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Review article

A systematic review of growth curve mixture modelling literature investigating trajectories of perinatal depressive symptoms and associated risk factors

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ABSTRACT

Background: The aim of this study was to review the growth curve mixture modelling (GCMM) literature investigating trajectories of perinatal maternal depressive symptoms and associated risk factors.
Methods: A systematic search of peer-reviewed articles published until November 2015 was conducted in seven databases. Articles using GCMM to identify trajectories of perinatal depressive symptoms were considered. Symptoms had to be assessed at least three times, anytime from pregnancy to two years postpartum (PROSPERO; 2016:CRD42016032600).
Results: Eleven studies met inclusion criteria. All reported a low risk trajectory, characterised by stable low depressive symptoms throughout the perinatal period. A stable moderate-high or high symptom trajectory was reported in eight of 11 studies, suggesting a high-risk group with persistent depressive symptoms. Six studies also reported transient trajectories, with either increasing, decreasing or episodic depressive symptoms. None of the demographic, personality or clinical characteristics investigated systematically differentiated groups of women with different symptom trajectories, within or across studies. Thus, it is difficult to differentiate women at high or low risk of specific perinatal depression trajectories.
Limitations: A meta-analysis was not possible. The studies' settings and inclusion criteria limit the generalisability of the findings to low-risk, middle- to high-income women.
Conclusions: Relatively similar trajectories of perinatal depressive symptoms were identified across studies. Evidence on factors differentiating women assigned to different trajectories was inconsistent. Research with larger samples and in more diverse settings is needed to inform services and policies on how and when to effectively identify subgroups of women at high risk of perinatal depression.

1. Introduction

The high prevalence of perinatal maternal depression is a well-documented global phenomenon. In high-income countries, common mental disorders are reported on average by 10% and 13% of pregnant and postnatal women, respectively (O'hara and Swain, 1996). A recent review of the literature suggests that in low- and middle-income countries (LMICs), approximately 16% of women experience antenatal depression and 20% postnatal depression (Fisher et al., 2012). Perinatal depression contributes to the global burden of disease, both directly, given that depression accounts for over 40% of disability adjusted life years caused by mental disorders (Whiteford et al., 2013), and indirectly, through associations with suicidal behaviour (Rahman et al., 2013; World Health Organization, 2008). Untreated perinatal depression also has detrimental effects on birth outcomes (Lusskin et al., 2007), as well as on children's health and socio-emotional development (Hayes and Sharif, 2009; Wachs et al., 2009).

Effective prevention of perinatal depression and associated poor maternal and child health outcomes requires understanding when women are most at risk and what factors are associated with the disorder's onset, severity and chronicity. To achieve this aim, longitudinal mixed-effects and latent growth curve models are commonly used to assess the progression of depressive symptoms during the perinatal period. Though these methods allow for individual variability, they assess the average pattern of change in symptoms over time and assume individuals belong to the same underlying population, represented by a

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Table 1
Database search strategy for the systematic review.

Concept	Search terms
1. perinatal depressive symptoms	(depression OR depressive symptoms OR mood OR dysthymia OR distress OR mental health) AND (perinatal OR antenatal OR prenatal OR pregnancy OR pregnant OR birth OR postnatal OR postpartum OR maternal)
2. trajectories	trajectory OR trajectories OR evolution OR evolutionary OR progress OR progression OR development OR growth OR prognosis OR remission OR epidemiology OR persistence OR chronic OR change
3. factors associated with trajectories	profiles OR "risk factors" OR symptoms OR "socio-economic" OR socioeconomic OR "psychosocial factors" OR correlates OR "prognostic factors" OR predictors
4. longitudinal design using latent variable modelling	cohort OR prospective OR longitudinal OR modelling OR modelling OR follow-up OR latent classes OR "growth mixture modelling"

single growth curve. Yet, existing evidence suggests heterogeneity in time of onset and progression of perinatal depressive symptoms. While some studies have identified antenatal depression as a major risk factor for postpartum depression (Robertson et al., 2004), others have shown a natural decline in depressive symptoms during pregnancy and the postpartum period, or symptoms developing only after giving birth (Gavin et al., 2005; Stowe and Nemeroff, 1995). These methods' assumptions therefore risk oversimplifying the complex process involved in the development and progression of perinatal depression.

