Chest pain is one of the most common reasons patients visit physicians. One non-invasive means of evaluating chest pain, CCTA, has been evolving for 15 years. Its use in assessing chest pain has yet to become standard of care. The current standard of care for evaluation of low and intermediate pre-test probability chest pain patients is initiated with stress single-photon emission computed tomography (SPECT) or stress echocardiogram (STE). The standard of care workup is typically expensive, potentially invasive, or present significant radiation dose(s); false positives and false negatives tests are not uncommon.

When the initial workup leads to a cardiac catheterization (CATH), it may present more potential harm to the patient, as CATHs have a complication rate between 1% and 4%. Despite the volume of patients experiencing chest pain each year, prior studies investigating invasive and non-invasive physiologic testing for coronary artery disease (CAD) in stable chest pain patients have focused on small population subsets.

1) Quantifying catheterizations following initial non-invasive workups
2) Evaluating the rate of stent placement following either initial CCTA assessment or catheterization (CATH) without CCTA

Objective
To investigate the role of coronary computed tomographic angiography (CCTA) in the initial assessment of chest pain by:

1. The rate of CCTA following initial non-invasive workups of chest pain
2. The rate of stent procedures following initial CCTA or CATH

Methods
Background
• Chest pain is one of the most common reasons patients visit physicians. One non-invasive means of evaluating chest pain, CCTA, has been evolving for 15 years. Its use in assessing chest pain has yet to become standard of care.
• The current standard of care for evaluation of low and intermediate pre-test probability chest pain patients is initiated with stress single-photon emission computed tomography (SPECT) or stress echocardiogram (STE). The standard of care workup is typically expensive, potentially invasive, or present significant radiation dose(s); false positives and false negatives tests are not uncommon.
• When the initial workup leads to a cardiac catheterization (CATH), it may present more potential harm to the patient, as CATHs have a complication rate between 1% and 4%. Despite the volume of patients experiencing chest pain each year, prior studies investigating invasive and non-invasive physiologic testing for coronary artery disease (CAD) in stable chest pain patients have focused on small population subsets.

The rate of initial CCTA among Medicare beneficiaries with chest pain was compared for each group using a two-tailed t-test.

Design: Retrospective analysis using administrative claims data from a large, national health insurer
Population: Patients diagnosed with chest pain who received either an initial CCTA or CATH with no CCTA. Patients receiving a stent prior to the CCTA or CATH were excluded.
Timeframe: Chest pain diagnosis in 2010; continuous enrollment for 24 months after the initial assessment and no prior history of chest pain or related procedure in the year prior.

Outcomes and Analysis:
The number of patients receiving 1 or more procedures, as well as the proportion of patients with a CATH following their initial assessment, were reported.

Results

Table 1: Distribution of initial non-invasive workup for chest pain by type and number of procedures, Medicare population

<table>
<thead>
<tr>
<th>Initial Procedure</th>
<th>1st procedure n (%)</th>
<th>2nd procedure n (%)</th>
<th>3rd procedure n (%)</th>
<th>Total number of procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTCA</td>
<td>697 (42.6%)</td>
<td>98 (14.3%)</td>
<td>1,092</td>
<td></td>
</tr>
<tr>
<td>CNUC</td>
<td>12,419 (34.9%)</td>
<td>2,062 (13.4%)</td>
<td>22,803</td>
<td></td>
</tr>
<tr>
<td>STE</td>
<td>6,979 (38.9%)</td>
<td>620 (8.9%)</td>
<td>10,317</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>23,095</td>
<td>2,780</td>
<td>34,222</td>
<td></td>
</tr>
</tbody>
</table>

- CNUC was the most common initial cardiac procedure.
- Among those with an initial workup, 36.1% went on to have 2 or more procedures and 12.0% had 3 procedures.

Table 2: Frequency of stent placement

<table>
<thead>
<tr>
<th>Initial CCTA with no CATH cohort</th>
<th>CATH</th>
<th>STENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCTA</td>
<td>1,143</td>
<td>78</td>
</tr>
<tr>
<td>CATH</td>
<td>24</td>
<td>162</td>
</tr>
<tr>
<td>STENT</td>
<td>12</td>
<td>2</td>
</tr>
</tbody>
</table>

- Among those with an initial CATH (n=24), 30.2% had a catheterization and 24.6% of those went on to have a stent.
- Among the initial assessments, 50.4% of Medicare patients with CNUC had a catheterization, compared to 26.8% with CCTA and 21.6% with STE.

Implications
- Given the following:
  - Substituting CCTA for CNUC saves between 0 and 6 millisieverts (mSv) per individual,
  - 1 mSv equals to 3.125 life-years lost per 1,000 individuals,

If a balanced population of 100,000 men and women each received a single CCTA instead of CNUC, the collective impact would be to save 795 less years of life lost due to reduced radiation exposure.

- Patients also may benefit from reduced CATHs.
- Assuming that the patients who received each of the initial procedures were otherwise comparable, if a population of 100,000 patients destined to receive non-invasive procedures were given an initial CCTA instead of an initial CNUC, our findings suggest that the population might receive 6,500 fewer CATHs.
- If CATHs have a complication rate between 1.4%, this switch would save 63 to 260 of the patients from experiencing complications.

Conclusions
• CCTA or STE as an initial, non-invasive cardiac procedure result in fewer cardiac catheterizations, and may therefore reduce radiation exposure and risk of complications from invasive tests.
• The rate of stent placement was lower among those who had an initial CATH assessment, compared to when catheterization was used alone.
• CATH’s role should be clarified through prospective, randomized studies.

Limitations
- The study was subject to limitations inherent in administrative claims analysis, including coding errors, missing data and unmeasured factors
- Use of claims data for principal analysis did not allow for observation of clinical endpoints.
- Patients were not randomly assigned to interventions, as this was a retrospective study.
- There may have been demographic differences between the cohorts of patients who received different interventions; however, these differences were not controlled for in the analysis.

References