016. The total risk score for the patients varied between 0 and 9. Weka provided us with a list of independent attributes with rankings based on the intensity of correlation with the dependent variable, early mortality. Evaluation of the data set suggests that one attribute (Total Score) has the highest correlation with mortality, while other individual attributes (KPS, CMV status, DRI, HCT-CI and psychosocial factors such as caregiver support, coping skills, and health literacy) demonstrated a moderate to high correlation (Figure 2).

Conclusion: The Risk Monitor can serve as a useful tool for screening adult patients prior to allogeneic transplant. In addition, the tool may help to identify patients who need additional

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- **Figure 1.** Design and Multi-Functionality for Nationwide Children’s Hospital BMT Smart Forms.

- **Figure 2.** Capabilities of Nationwide Children’s Hospital BMT Smart Forms.
screening and social support to minimize the possibility of early mortality after transplantation. The Access database has been transitioned to a web-based (SQL Server/PHP/JavaScript) application to overcome certain Access-related issues such as client software installation, file corruption and interface update issues. Furthermore, this will enable easy cross platform usage, enhance security, and allow more concurrent users.

Implementation of a Flowsheet in an Electronic Medical Record (EMR) to Standardize Chimeric Antigen Receptor T-Cell (CAR T-cell) Toxicity Reporting

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Topic Significance & Study Purpose/Background/Rationale:
We initially conducted a quality review of patients treated with CAR-T therapies and noted inconsistencies in cytokine release syndrome (CRS) and neurotoxicity grading due to data located in various areas within our EMR and fragmented documentation between the EMR and paper record. Consistent documentation of CAR T-cell toxicity amongst providers is important for assessment and management of toxicities post-infusion in cellular therapy programs. EMR flowsheets facilitate tracking and communication within the healthcare team and ensuring proper clinical documentation.

Method, Interventions, & Analysis: Key members from the Informatics and Adult Stem Cell Transplant Program collaborated to develop a flowsheet to capture all elements to grade, identify symptoms and toxicities. To enhance clinical documentation, we created a tool that brings in several flowsheet entries to the notes and to guide providers for accurate grading of CRS and neurotoxicity related to CAR T-cell infusions for the Epic EMR.

Findings & Interpretation: These electronic tools were developed during the planning phase of the CAR T-cell program. Two flowsheets were used by nurses to document CRS (Figure 1) and neurotoxicity (Figure 2) based on practice guidelines established by program leaders. The flowsheet entries were added to provider’s daily documentation through “smart phrases” (Figure 3) that captured grading of toxicities and guided clinical decision making.

Discussion and Implications: Development of tools to standardize symptomology reporting and effectively capture data is imperative for CAR T-cell therapy programs. EMR tools can facilitate management and streamline data collection for reporting of toxicities. As more patients receive this novel immunotherapy, it will be important to have tools in place to assist with tracking patient outcomes. The future goal is to have grading auto-generated to enhance real time care delivery with alert based warnings for worsening CRS or neurotoxicity, and for these tools to reflect current standards of care, including revised consensus criteria for grading and reporting of CAR-T toxicities currently being developed by the ASBMT.