*DC-Obesity*:A new model for estimating Differential lifetime Costs

of overweight and Obesity by socioeconomic status

Appendices

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Appendix 1**:** Parameter values for Markov Model and distribution of Monte Carlo Simulation

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| Model Parameter | Parameter Value | Distribution used | Source |
|  |  | Monte Carlo |  |
|  |  | Simulation |  |
| **I. Epidemiology** |  |  |  |
| *Transition Probabilities* |  |  |  |
| Mortality (male) | # | - | (23) |
| Mortality (female) | \* | - |
|  |  |  |  |
| transition probability normal to overweight |  |  | calculated by authors |
| *low SES:* |  |  |  |
| *age group:* |  |  |  |
| 18-24 | 0.049 | Uniform |  |
| 25-34 | 0.052 | Uniform |  |
| 35-44 | 0.072 | Uniform |  |
| 45-54 | 0.074 | Uniform |  |
| 55-64 | 0.079 | Uniform |  |
| 65-74 | 0.082 | Uniform |  |
| 75+ | 0.103 |  |  |
|  |  |  |  |
| *middle SES* |  |  |  |
| *age group:* |  |  |  |
| 18-24 | 0.051 | Uniform |  |
| 25-34 | 0.056 | Uniform |  |
| 35-44 | 0.058 | Uniform |  |
| 45-54 | 0.062 | Uniform |  |
| 55-64 | 0.065 | Uniform |  |
| 65-74 | 0.070 | Uniform |  |
| 75+ | 0.082 |  |  |
|  |  |  |  |
| *high SES* |  |  |  |
| *age group:* |  |  |  |
| 18-24 | 0.018 | Uniform |  |
| 25-34 | 0.047 | Uniform |  |
| 35-44 | 0.049 | Uniform |  |
| 45-54 | 0.053 | Uniform |  |
| 55-64 | 0.058 | Uniform |  |
| 65-74 | 0.064 | Uniform |  |
| 75+ | 0.048 | Uniform |  |
|  |  |  |  |
| transition probability overweight to obese |  |  | calculated by authors |
| *low SES:* |  |  |  |
| *age group:* |  |  |  |
| 18-24 | 0.078 | Uniform |  |
| 25-34 | 0.056 | Uniform |  |
| 35-44 | 0.060 | Uniform |  |
| 45-54 | 0.055 | Uniform |  |
| 55-64 | 0.063 | Uniform |  |
| 65-74 | 0.047 | Uniform |  |
| 75+ | 0.056 | Uniform |  |
|  |  |  |  |
| *middle SES* |  |  |  |
| *age group:* |  |  |  |
| 18-24 | 0.054 | Uniform |  |
| 25-34 | 0.041 | Uniform |  |
| 35-44 | 0.048 | Uniform |  |
| 45-54 | 0.045 | Uniform |  |
| 55-64 | 0.042 | Uniform |  |
| 65-74 | 0.041 | Uniform |  |
| 75+ | 0.046 | Uniform |  |
|  |  |  |  |
| *high SES* |  |  |  |
| *age group:* |  |  |  |
| 18-24 | 0.000 | Uniform |  |
| 25-34 | 0.041 | Uniform |  |
| 35-44 | 0.028 | Uniform |  |
| 45-54 | 0.042 | Uniform |  |
| 55-64 | 0.032 | Uniform |  |
| 65-74 | 0.034 | Uniform |  |
| 75+ | 0.035 | Uniform |  |
|  |  |  |  |
| transition probability overweight to normal weight |  |  | calculated by authors |
| *low SES:* |  |  |  |
| *age group:* |  |  |  |
| 18-24 | 0.110 | Uniform |  |
| 25-34 | 0.085 | Uniform |  |
| 35-44 | 0.072 | Uniform |  |
| 45-54 | 0.067 | Uniform |  |
| 55-64 | 0.059 | Uniform |  |
| 65-74 | 0.064 | Uniform |  |
| 75+ | 0.071 | Uniform |  |
|  |  |  |  |
| *middle SES* |  |  |  |
| *age group:* |  |  |  |
| 18-24 | 0.105 | Uniform |  |
| 25-34 | 0.072 | Uniform |  |
| 35-44 | 0.058 | Uniform |  |
| 45-54 | 0.053 | Uniform |  |
| 55-64 | 0.047 | Uniform |  |
| 65-74 | 0.050 | Uniform |  |
| 75+ | 0.050 | Uniform |  |
|  |  |  |  |
| *high SES* |  |  |  |
| *age group:* |  |  |  |
| 18-24 | 0.205 | Uniform |  |
| 25-34 | 0.068 | Uniform |  |
| 35-44 | 0.057 | Uniform |  |
| 45-54 | 0.052 | Uniform |  |
| 55-64 | 0.044 | Uniform |  |
| 65-74 | 0.051 | Uniform |  |
| 75+ | 0.050 | Uniform |  |
|  |  |  |  |
| transition probability obese to overweight |  |  | calculated by authors |
| *low SES:* |  |  |  |
| *age group:* |  |  |  |
| 18-24 | 0.023 | Uniform |  |
| 25-34 | 0.049 | Uniform |  |
| 35-44 | 0.049 | Uniform |  |
| 45-54 | 0.060 | Uniform |  |
| 55-64 | 0.068 | Uniform |  |
| 65-74 | 0.062 | Uniform |  |
| 75+ | 0.059 | Uniform |  |
|  |  |  |  |
| *middle SES* |  |  |  |
| *age group:* |  |  |  |
| 18-24 | 0.046 | Uniform |  |
| 25-34 | 0.041 | Uniform |  |
| 35-44 | 0.052 | Uniform |  |
| 45-54 | 0.051 | Uniform |  |
| 55-64 | 0.049 | Uniform |  |
| 65-74 | 0.044 | Uniform |  |
| 75+ | 0.034 | Uniform |  |
|  |  |  |  |
| *high SES* |  |  |  |
| *age group:* |  |  |  |
| 18-24 | 0.195 | Uniform |  |
| 25-34 | 0.046 | Uniform |  |
| 35-44 | 0.055 | Uniform |  |
| 45-54 | 0.050 | Uniform |  |
| 55-64 | 0.047 | Uniform |  |
| 65-74 | 0.038 | Uniform |  |
| 75+ | 0.044 | Uniform |  |
|  |  |  |  |
|  |  |  |  |
| **II. Costs** |  |  |  |
| *Costs per capita and BMI classification* |  |  |  |
|  |  |  |  |
| *Direct costs* |  |  |  |
| BMI<25 | 1,448 | Gamma\*\* |  |
|  | (748-2,804) |  |  |
| 25<BMI<30 | 1,495 | Gamma\*\* | calculated by authors |
|  | (862-2,588) |  |  |
| BMI>30 | 1,989 | Gamma\*\* |  |
|  | (1,272-3,114) |  |  |
|  |  |  |  |
|  |  |  |  |
| Indirect costs |  |  |  |
| BMI<25 | 1,353 | Gamma\*\* |  |
|  | (148-12,383) |  |  |
| 25<BMI<30 | 1,451 | Gamma\*\* | calculated by authors |
|  | (118-17,518) |  |  |
| BMI>30 | 1,610 | Gamma\*\* |  |
|  | (502-14,016) |  |  |
|  |  |  |  |
| # Male age-specific morality rate in Germany, \* Female age-specific mortality rate in Germany | | | |
| \*\* Costs derived using random effect meta analyses from 3 studies [8, 12, 28]. | | |  |

