1 **Supplementary Methods**

1.1 Details of predictor variables

The 28 variables used in the prediction modelling are indicated with a \*

1.1.1 Socio-demographic

* Age (in years)
* Sex at birth (all participants disclosing as Male or Female)
* Ethnicity (White, Asian, Black, Mixed or Other)
* Education (No qualifications, GCSE, A Levels, University or Higher)
* Employment status (Employed, Student, Unemployed, Long term sick)
* Income (£0-£5,475, £5,476-£12,097, £12,098-£20,753, £20,754-£31,494, £31,495 or more)
* Relationship status (Single or Divorced, In a relationship, Married, Other)

1.1.2 Clinical status

* Age of patient of the first onset of psychiatric symptoms (in years, date of current episode onset - date of birth)
* Duration of the current episode (in months)
* Current anti-depressant use (Yes or No)
* Depression Severity (Patient Health Questionnaire, PHQ 9)
* Anxiety Disorder (Generalized Anxiety Disorder, GAD 7)
* Diagnoses selected from the MINI diagnostic interview (Sheehan et al., 1998) not covered by PHQ-9 or GAD-7:
	+ Bipolar Status (Unipolar or Bipolar)
	+ Social phobia (Yes or No)
	+ Panic Disorder (Yes or No)
	+ Agoraphobia (Yes or No)
	+ Obsessive Compulsive Disorder, OCD (Yes or No)
	+ Post-traumatic stress disorder, PTSD (Yes or No)
	+ Alcohol abuse (Yes or No)
	+ Substance Abuse or Dependence (Yes or No)
	+ Anorexia (Yes or No)
	+ Bulimia (Yes or No)
* Personality disorder traits (Standardised Assessment of Personality – Abbreviated Scale, SAPAS, Moran et al., 2003)
* Physical health using the Cumulative Illness Rating Scale (Linn et al., 1968, CIRS)

1.1.3 Psycho-social status and history

* Current beliefs about mental illness by the total score of the Brief Illness Perceptions questionnaire, (α, B-IPQ, (Broadbent et al., 2006)
* Self-criticism, Forms of Self Reassurance and Self Criticism scale (Gilbert et al., 2004, FSRC)
	+ The FSRC has 3 subscales, but a confirmatory factor analysis (CFA) showed that self-inadequacy and self-hatred could be combined into one ‘negative cognitions’ measure. The self-reassurance dimension was the other subscale. Items were summed by these two dimensions.
* Self-efficacy by the sum score of the general self-efficacy scale (Schwarzer & Jerusalem, 1995)
* Quality of life was assessed using the EuroQol questionnaire (Herdman et al., 2011, EQ5D)
* The 5 domains (usual activities, anxiety and depression, mobility ratings) were converted into a single utility index using an algorithm weighted by country, ranging from – 0.285 (worse than being dead) to 1 (Devlin et al., 2018). For this analysis we excluded the additional visual analogue scale for conceptual and statistical overlap with the utility index (r = 0.58, 95% CI: 0.48, 0.64)
* Strength of social support was measured with the Oslo Social Support scale, OSS (Dalgard et al., 2006)
* The List of Threatening Events Questionnaire, LTE (Brugha et al., 1985)
	+ A count of 12 stressful events over lifetime such as death and unemployment, used as a total score
* Childhood Trauma Questionnaire, CTQ (Bernstein et al., 2003)
	+ This scale assesses five types of maltreatment: sexual abuse, physical abuse, emotional neglect, physical neglect, and emotional abuse. Here we used the total score.

1.1.4 Pre-processing of predictor variables

The details of the pre-processing of predictor variables is as follows. Several demographic variables had the number of categories reduced. The number of ethnicity categories was reduced to 2 (BME or white). The mainly white sample (78%) meant there were few participants in individual non-white categories by outcome condition. Similarly, education was re-categorised according to level of qualification (none, school, and university) and employment was reduced to 3 categories: employed (including students and homemakers), unemployed and long-term sick, the latter identified as a particularly vulnerable category. All variables were standardised to mean 0 and 1 to allow evaluation of relevance and facilitate model computation (Gelman et al., 2020). All continuous variables were checked for non-linear relationships with outcome variables via spike histograms (binary) and loess smooths (continuous), none of which showed significant deviation from linearity.

2 Supplementary Results

2.1 Missing data



Figure 1: Percentage missing data by variable and recovery outcome

Overall, rates of missingness were relatively high ( > 20%) for 4 variables, duration of current illness episode, age of illness onset, ethnicity and physical health (CIRS).

