

Implications of Misclassification of Melanoma Thickness Measurement (Breslow's Depth) in Detroit SEER Data, 2004-2010

Ronald Shore^{1,2}, Nancy Lozon^{1,2}, Fawn Vigneau^{1,2}, Jeanne Whitlock^{1,2}, Julie George^{1,2}, DuPont Guerry³, Phyllis Gimotty³



1) Karmanos Cancer Institute, 2) Wayne State University School of Medicine, Dept. of Oncology, Detroit, MI, and
3) University of Pennsylvania Perelman School of Medicine, Philadelphia, PA, United States

BACKGROUND AND PURPOSE

Issues arise with Melanoma Thickness in Detroit SEER data

- Prognosis of melanoma is directly related to the "thickness" of the primary tumor
- In August 2013, our colleague Dr. Phyllis Gimotty contacted us concerning an anomaly with SEER Skin Melanoma data.
- Dr. Gimotty was studying "very-thin" melanomas, those with a thickness ≤ 0.25 mm.
- "Very-thin" melanomas have a high survival rate, but paradoxically, have a tendency to metastasize.

What Dr. Gimotty noticed

- In previous studies, patients with very thin melanomas had been found to have a very high five-year survival rate, generally over 99 per cent.
- However, when Dr. Gimotty's team examined very thin melanomas from our SEER registry in Detroit diagnosed from 2004-2010, she found a lower disease-specific survival rate of 97.4%.

Why the lower than expected survival rate for our "very-thin" melanoma patients?

- In data from both our registry and combined data from all SEER registries nationwide, Dr. Gimotty saw a higher proportion of "very-thin" lesions out of "thin" melanomas than in previous studies.
- In previous studies "very-thin" melanomas were found to be 4.5%-8.9% of all "thin" melanomas (those ≤ 1 mm in thickness), but in our data, "very-thin" melanomas made up 17.3% of "thin" melanomas.

One possible explanation

- Miscoding of thickness measurements causing some thicker (more deadly) melanomas to be included in the "very-thin" category.
- Coders are instructed that the decimal point is "implied", i.e. only the three digits and not the decimal point are to be recorded.
- For example, 0.01 millimeters should be coded as 001, 0.74 millimeters as 074, 1.05 millimeters as 105.
- Misplacement of the implied decimal point could explain misclassification.
- Thus we conducted a quality review of our melanoma thickness (Breslow's depth, SSF1) measurements.

METHODS

Data quality review

Based on our original measurements, the breakdown of Skin Melanomas in our registry's data by thickness category is shown at right.

- We began by investigating our "very-thin" melanomas (≤ 0.25 mm thick).
- There were 447 melanomas in this category, which we reviewed first.
- Later we reviewed the 1151 in the "medium" (0.26-0.50 mm) thickness category and
- lastly the 2201 in the thickest category (0.51 mm – 9.8 mm).

Instructions for data quality review

- 12 editors reviewed between 210 and 380 records each.
- Editors reviewed cases on our SEER Data Management System (DMS) using all staging documentation, including electronic (HL7) records and images of lab reports.

Data analysis

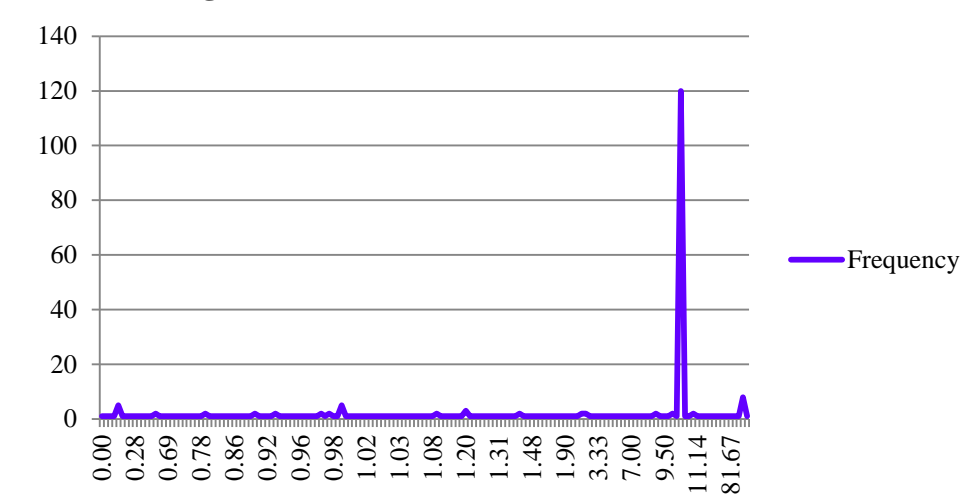
- Frequency distributions of Melanoma thickness were analyzed before and after correction.
- A Cox regression was performed to compare the effect of misclassification on estimated hazard ratios.
- Hazard ratios were adjusted by age and sex. Race was determined to not effect the Cox regression model significantly.

