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***Detailed Response to Reviewers**

Ms. Ref. No.: EURPSY-D-09-00296
Title: Inpatient mother-and-child postpartum psychiatric care: factors associated with improvement in maternal mental health
European Psychiatry

Dear Sophia

Thank you and the three reviewers for their interesting comments, which we have read carefully.

Herewith the revised manuscript that we hope provides all the requested revisions.

Yours sincerely,

Nine Glangeaud

Answers to reviewers' comments:

Reviewer #1:

All studies on MBUs cited by Joy and Saylan have been added in the introduction, including the missing one on Australian mother-baby units. We apologize for this accidental omission. *We note and cite others studies that describe the importance of such mother-baby inpatient car: Joint mother-baby units allow mothers to remain with their babies during psychiatric treatment and thus prevent both the potential detrimental effects to the baby of separation from the mother and the effects this separation could have on the mother's self confidence. MBUs are recommended for mothers with perinatal psychoses in the UK, but outside the UK and some parts of Australia, Europe, Canada, and New Zealand, they are, as Joy & Salan (18) pointed out, either "virtually nonexistent or very limited". They also note the lack of any clear explanation in the literature for these differences in treatment of women with mental illness around the world. Data on improvement in women's mental health in such care units may therefore improve our understanding of how best to care for these women. It may also encourage future studies to further evaluate the efficacy of Mother-Baby Units vs. other treatment options for pregnant women with mental health illness."*

We agree with the reviewer's comments on limitations of our study. We have acknowledged and discussed them in the discussion section, as follows: *"In addition, even though we used a standardized questionnaire for data collection, a potentially important limitation of our study is that women's improvement was evaluated by the health care provider in charge of their treatment. In particular, the proportion of women who improved may have been over- (or under-) estimated. However, it seems unlikely that any such bias was differential across the predictor variables included in the study. Therefore, the associations we found between the odds ratio of improvement and the predictor variables are less likely to be biased*".

Reviewer #2:

We agree with our reviewer about "some limitations to the sample, particularly the fact that it only includes women admitted with their infant to an MBU. Women admitted elsewhere, and women not admitted to a treating facility may have different characteristic and outcomes than the MBU population". However, the objective of our study was not to compare the outcomes for women cared for in MBU's vs those in other settings. This is obviously an important question that we mention in the discussion: "*Nonetheless, our sample is not representative of all women with psychiatric disorders after childbirth, and its results should not be generalized without further studies in the community"*. We have noted that future studies should address

this question in the introduction that our study "*may also encourage future studies to further evaluate the efficacy of Mother-Baby Units vs. other treatment options for pregnant women with mental health illness."* and in the discussion: *"In any case, future studies should compare outcomes of women and infants cared for in Mother-Baby-Units compared with managed in other settings and receive alternative strategies of clinical care".*

Recruitment of women was systematic and patient agreement was request before inclusion in the database. The questionnaire and protocol were submitted to an official ethics committee and approved. It is mentioned in methods section as follows: "*The French Data Protection Authority (CNIL) approved the study. Because no intervention was involved, no additional approval was required by French law. All subjects provided informed consent to their inclusion in the database*".

Additional details are included in methods. The first part of the questionnaire was completed at admission and the second part at discharge. On average, women stayed at the hospital for several weeks. We therefore considered that the study was prospective in nature.

We have specified in methods that "treatment" during pregnancy means "*treatment with psychiatric medications*". "Significant improvement" is defined in the methods section.

The mistakes in Table 1 have been corrected.

The Abstract has been corrected and Methods section has been revised.

The Keywords have been changed.
"Affective disorders; Schizophrenia and psychosis; Personality disorders;
Psychiatry in Europe; Epidemiology; *Social and Cross Cultural*
Postpartum disorders; Mother-baby unit"
However, it would be useful to include "postpartum disorders" as a keyword but it is not in the proposed list. Can it be added to our keyword list.

Reviewer #3:

First comment: Two references describing mother-baby units in France and details on the MBU-SMF network have been added to the methods section. We also added information and one reference on the aims for treatment and functioning of French MBU units in the introduction as follows: *"All the MBUs participating in the study are part of a working group from the French Marcé Society and have worked together since 1995 to set up this database. This collaboration, as well as biannual meetings of the French MBUs, has made it possible to develop common practices, even though, because of administrative constraints, some are attached to the child psychiatry and others to adult psychiatry departments (30).".*

Second comment: We are in agreement with this reviewer that " the need to provide more intense treatments for high risk complex patients and to inform women with chronic mental illness and their families of the risks or relapse/recurrence associated with pregnancy and childbirth"..."depends on a proper understanding of the maternity context and its relationship to mental health and mental illness which require health professionals with specialised skills, knowledge and expertise in perinatal mental health".

We have added a short paragraph stressing this point in the discussion: "*The United Kingdom models for specialized perinatal mental health services, emphasize the need for properly integrated mother-baby in-patient units and perinatal community psychiatric teams to ensure that the needs of mothers and their infants are met both during and after in-patient care (28). Our results underscore this need even during the prenatal period, to provide optimal management for these high-risk patients".*

Third comment: We also agree that there is a “need for properly integrated mother and baby in-patient units and perinatal community psychiatric teams to ensure that the needs of mothers and their infants are met both during and after an in-patient stay”. We have added the comment suggested by this reviewer at the end of the discussion “*Perinatal community psychiatric teams play an essential in the continued care and management of women following their discharge from the MBU, especially those with poorer clinical outcomes at discharge, including those with chronic mental illness or with social integration problems”.*

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INPATIENT MOTHER-AND-CHILD POSTPARTUM PSYCHIATRIC CARE: FACTORS ASSOCIATED WITH IMPROVEMENT IN MATERNAL MENTAL HEALTH

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ABSTRACT

Purpose:

This study assessed the underexplored factors associated with significant improvement in mothers' mental health during postpartum inpatient psychiatric care.

