Appendix 1 Participant flow

- Identified: n=340
  - Baseline eligibility: n=276
    - Baseline: n=274
      - Randomised: (n=268)
        - Allocated to CBT: n=134 (50%)
          - Outcomes for primary analysis (n=134)
            - Not eligible for multiple imputation: (n=0)
        - Allocated to OST: n=134 (50%)
          - Outcomes for primary analysis (n=133)
            - Not eligible for multiple imputation: (n=1)

- No further involvement (n=62)
  - Not interested/not consented: (n=7)
  - Not eligible: (n=23)
  - No contact: (n=5)
  - Baseline visit not arranged: (n=25)
  - Other: (n=2)

- Discontinued pre baseline (n=4)
  - Did not consent: (n=2)
  - Not eligible: (n=2)

- Discontinued pre randomisation (n=6)
  - Participant without consent: (n=5)
  - Investigator decision: (n=1)
Appendix 2 missing pattern

|                          | Baseline          | 6-month follow-up | Baseline + 6-month follow-up |
|--------------------------|-------------------|-------------------|------------------------------|
|                          | Total             | OST               | CBT                          | Total             | OST               | CBT                          |
|                          | (n=267)           | (n=133)           | (n=134)                      | (n=267)           | (n=133)           | (n=134)                      |
|                          | n (%)             | n (%)             | n (%)                        | n (%)             | n (%)             | n (%)                        |
| **EQ-5D-Y and resource use questionnaire** |                  |                   |                              |                  |                   |                              |
| Completed both           | 266 (99.6)        | 132 (99.2)        | 134 (100.0)                  | 191 (71.5)        | 95 (71.4)         | 96 (71.6)                    |
| Resource use only        | 1 (0.4)           | 1 (0.8)           | -                            | 2 (0.7)           | 1 (0.8)           | 1 (0.8)                      |
| EQ-5D-Y only             | -                 | -                 | -                            | 2 (0.7)           | 2 (1.5)           | -                            |
| Completed none of both   | -                 | -                 | -                            | 72 (27.0)         | 35 (26.3)         | 37 (27.6)                    |
| **EQ-5D-Y**              |                   |                   |                              |                  |                   |                              |
| No missing               | 267 (100.0)       | 133 (100.0)       | 134 (100.0)                  | 193 (72.3)        | 97 (72.9)         | 96 (71.6)                    |
| Resource use questionnaire |                  |                   |                              |                  |                   |                              |
| No missing               | 266 (99.6)        | 132 (99.2)        | 134 (100.0)                  | 193 (72.3)        | 96 (72.2)         | 97 (72.4)                    |

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### Appendix 3 Intervention costs by trial arm

|                      | OST                        | CBT                        |
|----------------------|----------------------------|----------------------------|
|                      | Total cost (£) | Cost per session per CYP (£) | Total cost (£) | Cost per session per CYP (£) |
| **Training costs**   |               |                            |               |                            |
| Train the trainers   |               |                            |               |                            |
| Venue                | £140.00       | £1.47                      | -             | -                          |
| Refreshment          | £335.00       | £1.45                      | -             | -                          |
| Consumable costs     | £0.00         | £0.00                      | -             | -                          |
| Trainer’s travel costs | £6,117.00  | £26.48                     | -             | -                          |
| Trainer fee          | £1,940.00     | £8.40                      | -             | -                          |
| Total                | £8,392.00     | £36.33                     | -             | -                          |
| **Therapist training** |              |                            |               |                            |
| Venue                | £160.00       | £0.69                      | -             | -                          |
| Refreshment costs    | £732.40       | £3.17                      | -             | -                          |
| Consumable costs     | £264.00       | £1.14                      | -             | -                          |
| Trainer’s travel costs | £317.20   | £1.37                      | -             | -                          |
| Trainer fee          | £4,500.00     | £19.48                     | -             | -                          |
| Total                | £5,973.60     | £25.86                     | -             | -                          |
| **Intervention delivery costs** |       |                            |               |                            |
| Intervention (staff time) |       |                            |               |                            |
| Therapy session      | £19,054.33    | £82.49                     | £29,908.85    | £45.45                     |
| Administration / preparation | £5,151.17 | £22.30                     | £5,507.37     | £8.40                      |
| Additional resource  |               |                            |               |                            |
| Second therapist     | £2,037.00     | £8.82                      | £550.67       | £0.84                      |
| Assistant / nurse    | £331.88       | £1.44                      | £55.13        | £0.09                      |
| Stimuli              | £503.84       | £2.18                      | £811.36       | £1.23                      |
| Supervision*         | £1,119.77     | £4.84                      | £1,717.01     | £2.61                      |
| Total                | £28,197.98    | £122.07                    | £38,553.38    | £58.59                     |

