

# Using Cancer Registry Data to Estimate the Percentage of Melanomas Attributable to UV Exposure

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## Melanoma and UV: Background

- ❑ **Most melanomas are caused, at least in part, by exposure to ultraviolet radiation (UV)**
  - Genetic factors, such as being fair-skinned or having a family history of skin cancer, strongest risk factor but are non-modifiable
  - Relationship with UV is well-established
  - Genotyping studies are demonstrating a “UV signature” in melanomas
- ❑ **Type of exposure matters**
  - Intense exposures are thought to be stronger risk factors for melanoma than chronic/low-dose exposures
    - Trunk vs. head and neck
  - Note: indoor tanning is considered a high-dose exposure

# Melanoma: Relationship with UV

## Armstrong and Kricker

### □ Key reference:

- Armstrong BK, Kricker A. How much melanoma is caused by sun exposure? 1993. *Melanoma Research*, 3, p. 395-401.
- States 68%-97% of melanomas are thought to be attributable to UV exposure
- Population Attributable Fraction (PAF) = 
$$\frac{\text{Exposed Population} - \text{Unexposed Population}}{\text{Exposed Population}}$$
- Since there is no known population *unexposed* to UV, Armstrong & Kricker used several proxy measures for “ideal”/unexposed/population with lowest rates

Armstrong BK, Kricker A. How much melanoma is caused by sun exposure? 1993. *Melanoma Research*, 3, p. 395-401.

World Health Organization. Metrics: Population Attributable Fraction (PAF). Available at [http://www.who.int/healthinfo/global\\_burden\\_disease/metrics\\_paf/en/](http://www.who.int/healthinfo/global_burden_disease/metrics_paf/en/).

## Melanoma: Relationship with UV Armstrong and Kricger, 1993

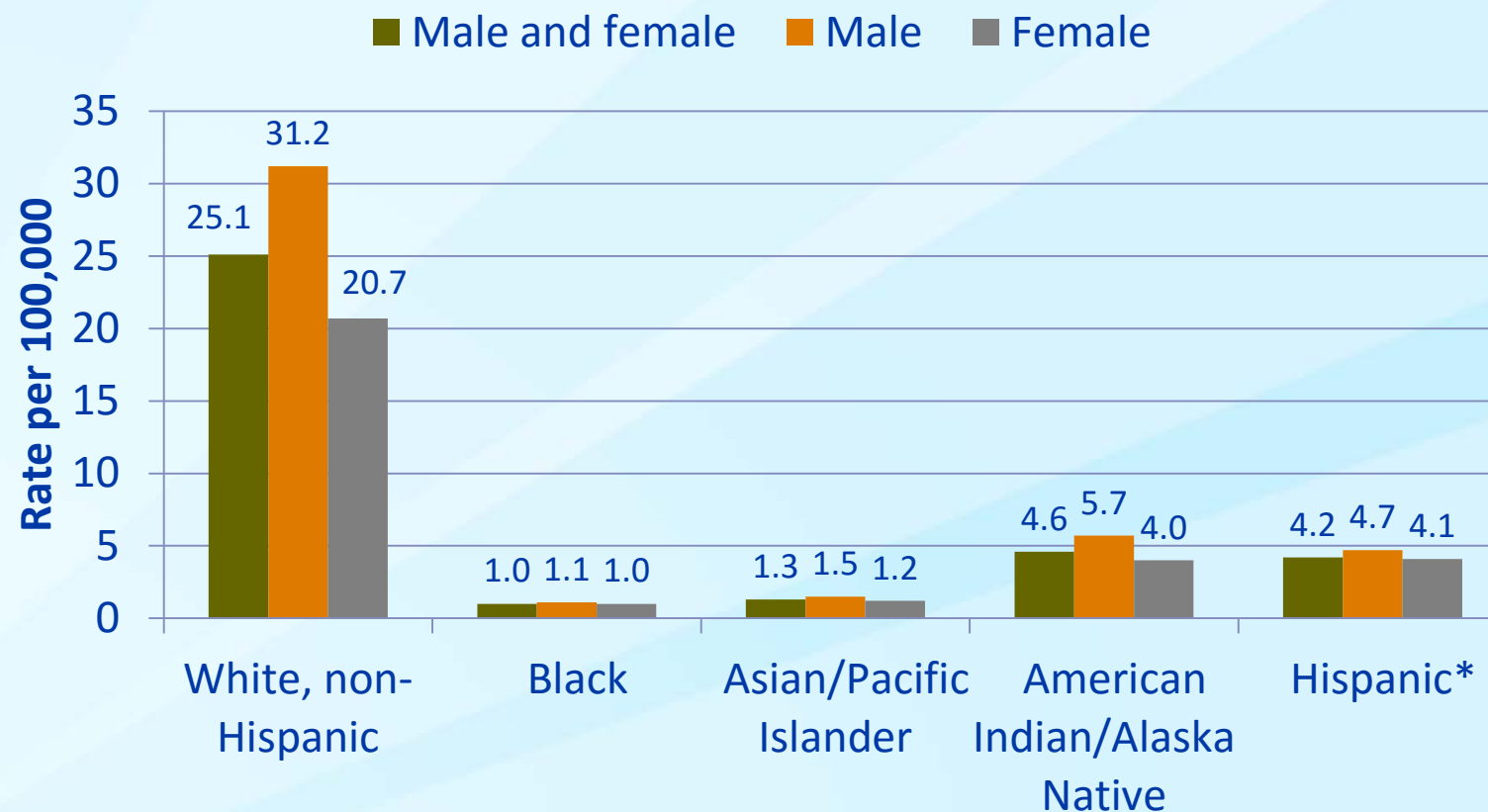
| Data Source                         | Exposed                       | Comparison                       | Males | Females |
|-------------------------------------|-------------------------------|----------------------------------|-------|---------|
| SEER                                | Whites                        | Blacks                           | 96%   | 92%     |
|                                     | Population of New South Wales | Populations of England and Wales | 89%   | 79%     |
|                                     | Australia born                | Immigrant populations from UK    | 68%   |         |
| Population of Queensland, Australia | Typically exposed body sites  | Typically unexposed body sites   | 97%   | 96%     |