2.2 Reference models and variable selection

2.2.1 IAPT Recovery

| Table 1: Model coefficients for reference model including median odds ratio, 95 CI, Rhat and effective sample size (ESS) of posterior distribution. |
| --- |
| **Parameter** | **Median** | **CI** | **CI\_low** | **CI\_high** | **Rhat** | **ESS** |
| (Intercept) | 1.18 | 0.95 | 0.88 | 1.60 | 1.000 | 10853 |
| age | 1.01 | 0.95 | 0.95 | 1.41 | 1.000 | 6038 |
| sex | 1.00 | 0.95 | 0.80 | 1.09 | 1.000 | 8004 |
| bme | 1.00 | 0.95 | 0.71 | 1.15 | 1.000 | 7162 |
| education | 1.00 | 0.95 | 0.89 | 1.14 | 1.000 | 8101 |
| unemployed | 1.00 | 0.95 | 0.74 | 1.16 | 1.000 | 7279 |
| long\_term\_sick | 1.00 | 0.95 | 0.58 | 1.12 | 1.000 | 5638 |
| income | 1.02 | 0.95 | 0.95 | 1.51 | 1.000 | 5066 |
| age\_onset\_lifetime | 1.00 | 0.95 | 0.91 | 1.21 | 1.000 | 7706 |
| ln\_curr\_ep\_dur | 1.00 | 0.95 | 0.85 | 1.10 | 1.000 | 8797 |
| curr\_AD | 1.00 | 0.95 | 0.83 | 1.10 | 1.000 | 8492 |
| bipolar | 1.00 | 0.95 | 0.87 | 1.12 | 1.000 | 8734 |
| sapas | 0.98 | 0.95 | 0.65 | 1.05 | 1.000 | 4963 |
| ln\_cirs | 1.00 | 0.95 | 0.83 | 1.10 | 1.001 | 7587 |
| panic\_disorder2 | 0.99 | 0.95 | 0.72 | 1.07 | 1.000 | 6503 |
| agoraphobia | 0.95 | 0.95 | 0.59 | 1.04 | 1.001 | 4102 |
| social\_phobia | 0.99 | 0.95 | 0.73 | 1.06 | 1.000 | 6333 |
| ocd | 0.80 | 0.95 | 0.51 | 1.02 | 1.000 | 3092 |
| ptsd | 0.99 | 0.95 | 0.75 | 1.06 | 1.000 | 5682 |
| alcohol | 1.00 | 0.95 | 0.91 | 1.16 | 1.000 | 7902 |
| substance\_use | 0.99 | 0.95 | 0.71 | 1.06 | 1.000 | 6336 |
| ipq | 0.99 | 0.95 | 0.72 | 1.07 | 1.000 | 4806 |
| neg\_cogs | 1.00 | 0.95 | 0.88 | 1.15 | 1.000 | 8434 |
| self\_reassure | 1.00 | 0.95 | 0.90 | 1.18 | 1.000 | 9102 |
| efficacy | 1.00 | 0.95 | 0.89 | 1.16 | 1.000 | 8103 |
| eq5d\_wd | 1.01 | 0.95 | 0.95 | 1.51 | 1.000 | 5043 |
| soc\_support | 1.00 | 0.95 | 0.91 | 1.20 | 1.000 | 8861 |
| life\_events | 1.00 | 0.95 | 0.83 | 1.10 | 1.000 | 8345 |
| ch\_trauma | 1.00 | 0.95 | 0.82 | 1.10 | 1.000 | 7814 |
| phq9\_t0 | 0.32 | 0.95 | 0.21 | 0.46 | 1.000 | 7952 |
| gad7\_t0 | 1.00 | 0.95 | 0.82 | 1.14 | 1.000 | 8666 |

| Table 2: Projection model variable selection path and variable stability |
| --- |
| **size** | **solution\_terms** | **elpd** | **elpd.se** | **rmse** | **rmse.se** | **prop\_included** |
| 0 | intercept | -182.6 | 0.9 | 0.501 | 0.002 | 1.000 |
| 1 | phq9\_t0 | -146.8 | 7.4 | 0.434 | 0.014 | 1.000 |
| 2 | ocd | -144.7 | 7.8 | 0.429 | 0.014 | 0.996 |
| 3 | agoraphobia | -142.3 | 7.5 | 0.426 | 0.014 | 1.000 |
| 4 | sapas | -142.9 | 7.6 | 0.427 | 0.014 | 0.981 |
| 5 | income | -144.7 | 7.8 | 0.431 | 0.014 | 0.890 |
| 6 | eq5d\_wd | -145.7 | 7.9 | 0.432 | 0.015 | 0.875 |
| 7 | panic\_disorder2 | -144.9 | 7.9 | 0.431 | 0.015 | 0.894 |
| 8 | substance\_use | -144.3 | 7.8 | 0.430 | 0.014 | 0.901 |
| 9 | social\_phobia | -144.2 | 7.8 | 0.429 | 0.015 | 0.913 |
| 10 | ptsd | -144.8 | 7.8 | 0.430 | 0.014 | 0.665 |
| 11 | age | -145.1 | 7.8 | 0.431 | 0.014 | 0.525 |
| 12 | ipq | -144.1 | 7.8 | 0.429 | 0.014 | 0.966 |
| 13 | ch\_trauma | -144.7 | 7.8 | 0.430 | 0.014 | 0.422 |
| 14 | age\_onset\_lifetime | -144.6 | 7.9 | 0.430 | 0.014 | 0.772 |
| 15 | sex | -144.4 | 7.9 | 0.429 | 0.014 | 0.852 |
| 16 | ln\_cirs | -144.2 | 7.9 | 0.429 | 0.014 | 0.878 |
| 17 | soc\_support | -144.5 | 7.9 | 0.429 | 0.014 | 0.730 |
| 18 | curr\_AD | -144.8 | 7.9 | 0.430 | 0.015 | 0.654 |
| 19 | long\_term\_sick | -145.2 | 7.9 | 0.431 | 0.014 | 0.673 |



