Video 14 of 21: Weighting Adjustments for unknown eligibility

Sampling
Adjustments for unknown eligibility (I)

- Unknown eligibility is driven by the inability to initiate the contact with the sample element:
  - Ring/no-answers in a phone survey
  - Undeliverable addresses in a mail survey
  - Never at home in personal visit survey
- Weight adjustments for unknown eligibility and nonresponse are usually made to allow the respondents to weight up to the full eligible population
- If the ineligible cases can be excluded from the frame before the sampling stage, no need for this step
General steps used in weighting: Adjustments for unknown eligibility

1. **Frame**
   - Frame \( N \)

2. **Sample**
   - Sample \( n \)

3. **Known Eligibility**
   - Eligible \( s_E \)
   - Not Eligible \( s_{EN} \)

4. **Unknown Eligibility**
   - Compensate for unknown eligibility by distributing base weights of unknowns over known eligibility

5. **Compensation for nonresponse problem**
   - Elig resp \( s_{ER} \)
   - Elig nonresp \( s_{ENR} \)

Compensation for unequal selection probabilities:

- Compensate for unequal selection probabilities
Adjustments for unknown eligibility (II)

- Single class adjustment:
  - We can simply distribute the total sample weight of the unknown eligibility set $s_{UKN}$ among those whose eligibility status is known $s_{KN}$
  - The unknown eligibility adjusted household weight, $d_{i1}$, is computed as:

\[
d_{1i} = d_{0i} \times a_{1i}
\]

where $a_{1i}$ is the unknown eligibility adjustment factor computed as:

\[
a_{1i} = \begin{cases} 
\frac{\sum_s d_{0i}}{\sum_{s_{KN}} d_{0i}}, & i \in s_{KN} \\
0, & i \in s_{UKN}
\end{cases}
\]
Adjustments for unknown eligibility (III)
Single class adjustment example

<table>
<thead>
<tr>
<th>Final Disposition</th>
<th>$\sum d_{0i}$</th>
<th>$a_{1i}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eligible respondents</td>
<td>33,256,181</td>
<td>1.4517</td>
</tr>
<tr>
<td>Eligible non-respondents</td>
<td>20,601,509</td>
<td>1.4517</td>
</tr>
<tr>
<td>Ineligible</td>
<td>28,801,071</td>
<td>1.4517</td>
</tr>
<tr>
<td>Unknown eligibility</td>
<td>37,335,106</td>
<td>0</td>
</tr>
</tbody>
</table>

$$a_{1i} = \begin{cases} 
\frac{\sum_s d_{0i}}{\sum_{s_{KN}} d_{0i}}, & i \in s_{KN} \\
0, & i \in s_{UKN} 
\end{cases}$$
Adjustments for unknown eligibility (IV)

- Class-based adjustment:
- Use frame information known for all cases to form B classes
- Let $s_b$ be the set of sample units in class $b$, regardless of eligibility or response status, and $s_{b,KN} = s_b \cap s_{KN}$ be the set with known eligibility in class $b$
- The unknown eligibility adjustment for sample units in class $b$ is:

$$a_{1bi} = \begin{cases} 
\frac{\sum_{i \in s_b} d_{0i}}{\sum_{i \in s_{b,KN}} d_{0i}}, & i \in s_{b,KN} \\
0, & i \in s_{b,UKN}
\end{cases}$$
### Adjustments for unknown eligibility (V)
#### Class-based adjustment example

<table>
<thead>
<tr>
<th>Region</th>
<th>Eligible respondents</th>
<th>Eligible non-respondents</th>
<th>Ineligible</th>
<th>Unknown eligibility</th>
<th>Total</th>
<th>(a_{1b})</th>
</tr>
</thead>
<tbody>
<tr>
<td>West</td>
<td>6,822,109</td>
<td>4,320,669</td>
<td>5,116,581</td>
<td>8,755,039</td>
<td>25,014,398</td>
<td>1.5385</td>
</tr>
<tr>
<td>Midwest</td>
<td>9,579,554</td>
<td>4,461,710</td>
<td>6,955,018</td>
<td>7,086,245</td>
<td>28,082,527</td>
<td>1.3375</td>
</tr>
<tr>
<td>Northeast</td>
<td>6,383,883</td>
<td>4,103,925</td>
<td>7,361,008</td>
<td>7,165,583</td>
<td>25,014,398</td>
<td>1.4015</td>
</tr>
<tr>
<td>South</td>
<td>10,470,636</td>
<td>7,715,205</td>
<td>9,368,464</td>
<td>14,328,238</td>
<td>41,882,543</td>
<td>1.5200</td>
</tr>
</tbody>
</table>

For the West region, \(d_{0i} = 113,701.81 \rightarrow d_{1i} = d_{0i} \times a_{1i} = 113,701.81 \times 1.5385 = 174,930.2\)