**Supplementary information**

**Figure 1 – Study Recruitment Flow Diagram**

**RECRUITMENT PERIOD**

**Women approached about study at discharge (or shortly after)**

(23.2.15 to 6.3.18)

If consent given by women, researchers then access women’s clinical case notes for more data about the admission period (T0)

Researchers’ access women’s clinical case notes for data about service contacts since discharge up to one year later (T2)

At interview, women provide self-reported data about admission period (T0) and the one-month since discharge (T1)

At interview, women provide self-reported data about service contacts since discharge up to one year later (T2)

**ONE-YEAR POST-DISCHARGE**

**Women undertake telephone call interview**

(29.1.16 to 19.1.19)

**ONE-MONTH POST-DISCHARGE**

**Women undertake face-to-face interview**

(13.3.15 to 6.3.18)

**Figure 2 - Study flow-diagram**

Assessed for eligibility

n=1084

**Enrolment**

Excluded (n=805):

- Not contactable in time-frame (n=415)

- Declined to participate (n=297)

- Did not meet inclusion criteria (n=93)

**Allocation**

Baseline: index admission (n=279)

Mother & Baby Unit

(n=108)

Crisis Resolution Teams

(n=108)

Lost-to-follow-up: n=1

(no consent to collection of long-term outcomes)

Mother & Baby Unit

(n=108)

Generic acute psychiatric wards (n=62)

Crisis Resolution Teams

(n=109)

**Follow-up**

Generic acute psychiatric wards (n=62)

**Follow-up**

Short-term follow-up: one-month post-discharge (n=279)

Allocated to generic acute psychiatric wards

(n=62)

Allocated to Mother & Baby Unit

(n=108)

Allocated to Crisis Resolution Teams

(n=109)

Long-term follow-up: one-year post-discharge (n=278)

**Table 1: Index admission descriptives (n=279 participants) by cohort allocation**

|  |  | **CRT****(n=109)** | **Ward****(n=62)** | **MBU****(n=108)** | **Total****(n=279)** |
| --- | --- | --- | --- | --- | --- |
| Number of admissions - n (%) | 1-2 | 109 (100·0) | 44 (71·0) | 67 (62·0) | 220 (78·9) |
| 3-4 | 0 (0·0) | 17 (27·4) | 34 (31·5) | 51 (18·3) |
| 5-7 | 0 (0·0) | 1 (1·6) | 7 (6·5) | 8 (2·9) |
| Days per admission - median (IQR) |  | 25·0 (16·0-38·0) | 14·0 (5·0-24·5) | 30·0 (8·0-54·0) | 21·0 (9·0-42·0) |
| Number of services used - n (%)  | 1 | 109 (100·0)  | 18 (29·0)  | 33 (30·6)  | 160 (57·3)  |
| 2 | 0 (0·0)  | 44 (71·0)  | 50 (46·3)  | 94 (33·7)  |
| 3 | 0 (0·0)  | 0 (0·0)  | 25 (23·1)  | 25 (9·0)  |
| Total number of days in services - median (IQR)  | ·· | 25·0 (16·0-38·0)  | 34·0 (18·0-53·0)  | 75·5(55·0-97·0)  | 42·0 (21·0-76·0)  |
| % of time in cohort service out of total time in all services - n (%)  | <25% | 0 (0·0)  | 13 (21·0)  | 10 (9·3)  | 23 (8·2)  |
| ≥ 25% and <50% | 0 (0·0)  | 9 (14·5)  | 8 (7·4)  | 17 (6·1)  |
| ≥ 50% and <75% | 0 (0·0)  | 16 (25·8)  | 22 (20·4)  | 38 (13·6)  |
| ≥75% | 109 (100·0)  | 24 (38·7)  | 68 (63·0)  | 201 (72·0)  |

**Statistics Supplementary Material**

**Details on the calculation of geographical location from MBU services**

For each study participant, the driving distance from their home to the nearest MBU (all MBUs open in England and Wales at the time of recruitment) was determined. This calculation was conducted in two steps: 1) the as-the-crow-flies distance, using Haversine formula (see below); 2) the driving distance (as per as-the-crow-flies distance).

 This involved the following:

* The geolocation (latitude, longitude) was determined for each participant’s residence and each MBU using UK Postcode geo data for the outward codes
* The “as the crow flies” distance in miles for each participant and each MBU was determined using Haversine formula, which is used to generate the distance between two points on a sphere based on their latitude and longitude):
* Haversine formula:
	+ Distance=ACOS(COS(RADIANS(90-Lat1)) \*COS(RADIANS(90-Lat2)) +SIN(RADIANS(90-Lat1)) \*SIN(RADIANS(90-Lat2)) \*COS(RADIANS(Long1-Long2))) \*6371
* For each participant, the shortest distance (“as the crow flies”) and corresponding MBU was subsequently identified by determining the minimum distance across MBUs per subject.

For the MBU closest to each participant’s home residence the driving distance was manually calculated.

**Sample size calculation (see also Protocol paper Trevillion et al 2019)**

Our pilot data using the Clinical Record Interactive Search (CRIS) database (the anonymised Case Register local to King’s College Hospital, London) revealed the following for 20 perinatal women on generic acute wards, 20 admitted to MBUs and 20 under CRTs: acute ward patients were most likely to be readmitted to these services with 95% being readmitted at some point during 12-month follow-up, compared with 35% of women who received MBU or CRT care. Power of 90% would be obtained for a comparison of one-year readmission proportions of 0.35 (MBU) and 0.70 (acute ward) with just 47 women in each group with alpha=0.05 (Stata 16 sampsi). Our intention to recruit 100 women in each group provided allowance for loss to follow-up, exclusion of unmatchable cases excluded as beyond the region of support (i.e., whose characteristics make them unmatchable with women in another treatment arm—see below for further details), and power losses associated with propensity score adjustment.

**Further details on primary analysis methods**

*Propensity score*

Pre-specified variables in the propensity scores were explored blind to outcome data (see list of variables in Table 2), an advantage of this method of analysis. Two out of the 23 variables were continuous; age at consent which was normally distributed mean 31·5 (6·0 SD), and number of children between one and seven. Number of children was transformed by taking the square root, so a more continuous distribution was present. Following pro-rating for scales with sporadic missing items, 12 of 23 pre-specified variables had missing data ranging from 1-46 missing values, 11 of which were binary and one categorical. Iterative chained equations were used to impute missing values on these 12 variables, together with the other 11 complete variables in the model. A single imputed dataset (seed 123) with a burning of 10 cycles, logit models to impute the binary variables and *mlogit* to impute a categorical variable was used. The augment option was added to perform augmented regression in the presence of perfect prediction. One pre-specified binary predictor (mother ever adopted/fostered) with a high level of missingness and unstable imputation over multiple seeds was omitted, so 22 variables were included in the propensity score.

With the complete set of variables, the propensity score for MBU vs Non-MBU was computed using *pscore*. Rather than the *teffects* command at this stage to check the region of common support and balance between groups blind to outcome. Initial analysis suggested exclusion of 12 beyond the region of common support and that achieving convincing balance was non-trivial.

A weight was generated from the propensity score to examine if the propensity score reduced the imbalance of key variables across groups for participants in the region of common support (n=267). Each variable was summarised by group with and without the weighting (Table 3/Figure 3). From visual inspection number of children, detention under the Mental Health Act and Composite Abuse Scale scores were still slightly imbalanced after adjusting for propensity score, suggesting additional covariate adjustment for the effects of these variable would be appropriate.

**Table 2: Propensity Score Variables**

|  |
| --- |
| **Variable**  |

|  |
| --- |
| Axis 1 Diagnosis: Schizophrenia and related disorders (ICD F20-29) excluding acute psychotic episode as in the postpartum these are likely to represent affective psychosis) as primary or secondary diagnosis – yes or no |
| Personality disorder as primary or secondary diagnosis (F60-69) – yes or no  |
| Self-harm in the two weeks before admission – yes or no |
| Previous admissions in last two years – yes or no |
| Age of onset (i.e. contact with services) before age 18 – yes or no |
| Psychotic symptoms (composite variable of psychosis on Brief Psychiatric Rating Scale (BPRS) (i.e. hallucinations item 10) or Health Of the Nation Outcome Scale (HONOS) (hallucinations and/or delusions item 6) or Camberwell Assessment of Need-Mother’s Version (CAN-M) item 9 all at T0 – yes or no |
| Substance misuse (composite variable of CAN-M substance misuse unmet need or ICD-10 Code or HONOS substance misuse domain or yes to substance misuse within drug history form) – yes or no |
| Smoking – yes or no |
| Chronic physical health conditions – yes or no |
| Detention under Mental Health Act – yes or no |
| Childhood trauma (measured using the Childhood Trauma Questionnaire) – yes or no for any domain for moderate to severe abuse/neglect |
| Intimate partner violence (total score on composite abuse scale (measured using the Composite Abuse Scale) >3)  |
| Adopted/fostered as a child – yes or no \* |
| Living alone – yes or no |
| Partner at admission – yes or no |
| Age (continuous) |
| Ethnicity (categorical) |
| Insecure immigration status – yes or no |
| English not the primary language – yes or no |
| Highest qualification (categorical) |
| Learning disability or difficulty reading one’s own language – yes or no |
| Number of children (continuous) |
| Age of index child at index admission (categorical) |
| \*Omitted due to unstable imputation  |

**Table 3: Summary statistics of the imputed variables in the propensity score by cohort status (MBU VS Non-MBU) before and after propensity score adjustment (excluding those outside the region of common support, n=267). n (%) presented unless otherwise specified**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | Without propensity score adjustment | With propensity score adjustment |
| Variable  |  | MBU (n=108) | Non-MBU(n=159) | MBU(n=108) | Non-MBU(n=159) |
| Age at consent, mean (sd)  |  | 32·5 (5·8) | 31·0 (6·0) | 31·3 (5·9) | 30·7 (6·0) |
| Number of children Mean (sd) |  | 1·24 (0·36) | 1·30 (0·36) | 1·26 (0·36) | 1·39 (0·42) |
| Schizophrenia diagnosis n (%) | Yes | 9 (8) | 7 (4) | 4 (5) | 9 (5) |
| Personality disorder diagnosis n (%) | Yes | 14 (13) | 31 (20) | 11 (15) | 48 (25) |
| Self-injury two weeks before admission n (%) | Yes | 31 (29) | 53 (33) | 22 (30) | 73 (38) |
| Previous admission in last 2 years n (%) | Yes | 22 (20) | 26 (16) | 16 (22) | 36 (19) |
| Age of onset (i.e. contact with services) before age 18 n (%) | Yes | 16 (15) | 34 (21) | 17 (23) | 46 (24) |
| Psychotic symptoms n (%) | Yes | 80 (74) | 95 (60) | 50 (68) | 114 (59) |
| Substance misuse n (%) | Yes | 4 (4) | 17 (11) | 9 (13) | 39 (20) |
| Smoke n (%) | Yes | 26 (24) | 44 (28) | 22 (29) | 61 (32) |
| Any chronic physical health conditions n(%) | Yes | 50 (46) | 78 (49) | 37 (51) | 96 (50) |
| Detention under Mental Health Act n (%) | Yes | 53 (49) | 27 (17) | 20 (27) | 22 (11) |
| Childhood trauma (measured using the Childhood Trauma Questionnaire) n (%) | Yes | 52 (48) | 84 (53) | 31 (43) | 111 (57) |
| Intimate partner violence (total score on composite abuse scale >3) n (%) | Yes | 30 (28) | 55 (35) | 18 (25) | 84 (44) |
| Living Alone n(%) | Yes | 13 (12) | 29 (18) | 9 (12) | 49 (25) |
| Partner at admission n (%) | Yes | 92 (85) | 128 (81) | 63 (85) | 142 (73) |
| Insecure immigration status n (%) | Yes | 8 (7) | 4 (3) | 3 (4) | 2 (1) |
| English not the primary language n (%) | Yes | 80 (74) | 135 (85) | 61 (83) | 168 (86) |
| Learning disability or difficulty reading one’s own language n (%) | Yes | 10 (9) | 20 (13) | 6 (8) | 35 (18) |
| Ethnicity n (%) | White | 83 (77) | 121 (76) | 55 (76) | 137 (71) |
|  | Black | 11 (10) | 9 (6) | 9 (12) | 8 (4) |
|  | Asian | 8 (7) | 16 (10) | 3 (4) | 28 (14) |
|  | Mixed/multiple | 3 (3) | 6 (4) | 3 (5) | 8 (4) |
|  | Other | 3 (3) | 7 (4) | 2 (3) | 13 (7) |
| Highest qualification n (%) | GCSE or no formal qualifications | 23 (21) | 29 (18) | 13 (18) | 32 (16) |
|  | Age 18 school leaving qualifications | 43 (40) | 68 (43) | 25 (35) | 97 (50) |
|  | Higher education/professional qualifications | 42 (39) | 62 (39) | 35 (48) | 65 (34) |
| Age of index child at index admission n (%) | Admission before birth | 5 (5) | 5 (3) | 3 (4) | 4 (2) |
|  | 0-100 days | 80 (74) | 93 (59) | 40 (55) | 94 (49) |
|  | >100 days | 23 (21) | 61 (38) | 30 (41) | 95 (49) |

