

# Delay Adjustment

*Huann-Sheng Chen, Rocky Feuer, NCI  
Don Green, Steve Scoppa, Jeff Byrne IMS*

NCI Analytic Tools SEERies

# SEER Cancer Incidence Reporting

- SEER Registries report incidence cases in every November (by November 1<sup>st</sup>).
- Registries report cases approximately 2 years (or more exactly, 22 months) after the end of specific diagnosis year.
  - For example, November 2020 submission first reports cases diagnosed through 2018
- Every April, the NCI releases cancer statistics based on data submitted to the NCI in November of the previous year.
  - November 2020 submission was released in April 2021

# A typical example of reporting data

| Diagnosis Year | Submission Year |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|----------------|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|                | 2005            | 2006  | 2007  | 2008  | 2009  | 2010  | 2011  | 2012  | 2013  | 2014  | 2015  | 2016  | 2017  | 2018  | 2019  | 2020  |
| 2003           | 14824           | 15045 | 15092 | 15116 | 15153 | 15192 | 15191 | 15201 | 15207 | 15211 | 15220 | 15233 | 15233 | 15233 | 15240 | 15241 |
| 2004           |                 | 15246 | 15464 | 15536 | 15568 | 15594 | 15628 | 15645 | 15662 | 15671 | 15680 | 15690 | 15700 | 15702 | 15709 | 15709 |
| 2005           |                 |       | 15682 | 15865 | 15944 | 15967 | 15993 | 16029 | 16038 | 16067 | 16083 | 16106 | 16106 | 16113 | 16119 | 16129 |
| 2006           |                 |       |       | 16140 | 16493 | 16557 | 16594 | 16638 | 16656 | 16670 | 16702 | 16716 | 16733 | 16740 | 16750 | 16767 |
| 2007           |                 |       |       |       | 17112 | 17236 | 17433 | 17479 | 17518 | 17529 | 17557 | 17568 | 17575 | 17581 | 17586 | 17596 |
| 2008           |                 |       |       |       |       | 17048 | 17451 | 17538 | 17589 | 17618 | 17656 | 17673 | 17690 | 17697 | 17707 | 17724 |
| 2009           |                 |       |       |       |       |       | 17083 | 17422 | 17603 | 17638 | 17725 | 17754 | 17763 | 17765 | 17780 | 17787 |
| 2010           |                 |       |       |       |       |       |       | 17262 | 17621 | 17701 | 17885 | 17901 | 17940 | 17996 | 18015 | 18027 |
| 2011           |                 |       |       |       |       |       |       |       | 18076 | 18255 | 18482 | 18522 | 18561 | 18568 | 18583 | 18596 |
| 2012           |                 |       |       |       |       |       |       |       |       | 18137 | 18782 | 18856 | 18908 | 18940 | 18971 | 18990 |
| 2013           |                 |       |       |       |       |       |       |       |       |       | 19440 | 19802 | 19886 | 19923 | 20383 | 20409 |
| 2014           |                 |       |       |       |       |       |       |       |       |       |       | 19882 | 20113 | 20161 | 20600 | 20643 |
| 2015           |                 |       |       |       |       |       |       |       |       |       |       |       | 20673 | 20828 | 21216 | 21278 |
| 2016           |                 |       |       |       |       |       |       |       |       |       |       |       |       | 20294 | 20939 | 21059 |
| 2017           |                 |       |       |       |       |       |       |       |       |       |       |       |       |       | 21149 | 21356 |
| 2018           |                 |       |       |       |       |       |       |       |       |       |       |       |       |       |       | 21251 |

