

## **Appendix 2 (as supplied by the authors): Development of a multi-morbidity score**

All our analyses are based on regression models predicting ED utilization. We wish to adjust these models optimally for multi-morbidity. Better control can be achieved using coefficients from a regression model fitting the data in our study.[1]

### **Creation of the multi-morbidity score**

As a basis for the creation of the multi-morbidity score, the following conditions were considered: all conditions comprised in the Charlson Comorbidity [2] as well as the group of all mental health conditions excluding dementia, and the group of all injuries. The latter conditions were added due to their potential influence on the outcome.

Dichotomous variables were created indicating the presence or absence of the conditions, as assessed from diagnoses obtained from physician billing and hospital discharge data, during a 2-year baseline period. The multi-morbidity confounder score was computed as the weighted sum of these indicator variables. The weights used to compute the score were the regression coefficients of each diagnosis from a negative binomial regression model to predict the number of ED visits from the analysis cohort (N=311,701). The outcome was measured on one year following the baseline period. The created score consists of the linear combination that minimizes the residual sum of squares.[3] The pseudo-R<sup>2</sup> [4] of the regression model, a measure of model fit, was 6.2%. The weights associated with each condition are shown in Table A1.

**Table A1. Results from the regression of a negative binomial log-linear model to predict the number of ED visits from individual conditions**

| Condition   | Coefficient | Standard error |
|---|-------------|----------------|
| <b>Charlson Comorbidity Index conditions</b>  |             |                |
| Myocardial infarct  | 0.31        | 0.02           |
| Congestive heart failure  | 0.42        | 0.02           |
| Peripheral vascular disease   | 0.26        | 0.02           |
| Dementia  | 0.46        | 0.03           |
| Cerebrovascular disease   | 0.20        | 0.03           |
| Chronic pulmonary disease   | 0.43        | 0.01           |
| Connective tissue disease   | 0.23        | 0.03           |
| Ulcer disease   | 0.28        | 0.04           |
| Mild liver disease  | 0.26        | 0.04           |
| Hemiplegia  | 0.24        | 0.03           |
| Moderate or severe renal disease  | 0.36        | 0.02           |
| Diabetes  | 0.28        | 0.01           |
| Tumors  | 0.20        | 0.01           |
| Leukemia  | 0.39        | 0.07           |
| Lymphoma  | 0.28        | 0.05           |
| Moderate or severe liver disease  | 0.30        | 0.07           |
| Metastatic solid tumor  | 0.32        | 0.03           |
| <b>Additional conditions</b>  |             |                |
| Mental health condition   | 0.35        | 0.01           |
| Injury  | 0.40        | 0.01           |
| The regression coefficients are the weights associated to each condition in the multi-morbidity score |             |                |
| All p-values < .001   |             |                |

## References

1. Schneeweiss S, Maclure M. Use of comorbidity scores for control of confounding in studies using administrative databases. *Int J Epidemiol.* 2000; 29:891-898.
2. D'Hoore W, Bouckaert A, Tilquin C. Practical considerations on the use of the Charlson Comorbidity Index with administrative data bases. *J Clin Epidemiol.* 1996; 49 (12):1429-1433.
3. Miettinen OS. Stratification by a multivariate confounder score. *Am J Epidemiol.* 1976; 104 (6):609-620.
4. McFadden D. Conditional logit analysis of qualitative choice behavior. Zarembka, P. (ed), *Frontiers in Economics.* New York: Academic Press, 1974, pp. 105-142.

