Quality Control & Management of PPE within a Large Health Care Region

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Our Health Care Region

- British Columbia Lower Mainland
  - Population of ~ 2.6 mil (60% of the province)
  - 28 hospitals (rural -> primary trauma centres)
  - ~ 5000 pieces of PPE
    (thyroid, aprons, vest, skirts, gloves, etc.)
Accreditation Bodies & Standards

• Provincial accreditation body
  - Accredits medical imaging services at each hospital

Diagnostic Accreditation Program

• Federal health care standard
  - Health Canada Safety Code 35

Minimum PPE Requirements (DAP RS 4.3)

• 0.25 mm Pb equiv. $kV_{p_{\text{max}}} \leq 100$
• 0.35 mm Pb equiv. $100 < kV_{p_{\text{max}}} < 150$ kVp
• 0.5 mm Pb equiv. $kV_{p_{\text{max}}} \geq 150$
• 0.5 mm Pb front / 0.25 mm Pb back recommended for interventional procedures
• Pb equiv. must be permanently marked on all PPE
• Challenge: numerous lead composite and non-lead PPE are offered by manufacturers
Regular QC Requirements (DAP DES 3.10)

• Annual inspection for defects
  - Total defective area < 670 mm²
  - Defects < 5 mm diameter hole in area of thyroid / reproductive organs

• Challenge: hand written logs was a practice that often led to poor identification, inadequate tracking of PPE, and non-continuous records

PPE QC and Management Program

• Evaluation of new PPE materials
  - Performed by Medical Physics

• Acceptance testing of newly ordered/received PPE
  - Performed by Quality Coordinators

• PPE Inventory system to facilitate annual QC and tracking
  - Performed by Radiology Technologists
Evaluation of New PPE Materials

• Primary transmission fit to the Archer model\textsuperscript{1}
  using a gen rad suite and 99.95% pure lead foil
  \[ B = \left[ (1 + \frac{\beta}{\alpha})e^{\alpha x} - \frac{\beta}{\alpha} \right] \frac{1}{\gamma} \]

• Derived fitting parameters used to evaluate all new PPE materials offered by manufacturers
  - Build a preferred / approved materials list for the health region

Acceptance Testing

• Lead equivalency evaluation
  - Evaluate sub-sample of each shielding batch (lot #)

• Visual inspection
  - Ensures item matches order
  - Ensure PPE is properly labeled

• Fluoroscopic inspection
  - Ensure no defects in shielding
Visual Inspection Example

• Multiple matching creases
• Manufacturer replaced lead free of charge
• $600 value

Fluoroscopic Inspection

• Ensures no manufacture, repair, or shipping damage
Advantages of a Software PPE Inventory

• Standardization across hospital regions
  - Testing procedure
  - Identification system

• Web accessible database
  - Facilitates providing documentation for accreditation
  - Inventory continually updated as new items arrive

• More accurate records
  - Able to uniquely identify similar looking items

• Time savings during annual inspections

Unique Barcode Identifiers

• 2D barcode buttons
  - Fasten onto PPE via rivet-like mechanism
  - Provide fast ID via a barcode scanner

13 mm
PPE with Barcode Applied

PPE Inventory Interface
Features

• Tracking
  - In use, Out for repair, Removed from use

• History
  - Full history of all QC (and results) performed on the PPE throughout its lifetime

• Report generation
  - Individual reports or lists to facilitate accreditation

• Accessibility
  - Database is stored on a web-accessible collaboration platform (Microsoft Sharepoint)

Example Report

Detailed Report on Personal Protective Equipment

Barcode ID: 57503071
PPE Article: Fruen - third only

Current Status: Current

Manufacturer: Max Medical
Model: 2020-2021
Color: Red

Last QC Inspection Results

<table>
<thead>
<tr>
<th>Date</th>
<th>Type</th>
<th>QC Result</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>02/01/2021</td>
<td>Fruen</td>
<td>Passed</td>
<td>New stock in use from 02/01/2021</td>
</tr>
<tr>
<td>03/01/2021</td>
<td>Fruen</td>
<td>Passed</td>
<td>QC Passed - Все в порядке</td>
</tr>
</tbody>
</table>

History

<table>
<thead>
<tr>
<th>Date</th>
<th>Status</th>
<th>QC Result</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>02/01/2021</td>
<td>In use</td>
<td>Passed</td>
<td>New stock in use from 02/01/2021</td>
</tr>
<tr>
<td>03/01/2021</td>
<td>In use</td>
<td>Passed</td>
<td>QC Passed - Все в порядке</td>
</tr>
<tr>
<td>04/01/2021</td>
<td>Out for repair</td>
<td>Passed</td>
<td>Ready for use</td>
</tr>
<tr>
<td>05/01/2021</td>
<td>In use</td>
<td>Passed</td>
<td>QC Passed - Все в порядке</td>
</tr>
<tr>
<td>06/01/2021</td>
<td>In use</td>
<td>Passed</td>
<td>QC Passed - Все в порядке</td>
</tr>
<tr>
<td>07/01/2021</td>
<td>Out for repair</td>
<td>Passed</td>
<td>Ready for use</td>
</tr>
<tr>
<td>08/01/2021</td>
<td>In use</td>
<td>Passed</td>
<td>QC Passed - Все в порядке</td>
</tr>
<tr>
<td>09/01/2021</td>
<td>Out for repair</td>
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<td>Ready for use</td>
</tr>
<tr>
<td>10/01/2021</td>
<td>In use</td>
<td>Passed</td>
<td>QC Passed - Все в порядке</td>
</tr>
<tr>
<td>11/01/2021</td>
<td>Out for repair</td>
<td>Passed</td>
<td>Ready for use</td>
</tr>
<tr>
<td>12/01/2021</td>
<td>In use</td>
<td>Passed</td>
<td>QC Passed - Все в порядке</td>
</tr>
<tr>
<td>01/02/2021</td>
<td>Out for repair</td>
<td>Passed</td>
<td>Ready for use</td>
</tr>
</tbody>
</table>
PPE Inventory System

• Travel case, computer, barcode reader & ID supplies

Advantages of In-house Developed System

• Low cost
  - Competing systems offered by vendors can have large upfront costs, plus annual licensing fees

• Non biased
  - Some vendor’s system are biased to work best with their own product

• Ownership and personalization
  - Data is owned by the health care system
  - System can be tailored (on the fly) to meet personal needs
The End