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# Assessment of melanoma follow-up trends in Medicare patients: a large scale, multi-regional analysis

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## Abstract

**Background**: Research on patient follow-up compliance after a diagnosis of melanoma has been limited.

**Objective**: To assess the timelines for follow-up among patients who are diagnosed with melanoma and to assess the socioeconomic and provider factors which influence follow-up adherence.

**Methods**: A retrospective, population-based study using nationally representative data from the Surveillance, Epidemiology, and End Results (SEER)-Medicare linked database was conducted to evaluate 10,813 patients who were diagnosed with melanoma from 2005-2013.

**Results**: We found that 97% of the individuals with melanoma had at least one follow-up visit, with 80.5% having their first follow-up visit within the first 6 months and 88.6% having their first follow-up visit within 12 months. Patients who had a dermatologist as the diagnosing provider were significantly more likely to follow up. Additionally, patients who returned were more likely to live in a community with a higher socioeconomic status.

**Limitations**: Applicability of the data to a non-Medicare population and confounding variables such as co-morbid conditions are limitations.

**Conclusions**: The majority of patients diagnosed with melanoma follow up with a provider within one year. However, socioeconomic and provider factors play important roles in influencing patient return visits.

*Keywords: melanoma, follow-up, SEER*

## Introduction

Cutaneous melanoma incidence is rising rapidly in the United States. yet melanoma is highly curable when detected early [1, 2]. The risk of a second melanoma is increased in patients with a prior history of melanoma, with estimates of cumulative risk ranging from 2-5% within 5 to 20 years following the initial diagnosis [3]. Clinical guidelines by the American Academy of Dermatology have recommended follow-up examinations with a dermatologist for patients with a history of cutaneous melanoma every 3 months to 12 months, depending on the stage of melanoma and other risk factors, to detect recurrence or metastatic disease [4].

Currently, research on patient compliance with melanoma follow-up has been mainly retrospective and descriptive. These include small qualitative studies, such as those conducted through retrospective surveys and interviews or collected electronic medical record data from a single group of providers internationally [5-13]. Despite much interest in this topic, there is little quantitative information on how patients in the United States adhere to melanoma follow-up guidelines and the factors that influence follow-up adherence.

The Surveillance, Epidemiology and End Results (SEER) Medicare linked database is a collection of data from cancer registries containing detailed clinical, demographic, and cause of death information for persons with cancer since 1991. This study is a foundational analysis of the SEER-Medicare database intended to provide quantitative, multi-

regional evidence to determine the rates of melanoma follow-up among the Medicare population, to address whether socioeconomic factors play a role in improved routine follow-up after a diagnosis of melanoma, and to distinguish whether provider type (dermatologist versus non-dermatologist) plays a role in patient follow-up intervals.

## Methods

### Study population

We used the 2005-2013 SEER-Medicare linked database to identify Medicare patients who were diagnosed with melanoma. The SEER-Medicare linked database provides information on a nationally representative collection of population-based registries from various geographic regions in the United States. These registries include approximately 26% of the United States population.

Patients who were not enrolled in part A of Medicare during the 12 months before and/or within one year following diagnosis or who were enrolled in an HMO during this time were excluded. Patients who died within 6 months of diagnosis were also excluded.

### Measures studied

*A. Excision of malignant lesion claims*

The sample was restricted to patients who had cancer directed surgery according to the Current Procedural Terminology (CPT) procedure codes 11600-11646 (excision of malignant lesion) linked with diagnosis code of 172.XX (melanoma) in hospital or outpatient claims, or who were identified as having a melanoma in the SEER PEDSF database with corresponding site-specific surgery. Patients who did not have definitive surgery reported in these datasets during the month of diagnosis or within the subsequent 3 months were excluded from the analysis.

*B. Patient follow-up claim*

After excision, we used carrier claims to identify the appropriate follow-up. Future claims following the initial diagnosis were queried to identify 172.XX (melanoma) or V10.82 (history of melanoma) diagnosis codes, and CPT codes 99211, 99212, 99213, 99214, 99215 (office visits), 11100 (skin biopsy), 11300-11313 (shave removal), and 17000, 17003, 17004 (destruction of premalignant lesion) were used to identify follow-up date. For providers who did not enter V10.82, this criterion was tracked by providers who submitted skin biopsy (CPT 11100) with ICD-9 code 238.2 (neoplasm uncertain behavior) or 17000 with diagnosis 702.0 (actinic keratosis). These additional procedure codes were selected because, when patients present for melanoma follow-up, many providers may not submit a charge for an office visit if (during that encounter) a procedure is performed on another pigmented lesion or if a precancerous lesion is treated, because evaluation and management is sometimes bundled into those procedures.