## Melanoma and UV: Methods

- ❑ Used NPCR/SEER data covering 99% of US population to update Armstrong & Kricger analysis using available categories
- ❑ Data source: NPCR/SEER 2008-2012

| Proxy for Exposed             | Proxy for Unexposed        |
|-------------------------------|----------------------------|
| Non-Hispanic White Population | Black Population           |
| NHW in Hawaii                 | NHW in Alaska              |
| Histologic type               | Acral lentiginous melanoma |
| Exposed sites                 | Unexposed sites            |

# Populations at Greatest Risk of Melanoma, NPCR/SEER, 2008-2012



\*Hispanic ethnicity includes persons of all races

Data are from population areas that meet United States Cancer Statistics publication criteria ( [www.cdc.gov/cancer/npcr/uscs/technical\\_notes/criteria.htm](http://www.cdc.gov/cancer/npcr/uscs/technical_notes/criteria.htm) ) for 2008-2012 covering 99.1% of the population and were reported to the National Program of Cancer Registries (CDC) and the Surveillance, Epidemiology and End Results (SEER) program (NCI)

## Estimated PAF using race categories NPCR/SEER 2008-2012

|            | NHW Rate | Black Rate | Estimated PAF |
|------------|----------|------------|---------------|
| Both Sexes | 25.1     | 1.0        | 96.0%         |
| Male       | 31.2     | 1.1        | 96.5%         |
| Female     | 20.7     | 1.0        | 95.2%         |

Rate per 100,000.

PAF= (NHW Rate– Black Rate) /NHW Rate

## Estimated PAF using highest and lowest UV states NPCR/SEER 2008-2012

|            | NHW Rate<br>Alaska | NHW Rate<br>Hawaii | Estimated PAF |
|------------|--------------------|--------------------|---------------|
| Both Sexes | 15.5               | 67.1               | 76.9%         |
| Male       | 16.9               | 87.0               | 80.6%         |
| Female     | 13.9               | 48.1               | 71.1%         |

Rate per 100,000.

PAF= (NHW Alaska Rate– NHW Hawaii Rate) /NHW Alaska Rate



## Estimated PAF using race & histology NPCR/SEER 2008-2012

|                                | NHW Rate | Black Rate | Estimated PAF |
|--------------------------------|----------|------------|---------------|
| Superficial spreading melanoma | 7.7      | 0.1        | 98.7%         |
| Nodular melanoma               | 1.9      | 0.1        | 94.7%         |
| Lentigo maligna melanoma       | 1.4      | 0.0        | 100.0%        |
| Acral lentiginous melanoma     | 0.2      | 0.2        | 0.0%          |
| Melanoma NOS and other         | 13.7     | 0.6        | 95.6%         |

Rate per 100,000.

