

'Baby Steps' towards a Better Start: evaluation of a perinatal parenting programme for improving maternal sensitivity, mental health, and healthcare costs

Kate E. Mooney

kate.mooney@york.ac.uk

University of York <https://orcid.org/0000-0003-4231-1643>

Josie Dickerson

Bradford Institute for Health Research <https://orcid.org/0000-0003-0121-3406>

Dacheng Huo

University of York <https://orcid.org/0009-0009-4204-5323>

Tracey Bywater

University of York <https://orcid.org/0000-0001-7207-8753>

John Wright

Bradford Institute for Health Research <https://orcid.org/0000-0001-9572-7293>

Sara Ahern

Bradford Institute for Health Research <https://orcid.org/0000-0002-9248-4887>

Sebastian Hinde

University of York <https://orcid.org/0000-0002-7117-4142>

Sarah Blower

University of York <https://orcid.org/0000-0002-9168-9995>

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Abstract

Early intervention could improve outcomes for parents and children. This quasi-experimental study investigated the effectiveness and costs of a perinatal parenting programme, 'Baby Steps'. Using the Born in Bradford's Better Start (BiBBS) interventional family cohort study data, propensity score matching created intervention and pseudo-control groups.

Baby Steps did not have a meaningful impact on maternal-infant relationships, via warmth and invasion [$B=0.62$, -0.79 - 2.03 ; and $B=0.57$, -0.67 - 1.82], nor reducing risk of early gestation and low birthweight [$OR=0.33$, 0.07 to 1.59 ; $OR=0.63$, 0.25 - 1.61]. Baby Steps reduced depression and anxiety [$B=-0.74$, -1.56 - 0.07 ; $B=0.50$, -1.28 - 0.28], particularly for those with antenatal depression, and increased odds of non-vaginal deliveries [$OR=2.18$, 1.35 - 3.51]. Baby Steps had minimal impact on overall service use related costs [$-\pounds96.6$, -835.8 to 642.6]. Disaggregated analysis suggested that participation increased mothers healthcare use [$+\pounds265.1$, -268.6 to 798.7], via delivery-related and inpatient care, and decreased infant healthcare use [$-\pounds361.6$, -793.4 to 70.1], via reduced inpatient admissions.

Baby Steps was delivered successfully in real-world practice, and engaged underserved families. Baby Steps showed promise for maternal mental health, and additional healthcare for mothers may have reduced infant inpatient needs. Mechanisms underpinning birth outcomes, maternal sensitivity and healthcare costs remain uncertain. Baby Steps is a viable, promising intervention for embedding within a wider, systemic support system.

Introduction

The perinatal period refers to both pregnancy (the antenatal period) and the first 12 months after childbirth (the postnatal period) (NHS England, 2018). Perinatal mental health difficulties can adversely impact a mother's ability to interact with her child, influencing parent-infant relationships (Davies et al., 2021), and the child's wellbeing, cognitive, and behavioural development (Kingston et al., 2012; Newman et al., 2016). In the United Kingdom (UK), these difficulties carry a long-term cost of £6.6 billion per annual birth cohort, primarily due to negative impacts on the child (Bauer et al., 2014). Supporting mental health during the perinatal period is therefore crucial to foster early child development (Deans, 2020; Newman et al., 2016).

Perinatal parenting programmes may include aspects of antenatal education which offer information about pregnancy, labour, birth, (Zaman et al., 2025), promoting positive parenting and mental health to improve early relationships and development (Al Sager et al., 2024). Such interventions can prevent the onset of difficulties during the transition to parenthood, reducing both the negative impact on the child and the economic burden on society (Bachmann et al., 2022).

Two systematic reviews have found positive effects of perinatal interventions on maternal depression and anxiety (Pinquart & Teubert, 2010a; Lin-Lewry et al., 2024), while two others reported null effects (Al Sager et al., 2024; Hong et al., 2021). Three reviews found positive impacts on birth outcomes, including

childbirth self-efficacy, fear of childbirth, and reduced caesarean rates (Hong et al., 2021; Lin-Lewry et al., 2024; Zaman et al., 2025). Two also reported positive effects on early child cognitive, motor, and socioemotional development (Al Sager et al., 2024; Pinquart & Teubert, 2010b). By comparison, far fewer studies examine impacts on maternal sensitivity (Deans, 2020); with one review of only four studies finding that interventions improved infant attachment security and reduced disorganised attachment rates (Mountain et al., 2017).

