



# **Post Coverage Analysis: Use of Positron Emission Tomography (PET) Scans: Final Report**

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## **PET Scan Final Report:**

**SUMMARY:** This analysis of the impact of PET scan coverage began with the rather ambitious goal of assessing whether PET scans have improved patient care. In the process of addressing this question we have made some observations about PET scan coverage and claims processing that are worth noting:

1. There is persistent mis-match between specific PET scan HCPCS code and ICD-9 diagnosis code. A small percentage of cases do not have a diagnosis code reflecting a covered indication for PET scans. Carriers and FIs should more closely monitor clinical indications for PET scans.
2. A small percentage of cases receive 3 or more PET scans in a 12-month period. These cases are often undetected due to the multitude of HCPCS codes available for coding the scans. Carriers and FIs should implement checks and limits on the frequency of PET scans.
3. PET scans for lung cancer are presently limited to specific histologies. This may be supported by the scientific literature but cannot be enforced by FIs and carriers due to the lack of information about histology found in ICD-9 diagnosis codes. Analysis of linked tumor registry/Medicare claims data reveals a considerable number of PET scans are for persons whom the tumor registries determine have lung cancer with a non-covered histology.

**Background:** The Medicare program first included positron emission tomography (PET) scans as a benefit in 1995 for myocardial perfusion imaging. In 1998, coverage expanded to include staging of Non-Small-Cell lung cancer (but not Small Cell lung cancer) and follow-up of a single pulmonary nodule (small-cell lung cancer not a covered indication). Coverage of PET scans was slightly expanded in 1999, greatly expanded in July 2001, and further expanded throughout 2002. Across all indications PET scans are coded using separate HCPCS codes for each disease indication and purpose (e.g., staging, diagnosis). At present there are xxx HCPCS in use for various indications for PET scan. Initial coverage decisions for PET scans included requiring a 2-digit modifier for all professional claims (i.e., radiologist) that noted the results of the previous test and the results of the PET scan. Thus, PET scans are unique in that they have assigned codes not just by procedure but also by indication and because they include a mechanism that can be easily incorporated into CMS-1500 billing processes that allows for the tracking of test indication and test results.

The goal of this project is to examine use of PET scans over the period 1999-2002, to examine the appropriateness of their use and to assess whether they have resulted in more appropriate patient care. Largely descriptive, this project is somewhat limited by the reality that claims indicate services received, not services needed. We use two forms of Medicare administrative data: claims for the entire US from the CMS mainframe and linked SEER/Medicare data. The linked data obtained from the National Cancer Institute link cancer registry information such as diagnosis date, stage and histology with claims data that provide information about services received. The SEER/Medicare data are only available for incident cancers diagnosed through 1999 and with claims through 2001. We use SEER/Medicare data to study whether use of PET scans results in a change in thoracotomy patterns.

For each of our specific tasks, we briefly provide background to the question, a summary of the methods we used to address the question, the results and conclusions specific to the topic being addressed. We address the following:

- Identifying PET scans from claims;
- Assessing the concordance between the indication for each type of PET scan HCPCS code with the ICD-9 diagnosis included on the claim;
- The utility of HCPCS modifiers that were discontinued in July 2001
- Secular and geographic trends in PET scan use
- Receipt of multiple PET scans in a 12-month period
- Costs to the Medicare program of PET scans
- Use of PET/CT

## Tasks:

### 1. Finding PET scans in claims:

- a. **Background:** three options exist for identifying PET scans from Medicare claims: HCPCS codes, ICD-9 procedure codes and Revenue center codes. While coverage decisions all are based on HCPCS codes, we sought to identify whether additional scans would be found using other coding alternatives.
- b. **Method:** we searched the following files for HCPCS, ICD-9 procedure codes and Revenue Center codes: Inpatient SAF, Outpatient SAF and Carrier SAF. Because the PET scan Revenue Center code (0404) is aggregated into a general 'Radiology' variable, which contains many Revenue Center codes not specific to PET, we chose not to use the MedPAR. In addition, HCPCS codes are not included in the file.
- c. **HCPCS codes active between 1999-2002:**
  - Myocardial perfusion imaging: G0030, G0031, G0032, G0033, G0034, G0035, G0036, G0037, G0038, G0039, G0040, G0041, G0042, G0043, G0044, G0045, G0046, G0047, G0230, 78492, 78491, 78459
  - Solitary Pulmonary Nodule: G0125/G0126
  - Non-Small Cell Lung Cancer: G0210, G0211/G0126, G0212, G0234
  - Colorectal Cancer: G0213, G0214, G0215/G0163, G0231
  - Melanoma: G0216, G0217, G0218/G0165, G0219, G0233
  - Lymphoma: G0220, G0221/G0222/G0164, G0232
  - Head and Neck Cancer: G0223, G0224, G0225
  - Esophageal Cancer: G0226, G0227, G0228
  - Refractory Seizures: G0229, 78608, 78609
  - Breast Cancer: G0252, G0253, G0254
- d. **ICD-9 procedure codes:** PET scans are included in the category of radioisotope scans. The relevant codes are in the range of 92.00-92.19.
- e. **Revenue Center Codes:**
  - 0404 is the only revenue center code specific to PET scans.
  - Other options for coding PETs include:
    - 0320 (diagnostic radiology, general)
    - 0329 (diagnostic radiology, other)
    - 0340 (Nuclear Medicine, general)
    - 0341 (Nuclear Medicine, diagnostic)
    - 0349 (Nuclear Medicine, other)
- f. **Findings:** We rejected an algorithm identifying PET scans from sources other than HCPCS. We did not find evidence suggesting that either ICD-9 procedure codes or Revenue Center codes were specific enough to identify PET scans. In addition to lack of specificity, Revenue Center codes were rejected because Outpatient claims containing a PET Revenue Center code only and/or a non-

specific CPT code of 78810 were denied payment in 98.9% (1241 of 1251) of claims between 1999-2002. Denied claims were not included in any analysis unless specifically noted. The code we use to identify PET claims, to classify them and to combine them into a single scan is included in the appendix.