Methods:

This study analyzed clinical improvement in a prospective cohort of 869 women jointly admitted with their infant to 13 psychiatric Mother-Baby Units (MBUs) in France between 2001 and 2007. Predictive variables tested were: maternal mental illness (ICD-10), socio-demographic characteristics, mental illness and childhood abuse history, acute or chronic disorder, pregnancy and birth data, characteristics and mental health of the mother's partner, and MBU characteristics.

Results:

Two thirds of the women improved significantly by discharge. Admission for 25% was for a first acute episode very early after childbirth. Independent factors associated with marked improvement at discharge were bipolar or depressive disorder, a first acute episode or relapse of such an episode. Schizophrenia, a personality disorder, and poor social integration (as measured by occupational status) were all related to poor clinical outcomes.

Discussion:

Most women improved significantly while under care in MBUs. Our results emphasize the importance of the type of disease but also its chronicity and the social integration when providing postpartum psychiatric care.

KEYWORDS

Affective disorders; Schizophrenia and psychosis; Personality disorders;
Psychiatry in Europe; Epidemiology; Social and Cross Cultural, Postpartum disorders;
Mother-baby unit

INTRODUCTION

Perinatal psychiatry, a recent and developing field of psychiatry, seeks to treat maternal mental disorders and promote child development. The most frequent disorders observed during the perinatal period are mood disorders, notably postpartum depression, which affects more than 10% of women. Most puerperal illness, as Bell et al. (3) noted, "is affective in nature." Except for postpartum depressions, however, little is known about the particularities of perinatal psychiatric episodes in terms of clinical care and outcome. For example, the recent review by Joy & Saylan (18) reports that very few studies describe joint mother-and-baby inpatient admissions to psychiatric Mother-Baby Units (MBUs).and cites several (1, 4, 12, 16, 19, 21, 26, 34-35). We note others that describe the importance of such mother-baby inpatient care (17, 28, 32, 38, 42-43, 45). Joint mother-baby units allow mothers to remain with their babies during psychiatric treatment and thus prevent both the potential detrimental effects to the baby of separation from the mother and the effects this separation could have on the mother's self confidence. MBUs are recommended for mothers with perinatal psychoses in the UK, but outside the UK and some parts of Australia, Europe, Canada, and New Zealand, they are, as Joy & Salan (18) pointed out, either "virtually nonexistent or very limited". They also note the lack of any clear explanation in the literature for these differences in treatment of women with mental illness around the world. Data on improvement in women's mental health in such care units may be useful for improving their care . It may also encourage future studies to further evaluate the efficacy of Mother-Baby Units vs. other treatment options for pregnant women with mental health illness.

Two groups have collected large quantities of MBU data: one in England, which included cases from 1994 to 2004 and recorded data according to the Marcé checklist (34), and one by the MBU-SMF working group, which began ongoing data collection in 1998, using a revised French version of the Marcé checklist (12). All the MBUs participating in the study

are part of a working group from the French Marcé Society and have worked together since 1995 to set up this database. This collaboration, as well as biannual meetings of the French MBUs, has made it possible to develop common practices, even though, because of administrative constraints, some are attached to the child psychiatry and others to adult psychiatry departments (30).

In a study of 1081 cases based on the English data, Salmon et al. (34) reported that 78% of the women had a good clinical outcome, defined as being symptom-free or considerably improved, despite the persistence of some symptoms. Predictors of poor clinical outcome were schizophrenia (defined in their study as chronic or acute delusional psychosis), behavioral disturbances, low social class, and a partner with either a psychiatric illness (details were not given) or with whom the woman's relationship is poor. In a subsequent paper (35), these authors confirmed the poor outcome in mothers with schizophrenia, compared to those with affective disorders.

Several potentially important factors have not yet been adequately assessed in the literature on MBUs. These include past mental illness, a known risk factor for later relapse (3, 10), admission for acute episode vs chronic pathology (40), psychiatric treatment during pregnancy, and traumatic events during the mother's childhood. Moreover, the characteristics of women' partners that may influence relapse of psychiatric disorders (13, 22) have not been studied sufficiently.

The aim of the present study was to evaluate the factors associated with significant improvement in a large sample of inpatient mothers hospitalized in 13 different MBUs, by studying previously identified risk factors in more detail and examining other potentially important factors that have not been assessed in previous literature.

MATERIALS AND METHODS

Data source

Data for this study of women hospitalized in 13 MBUs belonging to a French network (the MBU-SMF group) were collected with the French version of the Marcé clinical checklist (5, 12), originally developed in the UK (36) for clinical data collection in MBUs. The Marcé checklist includes information on the woman's mental illness, the mental health history of the infant's parents, the mother's social and demographic characteristics, her treatment and MBU admission, and outcome at discharge. The French version of the questionnaire includes additional questions about traumatic events that parents might have experienced during their own childhood or adolescence, the partner/father's social and demographic characteristics and mental health history, and more detailed data on the woman's diagnosis and treatment. The physician managing the MBU completed the questionnaire, and all MBUs followed a standardized procedure to collect and code the data.

