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Effectiveness and cost-effectiveness of psychiatric mother and baby units: quasi-experimental study

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Background

Psychiatric mother and baby units (MBUs) are recommended for severe perinatal mental illness, but effectiveness compared with other forms of acute care remains unknown.

Aims

We hypothesised that women admitted to MBUs would be less likely to be readmitted to acute care in the 12 months following discharge, compared with women admitted to non-MBU acute care (generic psychiatric wards or crisis resolution teams (CRTs)).

Method

Quasi-experimental cohort study of women accessing acute psychiatric care up to 1 year postpartum in 42 healthcare organisations across England and Wales. Primary outcome was readmission within 12 months post-discharge. Propensity scores were used to account for systematic differences between MBU and non-MBU participants. Secondary outcomes included assessment of cost-effectiveness, experience of services, unmet needs, perceived bonding, observed mother–infant interaction quality and safeguarding outcome.

Results

Of 279 women, 108 (39%) received MBU care, 62 (22%) generic ward care and 109 (39%) CRT care only. The MBU group (n = 105) had similar readmission rates to the non-MBU group (n = 158) (aOR = 0.95, 95% CI 0.86–1.04, P = 0.29; an absolute difference of −5%, 95% CI −14 to 4%). Service satisfaction was significantly higher among women accessing MBUs compared with non-MBUs; no significant differences were observed for any other secondary outcomes.

Conclusions

We found no significant differences in rates of readmission, but MBU advantage might have been masked by residual confounders; readmission will also depend on quality of care after discharge and type of illness. Future studies should attempt to identify the effective ingredients of specialist perinatal in-patient and community care to improve outcomes.

Keywords

Perinatal psychiatry; cost-effectiveness; epidemiology; in-patient treatment; outcome studies.

Psychiatric mother and baby units (MBUs) are recommended by the National Institute for Health and Care Excellence (NICE)[1] to provide joint mother–infant in-patient admissions for women with severe acute postpartum mental disorders and to facilitate mother–infant relationships. However, provision varies considerably and there has been geographical inequity of access to MBUs in the UK and elsewhere.[2,3] To date, no primary research has directly compared the clinical effectiveness or cost-effectiveness of MBUs with other acute psychiatric services;[4] international consensus on structure, staffing and skill mix for MBUs is also lacking. However, a randomised controlled trial was impractical and unethical owing to the large geographical dispersion of MBUs in England and Wales at the time this study was conceived and conducted. We therefore employed a quasi-experimental design to examine the effectiveness and cost-effectiveness of MBUs compared with other forms of acute care available in England and Wales (generic acute psychiatric wards or crisis resolution teams (CRTs)). Our primary hypothesis (co-produced with our Patient Advisory Group) was that women admitted to MBUs would be less likely to be readmitted to acute care in the 12 months following discharge, compared with women admitted to non-MBU acute care. We also hypothesised that admission to MBUs would be cost-effective compared with admission to generic acute psychiatric wards or CRTs 1 month post-discharge and 12 months post-discharge. We further hypothesised that, at 1 month post-discharge, women admitted to an MBU, compared with women admitted to generic services, would have significantly fewer unmet health and social care needs, significantly higher levels of service satisfaction and better perceived bonding, be significantly more sensitive and responsive when interacting with their babies, and that their infants would be more cooperative and less passive. Finally, we hypothesised that women admitted to an MBU would be more likely to retain custody of their child than women admitted to generic acute psychiatric wards or CRTs in the year following discharge.

Method

Quasi-experimental cohort study

STROBE reporting guidelines were followed; see the study protocol for further details on the methodology.[2] The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. All procedures involving human participants were approved by the London – Camberwell St Giles NHS Research Ethics Committee (number: 14/LO/0765). Written informed consent was obtained from all participants.

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Service definitions

MBUs were defined as units with at least four beds, separate from other in-patient units and providing care for both mother and baby where the mother had an acute postpartum psychiatric episode.[1] Acute wards were defined as psychiatric wards (including psychiatric intensive care wards) that administratively recorded people receiving care as in-patient admissions and that provided daily medical cover. Crisis resolution teams (CRTs) were defined as intensive mental health home treatment teams for people in acute crises; this model of care needed to include rapid response, out-of-hours multidisciplinary care and the ability to see people in mental health crises daily, where necessary, over an extended period (i.e. at least 12 h a day). Process evaluation involved data collection on service interventions/facilities using staff report.

Defining the cohort groups

Limited availability meant that some women offered MBU admission were temporarily admitted to an acute ward and that many women received care from more than one service. We defined cohorts by 'highest level of care' (i.e. more specialised); women were categorised using this definition for our main analyses, with MBUs as the 'highest level of care', followed by generic acute psychiatric wards, then CRTs. Women who spent any time in an MBU were therefore categorised under MBU and women categorised under CRT only accessed CRTs.

Study population

The study sample comprised women with psychiatric disorders who needed acute care in the first year postpartum and were admitted to psychiatric MBUs, generic acute psychiatric wards or CRTs in England and Wales (the selected regions represented diverse urbanicity/rurality and differences in MBU access). No diagnostic or language restrictions were applied; interpreters were used where necessary. Women were excluded if: (a) they were admitted 'prophylactically' (i.e. for monitoring in high-risk cases or for statutory parenting assessments); (b) their baby was permanently removed from their care prior to admission.

Recruitment, data collection and cohort comparisons

After giving consent, women were interviewed by trained postgraduate researchers (usually at home) around 4 weeks post-discharge. Women were recruited between 23 February 2015 and 6 March 2018. Researchers collected baseline information about women's admission (t_0), along with data on their short-term outcomes at 1 month post-discharge (t_1). The start of the study period was defined as the first day of the first admission, even if women were then transferred to another type of care. If women consented, we also obtained baseline information (t_0) and longer-term clinical/social care outcomes at 12 months post-discharge (t_2) from medical records. Women were also asked to take part in a 5-min telephone interview at 12 months post-discharge (t_2) (supplementary Fig. 1, available at https://doi.org/10.1192/bjp.2022.48). We intended to collect clinician-rated Health of the Nation Outcome Scale data from women's clinical records. However, these data were available in only 39 of 279 records. Similarly, most women did not have easy access to their infant's clinical records for us to record APGAR scores and early weight measurements.