PAF= (NHW Rate- Black Rate) /NHW Rate

## Estimated PAF using histology NHW using ALM as a comparison NPCR/SEER 2008-2012

|                                    | Both sexes | Male  | Female |
|------------------------------------|------------|-------|--------|
| Superficial spreading melanoma     | 97.4%      | 97.7% | 97.2%  |
| Nodular melanoma                   | 89.5%      | 92.3% | 84.6%  |
| Lentigo maligna melanoma           | 85.7%      | 90.9% | 75.0%  |
| Melanoma NOS and other             | 98.5%      | 98.8% | 98.2%  |
| All histologic types excluding ALM | 99.0%      | 99.2% | 98.7%  |

Rate per 100,000.

PAF= (SSM or other histology Rate– ALM Rate) /SSM or other histology Rate

## Estimated PAF: Anatomic site Armstrong & Kricker

| Site                       | Males    |                   |                   | Females  |                   |                   |
|----------------------------|----------|-------------------|-------------------|----------|-------------------|-------------------|
|                            | <i>n</i> | Rate <sup>a</sup> | PAF               | <i>n</i> | Rate <sup>a</sup> | PAF               |
| Scalp                      | 18       | 17.5              | 0.94              | 2        | 1.2               | —                 |
| Face                       | 77       | 115.6             | 0.99              | 76       | 101.8             | 0.99              |
| Ears                       | 22       | 158.9             | 0.99              | 6        | 42.4              | 0.97              |
| Neck                       | 59       | 93.7              | 0.99              | 25       | 35.2              | 0.97              |
| Shoulders                  | 96       | 118.0             | 0.99              | 62       | 79.9              | 0.99              |
| Chest                      | 76       | 44.0              | 0.97              | 41       | 25.3              | 0.96              |
| Abdomen                    | 26       | 15.2              | 0.93              | 14       | 8.0               | 0.86              |
| Back                       | 305      | 115.8             | 0.99              | 144      | 54.6              | 0.98              |
| Buttocks                   | 1        | 0.5               | —                 | 3        | 1.8               | —                 |
| Upper arms                 | 69       | 32.4              | 0.96              | 134      | 64.3              | 0.98              |
| Forearms                   | 44       | 27.7              | 0.96              | 61       | 34.0              | 0.97              |
| Backs of hands             | 6        | 7.7               | 0.85              | 3        | 4.5               | 0.75              |
| Thighs                     | 53       | 10.7              | 0.90              | 105      | 21.6              | 0.95              |
| Legs                       | 97       | 26.1              | 0.96              | 192      | 51.3              | 0.98              |
| Dorsa of feet              | 6        | 6.5               | 0.83              | 12       | 13.8              | 0.92              |
| Soles                      | 3        | 3.3               | 0.66              | 7        | 6.4               | 0.83              |
| Exposed sites <sup>b</sup> | 957      | —                 | 0.97 <sup>c</sup> | 885      | —                 | 0.97 <sup>c</sup> |
| All sites                  | 958      | —                 | 0.97 <sup>c</sup> | 890      | —                 | 0.96 <sup>c</sup> |

## Distribution of anatomic site by sex among NHW NPCR/SEER 2008-2012

|                                       | Male and Female | Male | Female |
|---------------------------------------|-----------------|------|--------|
| C44.0-Skin of lip, NOS                | 0               | 0.1  | 0      |
| C44.1-Eyelid                          | 0.1             | 0.1  | 0.1    |
| C44.2-External ear                    | 0.7             | 1.4  | 0.2    |
| C44.3-Skin other/unspec parts of face | 2.3             | 3.4  | 1.4    |
| C44.4-Skin of scalp and neck          | 2.0             | 3.4  | 0.8    |
| C44.5-Skin of trunk                   | 8.1             | 11.2 | 5.7    |
| C44.6-Skin of upper limb and shoulder | 6.2             | 7.1  | 5.6    |
| C44.7-Skin of lower limb and hip      | 4.4             | 2.6  | 6.0    |
| C44.8-Overlapping lesion of skin      | 0.0             | 0.0  | 0.0    |
| C44.9-Skin, NOS                       | 1.0             | 1.5  | 0.6    |

Rate per 100,000.

