IMPLEMENTATION OF AN EVIDENCE-BASED ON-DEMAND STRATEGY TO REDUCE ROUTINE DAILY CHEST RADIOGRAPHS IN ICU PATIENTS

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American College of Radiology recommends routine daily CXRs for mechanically ventilated patients, and use of further radiographs if necessary.

Cluster-randomised, open-label crossover study, randomly assigned 21 ICUs at 18 hospitals in France to use a routine or an on-demand strategy for prescription of CXRs.

On-demand strategy reduced CXRs by 32%.

On-demand strategy did not change the number of CXRs that led or contributed to diagnostic or therapeutic interventions, duration of mechanical ventilation or stay in ICU, or mortality.
Objectives and Aim of QI Study

1. To reduce the number of ‘routine’ chest radiographs ordered for patients admitted to the ICU at St. Paul’s Hospital

1. To develop a set of indications for when chest radiographs should be appropriately ordered for patients admitted to the ICU at St. Paul’s Hospital

1. To educate and change the practice of ICU housestaff and physicians about the utility of decreasing routine chest radiographs by employing an evidence-based on-demand strategy
Methods – Aim statement

“To reduce the number of chest radiographs ordered for patients admitted to the medical-surgical ICU of St. Paul's Hospital by 25% within 3 months by employing an on-demand strategy versus the current routine standard strategy”
Methods – Overall approach to employ the ‘on-demand’ strategy

- education of housestaff at start of each ICU rotation of the current evidence for daily chest radiography:
  - 5 minute presentation explaining current evidence against the use of routine chest radiographs
  - Reinforcing acceptable indications for ordering a chest radiograph
Methods – Overall approach to employ the ‘on-demand’ strategy

- Implementation of a prompt in the computer order entry system:
  - Unexplained new cardiopulmonary symptoms or signs e.g. chest pain, dysnea, hemoptysis, hypoxemia, hypercapnea, decreased pulmonary compliance
  - Suspected new pneumonia
  - Suspected new pneumothorax
  - Suspected new pleural effusion
  - Insertion of new tubes endotracheal, central venous, nasogastric/enteral feeding, chest tube
  - Suspected malposition or malfunction of existing tubes
  - Other (‘Routine’ or ‘mechanical ventilation’ are not indications by themselves)

- Additional Comments

- Portable?

- Isolation

- Additional Copies To
Methods – Overall approach to employ the ‘on-demand’ strategy

- Distribution of posters in the SPH ICU indicating acceptable indications for chest radiography:

Routine chest x-rays:
1) Do not reduce ICU mortality, length of ICU stay or number of days on ventilator
2) Rarely lead to therapeutic or diagnostic interventions

Acceptable indications for ordering chest x-ray in ICU:
1) Unexplained new cardiopulmonary symptoms or signs—chest pain, dyspnea, hemoptysis, hypoxemia, hypoxemia, hypercapnia, decreased pulmonary compliance
2) Suspected pneumonia
3) Suspected pneumothorax
4) Suspected pleural effusion
5) Insertion of new tubes or suspected malposition/malfunction of existing tubes—endotracheal, central venous, nasogastric/enteral feeding, chest tube
Results

Data have been collected continuously from initiation of study:

- **Pre-intervention period**: June 20, 2010 up to June 15, 2011

- **Post-intervention period**: June 15, 2011 – December 11, 2011
Results – intervention timeline

- June 15/11: ICU Posters
- June 22/11: Computer Order Entry
- July 6, 2011: Education of housestaff at start of rotation
<table>
<thead>
<tr>
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<th>Before June 15th, 2011</th>
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<tbody>
<tr>
<td><strong>ICU admissions</strong></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>616</td>
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<tr>
<td>Age (mean ± SD)</td>
<td>57.7 ± 16.5</td>
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<tr>
<td>Sex (% male)</td>
<td>62.3%</td>
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<tr>
<td>APACHE II score (mean ± SD)</td>
<td>22 ± 9</td>
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<tr>
<td>ICU Mortality</td>
<td>22.1%</td>
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<tr>
<td>Hospital Mortality</td>
<td>32.0%</td>
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<td>ICU Length of Stay (median (IQR))</td>
<td>6 (3, 11)</td>
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<td>Ventilation days (median (IQR))</td>
<td>2 (0, 6)</td>
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</table>
When comparing CXRs per patient-day before and after the intervention period, the standardized ratio of proportions was

0.78 (95% CI 0.75 – 0.80)

This corresponds to a reduction of 22%
Reduction in CXRs was not associated with any change in the number of CT Chest scans (or number of procedures).
Discussion and Limitations

- **22% reduction of CXRs versus original goal of 25%**
- **Patient Benefits:** less radiation, less adverse events by repositioning for CXR and mortality unaffected
- **MDs:** less time discussing routine films, thus increasing rounds efficiency
- **RNs:** less time spent re-positioning/moving patients
- **Hospital Benefits:** ~700 fewer CXRs per year

- **Limitations:** strategies to reduce CXR ordering *(education, computer order entry, posters)* were implemented simultaneously and so unable to precisely determine which was most effective – changes occurred rapidly and long term sustainability undetermined at this time point
Conclusions and Recommendations

- educating rotating house-staff and attending physicians on chest radiograph ordering in the ICU for specific indications, reinforced by controlled computer order entry, is effective in both significantly reducing the number of unnecessary radiographs ordered (without increased morbidity) and translates into substantial health-care savings:

  - $28,000 CAD can be saved over a 1 year period (~700 fewer annual chest radiographs) which could be used to purchase a portable ICU bedside ultrasound (better than CXR at detecting many chest findings)

- The findings from this pilot study should be extended for implementation in all ICUs employing routine chest radiography – easy and takes minimal time and cost
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