**g. Finding the professional and technical component of the PET:**

In the Carrier file, a HCPCS modifier of 'TC' indicates the technical component of a PET scan, a modifier of '26' indicates the professional component, and absence of the individual 'TC' and '26' modifiers theoretically indicates both professional and technical components of PET scan. Using this information, we found:

Overall, 74% have both technical and professional components. The remaining 26% had either a technical or professional component but not both. Technical components only were only slightly more common (14% of PETs) than professional component only 12%.

Specifically,

- 13% of PET scans had an Outpatient technical component claim only
- 32% had outpatient technical component and Carrier professional component claim
- 54% Carrier claims only. Of those with only a Carrier claim:
  - 78% contain both technical and professional components
  - 2% contain technical component only
  - 20% contain professional component only

**h. Denied claims and line-items:**

**Outpatient SAF for calendar years 1999-2002:** Presence of PET HCPCS on claim. Unless noted: Claim not denied based on 'Claim Medicare Non Payment Reason Code'. This field did not exist prior to mid-2000. If denied claims were included in the OP SAFs prior to the inclusion of this field, they were not removed from analysis. Attempts at removing revenue center-level denials were undertaken only in the reimbursement analysis. Revenue center payment fields also did not exist prior to mid-2000.

**Carrier SAF for calendar years 1999-2002:** Presence of PET HCPCS on claim. Unless noted: non-denied claim and non-denied line item.

There were a total of 253,638 unique (based on HIC and claim date) non-denied PET scan claims in the Carrier and/or OP SAFs between 1999-2002.

**2. Accuracy of Coding PET scans using specific HCPCS codes/concordance between diagnosis and procedure codes.**

- a. Background:** As noted earlier, PET scan coverage decisions are somewhat unique in that a specific HCPCS code is used for each indication. That is, different codes are assigned for each cancer and for diagnosis, staging and restaging. For each HCPCS code, there is also a list of covered diagnosis codes, listed in the table below. If the specific HCPCS codes match the associated diagnosis codes, it would suggest that the codes themselves could be used to understand how PET scans are incorporated into patient care. This analysis sought to examine whether there was some consistency between HCPCS and ICD-9 diagnosis codes that would support using HCPCS to provide clinical inference.
- b. Method:** Using 100% of non-denied 1999-2002 Carrier PET line items, we examined whether the line item diagnosis field was consistent with the line item HCPCS code. Appropriate diagnoses (listed in Appendix 1) were gathered from both CMS Memoranda and documents from carriers that process Medicare claims. In cases where there was an inconsistency, we checked whether the ICD-9 code matched another covered PET scan indication or whether it matched no covered indication.
- c. Results:** Grouping PET scans by diagnostic group and examining the agreement between diagnosis code and PET indication, agreement ranges from 34% for myocardial perfusion imaging PET scans to greater than 90% for colo-rectal, esophageal, lymphoma and some lung/SPN PET scans. A more detailed analysis looking dividing scans into those where the HCPCS code is consistent with both diagnosis code and stage, those where the HCPCS code is consistent with a different PET scan indication and those not consistent with a currently covered indication reveals that there is a good deal of mismatch between the specific HCPCS code used and the diagnosis code listed on the claim.

	Number of line items (1999-2002)	Percent with appropriate DX for PET HCPCS	Percent with DX consistent with other PET scan HCPCS	Percent with DX not consistent with PET scan HCPCS
<b>Diagnostic PET scans</b>				
<b>G0226— Esophageal</b>	606	83% N = 501	8% N = 48	9% N = 57
<b>G0223— Head &amp; Neck</b>	1,116	64% N = 712	7% N = 78	29% N = 326
<b>G0220— Lymphoma</b>	3,171	81% N = 2,559	4% N = 125	15% N = 487
<b>G0125— SPN</b>	61,781	63% N = 38,650	4% N = 2,878	33% N = 20,253
<b>G0210— NSCLC</b>	16,702	71% N = 11,931	7% N = 1,073	22% N = 3,968
<b>G0213— Colo-rectal</b>	2,349	85% N = 1,943	4% N = 96	11% N = 260
<b>G0216— Melanoma</b>	712	81% N = 578	7% N = 52	12% N = 82
<b>Initial staging</b>				
<b>G0227— Esophageal</b>	2,654	93% N = 2,456	2% N = 51	5% N = 147
<b>G0224— Head and Neck</b>	2,681	86% N = 2,301	5% N = 130	9% N = 250
<b>G0221/G0164 —Lymphoma</b>	14,778	93% N = 13,739	2% N = 336	5% N = 703
<b>G0211/G0126 —NSCLC</b>	42,588	90% N = 38,145	4% N = 1,702	6% N = 2,741
<b>G0214— Colo-rectal</b>	5,220	94% N = 4,885	1% N = 80	5% N = 255
<b>G0217— Melanoma</b>	2,604	90% N = 2,336	4% N = 111	6% N = 157
<b>Restaging</b>				
<b>G0228— Esophageal</b>	1,930	88% N = 1,697	4% N = 70	8% N = 163
<b>G0225— Head and Neck</b>	3,702	83% N = 3,059	6% N = 229	11% N = 414
<b>G0222— Lymphoma</b>	16,056	95% N = 15,204	1% N = 174	4% N = 676
<b>G0212— NSCLC</b>	21,687	92% N = 19,878	3% N = 725	5% N = 1,084
<b>G0215/G0163 —Colo-rectal</b>	20,226	92% N = 18,607	2% N = 449	6% N = 1,170
<b>G0218— Melanoma</b>	5,635	87% N = 4,901	6% N = 326	7% N = 405



- d. Impressions:** With cancers, diagnoses are very consistent with Initial Staging and Restaging PET HCPCS, but there is considerably more slippage across Diagnosis PET HCPCS. Over the four year period, there were 33,598 PET scans that did not have ICD-9 diagnosis codes which were approved by CMS. Considering the cost to CMS of over \$2000 per PET scan, this represents a potential for considerable savings. The strong implication from this finding is that greater attention should be paid to the agreement between diagnosis code and PET coverage policy.