Study population

The initial study population included all women hospitalized in the participating MBUs (11, 27) who were discharged between January 1, 2001, and December 31, 2007. Women were eligible to participate in the study if they were jointly hospitalized with a baby aged less than one year and had a hospitalization of at least five consecutive days. Eligible women (N=870) were invited to participate in the study, one refused to participate and one had missing information for maternal mental illness. In addition, information was missing for 54 women (6%) on one or more of the following variables: educational level, parity, country of birth, and compulsory admission, and they were excluded from the multivariable analyses. The final study population for these analyses thus included 814 women. The French Data Protection

Authority (CNIL) approved the study. Because no intervention was involved, no additional approval was required by French law. All subjects provided informed consent to their inclusion in the database.

We compared the outcomes and the distribution of maternal illness categories for the 814 women included in the multivariable analyses with those of the 54 women excluded for missing data and found no significant differences between them.

Outcome variable

The outcome variable was whether or not the woman's mental illness improved substantially during her index hospitalization, that is, her clinical status at discharge, evaluated according to the following five-point scale in the French Marcé checklist: (1) symptom-free, (2) considerably improved, with some persisting symptoms, (3) slightly improved, with persisting symptoms, (4) no change in clinical status, (5) deterioration of clinical status. In consultation with the clinicians participating in the study, we regrouped the first two response categories (responses 1+2) as “marked improvement in symptoms” and the last three categories (3-5) as “no marked improvement in symptoms”. The outcome variable was then analyzed as a binary variable (marked improvement in symptoms or not). This variable corresponds to what Salmon et al. (34) defined as a “good clinical outcome” in their studies.

Predictor variables

The main predictor variable of interest was maternal mental illness, categorized in the following seven diagnostic groups (according to ICD-10 codes):

- F30-31 and F25: bipolar and schizoaffective disorders
- F32-F33: depressive episode and recurrent depressive disorder

- F23: acute and transient psychotic disorders
- F20-F22 and F28-F29: schizophrenia and other non-affective disorders
- F60-F69: adult personality and behavior disorders
- F34, F38, F39, F40-F43 and F50-F53: other persisting mood disorders, neurotic and stress-related disorders, somatoform disorders, and behavioral syndromes associated with physiological disturbances and physical factors
- F00-F19 and F70-F94: other disorders.

Our model included 24 other predictor variables, based on the literature and the available data. These variables covered the following 10 categories:

1) mother's social and demographic characteristics
2) maternal occupation, employment status, and whether she lives with a partner
3) diagnosis of the maternal mental illness and history of mental illness
4) treatment with psychiatric medication during pregnancy
5) abuse or foster care during the mother's childhood
6) pregnancy and birth data, including parity, pregnancy complications, baby's age at admission, and whether or not the baby was transferred to a neonatal intensive care unit
7) reason for the index hospitalization (admission for a first or recurrent acute episode or a chronic illness or for a maternal competence evaluation) and maternal legal status at admission
8) history of mental illness and occupational status of the partner or, if there is no partner, the child's father
9) risk behaviors during pregnancy, including tobacco, alcohol, and illicit drug use
10) type of unit, including size of unit and type of service (MBU directed by adult or child psychiatrist).

For some questions, if the clinicians lacked sufficient information for a definite response, notably about history of abuse and foster care, pregnancy complications, and tobacco, alcohol, and drug use during pregnancy, we classified the reply as “no known history of abuse” or “no known tobacco use during pregnancy", etc. We conducted a sensitivity analysis in which these observations were excluded as missing data; the results were essentially identical to those we present here. For mental illness in the partner/father, we created a separate category “unknown” when no information was available about the partner/father, as well as a category “no known mental illness in partner/father”.
In the analyses, we combined certain categories of responses to predictor variables after we verified the effects associated with the categories that were combined. This was the case, for example, for psychiatric history, for which we regrouped “other disorders” with “missing”. We also combined the category “no known history of foster care” (i.e., no information available on foster care) with “no foster care” (i.e., specific information available indicating the absence of a history of foster care); similarly, we combined “no known tobacco use” with “no tobacco use”.

Statistical analysis

We calculated proportions (with 95% confidence intervals, CIs) of women with marked improvement in their mental illness for each predictor variable category. We used chi-square tests to assess the statistical significance of differences in the proportions of women with marked improvement across the categories. Using logistic regression models, we then estimated the unadjusted and adjusted ORs and their 95% CIs for the effects of each predictor variable on the likelihood of a marked improvement in the women's clinical status. Analyses were adjusted for maternal mental illness as well as for the other predictor variables noted above. All analyses were done with SAS version 9.1 (SAS Institute).

RESULTS

Characteristics of the study population (Table 1)

The majority of the 869 admissions occurred in the early postpartum period, 58% of them within 8 weeks of delivery. The mean age of the babies was 9.6 ± 7.3 weeks. The mothers' mean age was 31 ± 6 years (range: 15 to 47 years). More than half of the women were primiparous, and 21% of the infants had been transferred to neonatal intensive care units. Two thirds of the women were living with a partner (39% were married). About one third had a high school diploma or higher level of education and was employed or in professional training at admission. Twenty percent were not born in France, 14% had a history of sexual or physical abuse, and 24% had been in foster care during their childhood.

Among the living partners or fathers, 49% had no known mental illness, but the information was missing for 30% of the cases. Overall, 68% were employed and 26% had a high school diploma or a higher level of education.

The women's main diagnoses were mood disorder, diagnosed in 38%; schizophrenia and other non-affective delusional disorders (23%), and adult personality or behavior disorders and cognitive or mental organic disorders (23%). More than one third of women had used tobacco, 7% alcohol, and 7% illicit drugs during pregnancy.

