Background
Using a root-cause analysis, the signs and symptoms surrounding intracranial hemorrhage (ICH) among adult hematologic malignancy patients was examined following an event in 2013 where a 72 year old acute myeloid leukemia patient experienced a fatal ICH. Prior to diagnosis, the patient manifested new-onset nausea, vomiting, headache, hypertension, and bradycardia, prompting the nurse to request a CT scan. This diagnostic scan was ultimately delayed 12 hours after the onset of symptoms and resulted in delayed treatment.

Signs and symptoms of ICH often mimic those of chemotherapy, which complicates diagnosis and may mask severity. As a result, this study aims to identify clusters of early signs and symptoms of ICH to better differentiate between an imminent or occurring ICH versus side effects of chemotherapy. Using these findings, an interdisciplinary communication tool will be produced to guide provider actions when hematologic malignancy patients present with these clustered manifestations, which will enable more prompt diagnosis and treatment of ICH.

A completed literature review found 35 articles related to ICH incidence among patients with a hematologic malignancy. However, within these articles was a dearth of information specifically dedicated to the identification of relevant manifestations of ICH among this population. Research does point to ICH as a leading cause of mortality in patients with AML, second to infection.

Methods
Following IRB approval, a retrospective chart review was conducted on 49 patients. Using ICD-9 coding, 27 patients were identified as ICH cases and confirmed using CT/MRI scans. Patients with confirmed ICH prior to admission were excluded. An additional 27 ICH cases and confirmed using CT/MRI scans. Patients with 49 patients. Using ICD

Results
Data analysis was completed for all lab, assessment, and vital signs data. An odds ratio for each data category was calculated, where an odds ratio greater than 1 indicates a greater likelihood of occurrence among the ICH group. Next, using a 95% confidence interval, a p-value for each data category was calculated to illuminate the statistical significance of the data. Items with an odds ratio greater than 1 and a p-value less than 0.05 were considered relevant signs and symptoms of ICH.

Using the above parameters, it was found that the following are statistically significant clinical manifestations of an impending or occurring ICH.

<table>
<thead>
<tr>
<th>Data Category</th>
<th>Odds Ratio</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>International Normalized Ratio (INR) &gt; 1.5</td>
<td>2.32</td>
<td>p = 0.0461</td>
</tr>
<tr>
<td>Cough</td>
<td>2.59</td>
<td>p = 0.0172</td>
</tr>
<tr>
<td>Emesis</td>
<td>2.60</td>
<td>p = 0.0047</td>
</tr>
<tr>
<td>Systolic blood pressure &gt; 140</td>
<td>2.98</td>
<td>p = 0.0054</td>
</tr>
<tr>
<td>Systolic blood pressure &gt; 160</td>
<td>2.83</td>
<td>p = 0.0014</td>
</tr>
</tbody>
</table>

Presence of a headache was not statistically significant, but headaches with higher pain ratings did correlate with a greater incidence of ICH.

Platelets, fibrinogen < 150 or > 450, diastolic blood pressure > 140, nausea, heart rate, activated partial thromboplastin time (aPTT) were found to be insignificant. Plotted below are combined significant and insignificant data.

Future Directions
An additional 12 cases and 12 controls have been identified and data collection for identical parameters on these patients is underway in an attempt to increase the sample size and strengthen the data’s significance.

Following analysis and inclusion of additional data, a multidisciplinary team will be developed to create a communication tool used to guide the identification, diagnosis, and early treatment of hematologic malignancy patients exhibiting identified signs and symptoms of ICH.

References