Primary outcome

Long-term (t_2): readmissions to acute care (MBUs, generic acute psychiatric wards, CRTs).

Cost-effectiveness

EuroQoL EQ-5D-5L self-report measure of health-related quality of life.[5,6]

Long-term (t_2): secondary care mental health service use.

Short-term (t_1): adapted version of the Adult Service Use Schedule (AD-SUS), a researcher-administered schedule measuring health and social care service use, including service use related to the birth and the infant.

Secondary outcomes

Long-term (t_2): social care/clinical case records (supplemented by self-report when no records available) on the safeguarding category of the infant.

Short-term (t_1):

(a) Camberwell Assessment of Needs for Mothers (CAN-M)[7]
(b) Perinatal VOICE questionnaire (details available from the author on request), a self-report satisfaction measure of psychiatric unit/services, adapted for this study using participatory methods, and Client Satisfaction Questionnaire (CSQ);[8] the analysis used the CSQ/VOICE results relating to the highest level of care accessed
(c) Postpartum Bonding Questionnaire[9]
(d) mother–infant interactions independently coded using Child and Adult Relational Experimental Index.[10]

Geographical scores

Driving distance from mother's home to the nearest MBU was determined (see supplementary material).

Sample size calculation

See study protocol[2] and supplementary material.

Statistical analysis

The analyses undertaken are specified in the study protocol,[2] detailed below and in the supplementary material, proposing treatment effect estimation using propensity score adjustment and an instrumental variable analysis using distance as the instrument. Detailed pre-specification was not possible prior to assessing data availability; however, all exploratory analyses for sample description and in the construction of the propensity score were undertaken masked to outcome. Small recruitment numbers for in-patient wards required the (Programme Steering Committee approved) primary comparison to be MBU (specialist) care versus non-MBU care (acute wards/CRTs). Analyses were performed using Stata version 15 for Windows.

The primary outcome (readmission within 12 months post-discharge) was analysed using complete case logistic regression. Propensity scores, developed using Stata *pscore*, were used to account for systematic differences between MBU and non-MBU participants across 22 baseline characteristics and covariates selected using problem knowledge and exploratory comparison of cohorts (the full list of variables is given in the supplementary material). These variables covered diagnosis, pathways to care, psychiatric history, psychotic symptoms, smoking and substance misuse, trauma, living arrangements and social support, age, ethnicity, education and immigration/language status. The Stata *teffects* effect estimator command identified 15 women with characteristics that placed them beyond the 'region of support' for whom there were no 'matches' (i.e. women with propensity scores either so high or so low that there were insufficient similar women receiving alternative treatment to make a comparison); these 15 women were excluded. See the supplementary material for further detail on the primary analysis/treatment of missing data.

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Sensitivity analyses tested assumptions and statistical techniques within the handling of missing data, the effect estimators and how the cohort groups were defined (supplementary material).

We also carried out an instrumental variable analysis within a bivariate probit framework using road distance from the woman's home to the nearest MBU as the instrumental variable. Although the primary analysis adjusted for many of the important differences in characteristics of women attending each treatment, the women may have been mismatched on unmeasured characteristics. The instrumental variable approach additionally accounts for such potential unmeasured confounders but makes the assumption that these other potential confounders are independent of the instrumental variable.

Secondary outcome analysis

Short-term (t_1) outcomes were analysed using linear regression models; the long-term (t_2) safeguarding outcome (loss of custody) was analysed using a logistic regression model. Propensity scores were included in the secondary analyses using the *teffects* command, as described above. Adjustment for the outcome measure at baseline (admission) was included in the model, if available.

Economic evaluation

Two cost-effectiveness analyses were carried out comparing MBUs with non-MBUs at 1 and 12 months post-discharge using quality-adjusted life-years (QALYs) calculated from the EQ-5D-5L. The 1-month post-discharge (t_1) analysis took the National Health Service (NHS) and personal social services perspective preferred by NICE,[11] whereas the 12-month post-discharge (t_2) analysis took a narrower mental health service perspective. The AD-SUS measured individual-level resource use from initial admission to 1 month post-discharge. Data on use of acute care (MBUs, wards and CRTs) in the 2 years prior to index admission and in the period from index admission to t_2, and community mental health contacts from discharge to t_2, were taken from clinical notes. Total costs were calculated by applying unit costs to resource use at the individual level (supplementary material). We calculated area under the curve values for QALYs with linear interpolation between assessments.[12] We used the propensity score approach to create the cohort for each cost-effectiveness analysis. Mean differences and 95% confidence intervals were obtained by non-parametric bootstrap regressions (10 000 repetitions, bias corrected) to account for non-normal distributions commonly found in economic data. To provide more relevant treatment-effect estimates,[13] 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 primary analysis. Cost-effectiveness was explored using the net benefit approach.[14] We used cost-effectiveness acceptability curves to explore uncertainty regarding costs and cost-effectiveness resulting from sampling variation and the maximum cost-effectiveness ratio that a decision maker would deem acceptable.[15] Curves were created from bootstrapped costs and effects to calculate the probability of each treatment being the optimum choice, subject to a range of possible maximum values that a decision maker might be willing to pay for a QALY increase (supplementary material).

Results

We recruited from 39 mental health service providers in England and 3 in Wales. MBUs had a similar staff skill mix; all five provided parenting support and specialist parent–infant therapy, with three providing family/relationship therapy. Little specialist mother–infant support was available in other acute care settings.

In total, 279 women participated, of whom 108 (39%) received MBU care (as 'highest level of care'), 62 (22%) generic ward care and 109 (39%) CRT care only (supplementary Fig. 2).

