**Supplementary Appendix**

This appendix has been provided by the authors to give readers additional information about their work.

Supplement to:Defining the Minimal Clinically Important Difference and Patient-Acceptable

Symptom State Score for Disability Assessment in Surgical Patients

**Methods of missing data assessment for World Health Organization Disability Assessment**

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**Methods of missing data assessment for World Health Organization Disability Assessment Schedule scores**

Thirty data sets were imputed using chained equations, with predictive mean matching using the five nearest neighbours for height, weight, ASA, and WHODAS components and score at baseline, with mortality status at 3 and 6 months and hospital readmission at 3 months imputed using logistic regression models. WHODAS scores at 3 and 6 months and DAILY SCORES were also imputed using chained equations, with predictive mean matching using the five nearest neighbours, conditional on survival to 3 or 6 months as appropriate. Imputations were performed separately for each study, and standard diagnostic plots were used to assess imputed datasets. Stata v 15.1 was used to impute datasets and to analyse imputed datasets, with results from the 30 imputed datasets combined using Rubin’s rules.1

4360 participants with ASA < 5 were included, and 21 of these participants had a missing ASA value. By month 3, 83 participants were known to have died, and 165 had unknown mortality status. By month 6, 143 participants were known to have died, and 387 had unknown mortality status. One participant who was known to have died by 6 months had unknown mortality status at 3 months. To ensure that multiple imputation could be conducted, this participant was assumed to have been alive at 3 months (leaving 164 participants with unknown mortality status at 3 months). Among participants in the WHODAS study known to be alive at 3 months, there was only one known additional death by 6 months. Again, to permit multiple imputation, the 15 WHODAS participants with unknown mortality status at 6 months who were known to have lived to 3 months were assumed to be alive at 6 months.

At baseline, 92 participants had missing WHODAS scores. Among those participants not known to have died by 3 months (4277 patients), 567 had unknown 3 month WHODAS scores. Among those participants not known to have died by 6 months (4217 patients), 662 had unknown 6 month WHODAS scores. Many of the missing scores could be expected to be missing at random, due to the timing of the introduction of the recording of WHODAS, or staffing levels. All missing baseline WHODAS scores were imputed, and missing 3 month and 6 month scores were imputed for all participants who had not died by 3 or 6 months. Since mortality status was itself imputed, the number of imputed WHODAS scores differed from imputation to imputation. This means that the number of participants with recorded WHODAS scores differs from imputation and is reported as a mean number of participants across all imputed datasets, with a standard deviation.

1. Carpenter J, Kenward M: Multiple Imputation and its Application. John Wiley & Sons, 2012

**Table S1***.* This table is the multiply imputed dataset version of Table 2. Average WHODAS scores\* and standard deviations at baseline, 3 and 6 months were calculated using 30 imputed datasets. The number of patients in each ASA physical status varies between imputed datasets because it was imputed when missing when missingness was not due to death.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Baseline | 3 months | 6 months |
| ASA physical status | Average N(SD) | WHODAS score %(SD) | Average N(SD) | WHODAS score %(SD) | Average N(SD) | WHODAS score %(SD) |
| 1 | 149.2 (1.1) | 11 (15) | 149.1 (1.1) | 7 (13) | 148.8 (1.3) | 6 (12) |
| 2 | 1538.7 (1.8) | 11 (14) | 1517.0 (2.2) | 11 (15) | 1498.3 (2.1) | 10 (15) |
| 3 | 2335.9 (1.9) | 16 (17) | 2286.0 (2.4) | 15 (18) | 2239.5 (3.3) | 14 (18) |
| 4 | 336.2 (1.3) | 23 (19) | 320.4 (1.1) | 16 (19) | 312.0 (2.0) | 15 (17) |
| Total | 4360.0 | 15 (16) | 4272.4 (2.2) | 14 (17) | 4198.6 (4.7) | 13 (17) |

Mean (SD)

\* Each of the 12 WHODAS items asks about how much difficulty the patient has had due to health problems in a specific functional domain over the past 30 days, and is scored on a 5-point Likert scale: none = 0; mild = 1; moderate = 2; severe = 3; and extreme = 4. The total 12-item score, between 0 and 48, was then divided by 48 and multiplied by 100 to convert it to a percentage score.

ASA = American Society of Anesthesiologists; WHODAS = World Health Organization Disability Assessment Schedule.

