

Impact of Palliative Care on Imaging Intensity for Cancer Patients During the End-of-Life Period

Kesav Raghavan¹ MD, Timothy P. Copeland¹ MPP, Michael Rabow¹ MD, Maya Landenheim¹ BA, Angela Marks¹ MEd, Steve Pantilat¹ MD, David O'Riordan¹ PhD, David Seidenwurm² MD, and Benjamin L. Franc¹ MD MS MBA

¹University of California San Francisco, San Francisco, CA

²Sutter Health, Sacramento, CA

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Purpose

- Cost of care for advanced cancer patients continues to increase, with expenditure for high-end imaging (CT, MRI, PET) rising faster than the total cost.
- Palliative care (PC) referral for advanced cancer patients is associated with decreased costs and improved quality of life, possibly due to better resource utilization. However, the impact of PC referral on imaging use in the end-of-life period is poorly studied.
- This descriptive study explores the association between PC involvement and levels of high-cost imaging utilization for cancer patients during the end-of-life period (defined here as last three months of life).

Methods

- Institutional cancer registry data was used to identify 3894 adult patients who died between 1/1/2012–5/31/2015 and were diagnosed at least 1 year prior to death.
- For each patient, ICD-9 codes were used to identify all non-emergent advanced oncologic imaging studies (CT, MRI, or PET) and institutional records were used to establish earliest palliative care encounter if any.
- Wilcoxon rank-sum and Chi-square analyses were used to evaluate association between PC referral and both the proportion of patients imaged and the mean number of studies per patient (*mean imaging intensity, MII*) during the last three months and the final month of life.
- 205 randomly matched case-control pairs of patients with and without PC referral were identified and association of PC referral with proportion imaging and MII in the last month of life was assessed with Wilcoxon rank-sum and Chi-square tests.

Results Highlights

- Among 3894 patients, 90% (n = 3523) were never referred to palliative care. Of the 371 patients referred to PC prior to death, 55% (n = 207) were referred before the final month of life.
- Proportion of patients imaged in their final three months of life was similar between patients without palliative care referral and those with initial palliative care visit three or more months prior to death. Total MII was also similar for these two groups.

Results Highlights

- No significant difference in proportion of patients imaged during the final month of life between those referred to palliative care one or more months before death and those without palliative care referral.
- While MII in the last month of life was significantly lower for PC patients, the absolute value was only 0.6 studies/patient and is of unclear clinical significance.
- Among the case-control matched pairs, a significantly greater proportion of patients referred to PC were imaged. There was no difference in MII between the two groups.

Table 1: Distribution of patient characteristics by palliative care referral and initial appointment timing

	No palliative care	All Palliative Care	Initial Palliative Care Prior to 3 mo. Pre-mortem	Initial Palliative Care 3 to 1 mo. Pre-mortem	Initial Palliative Care in Final Month of Life	Overall
	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)
Total	100% (3,523)	100% (371)	100% (131)	100% (76)	100% (164)	100 (3,894)
Sex						
Male	54% (1,909)	49% (182)	39% (51)	49% (37)	57% (94)	54% (2,091)
Female	46% (1,614)	51% (189)	61% (80)	51% (39)	43% (70)	46% (1,803)
Age Group						
18 to 39	6% (212)	8% (29)	5% (7)	13% (10)	7% (12)	6% (241)
40 to 64	42% (1,452)	53% (198)	54% (71)	54% (41)	52% (86)	43% (1,650)
65 and older	52% (1,809)	39% (144)	40% (53)	33% (25)	40% (66)	51% (1,953)
Race						
White	76% (2,684)	68% (252)	76% (99)	74% (56)	59% (97)	75% (2,936)
Black	6% (227)	9% (32)	8% (10)	7% (5)	10% (17)	7% (259)
Asian	12% (409)	18% (65)	9% (12)	16% (12)	25% (41)	12% (474)
Pacific Islander	3% (96)	4% (16)	6% (8)	3% (2)	4% (6)	3% (112)
Unknown	3% (107)	2% (6)	2% (2)	1% (1)	2% (3)	3% (113)
Cancer Type						
Head, Neck, & Throat	5% (167)	3% (12)	4% (5)	1% (1)	4% (6)	5% (179)
Gastrointestinal	26% (923)	33% (121)	26% (34)	41% (31)	34% (56)	27% (1,044)
Respiratory	11% (399)	16% (58)	15% (20)	12% (9)	18% (29)	12% (457)
Bone, Skin, & Connective Tissue	13% (474)	12% (44)	6% (8)	11% (8)	17% (28)	13% (518)
Breast	6% (221)	13% (47)	18% (24)	13% (10)	8% (13)	7% (268)
Male Reproductive	6% (194)	6% (24)	8% (11)	8% (6)	4% (7)	6% (218)
Female Reproductive	7% (249)	8% (29)	15% (20)	4% (3)	4% (6)	7% (278)
Kidney & Bladder	6% (207)	3% (12)	2% (2)	5% (4)	4% (6)	6% (219)
Endocrine & Neuroendocrine	15% (538)	5% (17)	3% (4)	3% (2)	7% (11)	14% (555)
Blood & Lymphatic	2% (60)	1% (2)	1% (1)	1% (1)	0% (0)	2% (62)