*The calculation method and unit cost were based on Wiles et al. study: Wiles N, Thomas L, Abel A et al. Clinical effectiveness and cost-effectiveness of cognitive behavioural therapy as an adjunct to pharmacotherapy for treatment-resistant depression in primary care: the CoBalT randomised controlled trial. Health Technol Assess. 2014 May;18(31):1-167.
## Appendix 4 Average service use by trial arm (complete case, n=139)

| Unit                          | Baseline | 6 months |
|-------------------------------|----------|----------|
|                               | OST, N=94| CBT, N=96| OST, N=94| CBT, N=96|
|                               | Mean     | Mean     | Mean     | Mean     |
|                               | (min-max)| (min-max)| (95% CI) | (95% CI) |
| **NHS and PSS**               |          |          |          |          |
| **Community-based services**  |          |          |          |          |
| CAMHS related                 |          |          |          |          |
| Child psychiatrist Appointment| 0.17 (0-2)| 0.12 (0-3)| 0.15 (0-3)| 0.18 (0-5)|
|                               | (0.07 – 0.27) | (0.22 – 0.21) | (0.04 – 0.26) | (0.16 – 0.34) |
| Child psychotherapist Appointment| 0.24 (0-8)| 0.20 (0-18)| 0.07 (0-3)| 0.34 (0-25)|
|                               | (0.01 – 0.47) | (-0.18 – 0.56) | (-0.01 – 0.16) | (-0.04 – 0.23) |
| Child psychologist Appointment| 0.06 (0-3)| 0.35 (0-11)| 0.30 (0-8)| 0.30 (0-8)|
|                               | (-0.01 – 0.14) | (0.07 – 0.64) | (0.07 – 0.52) | (0.04 – 0.57) |
| Mental health nurse Appointment| 1.91 (0-24)| 1.03 (0-9)| 1.97 (0-27)| 3.09 (0-24)|
|                               | (1.17 – 0.65) | (0.65 – 1.41) | (0.97 – 2.99) | (2.12 – 4.07) |
| Family therapist Appointment  | -        | 0.01 (0-1)| 0.02 (0-2)| -        |
|                               | (-0.01 – 0.03) | (-0.02 – 0.06) |          |          |
| **Non-CAMHS related**         |          |          |          |          |
| GP Appointment                | 1.65 (0-20)| 1.17 (0-10)| 0.55 (0-10)| 0.73 (0-8)|
|                               | (1.12 – 2.17) | (0.86 – 1.48) | (0.29 – 0.81) | (0.43 – 1.04) |
| Nurse Appointment             | 0.40 (0-11)| 0.44 (0-12)| 0.17 (0-3)| 0.39 (0-12)|
|                               | (0.14 – 0.67) | (0.13 – 0.74) | (0.06 – 0.28) | (0.05 – 0.72) |
| Community paediatrician  Appointment | 0.18 (0-4)| 0.08 (0-2)| 0.04 (0-2)| 0.03 (0-2) |
|                               | (0.05 – 0.32) | (0.01 – 0.15) | (-0.01 – 0.09) | (-0.01 – 0.08) |
| Child development centre Visit| 0.17 (0-12)| 0.01 (0-1)| 0.08 (0-3)| 0.01 (0-1)|
|                               | (-0.09 – 0.42) | (-0.01 – 0.03) | (-0.00 – 0.17) | (-0.01 – 0.03) |
| Helpline / NHS-direct Call    | 0.05 (0-2)| 0.05 (0-1)| 0.06 (0-3)| 0.04 (0-2)|
|                               | (-0.00 – 0.12) | (0.01 – 0.10) | (-0.01 – 0.14) | (-0.01 – 0.09) |
| Walk-in centre Visit          | 0.13 (0-2)| 0.11 (0-2)| 0.10 (0-3)| 0.10 (0-3)|
|                               | (0.04 – 0.22) | (0.04 – 0.19) | (0.01 – 0.18) | (0.02 – 0.18) |
| Social worker Visit           | 0.20 (0-8)| 0.25 (0-7)| 0.07 (0-3)| 0.04 (0-4)|
|                               | (0.00 – 0.40) | (0.05 – 0.45) | (-0.02 – 0.17) | (-0.04 – 0.12) |
| **Hospital-based services**   |          |          |          |          |
| Emergency services Visit      | 0.17 (0-2)| 0.09 (0-2)| 0.12 (0-2)| 0.07 (0-2)|
|                               | (0.08 – 0.26) | (0.03 – 0.16) | (0.04 – 0.20) | (0.01 – 0.14) |
| Inpatient admission Admission | 0.04 (0-2)| 0.03 (0-2)| 0.02 (0-1)| 0.04 (0-2)|
|                               | (-0.01 – 0.09) | (-0.01 – 0.08) | (-0.01 – 0.05) | (-0.02 – 0.10) |
| Outpatient visit Attendance   | 0.24 (0-5)| 0.26 (0-8)| 0.23 (0-3)| 0.28 (0-4)|


