The effectiveness of computerized drug-lab alerts: A systematic review

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Adverse drug events

- **Definition:** Injuries occurring as a result of medication use

- **Common:** Occur in 6-7% hospitalizations, 4\(^{th}\)-6\(^{th}\) leading cause of death

- Higher prevalence reported in older patients, nursing home patients, patient self report
Inadequate Lab Monitoring

- Ensure that given medication is safe for a given patient
- Detect adverse drug events
- 60.8% ADEs in ambulatory care associated with inadequate lab monitoring (including both failure to order lab tests and failure to respond to lab evidence of toxicity)
Policy makers assume EMRs will improve quality and safety

SRs of CPOE & CDSS show mixed results

Effectiveness of computerized drug lab alerts is unclear
Systematic review

Inclusion criteria:

1. RCT
2. Computerized drug lab reminder systems
3. Participants: prescribing clinicians
4. Outcomes:
   - Primary: ADE
   - Secondary: Change in lab monitoring, Change in prescribing, hospitalization, mortality, increased time in therapeutic range, overridden alerts, cost

Exclusion criteria: exclusively students, no clinician decision making, target improved guideline adherence rather than safety
CCDSS: Drug prescribing & TDM domains
n=107

MMIT: Medication monitoring domain
n=30

Records after duplicates removed
n=130

Updated search May 2011
n=1

Records screened
n=132

Records excluded
n=65

Reviewed in full text
n=67

Included studies n=32
22 single drug studies (22,360 participants)
10 multi drug studies (56,521 pts/Rx)

Anticoagulation: 14 studies
(18,540 pts)
Risk of bias and other methodological issues

- Blinding
- Contamination

Few studies gave basic demographic data on healthcare providers who were research subjects
Selected results
Multi drug studies
More appropriate prescribing

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>CDSS Events</th>
<th>Total</th>
<th>Control Events</th>
<th>Total</th>
<th>M-H, Random, 95% CI</th>
<th>Odds Ratio M-H, Random, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field 2009</td>
<td>142</td>
<td>227</td>
<td>126</td>
<td>234</td>
<td>44.1%</td>
<td>1.43 [0.99, 2.08]</td>
</tr>
<tr>
<td>McDonald 1976</td>
<td>31</td>
<td>110</td>
<td>9</td>
<td>68</td>
<td>27.8%</td>
<td>2.57 [1.14, 5.81]</td>
</tr>
<tr>
<td>Terrell 2010</td>
<td>42</td>
<td>73</td>
<td>12</td>
<td>46</td>
<td>28.1%</td>
<td>3.84 [1.72, 8.59]</td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>410</strong></td>
<td><strong>348</strong></td>
<td><strong>100.0%</strong></td>
<td></td>
<td></td>
<td><strong>2.22 [1.19, 4.17]</strong></td>
</tr>
<tr>
<td>Total events</td>
<td>215</td>
<td>147</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Heterogeneity: $\tau^2 = 0.20, \chi^2 = 5.59, df = 2 (P = 0.06); i^2 = 64$

Test for overall effect: $Z = 2.49 (P = 0.01)$
Anticoagulation studies: Adverse events

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Experimental Events</th>
<th>Control Events</th>
<th>Total Events</th>
<th>Weight</th>
<th>Odds Ratio M-H, Random, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fitzmaurice 2000</td>
<td>7</td>
<td>7</td>
<td>90</td>
<td>1.3%</td>
<td>0.96 [0.32, 2.87]</td>
</tr>
<tr>
<td>Poller 2008</td>
<td>513</td>
<td>555</td>
<td>6716</td>
<td>96.0%</td>
<td>0.89 [0.78, 1.00]</td>
</tr>
<tr>
<td>Vadher (BMJ) 1997</td>
<td>8</td>
<td>7</td>
<td>72</td>
<td>1.3%</td>
<td>1.23 [0.42, 3.59]</td>
</tr>
<tr>
<td>Vadher 1997</td>
<td>7</td>
<td>7</td>
<td>90</td>
<td>1.3%</td>
<td>0.96 [0.32, 2.87]</td>
</tr>
<tr>
<td>White 1987</td>
<td>0</td>
<td>4</td>
<td>39</td>
<td>0.2%</td>
<td>0.09 [0.00, 1.76]</td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td><strong>7007</strong></td>
<td><strong>6789</strong></td>
<td><strong>100.0%</strong></td>
<td><strong>0.89 [0.79, 1.00]</strong></td>
<td></td>
</tr>
</tbody>
</table>

Total events 535 580

Heterogeneity: Tau² = 0.00; Chi² = 2.68, df = 4 (P = 0.61); I² = 0%
Test for overall effect: Z = 1.89 (P = 0.06)
Conclusions

- Moderately strong evidence of improved prescribing and trend suggesting reduction in adverse events in anticoagulation

Future directions:
- Improved methodological rigour
- Focus of patient relevant outcomes
- Impact of new workflows
Thank you!

Questions?

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