Targeted training using a paediatric tracheostomy emergency algorithm improves performance in simulated scenarios

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Introduction
Clinical incidents involving tracheostomies are well documented1,2 and various patient safety initiatives have been aimed at targeting this in the adult population3. We wished to assess the effectiveness of a new paediatric tracheostomy emergency algorithm in improving safety. There is a strong evidence base for checklists, with one study showing a reduction in missed steps in emergency management from 23% to 6% with the addition of an emergency checklist4. In addition, simulation is a rapidly developing area of medical education used for training skills and scenarios, to practice uncommon or potentially life-threatening events in a safe environment, including training for cardiac arrest situations5. We utilized a simulated scenario in a novel way to assess the efficacy of our training package and emergency algorithm.

Method
141 volunteer healthcare professionals (52 ENT consultants, 37 anaesthetic trainees, 32 nurses and 19 ENT trainees) each managed a simulated scenario of a child with a blocked tracheostomy. Three performance metrics were measured and analyzed: time with oxygen saturations less than 88% (SpO2<88%), time to call for help, and total scenario time. Participants were then given a targeted training package using a new paediatric tracheostomy emergency algorithm. Following this, participants managed a second subtly different scenario with emergency algorithms available, and the same performance metrics were measured.

<table>
<thead>
<tr>
<th></th>
<th>Pre-training Mean (SD)</th>
<th>Post-training Mean (SD)</th>
<th>Mean difference (95% CI)</th>
<th>P*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total scenario time</td>
<td>541 (±73)</td>
<td>402 (±62)</td>
<td>139 (129-150)</td>
<td>&lt;0.005</td>
</tr>
<tr>
<td>Time SpO2 &lt;88%</td>
<td>474 (±101)</td>
<td>270 (±170)</td>
<td>204 (190-218)</td>
<td>&lt;0.005</td>
</tr>
<tr>
<td>Time to call help</td>
<td>342 (±181)</td>
<td>227 (±105)</td>
<td>116 (89-142)</td>
<td>&lt;0.005</td>
</tr>
</tbody>
</table>

Results
Average time for the scenario decreased from 541 seconds to 402 seconds, (mean difference 139 seconds, p<0.005). Mean time to call for help decreased to 227 seconds from 342 seconds, (mean difference 116 seconds, p<0.005). However the largest improvement came in the time with SpO2 <88%, with a pre-training mean time of 474 seconds, dropping to 270 seconds (mean decrease 204 seconds, p<0.005). Dividing results for subspeciality, post-training times for total scenario time and with SpO2<88% improved most for the ENT trainees (means of 164 and 246 seconds respectively), although this group had been slowest pre-training. Time to call for help improved most in the anaesthetic trainee group (mean 129 seconds), however results for this data set were very similar for all subspecialties.

Discussion
We have demonstrated clinically relevant and statistically significant improvements in the three time metrics measured: on average participants called for help 2 minutes sooner, simulated patients had SpO2<88% for 3.5 minutes less, and the entire scenario was completed 2.5 minutes faster. What is less clear is the exact reason for this improvement. It could be a result of our training package, having an emergency algorithm available for the participants to use in the second scenario, having already performed a similar scenario (i.e. they have practiced), or a combination of all of these factors. However we would argue that it does not necessarily matter which is the cause, as the most important point is improvement in oxygenation of patients in these emergency situations, plus getting appropriate help swiftly. These are the factors that could improve patient safety and importantly, may reduce the severity of clinical incidents related to tracheostomy situations when they occur.

In this study we have made use of human patient simulation in a novel way, to assess improvement in management of emergency situations before and after training.

References
5. Wayne et al (2008) - CHEST 2008; 133:56–61 Simulation-Based Education Improves Quality of Care During Cardiac Arrest Team Responses at an Academic Teaching Hospital