|                      | Type          | (0.07 – 0.42) | (0.07 – 0.45) | (0.11 – 0.36) | (0.13 – 0.44) |
|----------------------|---------------|---------------|---------------|---------------|---------------|
| Medication           |               |               |               |               |               |
| Mental health related|               | 0.22 (0-3)    | 0.18 (0-4)    | 0.22 (0-3)    | 0.18 (0-4)    |
|                      |               | (0.11 – 0.34) | (0.05 – 0.31) | (0.11 – 0.34) | (0.05 – 0.31) |
| Non-mental health related|           | 0.48 (0-7)    | 0.38 (0-8)    | 0.48 (0-7)    | 0.38 (0-8)    |
|                      |               | (0.25 – 0.71) | (0.17 – 0.58) | (0.25 – 0.71) | (0.17 – 0.58) |
| Education system related |       |               |               |               |               |
| Education psychologist | Appointment  | 0.13 (0-7)    | 0.04 (0-1)    | 0.07 (0-7)    | 0.07 (0-5)    |
|                      |               | (-0.03 – 0.28)| (0.00 – 0.08) | (-0.05 – 0.20)| (-0.03 – 0.18)|
| Education welfare officer | Appointment | 0.06 (0-3)    | 0.32 (0-20)   | 0.17 (0-10)   | 0.05 (0-2)    |
|                      |               | (-0.01 – 0.14)| (-0.11 – 0.76)| (-0.02 – 0.36)| (-0.01 – 0.11)|
| School nurse         | Appointment   | 0.20 (0-5)    | 0.67 (0-20)   | 0.13 (0-11)   | 0.01 (0-1)    |
|                      |               | (0.03 – 0.38) | (0.08 – 1.26) | (-0.00 – 0.26)| (-0.01 – 0.03)|
| School counsellor    | Appointment   | 1.84 (0-30)   | 0.60 (0-10)   | 1.04 (0-25)   | 0.60 (0-20)   |
|                      |               | (0.80 – 2.88) | (0.20 – 1.00) | (0.20 – 1.88) | (0.04 – 1.17) |
| Private expense      |               |               |               |               |               |
| Self-paid treatment  | Session       | 0.44 (0-24)   | 0.19 (0-10)   | 0.04 (0-2)    | 0.02 (0-2)    |
|                      |               | (-0.10 – 0.97)| (-0.08 – 0.45)| (-0.02 – 0.10)| (-0.02 – 0.06)|
| Travel for intervention | Hour          | -             | -             | 1.85 (0-7)    | 5.31 (0-16)   |
|                      |               |               |               | (1.64 – 2.06) | (4.57 – 6.04) |
| Productivity         |               |               |               |               |               |
| Parental productivity | Day          | 2.73 (0-63)   | 1.15 (0-19)   | 0.89 (0-10)   | 0.82 (0-12)   |
|                      |               | (1.10 – 4.36) | (0.56 – 1.74) | (0.48 – 1.30) | (0.43 – 1.22) |
| Productivity for intervention | Hour | -             | -             | 5.32 (0-16)   | 11.01 (0-33)  |
|                      |               |               |               | (4.79 – 5.85) | (9.55 – 12.47)|
## Appendix 5 EQ-5D-Y responses by trial arms by data collection time points

