Machine learning – use of AI in medical dispatch

PhD project by Nikolaj Blomberg
Disclosure

No conflict of interest in relation to this research project

• Received an unrestricted research grant from TrygFoundation

• Received centre support from Laerdal
The challenge:

• EMDC in Copenhagen receives 100,000 emergency calls per year

• 1-2% are OHCAs

• Hard to gain experience and improve in OHCA recognition for the individual dispatcher

• How can we improve OHCA recognition and time to OHCA recognition?
The role of the EMDC in OHCA
Among all patients with bystander CPR:
35% started CPR before 9-1-1 call
65% started CPR during the 9-1-1 call
Still – we do not always understand what callers are telling us

If we don't recognize cardiac arrest, we don't provide dispatcher assisted CPR and we don't refer caller to an AED
Can AI help? How EMDC-Copenhagen use AI

• We set out to investigate if AI can be used as a decision support tool in medical dispatch
• It is a tool for support, not a final bottom line
The technology: Machine Learning

- The basic premise of machine learning is to build algorithms that can receive input data and use statistical analysis to predict an output value.
- Machine Learning is pattern recognition.
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<tbody>
<tr>
<td>Sensitivity (95% CI)</td>
<td>84.1 (81.6;86.4)</td>
<td>72.4 (69.4;75.3)</td>
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<tr>
<td>Specificity (95% CI)</td>
<td>97.3 (97.2;97.4)</td>
<td>98.8 (98.7-98.8)</td>
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<td>Negative Predictive Value (95% CI)</td>
<td>99.9 (99.8;99.9)</td>
<td>99.8 (99.7;99.8)</td>
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<tr>
<td>Positive Predictive Value (95% CI)</td>
<td>20.9 (19.6;22.3)</td>
<td>33.0 (30.1;35.1)</td>
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<tr>
<td>Sensitivity (95% CI), calls unrecognized by dispatchers</td>
<td>44.5 (38.4-50.7)</td>
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<th>Time to recognition, paired observations</th>
<th>Machine learning framework</th>
<th>Dispatcher</th>
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<tr>
<td>Median (seconds)</td>
<td>41 (38;44)</td>
<td>54 (50;59)</td>
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<td>Lower quartile (seconds)</td>
<td>24 (22;26)</td>
<td>30 (28;33)</td>
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<tr>
<td>Upper quartile (seconds)</td>
<td>67 (63;72)</td>
<td>97 (89;110)</td>
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The Capital Region of Denmark
Emergency Medical Services Copenhagen

(a)

(b)
What it took to get here

To ”teach” the artificial intelligence

• Download >100,000 recorded calls to 1-1-2
• Identify > 2,000 calls regarding OHCA
• Make sure there are no calls on OHCA in the group not labelled OHCA
Challenges in getting here

• Download the calls – technical difficulties in downloading several hundred thousand calls
• Labelling calls – need an updated cardiac arrest registry
• Integrating the technology in the IT-infrastructure
  • We build a stand-alone device that connected directly with the phone. Ideally integrated in the dispatch system
Can AI work on live audio in clinical practice

• Prospective randomised trial
• Started september 2018
• 6 months,
• ~ 328 stops in each group
  • When the machine predicts a cardiac arrest, 50% of the alerts are shown to the dispatchers
• Alert: Dispatch A1; Dispatch HeartRunners
Thanks to:

Corti
TrygFonden
Laerdal