Appendix 2**:** Estimating SES-specific state transition probabilities between BMI states

State transition probabilities represent the chance of moving from one state (e.g. overweight) to another state (e.g. normal weight). Particularly in older ages, the probability of losing weight may be influenced by diseases such as cancer. To preclude this, we excluded 6,912 individuals with a low health status at baseline using the physical component scale (pcs<40) from the short-form survey 12 (SF12). Compared to individuals included in our analysis, individuals with pcs<40 are characterised by low SES and high BMI category.

To estimate SES-specific state transition probabilities, we included SES, sex and age as covariates (Equation 1). Moreover, the effect of age on changing BMI may vary by socioeconomic status (effect modifier). For instance, individuals with lower SES are more likely to gain weight than individuals with high SES ([7](#_ENREF_7)). To explore this relationship, we introduced an interaction term for SES and age. Finally, while individuals are at risk of more than one event, they can actually experience only one. For instance, an overweight individual can either become normal weight or obese, but not both at the same time. To include competing risks, we included for each transition a dummy variable *transij* to define whether a transition from BMI category *i* (e.g. overweight) to BMI category *j* (e.g. normal weight) has taken place (Equation 1):



where represents the hazard rate at time *t* for moving from BMI category *i* (e.g. normal weight) to BMI category *j* (e.g. overweight),  represents the baseline cumulative hazard function with two internal knots and  is the error term. To determine the number of knots, we used the Aike information criterion (AIC) in the -stpm2- routine in Stata.

Finally, to estimate one-year state transition probabilities  for moving from BMI category *i* (e.g. normal weight) to BMI category *j* (e.g. overweight), we used Equation 2:

