**Supplementary material**

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| **Table 1.** Akaike Information Criteria (AIC) and Bayesian Information Criteria (BIC) for each potential model.  |
|  | *AIC* | *BIC* |
| 8-class model | 27617.016 | 29207.794 |
| 7-class model | 27590.601 | 28986.703 |
| 6-class model | 27596.271 | 28792.136 |
| 5-class model | 27647.549 | 28643.176 |
| 4-class model | 27695.107 | 28484.934 |
| 3-class model | 27820.865 | 28416.016 |

**Table 2**. Predicted probabilities of latent multimorbidity 3-class membership

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|  | **Class 1** | **Class 2** | **Class 3** |
| Probability (class) | 0.34 | 0.47 | 0.19 |
| *Probability of* |
|  *Depression/anxiety* | **0.81** | **0.89** | **0.57** |
|  *Chronic pain* | **0.48** | **0.57** | **0.76** |
|  *Psoriasis/Eczema* | 0.28 | **0.39** | 0.23 |
|  *Asthma* | 0.24 | 0.29 | 0.15 |
|  *Substance dependency* | **0.51** | 0.02 | 0.04 |
|  *Hypertension*  | 0.05 | 0.07 | **0.62** |
|  *Alcohol problem* | **0.35** | 0.02 | 0.07 |
|  *Diabetes*  | 0.04 | 0.07 | **0.43** |
|  *Hearing problem* | 0.08 | 0.08 | 0.23 |
|  *IBS* | 0.06 | 0.12 | 0.06 |
|  *Blindness/Low vision* | 0.02 | 0.01 | 0.27 |
|  *Thyroid disorders* | 0.02 | 0.06 | 0.10 |
|  *HIV/AIDS*  | 0.11 | 0.03 | 0.01 |
|  *Chronic kidney disease* | <0.01 | <0.01 | 0.24 |
|  *Cancer* | 0.02 | 0.03 | 0.13 |
|  *Epilepsy*  | 0.04 | 0.03 | 0.06 |
|  *Stroke* | 0.01 | 0.01 | 0.18 |
|  *Dementia*  | <0.01 | <0.01 | 0.16 |
|  *Chronic liver disease* | 0.06 | 0.01 | 0.03 |
|  *Atrial fibrillation* | <0.01 | <0.01 | 0.13 |
|  *Chronic sinusitis*  | 0.02 | 0.03 | 0.01 |
|  *Coronary heart disease* | 0.01 | <0.01 | 0.10 |
|  *COPD* | 0.02 | <0.01 | 0.08 |
|  *Diverticular disease* | 0.01 | <0.01 | 0.09 |
|  *Heart failure* | <0.01 | <0.01 | 0.09 |
|  *Prostate disorders* | 0.02 | 0.01 | 0.07 |
|  *Anorexia/Bulimia* | 0.02 | 0.03 | <0.01 |
|  *RH/Arthritis* | 0.01 | 0.01 | 0.03 |
|  *Learning disability*  | 0.02 | 0.01 | 0.01 |
|  *Peptic ulcer*  | 0.01 | <0.01 | 0.04 |
|  *Peripheral vascular* *disease* | <0.01 | <0.01 | 0.06 |
|  *Inflammatory bowel* *disease* | <0.01 | 0.02 | <0.01 |
|  *Parkinson’s disease* | <0.01 | <0.01 | 0.02 |
|  *MS* | <0.01 | <0.01 | 0.01 |
|  *Bronchiectasis*  | <0.01 | <0.01 | 0.01 |
| Proportion of participants in each class | 28.17% | 53.85% | 17.98% |
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Abbreviations: IBS (irritable bowel syndrome); COPD (chronic obstructive pulmonary disease); RH (rheumatoid arteritis); MS (multiple sclerosis); LTCs (long-term conditions)

LTCs with a high probability (>0.3) are marked in bold