### 3. Use of modifiers to indicate test results:

- a. **Background:** Initial coverage policy for PET scans required the inclusion of a 2-digit modifier for all professional and joint technical/professional claims for PET scans submitted to carriers. Such coverage policies are quite unique and offer an opportunity to more carefully monitor both the indication for a PET scan (both specific use and the result of the prior test that is used as a justification for the scan) and the results of the scan. Use of the modifiers was discontinued effective July 1, 2001.

The 2-digit modifiers are as follows:

<u>Modifier</u>	<u>Description</u>
N	Negative;
E	Equivocal;
P	Positive, but not suggestive of, extensive ischemia or not suggestive of malignant single pulmonary nodule; and
S	Positive and suggestive of; extensive ischemia (greater than 20 percent of the left ventricle) or malignant single pulmonary nodule.

- b. **Methods:** We used 2000 and 2002 PET scan claims and examined the percentage of claims with modifiers, divided by processor (Carrier [Carrier SAF] vs. FI [OP SAF]) and facility vs. technical component (within the Carrier SAF). This analysis focused on PET scans covered as of July 1, 1999 (HCPCS G0030 – G0047, G0125, G0126, G0163, G0164, and G0165) when this mandate was added. Analysis of the results modifiers required searching multiple modifier fields; the professional/technical modifier described above was used to separate claims into technical component, professional component and joint and these same modifier fields were searched for indicators of test results. Coverage rules do not specify an order for modifiers.
- c. **Results:** As expected, the OP SAF contained almost no claims with ‘results’ HCPCS modifiers. In 2000, only 3% (259 of 7,966) contained such modifiers and after the requirement for the modifiers was dropped, we found only 12 of 12,857 to contain these modifiers in 2002.

The Carrier SAF showed more complete recording of modifiers. In 2000, 82% of PET scan line items (7,341 of 8,931) billing for both the technical and professional component contained a ‘results’ HCPCS modifier. 62% of line items billing for the professional component only (7,532 of 12,141) contained a ‘results’ modifier. Even though the modifiers were not required on the technical component line items, 29% (722 of 2,479) did contain them. In 2002, these modifiers were only found on 1% of any type of Carrier line item (496 of 33,737).

Despite the completeness of reporting, the results modifiers for 2000 (during the period when the modifiers were required) revealed little information. As the table below summarizes, most PET scans were reported to be in response to equivocal or suggestive prior tests and most PET scans did not yield definitive (either

positive or negative) results.

	<b>Professional Component Only</b>		<b>Both Professional &amp; Technical Component</b>	
	N	% of 7,532 PET scans with modifiers	N	% of 7,341 of PET scans with modifiers
<b>Results of Prior Test</b>				
Equivocal	2287	30.4%	2466	33.6%
Negative	741	9.8%	272	3.7%
Positive	2966	39.4%	1934	26.4%
Suggestive	1537	20.4%	2667	36.3%
<b>Results of PET scan</b>				
Equivocal	679	9.0%	671	9.0%
Negative	1830	24.3%	1420	19.3%
Positive	2241	29.8%	2153	29.3%
Suggestive	2782	36.9%	3097	42.2%

- d. Conclusions:** PET scan results reported in claims contain a high percentage of non-informative results. Overall, 51.2% of reported results were either equivocal or suggestive. The lack of information limited the ability of coverage policy to limit diagnostic testing to persons who were appropriate surgical candidates. For example, coverage policy links reported PET results with permission to perform a lymph node biopsy for lung cancer.

Where the patient is considered a surgical candidate, (given the presumed absence of metastatic NSCLC unless medical review supports a determination of medical necessity of a biopsy) a lymph node biopsy will not be covered in the case of a negative CT and negative PET. A lymph node biopsy will be covered in all other cases, i.e., positive CT + positive PET; negative CT + positive PET; positive CT + negative PET.

Notice, coverage policy is silent on whether biopsies are allowed for persons with ‘suggestive’ or ‘equivocal’ PET scans. As with the diagnosis codes, if completely used, they would have provided important information about extent of disease for patients undergoing a PET scan. As reported, the impact of linking approval of further tests to results of prior tests is likely highly limited. The impact is likely further diminished by the need to pass approvals between FI and Carriers.

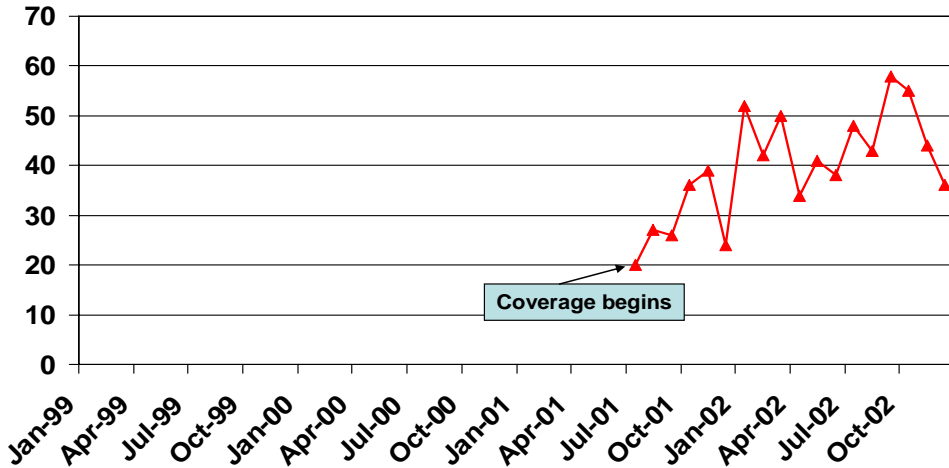
While there was not 100% presence of the ‘results’ HCPCS modifiers in the pre-2001 claims, there is some untapped potential in the professional component PET scan line items in the Carrier SAF. The potential could be reached only if effort were made to monitor the content of the results modifiers and to implement mechanisms that would improve the content of the modifiers. Nonetheless, it is unfortunate that this information is no longer collected.