 **Figure 3: Plot of the mean of the binary variables in the propensity score before and after propensity score adjustment**

*Modelling of primary outcome*

Following evidence of achieving balance using the developed propensity score, we included the selected predictor set within Stata *teffects aipw*, a procedure that recomputed the propensity scores, formed them into inverse-probability of treatment weights (IPTW) and estimated the Average Treatment Effect (ATE) (log-odds for readmission) and the potential outcomes for the “treated” and “untreated”. The AIPW estimator is an inverse-probability of treatment approach that includes an augmentation term that corrects the estimator when the treatment model is misspecified. The estimators are based on those of Rubin and van der Laan (2008), which did well in simulations reported by Tan (2010, 663). 1, 2 The *teffects* procedure also allowed for selective inclusion of covariate adjustment. Three variables (number of children, detention under the Mental Health Act and Composite Abuse Scale) were identified as the most unbalanced after propensity score weighting making the accounting for imbalance doubly robust; and six (personality disorder, ethnicity (other), learning disability, age of child at admission, partner, living alone) were selected as baseline predictors likely to increase power. Confidence intervals and significance tests were based on the sandwich estimator of the parameter covariance matrix. Fifteen women were excluded from the ATE estimate as beyond the region-of-support (see Sensitivity Analysis section below). Post-estimation commands were used for diagnostic checks. One assumption of this analysis was that each individual has a positive probability of receiving each treatment level (the overlap assumption). After exclusions through a region of support restriction, this assumption was not violated (see Figure 4). The balance of covariates over treatment groups was also checked using the ‘teffects summarize’ command.

**Figure 4: Overlap in distributions of propensity scores by service**



**Sensitivity analyses**

**Missing Data Sensitivity Analysis**: The large number of propensity score variables, some binary with low proportions, and the modest sample size resulted in inconsistent chained-equation imputation convergence. The properties of MI estimates from incomplete imputation replication sets are not known. A sensitivity analysis was performed with single imputation for 3 different imputation model seeds. Estimates obtained all met the balancing criterion and yielded log-odds treatment effect estimates that varied by +/- 0·01 Odds Ratio. The primary analysis was also repeated using complete data cases rather than the single imputed dataset and results were almost identical (OR: 0.94; 95% CI 0.86 to 1.03).

**Effect Estimator Sensitivity Analyses:** Robustness of the effect estimate to changes in estimator was also examined, by using different ATE estimators; block stratification, nearest neighbour and radius estimators (*atts*, *attr* and *attn*). While yielding larger standard errors than *teffects aipw*, the effect estimates themselves changed little*.*

**Cohort Classification Sensitivity Analysis:**We ran two further sensitivity analyses on the primary analysis changing the classification of women who, during their index admission, attended both MBU and ward services. This was done to examine whether the way in which women were classified as in the ‘MBU’ or ‘ward’ cohort may have influenced our results. Table 4 shows the composition of these alternative cohorts. There were 45 women who used both MBU and ward during their index admission; 20 who used an MBU and a ward and 25 who used all three services.

Finally, we added length of stay (total number of days in services during the index admission period – Table 1) as a covariate to our primary analysis model. This also showed no difference between groups (OR: 1.04, 95% CI 0.53 to 2.04).

**Table 4: Alternative definitions of cohort status used in sensitivity analyses**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Highest level of care**  | **Majority of days spent**  | **First service accessed**  |
| **Cohort** |  |  |  |
| **MBU** | 108 | 96 | 75 |
| **Ward** | 62 | 74 | 95 |
| **CRT** | 109 | 109 | 109 |
| **Total** | 279 | 279 | 279 |

12 out of the 45 women who were admitted to both MBU and ward during the index admission spent more time in the ward. Four out of these 12 women were admitted to an intensive care unit (ICU) during their index admission period (N.B. Any admissions into intensive care units were classified as acute ward). 33 out of the 45 women who were admitted to both an MBU and ward during the index admission accessed the ward first. Seven women changed cohort service in both circumstances, they spent more time in a ward and accessed the ward first, and two of these women were admitted to an ICU. One woman who attended ward first but spent majority of days in MBU was admitted to an ICU.

**Primary analysis using majority of days spent**

The primary analysis was re-run using the definition of MBU as those who spent the majority of their days in service at an MBU (see Table 5 below). Readmission rates at 12 months post-discharge were 22% in women who spent the majority of their days under MBU services (n=96), and 25% in women who spent the majority of their days in either an acute ward or CRT (Non-MBU) (n=182).

To maximise the power and robustness of the analysis, the same methods were used as for the primary analysis (see details in main paper and above). Single imputation was performed, propensity scores were formed blind to the outcome, and predictors were obtained excluding those out of the region of common support. Predictors in this case were personality disorder and ethnicity (other) only. These were adjusted for in addition to any covariates that visually had the potential to be imbalanced after propensity score adjustment (Composite Abuse Scale >3 yes/no). The findings are very similar to those when the classification is defined as highest level of care (i.e. MBU admission). The odds for readmissions to acute care at 12-months post-discharge were 0.97 (OR 0.97; 95% CI 0.88-1.06) lower in MBU women than Non-MBU women (n=263).

**Primary analysis using first service accessed**

The primary analysis was re-run using the definition of MBU as those who accessed an MBU first out of their time in all services during the admission period (see Table 5 below). Readmission rates at 12 months post-discharge were 23% in women who first accessed an MBU services (n=75), and 25% in women who first accessed either an acute ward or CRT (Non-MBU) (n=203). These are very similar to those rates split by the MBU status defined by highest level of care.

To maximise the power and robustness of the analysis, the same methods were used as for the primary analysis (see details in main paper and above). Single imputation was performed, propensity scores were formed blind to the outcome, and predictors were obtained excluding those out of the region of common support. Predictors in this case were personality disorder, ethnicity (other), level of qualification and age of child at admission which were adjusted for. There were not any covariates that visually had the potential to be imbalanced after propensity score adjustment. The odds for readmissions to acute care at 12-months post-discharge were 0.99 (OR 0.99; 95% CI 0.88-1.10) lower in MBU women than Non-MBU women (n=263).

**Table 5: Sensitivity analysis results on the primary outcome (readmission at 1 year post-discharge)**

|  | **MBU** | **Non-MBU** | **Total** | **Odds Ratio (95% CI)** |
| --- | --- | --- | --- | --- |
| **N** | **n(%)** | **N** | **n(%)** | **n** | **n(%)** |
| **Majority of days spent** |  |  |  |  |  |  |  |
| Readmission¥ - n(%)n=278/n\*=263 | 96 | 21 (22) | 182 |  46 (25) | 278 | 67 (24) | 0·97 (0·88 – 1·06) |
| **First service accessed** |  |  |  |  |  |  |  |
| Readmission¥ - n(%)n=278/n\*=263 | 75 | 17 (23) | 203 | 50 (25) | 278 | 67 (24) | 0·99 (0·88 – 1·10) |

**Other**

**Women outside region of common support**

Fifteen women were excluded from the primary analysis due to being outside the region of common support, i.e. their propensity score was either so high or so low there were insufficient similar women receiving the alternative treatment to make a comparison. Out of the 15 women, 13 had a low propensity score (low probably of attending an MBU) and 2 had a very high propensity score.

Table 6 provides a baseline description for variables of interest comparing women who were included in the analysis against women who were excluded from the analysis due to a very low propensity score. The data shows for these women it was most likely not their first episode of a psychiatric disorder, their first admission was when they were younger than 18 years old, but they had not had any admissions in the previous two years. They had a high probability of substance misuse, most had other physical health complications, and all the women were admitted when their baby was more than 100 days old.

**Table 6: ESMI MBU baseline measures comparing those included in primary analysis against those excluded from primary analysis due to a low propensity score (outside region of common support) (n=276)**

|  |  | **Included****(n=263)** | **Excluded\*****(n=13)** | **Total****(n=276)** |
| --- | --- | --- | --- | --- |
| **Variable** |  |  |  |  |
| Any previous admissions in last 2 years - n (%) (N=276)  | No | 217 (83)  | 12 (92)  | 229 (83)  |
| Yes | 46 (18)  | 1 (8)  | 47 (17)  |
| First episode of psychiatric disorder - n (%) (N=275)  | No | 182 (70)  | 11 (85)  | 193 (70)  |
| Yes | 80 (31)  | 2 (15)  | 82 (30)  |
| Age at first contact with mental health services <18 years - n (%) (N=267)  | No | 208 (82)  | 6 (46)  | 214 (80)  |
| Yes | 46 (18)  | 7 (54)  | 53 (20)  |
| Placed under section during admissions (index and 2 years prior admissions) - n (%) (N=276)  | No | 185 (70)  | 13 (100)  | 198 (72)  |
| Yes | 78 (30)  | 0 (0)  | 78 (28)  |
| Smoked at point of admission - n (%) (N=267)  | No | 190 (75)  | 8 (62)  | 198 (74)  |
| Yes | 64 (25)  | 5 (39)  | 69 (26)  |
| Substance misuse - n (%) (N=276)  | No | 243 (92)  | 3 (23)  | 246 (89)  |
| Yes | 20 (8)  | 10 (77)  | 30 (11)  |
| Any chronic physical health conditions - n (%) (N=276)  | No | 138 (53)  | 2 (15)  | 140 (51)  |
| Yes | 125 (48)  | 11 (85)  | 136 (49)  |
| Primary clinical diagnosis at admission - n (%) (N=276)  | Depression and other unipolar mood disorders (F32, F33, F34, F38, F39) | 103 (39)  | 6 (46)  | 109 (40)  |
| Bipolar disorder (F30; F31) including acute psychosis (due to psychopathology of puerperal psychosis) | 71 (27)  | 1 (8)  | 72 (26)  |
| Schizophrenia and related disorders (F20-29 excluding acute psychotic episode) | 16 (6)  | 1 (8)  | 17 (6)  |
| Anxiety disorders (F40 and F41) | 36 (14)  | 3 (23)  | 39 (14)  |
| Eating disorders (F50) | 1 (0)  | 0 (0)  | 1 (0)  |
| Severe mental and behavioural disorders associated with the puerperium (F53) | 14 (5)  | 0 (0)  | 14 (5)  |
| Mental and behavioural disorder due to multiple/psychoactive drug use/cannabis/tobacco (F10-19) | 1 (0)  | 0 (0)  | 1 (0)  |
| Personality and behaviour disorders (F60-69) | 18 (7)  | 2 (15)  | 20 (7)  |
| No diagnosis given | 3 (1)  | 0 (0)  | 3 (1)  |
| Age of child at date of first admission - n (%) (N=275)  | Admission before birth | 10 (4)  | 0 (0)  | 10 (4)  |
| 0-100 days | 170 (65)  | 1 (8)  | 171 (62)  |
| >100 days | 82 (31)  | 12 (92)  | 94 (34)  |
| CAS Total >3 - n (%) (N=246)  | No | 166 (71)  | 6 (55)  | 172 (70)  |
| Yes | 69 (29)  | 5 (46)  | 74 (30)  |
| \*due to low propensity score |