However, these reviews have significant evidence gaps. First, four of these five reviews exclusively included randomised controlled trials, hence evidence regarding the impact of these programmes as delivered in real-world settings remains limited. While randomisation is considered the 'gold standard' for establishing effectiveness, it lacks ecological validity, and is not always ethical or practical in routine practice (Zimmerman, 2021). Second, there is relatively little research examining the impact of perinatal parenting programs in the UK, as only two studies included in the aforementioned reviews were conducted in the UK (Oakley et al., 1990 cited in Hong et al., 2021 and Escott et al., 2005 cited in Zaman et al., 2025). Two additional trials of intensive home-visiting in the perinatal period in the UK found no effects on neonatal or most maternal outcomes (Doyle et al., 2014; Robling et al., 2021), though one reported improvements in early child development and later school attainment (Robling et al., 2021). The UK's standardised routine antenatal care is delivered via the National Health Service (NHS), and involves a schedule of face-to-face appointments with a midwife, focusing on monitoring physical and psychological health, routine screening, and providing information about pregnancy, labour, and birth (NHS England n.d.). Health visitors deliver the Healthy Child Programme, providing health promotion with 5 mandatory visits from pregnancy to age 2, and additional visits if required (Office for Health Improvement and Disparities, 2023). However, the provision of parenting support interventions often relies on separate, locally commissioned services, meaning that delivery of these varies across local areas.

Third, effectiveness in socioeconomically disadvantaged settings remains underexplored. Whilst two of these UK based studies did not describe sample socioeconomic position (Oakley et al., 1990, Escott et al., 2005), one was delivered in a socioeconomically disadvantaged community (Doyle et al., 2014), and one was delivered to first-time teenage mothers (Robling et al., 2021). Perinatal mental health difficulties are more prevalent in disadvantaged areas in England (Ban et al., 2012), highlighting an increased need for intervention in these populations.

Collectively, the evidence indicates potential impacts of perinatal interventions on maternal mental health, and potentially on birth and child outcomes (Al Sager et al., 2024; Doyle et al., 2014; Hong et al., 2021). Evidence for improving maternal sensitivity remains scarce, as does evidence for programmes delivered in real-world settings in England - particularly for parents in socioeconomically disadvantaged areas. Addressing this gap is critical given England's unique healthcare structure and pronounced perinatal mental health inequalities.

Methods

Study design

The study is a quasi-experimental evaluation with an intervention and matched control group in a single centre. The study was prospectively registered (ISRCTN12196131), and the study protocol (Mooney et al., 2023) and analysis plan (osf.io/gf3pe/) were published prior to the end of data collection. We have used the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) (2021) guidelines for reporting (see Supplementary File A).

Study setting

Bradford is a city in Northern England characterized by a range of socioeconomic deprivation levels and ethnic diversity (Bradford Council, 2019). Baby Steps was commissioned as part of the Better Start Bradford initiative, funded by The National Lottery Community Fund. Better Start Bradford operated within three disadvantaged inner-city areas (see www.betterstartbradford.org.uk). The Born in Bradford's Better Start (BiBBS) study is an interventional family cohort, designed to evaluate the effectiveness of Better Start Bradford interventions integrated within the Born in Bradford (BiB) family of studies (Dickerson et al., 2022). Participating mothers and children are recruited during pregnancy, and they consent to routine linkage of their health and education records, as well as data regarding participation in routine services and Better Start Bradford interventions.

Intervention

The Theory of Change for Baby Steps is presented in Supplementary File B. Baby Steps is a 'relationship-based' antenatal parent education programme developed by the National Society for the Prevention of Cruelty to Children (NSPCC) (see <https://learning.nspcc.org.uk/services-children-families/baby-steps>) which begins between the 26th to the 30th week of pregnancy. The Better Start Baby Steps programme under evaluation was delivered from May 2022 to July 2024 by Action for Children. It differs from the original NSPCC programme in that it was delivered to groups remotely on videoconference but retains some face-to-face contact. Remote delivery was introduced after the COVID-19 pandemic, but maintained due to perceived success in reaching and retaining parents (Better Start Bradford Innovation Hub, 2024). Originally delivered as a targeted programme with specific eligibility criteria, the service shifted to universal in May 2022, hence any pregnant person (<28 weeks gestation) who is living in one of the three Better Start Bradford areas was eligible to be referred to Baby Steps. Universal delivery within inner-city Bradford means that many of the parents enrolled in Baby Steps have experience of socioeconomic disadvantage, poor health, and mental health difficulties, due to the higher need within this population as a whole (Dickerson et al., 2022).

To adapt to remote delivery, the Bradford service delivery team condensed the intended nine group sessions into six sessions, and offered additional one-to-one catch ups with parents. There are two one-to-one initial sessions (one home visit, one virtual) prior to the course commencing, followed by four

online, remote, group sessions before birth. After birth there is another in person home visit, followed by two online group sessions. Baby Steps sessions are facilitated by an Early Years Practitioner and a health practitioner (midwife or health visitor). The manual, curriculum and activities follow a set pattern at specific stages of pregnancy and following each baby's birth. Topics covered in the intervention include 'Relationships, respect and support', 'Parent-infant interactions', 'Healthy bodies, healthy minds' and 'Understanding babies development and practicalities of parenthood'.

Routine processes for collecting and analysing quantitative data on implementation (reach, retention and parent satisfaction) were embedded as standard in all Better Start Bradford interventions. Across the entire contract, Baby Steps successfully reached a diverse range of families reflecting the local population, exceeded anticipated targets for parents 'completing' the intervention (defined as attending a minimum of 6 sessions, including one postnatal session) and very high levels of parent satisfaction (see Better Start Bradford Innovation Hub, 2024).