A total of 493 admissions occurred among the 279 participants (range 1–7 admissions); 44/62 (71%) of the women admitted to an acute psychiatric ward and 75/108 (69%) of those admitted to an MBU used more than one acute service during their admission. The median number of days women spent in a service per admission was 21 days (30 days for the MBUs, 25 days for the CRTs, 14 days for the acute psychiatric wards; supplementary Table 1). Women in the MBU group spent longer in services overall than those in the acute psychiatric ward or CRT groups (75 *v.* 34 *v.* 25 days); the 'highest level of care' definition might have intensified this.

Women with an acute psychiatric ward as their highest level of care were more likely than women with an MBU or CRT as their highest level of care to be single, live alone, have a lower gross yearly household income, lower educational status, have had social care involvement during childhood, have experienced childhood maltreatment and have a partner with a history of mental health problems (Table 1 and supplementary Tables 7, 8 and 9). Women with an MBU as their highest level of care were more likely than women with an acute psychiatric ward or CRT as their highest level of care to be born outside of the UK and less likely to have reported recent intimate partner abuse.

Clinically, women with an acute psychiatric ward as their highest level of care were more likely than women with an MBU or CRT as their highest level of care to experience obstetric adversity, were younger at first contact with mental health services and were more likely to have a psychiatric history. They were also more likely to have higher levels of unmet health and social care needs, a diagnosis of personality disorder and more admissions in the previous 2 years. Adverse pathways to admission to acute care were also more likely for this group, with increased levels of police and accident and emergency department contacts, and higher numbers of contacts before admission. Women with an MBU as their highest level of care were more likely than women with an acute psychiatric ward or CRT as their highest level of care to be detained under the Mental Health Act 1983 but were less likely to have recently self-harmed. Women with CRT as their highest level of care were more likely than women with an acute psychiatric ward or MBU as their highest level of care to be cared for when their child was >100 days old, less likely to be admitted before the child's birth and less likely to have psychotic symptoms at presentation or psychiatric admission in the previous 2 years.

Primary outcome

Readmission rates during the 12 months post-discharge were collected for 278/279 women; the rates were 22% for the MBU group ($n = 108$) and 25% for the non-MBU group (i.e. generic acute psychiatric wards and CRTs) ($n = 170$) (acute wards 32%; CRT 21%). The odds of being readmitted within 12 months for women in the MBU group compared with the non-MBU group was 0.97 (95% CI 0.88–1.06, $P = 0.49$; $n = 263$) (adjOR = 0.95 (95% CI 0.86–1.04), $P = 0.29$; $n = 263$). The absolute difference in average number of readmissions was −5% (95% CI −14 to 4%). The analysed sample showed satisfactory overlap and a test for covariate balance after *teffects* inverse-probability weighting gave no indication of imbalance ($P = 0.99$).

Findings from sensitivity analyses were similar to those in the primary analysis (OR = 0.97 (95% CI 0.88–1.06) and OR = 0.99 (95% CI 0.88–1.10) respectively), as was a comparison restricted to acute ward care (OR = 0.97 (95% CI 0.84–1.11)) (supplementary Tables 4 and 5).

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Table 1 Sample demographic and clinical characteristics ($n = 279$ participants) by cohort allocation