Average length of stay for the joint admission was 10 ± 7 weeks (mean ± SD) with a minimum stay of one week and a maximum of 16 months. More than half of all admissions were for a relapse of an acute episode or a chronic disorder, and one quarter were for a first acute episode or first diagnosis of mental illness. In 18% of cases, problems of interactions

between mother (without any diagnosed mental illness) and child were a reason for admission.

Maternal mental health outcomes

Mental illness improved markedly in 69% (95% CI, 66-72) of the women: 16% of women had no clinical symptoms (complete recovery) at discharge, and 53% major improvement, while 21% of women had a slight improvement and 10% either no change (8%) or deterioration (2%).

Predictor factors for improvement and univariate analysis (Table 1)

Table 1 shows the associations of potential predictor factors with the likelihood of a marked improvement in maternal mental illness between admission and discharge. The most important predictor variables associated with this improvement included: maternal educational level, occupation, employment status, living with a partner, and tobacco, alcohol, or drug use during pregnancy. The history and current diagnosis of the illness and the reason for admission were also highly associated with the likelihood of improvement in symptoms. The partner's history of mental illness was also associated with the likelihood of a marked improvement.

In particular, 81% of the women with a high school education and higher had a marked improvement in symptoms, compared with 53% for those with a primary education or less ($p<0.0001$). Similarly, 84% of the women who were employed or in training improved markedly compared with 47% of those who received disability pay and 54% of those receiving a state allowance.

Women with a diagnosis of a mood disorder (depressive episode or recurrent depressive episode or bipolar disorder) or with an acute transient psychotic disorder had the highest

likelihood of improvement (87% and 85%) and those with an adult personality or behavior disorder the lowest (40%). Among women with schizophrenia or other non-affective psychotic disorders, 47% improved markedly, as did 40% with "other" diseases or mental health disorders.

Multivariable analyses of predictor factors for improvement (Table 2)

Table 2 shows the results of the multivariable analyses aimed at estimating the independent effects associated with each predictor variable. The most important factors independently associated with marked improvement were the specific diagnosis, the reason for admission, and maternal occupation. Women with a diagnosis of schizophrenia or other non-affective psychotic disorders were 2.5-fold less likely (adjusted OR = 0.27, 95% CI, 0.12-0.61) to improve markedly compared to those with a diagnosis of depressive episode or recurrent depressive episode (reference category). Women with a personality or behavioral disorder had the lowest likelihood of improvement with almost a five-fold lower odds ratio of marked improvement as women with mood disorders (adjusted OR = 0.21, 95% CI, 0.10-0.44). Women who had had only a previous acute episode before this admission had the highest likelihood of improvement (adjusted OR=2.24, 95% CI, 1.11-4.55), more than twice that of women with a first acute episode (reference category). Finally, women whose living partner (or child's father, if no partner) had mood disorders had a 3-fold lower odds ratio of improvement (adjusted OR=0.33, 95% CI, 0.14-0.79), compared with women whose partner had no known mental illness (reference category).

After taking these variables into account in multivariable logistic regression models, the other factors included (see Table 2) were not significantly associated with the likelihood of marked improvement in maternal mental illness symptoms. In particular, the type of unit (directed by an adult or child psychiatrist) was not significantly associated with the odds of marked improvement.

DISCUSSION

This cohort study of 869 women prospectively assessed during a joint admission in 13 French MBUs shows that one fourth of the women were admitted for a first acute episode very soon after childbirth, mainly for affective disorders, and that two thirds had improved significantly at discharge (symptom-free or considerably improved, with some persisting symptoms). The results also show that: (i) bipolar or depressive disorder, relapse of a previous acute episode or a first acute episode were all independent factors associated with marked improvement in mental health at discharge, (ii) and schizophrenia, personality disorder, or poor social integration (with occupational status as a proxy) were independent risk factors for poor clinical outcome.

Most women in our study improved markedly by discharge, albeit at a rate somewhat lower (69%) than the UK sample (78%) (34-35). These results may be due to differences in the patient profile in France and the UK. The UK sample appears to include a higher percentage of women with disorders for which the probability of a good outcome is high, such as mood disorders and, inversely, very few personality disorders, for which prognosis is poorer.

Postpartum acute psychoses should be evaluated separately from other psychotic disorders, as we do here, because they are specific to the postpartum period (6) and have a much better prognosis than other psychotic disorders, especially schizophrenia(10). In the UK sample, postpartum acute psychoses were not specified and were subsequently regrouped with the schizophrenia group. This classification difference may partially explain the difference in the schizophrenia rate between the UK (23%) and French samples (11%) and may also explain the differences in maternal outcomes.

The findings that an affective disorder (psychotic or not) was an independent factor associated with marked improvement at discharge and that schizophrenia or personality

disorders were independent risk factors for poor clinical outcome are consistent with previous results (19, 34-35). They may reflect the usual clinical course of these disorders. In any case, they point out the need to anticipate for such at-risk patients and to begin appropriate (more intensive) care early in the hospitalization of these high-risk patients (14, 39, 41).

We found that a relapse of a previous acute episode and a first acute episode were independent factors associated with maternal improvement, after taking the specific disorders into account. These results, related to factors not previously assessed in the literature on MBUs, may reflect the high risk during the postpartum period of acute episodes (first ones, or relapses after a long period of stability) that, if treated, have relatively good outcomes, contrary to mothers with chronic mental illness, who tend to have poorer outcomes. Such chronic illnesses may have poorer prognoses especially during the postpartum period when child care is demanding and stressful. This result also underlines the need for professionals to inform their patients and families about the risks associated with pregnancy for women with chronic disorders and to begin working with them as early as possible (14).

