**Appendix S1A**

The decomposition formula by Arriaga [14] is

$$\_{x}=\frac{l\_{x}^{1}}{l\_{o}^{1}}∙\left(\frac{\_{x}^{2}}{l\_{x}^{2}}-\frac{\_{x}^{1}}{l\_{x}^{1}}\right)+\frac{T\_{x+n}^{2}}{l\_{0}^{1}}∙\left(\frac{l\_{x}^{1}}{l\_{x}^{2}}-\frac{l\_{x+n}^{1}}{l\_{x+n}^{2}}\right)$$

where $\_{x}$ gives the contribution of the all-cause mortality difference in age group x to x+n to differences in life expectancy at birth between two populations in years. The method is based on conventional life table functions $l\_{x}$, $T\_{x}$ , and $\_{x}^{}$.

**Appendix S1B**

The formula for the extension is

$$=\_{x}∙\frac{\_{x}^{i}\left(2\right)∙\_{x}^{}\left(2\right)-\_{x}^{i}\left(1\right)∙\_{x}^{}\left(1\right)}{\_{x}^{}\left(2\right)-\_{x}^{}\left(1\right)}$$

Where $$ gives the number of years that a cause of death $i$ is contributing to differences in life expectancy between two populations. Here $$ is the mortality rate between ages $x$ and $x+n$ and $\_{x}^{i}\left(j\right)$ is the proportion of deaths from cause $i$ in age group x to x+n in population $j$. As shown in equation 1, $\_{x}$ is the all-cause mortality difference in age group x to x+n.