Variable[a]		CRT ($n = 109$)	Ward ($n = 62$)	MBU ($n = 108$)	Total ($n = 279$)
Age at consent to participate, years: mean (s.d.)		31.1 (5.8)	30.5 (6.5)	32.5 (5.8)	31.5 (6.0)
Ethnicity, *n* (%)	White	79 (72.5)	50 (80.6)	83 (76.9)	212 (76.0)
	Black	5 (4.6)	4 (6.5)	11 (10.2)	20 (7.2)
	Asian	14 (12.8)	3 (4.8)	8 (7.4)	25 (9.0)
	Mixed/multiple ethnic group	5 (4.6)	3 (4.8)	3 (2.8)	11 (3.9)
	Other	6 (5.5)	2 (3.2)	3 (2.8)	11 (3.9)
Country of birth, *n* (%)	UK	94 (86.2)	49 (79.0)	71 (65.7)	214 (76.7)
	Other Europe	2 (1.8)	8 (12.9)	11 (10.2)	21 (7.5)
	Africa	2 (1.8)	3 (4.8)	12 (11.1)	17 (6.1)
	Asia	9 (8.3)	1 (1.6)	8 (7.4)	18 (6.5)
	North America/Caribbean	1 (0.9)	0 (0.0)	2 (1.9)	3 (1.1)
	Central America	0 (0.0)	1 (1.6)	0 (0.0)	1 (0.4)
	South America	1 (0.9)	0 (0.0)	1 (0.9)	2 (0.7)
	Australasia/Oceania	0 (0.0)	0 (0.0)	3 (2.8)	3 (1.1)
Highest qualification, *n* (%)	GCSE or no formal qualifications	15 (13.8)	16 (25.8)	23 (21.3)	54 (19.4)
	Age 18 school leaving qualifications	48 (44.0)	28 (45.2)	43 (39.8)	119 (42.7)
	Higher education/professional qualifications	46 (42.2)	18 (29.0)	42 (38.9)	106 (38.0)
Employment status prior to maternity leave, *n* (%)	Working	85 (78.0)	37 (59.7)	68 (63.0)	190 (68.1)
	Not working	24 (22.0)	25 (40.3)	40 (37.0)	89 (31.9)
Gross yearly household income, *n* (%) [$n = 276$]	£0–5475	2 (1.8)	4 (6.6)	5 (4.7)	11 (4.0)
	£5476–14 999	18 (16.5)	15 (24.6)	22 (20.8)	55 (19.9)
	£15 000–30 999	30 (27.5)	14 (23.0)	31 (29.2)	75 (27.2)
	£31 000–45 999	17 (15.6)	10 (16.4)	15 (14.2)	42 (15.2)
	£46 000–60 999	15 (13.8)	5 (8.2)	6 (5.7)	26 (9.4)
	≥£61 000	19 (17.4)	5 (8.2)	22 (20.8)	46 (16.7)
	Would rather not say	8 (7.3)	8 (13.1)	5 (4.7)	21 (7.6)
Current relationship status, *n* (%)	Single	11 (10.1)	15 (24.2)	15 (13.9)	41 (14.7)
	Partner but not cohabiting	7 (6.4)	2 (3.2)	6 (5.6)	15 (5.4)
	Married/cohabiting	87 (79.8)	40 (64.5)	86 (79.6)	213 (76.3)
	Separated/divorced/widowed	4 (3.7)	5 (8.1)	1 (0.9)	10 (3.6)
Current partner history of mental health problems, *n* (%) [$n = 224/228$ with partner]		10 (10.6)	9 (23.7)	14 (15.2)	33 (14.7)
Number of children, median (IQR)		1.0 (1.0–2.0)	2.0 (1.0–3.0)	1.0 (1.0–2.0)	1.0 (1.0–2.0)
Currently living with (excluding children), *n* (%)	Alone	16 (14.7)	18 (29.0)	13 (12.0)	47 (16.8)
	Spouse/partner	82 (75.2)	36 (58.1)	82 (75.9)	200 (71.7)
	Parent(s)/other	11 (10.1)	8 (12.9)	13 (12.0)	32 (11.5)
Adopted/fostered as a child, *n* (%) [$n = 233$]	Yes	3 (3.1)	6 (10.9)	5 (6.1)	14 (6.0)
Social worker as a child, *n* (%) [$n = 228$]	Yes	10 (10.4)	8 (14.5)	5 (6.5)	23 (10.1)
Psychiatric admissions in previous 2 years, *n* (%)	Yes	12 (11.0)	14 (22.6)	22 (20.4)	48 (17.2)
First-episode psychiatric disorder, *n* (%) [$n = 278$]	Yes	33 (30.3)	15 (24.6)	35 (32.4)	83 (29.9)
Age at first contact with mental health services, years: mean (s.d.) [$n = 270$]		25.0 (8.2)	23.1 (7.6)	26.2 (8.1)	25.0 (8.1)
Postpartum *v*. earlier onset, *n* (%) [$n = 277$]	Postpartum	61 (56.5)	35 (56.5)	62 (57.9)	158 (57.0)
Number of services contacted for the crisis, median (LQ–UQ) [$n = 278$]		2.0 (2.0–3.0)	4.0 (3.0–4.0)	3.0 (2.0–5.0)	3.0 (2.0–4.0)
A&E first contacted, *n* (%) [$n = 278$]	Yes	27 (25.0)	22 (35.5)	27 (25.0)	76 (27.3)
Any police contact, *n* (%) [$n = 278$]	Yes	3 (2.8)	6 (9.7)	2 (1.9)	11 (4.0)
Detained (during index admission), *n* (%)	Yes	0 (0.0)	22 (35.5)	50 (46.3)	72 (25.8)
Detained (during index admission and/or anytime in 2 years prior to index admission), *n* (%)	Yes	1 (0.9)	26 (41.9)	53 (49.1)	80 (28.7)
Self-injury in 2 weeks before admission, *n* (%) [$n = 272$]	Yes	35 (33.0)	22 (36.1)	28 (26.7)	85 (31.3)
Total HONOS score, mean (s.d.) [$n = 163$]		12.8 (5.5)	14.8 (5.2)	14.1 (6.1)	13.8 (5.7)
Smoked at point of admission, *n* (%) [$n = 270$]	Yes	18 (17.0)	28 (45.2)	24 (23.5)	70 (25.9)
Substance misuse, *n* (%)	Yes	14 (12.8)	12 (19.4)	4 (3.7)	30 (10.8)
Chronic physical health condition, *n* (%)	Yes	55 (50.5)	33 (53.2)	50 (46.3)	138 (49.5)

(*Continued*)

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Table 1 *(Continued)*

Variable[a]		CRT (*n* = 109)	Ward (*n* = 62)	MBU (*n* = 108)	Total (*n* = 279)
Intellectual disability, including difficulty reading own language, *n* (%) [*n* = 278]	Yes	14 (13.0)	10 (16.1)	10 (9.3)	34 (12.2)
Childhood maltreatment (from CTQ), *n* (%) [*n* = 271]	Yes	46 (43.0)	39 (67.2)	52 (49.1)	137 (50.6)
	No	61 (57.0)	19 (32.8)	54 (50.9)	134 (49.4)
Emotional neglect (from CTQ), *n* (%) [*n* = 265]	Yes	24 (22.4)	15 (27.3)	26 (25.2)	65 (24.5)
	No	83 (77.6)	40 (72.7)	77 (74.8)	200 (75.5)
Physical neglect (from CTQ), *n* (%) [*n* = 269]	Yes	22 (20.6)	19 (33.3)	25 (23.8)	66 (24.5)
	No	85 (79.4)	38 (66.7)	80 (76.2)	203 (75.5)
Composite Abuse Scale total >3 (intimate partner violence), *n* (%) [*n* = 249]	Yes	31 (31.3)	21 (36.2)	22 (23.9)	74 (29.7)
Number of unmet needs (CAN-M), mean (s.d.)		9.4 (4.3)	10.6 (4.7)	9.7 (4.6)	9.8 (4.5)
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 BPRS score, mean (s.d.) [*n* = 278]		7.7 (3.4)	10.5 (3.6)	10.3 (3.9)	9.4 (3.9)
Psychotic symptoms, *n* (%) [*n* = 278]	Yes	53 (49.1)	50 (80.6)	80 (74.1)	183 (65.8)
Personality disorder, *n* (%) [*n* = 278]	Yes	17 (15.7)	18 (29.0)	14 (13.0)	49 (17.6)
ICD-10 primary diagnosis at admission, *n* (%) [*n* = 278]	Depression and other unipolar mood disorders (F32, F33, F34, F38, F39)	61 (56.5)	15 (24.2)	34 (31.5)	110 (39.6)
	Bipolar disorder (F30, F31) including acute psychosis (due to psychopathology of puerperal psychosis)	17 (15.7)	18 (29.0)	38 (35.2)	73 (26.3)
	Schizophrenia and related disorders (F20–F29, excluding acute psychotic episode)	1 (0.9)	7 (11.3)	9 (8.3)	17 (6.1)
	Anxiety disorders (F40, F41)	20 (18.5)	8 (12.9)	11 (10.2)	39 (14.0)
	Eating disorders (F50)	0 (0.0)	0 (0.0)	1 (0.9)	1 (0.4)
	Severe mental and behavioural disorders associated with the puerperium (F53)	1 (0.9)	1 (1.6)	12 (11.1)	14 (5.0)
	Mental and behavioural disorder due to psychoactive substance use (F10–F19)	0 (0.0)	1 (1.6)	0 (0.0)	1 (0.4)
	Personality and behavioural disorders (F60–F69)	6 (5.6)	11 (17.7)	3 (2.8)	20 (7.2)
	No diagnosis given	2 (1.9)	1 (1.6)	0 (0.0)	3 (1.1)
Children's social services assessment or intervention at baseline, *n* (%) [*n* = 278]	Yes	27 (24.8)	23 (37.1)	36 (33.6)	86 (30.9)
Age of child on mother's first admission, *n* (%) [*n* = 277]	Admission before birth	2 (1.9)	3 (4.8)	5 (4.7)	10 (3.6)
	0–100 days	58 (53.7)	36 (58.1)	79 (73.8)	173 (62.5)
	>100 days	48 (44.4)	23 (37.1)	23 (21.5)	94 (33.9)
Gestation ≥37 weeks, *n* (%) [*n* = 249]	Yes	76 (76.0)	32 (60.4)	73 (76.0)	181 (72.7)

CRT, crisis resolution team; ward, generic acute psychiatric ward; MBU, mother and baby unit; A&E, accident and emergency department; HONOS, Health of the Nation Outcome Scales; CTQ, Childhood Trauma Questionnaire; CAN-M, Camberwell Assessment of Need for Mothers; TAG, Threshold Assessment Grid; BPRS, Brief Psychiatric Rating Scale.
a. Data were available for the whole sample (*n* = 279) unless otherwise indicated in square brackets.

Instrumental variable analysis

Road distance from the participants' homes to the nearest MBU was available for 278/279 women; readmission data were unavailable for 1 woman; so the final analysis included 277/279 women. A basic probit model for MBU attendance predicting readmission rate, with propensity score as an adjusting covariate, replicated our previous non-significant findings. The simple instrumental variable analysis (Table 2) extended this to potentially account for additional unmeasured confounders by allowing a correlation in the errors of the equation for attendance and the equation for readmission. MBU attendance was clearly associated with distance from the service and the two equations are estimated to be highly correlated. The impact on the estimated effect of MBU attendance is striking ($P = 001$); it implies that MBU attendance reduced readmission rate from 44 to 9%. However, this analysis also assumes that the distance a woman lives from an MBU is not also linked to the likelihood of MBU attendance as a result of other variables, such as severity of illness/unmet need. The significant correlation (−0.120, $P = 0.045$) of the propensity score with distance, however, suggests that this assumption is not met. Extending the instrumental variable model to also adjust for differences associated with the propensity score made little difference to the estimated beneficial effect and significance of MBU admission, although the coefficient associated with propensity score changed sign. This suggests that distance might be associated with some other important variable not included in the propensity score, such as the quality of available services.

Secondary outcomes

Service satisfaction was significantly higher for women accessing MBUs than non-MBUs (i.e. generic acute psychiatric wards and CRTs), but there were no significant differences for other secondary outcomes (Table 3). Mean maternal sensitivity scores were low across MBU and non-MBU groups (supplementary Tables 12, 13).

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Table 2 Instrumental variable analysis model ($n = 277$)

	Basic instrumental variable model with distance instrument				Instrumental variable model with distance and propensity score			
	Probit coefficient	Lower 95% CI	Upper 95% CI	*P*	Coefficient	Lower 95% CI	Upper 95% CI	*P*
MBU	−1.187	−1.783	−0.592	<0.001	−1.191	−1.902	−0.479	0.001
Pscore					1.214	0.179	2.249	0.022
Pscore					2.892	2.163	3.621	<0.001
Distance	−0.900	−1.351	−0.490	<0.001	−0.899	1.348	−0.449	0.001
Error correlation	Rho = 0.749			Rho = 0.016	Rho = 0.690			Rho = 0.042
	Basic model with distance instrument				Instrumental variable			
	Coefficient	s.e.	*z*-statistic	*P*	Coefficient	s.e.	*z*-statistic	*P*
MBU	−0.119	0.198	−0.60	0.547	−1.191	0.363	−3.28	0.001
Pscore					1.213	0.528	2.30	0.022
Pscore					2.892	0.372	7.78	<.001
Distance					−0.899	0.230	−3.92	0.001

MBU, mother and baby unit; Pscore, propensity score developed using Stata *pscore*.

See supplementary Tables 10 and 11 for results of additional post-discharge follow-up measures.

Economic evaluation

EQ-5D-5L-based QALYs were similar in the MBU and non-MBU (i.e. generic acute psychiatric wards and CRTs) groups at 1 month and 12 months post-discharge (Table 4). 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 in the non-MBU group (£13 673) (adjusted mean difference £44 049, 95% CI 36 638–51 461, $P < 0.001$). Similarly, mental healthcare costs from admission to 12 months post-discharge were significantly higher in the MBU group (£50 904) than in the non-MBU group (£8168) (adjusted mean difference £40 798, 95% CI 32 389–49 206, $P < 0.0001$). These cost differences were due to a combination of higher unit costs for MBUs (£707 per day) compared with generic acute wards (£385 per day) and CRTs (£199 per contact) and a higher number of days in MBUs for the MBU group compared with the non-MBU group at 1-month post-discharge (129 days *v.* 95 days) and 12 months post-discharge (148 days *v.* 113 days) (supplementary material). This led to a higher cost per day (total cost) for women in the MBU group compared with those in the non-MBU group at 1 month post-discharge (£449 *v.* £169) and 12 months post-discharge (£97 *v.* £15). When broken down into MBU, generic acute psychiatric ward and CRT group, the costs remained different between the MBU and non-MBU groups: the mean total health and social care costs from admission to t_1 was £60 007 (s.d. = £32 065) in the MBU group, compared with £20 318 (s.d. = £15 170) in the generic acute psychiatric ward group and £9958 (s.d. = £8774) in the CRT group; from admission to 12 months post-discharge, these costs were £50 904

Table 3 Outcome measures[a] for mother and baby unit (MBU) versus non-MBU participants

	MBU ($n = 108$)		Non-MBU ($n = 171$)		Total ($n = 279$)			
	n	Mean (s.d.) or *n* (%)	*n*	Mean (s.d.) or *n* (%)	*n*	Mean (s.d.) or *n* (%)	Coefficient (95% CI)	*P*
Primary outcome 12 months post-discharge								
Readmission,[b] *n* (%) [$n = 278$; $n* = 263$]	108	24 (22.2)	170	43 (25.3)	278	67 (24.1)	0.95 (0.86 to 1.04)	0.29
Secondary outcomes 1 month post-discharge unless specified								
Number of unmet needs (CAN-M),[c] mean (s.d.) [$n = 279$; $n* = 264$]	108	4.0 (3.3)	171	4.1 (3.6)	279	4.0 (3.5)	−0.05 (−0.75 to 0.65)	0.89
Client Satisfaction Questionnaire total score, mean (s.d.) [$n = 262$; $n* = 249$]	100	26.9 (5.6)	162	25.0 (6.6)	262	25.7(6.3)	1.62 (0.20 to 3.05)	0.03
Perinatal VOICE total score,[d] mean (s.d.) [$n = 127$; $n* = 117$]	89	126.8 (13.9)	38	94.7 (21.2)	127	117.2 (22.0)	34.08 (28.23 to 39.93)	<0.001
Postpartum Bonding Questionnaire total, mean (s.d.) [$n = 261$; $n* = 249$]	100	12.6 (12.5)	161	15.7 (13.2)	261	14.5 (13.0)	−1.59 (−5.20 to 2.02)	0.39
Maternal sensitivity,[e] mean (s.d.) [$n = 201$; $n* = 189$]	78	4.3 (2.4)	123	3.9 (1.9)	201	4.0 (2.1)	0.13 (−0.46 to 0.71)	0.67
Infant cooperativeness,[e] mean (s.d.) [$n = 201$; $n* = 189$]	78	3.3 (2.4)	123	2.9 (1.9)	201	3.0 (2.1)	0.10 (−0.51 to 0.70)	0.75
Maternal unresponsiveness,[e] mean (s.d.) [$n = 201$; $n* = 189$]	78	7.3 (2.8)	123	7.1 (3.3)	201	7.2 (3.1)	0.52 (−0.35 to 1.40)	0.24
Infant passivity,[e] mean (s.d.) [$n = 201$; $n* = 189$]	78	4.9 (3.8)	123	5.1 (3.8)	201	5.0 (3.8)	−0.45 (−1.69 to 0.79)	0.48
No custody of baby[b,c] at 1 year post-discharge, *n* (%) [$n = 226$; $n* = 211$]	97	6 (6.2)	129	9 (7.0)	226	15 (6.6)	0.01 (−0.04 to 0.06)	0.72

CAN-M, Camberwell Assessment of Need for Mothers.
a. Values in square brackets show: *n*, available data; *n**, available data minus those excluded because they were outside of the 'common region of support'.
b. Logistic regression model.
c. Model adjusted for outcome at admission.
d. MBU and ward participants only.
e. Derived from the mother–infant interaction assessment at 1 month post-discharge.

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Table 4 Economic outcomes at 1 month and 12 months post-discharge

	MBU		Non-MBU		Unadjusted mean difference	Adjusted mean difference[a]
Costs	*n*	£, mean (s.d.)	*n*	£, mean (s.d.)	£ (95% CI, *P*)	£ (95% CI, *P*)
Acute care costs in the 2 years prior to index admission	67	1873 (7711)	145	2038 (9353)		
Total health and social care costs from admission to t_1	67	60 007 (32 065)	145	13 673 (12 472)	46 333 (38 380 to 54 286, <0.001)	44 049 (36 638 to 51 461, *P* <0.001)
Total mental health costs from admission to t_2	40	50 904 (25 938)	92	8168 (11 288)	42 736 (34 431 to 51 041, <0.001)	40 798 (32 389 to 49 206, *P* < 0.001)
Outcomes	*n*	Mean (s.d.)	*n*	Mean (s.d.)	Mean (95% CI, *P*)	Mean (95% CI, *P*)
EQ-5D-5L utility at t_1	67	0.825 (0.150)	145	0.790 (0.168)	0.036 (–0.010 to 0.081, *P* = 0.122)	0.007 (–0.039 to 0.053, *P* = 0.752)
EQ-5D-5L-based QALYs at t_1	67	0.282 (0.237)	145	0.224 (0.302)	0.058 (–0.017 to 0.133, *P* = 0.130)	0.007 (–0.013 to 0.027, *P* = 0.496)
EQ-5D-5L utility at t_2	40	0.868 (0.155)	92	0.827 (0.191)	0.041 (–0.020 to 0.103, *P* = 0.188)	0.003 (–0.055 to 0.061, *P* = 0.915)
EQ-5D-5L-based QALYs at t_2	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* = 0.733)

MBU, mother and baby unit; QALY, quality-adjusted life-year.
a. 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. MBU, mother and baby unit; QALY, quality-adjusted life-year.

(s.d. = £25 938) in the MBU group compared with £14 027 (s.d. = £16 791) in the generic acute psychiatric ward group and £4734 (s.d. = £2777) in the CRT group.

