

# Disability-Adjusted Life Year conversion

## CASE STUDY #4: CORONARY HEART DISEASE CASES TO DALYS

**Siyu Ma, PhD, Daniel Ollendorf, PhD**

### **AIM**

The objective of this study is to convert disease-specific health outcomes (i.e., coronary heart disease [CHD] cases) reported in economic evaluations to disability-adjusted life years (DALYs), a standardized health outcome measure that captures both longevity and morbidity. We estimated DALYs attributable to CHD cases among a population-based sample in Argentina consisting of individuals older than 34 years according to the results of an analysis conducted by Rubinstein and colleagues [1]. Since this paper reported both CHD cases and DALYs averted, it was a suitable candidate for a case study to illustrate the conversion process and calibrate the DALY estimation from our online calculator.

### **METHODS**

#### PARAMETERS

We extracted relevant information from Rubinstein et al.'s 2015 paper "Eliminating artificial trans fatty acids in Argentina: estimated effects on the burden of coronary heart disease and costs" [1]. The target population included all individuals age >34 years in Argentina. Outcomes of the study were reported in DALYs averted as well as the number of CHD cases averted before and after the implementation of policies to reduce trans fatty acids (TFA) in foods. The policies were projected to change CHD risks in three ways: scenario 1, through an improved dietary fat profile; scenario 2, through changes in other lipid and inflammatory biomarkers; and scenario 3, through substitution for carbohydrate intake. We aimed to use the number of CHD cases and deaths to recreate DALYs and compare the estimated DALYs from our calculator to the reported estimates. Life expectancy at age of premature death was derived from the Global Burden of Disease Study (GBD) 2016, [2] and years lived with disease was calculated as the sum of the age at disease onset and the duration of disease. Age of onset was not reported in the paper, and we therefore sourced this information externally. The disability weight and duration of disease was extracted from GBD 2016 [2]. A full list of parameters can be found in Table 1.

#### ONLINE CALCULATOR

The online DALY calculator is a Web app that, on individual and population levels estimates years of life lost (YLL), years lived with disease (YLD), and total DALYs attributable to a particular disease. Further details regarding the DALY calculator are

published elsewhere. [3] To add precision to the original calculator, we updated the original standard life expectancy table with country- and gender-specific life expectancy. As users are not able to specify custom disability weights and life expectancy inputs, the expectation was that the calculator would provide an approximate estimate for this conversion; the goal was to explore and calibrate its accuracy and usability. CHD disease disability parameters were assumed to be based on GBD estimates, since they were not specifically reported in the paper. [2, 4, 5]

#### ESTIMATE CALCULATION

For each disease state, we first estimated the YLDs (i.e. the influence on quality of life during this disease stage) accrued during each disease stage (i.e., acute myocardial infarction [AMI] within the first 2 days and AMI during 3 to 28 days). Then, we calculated the YLLs due to early death from AMI. Rubinstein *et al.* used same disability weights for AMI and acute coronary syndrome (ACS). Therefore, we calculated DALYs averted associated with cumulative CHD cases (AMI+ACS).

We identified parameters from external sources concerning disability weight for each disease stage, age of onset, age of death and life expectancy at premature death. Age of death was the sum of age of disease onset and length of time from disease onset to death. The latter was not reported in the original paper; we therefore extracted it from GBD [4].

We made some assumptions concerning age of onset. Based on the Argentina population age, we estimated the average age of adults aged >34 years in Argentina was 55 years based on vital statistics data.[6] We assumed that the onset of CHD events would be earlier than the population average, based on epidemiologic estimates,[7] and therefore used the midpoint between the between these two ages (i.e., 44 years). We conducted two sets of calculations using alternative age of onset estimates of 55 and 44 years.

## RESULTS

Estimated DALYs averted in this population can be found in Table 2. The original paper reported 5,237, 15,271, and 26,394 DALYs averted from scenarios 1-3 respectively. By using 55 years old as age of onset, our online calculator estimated 4,332, 12,636, and 21,832 DALYs averted according to scenarios 1-3. Using 44 years old as age of onset, we estimated that 5,158, 15,012, and 25,997 DALYs were averted by scenarios 1-3 respectively.

Differences between population-based DALY estimates created by our methods and those reported by Rubinstein *et al.* are less than 2% when using 44 years as age of onset. The remaining differences are likely because of the uncertainty of the exact figures for disability weight and life expectancy, and rounding mechanisms throughout the calculation process used in the paper.

In summary, the use of the online DALY calculator produced estimates of DALYs that were comparable to those used in an original, published cost-effectiveness evaluation of

the impact of Argentine policies to reduce trans fatty acids on coronary heart disease, although these calculations are dependent on assumptions regarding the age of onset of CHD events.

**Table 1: Parameters**

	<b>Description</b>	<b>Number</b>	<b>Source reported in article</b>	<b>Source externally</b>
<b>Disability weight</b>	Acute myocardial infarction within first 2 days	0.432		GBD [4]
	Acute myocardial infarction 3-28 days	0.074		
<b>Life expectancy</b>	At age 44	38.88		GBD [5]
	At age 55	25.43		GBD [2]
<b>Age of onset</b>	AMI within first 2 days	44 or 55		UN [6]
	AMI 3-28 days	44.005 or 55.005		GBD [4]
<b>Age of death</b>	AMI within first 2 days	44.005 or 55.005		GBD [4]
	AMI 3-28 days	44.077 or 55.077		
<b>Incident cases</b>	Scenario 1	Scenario 2	Scenario 3	Rubinstein (2015) [1]
	1,066	3,109	5,373	
<b>Incident deaths</b>	301	878	1,517	Rubinstein (2015) [1]
<b>Discount rate</b>	5%			
<b>Age weighting</b>	0%			

**Table 2: Outcomes of DALY conversion calculation on online calculator**

	Description	Scenario 1	Scenario 2	Scenario 3
Rubinstein et al.	DALYs averted	<b>5,237</b>	<b>15,271</b>	<b>26,394</b>
	YLDs (AMI first 2 days)	0	0	0
Online Calculator (Age of onset: 44)	YLDs (AMI first 3 to 28 days)	0	0	0
	YLLs (AMI first 3 to 28 days)	5,158	15,012	25,997
	<b>DALYs averted</b>	<b>5,158</b>	<b>15,012</b>	<b>25,997</b>
	YLDs (AMI first 2 days)	0	0	0
(Age of onset: 55)	YLDs (AMI first 3 to 28 days)	0	0	0
	YLLs (AMI first 3 to 28 days)	4,332	12,636	21,832
	<b>DALYs averted</b>	<b>4,332</b>	<b>12,636</b>	<b>21,832</b>

## REFERENCES

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## CONTACT US:

Daniel Ollendorf, PhD  
[dollendorf@tuftsmedicalcenter.org](mailto:dollendorf@tuftsmedicalcenter.org)  
617-636-2581