Our results about social and demographic variables show that last employment category and educational level did not contribute independently to maternal improvement. Only “occupational activity or ongoing training” was an independent factor linked to good clinical outcome, while not working outside home or receiving disability or unemployment benefits (factors not examined in previous studies) was predictive of poor outcome. These results suggest that the mother's social integration may be relevant to clinical care. Lack of social or occupational integration may be either a consequence of mental illness or a risk factor for failure to improve. Taking this social dimension into account during joint admissions is essential; both for managing maternal care, because being out of the labor force and having low social integration are important factors influencing care uptake (2) and outcome (9) of

mental disorders, as observed outside the perinatal period, and because social and community integration play a crucial role in the child's socio-affective development (8, 31).

Finally, the impact of the partner's characteristics on the course of a woman's psychiatric disease is highly relevant. For example, women with schizophrenia were more likely not to have a partner, and when they did, he was more likely to have a psychiatric illness, as other studies of MBU patients show (1, 13, 15, 19-20, 34-35). About 20% of partners in our study, and in that of Salmon et al. (35) had a mental disorder. However, neither they, nor we, found any relationship between marriage or cohabitation and clinical outcome in women admitted to MBUs. One of the strengths of our study is its more detailed investigation of the characteristics of partners/fathers. We found a trend in the association between the partner/father's mental health, especially for partners with mood disorders, and lesser likelihood of improvement in the woman's mental health. These results may be due to one or more of the following: (i) it is more difficult for a woman to improve when her partner is depressed; (ii) lack of improvement of her mental health may induce paternal depression; (iii) the parents' mental illnesses may be related (22-23), due to an assortative mating with a partner with the same disorder (24) or to one partner's inducing the disorder in the other (25, 37) or to a disorder related to the family structure (7). These results are important because the partner's mental health is important beyond the context of MBUs: it influences the quality of family relationships and contributes to depression or behavior disorders in offspring, independently of maternal mental health (23, 33, 37).

On the one hand, several other variables, although significantly associated in univariate analysis, were not independent predictive factors of marked improvement. These included psychotropic medication during pregnancy, psychiatric history, history of childhood abuse, and illicit drug abuse during pregnancy. This was probably due to: i) correlation between these variables and other factors included in the model, and ii) the fact that despite our

relatively large sample size we probably had limited power to detect the statistical significance of all the variables included in the model.

In choosing the number of variables to include in our model, we followed the recommendations in the statistics literature about selecting this number as a function of the number of events. Specifically, the literature recommends a minimum of 5-10 events per variable (29, 44). We had more than 500 events (i.e., women with marked improvement). Hence the number of variables (N=25) in our model was well within the number recommended for inclusion in multivariable analyses. However, these guidelines are based on simulation studies and may not always be appropriate for a given data set. For our study, particularly for variables that tended to be highly correlated (e.g., reason for admission and maternal diagnosis of mental illness), the precision of our estimates may have been limited. Accordingly, caution is required in interpreting the lack of statistical significance of some of the variables as independent predictor factors for the outcomes.

Moreover, the many variables in the multivariable analysis complicate the choice of modeling strategy. Because our principal aim was to assess to what extent each variable might be an independent prognostic factor for the outcome, the article presents the results of a “full” model including all variables in the same model. We conducted additional analyses using alternative, “reduced” models in which major variables of interest, notably maternal mental illness, partner/father mental illness, maternal occupation and employment status, and history of abuse and of foster care, were forced into the model. These showed that in general the estimates tended to be stable for the variables remaining in each model (results not shown, available from authors). Hence, the results we present here are at least to some extent robust with regard to the modeling strategy. Nevertheless, alternative models not tested here might be more appropriate for other objectives. In particular, it would be interesting to examine the extent to which different predictor factors might have a different

effect for mothers with different diagnoses. Such analyses would require more women in each diagnostic category than we had in our dataset, although this is one of the largest studies of its kind in the literature. To our knowledge, this is the first prospective multicenter study that has examined the joint effects of such a wide range of different variables on a broad sample of women admitted to MBUs. Nonetheless, our sample is not representative of all women with psychiatric disorders after childbirth, and its results should not be generalized without further studies in the community. In addition, even though we used a standardized questionnaire for data collection, a potentially important limitation of our study is that women's improvement was evaluated by the health care provider in charge of their treatment. In particular, the proportion of women who improved may have been over- (or under-) estimated. However, it seems unlikely that any such bias was differential across the predictor variables included in the study. Therefore, the associations we found between the odds ratio of improvement and the predictor variables are less likely to be biased. In any case, future studies should compare outcomes of women and infants cared for in Mother-Baby-Units compared with managed in other settings and receive alternative strategies of clinical care.

The United Kingdom models for specialized perinatal mental health services, emphasize the need for properly integrated mother-baby in-patient units and perinatal community psychiatric teams to ensure that the needs of mothers and their infants are met both during and after in-patient care (28). Our results underscore this need even during the prenatal period, to provide optimal management for these high-risk patients. Perinatal community psychiatric teams play an essential in the continued care and management of women following their discharge from the MBU, especially those with poorer clinical outcomes at discharge, including those with chronic mental illness or with social integration problems.