# Reporting delay

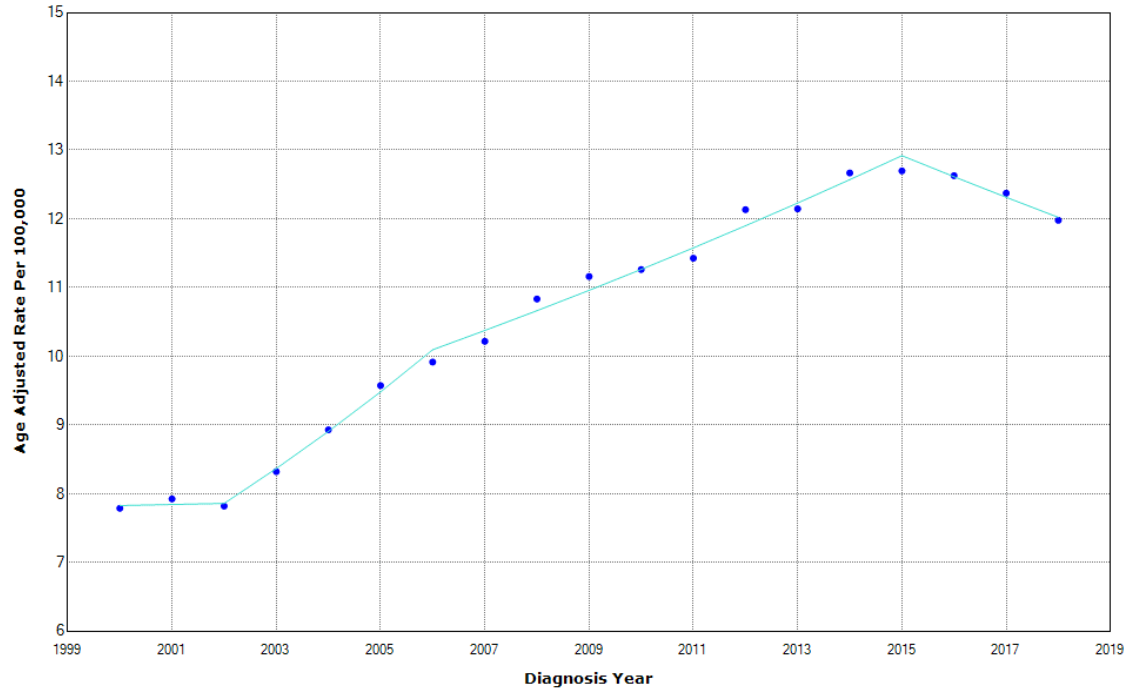
- Cases not reporting in the first submission
- Cases updated data elements for a previously reported case
  - race changed – white to API; Unknown to known
  - primary site
  - age at Dx

# Liver and Intrahepatic Bile Duct

## Recent Trends in SEER 21 Age-Adjusted Incidence Rates, 2000-2018

White (includes Hispanic), Male, All Ages, All Stages

Multiple Joinpoint Models



• Observed SEER Incidence Rate - 3 Joinpoints    2000-2002 APC = 0.19    2002-2006 APC = 6.46\*    2006-2015 APC = 2.78\*    2015-2018 APC = -2.37\*