RESULTS

Proportion of Melanoma Thickness Measurements Requiring Correction		
Corrected	306	8.1%
No change	3417	89.9%
No data available	76	2.0%
	3799	

- For 76 records, or 2% of all melanomas, we no longer had access to the lab reports, generally because they came from hospitals that submit their records to us.
- Errors were most common among those tumors originally coded as "very-thin" with 26.2% requiring correction, compared to 5.7% for all others.

Frequency of Skin Melanomas, by Ratio of Corrected vs. Original Thickness (n=306), Detroit SEER, 2004-2010



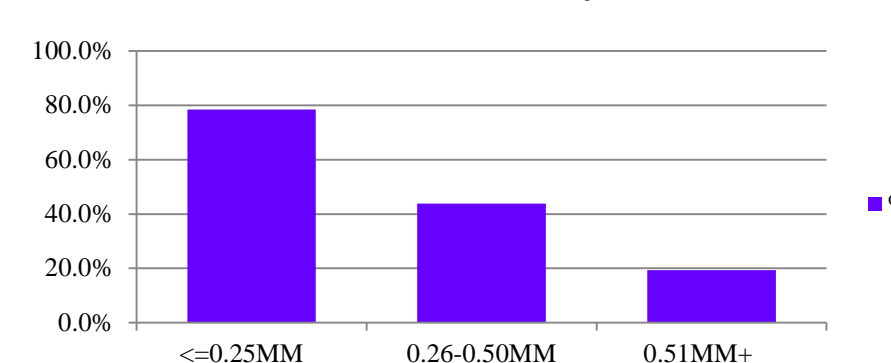
Possible explanations for miscoding

- Note the major spike at a 10-fold ratio and the minor spike at the 100-fold ratio.
- This is an indication that the biggest source of error was the placement of the decimal point in recording melanoma thickness in millimeters.

Which tumors were most often miscoded?

- Grouping the ratios that were "in the neighborhood" of 10.0 or 100 we found they were more common among those tumors originally coded as "very thin," or 0.25 mm or thinner. 78.4% of the incorrect measurements in this thinnest category were off by 10 or 100 times, compared with only 19.3% in the thickest category.
- For over 55% of tumors incorrectly coded by 10-fold, the effect of incorrect decimal point placement was to push them from their actual measures of between 0.25 -2.5 mm into the "very-thin" (≤ 0.25 mm) category.

Percentage of Skin Melanomas Incorrectly Coded Measurements off by 10- or 100-fold



Sources of Error	
Decimal point placement*	49%
"Minor" errors (within 20% of corrected measure)	20%
Transcription errors	5%
Other**	26%

*Includes 10- or 100-fold or 1/10 as large measures).

** Includes original measures being a record of the residual tumor thickness rather than the tumor removed, reviewers finding different source data than source for original measurements, and unexplained errors.

Distribution of original vs. corrected Melanoma Thickness (Breslow's Depth), Detroit SEER, 2004-2010					
Melanoma thickness (mm)	Original measurement		Corrected measurement		Difference
	N	%	N	%	
≤ 0.25 MM	447	11.8%	345	9.3%	-2.6%
0.26-0.50MM	1151	30.3%	1131	30.4%	0.1%
0.51MM+	2201	57.9%	2247	60.4%	2.5%
Grand Total	3799		3723		

Proportion of "very-thin" melanomas after correction

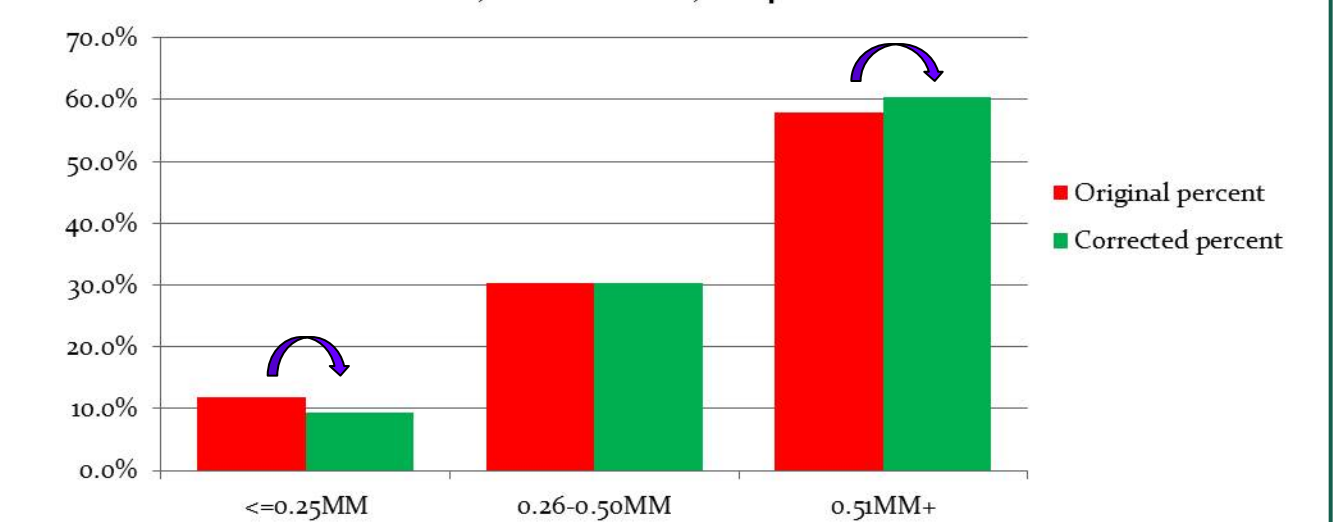
The distribution after correction was as shown at left:

- There were 345 tumors in the "very-thin" category, after correction.
- This makes the final proportion in the "very-thin" category 9.3%, compared with 11.8% originally.
- Restricting to "thin" melanomas, "very-thin" melanomas were 14.2% after correction, compared with 17.3% before.