A qualitative process evaluation was also conducted to explore the experience and implementation of Baby Steps from the perspectives of parents/caregivers (n=17) and practitioners (n=8) (Blower et al., in preparation). A descriptive thematic analysis of the interview data highlighted a range of perceived impacts including improved emotional wellbeing and reduced anxiety, particularly for those who had experienced birth-related trauma in previous pregnancies. Parents/caregivers described feeling more empowered to navigate complex maternity systems, highlighting increased awareness around their rights and choices and taking more active roles in developing their birth/delivery plans. Parents/caregivers also reported increased awareness of infant cues, with practitioners describing how they had observed greater attunement between Baby Steps participants and their infants.

Both staff and parents/caregivers valued home visits and the continuity of support and delivery because they created space to build trust and holistically assess parents' needs and offer tailored guidance before and after birth. Facilitator expertise and positive demeanour played a role in creating a safe space and assisting mothers to build their knowledge and skills. Discussions on the different forms of delivery unveiled the nuances of engaging parents face-to-face and online, highlighting the convenience of digital delivery while acknowledging the potential positive impacts of more face-to-face contacts, such as community-building and further social support.

Participants

Recruitment

Pregnant women were invited to join BiBBS by trained researchers during pregnancy, predominantly at Bradford Royal Infirmary's Glucose Tolerance Test (GTT) clinic at 24-28 weeks gestation. Recruitment to Baby Steps occurred through midwives and/or Perinatal Project Administrators asking mothers to

provide consent for their details to be shared with the Baby Steps team, who then made contact to arrange a home visit to discuss enrolment and complete evaluation questionnaires.

Eligibility

Study participants were pregnant women who were recruited into BiBBS on or after the 1st May 2022, up until July 2024. Data was collected at the level of the mother. Eligibility for the intervention group were: (1) have enrolled in Baby Steps. Eligibility for the propensity score matched comparison group were: (1) had a child aged between 0-3-months during service delivery of Baby Steps and (2) not currently receiving, and have not already received, Baby Steps at any time.

Data collection procedures

Pregnant women complete a detailed questionnaire when recruited to BiBBS. BiBBS mothers were contacted by telephone to complete outcome measures at 6-14 weeks after birth by BiBBS researchers. Through BiBBS, routinely linked primary and secondary care data were also obtained, including information on secondary care activity (e.g., inpatient admissions, outpatient attendances and A&E contacts) with associated Healthcare Resource Group (HRG) coding, and records of primary care engagements (e.g., consultation contacts), which were used in the health economic analysis. The Baby Steps delivery team additionally provided programme financial and operational data to support estimation of intervention delivery costs, including staffing inputs, venue and materials costs, and programme overheads.

Analysis

The analysis was preregistered at osf.io/gf3pe. Three changes were made to the analysis plan after preregistration: (1) the inclusion of Better Start Bradford area as a matching covariate and (2) inclusion of first language spoken as a covariate instead of English-speaking ability, and (3) use of the 'within' approach rather than the 'across' approach for combining propensity scores with multiple imputation.

Propensity score matching

The propensity score is the probability of a subject receiving a treatment, conditional on the set of covariates (Benedetto et al., 2018). Matching covariates were chosen based on prior literature that indicated confounding of parenting intervention uptake and parent outcomes. The covariates from the BiBBS baseline questionnaire were: Prenatal attachment (measured via Prenatal Attachment Inventory, continuous score between 18-72), Prenatal depression (PHQ-8, continuous score between 0-24), Prenatal anxiety (GAD-7, continuous score between 0-18), Mother age (continuous score between 16-44), Ethnic group (Black British/African/Caribbean; Other; Other South Asian; Other White/Central

Eastern European (CEE); Pakistani; White British/Northern Irish (NI)), Financial security (living comfortably; doing alright; just about getting by; finding it quite/very difficult), Parity (0, 1, or 2+ previous births), First language (English; not English), Country of birth (UK; not UK), Better Start Bradford antenatal intervention participation (no other intervention enrolments, or 1+ intervention enrolments), and Better Start Bradford area of residence (Bowling and Barkerend, Bradford Moor, and Little Horton).

We used 'one-to-many' propensity score matching to maximise statistical power (Barth et al., 2008) and utilise data from a larger pool of BiBBS cohort mothers who did not participate in Baby Steps. For each dataset, balance was inspected using a t-test for equality of means, the standardised percentage bias, the variance ratio, and the standardised mean difference between matched groups in terms of the matching covariates (Benedetto et al., 2018).

Regression analyses

Regression analyses were estimated with group assignment from the matched groups as the independent variable, and the outcomes as the dependent variables. In addition to group assignment, two covariates were included: child age in days at time of outcome, and a baseline measure of the mental health and maternal sensitivity outcomes from pregnancy.