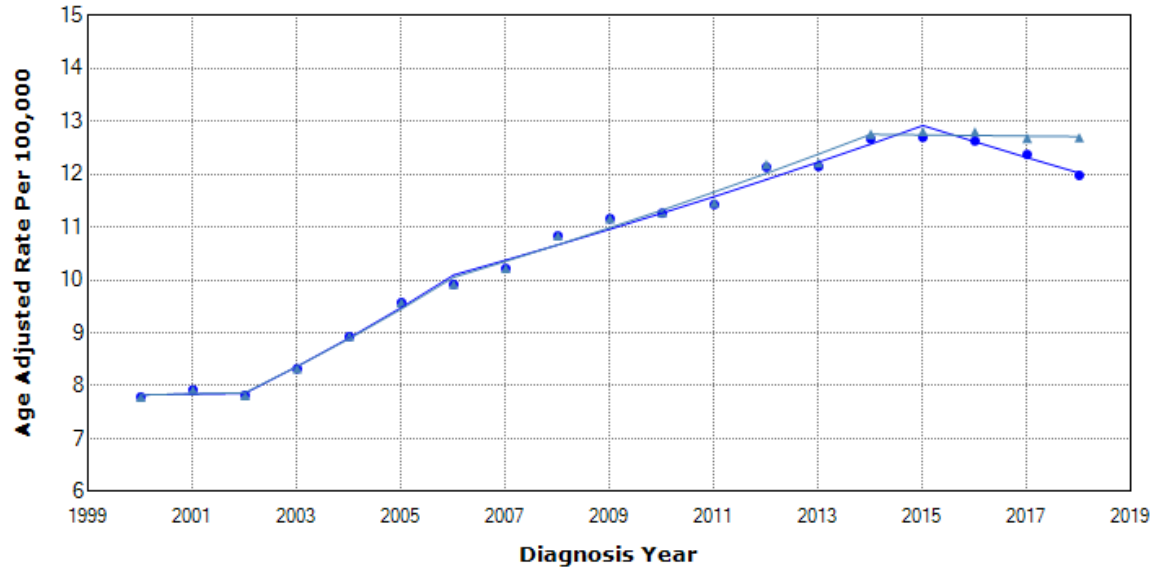
November 2020  
submission

# Liver and Intrahepatic Bile Duct

## Recent Trends in SEER 21 Age-Adjusted Incidence Rates, 2000-2018

White (includes Hispanic), Male, All Ages, All Stages

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November 2020 submission

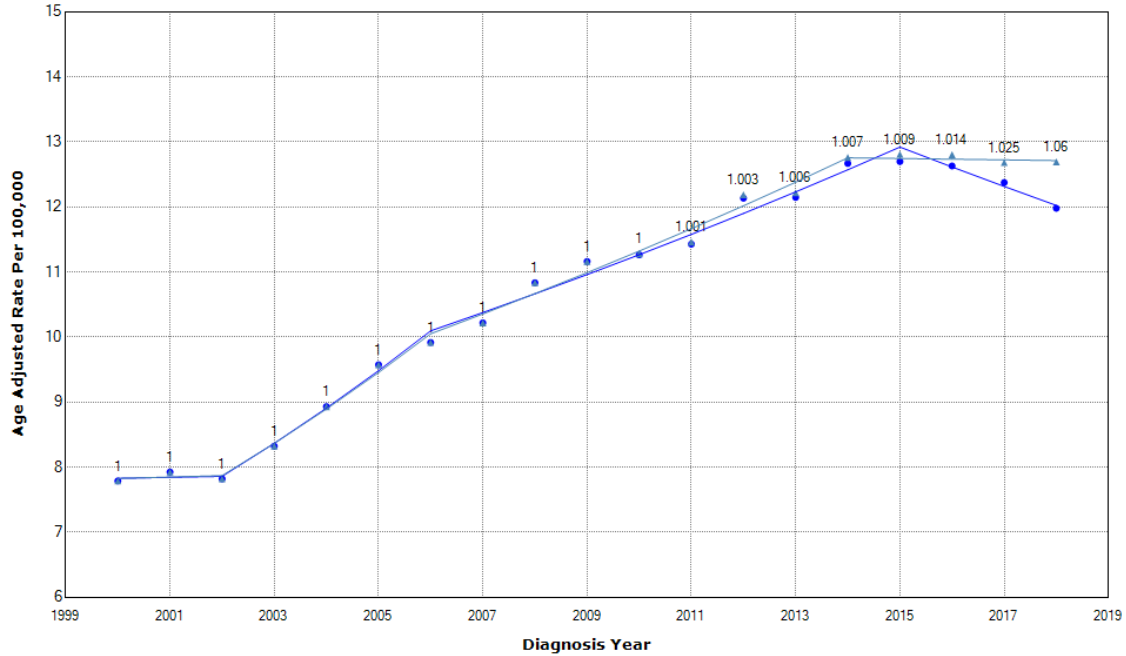
|   |   |
|---|---|
| ● Observed SEER Incidence Rate - 3 Joinpoints | ▲ Delay-adjusted SEER Incidence Rate - 3 Joinpoints |
| — 2000-2002 APC = 0.19                        | — 2000-2002 APC = 0.27                              |
| — 2002-2006 APC = 6.46*                       | — 2002-2006 APC = 6.30*                             |
| — 2006-2015 APC = 2.78*                       | — 2006-2014 APC = 3.02*                             |
| — 2015-2018 APC = -2.37*                      | — 2014-2018 APC = -0.08                             |

# Liver and Intrahepatic Bile Duct

## Recent Trends in SEER 21 Age-Adjusted Incidence Rates, 2000-2018

### White (includes Hispanic), Male, All Ages, All Stages

Multiple Joinpoint Models



- Observed SEER Incidence Rate - 3 Joinpoints
- 2000-2002 APC = 0.19
- 2002-2006 APC = 6.46\*
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- 2015-2018 APC = -2.37\*
- ▲ Delay-adjusted SEER Incidence Rate - 3 Joinpoints
- 2000-2002 APC = 0.27
- 2002-2006 APC = 6.30\*
- 2006-2014 APC = 3.02\*
- 2014-2018 APC = -0.08