**Additional detailed baseline descriptive characteristics**

**Table 7: Additional Sample demographic and clinical characteristics (n=279 participants) by cohort allocation**

|  |  | **CRT****(n=109)** | **Ward****(n=62)** | **MBU****(n=108)** | **Total****(n=279)** |
| --- | --- | --- | --- | --- | --- |
| **Variable** |  |  |  |  |  |
| Adopted/fostered as a child - n (%) (N=233) | Yes | 3 (3) | 6 (11) | 5 (6) | 14 (6) |
| A&E first contacted - n(%)(N=278) | Yes | 27 (25) | 22 (36) | 27 (25) | 76 (27) |
| Any police contact - n(%)(N=278) | Yes | 3 (3) | 6 (10) | 2 (2) | 11 (4) |

**Table 8: TAG variables**

| **Variable** |  | **CRT** | **Ward** | **MBU** | **Total** |
| --- | --- | --- | --- | --- | --- |
| **TAG** |  |  |  |  |  |
| Total TAG Score - median (IQR) (N = 278)  |  | 9·0 (7·0-11·0)  | 12·0 (10·0-18·0)  | 11·0 (9·0-14·0)  | 10·0 (8·0-14·0)  |
| Total TAG Score - mean (sd) (N = 278)  |  | 9·6 (4·0)  | 13·3 (5·1)  | 11·6 (4·0)  | 11·2 (4·5)  |
| TAG Domain 1: Intentional self-harm - n(%) (N = 278)  | 0. None rating - No concerns about risk of deliberate self-harm or suicide concept | 23 (21)  | 17 (27)  | 33 (31)  | 73 (26)  |
|  | 1. Mild rating - Minor concerns about risk of deliberate self-harm or suicide attempt | 34 (32)  | 13 (21)  | 21 (19)  | 68 (25)  |
|  | 2. Moderate rating - Definite indicators of risk of deliberate self-harm or suicide attempt | 29 (27)  | 13 (21)  | 25 (23)  | 67 (24)  |
|  | 3. Severe rating - High risk to physical safety as a result of deliberate self-harm or suicide attempt | 9 (8)  | 5 (8)  | 13 (12)  | 27 (10)  |
|  | 4. Very severe rating - Immediate risk to physical safety as a result of deliberate self-harm or suicide attempt | 13 (12)  | 14 (23)  | 16 (15)  | 43 (16)  |
| TAG Domain 2: Unintentional self-harm - n(%) (N = 278)  | 0. None rating - No concerns about unintentional risk to physical safety | 15 (14)  | 5 (8)  | 12 (11)  | 32 (12)  |
|  | 1. Mild rating - Minor concerns about unintentional risk to physical safety | 68 (63)  | 25 (40)  | 54 (50)  | 147 (53)  |
|  | 2. Moderate rating - Definite indicators of unintentional risk to physical safety | 22 (20)  | 20 (32)  | 32 (30)  | 74 (27)  |
|  | 3. Severe rating - High risk to physical safety as a result of self-neglect, unsafe behaviour or inability to maintain a safe environment | 3 (3)  | 12 (19)  | 10 (9)  | 25 (9)  |
|  | 4. Very severe rating - Immediate risk to physical safety as a result of deliberate self-harm or suicide attempt | 0 (-) | 0 (-) | 0 (-) | 0 (-) |
| TAG Domain 3: Risk from others- n(%) (N = 278)  | 0. None rating - No concerns about risk of abuse or exploitation from other individuals or society | 68 (63)  | 29 (47)  | 58 (54)  | 155 (56)  |
|  | 1. Mild rating - Minor concerns about risk of abuse or exploitation from other individuals or society | 18 (17)  | 17 (27)  | 27 (25)  | 62 (22)  |
|  | 2. Moderate rating - Definite risk of abuse or exploitation from other individuals or society | 11 (10)  | 4 (7)  | 12 (11)  | 27 (10)  |
|  | 3. Severe rating - Positive evidence of abuse or exploitation from other individuals or society | 11 (10)  | 12 (19)  | 11 (10)  | 34 (12)  |
|  | 4. Very severe rating - Immediate risk to physical safety as a result of deliberate self-harm or suicide attempt | 0 (-) | 0 (-) | 0 (-) | 0 (-) |
| TAG Domain 4: Risk to others - n(%) (N = 278)  | 0. None rating - No concerns about risk to physical safety or property of others | 84 (78)  | 31 (50)  | 59 (55)  | 174 (63)  |
|  | 1. Mild rating - Antisocial behaviour | 15 (13·9)  | 17 (27·4)  | 16 (14·8)  | 48 (17)  |
|  | 2. Moderate rating - Risk to property and/or minor risk to physical safety to others | 7 (7)  | 8 (13)  | 15 (14)  | 30 (11)  |
|  | 3. Severe rating - High risk to physical safety of others as a result of dangerous behaviour | 2 (2)  | 5 (8)  | 16 (15)  | 23 (8)  |
|  | 4. Very severe rating - Immediate risk to physical safety of others as a result of dangerous behaviour | 0 (0)  | 1 (2)  | 2 (2)  | 3 (1)  |
| TAG Domain 5: Risk to child(ren) - n(%) (N = 278)  | 0. None rating - No concerns about risk to physical or emotional safety of child | 1 (1)  | 0 (0)  | 0 (0)  | 1 (0)  |
|  | 1. Mild rating - Minor concerns about unintentional risk to physical or emotional safety of child | 42 (39)  | 17 (27)  | 34 (32)  | 93 (34)  |
|  | 2. Moderate rating - Indicators of risk to physical or emotional safety of child | 38 (35)  | 20 (32)  | 38 (35)  | 96 (35)  |
|  | 3. Severe rating - Positive evidence of physical or emotional harm | 21 (19)  | 5 (8)  | 29 (27)  | 55 (20)  |
|  | 4. Very severe rating - Evidence of severe physical or emotional harm | 6 (6)  | 20 (32)  | 7 (7)  | 33 (12)  |
| TAG Domain 6: Survival - n(%) (N = 278)  | 0. None rating - No concerns about basic amenities, resources or living skills | 74 (69)  | 32 (52)  | 71 (66)  | 177 (64)  |
|  | 1. Mild rating - Minor concerns about basic amenities, resources or living skills | 16 (15)  | 12 (19)  | 18 (17)  | 46 (17)  |
|  | 2. Moderate rating - Marked lack of basic amenities, recources or living skills | 9 (8)  | 6 (10)  | 15 (14)  | 30 (11)  |
|  | 3. Severe rating - Serious lack of basic amenities, resources or living skills | 8 (7)  | 9 (15)  | 3 (3)  | 20 (7)  |
|  | 4. Very severe rating - Life-threatening lack of basic amenities, resources or living skills | 1 (1)  | 3 (5)  | 1 (1)  | 5 (2)  |
| TAG Domain 7: Psychological - n(%) (N = 278) | 0. None rating - No concerns about basic amenities, resources or living skills | 0 (-) | 0 (-) | 0 (-) | 0 (-) |
|  | 1. Mild rating - Minor concerns about basic amenities, resources or living skills | 0 (-) | 0 (-) | 0 (-) | 0 (-) |
|  | 2. Moderate rating - Disabling or distressing problems with thinking | 82 (76)  | 19 (31)  | 45 (42)  | 146 (53)  |
|  | 3. Severe rating - Very disabling or distressing problems with thinking, feeling or behaviour | 26 (24)  | 43 (69)  | 63 (58)  | 132 (48)  |
|  | 4. Very severe rating - Life-threatening lack of basic amenities, resources or living skills | 0 (-) | 0 (-) | 0 (-) | 0 (-) |
| TAG Domain 8: Social - n(%) (N = 278)  | 0. None rating - No disabling problems with activities or in relationships with other people | 31 (29)  | 1 (2)  | 1 (1)  | 33 (12)  |
|  | 1. Mild rating - Minor disabling problems with activities or in relationships with other people | 30 (28)  | 17 (27)  | 47 (44)  | 94 (34)  |
|  | 2. Moderate rating - Disabling problems with activities or in relationships with other people | 42 (39)  | 31 (50)  | 51 (47)  | 124 (45)  |
|  | 3. Severe rating - Very disabling problems with activities or in relationships with other people | 5 (5)  | 13 (21)  | 9 (8)  | 27 (10)  |
|  | 4. Very severe rating - Life-threatening lack of basic amenities, resources or living skills | 0 (-) | 0 (-) | 0 (-) | 0 (-) |
| **TAG - Binary** |  |  |  |  |  |
| TAG Domain 1: Intentional self-harm - n(%) (N = 278)  | Moderate to very severe rating | 51 (47)  | 32 (52)  | 54 (50)  | 137 (49)  |
| TAG Domain 2: Unintentional self-harm - n(%) (N = 278)  | Moderate to very severe rating | 25 (23)  | 32 (52)  | 42 (39)  | 99 (36)  |
| TAG Domain 3: Risk from others - n(%) (N = 278)  | Moderate to very severe rating | 22 (20)  | 16 (26)  | 23 (21)  | 61 (22)  |
| TAG Domain 4: Risk to others - n(%) (N = 278)  | Moderate to very severe rating | 9 (8)  | 14 (23)  | 33 (31)  | 56 (20)  |
| TAG Domain 5: Risk to child(ren) - n(%) (N = 278)  | Moderate to very severe rating | 65 (60)  | 45 (73)  | 74 (69)  | 184 (66)  |
| TAG Domain 6: Survival - n(%) (N = 278)  | Moderate to very severe rating | 18 (17)  | 18 (29)  | 19 (18)  | 55 (20)  |
| TAG Domain 7: Psychological - n(%) (N = 278)  | Moderate to very severe rating | 108 (100)  | 62 (100)  | 108 (100)  | 278 (100)  |
| TAG Domain 8: Social - n(%) (N = 278)  | Moderate to very severe rating | 47 (44)  | 44 (71)  | 60 (56)  | 151 (54)  |