Linear regression models were estimated for each continuous outcome, and ordinal/binary logistic models for each categorical/binary outcome. The primary analyses included all mothers who enrolled in the intervention after an initial home visit, and a sensitivity analysis included only 'completers', defined as those who take part in at least 6 sessions (including at least one postnatal session). See Supplementary Material C for a summary of all models.

Outcomes

Outcomes collected in the 6–14 week postnatal BiBBS sweep were: (1) Primary outcome: Maternal warmth (subscale of MORS-SF) (continuous, score ranging 0-35), (2) Primary outcome: Maternal invasion-withdrawal (subscale of MORS-SF) (continuous, score ranging 0-35), (3) Secondary outcome: PHQ-8 (continuous, score ranging 0-24), and (4) Secondary outcome: GAD-7 (continuous, score ranging 0-21). Other outcomes ascertained via routinely linked data were: (1) Delivery method (binary, spontaneous vaginal delivery and any other delivery (includes elective and emergency caesarean, and assisted vaginal delivery)), (2) Gestation period (binary, birth before 37 weeks and birth after 37 weeks), (3) Baby birthweight (binary, >2500g healthy birthweight, and <2500g low birthweight).

Missing data

Multiple Imputation using Chained Equations (MICE) was used to impute missing data on covariates and outcome data, assuming that data are missing at random (Rubin, 1996). Every variable in the analysis

model was included in the imputation model, generating 25 imputed datasets (based on the highest proportion of missingness in any of the matching variables). The primary analysis imputed data on covariates and included only those with complete outcome data from the postnatal sweep, and a sensitivity analysis included those who had imputed covariate and outcome data for the MORS, PHQ and GAD outcomes. MICE was combined with propensity score matching via the 'within' approach, where propensity scores are used individually to obtain exposure effect estimates in each imputation and are then combined to produce an overall estimate (Granger et al., 2019).

Sensitivity analysis

The primary analysis was akin to an Intention to Treat (ITT) effect, including all individuals who enrolled in the intervention (Tripepi et al., 2020). A second sensitivity analysis tested whether the results differed when comparing participants who *completed* the Baby Steps programme (defined as attending at least six programme sessions, including one postnatal), to the matched control group for all outcomes.

Economic analysis

The potential short-term health service cost implications associated with the Baby Steps programme were explored over the postnatal follow-up period (from childbirth to 12 weeks postpartum). This economic component was intended to provide contextual information to support interpretation of the effectiveness findings, rather than a full cost-effectiveness evaluation.

The cost of delivering Baby Steps was estimated using internal programme financial summaries provided by the delivery organisation, collected concurrently alongside the delivery of the intervention. Intervention costs included programme operational costs and overheads derived from other referral activities cost, supplemented where applicable by staff time associated with programme administration and referral processes. Costs are reported as total programme cost and mean cost per enrolled participant.

Unit costs were assigned using the NHS National Cost Collection and the Unit Costs of Health and Social Care and are reported in 2023/24 GBP (£) (NHS England, 2024). Where coding information required to assign a specific unit cost was unavailable, an average unit cost for the relevant service category was applied. Further costing details are provided in Supplementary File D. Costs were estimated separately for mothers and children and summarised as mean costs per participant over the follow-up period. No discounting was applied due to the short time horizon.

EQ-5D-3L utility values were predicted using mapping functions incorporating PHQ-8 scores, GAD-7 scores, and age as predictors (Mukuria et al., 2024). EQ-5D is a generic, preference-based measure of health-related quality of life that generates a single index value based on population preferences (Rabin & de Charro, 2001).

Analysis interpretation

Reflecting previously published proposals from statisticians, we describe effect estimates and 95% confidence intervals as effects that are compatible with our data and do not apply a binary cut-off on reported p-values (Amrhein et al., 2019).

Results

Participant flow

Figure 1 here

Figure 1 describes the numbers included at each stage in the study. BiBBS recruited 5697 individual pregnancies. The primary analysis only included individuals with complete outcome data, hence 552 individuals were included in the propensity score matching. Socio-demographic baseline descriptives for these 522 individuals are provided in Supplementary File E.

Propensity score matching and balance

Propensity scores were created for the sample of 522 individuals per multiply imputed dataset, hence balance diagnostics were assessed within each dataset. Using propensity score matching, 120 intervention enrollees were successfully matched to 215 control group participants (see Supplementary File F). Of the 120 enrollees, 75/120 (63%) individuals were classed as intervention completers to be used in the per protocol analyses. Balance diagnostics generally indicated adequate balance (see Supplementary File G). As stated in our power calculations in our study protocol (Mooney et al., 2023), this sample size reaches statistical power to detect a difference of 2.35 points in the MORS-SF, or 2 points in the PHQ-8 and GAD-7.

