

Additional file 4: Overview of item definitions for quality evaluation of bottom-up standards.

| Group                                                                       | Concept # | Item Concept Query                                      | Item # | Top three search results in pragmatic MDR       | Occ. |
|-----------------------------------------------------------------------------|-----------|---------------------------------------------------------|--------|-------------------------------------------------|------|
| CDASH vital signs                                                           | 1         | Body Height<br>(total results: 4793)                    | 1      | Body height                                     | 21   |
|                                                                             |           |                                                         | 2      | Body Height                                     | 21   |
|                                                                             |           |                                                         | 3      | Body Height                                     | 11   |
|                                                                             | 2         | Body Weight<br>(total results: 6134)                    | 4      | Body weight                                     | 40   |
|                                                                             |           |                                                         | 5      | Body weight                                     | 19   |
|                                                                             |           |                                                         | 6      | Body weight                                     | 21   |
|                                                                             | 3         | Diastolic BP<br>(total results: 3062)                   | 7      | BP:                                             | 13   |
|                                                                             |           |                                                         | 8      | Semi-supine BP Diastolic                        | 10   |
|                                                                             |           |                                                         | 9      | Standing BP Diastolic                           | 10   |
|                                                                             | 4         | Systolic BP<br>(total results: 3361)                    | 10     | BP:                                             | 13   |
|                                                                             |           |                                                         | 11     | Systolic BP                                     | 1    |
|                                                                             |           |                                                         | 12     | Semi-supine BP Systolic                         | 10   |
|                                                                             | 5         | Pulse<br>(total results: 1285)                          | 13     | Pulse (bpm)                                     | 94   |
|                                                                             |           |                                                         | 14     | Pulse                                           | 28   |
|                                                                             |           |                                                         | 15     | Pulse                                           | 19   |
|                                                                             | 6         | Body Temperature<br>(total results: 5001)               | 16     | Body temperature                                | 22   |
|                                                                             |           |                                                         | 17     | Body Temperature                                | 9    |
|                                                                             |           |                                                         | 18     | Body Temperature                                | 6    |
| Most frequent LOINC codes                                                   | 7         | Creatinine<br>(total results: 3495)                     | 19     | Creatinine                                      | 5    |
|                                                                             |           |                                                         | 20     | Creatinine                                      | 18   |
|                                                                             |           |                                                         | 21     | Creatinine Clearance                            | 5    |
|                                                                             | 8         | Hemoglobin<br>(total results: 2190)                     | 22     | Hemoglobin                                      | 29   |
|                                                                             |           |                                                         | 23     | Hemoglobin                                      | 7    |
|                                                                             |           |                                                         | 24     | Hemoglobin                                      | 14   |
|                                                                             | 9         | Potassium<br>(total results: 739)                       | 25     | Potassium                                       | 30   |
|                                                                             |           |                                                         | 26     | Potassium                                       | 13   |
|                                                                             |           |                                                         | 27     | Potassium                                       | 12   |
|                                                                             | 10        | Glucose<br>(total results: 1808)                        | 28     | Glucose                                         | 30   |
|                                                                             |           |                                                         | 29     | Glucose                                         | 14   |
|                                                                             |           |                                                         | 30     | Glucose                                         | 11   |
|                                                                             | 11        | Sodium<br>(total results: 673)                          | 31     | Sodium                                          | 30   |
|                                                                             |           |                                                         | 32     | Sodium                                          | 20   |
|                                                                             |           |                                                         | 33     | Sodium                                          | 13   |
|                                                                             | 12        | Urea nitrogen<br>(total results: 664)                   | 34     | Blood urea nitrogen                             | 10   |
|                                                                             |           |                                                         | 35     | Serum Urea                                      | 1    |
|                                                                             |           |                                                         | 36     | Serum Urea Nitrogen                             | 1    |