**Table 9: BPRS variables**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Variable** |  | **CRT** | **Ward** | **MBU** | **Total** |
| **BPRS** |  |  |  |  |  |
| Total BPRS Score - mean (sd) (N = 278)  |  | 7·7 (3·4)  | 10·5 (3·6)  | 10·3 (3·9)  | 9·4 (3·9)  |
| 1. Somatic concern - n(%) (N = 278)  | Present | 36 (33)  | 23 (37)  | 35 (32)  | 94 (34)  |
| 2. Anxiety - n(%) (N = 278)  | Present | 96 (89)  | 47 (76)  | 96 (89)  | 239 (86)  |
| 3. Depression - n(%) (N = 278)  | Present | 100 (93)  | 55 (89)  | 96 (89)  | 251 (90)  |
| 4. Suicidality - n(%) (N = 278)  | Present | 82 (76)  | 39 (63)  | 70 (65)  | 191 (69)  |
| 5. Guilt - n(%) (N = 278)  | Present | 59 (55)  | 20 (32)  | 43 (40)  | 122 (44)  |
| 6. Hostility - n(%) (N = 278)  | Present | 40 (37)  | 35 (57)  | 54 (50)  | 129 (46)  |
| 7. Elevated mood - n(%) (N = 278)  | Present | 8 (7)  | 21 (34)  | 22 (20)  | 51 (18)  |
| 8. Grandiosity - n(%) (N = 278)  | Present | 7 (7)  | 7 (11)  | 11 (10)  | 25 (9)  |
| 9. Suspiciousness - n(%) (N = 278)  | Present | 33 (31)  | 36 (58)  | 57 (53)  | 126 (45)  |
| 10. Hallucinations - n(%) (N = 278)  | Present | 25 (23)  | 35 (57)  | 57 (53)  | 117 (42)  |
| 11. Unusual thought content - n(%) (N = 278)  | Present | 49 (45)  | 43 (69)  | 75 (69)  | 167 (60)  |
| 12. Bizarre behaviour - n(%) (N = 278)  | Present | 23 (21)  | 27 (44)  | 47 (44)  | 97 (35)  |
| 13. Self-neglect - n(%) (N = 278)  | Present | 64 (59)  | 43 (69·4)  | 71 (66)  | 178 (64)  |
| 14. Disorientation - n(%) (N = 278)  | Present | 7 (7)  | 14 (23)  | 31 (29)  | 52 (19)  |
| 15. Conceptual disorganization - n(%) (N = 278)  | Present | 11 (10)  | 21 (34)  | 39 (36)  | 71 (26)  |
| 16. Blunted affect - n(%) (N = 278)  | Present | 33 (31)  | 21 (34)  | 33 (31)  | 87 (31)  |
| 17. Emotional withdrawal - n(%) (N = 278)  | Present | 23 (21)  | 21 (34)  | 40 (37)  | 84 (30)  |
| 18. Motor retardation - n(%) (N = 278)  | Present | 27 (25)  | 12 (19)  | 36 (33)  | 75 (27)  |
| 19. Tension - n(%) (N = 278)  | Present | 38 (35)  | 28 (45)  | 55 (51)  | 121 (44)  |
| 20. Uncooperativeness - n(%) (N = 278)  | Present | 22 (20)  | 28 (45)  | 47 (44)  | 97 (35)  |
| 21. Excitement - n(%) (N = 278)  | Present | 14 (13)  | 17 (27)  | 27 (25)  | 58 (21)  |
| 22. Distractibility - n(%) (N = 278)  | Present | 15 (14)  | 16 (26)  | 23 (21)  | 54 (19)  |
| 23. Motor hyperactivity - n(%) (N = 278)  | Present | 21 (19)  | 30 (48)  | 42 (39)  | 93 (34)  |
| 24. Mannerisms and posturing - n(%) (N = 278)  | Present | 3 (3)  | 13 (21)  | 10 (9)  | 26 (9)  |

**Additional post-discharge measures**

**Table 10: Composite Abuse Scale and Social Provisions Scale at 1-month post-discharge**

| **Variable** |  | **CRT** | **Ward** | **MBU** | **Total** |
| --- | --- | --- | --- | --- | --- |
| Composite Abuse Scale Total >3 (Intimate Partner Violence) - n (%) (N = 235)  | No | 75 (79)  | 42 (78)  | 73 (85)  | 190 (81)  |
| Yes | 20 (21)  | 12 (22)  | 13 (15)  | 45 (19)  |
| Social Provisions Scale Total Score (N = 235)  |  | 80·4 (9·8)  | 76·0 (13·4)  | 77·2 (10·1)  | 78·2 (10·9)  |

**Table 11: Additional measures at 1-year post-discharge**

| **Variable** |  | **CRT** | **Ward** | **MBU** | **Total** |
| --- | --- | --- | --- | --- | --- |
| Placed under section at 1 year post-discharge - n (%) (N = 279)  | No | 106 (97)  | 58 (94)  | 104 (96)  | 268 (96)  |
|  | Yes | 3 (3)  | 4 (7)  | 4 (4)  | 11 (4)  |

**Secondary outcome measures**

**Analysis of the Bayley Scales of Infant and Toddler Development**

**Table 12: Bayley’s composite scores, mean (SD), by MBU and Non-MBU participants**

|  |  |  |  |
| --- | --- | --- | --- |
| **Bayley’s composite scale**  | **Non-MBU** | **MBU** | **Total** |
|  | N | mean(sd) | N | mean(sd) | N | mean(sd) |
| Cognitive  | 114 | 102·3 (14·4) | 72 | 104·6 (11·9) | 186 | 103·2 (13·5) |
| Language  | 112 | 91·9 (11·2) | 70  | 92·4 (12·8) | 182 | 92·1 (11·8) |
| Motor | 108 | 97·4 (13·7) | 68 | 96·2 (11·2) | 176 | 96·9 (12·8) |
| Socio-emotional | 110 | 102·9 (16·1) | 69 | 99·8 (15·2) | 179 | 101·7 (15·8) |

The results for analysis on the Bayley scale composite scores after propensity score adjustment are shown in Table 13; while the Bayley infant language composite scores were low, no MBU v non-MBU differences in any of the four composite scores were found (see below). The models also adjust for baby gender.

### Table 13: Treatment group differences with 95% CI and p value for the Bayley scale composite scores: Simple linear regression models with propensity scores.

|  |  |  |
| --- | --- | --- |
| **Bayley composite scale**  | **Difference (95% CI)** | **P value**  |
| Cognitive n=185 / n\*=176 | 3·48 (-0·37 – 7·32) | 0·08 |
| Language n=181 / n\*=171 | 1·07 (-3·24 – 5·38) | 0·63 |
| Motorn=175 / n\*=166 | -2·04 (-5·75 – 1·66) | 0·28 |
| Social-emotionaln=178 / n\*=170 | -2·58 (-6·73 – 1·57) | 0·22 |

n = Available data
n\* = Available data minus those excluded due to region of common support

**References for Main Statistical Analysis Section**

1. Rubin DB, MJ VdL. Empirical efficiency maximization: Improved locally efficient covariate adjustment in randomized experiments and survival analysis. International Journal of Biostatistics. 2008;4: 1–40

2. Z T. Bounded, efficient and doubly robust estimation with inverse weighting. Biometrika. 2010;97: 661–682.

**Economic evaluation methods**

***Aims and overview***

The economic evaluation aimed to assess the cost-effectiveness of Mother and Baby Units (MBUs) compared to generic acute psychiatric wards and crisis resolution teams for the treatment of women with severe mental illness following birth within a quasi-experimental cohort study. The research questions were:

1. Are MBUs cost-effective in the short-term (from index admission to 1-month post discharge) in the treatment of women with severe mental illness following birth compared to generic acute psychiatric wards and crisis resolution teams?
2. Are MBUs cost-effective in the longer-term (from index admission to 12-month post discharge) in the treatment of women with severe mental illness following birth compared to generic acute psychiatric wards and crisis resolution teams?

The planned comparisons were two two-way comparisons (MBU versus acute wards and MBU versus CRT), plus a three-way comparison. However, due to small sample sizes, comparison of MBUs versus both other groups combined were conducted.

***Perspective***

The economic evaluation at 1-month post discharge took the NHS/Personal Social Services perspective preferred by NICE (National Institute for Health and Care Excellence, 2013). Data relating to the 12-month post discharge follow-up point took a narrower mental health service perspective, since data were restricted to those available via mental health clinical records.

***Data collection***

An adapted version of AD-SUS was used to measure individual-level resource use at 1-month post discharge. The AD-SUS was developed in previous research for use with people with mental health problems (e.g.3,4 5) and adapted for the purpose of this study to include service use by the infant and services related to the birth. The AD-SUS was adapted and piloted in a relevant population as part of the ESMI NIHR programme development grant4. The AD-SUS was collected in face-to-face interviews with participants and covered the period from the date of initial index admission to the 1-month post discharge interview. It included all-cause hospital and community-based health and social care services for the woman and her index baby. This included accommodation provided by the NHS or Local Authorities, services for looked after children (fostering, adoption, formal kinship etc.), hospital services (inpatient stays, outpatient appointments, day patient contacts, accident and emergency contacts), community health and social care contacts (e.g. GP, midwife, community mental health team), and mental health related medication use.

Since the acute care index admission in this study was the intervention, and since the development work indicated that this can be difficult for women to recall, data on all index acute care admissions (MBU, psychiatric wards, CRT contacts) to the 1-month post discharge interview were taken from clinical notes.

Resource use data for the period from the date of discharge from the index admission to the 12-month post discharge follow-up point were collated using a proforma created by the research team and collected from secondary mental health records. This included all contacts with secondary mental health services including further periods in MBUs, generic acute psychiatric wards or CRTs plus any outpatient or community mental health contacts. A briefer version of the proforma was used to collect baseline data on the use of key acute care (MBUs, generic acute psychiatric wards or crisis resolution teams) in the 2-year period prior to the index admission.

***Costs***

All costs are reported in pounds sterling at 2015/16 prices. Discounting was not relevant to the short-term cost-effectiveness analysis as the follow-up did not exceed 12 months. Discounting was relevant to the cost-effectiveness analysis from index admission to 12 months post-discharge, but as index admission had varying lengths, discounting could not be applied reliably to the resources used after 12 months. Unit costs were applied to individual-level resource use data to calculate total costs per participant. In summary, the unit costs for most health and social care services were obtained from the NHS Reference costs6 , Unit Costs of Health and Social Care7 and the Prescription Cost Analysis8 (see table below).

***Outcomes***

The primary economic measure of outcome was quality-adjusted life years (QALYs) calculated using the five-level version of the EuroQol measure of health-related quality of life.9 The EQ-5D-5L was assessed via self-report at the 1-month post-discharge interview and by phone at 12-months post discharge. The 36 item Short Form Health Survey (SF-36)10 was additionally collected via self-report at 1-month post-discharge and was used to derive the SF-6D. Baseline EQ-5D-5L and SF-6D data were not collected as participants were in crisis at the time of recruitment to the study and it was not appropriate to approach them for research purposes. Therefore, we applied published baseline utility values from a similar population (women in crisis;3). Appropriate utility weights were attached to EQ-5D-5L and SF-6D health states11 12 and QALYs were calculated using the total area under the curve approach with linear interpolation between assessment points.13

***Analysis***

Data were analysed using STATA (2011). In line with the clinical analyses, groups were defined by “highest level of care” they received with MBUs classified as the ‘highest level of care’, followed by generic acute psychiatric wards, followed by CRTs. Also in line with the clinical analyses, we made use of a propensity score approach. Propensity scores were used to account for systematic differences between MBU and non-MBU participants using the Stata command pscore. Participants with no “matches” (i.e. women with propensity scores either so high or so low that there are insufficient similar women receiving either MBU or non-MBU treatment to make a comparison) were removed from the sample, again in line with the clinical analysis. This approach has been used in other economic evaluations13 and has been found to eliminate a greater degree of the systematic differences between treated and untreated subjects compared with stratification on the propensity score and adjusting for covariates using the propensity score (Austin, 2009). As with the clinical analysis, 22 pre-specified variables were used to create this cohort. Each economic analysis had a new propensity score created as each economic analysis had a different number of participants due to missing data, which influences the propensity scoring.