November 2020 submission

**Delay Adjustment Factors**  
 2018: 1.06  
 2017: 1.025  
 2016: 1.014  
 2015: 1.009  
 2014: 1.007  
 2013: 1.006  
 2012: 1.003  
 2011 and before: ≤ 1.001  
 2000-2009: 1:000 by assumption

# Reporting Delay (in years)

| Diagnosis Year | Submission Year |      |      |      |      |      |      |      |      |      |      |
|----------------|-----------------|------|------|------|------|------|------|------|------|------|------|
|                | 2010            | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
| 2008           | 2               | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   |
| 2009           |                 | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   |
| 2010           |                 |      | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   |
| 2011           |                 |      |      | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    |
| 2012           |                 |      |      |      | 2    | 3    | 4    | 5    | 6    | 7    | 8    |
| 2013           |                 |      |      |      |      | 2    | 3    | 4    | 5    | 6    | 7    |
| 2014           |                 |      |      |      |      |      | 2    | 3    | 4    | 5    | 6    |
| 2015           |                 |      |      |      |      |      |      | 2    | 3    | 4    | 5    |
| 2016           |                 |      |      |      |      |      |      |      | 2    | 3    | 4    |
| 2017           |                 |      |      |      |      |      |      |      |      | 2    | 3    |
| 2018           |                 |      |      |      |      |      |      |      |      |      | 2    |



# Reporting Delay (in years)

|                | Submission Year |      |      |      |      |      |      |      |      |      |      |
|----------------|-----------------|------|------|------|------|------|------|------|------|------|------|
| Diagnosis Year | 2010            | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
| 2008           | 2               | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   |
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| 2010           |                 |      | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   |
| 2011           |                 |      |      | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    |
| 2012           |                 |      |      |      | 2    | 3    | 4    | 5    | 6    | 7    | 8    |
| 2013           |                 |      |      |      |      | 2    | 3    | 4    | 5    | 6    | 7    |
| 2014           |                 |      |      |      |      |      | 2    | 3    | 4    | 5    | 6    |
| 2015           |                 |      |      |      |      |      |      | 2    | 3    | 4    | 5    |
| 2016           |                 |      |      |      |      |      |      |      | 2    | 3    | 4    |
| 2017           |                 |      |      |      |      |      |      |      |      | 2    | 3    |
| 2018           |                 |      |      |      |      |      |      |      |      |      | 2    |

# Purpose of Delay Modeling: Use the Data in Green to Project the Future

|                | Submission Year |      |      |      |      |      |      |      |      |      |      |    |    |    |    |    |    |    |    |    |    |  |
|----------------|-----------------|------|------|------|------|------|------|------|------|------|------|----|----|----|----|----|----|----|----|----|----|--|
| Diagnosis Year | 2010            | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |    |    |    |    |    |    |    |    |    |    |  |
| 2008           | 2               | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   |    |    |    |    |    |    |    |    |    |    |  |
| 2009           |                 | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12 |    |    |    |    |    |    |    |    |    |  |
| 2010           |                 |      | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11 | 12 |    |    |    |    |    |    |    |    |  |
| 2011           |                 |      |      | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10 | 11 | 12 |    |    |    |    |    |    |    |  |
| 2012           |                 |      |      |      | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9  | 10 | 11 | 12 |    |    |    |    |    |    |  |
| 2013           |                 |      |      |      |      | 2    | 3    | 4    | 5    | 6    | 7    | 8  | 9  | 10 | 11 | 12 |    |    |    |    |    |  |
| 2014           |                 |      |      |      |      |      | 2    | 3    | 4    | 5    | 6    | 7  | 8  | 9  | 10 | 11 | 12 |    |    |    |    |  |
| 2015           |                 |      |      |      |      |      |      | 2    | 3    | 4    | 5    | 6  | 7  | 8  | 9  | 10 | 11 | 12 |    |    |    |  |
| 2016           |                 |      |      |      |      |      |      |      | 2    | 3    | 4    | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 |    |    |  |
| 2017           |                 |      |      |      |      |      |      |      |      | 2    | 3    | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 |    |  |
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|                | Submission Year |      |      |      |      |      |      |      |      |      |      |    |    |    |    |    |    |    |    |    |    |  |
|----------------|-----------------|------|------|------|------|------|------|------|------|------|------|----|----|----|----|----|----|----|----|----|----|--|
| Diagnosis Year | 2010            | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |    |    |    |    |    |    |    |    |    |    |  |
| 2008           | 2               | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   |    |    |    |    |    |    |    |    |    |    |  |
| 2009           |                 | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12 |    |    |    |    |    |    |    |    |    |  |
| 2010           |                 |      | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11 | 12 |    |    |    |    |    |    |    |    |  |
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| 2015           |                 |      |      |      |      |      |      | 2    | 3    | 4    | 5    | 6  | 7  | 8  | 9  | 10 | 11 | 12 |    |    |    |  |
| 2016           |                 |      |      |      |      |      |      |      | 2    | 3    | 4    | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 |    |    |  |
| 2017           |                 |      |      |      |      |      |      |      |      | 2    | 3    | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 |    |  |
| 2018           |                 |      |      |      |      |      |      |      |      |      | 2    | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 |  |