#### 4. Secular and geographic trends in PET scan use:

- a. **Method:** To assess secular trends, monthly PET scan counts from January 1999 through December 2002 were generated using our standard PET scan definition.
- b. **Results:** There were significant and important increases in the use of PET scans over the period 1999-June 2001 and July 2001-December 2002. Increases were greatest for cancer diagnoses and least for myocardial perfusion studies. This is illustrated in the table below and the following figures.

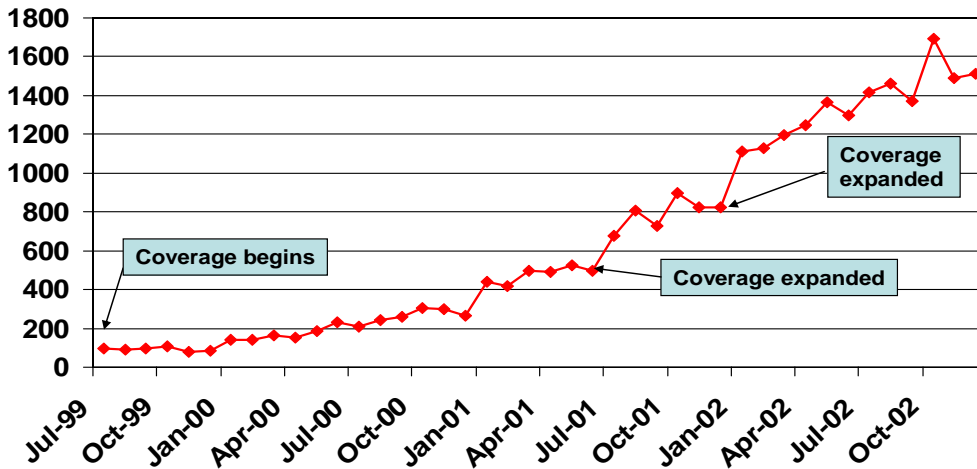
	January 1999-June 2001		July 2001-December 2004	
	Total PET scans performed	Percent increase from beginning to end of period	Total PET scans performed	Percent increase from beginning to end of period
<b>Esophageal cancer</b>	N/A	N/A	4,914	80%
<b>Brain Cancer</b>	N/A	N/A	713	80%
<b>Colorectal cancer</b>	6,023	430%	21,047	124%
<b>Head &amp; Neck</b>	N/A	N/A	7,503	128%
<b>Melanoma</b>	2,372	465%	6,885	94%
<b>Myocardial Perfusion</b>	9,467	20%	7,494	16%
<b>Lymphoma</b>	6,553	1,165%	27,288	140%
<b>Lung/SPN</b>	15,651	1,113%	N/A	N/A
<b>Lung Only</b>	N/A	N/A	62,828	96%
<b>SPN Only</b>	23,747	1,357%	43,255	43%

## Brain PET Scans 1999-2002 by Month



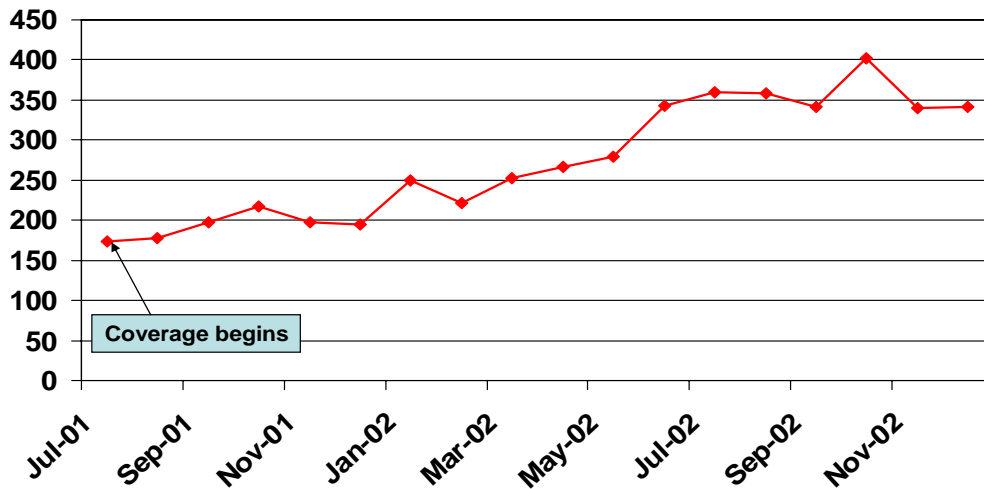
Combined data from 100% OP and Carrier Files

## Colo-Rectal PET Scans 1999-2002 by Month



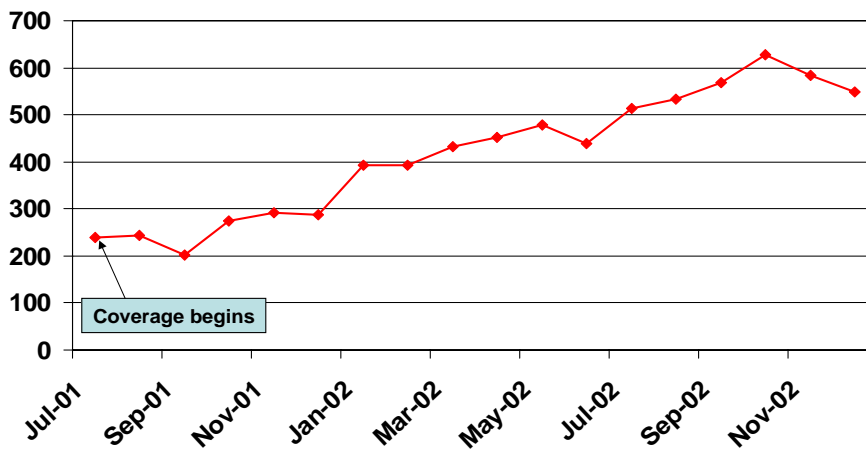
Combined data from 100% OP and Carrier Files