Effectiveness results

Table 1 here

Table 1 presents effect estimates for the impact on all continuous and binary outcomes. The results suggest small increases in maternal warmth and invasion scores, with differences ranging from small decreases to moderate increases also being compatible with the data [warmth $B=0.62$, -0.79 to 2.03; and invasion $B=0.57$, -0.67 to 1.82]. Higher scores indicate greater maternal warmth, and higher scores indicate higher maternal invasion. There were small decreases in depression and anxiety symptoms, with differences ranging from small decreases to very small increases also being compatible [depression $B=-0.74$, -1.56 to 0.07; and anxiety $B=0.50$, -1.28 to 0.28]. Lower scores indicate fewer symptoms of depression and anxiety. When using standard outcome categories for mental health

measures, the odds of having any depression and anxiety symptoms decreased for the Baby Steps group, though differences ranging from moderate decreases in the odds to small increases in the odds were also compatible with the data [depression OR=0.52, 0.26 to 1.04; and anxiety OR=0.59, 0.28 to 1.21].

For birth outcomes, our results suggest a decrease in the odds for early gestation and low birthweight, with differences ranging from large decreases in the odds to moderate increases in the odds being compatible with the data [gestation OR=0.33, 0.07 to 1.59; birthweight OR=0.63, 0.25 to 1.61]. The results suggested a large increase in the odds of having a non-spontaneous vaginal delivery for those who took part in Baby Steps, with differences ranging from small increases to very large increases in the odds of non-vaginal birth [OR=2.18, 1.35 to 3.51]. Descriptive investigation revealed that this was accounted for by Baby Steps participants being more likely to have caesarean sections (emergency 28%, elective 20%) in comparison to control group participants (emergency 18%, elective 10%).

Sensitivity analysis results

Sensitivity analyses, for both per protocol (n=266 total for MORS) and imputed outcome data (n=561 total for MORS), broadly reflected both the direction and magnitude of the primary analyses results (see Supplementary File H).

Exploratory analysis

Due to a small decrease in depression scores in the Baby Steps group, a post-hoc exploratory analysis, including an interaction term fitted between treatment group and baseline depression scores, was conducted. This revealed a significant interaction between treatment group and baseline depression scores ($B=-0.30$, 95% CI -0.48 to -0.12, $p=.001$).

Figure 2 here

Figure 2 presents the marginal predictions for this model, which revealed that Baby Steps significantly reduced follow-up depression scores when baseline depression scores were higher (represented by the bottom, green line in both graphs). This indicated a positive, clinically meaningful effect of Baby Steps for individuals with moderate antenatal depression (with PHQ scores >10). This was repeated with anxiety scores as the outcome with an interaction by baseline scores, and indicated a similar, but non-significant, trend, though the data were also compatible with no difference ($B=-0.16$, -0.36 to 0.02], $p=.096$).

Economic evaluation results

Over the programme period (2022-2024), the total cost of delivering the Baby Steps programme was £940,550, corresponding to a mean cost of £2,469 per enrollee based on a total of 381 enrollees in the same time period (including both BiBBS and non BiBBS participants). Staff-related costs accounted for approximately 90% of total programme costs.

Figure 3 here

Figure 3 presents the weighted net difference in total NHS resource use costs between the Baby Steps and matched control group over childbirth to 12 weeks postpartum (intervention minus matched control), excluding the cost of delivering the programme. Overall costs were similar between groups (net mean difference [−£96.6, −835.8 to 642.6]), reflecting higher costs for mothers [£265.1, −268.6 to 798.7] alongside lower costs for children [−£361.6, −793.4 to 70.1]. Across overall, maternal, and child costs, 95% confidence intervals were wide and overlapped zero.

Mother-related health service costs were approximately 12% higher among Baby Steps participants than in the matched control group, driven mainly by delivery-related costs (approximately 15% higher). In contrast, child-related costs were approximately 31% lower, largely attributable to lower inpatient costs. In both cases, estimates are associated with substantial uncertainty.

To further characterise the composition of these cost differences, the service-setting breakdown is reported in Supplementary File D. The pattern in overall costs was primarily driven by inpatient care (net difference [−£139.9, −815.5 to 535.7]), partially offset by higher outpatient costs [£52.3, −64.9 to 169.6], while differences in GP [−£2.5, −38.9 to 33.9] and A&E [−£6.5, −29.0 to 15.9] costs were small. As with the aggregate results, uncertainty around component-level estimates remained substantial.

Preference-based health-related quality of life, derived via mapping to EQ-5D-3L, was similar between groups. Mean EQ-5D utility values increased from approximately 0.84 to 0.88 in the Baby Steps group and from approximately 0.86 to 0.90 in the matched control group over the follow-up period, corresponding to a mean improvement of approximately +0.04 in both groups.

Discussion

The Bradford Better Start Baby Steps programme was successfully implemented, with routine monitoring demonstrating that the intervention was acceptable and successfully reached a diverse population of families (Better Start Bradford Innovation Hub, 2024). This study is the first quantitative effectiveness evaluation of this promising intervention, building the evidence base for preventative perinatal parenting programmes.