An emerging, alternative method which addresses this limitation is a person-centred, latent class approach, which allows researchers to identify and describe underlying subgroups or classes within a population, based on different patterns of symptom change, or trajectories (Leiby, 2012; Ram and Grimm, 2009). Within this approach, latent growth curve models, often referred to as growth curve mixture models (GCMM) (Leiby, 2012), are a flexible subtype of models that do not require the researcher to predefine the number of trajectories being identified. This is an advantage, particularly given that predefining the number of trajectories is likely to increase the likelihood of poor model fit (Ram and Grimm, 2009).

When GCMM is used, several models are generated. In each model, parameters of growth trajectories and inter-individual variation are estimated for each latent class or trajectory. The intercept is the initial level of symptom, and the slope is the rate in change of symptom level over time. In addition, posterior probability estimates in each model indicate the probability that an individual belongs to each trajectory. The optimal model of trajectories is selected using a range of fit statistics, including model fit indices, estimated posterior probabilities, and likelihood ratio tests. Post-hoc tests, such as multinomial regressions, are often performed to compare baseline characteristics or specific outcomes of individuals classified into the different trajectories. These analyses can also help assess whether the latent trajectories identified make pragmatic sense.

GCMM has been used in the analysis of mental health-related outcomes, including binge drinking (Tucker et al., 2003), psychosocial wellbeing (Zammit et al., 2012), and anxiety and mood disorders (Nandi et al., 2009). It has also increasingly been used to explore trajectories of depressive symptoms among women during the perinatal period (Kuo et al., 2014; Mora et al., 2009; Sutter-Dallay et al., 2012). To our knowledge, the findings of these studies have not yet been systematically synthesised. An overview of these studies would help identify how and when trajectories of perinatal depressive symptoms differ, and whether this is consistent across populations. Findings could also have implications for identifying optimal timing of screening for perinatal depression and for the content or focus of screening required to differentiate women with chronic symptoms from those with transient levels. Therefore, the aim of this study was to systematically review the growth curve mixture modelling literature investigating the trajectories and associated risk factors of maternal depressive symptoms during the perinatal period.

2. Methods

The review protocol was registered with PROSPERO (2016:CRD42016032600) and was developed and reported according to the MOOSE guidelines (Stroup et al., 2000).

2.1. Search strategy

A systematic search of peer-reviewed articles was conducted in the following seven databases: MEDLINE, Embase (via Scopus), the Cochrane Library (Cochrane Database of Systematic Reviews), Web of Science, PsychINFO, CINAHL and Africa Wide. A range of keywords and database subject headings were used to capture four key concepts combined using the Boolean term 'AND': (1) depressive symptoms during the perinatal period, (2) perinatal depressive symptoms trajectories, (3) factors associated with symptom trajectories, and (4) longitudinal designs using latent variable modelling approaches (see Table 1).

There were no publication date or language restrictions. Articles considered for review were those which reported the use of GCMM to identify trajectories of perinatal depressive symptoms and associated risk factors. These could be based on primary data from cohort studies, or based on secondary data from randomised controlled trials (RCTs), if no statistical differences in depressive symptoms were reported between the control and intervention arms. If a study reported only on trajectories and outcomes, rather than risk factors, results related to trajectories were still included in this review.

Depressive symptoms were defined as any sub-clinical (distress) or clinical depressive symptomatology, assessed on a longitudinal scale, either using a validated screening tool or a diagnostic assessment based on the Diagnostic and Statistical Manual of Mental Disorders (DSM) or the International Statistical Classification of Diseases and Related Health Problems (ICD) criteria. However, studies were excluded if depressive symptoms were investigated in the context of a comorbid primary mental disorder (e.g. anxiety, bipolar, schizophrenia, psychosis). This criterion was put in place to exclude studies investigating perinatal women without a primary presentation of depression. Psychological morbidities would likely influence the severity and course of depressive symptoms, and it would be difficult to distinguish actual change in depressive symptoms over time from change in depressive symptom as a function of the comorbid primary diagnosis. Trajectories were conceptualised as the change in depressive symptoms during the perinatal period, defined as pregnancy and up to two years after birth. Assessments could be conducted during pregnancy, during the postpartum period, or during pregnancy and the postpartum period. A minimum of four assessment points has been recommended when performing GCMM, as fewer assessments limit the functions that can be modelled, and therefore the type and number of trajectories that can be generated (Berlin et al., 2014; Johnson et al., 2007). Given the limited number of studies generated in a pilot search with this criterion, the authors decided to include studies with a minimum of three depression symptom assessments. In cases where additional assessments were conducted outside of the two year postpartum period, the study was