The incremental cost-effectiveness ratio was £6 436 087 (£44 409/0.0069 QALYs) 1 month post-discharge and £4 079 800 (£40 798/0.010 QALYs) 12 months post-discharge. The ratio far exceeds the NICE threshold of £20 000–£30 000 per QALY, implying that MBUs are not cost-effective compared with non-MBUs. The cost-effectiveness acceptability curve 1 month post-discharge did not rise above 0% for the full range of willingness-to-pay thresholds tested (£0–50 000 per QALY; see supplementary Economic Evaluation Results Fig. 2), indicating that the probability of MBUs being cost-effective compared with non-MBUs is 0% at the NICE preferred willingness-to-pay threshold of £20 000–£30 000 per QALY. Cost-effectiveness acceptability curves at 12 months post-discharge, using QALYs based on the Short-Form Six-Dimension (SF-6D) health index, and with missing data imputed, were similar (supplementary Figs 4 and 6).

Discussion

We found no difference in readmission rates for women with severe acute postpartum mental disorders accessing MBUs compared with non-MBUs (i.e. generic acute psychiatric wards and CRTs). There was no difference for most secondary outcomes (e.g. perceived parental bonding and observed quality of mother–infant interactions), with mean maternal sensitivity scores low across groups, which suggests a need for parenting interventions/support. Our findings did not change when we reassigned cohort definition from 'highest level of care' to 'the first service a woman was admitted to' or 'which service a woman spent most of her admission in'. However, satisfaction with care was considerably higher for women admitted to MBUs than non-MBUs, supporting previous research highlighting that women value the specialist support provided by MBUs[16] and can experience care from CRTs and generic wards as intrusive, disruptive and lacking continuity of care/tailored support.[16–18] The Perinatal VOICE measure highlighted that MBUs were rated as providing maternal care comparable to in-patient care and support for caring for the baby comparable to CRT care (details available from the author on request). Our advisory group, comprising mainly of women with lived experience of psychiatric care for acute severe perinatal mental illness, emphasised that services involving separation of mother (as opposed to father) from an infant may have a longer-term impact on mothers, with feelings of inadequacy and guilt and potentially contributing to risk of relapse.

The propensity score analysis provided our best estimate of the effects of service type on the primary outcome, adjusted for the potential confounders we were able to measure. Our instrumental variable sensitivity analysis made different assumptions and, in theory, can account for imbalance in any excluded or unmeasured variables used to match women in the propensity score approach. This analysis suggested that MBUs could reduce readmission rates by up to 70% ($P = 001$). However, we cannot confirm that all the assumptions of the instrumental variable analysis were met – in particular, that there was no correlation between quality of services and distance from an MBU.

Women in the acute psychiatric ward cohort had considerable clinical complexity and social disadvantage but did not experience better care pathways or the most specialist perinatal care. This finding warrants further exploration, in particular regarding equity of access to hospital- or community-based specialist perinatal mental healthcare.

Economic analyses suggest zero per cent probability of MBUs being cost-effective compared with non-MBUs (i.e. generic acute psychiatric wards and CRTs) over the short term (1 month post-discharge) and longer term (12 months post-discharge). This was driven by similar maternal outcomes combined with the long duration, high levels of specialist staffing and high cost of MBU admissions, where the baby also receives care provided by the healthcare service. However, if the instrumental variable analysis is valid and indicates potential bias in the primary analysis, cost-effectiveness advantages may exist, as the high cost of MBU admissions may be offset by savings from reduced subsequent admissions. Although we could not measure them within the timeline of the current study, it might also be important to take into account longer-term outcomes for the child when considering cost-effectiveness. Finally, our process evaluation, and other studies, highlight differences in interventions provided across MBUs.[16,19,20]

Strengths and limitations

This is the largest evaluation of specialist perinatal mental health services to date. The propensity score approach allowed us to compare women accessing different services non-randomly by

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matching them across an extended list of measures, including symptomatology and social and demographic characteristics. Nonetheless, imbalance in something excluded or unmeasured remains a possibility and the instrumental variable analysis highlights this; the lack of randomisation means that residual confounding remains possible. We did not have the statistical power to directly compare MBUs with generic acute wards only, owing to the limited number of women recruited from wards only. Combining the acute wards and CRT groups might have hidden important differences between MBUs and acute wards versus MBUs and CRTs. Admissions were often short, clinical staff were too busy to refer potential participants before discharge or women elected not to participate in the study; this might have affected the estimates to a material extent. The Ethics Committee did not approve collection of data on women who did not participate in the study, so we do not know their characteristics and the extent of this selection bias. There is the potential for recall bias when asking women about baseline information at t_1; therefore, we used case notes for most variables. Readmission may reflect the natural history of acute severe postpartum conditions, and other clinical and longer-term maternal and child outcomes may better reflect effectiveness. Indeed, the landscape in which care is delivered and, therefore, services research is undertaken is changing rapidly. Future examination of the effectiveness and cost-effectiveness of MBUs needs to reflect this. Current evidence suggests that the health, development and healthcare utilisation of children exposed to maternal mental illness is poor relative to non-exposed children.[21,22] Future research needs to examine how joint in-patient admission influences these outcomes for infants admitted with their mother to MBUs.

Implications

Over one in five women in our sample were readmitted to acute psychiatric care in the year after discharge from MBU or non-MBU acute care, implying significant relapse at a time when the mother–infant relationship remains critically important; mother–infant interaction was also suboptimal at 1 month after discharge. Outcomes may reflect subsequent availability of specialist community perinatal mental healthcare. Our research[23] on women's unmet needs post-discharge from in-patient services (including MBUs) suggests that more support is needed following acute care. The NHS Long Term Plan advises commissioning of perinatal mental health services up to the age of 2; these data support this and suggest that parenting support should also be commissioned.