**Table S2***.* This table is the multiply imputed dataset version of Table 3. This table is the multiply imputed dataset version of Table 3. Distribution-based estimates of the minimum clinically important difference derived from 30 multiply imputed datasets.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Baseline disability† | 0.3 SD | SEM | 5% of Range | Average |
| Total population | 20% | 5 | 6 | 5 | 5 |
| Gender Female Male | 25%17% | 55 | 65 | 55 | 55 |
| Age ≥ 70 years of age < 70 years of age | 21%20% | 55 | 66 | 54 | 55 |
| Baseline EQ-5D VAS\*  <65 (n=126) 65 to 85 (n=151) >85 (n=142) | 54%22%7% | 653 | 865 | 443 | 654 |
| History of malignancy Yes No | 13%28% | 45 | 56 | 55 | 56 |
| Type of surgery Thoracic (n=86) Neurosurgery (n=139) Cardiac (n=225) Orthopedic (n=159) General (n=2534) Urology (n=766) Plastics (n=198) | 24%50%31%57%16%14%25% | 5656445 | 7767655 | 3544534 | 5656545 |

 †Clinically significant disability defined as a World Health Organization Disability Assessment Schedule score ≥ 25%.

\* The baseline EQ-5D VAS was only measured in the WHODAS validation cohort. The WHODAS validation cohort was split into three equal tertiles according to the baseline EuroQol-5D VAS score (<65, 65 to 85, and >85).

EQ-5D VAS = EuroQol-5D Visual analogue score; SEM = Standard error of the measurement; WHODAS = World Health Organization Disability Assessment Schedule.

**Table S3.** This table is the multiply imputed dataset version of Table 4. Anchor-based estimates of the minimum clinically important difference in WHODAS scores from patient-reported change in health status at 3 and 6 months after surgery\* and 3-month hospital readmission data†. The number of patients tending to agree or disagree with the statement varies between imputed datasets because it was imputed when missing when missingness was not due to death.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | N (SD) | Baseline score | Score at 3 or 6 months | Mean Difference |
| “Surgery improved my daily life” |  |  |  |  |
|  Tend to agree at 3 months | 90.0 (4.0) | 16 | 11 | -5 |
|  Tend to agree at 6 months | 95.4 (3.7) | 15 | 10 | -5 |
|  Tend to disagree at 3 months | 34.1 (2.4) | 16 | 20 | 5 |
|  Tend to disagree at 6 months | 28.8 (1.8) | 17 | 22 | 5 |
| 3-month hospital readmission | 692.1 (14.7) | 19 | 21 | 3 |

 \*Patient-reported Change in Health Status data was from the initial WHODAS validation paper.1 Patients classified as “Tend to agree” were those who tended to agree that: surgery had improved their daily lives; AND that they felt better following surgery at the given time point after surgery. Patients classified as “Tend to disagree” were those who tended to disagree that: surgery had improved their daily lives; AND that they felt better following surgery at the given time point after surgery.

†3-month hospital readmission data was from all 3 studies included in the primary analysis. Patients included in this analysis where anyone who was readmitted to hospital within 3 months of their index surgery.

WHODAS = World Health Organization Disability Assessment Schedule

1. Shulman MA, Shulman MA, Myles PS, Chan MTV, McIlroy DR, Wallace S, Ponsford J: Measurement of disability-free survival after surgery. Anesthesiology 2015; 122:524–36

**Table S4.** Median WHODAS scores 3 and 6 months after surgery by readmission to hospital status.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Time point | Readmission status | N | WHODAS Score | P |
| 3 Months | No | 3130 | 6 [0 – 17] | <0.00005 |
|  | Yes | 525 | 17 [4 – 33] |
| 6 Months | No  | 2952 | 4 [0 - 15] | <0.00005 |
|  | Yes | 531 | 13 [4 – 33] |

Median [IQR]

WHODAS = World Health Organization Disability Assessment Schedule.

**Table S5***.* Proportion of patients with: i) minimal clinically important difference (MCID) in disability\* (increase or decrease) at 3 and 6 months after surgery; and ii) patient acceptable symptom state (PASS)†; clinically significant disability§ and new onset clinically significant disability¥ at 3 and 6 months after surgery.

|  |  |  |  |
| --- | --- | --- | --- |
| Variable | Baseline | 3 months | 6 months |
| MCID increase |  | 890 (24.4) | 750 (21.4) |
| MCID decrease  |  | 1023 (28.0) | 1060 (30.3) |
| PASS | 2826 (66.2) | 2577 (70.0) | 2603 (73.2) |
| Clinically significant disability | 513 (12.0) | 425(11.5) | 367 (10.3) |
| New onset clinically significant disability |  | 299 (8.2) | 249 (5.6) |

Number (%)

\*MCID is a change in WHODAS score of 5% or more

†PASS is a WHODAS score of less than 16%

§Clinically significant disability is a WHODAS score of 35% or more

¥New onset clinically significant disability is an increase in WHODAS score of 5% or more, to a final WHODAS score of 35% or more.

WHODAS = World Health Organization Disability Assessment Schedule.

**Figure S1.** The 12-item self-administered World Health Organization Disability Assessment Schedule 2.0 (WHODAS). Reproduced, with permission of WHO, from Measuring Health and Disability: Manual for WHO Disability Assessment Schedule. Geneva, World Health Organization, 2010 (WHODAS 2.0 12-item version self-administered www.who.int/classifications/icf/whodasii/en).

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