Figure 2: Calibration plot for projection model for IAPT recovery

2.2.2 IAPT Recovery (cases only)

| Table 3: Model coefficients for reference model including median odds ratio, 95 CI, Rhat and effective sample size (ESS) of posterior distribution. |
| --- |
| **Parameter** | **Median** | **CI** | **CI\_low** | **CI\_high** | **Rhat** | **ESS** |
| (Intercept) | 0.71 | 0.95 | 0.52 | 0.99 | 1.001 | 8600 |
| age | 1.01 | 0.95 | 0.94 | 1.44 | 1.000 | 4503 |
| sex | 1.00 | 0.95 | 0.83 | 1.08 | 1.000 | 7598 |
| bme | 1.00 | 0.95 | 0.74 | 1.14 | 1.000 | 6021 |
| education | 1.00 | 0.95 | 0.88 | 1.16 | 1.000 | 8391 |
| unemployed | 1.00 | 0.95 | 0.76 | 1.18 | 1.000 | 5778 |
| long\_term\_sick | 1.00 | 0.95 | 0.44 | 1.12 | 1.001 | 3621 |
| income | 1.01 | 0.95 | 0.94 | 1.41 | 1.000 | 4785 |
| age\_onset\_lifetime | 1.00 | 0.95 | 0.93 | 1.28 | 1.000 | 6150 |
| ln\_curr\_ep\_dur | 1.00 | 0.95 | 0.85 | 1.10 | 1.000 | 8159 |
| curr\_AD | 1.00 | 0.95 | 0.80 | 1.07 | 1.000 | 6777 |
| bipolar | 1.00 | 0.95 | 0.87 | 1.12 | 1.000 | 7971 |
| sapas | 0.99 | 0.95 | 0.69 | 1.06 | 1.000 | 4794 |
| ln\_cirs | 1.00 | 0.95 | 0.83 | 1.09 | 1.000 | 5962 |
| panic\_disorder2 | 1.00 | 0.95 | 0.82 | 1.08 | 1.000 | 6941 |
| agoraphobia | 0.98 | 0.95 | 0.67 | 1.05 | 1.000 | 4161 |
| social\_phobia | 1.00 | 0.95 | 0.76 | 1.07 | 1.000 | 5055 |
| ocd | 0.76 | 0.95 | 0.47 | 1.02 | 1.001 | 2323 |
| ptsd | 0.99 | 0.95 | 0.71 | 1.06 | 1.000 | 5414 |
| alcohol | 1.00 | 0.95 | 0.91 | 1.18 | 1.000 | 7972 |
| substance\_use | 0.99 | 0.95 | 0.64 | 1.05 | 1.001 | 4791 |
| ipq | 1.00 | 0.95 | 0.77 | 1.07 | 1.000 | 6387 |
| neg\_cogs | 1.00 | 0.95 | 0.88 | 1.14 | 1.000 | 8317 |
| self\_reassure | 1.00 | 0.95 | 0.91 | 1.18 | 1.000 | 7432 |
| efficacy | 1.00 | 0.95 | 0.87 | 1.12 | 1.000 | 8258 |
| eq5d\_wd | 1.01 | 0.95 | 0.93 | 1.40 | 1.000 | 5888 |
| soc\_support | 1.00 | 0.95 | 0.90 | 1.17 | 1.000 | 8022 |
| life\_events | 1.00 | 0.95 | 0.86 | 1.11 | 1.000 | 8141 |
| ch\_trauma | 1.00 | 0.95 | 0.83 | 1.10 | 1.000 | 7454 |
| phq9\_t0 | 0.47 | 0.95 | 0.32 | 0.68 | 1.000 | 7197 |
| gad7\_t0 | 1.00 | 0.95 | 0.89 | 1.18 | 1.000 | 8151 |

| Table 4: Projection model variable selection path and variable stability |
| --- |
| **size** | **solution\_terms** | **elpd** | **elpd.se** | **rmse** | **rmse.se** | **prop\_included** |
| 0 | intercept | -145.1 | 2.0 | 0.497 | 0.005 | 1.000 |
| 1 | phq9\_t0 | -130.7 | 5.2 | 0.464 | 0.012 | 1.000 |
| 2 | ocd | -128.1 | 5.6 | 0.457 | 0.012 | 1.000 |
| 3 | agoraphobia | -129.9 | 5.9 | 0.460 | 0.013 | 0.953 |
| 4 | sapas | -129.6 | 6.0 | 0.459 | 0.013 | 0.929 |
| 5 | eq5d\_wd | -130.3 | 6.0 | 0.461 | 0.013 | 0.844 |
| 6 | substance\_use | -131.9 | 6.0 | 0.465 | 0.013 | 0.720 |
| 7 | income | -132.0 | 5.9 | 0.465 | 0.013 | 0.654 |
| 8 | age\_onset\_lifetime | -129.1 | 5.9 | 0.459 | 0.013 | 0.991 |
| 9 | ptsd | -127.5 | 5.7 | 0.455 | 0.013 | 1.000 |
| 10 | social\_phobia | -128.9 | 5.8 | 0.458 | 0.013 | 0.635 |
| 11 | age | -128.6 | 5.8 | 0.458 | 0.013 | 0.891 |
| 12 | ipq | -129.5 | 5.9 | 0.459 | 0.013 | 0.673 |
| 13 | long\_term\_sick | -130.2 | 5.9 | 0.461 | 0.013 | 0.654 |
| 14 | bme | -130.6 | 6.0 | 0.462 | 0.013 | 0.441 |
| 15 | curr\_AD | -131.0 | 6.0 | 0.463 | 0.013 | 0.654 |
| 16 | alcohol | -131.3 | 6.0 | 0.463 | 0.013 | 0.265 |
| 17 | sex | -131.1 | 6.0 | 0.463 | 0.013 | 0.787 |
| 18 | self\_reassure | -130.3 | 5.9 | 0.461 | 0.013 | 0.303 |
| 19 | panic\_disorder2 | -130.3 | 5.9 | 0.461 | 0.013 | 0.839 |



Figure 3: Calibration plot for projection model for IAPT recovery (Cases only)