***Missing data***

Where the whole AD-SUS, EQ-5D-5L or SF-6D was missing, this remained missing and the participant was excluded from the complete case analysis. Within the AD-SUS, where there were missing components on a particular resource item, meaning a cost for that item could not be calculated, the mean cost for that item of resource for the same group was used. This was only done where at least 80% of the AD-SUS was complete. A single missing item on the EQ-5D-5L and SF-6D was replaced with the mean response for that item for the same group but where more than one item was missing, the participant was excluded from the complete case analysis.

***Analysis of costs and outcomes***

Costs were calculated for the period from index admission to 1-month post-discharge, discharge to 12-months post discharge, and index admission to 12-months post discharge. Costs and outcomes are presented as mean values with standard deviations by group. Mean differences and 95% confidence intervals (CIs) were obtained by non-parametric bootstrap regressions (10,000 repetitions, bias-corrected) to account for non-normally distributed data commonly found in economic data. To provide more relevant treatment-effect estimates14, regressions to calculate mean differences were repeated with the inclusion of covariates for the baseline value of the relevant variable (where available) plus variables included in the main clinical analysis. Further, follow-up length was included as a covariate.

***Cost-effectiveness analysis***

The primary economic evaluation was a complete case (i.e. excluding those lost to follow-up or with missing AD-SUS, EQ-5D-5L or SF-6D data) cost-effectiveness analysis based on EQ-5D-5L based QALYs at 1-month post discharge. Incremental cost-effectiveness ratios (ICERs) were calculated where either higher or equivalent costs and better or equivalent outcomes in either the intervention group or control group are demonstrated (it is unnecessary to calculate ICERs for any combinations where one group shows both lower costs and better outcomes as it is then considered to ‘dominate’ the other group).

Uncertainty was explored using cost-effectiveness planes and cost-effectiveness acceptability curves (CEACs) based on the net-benefit approach .15 These curves are an alternative to confidence intervals around ICERs and show the probability that one intervention is cost-effective compared to the other, for a range of values that a decision maker would be willing to pay for an additional unit of an outcome. A series of net benefits were calculated for each individual for a range of values for willingness to pay for a unit improvement on the outcome. After calculating net benefits for each participant for each value of willingness to pay, coefficients of differences in net benefits between the groups were obtained through a series of bootstrapped linear regressions (10,000 repetitions, bias corrected). The resulting coefficients are then used to calculate the proportion of times that the intervention group had a greater net benefit than the control group for each value of willingness to pay. These proportions are then plotted to generate CEACs for all cost-outcome combinations. All cost-effectiveness analyses included co-variates added to comparisons of costs and outcomes.

***Sensitivity analyses***

The primary economic analysis was a complete-case analysis (i.e. excluding those lost to follow-up or with missing ADSUS, EQ-5D-5L or SF-6D data). To explore the potential impact of excluding non-responders, the primary economic analysis was repeated including those lost to follow-up by imputing missing total costs and QALYs using single imputation (imputation command in STATA). Additionally, the 1-month post discharge cost-effectiveness analyses were repeated replacing the EQ-5D-5L based QALYs with SF-6D based QALYs.

***Deviations from the health economic analysis plan***

In our health economic analysis plan and protocol paper, we stated we would evaluate whether MBU services are cost-effective in the short term (from index admission to 1-month post discharge) and the longer term (from discharge from the index admission to 12-month post discharge) as analysis from admission to 12 months was not considered appropriate because lengths of index admission may vary greatly, which would heavily influence the total cost and thus the results of the cost-effectiveness analysis. However, in retrospect we acknowledged that analysis from index admission to 12-months would be preferable as it takes into account the cost of the intervention, and thus we amended our analysis at 12-months post discharge to cover the whole period from index admission to 12-months post-discharge.

