

**Title:** Probabilistic Workflow Modeling of Transfused Injured Children and Adolescents at a Level 1 Trauma Center

**Introduction:** Hemorrhagic shock is the leading preventable cause of death in injured children and adolescents. Timely recognition and intervention of hemorrhagic shock are associated with improved outcomes in adults and children.

**Methods:** We performed a retrospective medical record and video review of 57 injured children and adolescents who received a blood transfusion at a level 1 pediatric trauma center within four hours of hospital arrival. We reviewed videos of all resuscitations to identify the presence and time to performance of actions necessary for successful transfusion. Using a Bayesian belief network designed to predict the probability of transfusion within four hours of arrival, we categorized patients into low (<20%), intermediate (20-40%), and high (>40%) probabilities of transfusion. We then generated data-driven workflow models to identify the general sequence and timing of transfusion activities within each probabilistic category. A medical expert reviewed the workflows and considered them logical or illogical based on domain knowledge.

**Results:** Most children had a low probability (n=33, 57.9%) of blood transfusion, followed by high (n=14, 24.6%) and intermediate (n=10, 17.5%). Thirty-three out of 57 patients (57.9%) received blood in the emergency department. From these 33, those with a high probability received blood fastest (9.6 min [SD 15.4]) followed by intermediate (17.7 min [SD 6.7]) and low (23.1 min [SD 15.4]) probabilities. A medical expert determined that the sequence of transfusion activities was logical for patients with low and high probabilities, but not for intermediate probabilities.

**Conclusion:** Identification of hemorrhage is difficult, especially in children. Our study showed that clinicians may not easily recognize the need to transfuse some patients based on clinical gestalt alone. A decision support aid to identify these patients may improve the timely recognition and management of hemorrhagic shock.