Committee members

Prof. Alan Hedge, chair
Prof. Geri Gay, minor member
Prof. Nancy Wells, special member
Outline

- Problem statement
- Introduction to the work environment of radiologists
- Checklists
- Checklist Rationale
- Development of the Cornell Digital Reading Room Ergonomics Checklist (CDRREC)
- Evaluation of the CDRREC
  - Expert Feedback and Results
  - Individual Item Test and Results
- Changes and improvements to the CDRREC
- Acknowledgements
There is an upsurge in work related complaints from radiologists.

The incidence rate of carpal tunnel syndrome in radiologists has been found to be twice as high as that in administrative and other clerical staff.

Currently no evaluation documentation, tools or systematic strategies in place for this environment.
Work environment of radiologists

Work environment of radiologists

Work environment of radiologists

Checklists

- Well known tool in the field of ergonomics
- Referred to as the simplest form of observation
- Most commonly the observer will answer a list of questions with either a “yes” or a “no”
- A well designed checklist is considered to be fast, easy to learn and use
CDRREC Rationale

- Checklist would be a feasible option for hospitals
- Will provide a quick indication of problems in the environment
- Potential user group: Ergonomists, Facility managers, Health and Safety professionals
CDRREC Development

- Looked at existing environmental checklists and observational tools
- Researched literature of the digital radiology reading room environment
- Looked at commercially available literature for radiology
- Identified items that will represent a digital radiology reading room workstation
CDRREC Development

CDRREC Organization

- Ambient Environment 9
- Display Screens 7
- Input Devices 6
- Chair 9
- Workstation & Accessories 6
Each question is answered with yes/no checkmark, measurement or a rating

6. Please check the image that best describes the posture of the radiologist while (s)he is viewing the screens:
INSTRUCTIONS: Ask the radiologist to sit directly in front of and facing the left screen while evaluating the posture.
Repeat for the right screen.

<table>
<thead>
<tr>
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Correct distance/height  Screen too close  Screen too far away  Screen too low  Screen too high

35. Does the reading room noise level interfere with reading performance or verbal communication?

O NO       O YES  Noise level _____db (A)
CDRREC Evaluation

- Pilot Testing
- Expert Feedback
- Individual Item Test
CDRREC Evaluation: Expert feedback

- Distributed questionnaire with open and closed ended answer options.
- Asked about the usability, layout and overall comprehensiveness of the checklist.
- Distributed to practicing radiologists, hospital administrators, ergonomists, architects.
## Expert feedback Results

### Expert feedback summarized

<table>
<thead>
<tr>
<th>Section</th>
<th>Improvements or changes</th>
<th>New items</th>
<th>Questions, comments information</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display Screens</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Input devices</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Workstation and workstation accessories</td>
<td>4</td>
<td>6</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>Chair</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Ambient Environment</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>3</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>15</strong></td>
<td><strong>13</strong></td>
<td><strong>11</strong></td>
<td><strong>39</strong></td>
</tr>
</tbody>
</table>
Twenty-one people asked to complete 10 items from the checklist using images depicting a model radiologist performing various tasks
<table>
<thead>
<tr>
<th>Number and item description</th>
<th>P-P Agreement (%)</th>
<th>P-E Agreement (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4a) Is there glare on the display screens that affects image reading?</td>
<td>85.7</td>
<td>85.7</td>
</tr>
<tr>
<td>4b) If Yes, please mark or fill in the screen areas affected by glare</td>
<td>39 36.7</td>
<td>92.7 100</td>
</tr>
<tr>
<td>5 Check the current screen character luminance of the computer screens by comparing to these luminance examples</td>
<td>33 38</td>
<td>66.7 42.9</td>
</tr>
<tr>
<td>6 Please check the image that best describes the posture of the radiologist while (s)he is viewing the screens</td>
<td>71.4</td>
<td>71.4</td>
</tr>
<tr>
<td>8 What is the wrist angle?</td>
<td>85.7</td>
<td>85.7</td>
</tr>
<tr>
<td>11 What is the wrist position?</td>
<td>90.5</td>
<td>90.5</td>
</tr>
<tr>
<td>14 Does the work surface look cluttered?</td>
<td>95.2</td>
<td>95.2</td>
</tr>
<tr>
<td>17 Does the radiologist have sufficient space for feet underneath the desk?</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>18 Is the document placed at the same height and distance as the screen?</td>
<td>61.9</td>
<td>61.9</td>
</tr>
<tr>
<td>19 Is the telephone used with the head upright and shoulders relaxed?</td>
<td>90.5</td>
<td>90.5</td>
</tr>
</tbody>
</table>
Question 4b) - If Yes, please mark or fill in the screen areas affected by glare
Individual Item Test Results

Question 5 - Check the current screen character luminance of the computer screens by comparing to these luminance examples:

1 1 1 1 1 2 2 2 2 2 3 3 3 3 3 4 4 4 4 4 5 5 5 5 5 6 6 6 6 6

![Graph showing luminance comparison between left and right monitors.](chart-image)
Question 17 - Does the radiologist have sufficient space for feet underneath the desk?
Individual Item Test Results

Question 18b) - Is the document placed at the same height and distance as the screen?
Overall Results

- Final version contains 43 items – up from 37
- Display screen section based on three monitor set-up
- New items include questions on individual control for heat and lighting, type of display screen used and adjustability of workstation desk
- Eliminated item number 5 (Character luminance)
- Descriptive labels were added to images depicting postural items
- Word choice for clarification, further specification
Thank you!

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