***Unit costs***

Table: Unit costs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Resource** | **Unit** | **Cost (£)** | **Source** | **Notes** |
| **Section A** |  |  |  |  |
| ***Maternal assessment unit*** |  |  |  |  |
| Maternal assessment unit | per day | 241 | 1 | Day cases tab - Ante-natal routine observation (currency code: NZ16Z). |
| Maternal assessment unit | per night | 1054 | 1 | Non-elective long stay tab - Ante-natal routine observation (currency code: NZ16Z) |
| ***Birth*** |  |  |  |  |
| **Normal delivery** |  |  |  |  |
| Hospital delivery, Normal Delivery  | per event | 2476 | 1 | Non-elective long stay tab - Normal Delivery with CC Score 0 (currency code: NZ30C). |
| Hospital delivery, Normal Delivery, with Epidural or Induction | per event | 2742 | 1 | Non-elective long stay tab - Normal Delivery, with Epidural or Induction, with CC Score 0 (currency code: NZ31C). |
| Hospital delivery, Normal Delivery, with Epidural and Induction | per event | 3093 | 1 | Non-elective long stay tab - Normal Delivery, with Epidural and Induction, or with Post-Partum Surgical Intervention, with CC Score 0 (currency code: NZ32C). |
| **Assisted delivery** |  |  |  |  |
| Hospital delivery, Assisted Delivery | per event | 2777 | 1 | Non-elective long stay tab - Assisted Delivery with CC Score 0 (currency code: NZ40C). |
| Hospital delivery, Assisted Delivery, with Epidural or Induction | per event | 3131 | 1 | Non-elective long stay tab - Assisted Delivery, with Epidural or Induction, with CC Score 0 (currency code NZ41C). |
| Hospital delivery, Assisted Delivery, with Epidural and Induction | per event | 3475 | 1 | Non-elective long stay tab - Assisted Delivery, with Epidural and Induction, or with Post-Partum Surgical Intervention, with CC Score 0 (currency code: NZ42C). |
| **Caesarean** |  |  |  |  |
| Hospital delivery, Elective Caesarean Section | per event | 3370 | 1 | Non-elective long stay tab - Planned Caesarean Section with CC Score 0-1 (currency code: NZ50C). |
| Hospital delivery, Emergency Caesarean Section | per event | 4244 | 1 | Non-elective long stay tab - Emergency Caesarean Section with CC Score 0-1 (currency code: NZ51C). |
| **Home delivery** |  |  |  |  |
| Home delivery, Normal Delivery | per event | 1514 | 1 | Community health services tab - Normal Delivery with CC Score 0 (currency code: NZ30C). |
| **Home with transfer to hospital** |   |   |   |   |
| Home delivery, Normal Delivery plus transfer to hospital | per event | 4226 | 1 | Community health services tab - Normal Delivery with CC Score 0 (currency code: NZ30C) plus ambulance transfer - Ambulance tab - See and treat and convey (currency code: ASS02) plus hospital normal delivery - see above. |
| Home delivery, Normal Delivery, with Epidural or Induction plus transfer to hospital | per event | 4492 | 1 | Community health services tab - Normal Delivery with CC Score 0 (currency code: NZ30C) plus ambulance transfer - Ambulance tab - See and treat and convey (currency code: ASS02) plus hospital normal delivery with epidural or induction - see above. |
| Home delivery, Normal Delivery, with Epidural and Induction plus transfer to hospital | per event | 4843 | 1 | Community health services tab - Normal Delivery with CC Score 0 (currency code: NZ30C) plus ambulance transfer - Ambulance tab - See and treat and convey (currency code: ASS02) plus hospital normal delivery with epidural and induction - see above. |
| Home delivery, Assisted delivery plus transfer to hospital | per event | 4527 | 1 | Community health services tab - Normal Delivery with CC Score 0 (currency code: NZ30C) plus ambulance transfer - Ambulance tab - See and treat and convey (currency code: ASS02) plus hospital assisted delivery - see above. |
| ***Post-Birth*** |  |  |  |  |
| Maternity ward/post-natal ward (mother only) | per night | 0 | 1 | Non-elective long stay tab - Post-natal disorders with cc score 0-1 (currency code: NZ26B). |
| Maternity ward/post-natal ward (mother and baby) | per night | 0 | 1 | Non-elective long stay tab - Post-natal disorders with cc score 0-1 (currency code: NZ26B). |
| HDU – labour ward (mother) | per night | 759 | 1 | Critical care tab: Non-specific, general adult critical care patients predominate, Adult Critical Care, 0 Organs Supported (Currency code: XC07Z). |
| Intensive care – general hospital ward (mother) | per night | 759 | 1 | Critical care tab: Non-specific, general adult critical care patients predominate, Adult Critical Care, 0 Organs Supported (Currency code: XC07Z). |
| Neonatal special care – ITU | per night | 1218 | 1 | Critical care tab: Neonatal Critical Care, Intensive Care (Currency code: XA01Z). |
| Neonatal special care – High dependency | per night | 872 | 1 | Critical care tab: Neonatal Critical Care, high dependancy (Currency code: XA02Z). |
| Neonatal special care | per night | 384 | 1 | Critical care tab: Neonatal Critical Care, special care, with external carer (Currency code: XA04Z). |
| Neonatal intervention – UV light jaundice postnatal ward | per night | 384 | 1 | Critical care tab: Neonatal Critical Care, special care, with external carer (Currency code: XA04Z). |
| Neonatal intervention – IV antibiotics postnatal ward | per night | 384 | 1 | Critical care tab: Neonatal Critical Care, special care, with external carer (Currency code: XA04Z). |
|  |  |  |  |  |
| **Section B** |  |  |  |  |
| ***Index service*** |  |  |  |  |
| Mother and baby unit | per night | 707 | 1 | Mental health tab - Specialist Perinatal Mental Health Services, Admitted Patient (currency code: SPHMSMBUAPC). |
| General inpatient ward | per night | 385 | 1 | Non-elective long stay tab - bedday calculated from "All patients between 19 and 69 years with a Mental Health Primary Diagnosis, treated by a Non-Specialist Mental Health Service Provider" (Currency code: WD22Z). |
| Low secure unit | per night | 426 | 1 | Mental health tab - Low level secure services (currency code: SCU13). |
| Medium secure unit | per night | 495 | 1 | Mental health tab - Medium level secure services (currency code: SCU14). |
| High secure unit | per night | 885 | 1 | Mental health tab - High secure unit, womens services (currency code: SCU11). |
| High dependency unit | per night | 742 | 1 | Mental health tab - High dependency secure provision, womens service (currency code: SCU07). |
| Home treatment team | per contact | 199 | 2 | Crisis resolution community contact, p71. |
| Crisis house | per night | 205 | 5 | £177 2007/8 inflated to 2015/16 prices |
| Mother and baby day hospital | per night | 353·3 | 1 | Half the cost of a mother and baby unit inpatient. |
| Day hospital | per night | 398 | 1 | Day cases tab - All patients between 19 and 69 years with a Mental Health Primary Diagnosis, treated by a Non-Specialist Mental Health Service Provider (currency code: WD22Z). |
| Acute day houses  | per night | 398 | 1 | Day cases tab - All patients between 19 and 69 years with a Mental Health Primary Diagnosis, treated by a Non-Specialist Mental Health Service Provider (currency code: WD22Z). |
| ***Accommodation*** |  |  |  |  |
| Staffed accommodation (staff day time only/visiting staff) | per night | 41·14 | 2 | Based on £288 per week, extra-care housing including accommodation, housing management, support costs and living expenses (p30). |
| Staffed accommodation (staff 24 hours/resident staff) | per night | 93 | 2 | Private sector residential care including establishment costs and personal living expenses (p26). |
| Bed and breakfast - look for report | per night | 41·14 | - | Assumed to be similar to that fot a staffed accommodation (staff day time only/visiting staff) - this is similar to the lowest rates for B&Bs in UK cities. |
| ***Foster care*** |  |  |  |  |
| Foster care | per night | 84·43 | 2 | Based on £591 per child per week (excluding social services support but including education). |
| Friends / relatives | per night | 0 | - | - |
|  |  |  |  |  |
| **Section C** |  |  |  |  |
| ***Accommodation*** |  |  |  |  |
| Staffed accommodation (staff day time only/visiting staff) | per night | 41·14 | 2 | Based on £288 per week, extra-care housing including accommodation, housing management, support costs and living expenses (p30). |
| Staffed accommodation (staff 24 hours/resident staff) | per night | 93 | 2 | Private sector residential care including establishment costs and personal living expenses (p26). |
| ***Foster care*** |  |  |  |  |
| Foster care | per night | 84·43 | 2 | Based on £591 per child per week (excluding social services support but including education). |
| Friends / relatives | per night | 0 | - | - |
| ***Community services*** |  |  |  |  |
| Midwife | per contact | 53 | 1 | Community health services tab - Community midwife, ante natal visit (currency code: N01A). |
| Midwifery support worker | per contact | 53 | 1 | Community health services tab - Community midwife, ante natal visit (currency code: N01A). |
| Health Visitor | per contact | 79 | 1 | Community health services tab - Health visitor, ante natal review (currency code: N03A). |
| Nursery nurse (health visitor assistant) | per contact | 53 | 1 | Community health services tab - Community midwife, ante natal visit (currency code: N01A). |
| Examination of the newborn clinic | per contact | 105 | 1 | Community health services tab - Health visitor, new baby review (currency code: N03B). |
| GP | per contact | 31 | 2 | Per surgery consultation lasting 9·22 minutes, including direct care staff costs, without qualifications, p145. |
| Practice nurse | per contact | 9·3 | 2 | Based on £36 per hour excluding qualifications assuming 15·5 min appointment from Curtis, L. (2012) Unit Costs of Health and Social Care 2012, Personal Social Services Research Unit, University of Kent, Canterbury. |
| Community paediatrician | per contact | 199 | 2 | Paediatric outpatient attendances, p71. |
| Breastfeeding advisor | per contact | 53 | 1 | Community health services tab - Community midwife, ante natal visit (currency code: N01A). |
| Breastfeeding baby cafe | per contact | 0 | - | - |
| Post-natal group | per contact | 35 | 1 | Community health services tab - Parentcraft (currency code: N03PC). |
| Low intensity IAPT | per contact | 109 | 5 | Based on £99 at 2009/10 prices, inflated up to 2015/16 prices. |
| High intensity IAPT | per contact | 196 | 5 | Based on £177 at 2009/10 prices, inflated up to 2015/16 prices. |
| Community psychiatric nurse | per contact | 35·22 | 3 | Based on mental health nurse (p176) - £67 per hour of face to face contact, assuming 30 minute appointment, without qualifications, inflated to 2015/16 prices. |
| Clinical psychologist/counsellor | per contact | 97 | 2 | Based on a CBT session with a clinical psychologist, p77. |
| Community psychiatrist | per contact | 280 | 1 | Consultant led tab - Adult mental illness (Currency code: WF01A, service code 710). |
| Perinatal psychiatric/Home treatment team | per contact | 199 | 2 | Crisis resolution community contact, p71. |
| Smoking cessation service | per contact | 9·3 | 2 | Based on £36 per hour excluding qualifications assuming 15·5 min appointment from Curtis, L. (2012) Unit Costs of Health and Social Care 2012, Personal Social Services Research Unit, University of Kent, Canterbury. |
| Social worker - children's/family | per contact | 27 | 2 | Based on children's social worker (p157) - £54 per hour of client-related work, assuming 30 minute appointment, without qualifications. |
| Social worker - adult services | per contact | 27·5 | 2 | Based on adult social worker (p156) - £55 per hour of client-related work, assuming 30 minute appointment, without qualifications. |
| Baby/family support worker | per contact | 26 | 2 | Based on family support worker (p162) - £52 per hour of client-related work, assuming 30 minute appointment, without qualifications. |
| Drug/alcohol support worker | per contact | 22·5 | 2 | Based on Alcohol health worker/Alcohol liaison nurse/Substance misuse nurse (p53) - £45 per hour, assuming 30 minute appointment, without qualifications. |
| Domestic violence advice/support | per contact | 27·5 | 2 | Based on adult social worker (p156) - £55 per hour of client-related work, assuming 30 minute appointment, without qualifications. |
| Housing/debt advice/citizen’s advice worker | per contact | 27·5 | 2 | Based on adult social worker (p156) - £55 per hour of client-related work, assuming 30 minute appointment, without qualifications. |
| Employment advice worker | per contact | 27·5 | 2 | Based on adult social worker (p156) - £55 per hour of client-related work, assuming 30 minute appointment, without qualifications. |
| Mother and baby day hospital | per night | 353·3 | 1 | Half the cost of a mother and baby unit inpatient. |
| ***Other:*** |  |  |  |  |
| Sexual health clinic | per contact | 117·9 | 1 | Outpatient attendances tab - Genitourinary Medicine (Service code: 360). |
| Rehabilitation | per contact | 125·2 | 1 | Outpatient attendances tab - Rehabiliation service (Service code: 314). |
| Ultrasound | per contact | 125 | 1 | Outpatient procedures tab - Ante-Natal Standard Ultrasound Scan (currency code: NZ21Z) |
| ***Inpatient services*** |  |  |  |  |
| Maternity | per night | 528·16 | 1 | Non-elective long stay tab - Bedday calculated from all non-elective long stay entries. |
| Physical health | per night | 528·16 | 1 | Non-elective long stay tab - Bedday calculated from all non-elective long stay entries. |
| Mental health - general inpatient | per night | 385 | 1 | Non-elective long stay tab - bedday calculated from "All patients between 19 and 69 years with a Mental Health Primary Diagnosis, treated by a Non-Specialist Mental Health Service Provider" (Currency code: WD22Z). |
| Mental health - mother and baby unit | per night | 707 | 1 | Mental health tab - Specialist Perinatal Mental Health Services, Admitted Patient (currency code: SPHMSMBUAPC). |
| Mental health - crisis house | per night | 205 | 5 | £177 2007/8 inflated to 2015/16 prices |
| Neonatal care / paediatrics | per night | 622·1 | 1 | Non-elective long stay tab - Bedday calculated from all paediatric non-elective long stay entries. |
| ***Acute care*** |  |  |  |  |
| Mother and baby day hospital | per night | 353·3 | 1 | Half the cost of a mother and baby unit inpatient. |
| Other Day hospital | per night | 398 | 1 | Day cases tab - All patients between 19 and 69 years with a Mental Health Primary Diagnosis, treated by a Non-Specialist Mental Health Service Provider (currency code: WD22Z). |
| Day house | per night | 398 | 1 | Day cases tab - All patients between 19 and 69 years with a Mental Health Primary Diagnosis, treated by a Non-Specialist Mental Health Service Provider (currency code: WD22Z). |
| ***Outpatient services*** |  |  |  |  |
| Allergy | per contact | 168·67 | 1 | Total Outpatient Attendances tab - Allergy service (service code: 317). |
| Audiology | per contact | 58·33 | 1 | Total Outpatient Attendances tab - Audiology (service code: 840). |
| Cardiology | per contact | 127·67 | 1 | Total Outpatient Attendances tab - Cardiology (service code: 320). |
| Dentistry | per contact | 0 | - | - |
| Dermatology | per contact | 101·63 | 1 | Total Outpatient Attendances tab - Dermatology (service code: 330). |
| Diabetic Medicine | per contact | 159·31 | 1 | Total Outpatient Attendances tab - Diabetic medicine (service code: 307). |
| Dietetics | per contact | 71·17 | 1 | Total Outpatient Attendances tab - Dietetics (service code: 654). |
| Endocrinology | per contact | 157·74 | 1 | Total Outpatient Attendances tab - Endocrinology (service code: 302). |
| ENT | per contact | 96·87 | 1 | Total Outpatient Attendances tab - ENT (service code: 120). |
| Gastroenterology | per contact | 136·57 | 1 | Total Outpatient Attendances tab - Gastroenterology (service code: 301). |
| General Medicine | per contact | 167·05 | 1 | Total Outpatient Attendances tab - General medicine (service code: 300). |
| Genetics | per contact | 439·45 | 1 | Total Outpatient Attendances tab - Clinical genetics (service code: 311). |
| Genitourinary Medicine | per contact | 117·9 | 1 | Total Outpatient Attendances tab - Genitourinary medicine (service code: 360). |
| Gynaecology | per contact | 133·01 | 1 | Total Outpatient Attendances tab - Gynaecology (service code: 502). |
| Haematology | per contact | 160·58 | 1 | Total Outpatient Attendances tab - Clinical haematology (service code: 303). |
| Haemophilia | per contact | 612·52 | 1 | Total Outpatient Attendances tab - Haemophilia service (service code: 309). |
| Hepatology | per contact | 255·35 | 1 | Total Outpatient Attendances tab - Hepatology (service code: 306). |
| Immunology | per contact | 295·31 | 1 | Total Outpatient Attendances tab - Clinical immunology (service code: 316). |
| Mental health | per contact | 287·57 | 1 | Total Outpatient Attendances tab - Adult mental illness (service code: 710). |
| Neurology | per contact | 175·6 | 1 | Total Outpatient Attendances tab - Neurology (service code: 400). |
| Obstetrics | per contact | 127·54 | 1 | Total Outpatient Attendances tab - Obstetrics (service code: 501). |
| Occupational Therapy | per contact | 65·85 | 1 | Total Outpatient Attendances tab - Occupational therapy (service code: 651). |
| Ophthalmology | per contact | 90·64 | 1 | Total Outpatient Attendances tab - Ophthalmology (service code: 130). |
| Paediatrics including tongue tie clinic | per contact | 194·36 | 1 | Total Outpatient Attendances tab - Paediatrics (service code: 420). |
| Pain Management | per contact | 139·12 | 1 | Total Outpatient Attendances tab - Pain management (service code: 191). |
| Physiotherapy | per contact | 48·33 | 1 | Total Outpatient Attendances tab - Physiotherapy (service code: 650). |
| Respiratory Medicine | per contact | 154·77 | 1 | Total Outpatient Attendances tab - Respiratory medicine (service code: 340). |
| Rheumatology | per contact | 142·74 | 1 | Total Outpatient Attendances tab - Rheumatology (service code: 410). |
| Surgery | per contact | 130·06 | 1 | Total Outpatient Attendances tab - General surgery (service code: 100). |
| Trauma and Orthopaedics | per contact | 117·01 | 1 | Total Outpatient Attendances tab - Trauma & orthopaedics (service code: 110). |
| ***Accident and emergency*** |  |  |  |  |
| Accident and emergency | per contact | 146·86 | 1 | Total Outpatient Attendances tab - Accident & emergency (service code: 180). |
| Ambulance | per contact | 236·44 | 1 | Ambulance tab (AMB) - See and treat and convey (currency code: ASS02). |
|  |  |  |  |  |
| **Section D** |  |  |  |  |
| Medication | per drug per month | 8·34 | 4 | Net ingredient cost per item for all items. |

Sources: 6, 7, 16-18 .

**Economic evaluation results**

***Data availability***

Data availability, summarised in Table 1, was over 90% for the majority of measures over both time periods and did not drop below 79% for any component at any time point. Availability of data was similar in both groups.