|                      | Baseline | 6 months |
|----------------------|----------|----------|
|                      | Level 1  | Level 2  | Level 3 | Level 1 | Level 2 | Level 3 |
| **OST (n=97)**       |          |          |         |          |          |         |
| Mobility             |          |          |         |          |          |         |
| n (%)                | Level 1  | Level 2  | Level 3 | Level 1  | Level 2  | Level 3  |
| Mobility             | 87 (89.7) | 9 (9.3)  | 1 (1.0) | 89 (91.8) | 7 (7.2)  | 1 (1.0)  |
| Self-care            | 86 (88.7) | 7 (7.2)  | 4 (4.1) | 87 (89.7) | 10 (10.3) | -        |
| Usual activity       | 63 (64.9) | 31 (32.0) | 3 (3.1) | 79 (81.4) | 16 (16.5) | 2 (2.1)  |
| Pain/discomfort      | 61 (62.9) | 36 (37.1) | -       | 70 (72.2) | 24 (24.7) | 3 (3.1)  |
| Anxiety/depression   | 44 (45.4) | 43 (44.3) | 10 (10.3) | 55 (56.7) | 36 (37.1) | 6 (6.2)  |
| **CBT (n=96)**       |          |          |         |          |          |         |
| Mobility             |          |          |         |          |          |         |
| n (%)                | Level 1  | Level 2  | Level 3 | Level 1  | Level 2  | Level 3  |
| Mobility             | 82 (85.5) | 13 (13.5) | 1 (1.0) | 86 (89.6) | 10 (10.4) | -        |
| Self-care            | 85 (88.5) | 11 (11.5) | -       | 86 (89.6) | 10 (10.4) | -        |
| Usual activity       | 65 (67.7) | 27 (28.1) | 4 (4.2) | 76 (79.2) | 19 (19.8) | 1 (1.0)  |
| Pain/discomfort      | 61 (63.5) | 30 (31.3) | 5 (5.2) | 69 (71.9) | 25 (26.0) | 2 (2.1)  |
| Anxiety/depression   | 43 (44.8) | 47 (49.0) | 6 (6.2) | 49 (51.0) | 40 (41.7) | 7 (7.3)  |

Note: Level 1: none, Level 2: some, Level 3: extreme
### Appendix 6 CHU-9D responses by trial arms by data collection time points

|               | OST (n=45) |              |              |              |              |              |              |              |              |              |              |              |
|---------------|------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
|               | Baseline   |              |              |              |              |              |              |              |              |              |              | 6 months     |
|               | Level 1    | Level 2      | Level 3      | Level 4      | Level 5      | Level 1      | Level 2      | Level 3      | Level 4      | Level 5      | Level 1      | Level 2      | Level 3      | Level 4      | Level 5      |
| Worried       | 20 (44.4)  | 16 (35.6)    | 7 (15.6)     | -            | 2 (4.4)      | 22 (48.9)    | 12 (26.7)    | 5 (11.1)     | 3 (6.7)      | 3 (6.7)      |               |              |              |              |              |
| Sad           | 32 (71.1)  | 8 (17.8)     | 2 (4.4)      | 2 (4.4)      | 1 (2.2)      | 29 (64.4)    | 6 (13.3)     | 5 (11.1)     | 4 (8.9)      | 1 (2.2)      |               |              |              |              |              |
| Annoyed       | 27 (60.0)  | 13 (28.9)    | 4 (8.9)      | -            | 1 (2.2)      | 27 (60.0)    | 10 (22.2)    | 5 (11.1)     |               |              | 3 (6.7)      |              |              |              |              |
| Tired         | 9 (20.0)   | 15 (33.3)    | 8 (17.8)     | 5 (11.1)     | 8 (17.8)     | 12 (26.7)    | 13 (28.9)    | 9 (20.0)     | 5 (11.1)     | 6 (13.3)     |               |              |              |              |              |
| Pain          | 28 (62.2)  | 6 (13.3)     | 6 (13.3)     | 3 (6.7)      | 2 (4.4)      | 21 (46.7)    | 11 (24.4)    | 4 (8.9)      | 2 (4.4)      | 7 (15.6)     |               |              |              |              |              |
| Sleep         | 21 (46.7)  | 12 (26.7)    | 5 (11.1)     | 3 (6.7)      | 4 (8.9)      | 20 (44.4)    | 3 (6.7)      | 7 (15.6)     | 9 (20.0)     | 6 (13.3)     |               |              |              |              |              |
| Daily routine | 23 (51.1)  | 12 (26.7)    | 4 (8.9)      | 3 (6.7)      | 3 (6.7)      | 19 (42.2)    | 11 (24.4)    | 7 (15.6)     | 4 (8.9)      | 4 (8.9)      |               |              |              |              |              |
| Work          | 27 (60.0)  | 15 (33.3)    | 2 (4.4)      | 1 (2.2)      | -            | 23 (51.1)    | 11 (24.4)    | 7 (15.6)     | 1 (2.2)      | 3 (6.7)      |               |              |              |              |              |
| Able to join activities | 23 (51.1) | 6 (13.3) | 10 (22.2) | 3 (6.7) | 3 (6.7) | 10 (22.2) | 14 (31.1) | 10 (22.2) | 9 (20.0) | 2 (4.4) | | | | | |