Summary of findings and effectiveness

Evaluation at 6–14 weeks post-birth revealed slightly higher scores in the Baby Steps group for both maternal warmth and invasion. Given the conflicting desired directions of these subscales (where

warmth is positive and invasion is negative) alongside confidence intervals that were compatible with no differences, participation in Baby Steps does not have a clinically meaningful effect on overall short-term maternal sensitivity post-birth. However, Baby Steps may result in small improvements in short-term mental health, and this may be clinically meaningful for those experiencing moderate depression antenatally (with PHQ scores ≥ 10). Small improvements can be meaningful and yield population benefits when implemented at scale; for instance, a parent shifting from 'several days' to 'not at all' in feeling down or depressed could make a difference to parents and children's daily lives.

The finding regarding small impacts on maternal depression is consistent with some previous reviews (Lin-Lewry et al., 2024; Pinquart & Teubert, 2010b, 2010a), but contrasts with others (Al Sager et al., 2024; Hong et al., 2021). This is likely a reflection of the heterogeneity in the format of parenting programmes, and could also be due to the timing and measurement of maternal depression. To fully understand possible impacts in more depth, a future evaluation of Baby Steps could examine related maternal outcomes using measures that are developed for use in the perinatal period, for instance the Edinburgh Postnatal Depression Scale (EPDS), and measures of other constructs which may be sensitive to change by this intervention, such as fear of childbirth or observational measures of maternal sensitivity.

Comparatively fewer studies have evaluated the impact of parenting programs on maternal sensitivity. We measured maternal sensitivity at just 6–14 weeks post-birth, and related differences in infant attachment may be too early to detect (Barlow et al., 2010). Hence, our findings may suggest that Baby Steps does not impact maternal sensitivity, or could reflect that maternal sensitivity may be particularly difficult to alter so close to childbirth. Alternatively, the results may reflect the challenges with reliably measuring maternal sensitivity. We selected the MORS-SF after research using a similar scale was not suitable for use in this population (Bird et al., 2023), and because it has promising psychometric validation in British and Hungarian samples (Oates and Gervais, 2018). However, it has not yet been validated in an ethnically diverse population. Future evaluations of Baby Steps should incorporate long-term data collection across multiple measures of postnatal maternal sensitivity and maternal mental health.

Our results suggest a decrease in the odds for early gestation and low birthweight, though confidence intervals were wide, with no differences also being compatible. However, we did find an increase in odds of having a non-vaginal delivery for those who took part in Baby Steps, with compatible differences ranging from small increases to very large increases in the odds of non-spontaneous vaginal birth. This was accounted for by Baby Steps participants being more likely to have both emergency and elective caesareans. This conflicts with previous reviews regarding perinatal interventions, of which several have found reduced caesarean rates for those who take part (Hong et al., 2021; Zaman et al., 2025).

This may reflect unmeasured confounding, where midwives may have been more likely to refer women at risk of prior obstetric complications or complex pregnancy to perinatal support. This also may reflect that participation in Baby Steps may have allowed women to make a deliberate, informed choice to

advocate for the birth experience they feel is most appropriate for themselves. Empowerment and confidence to navigate maternity systems was identified as a theme in our qualitative process evaluation, where mothers who took part in Baby Steps who reported previous traumatic birth experiences described feeling more able to self-advocate for their choices around birth and delivery plans (Blower et al., in preparation).

The economic results do not indicate a clear reduction in total short-term NHS costs associated with Baby Steps over the first 12 weeks postpartum. Overall resource use related cost differences were small and estimated with substantial uncertainty, which is not unexpected in a period where healthcare expenditure is dominated by a small number of high-cost events, particularly delivery and inpatient admissions. Baby Steps was also an expensive programme to deliver, at £2,687 per participant. Disaggregated analyses suggest that participation in Baby Steps was associated with higher healthcare use for mothers, driven primarily by delivery-related and inpatient care, alongside lower healthcare use for infants, largely attributable to reduced inpatient admissions. However, the associated confidence intervals were moderately wide, incorporating no cost difference in all cases.

For mothers, higher delivery-related and inpatient resource use may reflect a different set of processes. Engagement with Baby Steps may be associated with closer contact with maternity and perinatal services, greater identification of risk, or differences in clinical decision-making around birth and women's own birth plans. As mentioned earlier, this may reflect residual confounding, or true differences in birth. Preference-based outcomes did not suggest meaningful short-term differences in maternal quality of life between groups.

Strengths and limitations

Detailed characteristics of participants prior to intervention enrolment enabled control for confounders which were chosen apriori in a pre-registered analysis plan. We have evaluated real-life service delivery and hence assessed the program as it is naturally implemented, ensuring ecological validity. The quasi-experimental design and use of linked routine health data means lower evaluation costs than an RCT, and enables evaluation in a setting where it may not have been feasible or ethical to randomise parents. Finally, parents living in this ethnically diverse and socioeconomically disadvantaged area represent those who may be less likely to enrol and stay engaged with parenting interventions (Axford et al., 2012).

Measuring outcomes at only 6–14 weeks postpartum may have been too early to detect impacts. We will be able assess longer-term impacts on child outcomes via routinely collected data over time. Propensity score matching reduced bias, however, it led to a reduced sample size due to dropping participants who could not be matched across groups, reducing statistical power. Whilst we achieved statistical power for detecting the moderate effects (Mooney et al., 2023), we lacked statistical power for detecting smaller, more modest impacts.