2.2.3 IAPT Reliable improvement

| Table 5: Model coefficients for reference model including median odds ratio, 95 CI, Rhat and effective sample size (ESS) of posterior distribution. |
| --- |
| **Parameter** | **Median** | **CI** | **CI\_low** | **CI\_high** | **Rhat** | **ESS** |
| (Intercept) | 1.19 | 0.95 | 0.91 | 1.57 | 1.000 | 10980 |
| age | 1.00 | 0.95 | 0.92 | 1.24 | 1.000 | 7175 |
| sex | 1.00 | 0.95 | 0.81 | 1.08 | 1.001 | 7476 |
| bme | 1.00 | 0.95 | 0.76 | 1.17 | 1.000 | 7372 |
| education | 1.02 | 0.95 | 0.95 | 1.43 | 1.001 | 5646 |
| unemployed | 1.00 | 0.95 | 0.80 | 1.19 | 1.000 | 7410 |
| long\_term\_sick | 1.00 | 0.95 | 0.60 | 1.14 | 1.000 | 5725 |
| income | 1.00 | 0.95 | 0.93 | 1.26 | 1.000 | 6809 |
| age\_onset\_lifetime | 1.00 | 0.95 | 0.87 | 1.12 | 1.000 | 8260 |
| ln\_curr\_ep\_dur | 1.00 | 0.95 | 0.89 | 1.15 | 1.000 | 9229 |
| curr\_AD | 0.98 | 0.95 | 0.71 | 1.05 | 1.000 | 5678 |
| bipolar | 1.00 | 0.95 | 0.91 | 1.19 | 1.000 | 7690 |
| sapas | 0.89 | 0.95 | 0.58 | 1.03 | 1.001 | 3919 |
| ln\_cirs | 0.99 | 0.95 | 0.75 | 1.07 | 1.000 | 6775 |
| panic\_disorder2 | 1.00 | 0.95 | 0.82 | 1.08 | 1.000 | 8504 |
| agoraphobia | 0.99 | 0.95 | 0.75 | 1.07 | 1.000 | 5988 |
| social\_phobia | 0.98 | 0.95 | 0.68 | 1.05 | 1.000 | 5081 |
| ocd | 0.90 | 0.95 | 0.58 | 1.03 | 1.000 | 3681 |
| ptsd | 1.00 | 0.95 | 0.81 | 1.08 | 1.000 | 7802 |
| alcohol | 1.00 | 0.95 | 0.88 | 1.12 | 1.000 | 8901 |
| substance\_use | 1.00 | 0.95 | 0.82 | 1.08 | 1.000 | 8064 |
| ipq | 1.00 | 0.95 | 0.80 | 1.09 | 1.000 | 7563 |
| neg\_cogs | 1.00 | 0.95 | 0.84 | 1.12 | 1.000 | 8820 |
| self\_reassure | 1.00 | 0.95 | 0.87 | 1.12 | 1.000 | 9195 |
| efficacy | 1.02 | 0.95 | 0.95 | 1.49 | 1.000 | 5081 |
| eq5d\_wd | 1.08 | 0.95 | 0.96 | 1.68 | 1.002 | 3904 |
| soc\_support | 1.00 | 0.95 | 0.91 | 1.19 | 1.000 | 8720 |
| life\_events | 1.00 | 0.95 | 0.79 | 1.07 | 1.001 | 5788 |
| ch\_trauma | 1.00 | 0.95 | 0.92 | 1.25 | 1.000 | 6124 |
| phq9\_t0 | 1.00 | 0.95 | 0.77 | 1.10 | 1.001 | 6726 |
| gad7\_t0 | 2.46 | 0.95 | 1.68 | 3.73 | 1.001 | 5424 |

| Table 6: Projection model variable selection path and variable stability |
| --- |
| **size** | **solution\_terms** | **elpd** | **elpd.se** | **rmse** | **rmse.se** | **prop\_included** |
| 0 | intercept | -182.5 | 1.2 | 0.500 | 0.002 | 1.000 |
| 1 | gad7\_t0 | -170.2 | 4.8 | 0.477 | 0.009 | 1.000 |
| 2 | sapas | -171.6 | 5.4 | 0.479 | 0.010 | 0.951 |
| 3 | eq5d\_wd | -168.5 | 5.5 | 0.473 | 0.010 | 0.989 |
| 4 | ocd | -165.1 | 5.5 | 0.467 | 0.010 | 1.000 |
| 5 | efficacy | -165.4 | 5.5 | 0.468 | 0.010 | 0.977 |
| 6 | social\_phobia | -168.7 | 5.6 | 0.474 | 0.010 | 0.798 |
| 7 | education | -165.5 | 5.6 | 0.468 | 0.010 | 0.977 |
| 8 | curr\_AD | -164.3 | 5.4 | 0.466 | 0.010 | 0.992 |
| 9 | agoraphobia | -166.5 | 5.6 | 0.470 | 0.010 | 0.768 |
| 10 | income | -167.4 | 5.6 | 0.472 | 0.010 | 0.840 |
| 11 | ptsd | -166.2 | 5.6 | 0.469 | 0.010 | 0.871 |
| 12 | ln\_cirs | -166.9 | 5.6 | 0.471 | 0.010 | 0.829 |
| 13 | ipq | -167.8 | 5.6 | 0.472 | 0.010 | 0.544 |
| 14 | sex | -168.2 | 5.6 | 0.473 | 0.010 | 0.677 |
| 15 | substance\_use | -167.6 | 5.6 | 0.472 | 0.010 | 0.738 |
| 16 | age | -167.5 | 5.6 | 0.472 | 0.010 | 0.563 |
| 17 | life\_events | -167.0 | 5.6 | 0.471 | 0.010 | 0.894 |
| 18 | phq9\_t0 | -166.6 | 5.6 | 0.470 | 0.010 | 0.924 |
| 19 | panic\_disorder2 | -166.8 | 5.6 | 0.471 | 0.010 | 0.764 |



