Out-of-Pocket Expenditures for Imaging Examinations: Perspectives from National Patient Surveys Over Two Decades
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Background

Increase in overall healthcare costs in the United States

Increase in diagnosing imaging utilization

Significant Medicare payment cuts for medical imaging

Changes in insurance eligibility and coverage, resulting in increasing co-payments and deductibles

Healthcare costs continue to rise in the US across most clinical services, with medical imaging implicated as a potential driver of healthcare spending growth [1,2]

Advanced imaging has recently ranked number one in influencing patient out-of-pocket (OOP) costs [3]

Evolution in trends for out-of-pocket costs incurred for non-invasive diagnostic imaging

References:
Objectives

• **Primary Objective**: Study the longitudinal trends in mean overall and out-of-pocket (OOP) costs for non-invasive diagnostic imaging

• **Secondary Objective**: Analyze the effects of sociodemographic, personal and clinical factors on incurring out-of-pocket costs for non-invasive diagnostic imaging
Methods

**Database:** Agency for Healthcare Research and Quality (AHRQ)’s Medical Expenditure Panel Survey (MEPS) data from 2000-2019.

What is this?
MEPS represents a set of large-scale surveys of families and individuals and their medical care providers and employers across the United States. It is the most complete source of data on the patient-reported cost and use of health care and health insurance coverage in the USA.

**Study Inclusion Criteria**

<table>
<thead>
<tr>
<th>1)</th>
<th>Patient encounter that occurred in an emergency room, outpatient setting, or office-based visit</th>
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<tbody>
<tr>
<td>2)</td>
<td>Underwent only a non-invasive diagnostic imaging examination during encounter, including mammography, radiography, ultrasonography (US) or computed tomography (CT) /magnetic resonance imaging (MRI).</td>
</tr>
</tbody>
</table>
Methods

**Outcomes Variable:** Patient-reported OOP costs for non-invasive diagnostic imaging

- Socioeconomic/personal/clinical variables identified: gender, age, race, ethnicity, insurance coverage, family income, family size, number of comorbid conditions, prior history of cancer diagnosis

- Trends in overall mean OOP cost per-person across years was calculated

- Trends in mean OOP cost per-person for all four modality groups (ultrasonography, radiography, mammography, CT/MRI) individually were calculated

- Analyzed the relationship between sociodemographic factors, clinical and personal characteristics with incurring OOP costs for non-invasive diagnosing imaging

- Costs were adjusted to 2020 dollars by using Consumer Price Index, personal healthcare index for physician and clinical services and overall personal healthcare index
Methods

Statistical Analyses

• Logistic regression used to model the relationship between sociodemographic, personal and clinical characteristics associated with OOP costs (Binomially distributed as zero, or >0)

• Relationship between different socio-demographic, personal, clinical characteristics and total positive OOP cost estimated by using a generalized linear model with log-link and gamma ($\gamma$) – distribution

• Statistical analysis conducted using SAS version 9.4 (SAS Institute, Inc; Cary, NC)

• All statistical analyses performed at a 0.05 level of significance.
Results

- Total number of patients = 102,717
- Total number of imaging-focused encounters = 228,920
- Majority were white (58.8%) and female (64.8%)
- Age: Mean = 45.6 years
- 38.3% respondents had at least two comorbidities
- Lifetime history of cancer: 11.2% of respondents
- Insurance Status: 93% of respondents had some form of insurance
- 22.8% of respondents belong to “Poor” (family income <100% of the federal poverty line) or “Near poor” (family income between 100% to <125% of the federal poverty line)
- 51% of all respondents incurred at least some OOP costs
**Figure 1:** Mean out of pocket cost ($) per person who reported having an imaging event in a calendar year

Overall imaging mean OOP costs increased by 35.4% from 2000 to 2019
Figure 2: Mean out of pocket cost ($) per person of mammography, radiography, ultrasonography and CT/MRI each year from 2000 to 2019

Mean OOP costs for mammography decreased by 29%; mean OOP costs for other modalities increased: 62.6% for radiography 110.1% for US, and 42.5% for CT/MRI.
Figure 3: Percentage of mean out of pocket cost ($) per person for mammography, radiography, ultrasonography, and CT/MRI each year from 2000 to 2019

Mean OOP costs as a percentage of mean total cost increased for radiography, ultrasonography, and CT/MRI and decreased for mammography between 2000 and 2019.
Table 1: Socio-demographic and clinical correlates of patients’ out of pocket costs