# Esophageal PET Scans 2001-2002 by Month



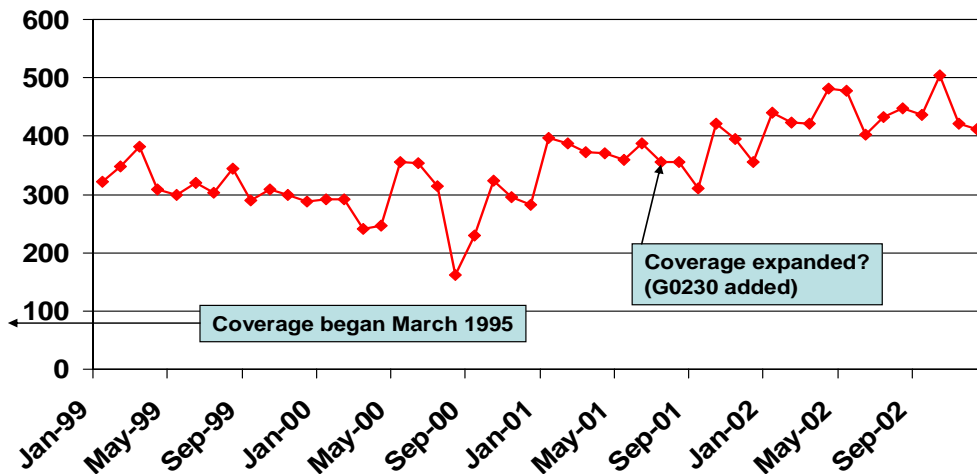
Combined data from 100% OP and Carrier Files

# Head&Neck PET Scans 2001-2002 by Month



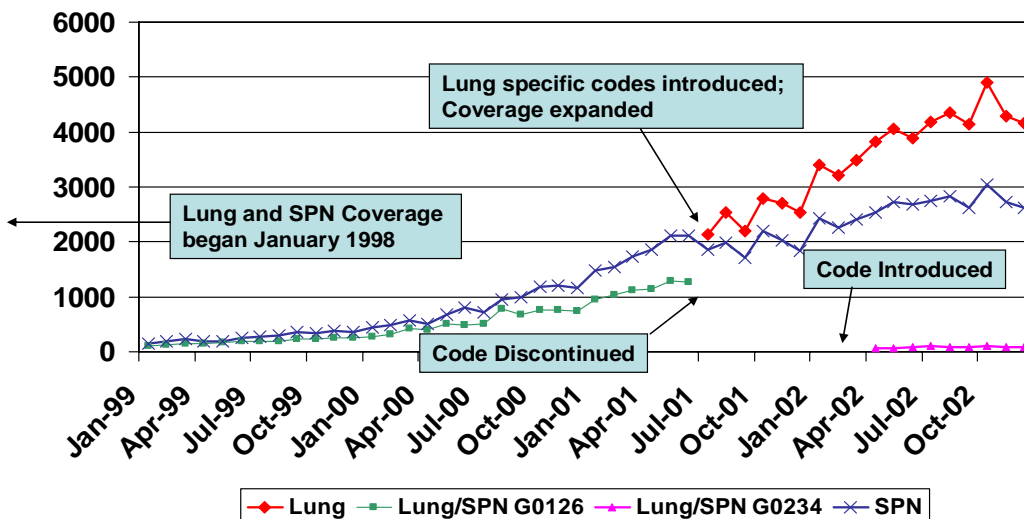
Combined data from 100% OP and Carrier Files

