Quality of Ultrasound Images Based on Machine Age
Anggelis E\textsuperscript{1}, Price S\textsuperscript{1}, Long C\textsuperscript{1}, Carneal G\textsuperscript{2}, Long J\textsuperscript{1}, Wilson T\textsuperscript{3}

\textsuperscript{1}Humana Inc., Louisville KY
\textsuperscript{2}RadSite, Annapolis MD
\textsuperscript{3}Trajectory Healthcare, Loveland OH

The authors are employees of their respective affiliations and no external funding was provided for this study.
Rationale for Study

1. Diagnostic ultrasound utilization has immensely increased in the past decade and therefore requires heightened attention\(^1\)

2. Ultrasound image quality can be affected by many factors, including machine age and maintenance\(^2\)

3. There is little federal regulation in the United States mandating machine upkeep\(^3\)

Objective: To measure the relationship between machine age and re-imaging as an indicator of image quality
Methods

- Retrospective, observational study
- Medical claims data from a large Medicare Advantage plan and a radiology benefit management company

Patients

- Patients who received at least one ultrasound between 1/2011-2/2012 at a facility with only one ultrasound machine

Outcome

- Re-imaging at the same facility within 30 days
- Reported for two mutually exclusive groups:
  - Initial ultrasound claim with unspecified body system: Repeat ultrasound
  - Initial ultrasound claim with specified body system: Repeat Non-ultrasound modalities
- Stratified by the age of machine at the time of the initial image
Results: Unspecified Body System and Repeat Ultrasounds

12% (N=836) of the initial images required secondary ultrasound imaging

Repeat ultrasounds were significantly more common with initial imaging machines over 12 years of age.

6,889 initial ultrasound with unspecified body systems

155 facilities

Repeat ultrasound imaging by age of machine

Machine age (years) at time of initial image

<table>
<thead>
<tr>
<th>Machine Age</th>
<th>Initial Images</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤12</td>
<td>6,444</td>
</tr>
<tr>
<td>&gt;12</td>
<td>445</td>
</tr>
</tbody>
</table>

12% (N=836) p<0.05
Results: Specified Body System and Repeat Non-ultrasounds

6.6% (N=928) of the initial images required secondary non-ultrasound imaging.

Repeat non-ultrasounds were significantly more common with initial imaging machines over 8 years of age.

There was no difference in repeat non-ultrasound imaging of specific body systems by machine age, except for the cardiovascular body system.

14,127 initial ultrasound with specified body systems
538 facilities

Repeat non-ultrasound imaging by age of machine

<table>
<thead>
<tr>
<th>Machine age (years) at time of initial image</th>
<th>N initial images</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;8</td>
<td>N=11,541</td>
</tr>
<tr>
<td>≥8</td>
<td>N=2,586</td>
</tr>
</tbody>
</table>

6%

11%
p<0.05
Conclusions

**Objective:** To measure the relationship between machine age and re-imaging as an indicator of image quality

**Results:** Increased re-imaging observed with older machines (≥8-12 years)

**Conclusions**

- Findings supports the premise that older ultrasound equipment can adversely impact image quality
- These outcomes highlight the need to investigate other machine-related factors that may impact image quality.
Implications

- May support strengthened quality standards
- May decrease rate of re-imaging
- May decrease misdiagnosis
- May improve patient care
- Additional data for machine maintenance impact on initial image quality
References


Thank You