CRF and CMF

\[
CRF = \frac{C_{t,wo} - E(C_{t,wo})}{E(C_{t,wo})} \times 100
\]

\[
CMF = \frac{C_{t,wo}}{E(C_{t,wo})}
\]

\[
CMF = 1 - (CRF / 100)
\]

Counterfactual

It is the crashes that would occur if the treatment site did not go through an improvement

\[
E(C_{t,wo})
\]

Example

An intersection improvement involved both adding a left turn lane and the provision of an exclusive left turn phase. Currently, there are 6 fatal or injury crashes per year and assume \( E(C_{t,wo}) = 6 \). What reductions in fatal and injury crashes can be expected due to the improvement? Assume a CRF of 53.

\[
CRF = 53
\]

\[
CMF = 0.47
\]

\[
C_{t,wo} = 6 \times 0.47 = 2.82
\]

\[
\approx 3
\]

Reduction: 3

Safety impact evaluation

- Crash reduction factor approach

Before and after studies

\[
E(C_{t,wo}) = C_{t,wo} \times C_{traffic}
\]

\[
C_{traffic} = \frac{V_{t,after}}{V_{t,before}}
\]

Before and after studies

At a certain site, 1.58 crashes per intersection per year were reported before a bicycle-lane project. This number reduced to 1.29 after installation of bike lanes. The traffic volume changed from 1,300 before the improvement to 1,200 after the improvement. Calculate the CRF. Assume all other factors remain the same.

\[
C_{traffic} = \frac{1.29}{1.34} = 0.96
\]

\[
E(C_{t,wo}) = 1.58 \times 0.96 = 1.508
\]

\[
CRF = \frac{1.508 - 1.29}{1.29} \times 100 \approx 8.7
\]
Cross-sectional studies

\[ E(C_{t,wo}) = C_{c,after} \times C_{traffic} \]

\[ C_{traffic} = \frac{V_{t,after}}{V_{c,after}} \]

At a certain site, 1.29 crashes per intersection per year were reported after installation of bike lane on a corridor. On a similar corridor where bike lane was not installed, 1.34 crashes per intersection per year was reported. The traffic volume of the two sites were 1,100 for the treatment site vs. 1,000 for the comparison site. Calculate the CFR. Assume all other factors remain the same.

\[ CFR = \left( \frac{1.29 - 1.34}{1.41} \right) \times 100 \approx -1.97 \]

\[ E(C_{wo}) = C_{wo} \times C_{traffic} \times C_{trend} \]

\[ C_{trend} = \frac{C_{c,after}}{C_{c,before}} \]

Before and after and Cross-sectional study

<table>
<thead>
<tr>
<th>Group</th>
<th>Crashes per intersection per year (before)</th>
<th>Crashes per intersection per year (after)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment</td>
<td>1.58</td>
<td>1.29</td>
</tr>
<tr>
<td>comparison</td>
<td>1.62</td>
<td>1.34</td>
</tr>
</tbody>
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</tbody>
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\[ \bar{E}(C_{t,wo}) = 1.58 \times 1.10 \times 0.82 = 1.32 \]

\[ CFR = \left( \frac{1.32 - 1.58}{1.32} \right) \times 100 \approx -2.27 \]

\[ C_{traffic} = \left( \frac{V_{t,after}}{V_{t,before}} \right)^{0.7} \]

\[ C_{trend} = \frac{C_{c,after}}{C_{c,before}} \]