# Myocardial PET Scans 1999-2002 by Month



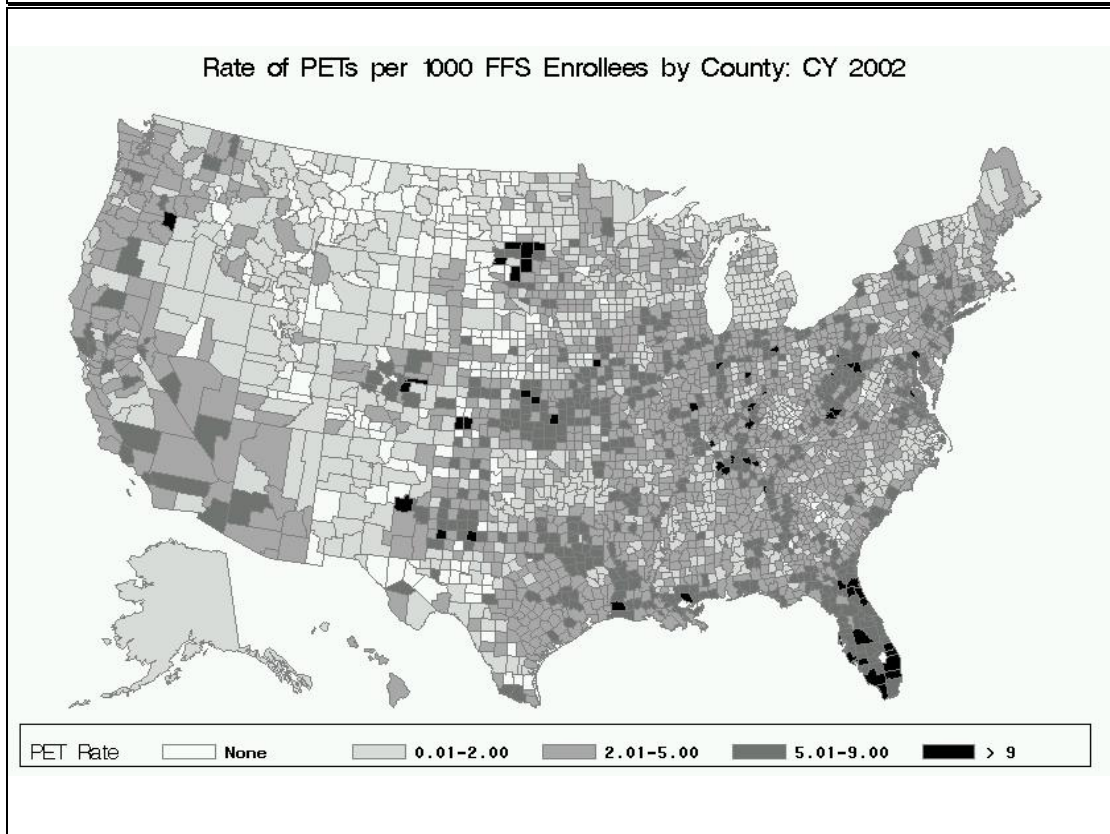
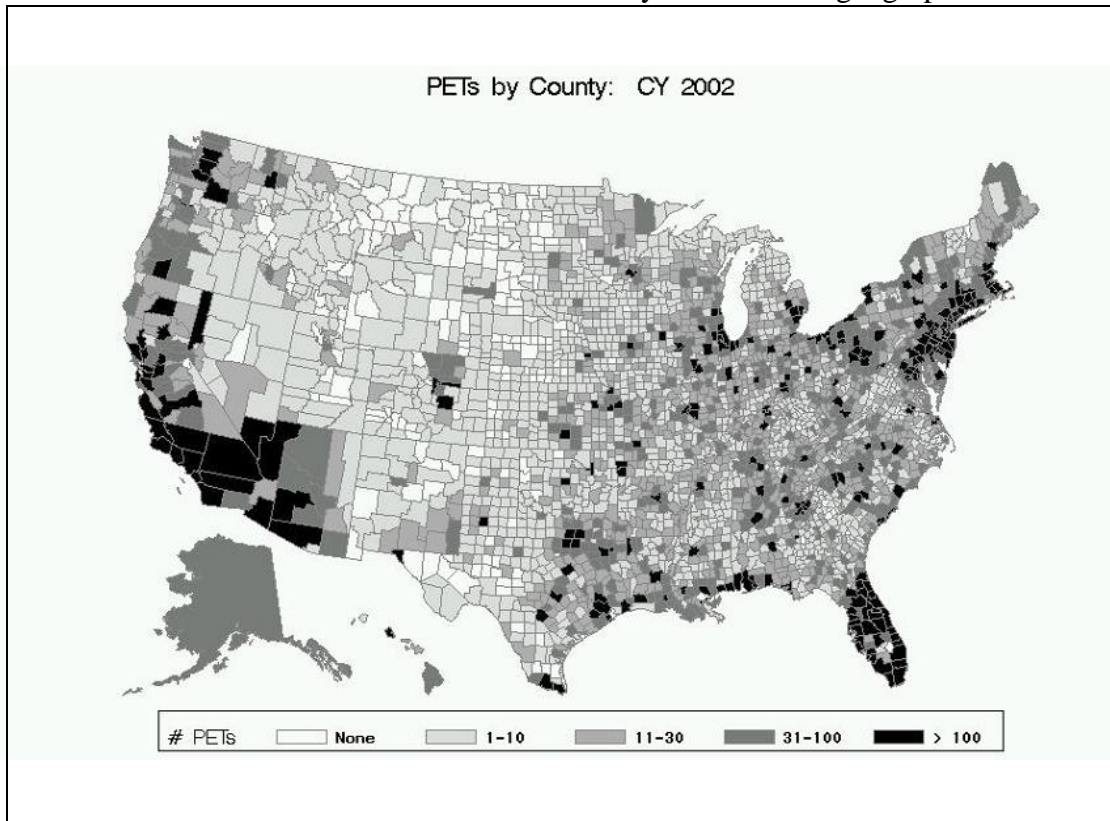
Combined data from 100% OP and Carrier Files

# Lung/SPN PET Scans 1999-2002 by Month



Combined data from 100% OP and Carrier Files

In addition to strong secular trends, there was considerable geographic variation in the number of PET scans conducted by county in 2002 (all reasons combined). When standardized to the number of PET scans per 1000 fee-for-service enrollees the results stabilized but still revealed considerable variability in use across geographic areas.



\* Larger maps in Appendix



**5. Multiple PET scans within a 12 month period:**

- a. Background:** In the process of identifying PET scan use and type, we noticed some mis-matches between facility and MD claims appeared to reflect multiple PET scans over a short period of time. We sought to identify use of multiple PET scans over a 12 month period beginning with the first PET scan found in 2001.
- b. Method:** Using our above-described algorithm, we used 100% Carrier and Outpatient data for 2001 and 2002. All persons receiving a PET scan in 2001 were included in this analysis. The number of PET scans received in the 12 months following a 2001 index PET scan were counted for the analysis of any PET use. The number of PET scans for the same indication were counted as the number of PET scans received in a 12-month period beginning with the first PET scan received for a particular indication were counted separately. PET scans were considered to be on the same site if the specific HCPCS code applied to the same body site (e.g., G0165, G0216, G0217, G0218 for melanoma).
- c. Findings:** There were a total of 66,459 beneficiaries who received a PET scan in 2001. The results reveal a small number of people received three or more additional PET scans in the 12-month period following the initial PET scan. These people were 0.7% of 2001 PET scan recipients but accounted for 2,031 of 79,830 total PET scans for persons receiving at least 1 scan in the 12-month period beginning in 2001. [15% received at least one more PET on same site within 12 months, 16% received at least one PET of any type after the first PET.]

**Number of PETs in a 12 Month Period, from Date of First PET  
2001 and 2002 Carrier and Outpatient Data Combined**

<b>Number of PETs in 12 months</b>	<b>Any PET Code</b>	<b>Percent of people</b>	<b>PET on the same body site</b>	<b>Percent of People</b>
<b>Initial PET scan only</b>	55,844	84%	56,613	85%
<b>1 Additional PET scan</b>	8,441	13%	7,875	12%
<b>2 Additional PET scans</b>	1,691	3%	1,551	2%
<b>3+ Additional PET scans</b>	483	< 1%	420	<1%
<b>Total</b>	66,459		66,459	

- d. Conclusions:** a measurable percentage of beneficiaries received multiple PET scans over a 12-month period. While there are clinical situations that would justify such use, the large number of people receiving multiple scans suggests that this is an area of potential abuse. The use of multiple HCPCS codes for PET scans due to different indications makes monitoring multiple scans more challenging. Nonetheless, it would be quite feasible for Carriers and FI to implement checks during claims processing that would flag cases with multiple PET scans over a 12-month period and submit them to more in-depth review.

