Using claims data to investigate RT use at the end of life

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Background

• 25% of Medicare budget spent on the last year of life. (Lubitz, et al., NEJM, 1993 and Riley, et al. HSR, 2010)

• Investigators have developed metrics for documenting aggressiveness of cancer care at the end of life
  – Overuse of chemotherapy before death
  – Treatment that results in high rates of ER, hosp, or ICU visits
  – Underutilization of hospice care

(Earle, et al. JCO 21, 2003)
Background

• Used claims data and these metrics to investigate end of life cancer care

• Documented patterns of increasingly aggressive care at the end of life since the mid-1990s
  
  (Earle, et al. JCO 22, 2004 and JCO 26, 2008)

• None of these metrics looked at RT utilization
Cumulative (over the period 2003–2009) Excess Per Capita Expenditure as a Percentage of 2002 Per Capita Expenditure

- Internal medicine
- Cardiology
- Ophthalmology
- Diagnostic radiology
- Family practice
- Orthopedic surgery
- Anesthesiology
- Dermatology
- Neurology
- Emergency medicine
- Radiation oncology
- Thoracic surgery
- Psychiatry
- Pathology
- Vascular surgery
- Geriatric medicine

Very few published studies on RT at the end of life in the US

- One US study suggested underutilization of RT for palliation in hospice population. (Lutz et al. JCO, 2004).

- German study suggested when it’s used; poorly tailored with dying patients spending a large proportion of final days receiving RT. (Gripp et al. CANCER, 2010).
Begging to be looked at—where to start?

• What types of radiation therapy are delivered at the end of life?
  – Some techniques are more expensive than others, but untested/unproven in the palliative setting

• How much radiation therapy is delivered at the end of life?
  – RT reimbursed per treatment; but more isn’t always better.
Changing trends in RT technologies in last year of life for metastatic disease

- SEER-Medicare database
- Pts dx’d with metastatic breast, colorectal, lung, pancreatic, or prostate cancer and died between 2000 and 2007

Cohort definition, N=64,525

- Must have pathologic confirmation of cancer (not diagnosed at autopsy or death)
- Age 65 or >
- Medicare Part A/B coverage and no HMO coverage for 12 mos prior to date of cancer diagnosis
- Exclude if no claims data available in the 12 mos prior to date of diagnosis
Outcomes

• We determined the proportion of patients who received RT in the last 12 mos of life (or fewer if survived < 12 mos after dx).

• We ascertained the type of RT they received (eg, 2D-RT, 3D-RT, IMRT, or SRS) in the last 12 mos using claims codes.

• Pts could have more than one course of RT; more than one type of modality
Outcomes

• 19,161 patients (29.7%) received any RT in their last 12 mos of life after diagnosis

• This proportion was stable from 2000-2007 (incident cases)...(p=0.11, Cochran Armitage test of trend).

• RT more likely if not-black, married, younger, higher income neighborhood, low comorbidities, southern SEER region
Outcomes

- Of 19,161 receiving RT, we could determine the types of RT in 18,718.

- Significant trends toward increasing use of advanced technology for these patients from 2000-to 2007
Percent of patients receiving RT in last year of life after dx (p=0.11)
Percent among those receiving RT who were treated with IMRT or SRS
% among those receiving RT who were treated with 2D and 3D RT

Receipt of 2D and 3D are not mutually exclusive.
IMRT and SRS predictors

• IMRT more likely if pancreatic cancer, advancing calendar year, non-white race, married, lowest income neighborhood quartile, trx in freestanding center, southern SEER region, highest density of radiation oncologists.

• SRS more likely, advancing calendar year, treatment in a hospital based facility, midwest or west/Hawaii SEER region.
A word about hospice

• Patients electing the Medicare hospice benefit at any point were more likely to have also received RT.

• However, they were less likely to be treated with IMRT.
Conclusions

• While the proportion receiving RT in the last yr of life after metastatic cancer dx has been stable, there is a trend away from the simplest/least costly techniques toward use of more complex and thus more costly techniques.

• Overall rates of advanced tech use seem to still be quite low (<6%), but slope of rates of emerging tech use has future cost implications.
2nd study-How much RT is being used at the end of life

- No question that RT an effective tool for palliation of pain, neuro symptoms, etc.

- Some suggestion (Lutz, et al. JCO) that there is underutilization of RT for palliation.

- However can be given via a number of dosing regimens (1 fraction in one day vs. multiple days or weeks of treatment)
2\textsuperscript{nd} study-How much RT is being used at the end of life

- Multiple studies showing RT courses of greater than 10 treatments offer no greater palliative benefit than courses of 10 treatments or fewer for treatments of brain, spinal, or bone mets.

- ASTRO evidence based guidelines state that courses of 1, 5, 6 or 10 fractions all provide equivalent symptom control with minimal toxicity for bone mets.
Cohort definition, N=202,299

- SEER-Medicare database

- Pts who died of breast, colorectal, lung, pancreatic, or prostate cancer between 2000 and 2007

- These chosen because they comprise the top 5 cancer causes of death (60% of cancer deaths in 2010).
Cohort definition, N=202,299

• Must have pathologic confirmation of cancer (not diagnosed at autopsy or death)

• Age 65 or >

• Medicare Part A/B coverage and no HMO coverage for 6 mos prior to study window of last 30 days of life (must have claims data available).
Outcomes

• Receipt of RT in the last 30 days of life

• Number of treatment days

• Costs of care
A word about costs

• Total costs of care normalized to the 2009 dollar

• Used Medicare adjusters for SEER regions and for medical inflation (Hospital Input Price Index for Part A and Medicare Economic Index for Part B—adjusters obtained via direct communication with NCI Health Economics Research section)
Results-RT in the last 30 days

- Total 15,287 (7.6%) received RT in last 30 days of life.

