Miscoding of Melanoma Thickness in SEER: Research and Clinical Implications

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Melanoma-related deaths and metastases among patients with thin (≤1 mm) and ultrathin (≤0.25 mm) melanomas have been reported. These observations might reflect adverse biology and/or errors in administrative data. Cumulative melanoma-related death rates for thickness groups of patients with thin melanomas were compared among five cohorts including the Surveillance, Epidemiology, and End Results (SEER) registry. Thickness in one SEER region was reexamined in pathology reports. The 5-year cumulative melanoma-related death rate of patients with ultrathin melanomas was higher in SEER (2.8%) compared with other registries (0.6–0.9%). The rates across the 16 SEER regions were 0.25% to 8.4%. In SEER, 21% of thin melanomas were ultrathin; in other registries, they comprised 5.8–15%. A reexamination of thickness in one SEER site revealed that 114 of 447 ultrathin melanomas had errors; after correction, only 17 of the 114 remained ultrathin. The majority of errors were related to decimal point placement. The 86 thin melanomas reclassified to >1.00 mm included 96% of the original ultrathin-associated deaths and 100% of the original positive lymph nodes. Significant miscoding of thickness that is concentrated in ultrathin lesions is present in SEER and results in mischaracterization of patient outcomes. When using administrative data, validation of results can identify critical data issues.

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INTRODUCTION

Individually, thin (≤1 mm) primary melanomas confer a good prognosis. However, patients with thin melanomas represent a high proportion of all melanoma-related deaths (Gimotty and Guerry, 2010; Hieken et al., 2015; Whiteman et al., 2015). Given the well-characterized relationship between thickness and prognosis (Balch et al., 2001), among patients with thin melanomas, those with lesions ≤0.75 mm have a better prognosis than those with lesions 0.76–1.00 mm (McKinnon et al., 2003). Surprisingly, a single-institution study reported that 10% of patients with lesions <0.75 mm had a recurrence within 5 years (Kalady et al., 2003). Also, a Surveillance, Epidemiology, and End Results (SEER)-based study (Bagaria et al., 2013) reported that 10% of patients who had positive lymph nodes at diagnosis (1998–2008) had primary tumors that were ≤0.5 mm, and patients with ≤0.5 mm lesions had a higher cumulative melanoma-related death (CMD) rate than patients with lesions that were 0.51–1.00 mm (37% vs. 22%, respectively). The study's authors counseled consideration of sentinel lymph node biopsies in patients with ≤0.5 mm melanomas. These unanticipated findings associated with very thin lesions raised the issue of reporting errors.

Cancer registries are an important source of information about patients with a low likelihood of death, such as patients with thin melanomas who are expected to be cured with definitive locoregional surgery. Coding errors in prognostic and predictive variables available in a registry can produce estimates that either over- or underestimate outcomes for important subgroups of patients. The presence of such errors (or "inconsistencies") has been identified in SEER data (Criscione and Weinstock, 2010), but has not been further investigated. In this study, we tested the hypothesis that miscoding of thinner melanomas in SEER data is a primary driver of adverse outcomes that are artifactual.

RESULTS

CMD rates by tumor thickness and other attributes

The 5-year CMD rate for SEER patients with thin melanomas diagnosed between 2004 and 2010 was 5.1% (95% confidence interval: 4.9–5.3%), and the 5-year and 10-year CMD rates for patients diagnosed between 1988 and 2003 were 3% (1.3–4.7%) and 4.8% (4.6–5.0%), respectively. For patients with melanomas in four thin subgroups (≤0.25 mm, 0.26–0.50 mm, 0.51–0.75 mm, and 0.76–1.00 mm), the 5-year CMD rates for the SEER (2004–2010), Sweden, Queensland, and Pigmented Lesion Group (PLG) cohorts are shown in a forest plot (Figure 1). As expected, the 5-year CMD rates were maximal in all cohorts for the 0.76–1.00 mm

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Abbreviations: CMD, cumulative melanoma-related death; PLG, Pigmented Lesion Group; SEER, Surveillance, Epidemiology, and End Results

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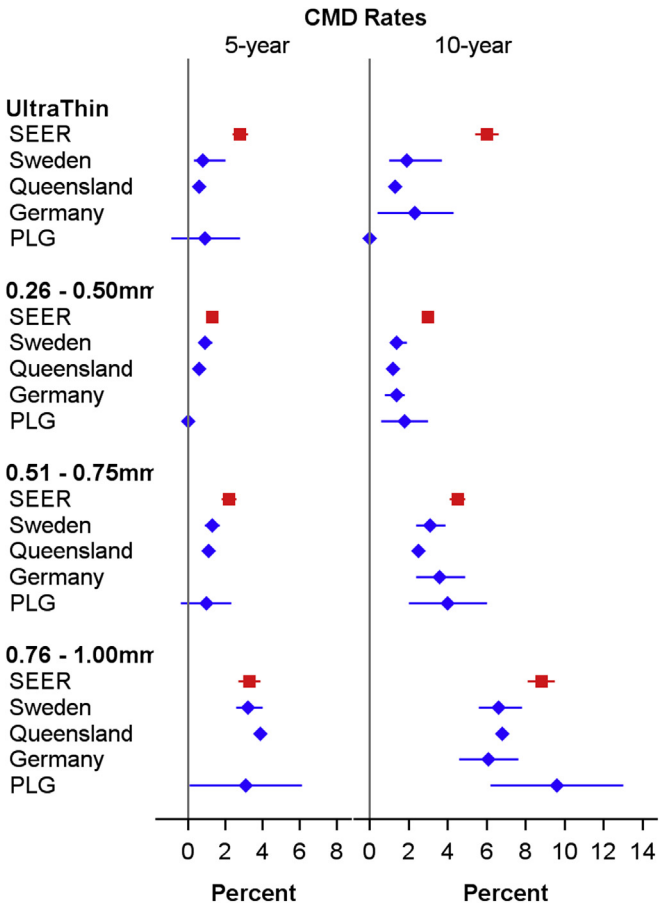