Figure 4: Calibration plot for projection model for IAPT reliable improvement

2.2.4 PHQ 9

| Table 7: Model coefficients for reference model including median, 95 CI, Rhat and effective sample size (ESS) of posterior distribution. |
| --- |
| **Parameter** | **Median** | **CI** | **CI\_low** | **CI\_high** | **Rhat** | **ESS** |
| (Intercept) | 9.03 | 0.95 | 8.30 | 9.72 | 1.000 | 9939 |
| age | -0.03 | 0.95 | -0.68 | 0.19 | 1.000 | 6554 |
| sex | 0.08 | 0.95 | -0.12 | 0.88 | 1.000 | 5009 |
| bme | 0.01 | 0.95 | -0.35 | 1.19 | 1.000 | 6757 |
| education | -0.01 | 0.95 | -0.54 | 0.24 | 1.000 | 8233 |
| unemployed | 0.00 | 0.95 | -0.51 | 0.80 | 1.000 | 7138 |
| long\_term\_sick | 0.02 | 0.95 | -0.38 | 1.43 | 1.000 | 6142 |
| income | -0.10 | 0.95 | -1.02 | 0.13 | 1.000 | 4846 |
| age\_onset\_lifetime | 0.00 | 0.95 | -0.34 | 0.34 | 1.000 | 8939 |
| ln\_curr\_ep\_dur | 0.00 | 0.95 | -0.34 | 0.35 | 1.000 | 9636 |
| curr\_AD | 0.01 | 0.95 | -0.28 | 0.44 | 1.000 | 9409 |
| bipolar | -0.02 | 0.95 | -0.57 | 0.23 | 1.000 | 7585 |
| sapas | 0.11 | 0.95 | -0.13 | 1.01 | 1.000 | 5052 |
| ln\_cirs | 0.01 | 0.95 | -0.23 | 0.55 | 1.000 | 7689 |
| panic\_disorder2 | 0.01 | 0.95 | -0.25 | 0.50 | 1.000 | 8409 |
| agoraphobia | 0.14 | 0.95 | -0.10 | 1.09 | 1.000 | 5081 |
| social\_phobia | 0.09 | 0.95 | -0.13 | 0.96 | 1.000 | 5479 |
| ocd | 0.67 | 0.95 | -0.03 | 1.48 | 1.000 | 3282 |
| ptsd | 0.03 | 0.95 | -0.20 | 0.66 | 1.000 | 7667 |
| alcohol | -0.02 | 0.95 | -0.53 | 0.22 | 1.000 | 7650 |
| substance\_use | 0.00 | 0.95 | -0.40 | 0.29 | 1.000 | 8440 |
| ipq | 0.00 | 0.95 | -0.45 | 0.33 | 1.000 | 8560 |
| neg\_cogs | 0.00 | 0.95 | -0.38 | 0.38 | 1.000 | 8672 |
| self\_reassure | 0.01 | 0.95 | -0.26 | 0.51 | 1.000 | 8053 |
| efficacy | 0.00 | 0.95 | -0.35 | 0.38 | 1.000 | 9161 |
| eq5d\_wd | -1.08 | 0.95 | -1.94 | -0.02 | 1.001 | 4621 |
| soc\_support | -0.06 | 0.95 | -0.83 | 0.16 | 1.000 | 6040 |
| life\_events | 0.00 | 0.95 | -0.35 | 0.34 | 1.000 | 9451 |
| ch\_trauma | 0.00 | 0.95 | -0.34 | 0.40 | 1.000 | 8544 |
| phq9\_t0 | 3.24 | 0.95 | 2.43 | 4.08 | 1.000 | 7738 |
| gad7\_t0 | -0.01 | 0.95 | -0.70 | 0.31 | 1.000 | 7661 |

| Table 8: Projection model variable selection path and variable stability |
| --- |
| **size** | **solution\_terms** | **elpd** | **elpd.se** | **rmse** | **rmse.se** | **prop\_included** |
| 0 | intercept | -883.7 | 9.9 | 6.949 | 0.260 | 1.000 |
| 1 | phq9\_t0 | -830.3 | 11.4 | 5.666 | 0.247 | 1.000 |
| 2 | eq5d\_wd | -824.1 | 11.0 | 5.542 | 0.233 | 1.000 |
| 3 | ocd | -821.0 | 11.0 | 5.478 | 0.233 | 1.000 |
| 4 | agoraphobia | -821.9 | 11.3 | 5.496 | 0.237 | 0.985 |
| 5 | income | -826.8 | 11.5 | 5.598 | 0.237 | 0.745 |
| 6 | sapas | -824.4 | 11.6 | 5.549 | 0.240 | 0.932 |
| 7 | sex | -824.0 | 11.6 | 5.541 | 0.239 | 0.890 |
| 8 | social\_phobia | -824.0 | 11.5 | 5.539 | 0.237 | 0.905 |
| 9 | soc\_support | -820.4 | 11.3 | 5.466 | 0.236 | 0.992 |
| 10 | ptsd | -820.6 | 11.2 | 5.469 | 0.235 | 0.992 |
| 11 | alcohol | -820.6 | 11.2 | 5.469 | 0.234 | 0.992 |
| 12 | bipolar | -822.2 | 11.3 | 5.503 | 0.234 | 0.487 |
| 13 | age | -823.2 | 11.4 | 5.524 | 0.235 | 0.795 |
| 14 | ln\_cirs | -823.6 | 11.4 | 5.532 | 0.235 | 0.844 |
| 15 | education | -823.7 | 11.4 | 5.535 | 0.236 | 0.555 |
| 16 | self\_reassure | -824.3 | 11.4 | 5.547 | 0.235 | 0.635 |
| 17 | gad7\_t0 | -824.3 | 11.4 | 5.547 | 0.235 | 0.639 |
| 18 | panic\_disorder2 | -823.8 | 11.4 | 5.536 | 0.235 | 0.863 |
| 19 | bme | -823.6 | 11.4 | 5.532 | 0.235 | 0.825 |