|               | CBT (n=51) |              |              |              |              |              |              |              |              |              |              |              |              |
|---------------|------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
|               | Baseline   |              |              |              |              |              |              |              |              |              |              | 6 months     |
|               | Level 1    | Level 2      | Level 3      | Level 4      | Level 5      | Level 1      | Level 2      | Level 3      | Level 4      | Level 5      | Level 1      | Level 2      | Level 3      | Level 4      | Level 5      |
| Worried       | 34 (66.7)  | 8 (15.7)     | 3 (5.9)      | 2 (3.9)      | 4 (7.8)      | 33 (64.7)    | 6 (11.8)     | 7 (13.7)     | 1 (2.0)      | 4 (7.8)      |               |              |              |              |              |
| Sad           | 40 (78.4)  | 5 (9.8)      | 2 (3.9)      | 1 (2.0)      | 3 (5.9)      | 37 (72.5)    | 5 (9.8)      | 5 (9.8)      | 1 (2.0)      | 3 (5.9)      |               |              |              |              |              |
| Annoyed       | 37 (72.5)  | 7 (13.7)     | 4 (7.8)      | 2 (3.9)      | 1 (2.0)      | 34 (66.7)    | 10 (19.6)    | 5 (9.8)      |               | 2 (3.9)      |               |              |              |              |              |
| Tired         | 14 (27.5)  | 19 (37.3)    | 5 (9.8)      | 3 (5.9)      | 10 (19.6)    | 17 (33.3)    | 19 (37.3)    | 4 (7.8)      | 7 (13.7)     | 4 (7.8)      |               |              |              |              |              |
| Pain          | 33 (64.7)  | 9 (17.6)     | 3 (5.9)      | 1 (2.0)      | 5 (9.8)      | 28 (54.9)    | 9 (17.6)     | 7 (13.7)     | 3 (5.9)      | 4 (7.8)      |               |              |              |              |              |
| Sleep         | 26 (51.0)  | 10 (19.6)    | 6 (11.8)     | 3 (5.9)      | 6 (11.8)     | 23 (45.1)    | 8 (15.7)     | 8 (15.7)     | 4 (7.8)      | 8 (15.7)     |               |              |              |              |              |
| Daily routine | 29 (56.9)  | 8 (15.7)     | 4 (7.8)      | 4 (7.8)      | 6 (11.8)     | 24 (47.1)    | 15 (29.4)    | 7 (13.7)     | 3 (5.9)      | 2 (3.9)      |               |              |              |              |              |
| Work          | 34 (66.7)  | 7 (13.7)     | 6 (11.8)     | 1 (2.0)      | 3 (5.9)      | 33 (64.7)    | 10 (19.6)    | 5 (9.8)      | 3 (5.9)      |               |               |              |              |              |              |
| Able to join activities | 30 (58.8) | 6 (11.8) | 5 (9.8) | 4 (7.8) | 6 (11.8) | 24 (47.1) | 8 (15.7) | 6 (11.8) | 8 (15.7) | 5 (9.8) | | | | | |

Note: Level 1: No, Level 2: A little bit, Level 3: A bit, Level 4: Quite a lot, Level 5 Very
## Appendix 7: Sensitivity analyses

| OST vs. CBT                              | Incremental costs (£), (95% CI) | Incremental QALYs (95% CI) | ICER (£/QALY gained), (95% CI) | Probability of OST being cost effective at WTP threshold of £20,000/QALYs |
|------------------------------------------|--------------------------------|-----------------------------|--------------------------------|--------------------------------------------------------------------------------|
| Base-case                                | -302.96 (-28.61, -598.86)      | 0.002 (-0.004, 0.008)       | Dominant                       | 98%                                                                            |
| Scenario 1: Complete case analysis from NHS/PSS perspective | -31.10 (-154.21, 88.14)        | 0.001 (-0.002, 0.005)       | Dominant                       | 81%                                                                            |
| Scenario 2: CUA on CYP who received at least one intervention session from NHS/PSS perspective | -298.40 (-599.68, -23.90)      | 0.002 (-0.005, 0.009)       | Dominant                       | 99%                                                                            |
| Scenario 3: CUA (utility measured by CHU9D) | -310.64 (-605.07, -44.10)      | 0.002 (-0.007, 0.012)       | Dominant                       | 98%                                                                            |
| Scenario 4: CUA (cost from societal perspective) | -384.81 (-685.01, -107.16)     | 0.002 (-0.004, 0.008)       | Dominant                       | 99%                                                                            |