| Most frequent ischaemic heart disease related UMLS concepts from MDM Portal | 13        | Myocardial Infarction<br>(total results: 2838)          | 37     | Myocardial infarction                           | 3    |
|                                                                             |           |                                                         | 38     | Myocardial Infarction                           | 21   |
|                                                                             |           |                                                         | 39     | Myocardial infarction                           | 10   |
|                                                                             | 14        | Coronary Artery Bypass Surgery<br>(total results: 7887) | 40     | CABG                                            | 1    |
|                                                                             |           |                                                         | 41     | Coronary artery bypass surgery (CABG-Op)        | 1    |
|                                                                             |           |                                                         | 42     | Coronary Artery Bypass Surgery                  | 2    |
|                                                                             | 15        | Angina Pectoris<br>(total results: 1297)                | 43     | Angina pectoris                                 | 8    |
|                                                                             |           |                                                         | 44     | Angina                                          | 1    |
|                                                                             |           |                                                         | 45     | Angina Pectoris                                 | 2    |
|                                                                             | 16        | Myocardial Ischemia<br>(total results: 2868)            | 46     | evidence of myocardial ischemia                 | 1    |
|                                                                             |           |                                                         | 47     | exercise-induced myocardial ischemia            | 1    |
|                                                                             |           |                                                         | 48     | 5. Other interventions: [6] ECG                 | 1    |
|                                                                             | 17        | Coronary heart disease<br>(total results: 27580)        | 49     | Any contraindication to the use of Adrenaline   | 1    |
|                                                                             |           |                                                         | 50     | Coronary Artery Disease (heart disease)         | 2    |
|                                                                             |           |                                                         | 51     | coronary heart disease                          | 2    |
|                                                                             | 18        | Coronary revascularization<br>(total results: 2692)     | 52     | [4] Non-coronary revascularisation              | 1    |
|                                                                             |           |                                                         | 53     | 4. Has the subject undergone a coronary         | 1    |
|                                                                             |           |                                                         | 54     | Time of revascularisation percutaneous coronary | 1    |
| Most frequent stroke related UMLS concepts from MDM Portal                  | 19        | Cerebrovascular accident<br>(total results: 1236)       | 55     | Cerebrovascular Accident                        | 21   |
|                                                                             |           |                                                         | 56     | Cerebrovascular accident within one year        | 1    |
|                                                                             |           |                                                         | 57     | Cerebrovascular disease                         | 1    |
|                                                                             | 20        | Hemorrhage<br>(total results: 814)                      | 58     | Is a vitreous hemorrhage present?               | 30   |
|                                                                             |           |                                                         | 59     | Hemorrhage                                      | 1    |
|                                                                             |           |                                                         | 60     | Retinal Hemorrhage                              | 4    |
|                                                                             | 21        | Transient Ischemic Attack<br>(total results: 1227)      | 61     | History of transient ischemic attack (TIA)      | 2    |
|                                                                             |           |                                                         | 62     | Transient Ischemic Attack                       | 21   |
|                                                                             |           |                                                         | 63     | Stroke/transient ischemic attack (TIA)          | 1    |
|                                                                             | 22        | Muscle Weakness<br>(total results: 922)                 | 64     | Muscle weakness                                 | 2    |
|                                                                             |           |                                                         | 65     | 39. Muscle weakness                             | 1    |
|                                                                             |           |                                                         | 66     | Musculoskeletal Muscle atrophy or weakness      | 1    |
|                                                                             | 23        | grip strength test left hand<br>(total results: 13963)  | 67     | Left Grip Strength Max-Grip Test 1              | 2    |
|                                                                             |           |                                                         | 68     | Left Grip Strength Max-Grip Test 1              | 2    |
|                                                                             |           |                                                         | 69     | Left Grip Strength Max-Grip Test 2              | 2    |
|                                                                             | 24        | Dysarthria<br>(total results: 126)                      | 70     | Dysarthria                                      | 4    |
|                                                                             |           |                                                         | 71     | Dysarthria                                      | 1    |
|                                                                             |           |                                                         | 72     | Dysarthria                                      | 1    |

For the quality evaluation of bottom-up standards we used the same proceeding to determine relevant data elements as for the standardization evaluation. So, we refer to the main manuscript for a detailed description. Note that this analysis was performed directly after the initial synchronization, so that it is based on fewer content than the standardization evaluation, which was performed one year later.