A Meta-Analysis of Crew Resource Management/Incident Command Systems Implementation in the Fire and Emergency Services

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Overview

– Origins of CRM
– CRM/ICS in the Fire and Emergency Services
– Studies included in Meta Analysis
– Results
– Conclusions
– Recommendations
Origins of CRM

- Flt 173 in 1978
- MRM Early 1990s US Air (codified in 2000)
- Sexton et al. and Medical CRM (2000)
- Firefighters and EMS
  - “...firefighter deaths have plateaued...(the idea that) ‘only the lead dog has a good view’ idea has come and gone...leaders must buy into CRM” (Lubnau and Okray, 2001)
CRM/TRM/ICS

• Inquiry to evaluate procedure
• Advocacy to respectfully question authority
• Conflict resolution to learn from errors
• Strong leadership to make group decisions
• Observe/critique team decisions to meet mission goals
• Open and accepting team environment (LeSage, Dyar, & Evans, 2011)
Previous studies

• Positive Results knowledge acquisition and behavior by numerous researchers

• Leverage what has been done in the aviation and medical fields with regard to CRM.

Methods

• Search/Criteria
  – Internet - ProQuest
  – Quantitative output
  – Measure student knowledge
  – Exclude study results without student measures

• Treatment
  – MedCalc to measure standard mean differences (effect sizes – Heges g statistic)
  – Significance - Full and random effects models
  – Heterogeneity - Cochrans’s Q and I²
## Studies Used

<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>Sample test results</th>
<th>Intervention</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Glow, Colucci, Allington et al. (2013)</strong> Fire fighters /prehospital EMS</td>
<td>One-group pretest-posttest design. Scores of CRM trained (n=68) vs scores prior to training (n=70).</td>
<td>138</td>
<td>Crew Resource Management training course</td>
<td>p&lt;.001</td>
</tr>
<tr>
<td><strong>Fisher (2000)</strong> Aeromedical Aircrew</td>
<td>Posttest only control group design. Scores of CRM trained (n=59) vs those who were not trained (n=8)</td>
<td>67</td>
<td>Crew Resource Management Training course</td>
<td>p =.031</td>
</tr>
<tr>
<td><strong>Hagemann, Kluge, Greve (2012)</strong> Fire fighters (1 day after training)</td>
<td>One group pretest-posttest design. Group tested before CRM training and one month after training.</td>
<td>56</td>
<td>CRM ½ day training session</td>
<td>p&lt;.001</td>
</tr>
<tr>
<td><strong>Hagemann, Kluge, Greve (2012)</strong> Fire fighters (7 months after training)</td>
<td>One group pretest-posttest design. Pre training and 7 month post training scores compared</td>
<td>22</td>
<td>CRM ½ day training session</td>
<td>p=.001</td>
</tr>
</tbody>
</table>
## Meta-Analysis Results

<table>
<thead>
<tr>
<th>Study</th>
<th>Total</th>
<th>SMD</th>
<th>95% CI</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glow et al., (2013) EMS and Firefighters</td>
<td>138</td>
<td>1.445</td>
<td>1.068 to 1.821</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fisher et al., (2000) Aeromedical Aircrew</td>
<td>67</td>
<td>1.139</td>
<td>0.370 to 1.909</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 day Hagemann et al., (2012) Firefighters</td>
<td>56</td>
<td>2.918</td>
<td>2.153 to 3.683</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 mo Hagemann, et al., (2012) Firefighters</td>
<td>22</td>
<td>1.435</td>
<td>0.468 to 2.402</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (fixed effects)</td>
<td>283</td>
<td>1.620</td>
<td>1.329 to 1.910</td>
<td>10.969</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Total (random effects)</td>
<td>283</td>
<td>1.726</td>
<td>1.000 to 2.452</td>
<td>4.678</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
Forest Plot

Glow et al., (2013) EMS and Firefighters
1 Day Hagemann et al., (2012) Firefighters
7 Mo Hagemann et al., (2012) Firefighters

Total (fixed effects)
Total (random effects)
Heterogeneity

• Q value of 14.143 (3 degrees of freedom, p=.0027)

• I² statistic indicated a 78.79% inconsistency level
  – 95% confidence interval for I² was 43.14 to 92.09
Findings

• All four results
  – CRM training significantly positive effect p<.001

• Meta-Analysis of all studies
  – Significant positive effect p<.001 (fixed and random effects models)

• Heterogeneity
  – Significant amount of variation between studies $I^2=78\%$
Conclusions

- Evidence to support the effectiveness of CRM training in the fire and emergency services
- Variation between study results due to different teaching and training methods
- Evidence to support the need for continuous training to maintain knowledge
- Possible publication bias
Recommendations

• Interdisciplinary training should be conducted periodically (Glow et al., 2013; Hagemann et al., 2012).

• Ongoing training should be tailored to specific professional disciplines (Glow et al., 2013).

• CRM training has shown to be effective. Leadership needs to create a continuing culture of CRM principles (Fisher et al, 2000).

• Future studies should focus on outcomes based on testing
Questions?

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References


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