## Estimated PAF using histology NHW by anatomic site NPCR/SEER 2008-2012

|                              | Male | Female | Estimated PAF |
|------------------------------|------|--------|---------------|
| C44.2-External ear           | 1.4  | 0.2    | 85.7%         |
| C44.4-Skin of scalp and neck | 3.4  | 0.8    | 76.5%         |

PAF= (Male Rate – Female Rate) / Male Rate

## Other ways to estimate PAF of UV in melanomas

- ❑ **Richards 2011 article examined county-level UV and melanoma**
  - Mixed results
  - Did not provide risk estimate
  - Individual UV exposure may be more important than area level?
- ❑ **Genotyping studies**
  - Meta-analysis or sample of registries would provide more population-based data
- ❑ **Potential to randomly sample and genotype from a registry?**
  - Unclear value

## Conclusion

- ❑ **Using similar methods to Armstrong & Kricger, PAF of UV in melanoma appears high, little change over time**
  - By race, possibly higher among females
- ❑ **Limitations**
  - Ecologic analysis; area levels of UV do not necessarily correspond with individual exposure
  - Different patterns of UV exposure (sunburns versus chronic, vacations in sunny places)
  - Increases could, in part, be related to increased surveillance by dermatologists
- ❑ **Genotyping is providing confirmation**

**Thank you!**

**Acknowledgement: Gery P. Guy, PhD**

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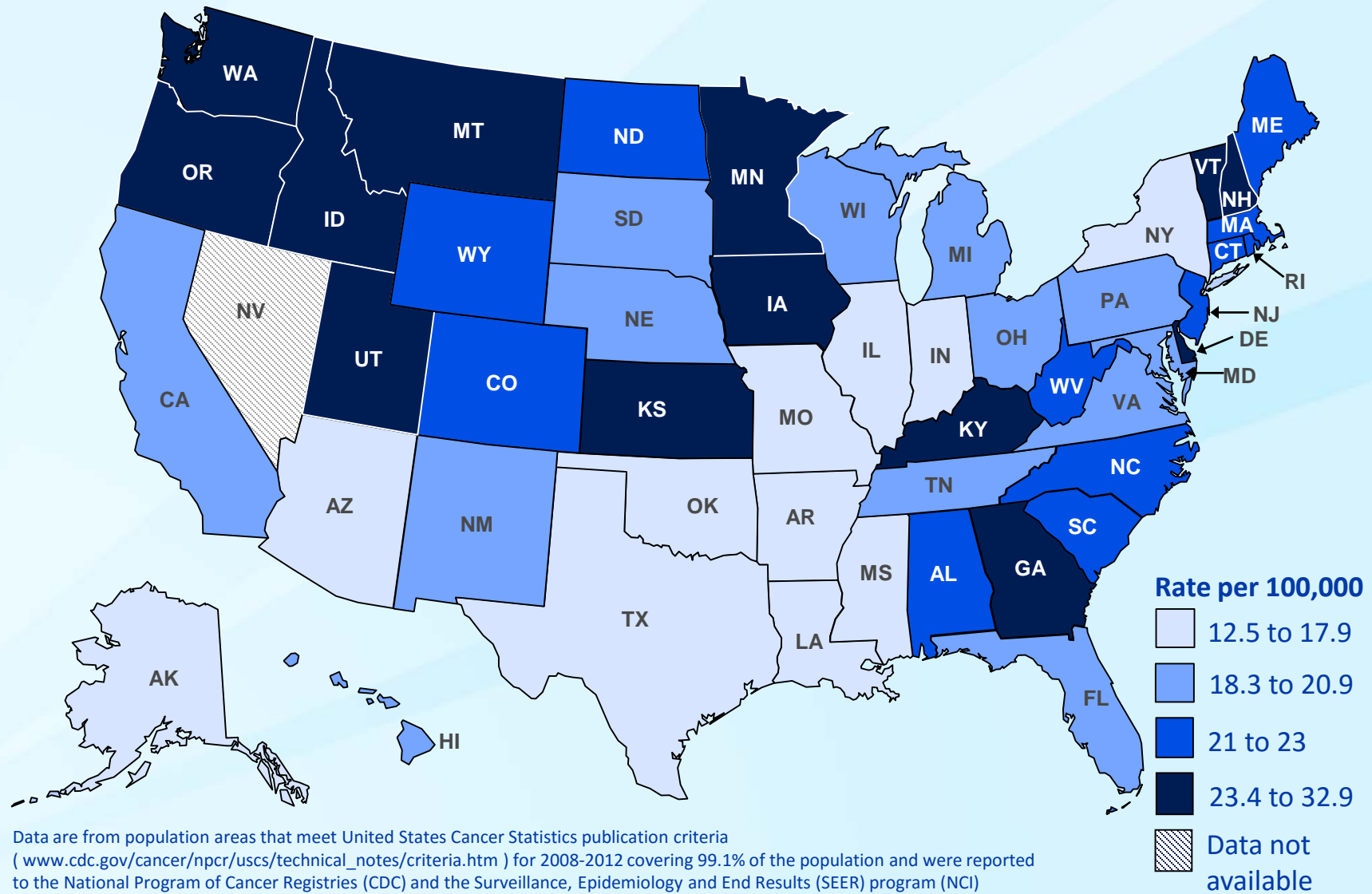
**For more information please contact Centers for Disease Control and Prevention**