MBUs were preferred by women, but in the short term (up to 1 year after discharge) there was no clinical or cost-effectiveness advantage for MBUs. In the longer term a cost-effectiveness advantage would require improved outcomes, reduced subsequent admissions and reduced lengths of stay. Development of future services should consider longer-term support for women, infants and families; from a human rights perspective, women's right to family life means ensuring that mothers and fathers/partners stay with their babies wherever possible. Future research should establish which components of acute care are critical for effectiveness and for maternal satisfaction, including aftercare.

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Supplementary material

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Data availability

The data that support the findings of this study are available on request from the corresponding author.

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Author contributions

L.M.H., K.M.A., A.P. and S.B. conceived the study design, wrote the protocol, supervised the research team and wrote the manuscript; C.D. led co-production of research questions and study procedures with women with lived experience of psychiatric care for severe acute perinatal mental illness; K.T. and L.M.H. led the writing of the protocol and related standard operating procedures (SOPs) regarding safeguarding and related issues, supervised data collection and data management; K.T. carried out the literature search; L.E.C., So.J., R.S., S.P., St.J., N.S., I.J., A.W., C.P. contributed to the protocol development and L.E.C., St.J., R.S., C.P. carried out data collection; R.M. carried out data collection and led the geographical data analysis; S.B. and M.H. wrote the health economic aspects of the protocol, related SOPs and analysis; A.P. led all the statistical aspects of the study and supervised L.P., who carried out the statistical analyses; N.S. led the social care aspects of the study; So.J. led the acute care aspects of the study; L.M.H., L.P., A.S., M.H. and S.B. accessed and verified the underlying data. All authors were involved in interpreting the results and editing the manuscript and all approved the final version. All authors had full access to the full data in the study and accept responsibility to submit for publication.

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REFERENCES

1 National Institute for Health and Care Excellence. *Antenatal and Postnatal Mental Health guidelines (Clinical Guideline CG192)*. NICE, 2014.

2 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; **9**(3): e025906.

3 Martin J, McLean G, Martin D, Cantwell R, Smith D. Admission to psychiatric hospital for mental illnesses 2 years prechildbirth and postchildbirth in Scotland: a health informatics approach to assessing mother and child outcomes. *BMJ Open* 2017; **7**(9): e016908.

4 Howard LM, Shah N, Salmon MP, Appleby L. Predictors of social services supervision of babies of mothers with mental illness after admission to a psychiatric mother and baby unit. *Soc Psychiatry Psychiatr Epidemiol* 2003; **38**: 450–5.

5 Herdman M, Gudex C, Lloyd A, Janssen M, Kind P, Parkin D, et al. Development and preliminary testing of the new five-level version of EQ-5D (EQ-5D-5L). *Qual Life Res* 2011; **20**: 1727–36.

6 van Reenen M, Janssen B. *EQ-5D-5L user guide: basic information on how to use the EQ-5D-5L instrument*. EuroQol Research Foundation, 2015.

7 Howard LM, Hunt K, Slade M, O'Keane SV, Leese M, Thornicroft G, et al. *CAN-M: Camberwell Assessment of Need for Mothers*. Royal College of Psychiatrists, 2008.

8 Larsen DL, Attkisson CC, Hargreaves WA, Nguyen TD. Assessment of client/patient satisfaction: development of a general scale. *Eval Program Plann* 1979; **2**: 197–207.

9 Brockington IF, Oates J, George S, Turner D, Vostanis P, Sullivan M, et al. A screening questionnaire for mother-infant bonding disorders. *Arch Womens Ment Health* 2001; **3**: 133–40.

10 Crittenden PM. *CARE-Index: Infants Coding Manual*. Family Relations Institute, 2003.

11 National Institute for Health and Care Excellence. *Guide to Methods of Technology Appraisal*. NICE, 2013.

12 Manca A, Hawkins N, Sculpher MJ. Estimating mean QALYs in trial-based cost-effectiveness analysis: the importance of controlling for baseline utility. *Health Econ* 2005; **14**: 487–96.

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

14 Briggs AH. A Bayesian approach to stochastic cost-effectiveness analysis. *Health Econ* 1999; **8**: 257–61.

15 Fenwick E, Byford S. A guide to cost-effectiveness acceptability curves. *Br J Psychiatry* 2005; **187**: 106–8.

16 Griffiths J, Taylor BL, Morant N, Bick D, Howard LM, Seneviratne G, et al. A qualitative comparison of experiences of specialist mother and baby units versus general psychiatric wards. *BMC Psychiatry* 2019; **19**(1): 401.

17 Rubio L, Lever Taylor B, Morant N, Johnson S. Experiences of intensive home treatment for a mental health crisis during the perinatal period: a UK qualitative study. *Int J Nurs* 2020; **30**: 208–18.

18 Powell C, Bedi S, Nath S, Potts L, Trevillion K, Howard L. Mothers' experiences of acute perinatal mental health services in England and Wales: a qualitative analysis. *J Reprod Infant Psychol* 2022; **40**: 155–67.

19 Elkin A, Gilburt H, Slade M, Lloyd-Evans B, Gregoire A, Johnson S, et al. A national survey of psychiatric mother and baby units in England. *Psychiatr Serv* 2009; **60**: 629–33.

20 Howard L, Khalifeh H. Perinatal mental health: a review of progress and challenges. *World Psychiatry* 2020; **19**: 313–27.

21 Pierce M, Hope HF, Kolade A, Gellatly J, Osam CS, Perchard R, et al. Effects of parental mental illness on children's physical health: systematic review and meta-analysis. *Br J Psych* 2020; **217**: 354–63.

22 Hope H, Osam CS, Kontopantelis E, Hughes S, Munford L, Ashcroft DM, et al. The healthcare resource impact of maternal mental illness on children and adolescents: a UK retrospective cohort study. *Br J Psych* 2021; **219**: 515–22.

23 Lever Taylor B, Kandiah A, Johnson S, Howard LM, Morant N. A qualitative investigation of models of community mental health care for women with perinatal mental health problems. *J Ment Health* 2021; **30**: 594–600.

https://doi.org/10.1192/bjp.2022.48 Published online by Cambridge University Press