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Conflict of interest

Conflict of interest: none

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Table 1: Rate of marked improvement at discharge according to factors tested

(N=869; mean rate of marked improvement=69%)

	sample size N (%)	marked improvement N (%)	95% CI	p
Social and demographic characteristics				
Educational level				
- high school and over	*305 (35.1)*	247 (81.0)	[77;85]	p < 0.0001
- secondary	*404 (46.5)*	267 (66.1)	[61;71]	
- primary or less or unknown	*155 (17.8)*	82 (52.9)	[45;61]	
Occupational status				
- occupational activity or training	*256 (29.5)*	216 (84.4)	[80;89]	p < 0.0001
- receiving unemployment benefits	*102 (11.7)*	66 (64.7)	[55;74]	
- receiving disability payments	*114 (13.1)*	53 (46.5)	[37;56]	
- on sick leave from work	*149 (17.2)*	120 (80.5)	[74;87]	
- not in labor force	*118 (13.6)*	74 (62.7)	[54;71]	
- other (state allowance,...)	*130 (15.0)*	70 (53.9)	[45;62]	
Last employment category				
- professional	*92 (10.6)*	78 (84.8)	[77;92]	p < 0.0001
- intermediate	*167 (19.2)*	138 (82.6)	[77;88]	
- clerical or sales	*282 (32.5)*	211 (74.8)	[70;80]	
- workers, artisan or farmer	*108 (12.4)*	65 (60.2)	[51;69]	
- no known profession	*220 (25.3)*	107 (48.6)	[42;55]	
Country of birth				
- France	*698 (83.6)*	476 (68.2)	[65;72]	p = 0.92
- Other	*137 (16.4)*	94 (68.6)	[61;76]	
Maternal age at admission (years)				
- 25-35	*105 (12.1)*	60 (57.1)	[48;67]	p = 0.01
- < 25	*541 (62.3)*	390 (72.1)	[68;76]	
- > 35	*223 (25.7)*	149 (66.8)	[61;73]	
Living with a partner (married or cohabiting)				
- yes	*569 (65.5)*	436 (76.6)	[73;80]	p < 0.0001
- no	*300 (34.5)*	163 (54.3)	[49;60]	
Maternal mental illness				
Index diagnosis				
- depressive episode and recurrent depressive disorder	*158 (18.1)*	137 (86.7)	[81;92]	p < 0.0001
- psychotic affective disorders	*207 (23.8)*	171 (82.6)	[77;88]	
- schizophrenia and other non-affective psychotic disorders	*116 (13.3)*	54 (46.6)	[38;56]	
- acute and transient psychotic disorders	*41 (4.7)*	35 (85.4)	[75;96]	
- adult personality or behavior disorder	*106 (12.)*	42 (39.6)	[30;49]	
- neurotic and other mood disorders	*146 (16.8)*	121 (82.9)	[77;89]	
- other diseases and disorders	*94 (10.8)*	38 (40.4)	[30;50]	
Psychiatric history				
no known pathology	*166 (19.1)*	133 (80.1)	[74;86]	p < 0.0001
- psychotic disorders	*194 (27.3)*	118 (60.8)	[54;68]	
- mood disorders	*289 (33.3)*	235 (81.3)	[77;86]	
- behavioral disorders	*95 (10.0)*	38 (40.0)	[30;50]	
- other disorders or missing	*125 (14.4)*	75 (60.0)	[51;69]	

History of trauma in childhood				
Foster care in childhood				
- no	*660 (76.0)*	471 (71.4)	[68;75]	p = 0,006
- yes	*209 (24.0)*	128 (61.2)	[55;68]	
Abuse in childhood and adolescence				
- no	*608 (70.0)*	442 (72.7)	[69;76]	p < 0.0001
- abuse other than sexual	*141 (16.2)*	71 (50.4)	[42;59]	
- sexual abuse	*120 (13.8)*	86 (71.7)	[64;80]	
Pregnancy and birth				
Mean age of baby at admission (weeks)	*869*	9.1	[8.3;9.8]	p = 0.78
Parity				
-primiparous	*540 (62.1)*	372 (68.9)	[65;73]	p = 0.19
- secundiparous	*190 (21.9)*	140 (73.7)	[67;80]	
- over secundiparous	*124 (14.3)*	77 (62.1)	[54;71]	
Obstetric(pregnancy) complication				
- no known complication	*648 (74.6)*	444 (68.5)	[65;72]	p = 0.65
- complications	*221 (24.4)*	155 (70.1)	[64;76]	
Child transferred to neonatal intensive care unit				
- no	*688 (79.2)*	490 (71.2)	[68;75]	p = 0.004
- yes	*181 (20.8)*	109 (60.2)	[53;67]	
Characteristics at admission				
Reason for index admission				
- first acute episode	*219 (25.4)*	178 (81.3)	[76;86]	p < 0.0001
- evaluation of maternal competence	*154 (17.7)*	66 (42.9)	[35;51]	
- acute and transient psychotic disorders	*287 (33.0)*	183 (63.8)	[58;69]	
- relapse of an acute episode	*188 (21.6)*	158 (84.0)	[79;89]	
- other, unknown	*21 (1.4)*	14 (66.7)	[47;87]	
Legal status at admission				
- informal	*800 (92.0)*	552 (69.0)	[66;72]	p = 0.95
-involuntary admission	*67 (8.0)*	46 (68.7)	[58;80]	
Partner characteristics*				
Mental and behavioral disorders				
- no psychiatric disorder	*426 (49.0)*	333 (78.2)	[74;82]	p < 0.0001
- bipolar or depressive disorders	*38 (4.4)*	23 (60.5)	[45;76]	
- schizophrenia or other psychotic disorders	*28 (3.2)*	12 (42.9)	[25;61]	
- behavioral disorders	*54 (6.2)*	34 (63.0)	[50;76]	
- other disorders	*67 (7.7)*	41 (61.2)	[50;73]	
- unknown	*256 (29.5)*	156 (60.9)	[55;67]	
Occupational status				
- occupational activity or training	*588 (67.7)*	446 (75.9)	[72;79]	p < 0.0001
- receiving unemployment or disability benefits or paid sick leave from work	*110 (12.7)*	70 (63.6)	[55;73]	
- other (at home, state allowance...)	*82 (9.4)*	43 (52.4)	[42;63]	
- unknown	*89 (10.2)*	40 (44.9)	[35;55]	
Treatments for mental illness during pregnancy				
Neuroleptics				
- no	*659 (75.8)*	466 (70.7)	[67;74]	p = 0.04
- yes	*210 (24.2)*	133 (63.3)	[57;70]	
Anxiolytic/antidepressor/thymoregulator during pregnancy				
- no	*620 (71.3)*	440 (71.0)	[67;75]	p = 0.04
- yes	*249 (28.7)*	159 (63.9)	[58;70]	
Drug taking behavior during pregnancy				