**Table 1: Availability of economic data by group**

|  |  |  |
| --- | --- | --- |
|  | **MBU (n=108)****N (%)** | **Non-MBU (n=171)****N (%)** |
| 2-year period prior to index admission |  |  |
| Acute care (MBU, acute ward, CRT) | 106 (98%) | 169 (99%) |
| Index admission to 1-month post-discharge |  |  |
| Acute care (MBU, acute ward, CRT) | 107 (99%) | 170 (99%) |
| AD-SUS | 100 (93%) | 162 (95%) |
| EQ-5D-5L | 98 (91%) | 162 (95%) |
| SF-6D | 96 (89%) | 161 (94%) |
| Discharge to 12-month post-discharge |  |  |
| Acute care (MBU, acute ward, CRT) | 105 (97%) | 158 (92%) |
| Community mental health | 85 (79%) | 141 (82%) |

Availability of full cost, outcome and co-variate data necessary for inclusion in economic analyses is reported in Table 2. Full data for inclusion in the short-term EQ-5D-based analysis were available for 220 participants (79%), 75 (69%) in MBU and 145 (85%) in non-MBU. Of these, 8 were removed following propensity matching leaving a total of 212 participants (76%), 67 (62%) in MBU and 145 (85%) in non-MBU.

Full data for inclusion in the short-term SF-6D-based analysis were available for 219 participants (78%), 74 (69%) in MBU and 145 (85%) in non-MBU. Of these, 7 were removed following propensity matching leaving a total of 212 participants (76%), 67 (62%) in MBU and 145 (85%) in non-MBU.

Full data for inclusion in the longer-term EQ-5D based analysis were available for 145 participants (52%), 53 (49%) in MBU and 92 (54%) in non-MBU. Of these, 13 were removed following propensity matching leaving a total of 132 participants (47%), 40 (40%) in MBU and 92 (54%) in non-MBU.

For the sensitivity analysis using imputation for missing data, and thus using the full sample, 7 participants were removed following propensity matching leaving a total of 272 (98%), 101 (94%) in MBU and 171 (100%) in non-MBU.

**Table 2: Sample with all data necessary for inclusion in the economic analyses**

|  |  |  |
| --- | --- | --- |
|  | **Sample with full data** | **Sample with full data after propensity matching** |
|  | **MBU (n=108)****N (%)** | **Non-MBU (n=171)****N (%)** | **MBU (n=108)****N (%)** | **Non-MBU (n=171)****N (%)** |
| Short-term (index admission to 1-month post-discharge) |  |  |  |  |
| All data for EQ-5D-5L-based analysis  | 75 (69%) | 145 (85%) | 67 (62%) | 145 (85%) |
| All data for SF-6D-based analysis  | 74 (69%) | 145 (85%) | 67 (62%) | 145 (85%) |
| Longer-term (index admission to 12-month post-discharge) |  |  |  |  |
| All data for EQ-5D-5L-based analysis | 53 (49%) | 93 (54%) | 39 (36%) | 93 (54%) |

***Short-term cost-effectiveness analysis***

*Short-term resource use*

Table 3 presents service use by group for the period from index admission to 1-month post-discharge, and for the two-year period prior to index admission. Acute care (MBU, acute ward, CRT) in the 2-year period prior to the index admission was used by 12% of the MBU group and 13% of the non-MBU group. Acute care was used by all participants in the period from index admission to 1-month post discharge as this was part of the eligibility criteria. The use of each category of resource was similar between the two groups. However, days in acute care varied by group with the MBU group spending a mean of 129 days (144 SD) in acute care compared to 95 days (185 SD) in the non-MBU.

**Table 3: Resource use in the 1-month post discharge EQ-5D sample**

|  |  |  |
| --- | --- | --- |
|  | **MBU (n=67)** | **Non-MBU (n=145)** |
|  | **N using (%)** | **N using (%)** |
| 2-year period prior to index admission |  |  |
| Acute care (MBU, acute ward, CRT) | 8/67 (12%) | 19/145 (13%) |
| Index admission to 1-month post-discharge |  |  |
| Acute care (MBU, acute ward, CRT) | 67/67 (100%) | 145/145 (100%) |
| Days in acute care (Mean (SD)) | 129 (144) | 95 (185) |
| Maternal assessment unit prior to giving birth | 32/64 (50%) | 70/145 (48%) |
| Hospital stay following birth | 10/66 (15%) | 22/145 (15%) |
| Other inpatient | 4/67 (6%) | 11/145 (8%) |
| Daypatient | 0/67 (0%) | 2/145 (1%) |
| Outpatient | 28/67 (42%) | 45/145 (31%) |
| A&E | 15/66 (23%) | 35/145 (24%) |
| Community based services | 65/65 (100%) | 140/141 (99%) |
| Medication during index admission | 46/47 (98%) | 95/103 (92%) |
| Medication after index admission | 61/61 (100%) | 107/120 (89%) |
| Accommodation during acute treatment period | 0/67 (0%) | 4/140 (3%) |
| Accommodation following acute treatment period | 1/65 (2%) | 5/145 (3%) |
| Foster care | 1/67 (1%) | 6/144 (4%) |

*Short-term length of follow-up – EQ-5D sample*

Length of follow-up was variable as follow-up covered the index admission, the length of which varied, plus the 1-month post-discharge period. Mean follow-up for the cohort was 145 days (range 31-1080), 165 days for MBU (range 55-819) and 135 days for non-MBU (range 31-1080).

*Short-term costs and outcomes – EQ-5D sample*

Cost and outcome data are reported in Table 4. The cost of acute care in the 2 years prior to index admission was similar in both groups (£1873 MBU versus £2038 non-MBU). The cost of all health and social care services from index admission to 1-month post discharge was significantly higher in the MBU group (£60,007) than the non-MBU group (£13,673) in unadjusted (mean difference £46,333, 95% CI 38,380 to 54,286, p<0·001) and adjusted analyses (mean difference £44,049, 95% CI 36,638 to 51,461, p<0·001). This was due to a combination of higher unit costs for MBUs (£707 per day) versus generic acute psychiatric ward (£385 per day) and CRT (£199 per contact) and a higher number of days in acute care in the MBU group (129 days) compared to the non-MBU group (95 days).

At 1-month post discharge, utility was 0·825 in the MBU group and 0·790 in the non-MBU group. This difference was not statistically significant in unadjusted (0·036, 95% CI -0·010 to 0·081, p=0·122) or adjusted analyses (0·007, 95% CI -0·039 to 0·053, p=0·752). EQ-5D-5L based QALYs were 0·282 in the MBU group versus 0·224 in the non-MBU group. This difference was not statistically significant in unadjusted (0·058, 95% CI -0·017 to 0·133, p=0·130) or adjusted analyses (0·007, 95% CI -0·013 to 0·027, p=0·496)

**Table 4: Cost and outcome data 1-month post discharge – EQ-5D sample**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **MBU** |  | **Non-MBU** |  | **Unadjusted mean difference** | **Adjusted mean difference\*** |
| **Costs** | **N** | **Mean (SD), £** | **N** | **Mean (SD), £** | **£ (95% CI, p value)** | **£ (95% CI, p value)** |
| Baseline acute care costs in the 2 years prior to index admission | 67 | 1873 (7711) | 145 | 2038 (9353) | - | - |
| Total health and social care costs admission to 1-month post-discharge | 67 | 60,007 (32,065) | 145 | 13,673 (12,472) | 46,333 (38,380 to 54,286, <0·0001) | 44,049 (36,638 to 51,461, <0·0001) |
| **Outcomes** | **N** | **Mean (SD)** | **N** | **Mean (SD)** | **£ (95% CI, p value)** | **£ (95% CI, p value)** |
| EQ-5D-5L utility at admission | 67 | 0·44 (-) | 145 | 0·44 (-) | - | - |
| EQ-5D-5L utility 1-month post-admission | 67 | 0·825 (0·150) | 145 | 0·790 (0·168) | 0·036 (-0·010 to 0·081, 0·12) | 0·007 (-0·039 to 0·053, 0·75) |
| QALYs | 67 | 0·282 (0·237) | 145 | 0·224 (0·302) | 0·058 (-0·017 to 0·133, 0·13) | 0·007 (-0·013 to 0·027, 0·50) |

\* Adjusted for personality, ethnicity, learning disability, age of child at admission, partner, living alone, number of children, section, Composite Abuse Scale score (abuse versus no abuse), follow-up length and baseline cost of acute care

*Short-term cost-effectiveness analysis using the EQ-5D*

Based on adjusted costs and QALYs, the incremental cost-effectiveness ratio was £6,292,714 (£44,049/0·007 QALYs). Figure 1 shows the bootstrapped replications for cost and effect pairs for MBU versus non-MBU at 1-month post discharge. All scatter points lie above the horizontal axis where MBU is more costly than non-MBU. A greater proportion of scatter points lie to the right of the vertical axis where MBU is more effective than non-MBU.

**Figure 1: Cost-effectiveness plane for MBU versus non-MBU at 1-month post discharge using EQ-5D-5L-based QALYs**

Figure 2 shows the CEAC for MBU versus non-MBU. The probability of MBU being cost-effective compared with non-MBU was 0% at all levels of willingness-to-pay between £0 and £50,000 per QALY. Analyses using imputation for missing data produced almost identical results and thus are not reported here.

**Figure 2: Cost-effectiveness acceptability curve for MBU versus non-MBU at 1-month post-discharge using EQ-5D-5L-based QALYs**

*Short-term length of follow-up – SF-6D sample*

Mean follow-up time for the cohort was 147 days (range 31-1080). This was 165 days for MBU (range 55-819) and 139 days for non-MBU (range 31-1080).

*Short-term costs and outcomes – SF-6D sample*

Cost and outcome data are reported in Table 5. The cost of acute care in the 2 years prior to index admission was similar in both groups (£1873 MBU versus £2334 non-MBU). Total health and social care costs from index admission to 1-month post discharge were significantly higher in the MBU group compared to the non-MBU group in unadjusted (mean difference £46,070, 95% CI 38,129 to 38,129, p<0·001) and adjusted analyses (mean difference £43,881, 95% CI 36,441 to 51,321, p<0·001).

At 1-month post discharge, utility was 0·674 in the MBU group and 0·640 in the non-MBU group. This difference was statistically significant in unadjusted analyses (0·035, 95% CI 0·002 to 0·067, p=0·035) but non-significant in adjusted analyses (0·001, 95% CI -0·033 to 0·011, p=0·959). QALYs were 0·251 in the MBU group versus 0·206 in the non-MBU group. This difference was not statistically significant in unadjusted (0·045, 95% CI -0·025 to 0·115, p=0·208) or adjusted analyses (<-0·001, 95% CI -0·012 to 0·011, p=0·959).

*Short-term cost-effectiveness analysis using the SF-6D*

Based on adjusted costs and QALYs, the incremental cost effectiveness ratio was -£4,388,1000 (£43,881/-0·001 QALYs). Figure 3 shows the bootstrapped replications for cost and effect pairs for MBU versus non-MBU at 1-month post discharge. All scatter points lie above the horizontal axis where MBU is more costly than non-MBU. Slightly more than half of the scatter points lie to the right of the vertical axis where MBU is more effective than non-MBU.