Implications

Future evaluation of Baby Steps should incorporate more parent self-report measures relevant to the perinatal period and collect them both immediately after the programme ends, and up to at least 12 months later, to reveal any possible 'sleeper' effects, for example on birth anxiety, parent-infant relationships and postnatal depression. Participation in Baby Steps was associated with a higher odds of non-spontaneous vaginal birth, likely contributing to higher mother resource use costs. However, as is the nature of observational studies, we cannot determine if this was due to residual confounding or a true impact of taking part in Baby Steps. Whilst a randomised control trial of Baby Steps would eliminate the possibility of residual confounding, it would compromise ecological validity and recruitment of parents who are most ready to change, possibly resulting in apparently reduced intervention effectiveness (Zimmerman, 2021; Stewart-Brown et al., 2011).

Some of our findings suggest that Baby Steps may be better suited as a targeted intervention, evidenced by the significant interaction with baseline depression, and qualitative evaluation (Blower et al., in preparation). Whilst Baby Steps was originally developed as a targeted intervention, it was delivered universally in three inner-city areas with high disadvantage. Instead of universal delivery, service managers may wish to introduce a triage system if places are limited on Baby Steps courses, where parents with symptoms of antenatal depression could be prioritised for taking part in Baby Steps, though this should be managed with careful consideration.

Altogether, there is a paucity of evidence for effective interventions that start antenatally, particularly for delivery in ethnically diverse, socioeconomically disadvantaged populations. The present study builds on this, finding Baby Steps to be potentially effective for improving maternal mental health, particularly for those with moderate symptoms of depression. Baby Steps is, therefore, a viable option for commissioners of early years interventions.

Conclusions

Baby Steps can be delivered successfully in real-world practice, and engages and retains underserved families. By reducing perinatal mental health symptoms for mothers with depressive symptoms during pregnancy, participation in Baby Steps could promote greater equity in longer-term maternal and childhood outcomes. However, the mechanisms underpinning impact on birth outcomes, and on maternal sensitivity and healthcare costs remain uncertain. For commissioners, Baby Steps is a viable and promising intervention for embedding within a wider, systemic support system - particularly for families living in socioeconomically disadvantaged and ethnically diverse communities.

Declarations

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Collaboration (ARC-YH; Ref: NIHR200166, see <https://www.arc-yh.nihr.ac.uk>). The views in this publication are those of the authors and not necessarily those of the NIHR or the Department of Health and Social Care.

Ethics approval: The protocol for BiBBS recruitment and collection of routine outcome data was approved by Bradford Leeds NHS Research Ethics Committee (15/YH/0455). Research governance approval was gained from Bradford Teaching Hospitals NHS Foundation Trust. The research conducted follows ethical standards outlined in the Declaration of Helsinki. The existing ethics includes approval for the evaluation of Better Start Bradford interventions using quasi-experimental methods, including the use of cohort participants to create control groups. The current evaluation is thereby covered by the above-mentioned ethical approval.

Baby Steps is delivered as a part of usual practice. Ethical considerations with regards to the delivery of the programme can be found in Baby Steps' service design plan, and issues arising are managed by the service delivery team and BSB as service commissioners, in accordance with local guidance. Key members of the research team were trained in good clinical practice.

Consent to participate: BiBBS takes written informed consent from all participants (ie. parents of children).

Conflicts of interest/Competing interests: The authors have no competing interests to declare.

Clinical trial registration: Not applicable.

Data, Material, or Code Availability: Data may be obtained from a third party and are not publicly available. Data cannot be shared publicly as they are available through a system of managed open access. Researchers interested in accessing the data can find details and procedures on the Born in Bradford website (<https://borninbradford.nhs.uk/research/how-to-access-data/>).

Author Contributions: Conceptualization, investigation, and methodology: KEM, SH, JD, TB, SLB; Formal analysis and visualisation: KEM, DH; Project administration: JD, SA. KEM; Writing – original draft; Writing – review & editing: all authors.

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Table

Table 1. Linear regression and binary logistic regression for all outcomes.

Continuous outcomes		
Outcome [measure]	B [95% CI]	p
Maternal warmth [MORS-SF]*, **	0.62 [-0.79 to 2.03]	0.388
Maternal invasion [MORS-SF]*	0.57 [-0.67 to 1.82]	0.367
Depression [PHQ-8]*	-0.74 [-1.56 to 0.07]	0.072
Anxiety [GAD-7]*	-0.50 [-1.28 to 0.28]	0.206
Binary outcomes		
Outcome [reference level]	Odds ratio [95% CI]	p
Depression categorized [reference=no depression]*	0.52 [0.26 to 1.04]	0.066
Anxiety categorized [reference=no depression]*	0.59 [0.28 to 1.21]	0.149
Gestation [reference=after 37 weeks]	0.33 [0.07 to 1.59]	0.169
Birth type [reference=vaginal delivery]	2.18 [1.35 to 3.51]	0.001
Birth weight [reference=healthy birthweight]	0.63 [0.25 to 1.61]	0.340

