<table>
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<th>Step</th>
<th>Example 1</th>
<th>Example 2</th>
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<td>1.</td>
<td>Using NHANES III data, we divided body mass index (BMI: kg/m²) into k meaningful ordered non-overlapping categories. We used the following categories: &lt; 17; integer-defined categories from 17 until 45, and &gt; 45.</td>
<td>40 year old white male with a BMI of 35 kg/m² (i=20, j=40)</td>
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<td>2.</td>
<td>Using the NHANES-III data and a non-parametric sliding-window smoothing procedure (described in the text), we estimated the values ( \hat{\pi}_{i,j} ) which represents the estimated probability of being in the ( i^{th} ) BMI category at the ( j^{th} ) age for ( i = 1 ) to ( k ) and for ( j = 18 ) to 85.</td>
<td>( \hat{\pi}_{i,j} = 0.01283 )</td>
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<td>3.</td>
<td>Also using the NHANES-III data, we estimated the mean BMI within each BMI category. Denote the estimates, ( \hat{\mu}_i ).</td>
<td>( \hat{\mu}_j = -100/35.40 = -2.82461 )</td>
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| 4.   | Using the combined NHANES-I and NHANES-II follow-up data, we ran a Cox regression with mortality as the outcome. As covariates, we used BMI, BMI², age, age², and their interaction terms. Using the resulting equation, we calculated the estimated hazard ratios for each BMI category at each integer-defined age interval by substituting the \( \hat{\mu}_j \) for BMI in the equation and the midpoint of the age interval (e.g., 18.5 for 18 to 19 year olds) for age in the equation. We denoted the estimated hazard ratio for the \( i^{th} \) BMI category at the \( j^{th} \) age by \( \hat{\lambda}_{i,j} \). | \( \hat{\lambda}_{i,j} = \exp(-0.01394*Age -0.000005*Age^2 +4.803759*BMI +0.5798*BMI^2 -0.05418*BMI*Age -0.00652*BMI^2*Age) 
= \exp(-0.01394*40.5 -0.000005*40.5^2 +4.803759*(-2.82461) +0.5798*(-2.82461)^2 -0.05418*(-2.82461)*40.5 -0.00652*(-2.82461)^2*40.5) 
=0.00441 \) | \( \hat{\lambda}_{i,j} = \exp(-0.07699*Age +0.000474*Age^2 +4.082842*BMI +0.471665*BMI^2 -0.04584*BMI*Age -0.00486*BMI^2*Age) 
= \exp(-0.07699*25.5 +0.000474*25.5^2 +4.082842*(-2.47326) +0.471665*(-2.47326)^2 -0.04584*(-2.47326)*25.5 -0.00486*(-2.47326)^2*25.5) 
=0.00119 \) |
| 5.   | For each integer defined age interval, we obtained an estimate of the total probability of death within the interval conditional upon having lived to the start of that interval. We obtained these values from life table for the total population of the United States in 1999 published by the CDC, and denoted them \( \hat{\gamma}_j \) for the \( j^{th} \) age interval. For example, \( \hat{\gamma}_{18} \) is the estimated probability of dying before age 19. | \( \hat{\gamma}_j = 0.00233 \) | \( \hat{\gamma}_j = 0.00090 \) |
given that one has survived until age 18.

6. For each integer defined age interval, we obtained an estimate of the probability of death within the interval conditional upon having lived to the start of that interval and being in the first BMI category as

\[
\hat{\gamma}_{1,j} = \frac{\hat{\gamma}_{1,j} \hat{\lambda}_{1,j}}{\sum_{i=1}^{k} \left( \pi_{i,j} \hat{\gamma}_{i,j} \right)}.
\]

\[
= (0.00233 \times 0.00882) / 0.00319 = 0.00645
\]

7. For each integer defined age interval, we obtained an estimate of the probability of death within the interval conditional upon having lived to the start of that interval and being in the \( i \)th BMI category as

\[
\hat{\gamma}_{i,j} = \hat{\gamma}_{i,j} \left( \frac{\hat{\lambda}_{i,j}}{\hat{\lambda}_{1,j}} \right).
\]

\[
= 0.00645 \times \frac{0.00441}{0.00882} = 0.00323
\]

8. For a person of age \( s \) in the \( i \)th BMI category, we estimated their expected age of death (defined as the median age of death for a person with their starting age and BMI) as

\[
\hat{\mu}_{i,s} = 77
\]

\[
\hat{\mu}_{i,s} = 79
\]

9. The years of life lost for a person of age \( s \) in the \( i \)th BMI category relative to being \( g \)th category can then be denoted

\[
\hat{\delta}_{i-g,s} = \hat{\nu}_{g,s} - \hat{\nu}_{i,s}.
\]

\[
80-77 = 3 \text{ YLL} \quad \text{(referent BMI of 24)}
\]

\[
80-79 = 1 \text{ YLL} \quad \text{(referent BMI of 24)}
\]