# A typical example of reporting data – Data used in modeling

| Diagnosis Year | Submission Year |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|----------------|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|                | 2005            | 2006  | 2007  | 2008  | 2009  | 2010  | 2011  | 2012  | 2013  | 2014  | 2015  | 2016  | 2017  | 2018  | 2019  | 2020  |
| 2003           | 14824           | 15045 | 15092 | 15116 | 15153 | 15192 | 15191 | 15201 | 15207 | 15211 | 15220 | 15233 | 15233 | 15233 | 15240 | 15241 |
| 2004           |                 | 15246 | 15464 | 15536 | 15568 | 15594 | 15628 | 15645 | 15662 | 15671 | 15680 | 15690 | 15700 | 15702 | 15709 | 15709 |
| 2005           |                 |       | 15682 | 15865 | 15944 | 15967 | 15993 | 16029 | 16038 | 16067 | 16083 | 16106 | 16106 | 16113 | 16119 | 16129 |
| 2006           |                 |       |       | 16140 | 16493 | 16557 | 16594 | 16638 | 16656 | 16670 | 16702 | 16716 | 16733 | 16740 | 16750 | 16767 |
| 2007           |                 |       |       |       | 17112 | 17236 | 17433 | 17479 | 17518 | 17529 | 17557 | 17568 | 17575 | 17581 | 17586 | 17596 |
| 2008           |                 |       |       |       |       | 17048 | 17451 | 17538 | 17589 | 17618 | 17656 | 17673 | 17690 | 17697 | 17707 | 17724 |
| 2009           |                 |       |       |       |       |       | 17083 | 17422 | 17603 | 17638 | 17725 | 17754 | 17763 | 17765 | 17780 | 17787 |
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| 2011           |                 |       |       |       |       |       |       |       | 18076 | 18255 | 18482 | 18522 | 18561 | 18568 | 18583 | 18596 |
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| 2013           |                 |       |       |       |       |       |       |       |       |       | 19440 | 19802 | 19886 | 19923 | 20383 | 20409 |
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| 2016           |                 |       |       |       |       |       |       |       |       |       |       |       |       | 20294 | 20939 | 21059 |
| 2017           |                 |       |       |       |       |       |       |       |       |       |       |       |       |       | 21149 | 21356 |
| 2018           |                 |       |       |       |       |       |       |       |       |       |       |       |       |       |       | 21251 |

# Registries Organization

- SEER: The Surveillance, Epidemiology, and End Results (SEER) Program of NCI
- NPCR: CDC's National Program of Cancer Registries
- Canadian Cancer Registry (CCR)
- NAACCR: The North American Association of Central Cancer Registries, a collaborative umbrella organization for cancer registries in the United States and Canada.

# The NAACCR-based factors

- Stratified by:
  - Cancer Site
  - Registry
  
- Modeled as a function of the following variables (if they are statistically significant):
  - Age Group (<50, 50-64, 65+)
  - Race: Whites, Blacks, API, AI/AN
  - Ethnicity: Hispanics, Non-Hispanics
  - Year of Diagnosis

