Reducing alarm burden by promoting judicious ordering of continuous pulse oximetry

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Reducing alarm burden by promoting judicious use of continuous pulse oximetry

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Presenter: Kathleen Berg, MD has documented no financial relationships to disclose or Conflicts of Interest (COIs) to resolve.
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Presenter: Kathleen Berg, MD has documented this presentation will not involve discussion of unapproved or off-label, experimental or investigational use.
Background

Overutilization of continuous pulse oximetry (CPO) and subsequent alarms may result in overdiagnosis and negatively impact:

- Duration of supplemental oxygen
- Length of stay
- Healthcare costs
- Sleep
- Mobility
- Response time to actionable alarms
Baseline

Jan 2019 – Dec 2019

1.13 million pulse oximetry (POx) alarms
38.7% of these alarms occurred at an SpO$_2$ $\geq$ 88%

Average of 30.16 POx alarms per patient day
Average of 12.66 POx alarms for SpO$_2$ $\geq$ 88% per patient day
Aims

1. To decrease total pulse oximetry alarms per patient day by 20% by January 2021

2. To decrease alarms for ≥88% $\text{SpO}_2$ per patient day by 20% by January 2021
Methods

Inclusion Criteria

• Admission to a Med/Surg unit from Jan 2019 – Feb 2021

Exclusion Criteria

• Cardiac care unit
• Admitted to intensive care (NICU & PICU)

19,671 patients included
Methods

Outcome Measures

1. Pulse oximetry alarms per patient day

2. Pulse oximetry alarms for ≥88% per patient day
Methods

January 2020

1. Changed **default** POx alarm limits on monitors from <90% to <88%

June 2020

1. Set POx order **default** to intermittent (q4h) rather than continuous
2. Changed order **default** target to 90% and lower alarm limit to 88%
3. Added required selection of an indication for ‘continuous’
Methods

Pulse oximetry

- Hypoxemia
- Cardiac pathology
- Non-invasive ventilation or high flow
- Home pulse oximetry use
- Artificial airway (i.e. tracheostomy)
- Medication effect (i.e. sedation)
- Critically ill
- Seizures/Altered Mental Status
- Other provider concern (see comment)

*Lower alarm limit:
*Upper alarm limit:
*Pulse oximetry indications:
Methods

Process Measures

1. Percentage of patients with any CPO order

2. Percentage of total patient days with CPO order in place
Methods

Balancing Measures

1. Frequency of “Emergency Transfers” to ICU with CPO order in place throughout the 3 hours prior

2. Frequency of Code Blue events with CPO order in place throughout the 3 hours prior
Results

Patients with any CPO order during hospitalization

Updated default alarm limits

Updated order

18.73% decrease
Results

Patient days during which CPO was ordered

- Updated default alarm limits
- Updated order

15.07% decrease
Results

All POx alarms per patient day

Updated default alarm limits

Updated order

32.89% decrease
# Results

POx alarms for ≥88% per patient day

<table>
<thead>
<tr>
<th>Month</th>
<th>Alarms per Patient Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan-19</td>
<td>CL</td>
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<tr>
<td>Feb-19</td>
<td>CL</td>
</tr>
<tr>
<td>Mar-19</td>
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<tr>
<td>Apr-19</td>
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<td>Jun-19</td>
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<tr>
<td>Jan-21</td>
<td>UCL</td>
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<tr>
<td>Feb-21</td>
<td>UCL</td>
</tr>
</tbody>
</table>

**Updated default alarm limits**

**CL**

**UCL**

**LCL**

55.61% decrease
## Results

### Balancing Measures

<table>
<thead>
<tr>
<th></th>
<th>Pre-intervention (95% CI)</th>
<th>Post-intervention (95% CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPO order in place prior to Code Blue</td>
<td>45.5% (21.3-72.0%)</td>
<td>71.4% (35.2-92.4%)</td>
<td>0.3665</td>
</tr>
<tr>
<td>CPO order in place prior to Emergency Transfer</td>
<td>68.4% (45.8-84.4%)</td>
<td>59.6% (46.1-71.0%)</td>
<td>0.5875</td>
</tr>
</tbody>
</table>
Limitations

- Discrepancies between monitor orders and actual use were not evaluated.
- Alarms data were not linked to specific patients.
- Balancing measures had wide confidence intervals.
- Seasonal variation
- Census variation (COVID-19)
Conclusions

• Change in default POx alarm limits was associated with decreased in POx alarms, particularly in alarms ≥88%.

• Changes to POx order defaults and requirements impacted provider ordering behavior with subsequent decrease in frequency of CPO orders, but had a lesser impact on alarms.

• Code Blue events and “Emergency Transfers” to intensive care with CPO orders in place prior to the events did not decrease.
Future Direction

• Promote discontinuation of CPO orders when no longer indicated
• Apply these system-level changes to cardiorespiratory monitors
• Evaluate alarms in relation to monitor orders for a specific patients
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