Figure 1. Cumulative melanoma-related death rates by thickness and cohort. Forest plots of 5- and 10-year cumulative melanoma-related death (CMD) rates and 95% confidence intervals by thickness subgroups and cohorts for patients with thin (≤1 mm) melanomas. The German cohort reported only 10-year CMD rates. PLG, Pigmented Lesion Group; SEER, Surveillance, Epidemiology, and End Results.

subgroup. Surprisingly, the ultrathin group in SEER had a 5-year CMD rate that was 3-fold and 4-fold higher than those in Sweden and Queensland, respectively, and 2.7-fold higher than that in the University of Pennsylvania's PLG cohort. In both the ultrathin and 0.26–0.50 mm subgroups, the SEER (1988–2003) 10-year CMD rates (6% and 3%, respectively) were higher than the corresponding rates observed in the four non-SEER cohorts.

Tumor characteristics in the four subgroups differed among the cohorts. For example, more SEER (2004–2010) patients had ultrathin melanomas (21%) compared with the other cohorts (5.8–15%), and fewer SEER patients were in the 0.76–1.00 mm subgroup (14.2%) compared with the other cohorts (16.6–27.9%) (Table 1). More level IV/V lesions were reported for the ultrathin melanomas in SEER compared with PLG (10.0% vs. 1.5%), and more SEER lesions were ulcerated compared with PLG lesions (Supplementary Table S1 online).

Review of pathology reports and coding for a SEER region (Detroit)

Because of these inconsistencies and, particularly, the finding of a high CMD rate in SEER patients with ultrathin melanomas, we reviewed thickness in the pathology notes for the 1955 patients with thin melanomas reported by the Detroit SEER site (Supplementary Table 2 online). Overall, 88% of patients' lesions were correctly coded for thickness; however, the percentage correctly coded varied among the thin subgroups. The ultrathin subgroup had the lowest percentage of cases correctly coded (71%). In contrast, the percentages correctly coded were 95%, 92%, and 89% in the 0.26–0.50 mm, 0.51–0.75 mm, and 0.76–1.00 mm subgroups, respectively.

Among the 190 thin melanomas with a thickness error (9.7% of 1955), 68% were due to decimal point miscoding errors (Supplementary Table 2). These errors led to three magnitudes of mistake. First, 61% of all incorrect values were too small by a factor of 10 (e.g., 0.11 became 1.10). Second, 6% were too small by a factor of 100 (e.g., 0.02 became 2.00). Third, 1% of the incorrect values for thickness were too large by a factor of 10 (e.g., 0.8 became 0.08). Decimal point errors were most frequent in the ultrathin subgroup.

Consequences of data correction

Among 447 thin melanomas originally characterized as ultrathin in Detroit SEER data, 75% remained ultrathin after correction of thickness, 6.7% were reclassified as 0.26–0.50 mm, and 10.3% were reclassified as nonthin (>1 mm) (Supplementary Table 3 online). Among the other three thickness subgroups, 2.3% to 3.3% of melanomas were reclassified as nonthin. The thickness distributions post- and precorrection melanomas ≤0.50 mm are shown in Figure 2 (first and second histograms). The change in the left tail reflected the elimination of 86 ultrathin melanomas, some of which were corrected to nonthin. The distribution of corrected thickness (first histogram) was similar to the distribution for the PLG cohort (third histogram).

Most adverse prognostic factors and poor outcomes attributed to putatively thin melanomas were associated with those that were reclassified ("corrected") as nonthin (Table 2). The thin melanomas originally observed as ulcerated were largely reclassified as nonthin. Level IV/V ultrathin melanomas decreased, because 79% of the thin melanomas reclassified to nonthin melanomas were level IV. The percentage of patients who had lymph nodes examined in the ultrathin, 0.26–0.50 mm, and 0.51–0.75 mm subgroups decreased to less than 8% from the originally reported percentages of 36%, 42%, and 44%, respectively. After correction, none of these patients had a lymph node positive for metastatic melanoma and none died of melanoma. Among the 86 patients reclassified as nonthin, 69% had their lymph nodes examined and 21% had at least one involved lymph node.

Heterogeneity among SEER regions

The distribution of thickness reported from the 15 SEER sites not included in the review (n = 47,828 patients; Figure 2, fourth histogram) was similar to the uncorrected cases in the Detroit SEER registry (second histogram). We ranked all SEER regions by their 5-year CMD rates for the ultrathin subset and displayed the paired rates for the ultrathin and 0.76–1.00 mm subsets (Figure 3). For patients with ultrathin primaries, only two regions had CMD rates between 0.3% and 0.9%, comparable to rates in the non-SEER cohorts presented in Figure 1.