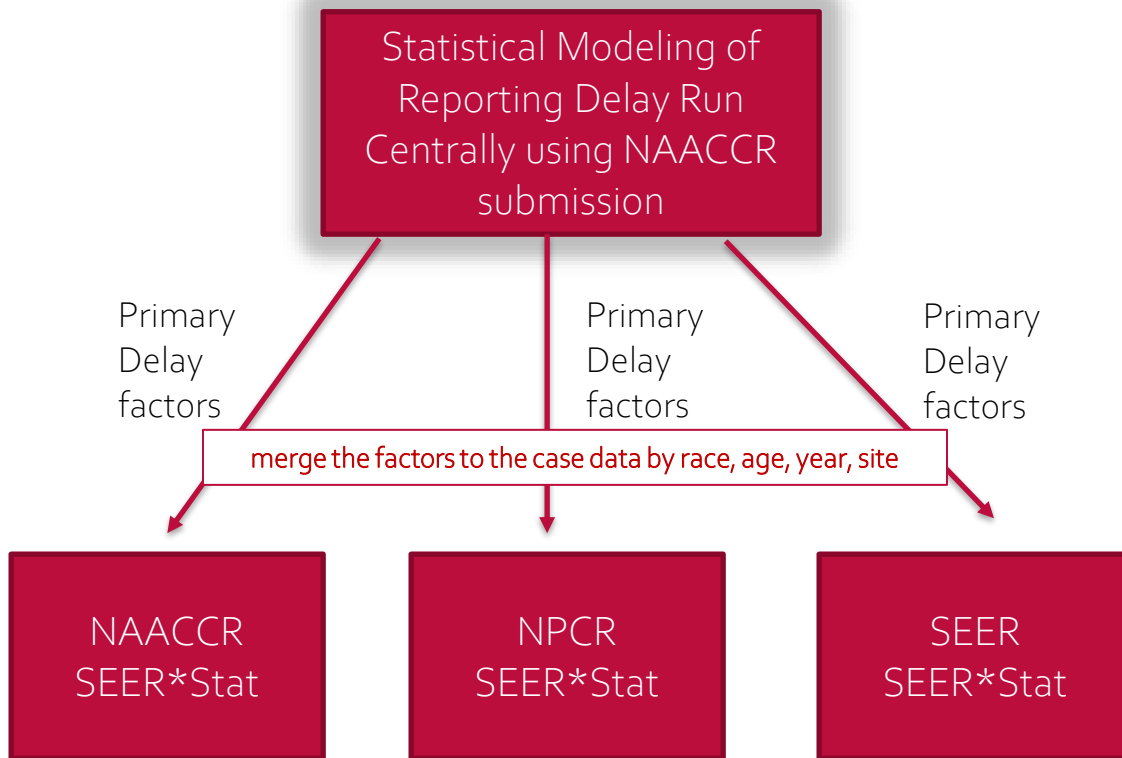
# Delay Adjustment Factors

- For each tumor, using NAACCR December submission to produce primary delay factors for each combination:

|               | All races | Race-specific (White, Black, API, AI/AN-CHSDA) | Ethnicity (Hispanic, Non-Hispanic) | Race x Ethnicity (White NH, White H, Black NH, Black H) |
|---------------|-----------|--|------------------------------------|---|
| All sites     | X         | X  | x                                  | x   |
| Site-specific | X         | X  | x                                  | x   |