## 6. Costs of PET scans

- a. Background:** One aspect of the increasing use of PET scans is their cost to the Medicare program and total reimbursements. Costs to facilities for performing PET scans are not knowable and do not necessarily equal charges. We cannot attribute the payments of co-payments and deductibles to the beneficiary, a MediGap policy or Medicaid because that information is not available in claims files. However, for ease of explanation, we describe these charges as by the beneficiary.
- b. Method:** Using our standard definition, we calculated cost of PET scan for scans where we found both facility and professional claims. In addition, we removed claims that were partially or completely paid by another primary payer. We consider claims to be for facility-related services if they meet our standard definition of facility claims, regardless of whether they appear in the Carrier or Outpatient file. We do not include payments related to CT scans for persons simultaneously undergoing PET and CT (see 6, below, for details of joint PET/CT analysis). Because individual revenue center level payments were not included in the OP SAF until mid-2000, we restricted our analysis to 2002 claims only. We included in our calculation both PET-specific HCPCS and HCPCS covering the FDG that is billed separately (coded as C1775 on facility claims).
- c. Results:** The median total payments per scan were \$2306. The majority of the payments are made to facilities with the professional component, representing payments for reading the scans was only \$75 per scan. The costs to beneficiaries (or their supplemental insurance) were \$403 per scan. In 2002, a total of \$179.4 million was paid by CMS to providers and facilities for 112,729 PET scans.

## 7. PET and PET/CT:

- a. Background:** PET/CT was brought to our attention during the course of this project. It is widely advertised and not explicitly addressed in current PET or CT coverage policy. We sought to examine the use of PET/CT as well as examine the frequency of a pattern of CT then PET/CT.
- b. Methods:** We selected all 1999-2002 CT OP and Carrier claims (HCPCS 70450-70492, 71250-71270, 72125-72133, 74150-74170) and retained only the claims for those who also had a PET scan between 1999-2002. Denied PET claims were removed for this analysis. We counted the number of beneficiaries who had a CT, the number who had a CT on the same date as the PET, and also calculated the lag between the CT and the PET. In order to allow at least a 90-day window to search for prior CTs, we kept PETs that were performed April 1, 1999 or later.
- c. Results:** 92% (231,450 of 251,369) of PET scans performed between April 1, 1999 and Dec, 31, 2002 were either preceded by a CT scan or had a CT performed on the same date as the PET. Of those that had a CT scan, 5% (11,303 of 231,450) had a CT on the same date as the PET. The use of PET and CT on the same date was fairly stable from 1999-2001 (~4%) with a noticeable jump in 2002 to 6% of PETs having a CT on the same date. To estimate how often redundant CTs are performed, we calculated the rates of CT 1-7 days prior to PET, and 8-31 days prior, and greater than 31 days prior to PET for the population that had a concurrent PET/CT, and for those that did not have a concurrent PET/CT (but did have a CT prior to the PET). The results are in the table below.

	Had PET and CT on same date				Did not have CT on same date as PET			
	1999	2000	2001	2002	1999	2000	2001	2002
<b>N</b>	234	743	2,607	7,719	6,548	22,867	64,543	126,189
<b>CT on same date as PET only</b>	21%	16%	11%	10%	N/A	N/A	N/A	N/A
<b>Had most recent CT 1-7 days before PET</b>	10%	9%	8%	8%	15%	15%	16%	17%
<b>Had most recent CT 8-31 days before PET</b>	30%	22%	24%	22%	48%	47%	47%	46%
<b>Had most recent CT 32+ days before PET</b>	38%	53%	58%	61%	37%	38%	37%	37%

- d. Conclusions:** Although the rate of concurrent PET/CT is low, there is evidence that quite a few possible redundant CTs are being performed in this group. Since PET/CT is on the rise, this area warrants further investigation. The ability to judge whether PET/CT use is appropriate and consistent with coverage policy requires greater attention to specific HCPCS codes used for PET scans combined with clinical context to make sure they are appropriate.

## 8. Use of PET scan by lung cancer patients

- a. Background:** A limitation to analysis based on Medicare claims only is that the claims contain no information about whether a cancer diagnosis is confirmed, where in the process a patient is (diagnosis, staging or restaging) and, for the case of lung cancer, histology is not present in Medicare claims although the coverage policy explicitly limits PET scans to one histologic type. We used linked Surveillance, Epidemiology and End Results (SEER) cancer registry and Medicare claims (SEER/Medicare) data to examine use of PET scans by patients with non-small cell lung cancer (NSCLC) and small-cell lung cancer (SCLC). We examined whether there was measurable use of PET scans by patients with SCLC (not a covered indication), examined use of PET scans for SCLC patients by demographic characteristics and stage. Finally, we compared PET scan users and non-users in terms of surgeries and survival.

The classification of lung cancers into SCLC and NSCLC is important clinically. Clinically, only 19.5% of lung cancers are small cell and the majority (80.5%) are non-small cell. Compared with SCLC, NSCLC is diagnosed at earlier stages and has better stage-specific survival and first course of treatment is often surgery. In contrast, SCLC is more chemo-sensitive. Both histologies are associated with exposure to tobacco smoke.