Tobacco				
- no	*561 (64.6)*	419 (74.7)	[71;78]	p < 0.0001
- yes	*308 (34.4)*	180 (58.4)	[53;64]	
Alcohol				
- no	*811 (93.3)*	567 (69.9)	[67;73]	p = 0.02
- yes	*58 (6.7)*	32 (55.2)	[42;68]	
Drug use				
- no	*804 (92.5)*	570 (70.9)	[68;74]	p < 0.0001
- yes	*65 (7.5)*	29 (44.6)	[33;57]	
Unit characteristics				
Size of unit				
- large unit	*483 (55.6)*	315 (65.2)	[61;69]	p = 0.004
- medium unit	*263 (30.3)*	202 (76.8)	[72;82]	
- small unit	*123 (14.1)*	82 (66.7)	[58;75]	
Unit director's professional domain				
- child psychiatrist	*424 (48.8)*	275 (64.9)	[60;69]	p = 0.01
- adult psychiatrist	*445 (51.2)*	324 (72.8)	[69;77]	

……..
*partner and, if no partner, baby's father

Table 2: Model for maternal marked improvement at discharge

(N = 814; ORb logistic regression per variable*; ORa multivariable logistic regression *)

	ORb (CI)	p	ORa (CI)	p
Social and demographic characteristics				
Educational level				
- high school and over	1	p <0,0001*	1	p = 0,54
- secondary	0.46 [0.32;0.65]		0.88 [0.54;1.46]	
- primary or less or unknown	0.28 [0.18;0.43]		1.23 [0.64;2.48]	
Occupational status				
- occupational activity or training	1	p <0.0001*	1	p = 0.02*
- receiving unemployment benefits	0.34 [0.20;0.58]		0.50 [0.26;0.98]	
- receiving disability payments	0.16 [0.10;0.27]		0.37 [0.18;0.76]	
- on sick leave from work	0.77 [0.45;1.30]		0.83 [0.44;1.57]	
- not in labor force	0.31 [0.19;0.52]		0.36 [0.18;0.70]	
- other (state allowance,...)	0,23 [0.14;0.38]		0.46 [0.23;0.93]	
Last employment category				
- professional	1	p <0.0001*	1	p = 0.31
- intermediate	0.85 [0.43;1.71]		0.98 [0.44;2.22]	
- clerical or sales	0.53 [0.28;1.00]		0.93 [0.41;2.08]	
- workers, artisan or farmer	0.27 [0.14;0.54]		0.53 [0.21;1.33]	
- no known profession	0.17 [0.09;0.31]		0.60 [0.24;1.50]	
Country of birth				
- France	1	p = 0.13	1	p = 0.18
- Other	1.02 [0.69;1.51]		1.44 [0.85;2.42]	
Maternal age at admission (years)				
- 25-35	1	p = 0.01*	1	p = 0.20
- < 25	0.52 [0.34;0.79]		1.13 [0.63;2.04]	
- > 35	0.78 [0.56;1.09]		0.68 [0.44;1.06]	
Living with a partner (married or cohabiting)				
- yes	1	p <0.0001*	1	p = 0.98
- no	0.36 [0.27;0.49]		1.01 [0.63;1.60]	
Maternal mental illness				
Index diagnosis				
- depressive episode and recurrent depressive disorder	1	p <0.0001*	1	p <0.0001*
- psychotic affective disorders	0.68 [0.37;1.24]		1.07 [0.51;2.22]	
- schizophrenia and other non-affective psychotic disorders	0.13 [0.07;0.24]		0.27 [0.12;0.61]	
- acute and transient psychotic disorders	0.77 [0.29;2.10]		0.42 [0.14;1.28]	
- adult personality or behavior disorder	0.09 [0.05;0.18]		0.21 [0.10;0.44]	
- neurotic or other mood disorders	0.72 [0.37;1.40]		0.88 [0.43;1.81]	
- other diseases and disorders	0.10 [0.05;0.19]		0.22 [0.10;0.48]	
Psychiatric history				
- no known pathology	1	p <0.0001*	1	p = 0.47
- psychotic disorders	0.39 [0.24;0.62]		0.83 [0.38;1.79]	
- mood disorders	1.08 [0.67;1.75]		0.97 [0.50;1.87]	
- behavioral disorders	0.17 [0.09;0.29]		0.54 [0.25;1.14]	
- other disorders or missing	0.37 [0.22;0.63]		0.77 [0.36;1.62]	