2.2.5 GAD 7

| Table 9: Model coefficients for reference model including median, 95 CI, Rhat and effective sample size (ESS) of posterior distribution. |
| --- |
| **Parameter** | **Median** | **CI** | **CI\_low** | **CI\_high** | **Rhat** | **ESS** |
| (Intercept) | 7.66 | 0.95 | 7.03 | 8.27 | 1.000 | 8763 |
| age | -0.05 | 0.95 | -0.70 | 0.18 | 1.000 | 6615 |
| sex | 0.18 | 0.95 | -0.10 | 0.90 | 1.000 | 5366 |
| bme | 0.06 | 0.95 | -0.28 | 1.68 | 1.000 | 5468 |
| education | -0.03 | 0.95 | -0.62 | 0.22 | 1.001 | 7612 |
| unemployed | 0.02 | 0.95 | -0.41 | 1.19 | 1.000 | 6650 |
| long\_term\_sick | 0.01 | 0.95 | -0.48 | 1.04 | 1.000 | 7320 |
| income | -0.15 | 0.95 | -0.97 | 0.13 | 1.001 | 5406 |
| age\_onset\_lifetime | -0.01 | 0.95 | -0.42 | 0.30 | 1.000 | 9152 |
| ln\_curr\_ep\_dur | 0.02 | 0.95 | -0.24 | 0.49 | 1.000 | 8612 |
| curr\_AD | 0.05 | 0.95 | -0.18 | 0.65 | 1.000 | 5801 |
| bipolar | 0.00 | 0.95 | -0.33 | 0.38 | 1.000 | 9096 |
| sapas | 0.08 | 0.95 | -0.15 | 0.81 | 1.000 | 5696 |
| ln\_cirs | 0.02 | 0.95 | -0.24 | 0.52 | 1.000 | 7731 |
| panic\_disorder2 | 0.13 | 0.95 | -0.13 | 0.90 | 1.000 | 4821 |
| agoraphobia | 0.57 | 0.95 | -0.04 | 1.41 | 1.001 | 3513 |
| social\_phobia | 0.11 | 0.95 | -0.14 | 0.87 | 1.000 | 5238 |
| ocd | 0.48 | 0.95 | -0.04 | 1.19 | 1.001 | 3869 |
| ptsd | 0.06 | 0.95 | -0.18 | 0.69 | 1.000 | 6086 |
| alcohol | 0.00 | 0.95 | -0.35 | 0.34 | 1.000 | 8882 |
| substance\_use | 0.01 | 0.95 | -0.24 | 0.47 | 1.000 | 8675 |
| ipq | 0.02 | 0.95 | -0.26 | 0.60 | 1.000 | 7993 |
| neg\_cogs | 0.00 | 0.95 | -0.45 | 0.32 | 1.000 | 7987 |
| self\_reassure | 0.06 | 0.95 | -0.16 | 0.73 | 1.000 | 5471 |
| efficacy | 0.01 | 0.95 | -0.29 | 0.43 | 1.000 | 8742 |
| eq5d\_wd | -0.56 | 0.95 | -1.41 | 0.04 | 1.000 | 4224 |
| soc\_support | -0.02 | 0.95 | -0.56 | 0.23 | 1.000 | 6911 |
| life\_events | 0.01 | 0.95 | -0.26 | 0.44 | 1.000 | 8925 |
| ch\_trauma | 0.01 | 0.95 | -0.26 | 0.48 | 1.000 | 8814 |
| phq9\_t0 | 1.36 | 0.95 | 0.04 | 2.49 | 1.000 | 3750 |
| gad7\_t0 | 1.22 | 0.95 | 0.00 | 2.36 | 1.000 | 3621 |

| Table 10: Projection model variable selection path and variable stability |
| --- |
| **size** | **solution\_terms** | **elpd** | **elpd.se** | **rmse** | **rmse.se** | **prop\_included** |
| 0 | intercept | -841.4 | 9.2 | 5.918 | 0.205 | 1.000 |
| 1 | gad7\_t0 | -824.5 | 12.1 | 5.518 | 0.222 | 0.894 |
| 2 | phq9\_t0 | -820.8 | 12.3 | 5.431 | 0.219 | 0.859 |
| 3 | agoraphobia | -800.3 | 11.6 | 5.053 | 0.217 | 0.859 |
| 4 | eq5d\_wd | -789.3 | 11.1 | 4.848 | 0.210 | 1.000 |
| 5 | ocd | -787.2 | 11.0 | 4.808 | 0.208 | 1.000 |
| 6 | income | -792.3 | 11.5 | 4.904 | 0.212 | 0.871 |
| 7 | sex | -789.5 | 11.5 | 4.851 | 0.213 | 0.962 |
| 8 | panic\_disorder2 | -791.5 | 11.4 | 4.889 | 0.209 | 0.875 |
| 9 | sapas | -790.5 | 11.4 | 4.870 | 0.209 | 0.814 |
| 10 | social\_phobia | -788.6 | 11.3 | 4.834 | 0.208 | 0.951 |
| 11 | ptsd | -788.5 | 11.2 | 4.833 | 0.207 | 0.916 |
| 12 | bme | -788.7 | 11.4 | 4.837 | 0.210 | 0.970 |
| 13 | curr\_AD | -790.0 | 11.4 | 4.860 | 0.208 | 0.802 |
| 14 | self\_reassure | -789.6 | 11.4 | 4.852 | 0.208 | 0.859 |
| 15 | education | -790.0 | 11.4 | 4.861 | 0.209 | 0.882 |
| 16 | age | -790.7 | 11.4 | 4.873 | 0.209 | 0.627 |
| 17 | ln\_cirs | -791.4 | 11.5 | 4.885 | 0.209 | 0.582 |
| 18 | ch\_trauma | -792.3 | 11.5 | 4.903 | 0.209 | 0.373 |
| 19 | ipq | -791.7 | 11.5 | 4.892 | 0.210 | 0.274 |