Table 2a: Proportion of patients imaged and mean imaging intensity in the final 3 months of life

Palliative Care Referral	Tomographic Imaging % (mean)	CT % (mean)	MR % (mean)	PET % (mean)
Not referred to palliative care (n=3,523)	36% (2.9)	27% (2.6)	16% (1.6)	8% (1.1)
Referred to palliative care prior to final 3 months of life (n=131)	40% (2.8)	29% (2.6)	18% (1.7)	11% (1.1)

Proportions of patients imaged and mean imaging intensity in the final three months of life, both total and by imaging modality, based on palliative care referral. Percentages denote the proportion of patients within a given palliative care classification who received at least one study of a given imaging modality. The values in parentheses denote mean number of imaging studies per patient among those who received at least one study of a given imaging modality.

Table 2b: Proportions of patients imaged and mean imaging intensity in the final month of life

Palliative Care Referral Status	Tomographic Imaging % (mean) ^a	CT % (mean) ^b	MR % (mean)	PET % (mean)
Not referred to palliative care (n=3,523)	17% (2.3)	13% (2.2)	6% (1.3)	2% (1.0)
Referred to palliative care prior to final month of life (n=207)	19% (1.7)	16% (1.5)	5% (1.2)	2% (1.0)

Proportions of patients imaged and mean imaging intensity in the final month of life, both total and by imaging modality, based on palliative care referral. Percentages denote the proportion of patients within a given palliative care classification who received at least one study of a given imaging modality. The values in parentheses denote mean number of imaging studies per patient among those who received at least one study of a given imaging modality.

^aWilcoxon-Rank sum test of mean imaging intensity, p<0.01

^bWilcoxon-Rank sum test of mean imaging intensity, p=0.01

Table 3: Matched-pairs analysis of imaging utilization during the last month of life

Palliative Care Referral	Tomographic Imaging % (mean) ^a	CT % (mean)	MR % (mean)	PET % (mean)
Not referred to palliative care (n=205)	23% (6.2)	3% (1.3)	17% (4.9)	6% (2.8)
Referred to palliative care (n=205)	43% (5.3)	7% (1.1)	36% (3.9)	8% (2.8)

Among the matched pairs, proportions of patients imaged and mean imaging intensity in the final month of life based on palliative care referral. Percentages denote the proportion of patients within a given palliative care classification who received at least one study of a given imaging modality. The values in parentheses denote mean number of imaging studies per patient among those who received at least one study of a given imaging modality.

^aChi-square test of proportion of patients imaged, p<0.0001

Conclusions

- Our findings suggest that PC involvement in end-of-life oncologic care is not associated with decreased utilization of non-emergent, high-cost cancer imaging.
- Decreased imaging does not appear to directly contribute to the cost savings typically attributed to PC. However, the role of imaging in PC, and potential indirect benefits, are unclear.
- As PC becomes more integrated in end-of-life cancer care, increased attention to patient goals of care and minimizing excessive resource utilization is important. Particular focus on advanced imaging use is warranted given the associated rapidly escalating costs.

Limitations

- Referral bias at our single academic center and small number of patients referred to PC.
- Indication for PC referral was unclear (may have ranged from help with symptom management to goals of care discussion) and outpatient versus inpatient PC was not differentiated.
- ICD-9 coding errors may have led to inclusion of imaging studies for emergent indications
- Temporal effects of PC intervention were not accounted for.

→ However, the matched pairs analysis should help equalize some variation between patients referred to and not referred to PC.

Future Directions

- Further investigate association between palliative care involvement and imaging utilization in larger oncologic cohorts.
- Assess how demographic factors, clinical variables, inpatient versus outpatient PC, and temporal differences influence imaging use during the end-of-life.
- Better understand the role of imaging in the setting of palliative care and the potential choices and decisions that may depend on imaging.