*C. Provider type*

The provider type at the time of initial diagnosis and at the time of first follow-up was determined. Visits with either 172.XX or V10.82 codes in the initial diagnosis of melanoma claim were linked with the Medicare specialty number of the provider submitting the claim to determine if the claim was submitted by a dermatologist or non-dermatologist.

We divided provider types into three groups:

Dermatology

Other Clinical Providers = Family Practice, Hematology/Oncology, Surgical Oncology, Medical Oncology, General Practice, General Surgery, Otolaryngology, Internal Medicine, Obstetrics/gynecology, Plastic and Reconstructive Surgery, Podiatry, Nurse Practitioner, Multispeciality clinic or group practice.

Non-clinical providers = All other codes including Pathology and Clinical Lab.

*D. Patient demographic, clinical, and area-level characteristics*

Information on each patient's age at diagnosis, marital status, SEER region, residence in a rural versus. metropolitan county, diagnosis year, stage of disease, node status, histology, tumor size, tumor grade, and history of prior non-melanoma cancers

was provided in the SEER data. We characterized the proportion of high school graduates, rural versus urban, and median household income of the census tract of each patient's residence.

### Statistical Analysis

All statistical analysis was performed using SAS 9.4 and statistical significance was assessed using a significance level of 0.05. Descriptive statistics (frequencies and percentages or means and standard deviations) overall, and by follow-up status (followed-up, did not follow-up) following surgery for melanoma were determined. Chi-square tests and t-test were used to examine preliminary differences by follow-up status.

To examine risk factors for follow-up, a Cox Proportional Hazards (CPH) model building strategy was used. Time to first follow-up was the outcome measure. The main independent variable was provider at initial diagnosis (dermatology, other clinical provider, or all other). Other potential risk factors were examined including age at first diagnosis, race, ethnicity, sex, marital status, residence in a rural community, stage of melanoma, median family income of the community, percent with a high school education in the community, and percent living below the poverty level in the community.

Each main independent or other risk factor was first examined in simple bivariate CPH models and the hazard ratio (HR) and corresponding 95% confidence interval (CI) were estimated. All variables were then entered into a comprehensive full model and a

**Table 1:** *Descriptive statistics for overall study population (N=10,813) by follow-up.*

| Variable – n (%) or mean (SD) presented | Level of Variable | Overall N=10,813 (100%) | Patients who Follow-Up N=10518 (97.3%) | Patients Without Follow-Up N=295 (2.7%) | P-value |
|---|---|---|---|---|---|
| **Main Independent Variable** | | | | | |
| Initial Provider – n (%) | Other (non-clinical) | 2912 (26.9) | 2818 (26.8) | 94 (31.9) | <0.0001 |
| | Other Clinical Provider | 2543 (23.5) | 2450 (23.3) | 93 (31.5) | |
| | Dermatology | 5358 (49.6) | 5250 (49.9) | 108 (36.6) | |
| **Demographics** | | | | | |
| Age – mean (SD) | | 70.4 (2.8) | 70.4 (2.8) | 70.0 (2.8) | 0.0432 |
| Sex – n (%) | Male | 6751 (62.4) | 6562 (62.4) | 189 (64.1) | 0.5569 |
| | Female | 4062 (37.6) | 3956 (37.6) | 106 (35.9) | |
| Mortality – n (%) | Died | 1457 (13.5) | | | |
| | Alive | 9356 (86.5) | | | |
| Median Income – mean (SD) | | $59149.4 (27034.6) | $59300.8 (27102.2) | $53749.4 (23923.9) | 0.0001 |
| % with HS Education – mean (SD) | | 25.2 (10.4) | 25.1 (10.4) | 27.5 (10.2) | 0.0001 |
| % below Poverty Level – mean (SD) | | 8.2 (6.9) | 8.2 (6.9) | 9.3 (7.6) | 0.0124 |
| Follow-Up within 6 Months – n (%) | Yes | 8709 (80.5) | | | |
| | No | 2104 (19.5) | | | |
| Follow-Up within 12 Months – n (%) | Yes | 9577 (88.6) | | | |
| | No | 1236 (11.4) | | | |
| Follow-Up Provider – n (%) | Other Clinical Provider | 1291 (11.9) | 1291 (11.9) | | |
| | Dermatology | 9227 (85.3) | 9227 (85.3) | | |