History of trauma in childhood				
Foster care in childhood				
- no	1	p = 0.01*	1	p = 0.23
- yes	0.63 [0.46;0.88]		0.76 [0.48;1.20]	
Abuse in childhood and adolescence				
- no	1	p <0.0001*	1	p = 0.10
- abuse other than sexual	0.38 [0.26;0.55]		0.79 [0.47;1.32]	
- sexual abuse	0.95 [0.62;1.47]		1.60 [0.89;2.87]	
Pregnancy and birth				
Parity				
-primiparous	1	p = 0.19	1	p = 0.29
- secundiparous	1.26 [0.87;1.83]		0.97 [0.60;1.57]	
- over secundiparous	0.74 [0.49;1.11]		0.65 [0.37;1.12]	
Obstetric (pregnancy) complication				
- no known complication	1	p = 0.65	1	p = 0.84
- complications	1. 08 [0.77;1.50]		0.96 [0.62;1.47]	
Child transferred to neonatal intensive care unit				
- no	1	p = 0.005*	1	p = 0.28
- yes	0.61 [0.44;0.86]		0.78 [0.49;1.23]	
Characteristics at admission				
Reason for index admission				
- first acute episode	1	p <0.0001*	1	p = 0.01*
- evaluation of maternal competence	0.17 [0.11;0.28]		0.72 [0.38;1.38]	
- acute episode of a chronic disorders	0.41 [0.27;0.62]		0.97 [0.51;1.83]	
- relapse of an acute episode	1.21 [0.72;2.04]		2.24 [1.11;4.55]	
- other, unknown	0.46 [0.18;1.21]		1.84 [0.50;6.73]	
Legal status at admission				
- informal	1	p = 0.85	1	p = 0.64
-involuntary admission	0.98 [0.58;1.69]		0.84 [0.41;1.72]	
Partner characteristics**				
Mental and behavioral disorders				
- no psychiatric disorder	1	p <0.0001*	1	p = 0.13
- bipolar or depressive disorders	0.21 [0.10;0.46]		0.33 [0.14;0.79]	
- schizophrenia or other psychotic disorder	0.43 [0.22;0.85]		0.70 [0.27;1.85]	
- behavioral disorders	0.48 [0.26;0.86]		1.26 [0.59;2.69]	
- other disorders	0.44 [0.26;0.76]		1.40 [0.66;2.98]	
- unknown	0.44 [0.31;0.61]		1.00 [0.59;1.71]	
Occupational status				
- Occupational activity or training	1	p <0.0001*	1	p = 0.30
- receiving unemployment or disability benefits or paid sick leave from work	0.56 [0.36;0.86]		1.09 [0.61;1.96]	
- other (at home, state allowance...)	0.35 [0.22;0.56]		0.67 [0.36;1.26]	
- unknown	0.26 [0.16;0.41]		0.60 [0.30;1.18]	
Treatments for mental illness during pregnancy				
Neuroleptics				
- no	1	p = 0.04*	1	p = 0.71
- yes	0.72 [0.52;0.99]		0.91 [0.55;1.50]	
Anxiolytic, antidepressor or thymoregulator				
- no	1	p = 0.04*	1	p = 0.98
- yes	0.72 [0.53;0.99]		0.99 [0.63;1.56]	

Drug taking behavior during pregnancy

Tobacco				
- no	1	p <0.0001*	1	p = 0.68
- yes	0.48 [0.35;0.64]		0.91 [0.59;1.41]	
Alcohol				
- no	1	p = 0.02*	1	p = 0.22
- yes	0.53 [0.31;0.91]		1.64 [0.74;3.63]	
Drug use				
- no	1	p <0.0001*	1	p = 0.33
- yes	0.33 [0.20;0.55]		0.70 [0.34;1.44]	

Unit characteristics

Unit director's professional domain				
- child psychiatrist	1	p = 0.01*	1	p = 0.59
- adult psychiatrist	1.45 [1.09;1.94]		1.12 [0.73;1.75]	

……..

*adjusted for age of baby and size of MBU

**partner and if no partner baby's father

***Reviewer Names**

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*Cover Letter

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to : Editors of European Psychiatry

November 14th, 2009

Please find attached our manuscript entitled "Inpatient mother and child postpartum psychiatric care: factors associated with maternal mental health improvement" which we submit for publication in European Psychiatry

Our article treats an important subject — the factors related to improvement in women hospitalized for postpartum mental illness. The number of pregnancies in these women continues to grow, as medication permits many women with psychiatric illnesses to live in the community. The perinatal period is a high-risk period for psychiatric morbidity, especially for first episodes of affective disorders.

The originality of our study lies in the rarity of such extensive data for a large population of women at this critical period in their lives. Our patients were all hospitalized in mother-baby psychiatric units, with their infants. Our study tested the effect on improvement of new variables and refined those already known while taking all of the variables into account in a logistic regression. We found that most of the women had significantly improved by discharge. The independent factors associated with a marked improvement of women's mental health at discharge were bipolar or depressive disorder, a first acute episode or relapse of a previous such episode, while schizophrenia, a personality disorder, and poor social integration (as measured by occupational employment status), partner's mood disorder were all related to poor clinical outcomes.

This study does not pretend to assess treatment in MBUs and does not compare the treatment or outcome with other forms of care. Nonetheless, the findings of our study provide important information to all practitioners dealing with women during pregnancy and in the postpartum period. Our results emphasize the importance of considering not only the type of disease but also its chronicity, the importance of social and occupational integration and mental health of women's partner when providing postpartum psychiatric care

This analysis has not been published previously and is not under consideration for publication elsewhere.
We complied with the "Principles of the Ethical Practice of Public Health" code.
We have no conflict of interest to declare.

All authors have participated sufficiently in the work to take public responsibility for the content. They had access to all data from the study, both what is reported and what is unreported. They made 1) substantial contributions to conception and design or analysis and interpretation of data;.2) Substantial contributions to drafting the article or revising it critically for important intellectual content; 3) Final approval of the version to be submitted.

Thank you,
Yours sincerely,

Ms Nine M-C Glangeaud-Freudenthal