	Stage at Diagnosis (%)		Stage-specific % 1 year survival	
	SCLC	NSCLC	SCLC	NSCLC
Total	N/A	N/A	27%	37%
Local	10%	22%	66%	70%
Regional	33%	39%	34%	38%
Distant	44%	31%	13%	12%
Unstaged	13%	8%	23%	34%

- b. Methods:** We used SEER/Medicare linked data described above. The process of linking the SEER and Medicare data bases as well as their use for studying process of cancer care is well established in the literature (Potosky, 1993). The most recent update of the SEER/Medicare linkage was for incident cancers through 1999 with claims through 2001. We limited this analysis to persons whose cancer was diagnosed in 1999. We defined NSCLC using criteria established by Bach and colleagues (2001). Lung cancer patients who did not have a morphology code of 8000,8002,8041-8045,8240,8241,8244,or 8246 were considered to have NSCLC. Those with the listed morphology codes were considered to have SCLC. PET scans were identified from Medicare claims using the methodology established for this project with the additional restriction that the PET had to occur +/- two months of diagnosis date. Consistent with Bach (2001), we consider MedPAR records containing ICD-9 procedure codes of 32.1x-32.6x or 34.02 to be a thoracotomy. Using a classification also described by Bach and colleagues (2001), we divided incident lung cancer cases into those whose disease is potentially curable and those whose disease is not (stages I - IIIA vs. all later stages). Compared with a local/regional/distant classification scheme, the

potentially curable/not divides persons with regional disease into two categories.

**c. Case selection:** The number of SCLC and NSCLC cancer cases varied considerably by registry as did the number of NSCLC cases with a PET scan. Based on this variation we chose to limit analysis to those registries with at least 3% and at least 20 NSCLC cases receiving PET scans. This would provide enough statistical power to allow for adjustment for registry in our statistical models examining the impact of PET scans on survival. Further, if we had allowed all registries to contribute to the non-PET scan comparison group while only select registries contributed to the PET scan group it would be possible that we would mistakenly attribute to PET scans differences that were due to geography. Our final sample of registries included Los Angeles, Detroit, Hawaii, Connecticut and Iowa.

	# NSCLC cases in 1999 linked SEER/Medicare data	# NSCLC cases with PET scans	#SCLC cases in 1999 linked SEER/Medicare data
<b>Los Angeles</b>	1085	104	210
<b>Detroit</b>	1364	59	285
<b>Atlanta</b>	416	6	87
<b>Hawaii</b>	212	26	43
<b>Iowa</b>	1009	62	278
<b>Connecticut</b>	890	29	215
<b>New Mexico</b>	267	0	70
<b>Utah</b>	244	0	61
<b>San Jose</b>	298	5	75
<b>San Francisco</b>	515	11	95
<b>Seattle</b>	894	12	61

**d. Results:** Our analytic file includes 5291 lung cancer cases whose cancer was diagnosed in 1999. Of these, 4260 (80.5%) had NSCLC and the remaining 19.5% had SCLC. A minority of incident cancer cases (5.7%) underwent a PET scan within  $\pm 2$  months of diagnosis. Use of PET scans was higher for patients with NSCLC than with SCLC (6.1% vs. 1.8%), consistent with coverage policy that does not include SCLC.

Limiting analysis to the 4260 NSCLC cases, use of PET scans within  $\pm 2$  months of diagnosis was strongly associated with stage with greater use of PET scans for patients with earlier-staged disease (see table). Because our time-frame for PET scans corresponds to the time frame SEER uses for collecting stage information it is interesting that 3.1% of unstaged cases received a PET scan. The table below also illustrates the considerable variation in PET scans by demographic characteristics and across SEER registries. The association between PET scan use and age is particularly strong, showing declining use with increasing age. The high rates of PET scans among Asian/PI people reflects, to a great deal, local practice patterns of the Hawaii registry.

	<b>Number of Cases</b>	<b>% with PET scans (unadjusted)</b>	<b>p-value*</b>
<b>Stage</b>			
<b>Local</b>	992	10.9%	<.0001
<b>Regional</b>	1786	6.4%	
<b>Distant</b>	1391	3.2%	
<b>Unstaged</b>	384	3.1%	
<b>Sex</b>			
<b>Male</b>	2752	6.1%	.8935
<b>Female</b>	1988	6.1%	
<b>Race</b>			
<b>White</b>	3676	6.2%	.0009
<b>Black</b>	463	1.9%	
<b>Asian/PI</b>	292	13.7%	
<b>Hispanic</b>	120	4.2%	
<b>Age</b>			
<b>65-69</b>	919	7.8%	.0003
<b>70-74</b>	1260	7.1%	
<b>75-79</b>	1145	6.7%	
<b>80-84</b>	756	3.3%	
<b>85-89</b>	362	4.4%	
<b>90+</b>	108	0.9%	
<b>Registry</b>			
<b>Connecticut</b>	890	3.3%	<.0001
<b>Detroit</b>	1364	4.3%	
<b>Hawaii</b>	212	12.3%	
<b>Iowa</b>	1009	6.1%	
<b>Los Angeles</b>	1085	9.6%	

\*adjusting for all other factors in the table; logistic regression with 18 d.f.

- c. **Conclusions:** The results of this analysis reveal that some patients with SCLC undergo PET scans even though officially they are not covered by Medicare. Yet, the majority of lung cancer cases undergoing PET scans are appropriately NSCLC.

## **9. Global findings, recommendations and policy implications:**

From a coverage perspective, CMS' approach to PET scans is important and could offer opportunities for both studying the impact of PET scans as well as monitoring their use and effectiveness. There appears to be a disconnect between the policy and claims processing. Some of the problem is inherent in the specifics of the coverage decisions. For example, there are no ICD-9 codes to distinguish between NSCLC and SCLC. The former is covered, the latter is not. Identifying an easily implemented coverage policy is not obvious. In other cases, there seems to be a disconnect between the language of the policies and how claims are processed. There should be greater concordance between diagnosis and HCPCS codes than we found. Likewise, people undergoing PET scans for diagnosis after having undergone staging seems nonsensical.

**References:**

1. Potosky AL, Riley GF, Lubitz JD, Mentnensch RM, Kessler LG. Potential for cancer related health services research using a Medicare-tumor registry database. Med Care; 31:732-48, 1993.
2. Bach PB. Cramer LD. Warren JL. Begg CB. Racial differences in the treatment of early-stage lung cancer. New England Journal of Medicine. 341(16):1198-205, 1999.
3. Bach PB. Cramer LD. Schrag D. Downey RJ. Gelfand, SE. Begg CB. The influence of hospital volume on survival after resection for lung cancer. New England Journal of Medicine. 345(3): 181-188, 2001.