1600 Clifton Road NE, Atlanta, GA 30333  
Telephone, 1-800-CDC-INFO (232-4636)/TTY: 1-888-232-6348  
E-mail: [cdcinfo@cdc.gov](mailto:cdcinfo@cdc.gov) Web: [www.cdc.gov](http://www.cdc.gov)

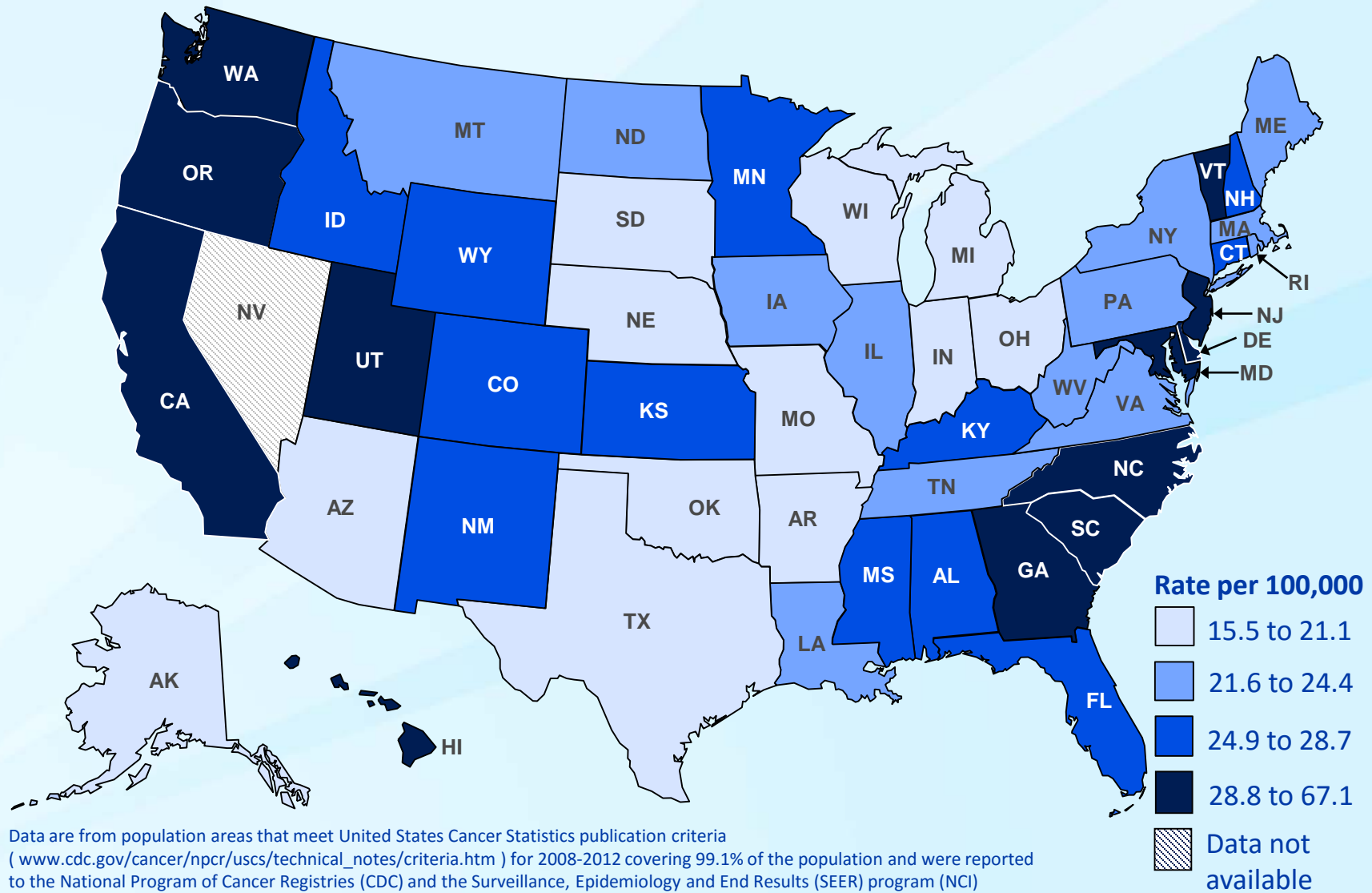
The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.