<table>
<thead>
<tr>
<th>Variable</th>
<th>Having any OOP cost Odds ratio (95% CI), p-value</th>
<th>Among those with positive OOP cost Estimates (95% CI), p-value</th>
</tr>
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<tbody>
<tr>
<td>Age</td>
<td>0.99 (0.99 – 0.99), p = 0.0003</td>
<td>0.994 (0.993-0.995), p&lt;0.0001</td>
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<tr>
<td>Male (Reference: Female)</td>
<td>1.02 (0.99-1.04), p = 0.2556</td>
<td>0.99 (0.96-1.01), p=0.0232</td>
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<td>Race (Reference: Non-Hispanic White)</td>
<td>0.76 (0.73-0.79), p &lt; 0.0001</td>
<td>0.84 (0.81-0.87), p &lt; 0.0001</td>
</tr>
<tr>
<td>Non-Hispanic Black</td>
<td>0.84 (0.81-0.87), p = 0.0257</td>
<td>0.88 (0.85-0.91), p &lt; 0.0001</td>
</tr>
<tr>
<td>Hispanic</td>
<td>0.39 (0.37-0.41), p &lt; 0.0001</td>
<td>1.05 (1.01-1.09), p = 0.0404</td>
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<tr>
<td>Family income as a percentage of poverty line (Reference: High income)</td>
<td>0.50 (0.47-0.53), p &lt; 0.0001</td>
<td>1.24 (1.16-1.32), p &lt; 0.0001</td>
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<td>Poor</td>
<td>0.61 (0.58-0.64), p &lt; 0.0001</td>
<td>0.95 (0.92-0.99), p = 0.0149</td>
</tr>
<tr>
<td>Near Poor</td>
<td>0.82 (0.79-0.84), p &lt; 0.0001</td>
<td>0.95 (0.92-0.98), p = 0.0002</td>
</tr>
<tr>
<td>Low income</td>
<td>0.35 (0.34-0.36), p &lt; 0.0001</td>
<td>0.88 (0.85-0.92), p &lt; 0.0001</td>
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<tr>
<td>Middle income</td>
<td>1.44 (1.37-1.52), p &lt; 0.0001</td>
<td>2.44 (2.33-2.54), p &lt; 0.0001</td>
</tr>
<tr>
<td>Insurance status (Reference: Any private)</td>
<td>1.00 (0.97-1.04), p = 0.1374</td>
<td>1.06(1.02-1.09), p = 0.0006</td>
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<tr>
<td>Comorbidity (Reference = 0)</td>
<td>1.05 (1.01-1.09), p = 0.0049</td>
<td>1.11 (1.07-1.14), p &lt; 0.0001</td>
</tr>
<tr>
<td>Cancer (Reference= No)</td>
<td>0.97 (0.93-1.02), p = 0.2081</td>
<td>1.23 (1.19-1.28), p &lt; 0.0001</td>
</tr>
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</table>

- Patients were less likely to incur OOP costs when older, racial/ethnic minorities, of lower income or recipients of public only insurance (compared to private).
- Among those with some OOP costs, the presence of comorbidities, lack of insurance, lower family income, and history of cancer significantly increased OOP costs.
Discussion

- Steep increases in mean OOP costs for imaging examinations from 2000 through 2009, and then a gradual decline between 2009 and 2017. Between 2017 and 2019, however, we again observed a sharp 40.9% increase in mean OOP costs

- Decline between 2009 to 2017 may be attributable to introduction of Affordable Care Act [4,5]

- Decline in OOP costs between 2009 and 2017 may also be due to increasing access to Medicaid and creating subsidy eligibility for those with incomes up to the 138% of the Federal Poverty Level (FPL) [6,7]

- Increase between 2017 to 2019 may be due to abatement of ACA-related interventions and other policy changes that contribute to reduced access to and enrollment in health plans. [8]

Discussion

- **Patients who are older, of racial or ethnic minorities and have public insurance are less likely to incur any OOP imaging costs, or incur lower OOP imaging costs.**
  - Older individuals are more likely to be Medicare beneficiaries and are less likely to have gaps in insurance coverage. [9]
  - Racial and ethnic minority groups are more likely to have public insurance, which is associated with lower OOP cost plans. [8]

- **Patients with lower family income were less likely to incur OOP costs, however once they do incur OOP costs, they tend to have higher OOP costs than those in higher-income groups**
  - Due to possible enrollment in higher deductible insurance plans through the ACA Marketplace

- **Having comorbid conditions or lifetime history of cancer is associated with incurring any OOP costs and higher OOP costs**

Discussion

• High OOP cost burdens can adversely impact financially challenged patients and limit their access to imaging services

• Interventions such as patient-level screening for financial fragility and providing rideshare services to reduce indirect costs for imaging examinations can reduce financial burden and improve access to imaging services

• Advancing price transparency initiatives and training patient-facing personnel on addressing patients’ concerns on insurance coverage and OOP costs can help mitigate financial hardship, especially to susceptible populations