**Table 5: Cost and outcome data 1-month post discharge – SF-6D sample**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **MBU** |  | **Non-MBU** |  | **Unadjusted mean difference** | **Adjusted mean difference\*** |
| **Costs** | **N** | **Mean (SD), £** | **N** | **Mean (SD), £** | **£ (95% CI, p value)** | **£ (95% CI, p value)** |
| Baseline acute care costs in the 2 years prior to index admission | 67 | 1873 (7711) | 145 | 2334 (9947) | - | - |
| Total health and social care costs admission to 1-month post-discharge | 67 | 59,849 (32,152) | 145 | 13,780 (12,508) | 46,070 (38,129 to 38,129, <0·0001) | 43,881 (36,441 to 51,321, <0·0001) |
| **Outcomes** | **N** | **Mean (SD)** | **N** | **Mean (SD)** | **£ (95% CI, p value)** | **£ (95% CI, p value)** |
| SF-6D utility at admission | 67 | 0·44 (-) | 145 | 0·44 (-) | - | - |
| SF-6D utility 1-month post-admission | 67 | 0·674 (0·101) | 145 | 0·640 (0·119) | 0·035 (0·002 to 0·067, 0·035) | 0·001 (-0·033 to 0·034, 0·97) |
| QALYs | 67 | 0·251 (0·216) | 145 | 0·206 (0·287) | 0·045 (-0·025 to 0·115, 0·21) | <-0·001 (-0·012 to 0·011, 0·96) |

\* Adjusted for personality, ethnicity, learning disability, age of child at admission, partner, living alone, number of children, section, Composite Abuse Scale score (abuse versus no abuse), follow-up length, and plus baseline cost of acute care

**Figure 3: Cost-effectiveness plane for MBU versus non-MBU at 1-month post-discharge using SF-6D-based QALYs**

Figure 4 shows the CEAC for MBU versus non-MBU at 1-month post discharge. The probability of MBU being cost-effective compared with non-MBU was 0% for all levels of willingness-to-pay between £0 and £50,000 per QALY. Analyses using imputation for missing data produced almost identical results and thus are not reported here.

**Figure 4: Cost-effectiveness acceptability curves for MBU versus non-MBU at 1-month post-discharge using SF-6D-based QALYs**

***Longer-term cost-effectiveness analysis***

*Resource use*

Acute care (MBU, acute ward and CRT) between discharge from the index admission to 12-months post-discharge, reported in Table 6, was used by 21% of the sample (30/145) between discharge and 12-month follow-up. This was similar between MBU (19%) and non-MBU (21%). Days in acute care from discharge from index admission to 12-months was 12 days (56 days SD) in the MBU group compared to 5 days (14 days SD) in the non-MBU group.

Four participants (3%) were readmitted to MBUs in the year following discharge from index admission, three from the MBU group (6%) and one from the non-MBU group (1%). Eleven (8%) were readmitted to generic acute psychiatric wards, four from the MBU group (9%) and seven from the non-MBU group (7%). Twenty-five participants (17%) were taken on by crisis resolution teams, six from the MBU group (13%) and 19 from the non-MBU group (19%).

Contact with community services was common (88% of the cohort) following discharge from the index admission, 96% of MBU and 81% of non-MBU participants.

**Table 6: Mental health resource use from discharge to 12-months post discharge**

|  |  |  |
| --- | --- | --- |
|  | **MBU (n=47)** | **Non-MBU (n=98)** |
| **Service use** | **N used (%)** | **N used (%)** |
| Acute care (MBU, acute ward, CRT) | 9/47 (19%) | 21/98 (21%) |
| Community services | 45/47 (96%) | 83/98 (85%) |
|  | **Mean (SD)** | **Mean (SD)** |
| Days in acute care | 12 (56) | 5 (14) |

*Length of follow-up*

Length of follow-up was variable as follow-up covered the index admission, the length of which varied, plus the 12-month post-discharge period. However, mean follow-up for the cohort (mean 540 days, range 368-1448) was similar in the two groups (545 days for MBU, range 368-1183; 537 days for non-MBU, range 392-1448).

*Costs and outcomes*

Cost and outcome data are reported in Table 7. Mental health care costs from admission to 12-months post discharge were significantly higher in the MBU group (£50,904) than the non-MBU group (£8,168) in unadjusted (mean difference £42,736, 95% CI 34,431 to 51,041, p<0·001) and adjusted analyses (mean difference £40,798, 95% CI 32,389 to 49,206, p<0·001).

At 12-month post discharge, utility was 0·868 in the MBU group and 0·827 in the non-MBU group. This difference was not statistically significant in unadjusted (0·041, 95% CI -0·020 to 0·103, p=0·188) or adjusted analyses (0·003, 95% CI -0·055 to 0·061, p=0·915). EQ-5D-5L based QALYs were 1·060 in the MBU group versus 1·000 in the non-MBU group. This difference was not statistically significant in unadjusted (0·059, 95% CI -0·080 to 0·198, p=0·403) or adjusted analyses (0·010, 95% CI -0·049 to 0·069, p=0·733).

*Cost-effectiveness analysis*

Based on adjusted costs and QALYs generated from the EQ-5D, the incremental cost-effectiveness ratio was £4,079,800 (£40,798/0·010 QALYs). Figure 5 shows the bootstrapped replications for cost and effect pairs for MBU versus non-MBU at 12-months post discharge. All scatter points lie above the horizontal axis where MBU is more costly than non-MBU. A greater proportion of scatter points lie to the right of the vertical axis where MBU is more effective than non-MBU.

**Table 7: Cost and outcome data in the 12-months post discharge sample**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **MBU** |  | **Non-MBU** |  | **Unadjusted mean difference** | **Adjusted mean difference\*** |
| **Costs** | **N** | **Mean (SD), £** | **N** | **Mean (SD), £** | **£ (95% CI, p value)** | **£ (95% CI, p value)** |
| Baseline acute care costs in the 2 years prior to index admission | 40 | 1,381 (6,267) | 92 | 2,535 (10,941) | -1,154 (-4,065 to 1,757, p 0·44) | -1,682 (-5,343 to 1,979, p 0·37) |
| Total mental health costs admission to 12-month post-discharge | 40 | 50,904 (25,938) | 92 | 8,168 (11,288) | 42,736 (34,431 to 51,041, <0·0001) | 40,798 (32,389 to 49,206, p<0·0001) |
| **Outcomes** | **N** | **Mean (SD)** | **N** | **Mean (SD)** | **Coef (95% CI, p value)** | **Coef (95% CI, p value)** |
| EQ-5D-5L utility 12-month post-discharge | 40 | 0·868 (0·155) | 92 | 0·827 (0·191) | 0·041 (-0·020 to 0·103, p 0·19) | 0·003 (-0·055 to 0·061, p 0·92) |
| EQ-5D-5L based QALYs | 40 | 1·060 (0·362) | 92 | 1·000 (0·410) | 0·059 (-0·080 to 0·198, p 0·403) | 0·010 (-0·049 to 0·069, p 0·73) |

\* Adjusted for personality, ethnicity, learning disability, age of child at admission, partner, living alone, number of children, section, Composite Abuse Scale score (abuse versus no abuse), follow-up length and baseline cost of acute care

**Figure 5: Cost-effectiveness plane for MBU versus non-MBU at 12-months post discharge using EQ-5D-5L-based QALYs**

Figure 6 shows the CEAC for MBU versus non-MBU. The probability of MBU being cost-effective compared with non-MBU was 0% at all levels of willingness-to-pay between £0 and £50,000 per QALY. Analyses using imputation for missing data produced almost identical results and thus are not reported here.

**Figure 6: Cost-effectiveness acceptability curve for MBU versus non-MBU at 12-months post-discharge using EQ-5D-5L-based QALYs**

**Economic evaluation discussion**

***Strengths and limitations***

There were some limitations to the economic evaluation which must be considered. Different lengths of follow-up between the groups occurred because time in index admission was variable. However, this was controlled for in all analyses. Discounting was not able to be applied due to varying follow-up periods and lack of detail about when each item of resource was used (e.g. whether resource use was before or after the first 12-months post index admission). However, this was applicable to both the MBU and non-MBU group equally and is therefore unlikely to change the findings. Further, due to the way in which data was collected, there may have been some double counting of mental health resources used in the one month from discharge to 1-month follow-up. This is because data collection via the AD-SUS covered the period from discharge from the index admission to 1-month post discharge, whilst data collected from clinical notes covered the period from discharge from index admission to 12-months post-discharge, which includes the 1-month post-discharge period. However, this impacts on both groups equally. Further, the major cost driver in the difference between the MBU and non-MBU group was the index admission (for which double counting was not an issue), thus any double counting is unlikely to have a major impact on the differences reported between the groups. Finally, the limited perspective of the 12-month analysis means any differences in non-mental health service use by the mother or index child may have been missed, and follow-up at T2 was lower than 50% and was worse in the MBU group at 40% versus 54% in the non-MBU group.

**References for Health Economics Section**

**References**

3. Howard L, Flach C, Leese M, Byford S, Killaspy H, Cole L, et al. Effectiveness and cost-effectiveness of admissions to women's crisis houses compared with traditional psychiatric wards: pilot patient-preference randomised controlled trial. The British Journal of Psychiatry. 2010;197(S53):s32-s40.

4. Howard LM. Effectiveness and cost-effectiveness of perinatal psychiatry services. NIHR Programme Development Grant, Final Report London: NIHR; 2011.

5. Crawford M, Killaspy H, Barnes T, Barrett B, Byford S, Clayton K, et al. Group art therapy as an adjunctive treatment for people with schizophrenia: a randomised controlled trial (MATISSE). Health Technology Assessment. 2012;16(8):1-76.

6. Department of Health. NHS reference costs 2015/6 2015/6 [Available from: <https://www.gov.uk/government/publications/nhs-reference-costs-2015-to-2016.19.02>

7. Curtis L, Burns A. Unit costs of health and social care 2016. Personal social services research unit. Canterbury: University of Kent. 2016.

8. Prescription Cost Analysis: England 2016 [Internet]. 2016. Available from: <http://www.content.digital.nhs.uk/catalogue/PUB23631>

9. EQ-5D. EQ-5D-5L User Guide: Basic information on how to use the EQ-5D-5L instrument. Version 2.0. 2013.

10. Ware Jr JE. SF-36 health survey update. Spine. 2000;25(24):3130-9.

11. Devlin N, Shah K, Feng Y, Mulhern B, van Hout B. Valuing Health-Related Quality of Life: An EQ-5D-5L Value Set for England. OHE Research Paper 16/01. . London: Office of Health Economics; 2016.

12. Brazier J, Roberts J, Deverill M. The estimation of a preference-based measure of health from the SF-36. Journal of Health Economics. 2002;21(2):271-92.

13. Manca A, Hawkins N, Sculpher MJ. Estimating mean QALYs in trial‐based cost‐effectiveness analysis: the importance of controlling for baseline utility. Health economics. 2005;14(5):487-96.

14. Assmann SF, Pocock SJ, Enos LE, Kasten LE. Subgroup analysis and other (mis) uses of baseline data in clinical trials. The Lancet. 2000;355(9209):1064-9.

15. Briggs AH. A Bayesian approach to stochastic cost‐effectiveness analysis. Health Economics. 1999;8(3):257-61.

16. Curtis L. Unit Costs of Health and Social Care 2012. Personal Social Services Research Unit. Canterbury; University of Kent. 2012.

17. Health and Social Care Information Centre. Prescription Cost Analysis: England 2016 [Available from: <http://www.content.digital.nhs.uk/catalogue/PUB23631.22.07>

18. Private communication from Sarah Byford based on costs from Howard L FC, Leese M, Byford S, Killaspy H, Cole L, Lawlor C, Betts J, Sharac J, Cutting P, McNicholas S. Effectiveness and cost-effectiveness of admissions to women's crisis houses compared with traditional psychiatric wards: pilot patient-preference randomised controlled trial. The British Journal of Psychiatry; 2010.

19. Trevillion K, Shallcross R, Ryan E, Heslin M, Pickles A, Byford S, et al. Protocol for a quasi-experimental study of the effectiveness and cost-effectiveness of mother and baby units compared with general psychiatric inpatient wards and crisis resolution team services (The ESMI study) in the provision of care for women in the postpartum period. BMJ Open. 2019;Mar 23;9(3):e025906.