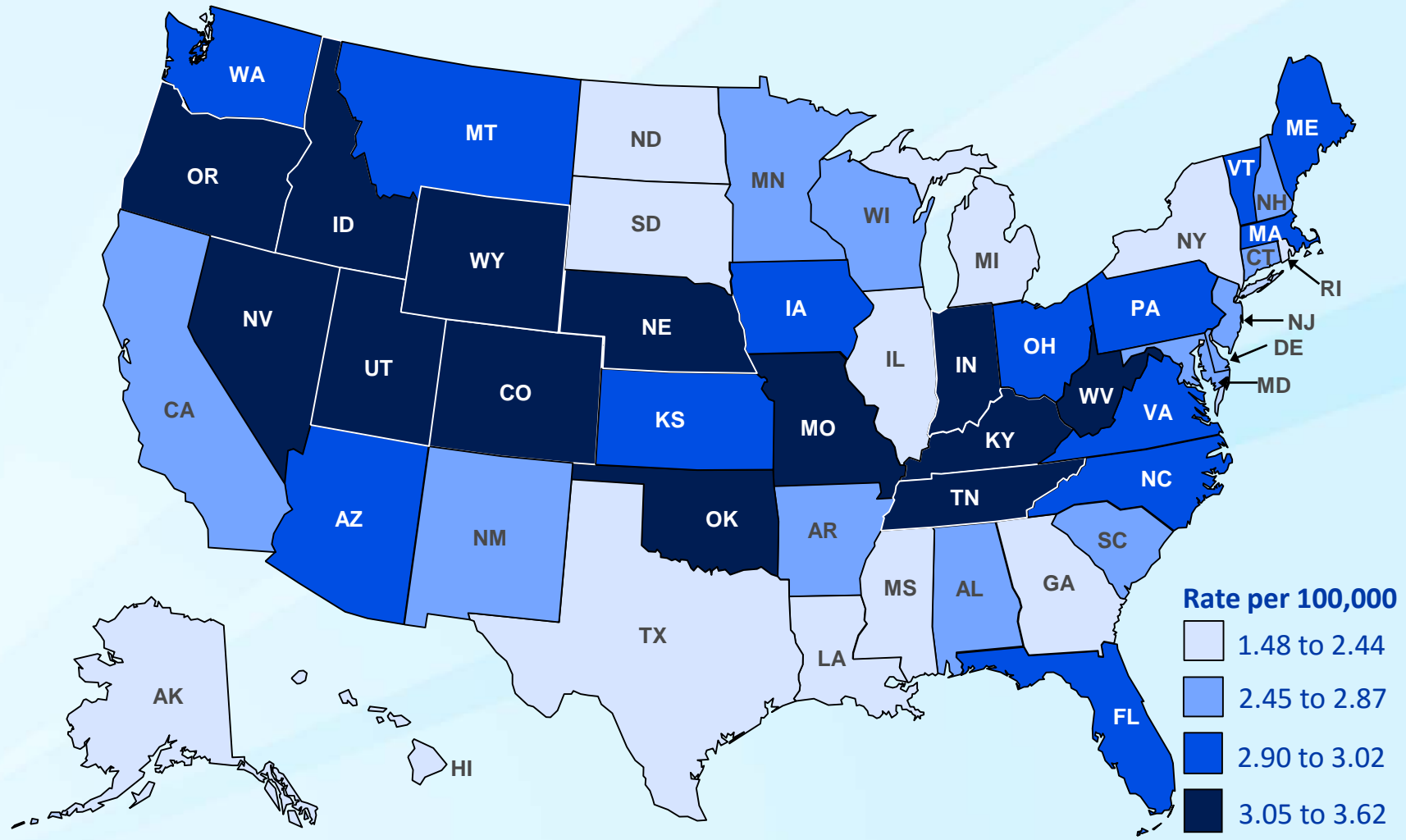
# Melanoma Incidence, United States NPCR/SEER, 2008-2012