RESULTS (cont.)

- Nearly all of the change is due to previously coded "very-thin" melanomas being shifted to the thickest category.
- The miscoding of thicker, more deadly melanomas into the "very-thin" category accounts for the lower observed 5-year survival rate for the thinnest category.

Comparison of original to corrected distribution of Skin Melanomas, Detroit SEER, 2004-2010

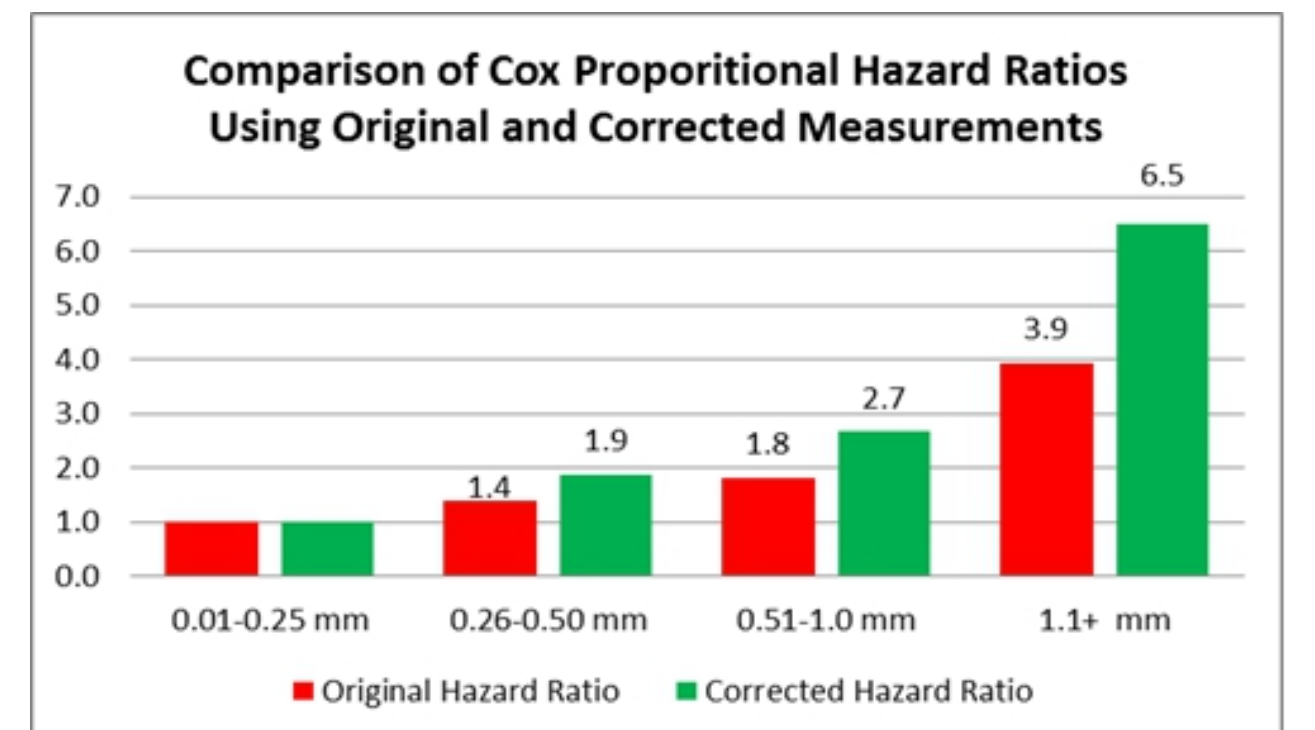


Effect of misclassification on Cox Regression findings:

- Using uncorrected measures, the HR for the 2nd thinnest (0.26 – 0.50 mm) category was not significantly greater than that for the "very-thin."

- Following correction, however, the HRs for all three of the thicker categories were significantly greater than that for the "very-thin" category.

- HRs calculated using corrected values show there is a consistent "dose response" relationship between melanoma thickness and risk of death.



CONCLUSIONS

Initial miscoding and misclassification of melanoma thickness led to underestimation of survival rates for very-thin melanomas and would have led to an incorrect conclusion in hypothesis testing for the hazard ratio of one melanoma thickness category.

These findings suggest:

- Implied decimals should be avoided in coding schemas.
- American Cancer Registrars require more training in metric system measurements and in Breslow's Depth.
- Registrars should refrain from coding from memory. Other tumor size measures are coded in centimeters, which may have contributed to confusion over decimal placement.
- Collaboration of researchers is an essential supplement to routine quality checking.