Alarm-Related Ventilator Deaths

**Cause Map**

1. **Patient death, serious injury**
2. **Patient receiving insufficient oxygen**
3. **Ventilator malfunction**
   - **Evidence:** Ventilator malfunction
   - **Evidence:** ECRI study: 2 out of 119 cases
4. **Ventilator blocked**
   - **Evidence:** Ventilator blocked
   - **Evidence:** Frequent vacuuming
   - **Evidence:** FDA concern/alert
5. **Ventilator not providing sufficient oxygen**
6. **Patient movement**
7. **Lack of prompt treatment of ventilator issue**
8. **Caregiver not aware of issue**
9. **Caregiver dependent on alarm**
   - **Evidence:** FDA concern/alert
10. **Possible Solutions:** Attempt to reduce dependence on alarm
11. **Alarm did not sound**
   - **Evidence:** ECRI study: 2 out of 119 cases
   - **Evidence:** Joint Commission: 65% of ventilator deaths occurred when caregivers did not respond to alarms, set alarms incorrectly or didn’t hear alarms at low volume
   - **Possible Solutions:** Minimize use of similar alarm
   - **Possible Solutions:** Use alerts for items that do not need to be attended to immediately
   - **Possible Solutions:** Attempt to reduce dependence on alarm
12. **Alarm insufficiently obvious**
   - **Evidence:** ECRI study: 16 out of 119 cases
   - **Possible Solutions:** Alarm continues until reset
   - **Possible Solutions:** Use alerts for items that do not need to be attended to immediately
13. **Alarms set inappropriately**
   - **Evidence:** ECRI study: In 53 out of 119 cases, caregivers believed alarm did not go off
   - **Possible Solutions:** Alarm continues until reset
14. **Caregivers not aware how to set alarms properly**
15. **Lack of funds**
16. **Lack of time**
17. **Relatively few patients on ventilators**

**Impact to the Goals**

- **Patient Safety**
  - **Patient death, serious injury**
  - **Alarm fatigue**
  - **Compliance?**
  - **Organization?**
  - **Patient Services?**
  - **Lack of prompt treatment of ventilator issue**
  - **Environmental?**
  - **Property, Equip, Mtls?**
  - **Labor, Time?**

**Frequency**

- 119 deaths from 2005-2011 from alarm-related problems; ~800 adverse events for ventilator patients in 2010

**What**

- Problem(s): Deaths, serious injury from ventilator alarm problems

**When**

- Different, unusual, unique

**Where**

- Facility, site
  - Various
  - Unit, area, equipment
  - Ventilators
  - Task being performed
  - Warning alarm going off

**This incident?**

- **Annualized Cost?**

**Step 1. Outline**

- **Step 1. Outline**
  - **Debates, serious injury from ventilator alarm problems**
  - **Verdict**
  - **Evidence**
  - **Alarms not noticed by staff**
  - **Ventilators**

**Step 2. Cause Map**

- **Patient Safety Goal Impacted**
- **Patient death, serious injury**
- **Patient receiving insufficient oxygen**
- **Ventilator malfunction**
  - **Evidence:** Ventilator malfunction
  - **Evidence:** ECRI study: 2 out of 119 cases
- **Ventilator blocked**
  - **Evidence:** Ventilator blocked
  - **Evidence:** Frequent vacuuming
  - **Evidence:** FDA concern/alert
- **Ventilator not providing sufficient oxygen**
- **Patient movement**
- **Lack of prompt treatment of ventilator issue**
- **Caregiver not aware of issue**
- **Caregiver dependent on alarm**
  - **Evidence:** FDA concern/alert
- **Possible Solutions:** Attempt to reduce dependence on alarm
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  - **Evidence:** Joint Commission: 65% of ventilator deaths occurred when caregivers did not respond to alarms, set alarms incorrectly or didn’t hear alarms at low volume
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  - **Possible Solutions:** Alarm continues until reset
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- **Alarms set inappropriately**
  - **Evidence:** ECRI study: In 53 out of 119 cases, caregivers believed alarm did not go off
  - **Possible Solutions:** Alarm continues until reset
- **Caregivers not aware how to set alarms properly**
- **Lack of funds**
- **Lack of time**
- **Relatively few patients on ventilators**

**NOTE:** Read the Cause Map from left to right with the phrase “Was Caused By” in place of each arrow.

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