- Decrease in proportion receiving RT from 8.1% to 6.9% from 2000 to 2007 (Cochran Armitage test of trend p <0.0001).

- Corresponding increase in hospice utilization: 44% in yrs 2000-03 vs. 51% 2004-07 (p<0.0001)
Multivariate model—RT in last 30 days

- More likely in: younger age (65-69 vs. older ages); lung cancer; Charlson co-morbidity score of 0 (vs. ≥1 or unknown).

- Also more likely in: males; married patients; race other than non-Hispanic Black; Southern SEER region; urban residence; higher income quartiles (3rd and 4th)

- Biggest measure of effect: less likely if Hospice benefit elected: OR= 0.64 ; 95% CI=0.62-0.67
Results-Duration of RT (among those who got RT)

• Categorized as: 1 day, 2-5 days, 6-10 days, or > 10 days

• 53.7% received > 5 days of treatment

• 17.8% received > 10 days of treatment
Multivariate model: > 10 days of RT in the last 30 days of life

- Lung=pancreatic > breast and prostate
- Colorectal patients more likely than all other sites to receive > 10 days of treatment
- More likely in Non-Hispanic white patients
- Patients in Northeast SEER region had lower likelihood of > 10 days than all other regions
Multivariate model: > 10 days of RT in the last 30 days of life

- Patients treated in freestanding facility had greater likelihood than hospital based to receive > 10 days of RT: OR= 1.31, 95% CI= 1.20-1.43

- Patients not electing Hospice care approximately twice as likely to receive > 10 days of RT: OR= 1.97; 95% CI= 1.81-2.15
Resource utilization

• Higher proportion had hospital admission in the RT group vs. no RT (71% vs. 49%, p <0.0001)

• Higher proportion had ICU admission in the RT group (17% vs. 14%, p< 0.0001)

• Higher proportion had an ER visit in the RT group (55% vs. 37%, p < 0.0001)
# Costs of care---entire cohort

Table 6. Cost and Length of Stay for inpatient care (LOS) comparison between RT and no-RT cohorts (N=202,299)

<table>
<thead>
<tr>
<th>Model</th>
<th>Radiation</th>
<th>Hospice</th>
<th>Mean</th>
<th>Adjusted Cost difference (RT-no RT)$^2$</th>
<th>diff</th>
<th>95%CI</th>
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<tbody>
<tr>
<td>Total Cost (CMS pay)$^1$</td>
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<td>Yes</td>
<td>$12,822</td>
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<td>$984</td>
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<td></td>
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<td>$3176</td>
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<tr>
<td></td>
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<td>Length of stay (LOS)</td>
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<td>Yes</td>
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<td>Yes</td>
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<td>9.25</td>
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<td>(Ref.)</td>
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</table>

Note:
(1) Estimates was derived base on Extended generalized linear model (Basu and Rathouz, Biostatistics, 2005).

(2) Independent variables included
   (2.a) For cost model: Radiation, hospice and LOS (with interaction of radiation and hospice);
   (2.b) For LOS model: age at death, sex, ethnicity, SEER region, rural/urban, income, Charlson comorbidity index, radiation oncologist density, hospice, Radiation, and cause of death (with interaction of radiation and hospice);

(3) Goodness-of-fit: $p=0.2985$ for cost model and $p= 0.8696$ for LOS model

(4) LOS includes all ER, hospital, and ICU days
### Costs of care among those who received RT (n=15,287)

<table>
<thead>
<tr>
<th>RT/hospice sequence</th>
<th>Mean costs</th>
<th>Δ</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>No hospice (ref.)</td>
<td>$18,898</td>
<td></td>
<td></td>
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<tr>
<td>Hospice before RT completion</td>
<td>$10,461</td>
<td>-$1817</td>
<td>-$3187</td>
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<td>RT completion before hospice</td>
<td>$12,885</td>
<td>-$2011</td>
<td>-$2352</td>
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Variables in model: age at death, sex, race/ethnicity, SEER region, rural/urban, income, Charlson score, radiation oncologist density
Limitations

• Death is a retrospective endpoint-no information regarding performance status, patient or provider preferences/reasoning.

• Unable to obtain RT dosing information or determine whether multiple sequential courses were given which limits interpretation regarding number of days of treatment.
Limitations

• Unable to determine why patients got RT

• ICD9 coding imprecise about anatomical site and reason...eg, current code for metastases to brain and spine are same same code.

• This will change for ICD10 (more specificity, laterality, etc.)
Conclusions

• Low overall proportion receiving RT in the last month—? Underutilization

• Variation in receipt of RT and number of treatments by non-clinical factors.

• Hospice care significantly decreases receipt of RT, number of treatment days and costs—? Acceptance of death, ? De-incentivization from capitated payments under Hospice benefit.
Future analyses

• Using updated SEER-Medicare data sets (with incident cases through 2009) to look at advanced technology use in last 90 days of life, costs of RT in that time period.

• TX registry/Medicaid data to look at influence of Medicaid status and dual eligibility on receipt of RT, duration of RT, and types of RT at the end of life.
Future considerations

• More research needed in era of quality indicators (ASTRO palliative care guidelines) which can be used as metrics to track care patterns.

• Research with administrative data could be aided by development of more specific palliative radiotherapy diagnosis and procedure codes.
Thank you

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