* Details on race, ethnicity, rural vs urban, marital status, melanoma stage, tumor stage, node stage, metastasis stage, histology and melanoma grade were censored per SEER guidelines due to low frequencies of occurrence within some subgroups.
n (%) or mean (SD) presented in overall, patients who follow-up, and patients without follow-up columns.
Descriptive statistics on follow-up for 10,813 patients diagnosed with melanoma. 88.6% of patients received follow-up within one year. Patients who followed-up were more likely to be above the poverty line and have a higher median income than those who did not follow-up.

backward model building strategy was used to arrive at the final model. Variables that had the least significant P-value in each full model were eliminated one-by-one until the final model consisted of those variables that were statistically significant at the 0.05 significance level or needed in the model using Aikake's Information Criterion (AIC) and Bayesian Information Criterion (BIC) model fit criteria. The AIC and BIC were examined after each non-significant variable was removed from the model to ensure better fit of the reduced model. Additionally, the estimate for the main independent variable was examined to ensure that the elimination of a potential risk factor did not result in a large change in the estimated risk of the main independent variable on time to follow-up. The final model consisted of the main independent variable and all risk factors that were statistically significant or needed in the model to improve model fit to the data. The adjusted hazard ratio (aHR) and corresponding 95%CI for follow-up were estimated for each variable in the final model. Note that the aHR is interpreted as the hazard ratio for that specific variable adjusting for all other variables in the final model.

## Results

Descriptive statistics by follow-up status are given in **Table 1**. However, details on race, ethnicity, rural versus urban, marital status, melanoma stage, tumor stage, node stage, metastasis stage, histology, and melanoma grade were censored per SEER guidelines owing to low frequencies of occurrence within some subgroups. Ninety-seven percent of the individuals with melanoma had at least one follow-up visit, with

**Table 2:** *Crude hazard ratios for initial and follow-up provider types and other potential risk factors on time to first follow-up.*

| Variable | Level | Hazard Ratio | 95% CI | | P-value |
|---|---|---|---|---|---|
| | | | Lower | Upper | |
| **Main Independent Variables** | | | | | |
| Initial Provider | Other vs. Dermatology | 0.89 | 0.85 | 0.94 | <0.0001 |
| | Other Clinical vs. Dermatology | 0.71 | 0.67 | 0.74 | |
| **Demographic and Other Risk Factors** | | | | | |
| Age at First Diagnosis | 1yr change | 1.01 | 1.00 | 1.01 | 0.1701 |
| Sex | Male vs. Female* | 0.97 | 0.93 | 1.01 | 0.1451 |
| Race | Black vs. White* | 1.34 | 0.95 | 1.90 | 0.2215 |
| | Other vs. White* | 1.05 | 0.87 | 1.26 | |
| Ethnicity | Hispanic vs. Non-Hispanic* | 1.00 | 0.85 | 1.17 | 0.9702 |
| Rural | Rural vs. Urban* | 1.02 | 0.88 | 1.17 | 0.8222 |
| Marital Status | Divorced vs. Widowed* | 1.05 | 0.93 | 1.17 | <0.0001 |
| | Married vs. Widowed* | 1.02 | 0.95 | 1.11 | |
| | Separated vs. Widowed* | 1.14 | 0.71 | 1.82 | |
| | Single vs. Widowed* | 1.07 | 0.97 | 1.20 | |
| | Unknown vs. Widowed* | 1.18 | 1.08 | 1.28 | |
| Melanoma Stage | I vs. 0* | 1.05 | 1.01 | 1.10 | 0.1174 |
| | II vs. 0* | 0.99 | 0.92 | 1.06 | |
| | III vs. 0* | 1.07 | 0.97 | 1.18 | |
| | IV vs. 0* | 0.95 | 0.69 | 1.32 | |
| | Unknown vs. 0* | 0.99 | 0.90 | 1.09 | |
| Median Income | $1 change in income | 1.00 | 1.00 | 1.00 | 0.0022 |
| % with High School Education | 1% change | 1.00 | 0.99 | 1.00 | <0.0001 |
| % below Poverty Level | 1% change | 1.00 | 1.00 | 1.00 | 0.1791 |

* Indicates Referent Group; CI=confidence interval.

Other Clinical Providers= Family Practice, Hem/Onc, Surg Onc., Med Onc, General Practice, General Surgery, Otolaryngology, Internal Medicine, Obstetrics/gynecology, Plastic and Reconstructive Surgery, Podiatry, Nurse Practitioner, Multispeciality clinic or group practice, Hemotology/Oncology.

Other providers = All other providers including Pathology and Clinical Lab.