2.2.6 IAPT reliable recovery

* Note that this outcome was not included in the main analysis

| Table 11: Model coefficients for reference model including median, 95 CI, Rhat and effective sample size (ESS) of posterior distribution. |
| --- |
| **Parameter** | **Median** | **CI** | **CI\_low** | **CI\_high** | **Rhat** | **ESS** |
| (Intercept) | 0.59 | 0.95 | 0.45 | 0.77 | 1.000 | 10043 |
| age | 1.00 | 0.95 | 0.96 | 1.21 | 1.000 | 5730 |
| sex | 1.00 | 0.95 | 0.85 | 1.05 | 1.000 | 5849 |
| bme | 1.00 | 0.95 | 0.86 | 1.10 | 1.000 | 7255 |
| education | 1.00 | 0.95 | 0.95 | 1.16 | 1.000 | 7460 |
| unemployed | 1.00 | 0.95 | 0.80 | 1.10 | 1.000 | 7039 |
| long\_term\_sick | 1.00 | 0.95 | 0.68 | 1.08 | 1.001 | 3952 |
| income | 1.00 | 0.95 | 0.96 | 1.26 | 1.000 | 4857 |
| age\_onset\_lifetime | 1.00 | 0.95 | 0.93 | 1.10 | 1.000 | 8805 |
| ln\_curr\_ep\_dur | 1.00 | 0.95 | 0.91 | 1.07 | 1.000 | 7891 |
| curr\_AD | 1.00 | 0.95 | 0.80 | 1.04 | 1.000 | 5656 |
| bipolar | 1.00 | 0.95 | 0.93 | 1.09 | 1.000 | 8374 |
| sapas | 1.00 | 0.95 | 0.76 | 1.04 | 1.001 | 4336 |
| ln\_cirs | 1.00 | 0.95 | 0.90 | 1.07 | 1.001 | 7369 |
| panic\_disorder2 | 1.00 | 0.95 | 0.90 | 1.06 | 1.000 | 7149 |
| agoraphobia | 1.00 | 0.95 | 0.86 | 1.05 | 1.000 | 5458 |
| social\_phobia | 1.00 | 0.95 | 0.84 | 1.04 | 1.001 | 5047 |
| ocd | 0.90 | 0.95 | 0.54 | 1.01 | 1.002 | 1854 |
| ptsd | 1.00 | 0.95 | 0.76 | 1.04 | 1.000 | 5050 |
| alcohol | 1.00 | 0.95 | 0.93 | 1.10 | 1.000 | 8739 |
| substance\_use | 1.00 | 0.95 | 0.81 | 1.04 | 1.001 | 5083 |
| ipq | 1.00 | 0.95 | 0.87 | 1.06 | 1.000 | 7529 |
| neg\_cogs | 1.00 | 0.95 | 0.93 | 1.11 | 1.000 | 8420 |
| self\_reassure | 1.00 | 0.95 | 0.92 | 1.08 | 1.000 | 7812 |
| efficacy | 1.00 | 0.95 | 0.95 | 1.15 | 1.000 | 6391 |
| eq5d\_wd | 1.00 | 0.95 | 0.97 | 1.41 | 1.000 | 4082 |
| soc\_support | 1.00 | 0.95 | 0.93 | 1.11 | 1.000 | 8250 |
| life\_events | 1.00 | 0.95 | 0.90 | 1.06 | 1.000 | 7616 |
| ch\_trauma | 1.00 | 0.95 | 0.92 | 1.09 | 1.000 | 8463 |
| phq9\_t0 | 1.00 | 0.95 | 0.52 | 1.04 | 1.001 | 1306 |
| gad7\_t0 | 1.00 | 0.95 | 0.97 | 2.02 | 1.002 | 1194 |

* OCD was the only non 0 (OR = 1) coefficient

2.3 Sensitivity analyses

2.3.1 Equivalent subsets (PHQ 9)

Projection paths for PHQ-9 outcome model including 3 other predictors (income, agoraphobia and ocd diagnoses) as alternative to Quality of Life as a predictor, able to match reference model performance

| Table 12: Projection paths for PHQ-9 outcome model including 3 other predictors (income, agoraphobia and ocd diagnoses) as alternative to Quality of Life as a predictor, able to match reference model performance |
| --- |
| **size** | **solution\_terms** | **elpd** | **elpd.se** | **rmse** | **rmse.se** | **prop\_included** |
| 0 | intercept | -883.6 | 10.0 | 6.948 | 0.260 | 1.000 |
| 1 | income | -870.5 | 10.1 | 6.608 | 0.257 | 1.000 |
| 2 | agoraphobia | -865.8 | 9.7 | 6.490 | 0.245 | 0.992 |
| 3 | ocd | -861.1 | 9.9 | 6.373 | 0.250 | 1.000 |
| 4 | phq9\_t0 | -823.1 | 11.1 | 5.514 | 0.239 | 0.000 |



Figure 5: Projection path for PHQ-9 outcome model ewith income, agoraphobia and OCD diagnosis

