Understanding and Managing Cyanide Toxicity in Victims of Smoke Inhalation

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Background & Significance

Fire fatalities in the United States are up 20.5% from 2009.

Fires in the U.S. are down 2.5% and fire-related injuries have dropped 17% since 2009, while the fatality rate has increased dramatically over the past 11 years.

Newer materials burn hotter, faster and off gas lethal levels of Hydrogen Cyanide before bursting into flames. Cyanide has surpassed carbon monoxide to become the most toxic component of smoke, leading to rapid incapacitation and death.

Emergency department (ED) nurses must be confident and knowledgeable when triaging fire victims yet only 22% of anonymous ED survey respondents reported they were familiar with the lethality of cyanide in fire smoke. The purpose of this project is to increase emergency department nurse knowledge and confidence, and improve the ability to accurately triage these low frequency, high risk patients.

Methods

The Iowa Model of Evidence-Based Practice to Promote Quality Care process implementation guided development of a successful education process. Nurses attended one of eight mandatory Skill Competency Days where the DNP Project was embedded. Participation in the project surveys was voluntary.

Focused Project Aims

1. Increase reported confidence in the EBP of toxicology and pathophysiology surrounding hydrogen cyanide and carbon monoxide as toxins present in smoke.
2. Increase reported knowledge of using EBP to care for the unique cohort of smoke inhalation victims.
3. Evaluate the ability to accurately triage smoke inhalation victims when presented with case study scenarios.

Results

Forty-one emergency department nurses individually attended one of eight Skill Competency Days offered in November and December 2020. All volunteered to participate in the pre- and post- education surveys.

Nursing confidence increased significantly post education (Table 1). Nursing knowledge increased post education (Table 1). Correlation analysis found that knowledge was not a predictor of confidence but years of experience was positively correlated (Table 2).

29% (N=12) of the nurses participated in a voluntary post-education, case study based knowledge assessment two weeks after the class. The participants achieved a median score of 82%, demonstrating the ability to accurately triage smoke inhalation victims.

Table 1. Paired Samples Test

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
<th>t</th>
<th>Sig. (2-tailed)</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge Score and Post-Education Knowledge Survey</td>
<td>8.577</td>
<td>8.063</td>
<td>1.818</td>
<td>0.074</td>
<td>(0.000, 8.951)</td>
</tr>
<tr>
<td>Knowledge Score</td>
<td>8.482</td>
<td>8.063</td>
<td>1.818</td>
<td>0.074</td>
<td>(0.000, 8.951)</td>
</tr>
<tr>
<td>Post-Education Knowledge Survey</td>
<td>0.095</td>
<td>8.063</td>
<td>0.000</td>
<td>1.000</td>
<td>(0.000, 8.951)</td>
</tr>
</tbody>
</table>

Table 2. Correlation Table – Post-Education Confidence Scores as Dependent Variable

<table>
<thead>
<tr>
<th>Variable</th>
<th>Correlation Coef.</th>
<th>N</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DNP Post-Education Knowledge Survey</td>
<td>0.391</td>
<td>40</td>
<td>0.003</td>
</tr>
<tr>
<td>Clinical Knowledge Survey</td>
<td>0.343</td>
<td>40</td>
<td>0.010</td>
</tr>
<tr>
<td>Post-Education Knowledge Survey</td>
<td>0.391</td>
<td>40</td>
<td>0.003</td>
</tr>
<tr>
<td>Pre-Education Knowledge Survey</td>
<td>0.095</td>
<td>8.063</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Conclusions

Confidence fosters the ability to quickly and aggressively assess, triage and initiate treatment to sick and injured patients, and confidence provides the vehicle in which nurses carry their knowledge and determines the deployment of assessments and skills when needed. Identifying gaps in education and initiatives is an important driver to achieve high-value patient care.

Implications

The COVID-19 pandemic restricted the ability to include simulation with the education. In future scholarship simulation may compensate for lack of years of nursing experience and as a result may better improve confidence.

Understanding the toxicity of hydrogen cyanide in fire victims is an important step in improving patient outcomes. Low-frequency high-risk smoke inhalation victims require confident nursing and applied evidence based assessment, triage and management to ensure the best chance of survival.

References


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A special thank you to the State Fire Academy and the numerous Fire Departments who recognize the importance of this work and helped the author facilitate delivery of education out to the masses.

Tell me and I forget. Teach me and I remember. Involve me and I learn...