80.5% having their first follow-up visit within the first 6months and 88.6% having their first follow-up visit within 12 months. Our analysis found that patients diagnosed with melanoma were 98.6% white, non-Hispanic individuals and 87.7% of patients who followed up did so with a dermatologist. Differences between those with follow-up and those without follow-up were found for the initial provider, age, median family income in the community, percent with a high school education in the community, percent living below the poverty level in the community, stage of melanoma, and tumor stage. Those who had follow-up were more likely to have initially seen a dermatologist with 49.9% of patients who followed up having initially been seen by a dermatologist versus only 36.6% of patients who did not follow-up were seen by a dermatologist. Patients who follow up were also older (average age 70.4 versus 70.0), had a higher median family income in the community ($59,300 versus $53,749), and were less likely to be living below the poverty limit (8.2% versus 9.3%).

**Table 2** gives the unadjusted, crude hazard ratios from simple Cox Proportional Hazards models for provider at initial diagnosis, provider at follow-up, and other potential risk factors on time to follow-up. **Table 3** gives the adjusted hazard ratios for the full and final Cox Proportional Hazards model for provider at initial diagnosis. The final model for the provider at initial diagnosis on time to first follow-up (**Table 3**) indicated that those who saw some other type of provider initially (adjusted hazard ratio=0.90) or saw a clinical (primary care or surgical provider) initially (adjusted hazard ratio=0.71) were significantly less likely to have follow-up within 5 years than those who saw a dermatologist, initially controlling for sex, marital status, melanoma stage, and the median family income in the community.

## Discussion

Follow-up after melanoma diagnosis is an important aspect of management to detect early recurrence, identify new primary melanomas, and potentially to improve patient survival [14, 16]. This study analyzed melanoma follow-up for over 10,000 Medicare patients in diverse geographic regions of the United States through objective claims history.

Our study showed that approximately 88% of melanoma Medicare patients follow up with a provider within a year. This result supports previous research, which has used providers' perspectives and retrospective data to determine melanoma follow-up to be high [6, 16, 17]. Our analysis also found, similar to previous studies, that socioeconomic factors play a role in influencing follow-up for patients. Factors such as age, race, income status, marital status, education level, and location play significant roles in patient's adherence to follow-up guidelines.

Beyond the primary objectives of measuring follow-up and mortality, this study also provides a baseline of information regarding melanoma patients. This analysis found similar results to previous analysis, which found melanoma to disproportionately affect Caucasians and be highly followed up by dermatologists [6,19, 20] Finally, our study found marital status to have a statistically significant impact on follow-up. This finding is in keeping with other studies which have found poorer outcomes for melanoma for widowers and non-married individuals [21,22], highlighting a population of patients who could benefit from further study and,perhaps, targeted intervention.

One important result of the study was the difference between follow-up intervals among patients who were initially seen by a dermatologist compared to being followed up with a dermatologist. Patients who saw a dermatologist initially were significantly more likely to follow up than patients who saw a different provider. This finding supports the importance of dermatologist-led patient education in supporting follow-up education for patients [15] Additionally, these findings present an opportunity for cross disciplinary education between different specialties and the need for increased awareness about the importance of follow-up for melanoma patients.

**Table 3.** *Adjusted hazard ratios of initial provider type on time to first follow-up in months controlling for other risk factors.*