2.3.2 PHQ 9 Projection model no Baseline

| Table 13: Projection path excluding baseline for PHQ 9 scores |
| --- |
| **size** | **solution\_terms** | **elpd** | **elpd.se** | **rmse** | **rmse.se** | **prop\_included** |
| 0 | intercept | -883.6 | 10.0 | 6.948 | 0.260 | 1.000 |
| 1 | eq5d\_wd | -859.7 | 10.3 | 6.342 | 0.245 | 1.000 |
| 2 | ipq | -863.2 | 11.4 | 6.423 | 0.263 | 0.943 |
| 3 | ocd | -851.3 | 10.6 | 6.144 | 0.248 | 0.996 |
| 4 | income | -848.2 | 10.8 | 6.070 | 0.250 | 1.000 |
| 5 | neg\_cogs | -847.2 | 10.8 | 6.049 | 0.249 | 1.000 |
| 6 | bme | -846.2 | 10.9 | 6.024 | 0.251 | 0.992 |
| 7 | agoraphobia | -844.3 | 10.6 | 5.980 | 0.244 | 1.000 |
| 8 | ln\_cirs | -844.7 | 10.8 | 5.990 | 0.247 | 0.989 |
| 9 | education | -846.3 | 10.8 | 6.027 | 0.246 | 0.939 |
| 10 | ptsd | -845.0 | 10.9 | 5.998 | 0.249 | 0.985 |
| 11 | unemployed | -846.1 | 11.0 | 6.023 | 0.249 | 0.882 |
| 12 | soc\_support | -846.9 | 11.0 | 6.042 | 0.249 | 0.715 |
| 13 | panic\_disorder2 | -845.1 | 11.1 | 6.000 | 0.251 | 0.973 |
| 14 | age | -847.8 | 11.1 | 6.062 | 0.250 | 0.681 |
| 15 | age\_onset\_lifetime | -848.0 | 11.0 | 6.068 | 0.248 | 0.734 |
| 16 | social\_phobia | -847.3 | 11.1 | 6.050 | 0.249 | 0.829 |
| 17 | bipolar | -845.8 | 11.0 | 6.015 | 0.248 | 0.981 |
| 18 | substance\_use | -843.7 | 10.9 | 5.968 | 0.248 | 0.996 |
| 19 | efficacy | -844.1 | 10.9 | 5.978 | 0.248 | 0.966 |
| 20 | life\_events | -844.9 | 10.9 | 5.996 | 0.248 | 0.924 |
| 21 | ch\_trauma | -845.6 | 11.0 | 6.012 | 0.249 | 0.829 |
| 22 | long\_term\_sick | -845.2 | 11.0 | 6.003 | 0.248 | 0.970 |
| 23 | ln\_curr\_ep\_dur | -845.0 | 10.9 | 5.999 | 0.248 | 0.920 |
| 24 | curr\_AD | -845.4 | 11.0 | 6.009 | 0.249 | 0.905 |
| 25 | alcohol | -845.8 | 11.0 | 6.016 | 0.247 | 0.582 |
| 26 | sex | -845.2 | 10.9 | 6.003 | 0.248 | 0.962 |
| 27 | self\_reassure | -845.4 | 10.9 | 6.008 | 0.248 | 0.821 |
| 28 | sapas | -845.5 | 11.0 | 6.011 | 0.248 | 1.000 |

3 or 4 variables provide a solution within the SE of near maximum performance. For this projection model Bayesian R2 (95% CI) = 0.24 (0.14, 0.32)

2.3.3 GAD 7 Projection model no Baseline

| Table 14: Projection path excluding baseline for GAD 7 scores |
| --- |
| **size** | **solution\_terms** | **elpd** | **elpd.se** | **rmse** | **rmse.se** | **prop\_included** |
| 0 | intercept | -841.4 | 9.2 | 5.918 | 0.205 | 1.000 |
| 1 | eq5d\_wd | -832.0 | 10.7 | 5.705 | 0.221 | 0.962 |
| 2 | agoraphobia | -825.8 | 11.0 | 5.570 | 0.218 | 0.954 |
| 3 | ipq | -827.2 | 11.2 | 5.590 | 0.216 | 0.772 |
| 4 | ocd | -805.3 | 10.1 | 5.152 | 0.207 | 1.000 |
| 5 | income | -803.1 | 10.2 | 5.108 | 0.208 | 1.000 |
| 6 | bme | -801.0 | 10.2 | 5.066 | 0.208 | 0.996 |
| 7 | neg\_cogs | -800.5 | 10.4 | 5.057 | 0.210 | 1.000 |
| 8 | ln\_cirs | -801.1 | 10.6 | 5.069 | 0.215 | 0.992 |
| 9 | education | -803.7 | 10.8 | 5.122 | 0.215 | 0.882 |
| 10 | social\_phobia | -802.2 | 10.8 | 5.092 | 0.217 | 0.970 |
| 11 | unemployed | -804.0 | 11.2 | 5.128 | 0.221 | 0.935 |
| 12 | ptsd | -805.8 | 11.3 | 5.163 | 0.221 | 0.863 |
| 13 | substance\_use | -807.3 | 11.3 | 5.192 | 0.220 | 0.483 |
| 14 | self\_reassure | -806.4 | 11.3 | 5.176 | 0.220 | 0.920 |
| 15 | long\_term\_sick | -804.2 | 11.2 | 5.132 | 0.220 | 0.924 |
| 16 | soc\_support | -804.1 | 11.2 | 5.130 | 0.220 | 0.821 |
| 17 | sex | -805.4 | 11.2 | 5.156 | 0.219 | 0.570 |
| 18 | efficacy | -805.3 | 11.2 | 5.153 | 0.218 | 0.867 |
| 19 | sapas | -805.4 | 11.2 | 5.155 | 0.218 | 0.852 |
| 20 | age | -805.9 | 11.1 | 5.165 | 0.217 | 0.802 |
| 21 | age\_onset\_lifetime | -806.0 | 11.1 | 5.167 | 0.217 | 0.825 |
| 22 | ch\_trauma | -805.0 | 11.1 | 5.147 | 0.216 | 0.711 |
| 23 | panic\_disorder2 | -803.3 | 11.0 | 5.113 | 0.216 | 0.977 |
| 24 | bipolar | -804.2 | 11.0 | 5.132 | 0.216 | 0.445 |
| 25 | curr\_AD | -804.0 | 11.0 | 5.127 | 0.216 | 0.806 |
| 26 | alcohol | -803.3 | 11.0 | 5.113 | 0.215 | 1.000 |
| 27 | life\_events | -803.5 | 11.0 | 5.118 | 0.215 | 0.825 |
| 28 | ln\_curr\_ep\_dur | -803.6 | 11.0 | 5.120 | 0.216 | 1.000 |

4 variables provide a solution within the SE of near maximum performance. For this projection model Bayesian R2 (95% CI) = 0.24 (0.16, 0.32)

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