# Melanoma Incidence-Non Hispanic Whites NPCR/SEER, 2008-2012

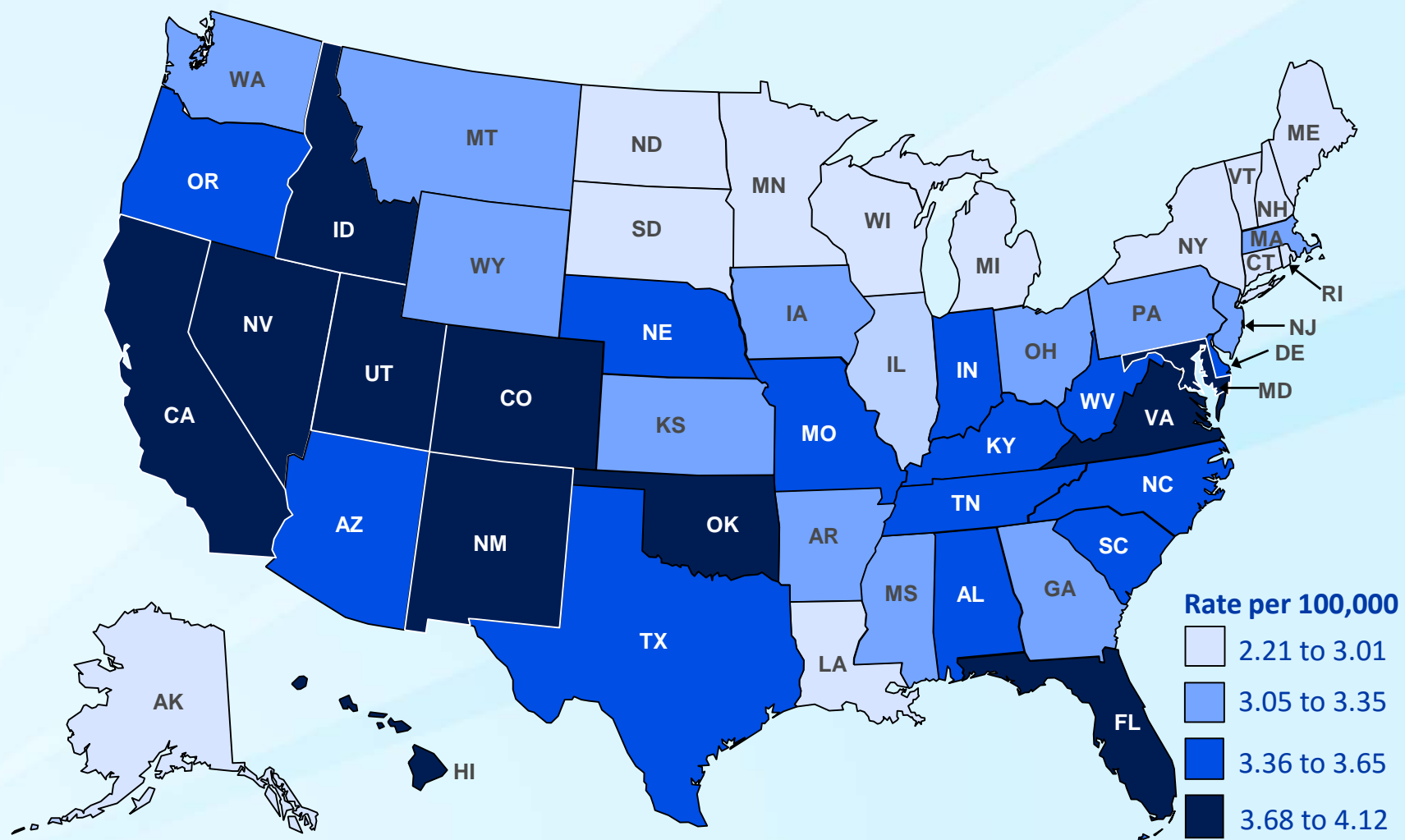


# Melanoma Mortality, United States, 2008-2012



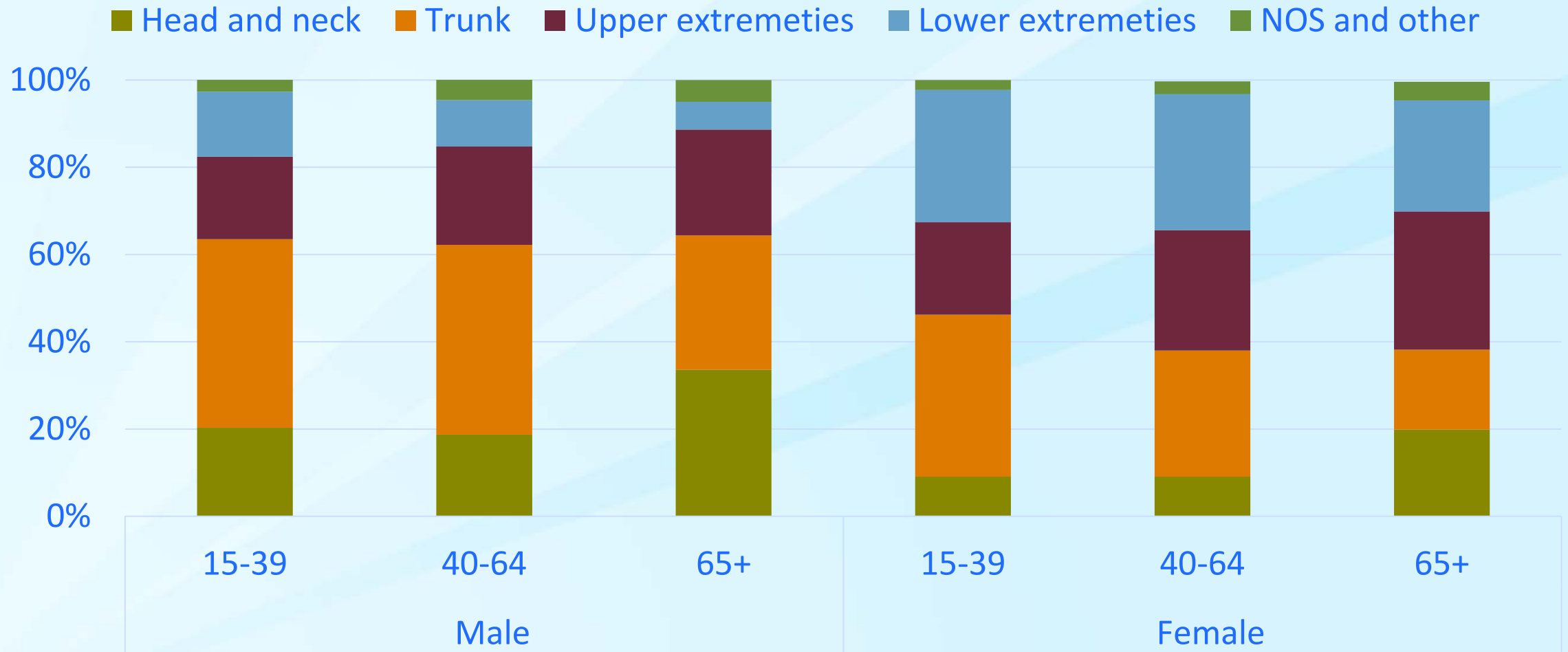
United States Cancer Statistics: 1999 - 2012 Mortality, WONDER Online Database. United States Department of Health and Human Services, Centers for Disease Control and Prevention; 2015. Accessed at <http://wonder.cdc.gov/CancerMort-v2012.html> on Oct 28, 2015.

# Melanoma Mortality-Non Hispanic Whites United States, 2008-2012



United States Cancer Statistics: 1999 - 2012 Mortality, WONDER Online Database. United States Department of Health and Human Services, Centers for Disease Control and Prevention; 2015. Accessed at <http://wonder.cdc.gov/CancerMort-v2012.html> on Oct 28, 2015.

## Distribution of anatomic site by sex among NHW by age NPCR/SEER 2008-2012



# Differences in estimated PAF of UV in melanomas SEER 9