| Variable | Level | Full Model | | | | Final Model | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | 95% CI | | | | 95% CI | | |
| | | aHR | Lower | Upper | P-value | aHR | Lower | Upper | p-value |
| **Main Independent Variables** | | | | | | | | | |
| Initial Provider | Other vs. Dermatology | 0.90 | 0.86 | 0.94 | <0.0001 | 0.90 | 0.86 | 0.94 | <0.0001 |
| | Other Clinical vs. Dermatology | 0.72 | 0.68 | 0.75 | | 0.71 | 0.68 | 0.75 | |
| **Demographic and Other Risk Factors** | | | | | | | | | |
| Age at First Diagnosis | 1yr change | 1.01 | 1.00 | 1.01 | 0.1389 | | | | |
| Sex | Male vs. Female* | 0.96 | 0.93 | 1.00 | 0.0805 | 0.97 | 0.93 | 1.01 | 0.0894 |
| Race | Black vs. White* | 1.29 | 0.91 | 1.82 | 0.3212 | | | | |
| | Other vs. White* | 1.05 | 0.87 | 1.27 | | | | | |
| Ethnicity | Hispanic vs. Non-Hispanic* | 1.00 | 0.85 | 1.18 | 0.9806 | | | | |
| Rural | Rural vs. Urban* | 1.07 | 0.93 | 1.24 | 0.3435 | | | | |
| Marital Status | Divorced vs. Widowed* | 1.05 | 0.93 | 1.18 | <0.0001 | 1.04 | 0.93 | 1.17 | <0.0001 |
| | Married vs. Widowed* | 1.03 | 0.95 | 1.11 | | 1.02 | 0.94 | 1.11 | |
| | Separated vs. Widowed* | 1.18 | 0.74 | 1.89 | | 1.18 | 0.74 | 1.89 | |
| | Single vs. Widowed* | 1.08 | 0.97 | 1.20 | | 1.07 | 0.96 | 1.19 | |
| | Unknown vs. Widowed* | 1.15 | 1.06 | 1.26 | | 1.15 | 1.05 | 1.25 | |
| Melanoma Stage | I vs. 0* | 1.10 | 1.06 | 1.15 | 0.0003 | 1.10 | 1.06 | 1.15 | 0.0002 |
| | II vs. 0* | 1.09 | 1.01 | 1.17 | | 1.09 | 1.01 | 1.17 | |
| | III vs. 0* | 1.16 | 1.04 | 1.28 | | 1.16 | 1.05 | 1.29 | |
| | IV vs. 0* | 1.09 | 0.79 | 1.50 | | 1.09 | 0.79 | 1.50 | |
| | Unknown vs. 0* | 1.07 | 0.97 | 1.17 | | 1.07 | 0.97 | 1.17 | |
| Median Income | $1 change in income | 1.00 | 1.00 | 1.00 | 0.0603 | 1.00 | 1.00 | 1.00 | 0.0021 |
| % with High School Education | 1% change | 1.00 | 1.00 | 1.00 | 0.3246 | | | | |
| % below Poverty Level | 1% change | 1.00 | 1.00 | 1.01 | 0.4997 | | | | |

*Indicates Referent Group; aHR = adjusted hazard ratio; CI = confidence interval.

Other Clinical Providers= Family Practice, Hem/Onc, Surg Onc., Med Onc, General Practice, General Surgery, Otolaryngology, Internal Medicine, Obstetrics/gynecology, Plastic and Reconstructive Surgery, Podiatry, Nurse Practitioner, Multispeciality clinic or group practice, Hemotology/Oncology.

Other providers = All other providers including Pathology and Clinical Lab.

Hazard ratio for factors influencing follow-up when controlling for risk factors. The full model includes all variables and the final model controls each variable for the statistically significant variables of the full model. The final model indicates that those who saw some other type of provider initially (adjusted hazard ratio=0.90) or saw a clinical provider (primary care or surgical provider) initially (adjusted hazard ratio=0.71) were significantly less likely to follow-up within 5 years than those who saw a dermatologist initially controlling for sex, marital status, melanoma stage and the median family income in the community.

Limitations of this study include the difficulty of interpreting the coding for diagnosis, treatment, and follow-up of the various databases since coding practices have changed over time and providers may have used different codes for different practice settings. In order to address these limitations, we have used multiple criteria for coding based on different styles of practice. However, coding variations or misuse of codes (such as the use of an office visit code for a no charge suture removal visit) remain a limitation of the study. Additionally, disease-specific mortality was not analyzed owing to the small sample size of patients who died as a result of melanoma and co-morbid conditions were not used as criteria in analysis of follow-up. Finally, the SEER-Medicare database is a database of Medicare patients, which neglects the population of patients who are not yet on Medicare, including a younger population with an increasing incidence of melanoma [18]. Ultimately, this study serves as a foundation for future research to investigate the causes in follow-up disparity between provider specialty with melanoma follow-up, study the development of programs to reduce socioeconomic disparity in melanoma treatment and follow-up, assess the survival benefit of melanoma follow-up, or promote interdisciplinary work, which can standardize patient education, treatment, and follow-up for melanoma.

## Conclusion

Follow-up after diagnosis of primary melanoma is an important aspect of melanoma management. This study aimed to provide a foundation for the adherence of Medicare patients to follow-up guidelines for melanoma and to identify risks factors and barriers to follow-up. The study found that 88.6% of Medicare patients follow up with a provider within one year. We also showed that the adjusted factors, which influenced follow-up were race (blacks have 1.29 hazard ratio of non-follow-up compared to whites) and initial diagnosing provider (having a dermatologist initially diagnose the melanoma reducing a patient's hazard ratio for follow-up to 0.72 when compared to other clinical providers).

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