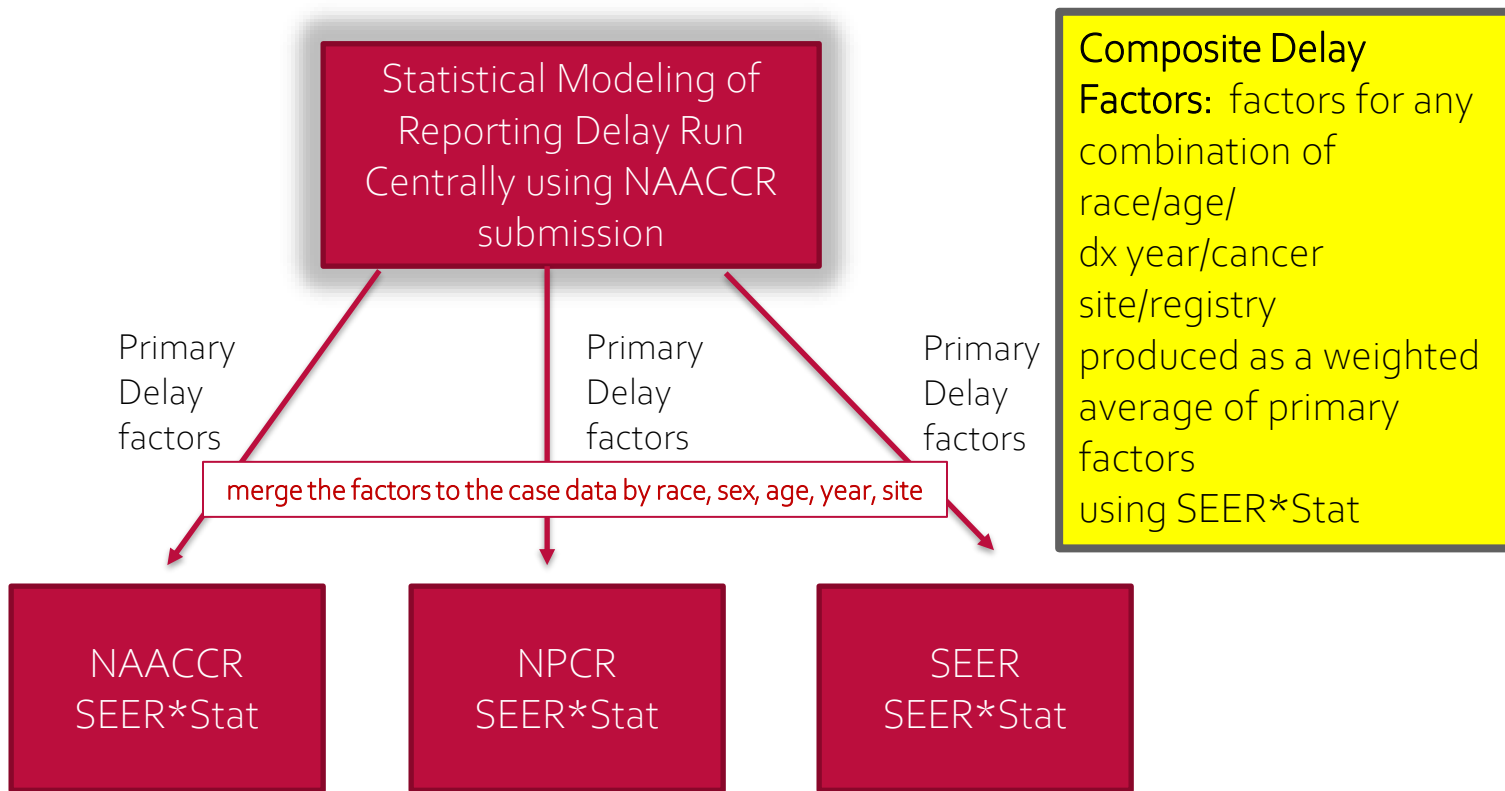
- Cancer Site
  - Since not every cancer site is covered, we cannot have SEER\*Stat weight individual sites specific factors to produce delay adjusted rates for All Sites. We need a separate All Sites factor
  - If cancer site is changed, it will change site-specific delay, but not all site delay
- Race and Ethnicity
  - Separate all race and race specific factors are needed to account for the fact that some cases first come into the registry without a race designation, and assigned a race in later submissions
  - Race specific factor for Whites, Blacks, API, AIAN (factor differs from all races but modeled as equal for W, B, API because of instability)

# Create SEER\*Stat data sets for SEER, NAACCR, and NPCR





# Create SEER\*Stat data sets for SEER, NAACCR, and NPCR



# Delay Adjustment Factors

- Data base are released with the *SEER Research and SEER Research Plus* data.
  - SEER Research Plus can stratify by geographic identifier (registry, county) and can get delay adjustment of any combination of geographies.
  - SEER Research does not have geographic identifiers , and they are different databases for SEER9, SEER13, SEER18 and SEER21

# Delay Adjustment Factors by Stage

- Delay adjustment factors by stage for
  - prostate
  - female breast cancer
- Stage Data base are released only with *SEER Research Plus* data.

# SEER\*Stat Warnings

- Warning when try to derive delay factors other than considered in the modeling
  - For example,
    - stage for other than prostate and breast cancer
    - cancer subtypes – triple negative (ER, PR, HER2) breast cancer
  - Sex is not in the model, but we determined that delay factors do not differ by sex, so you don't get a warning



**NATIONAL  
CANCER  
INSTITUTE**

[www.cancer.gov](http://www.cancer.gov)

[www.cancer.gov/espanol](http://www.cancer.gov/espanol)