**=models adjusted for child age in days at time of outcome, and baseline measure of the relevant outcome. Other models did not adjust for child age as period was not relevant, and no baseline measure of these outcomes existed e.g. of birthweight. **=a lower score/category is considered more desirable for all outcomes, except for maternal warmth (MORS-SF).*

Figures

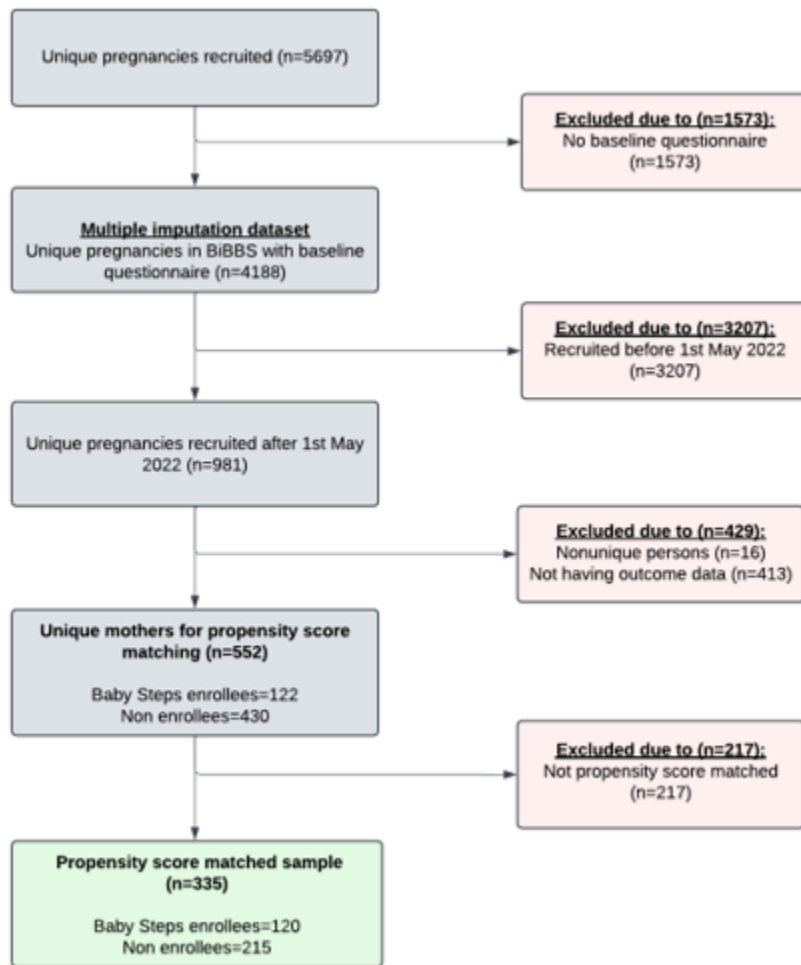


Figure 1

Flow diagram describing participants at each stage of inclusion in the study

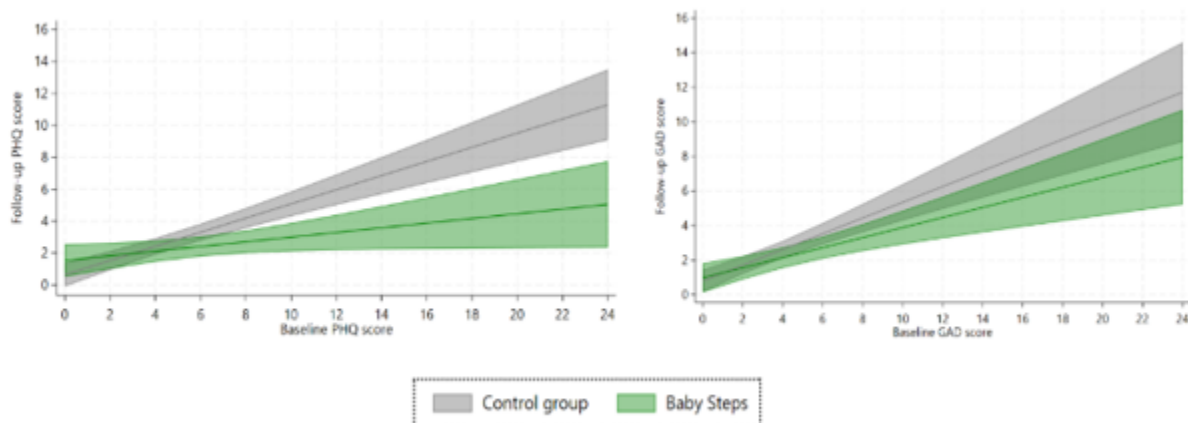


Figure 2

Adjusted predictions and 95% CIs (shaded areas) of follow-up GAD score and PHQ score by baseline scores

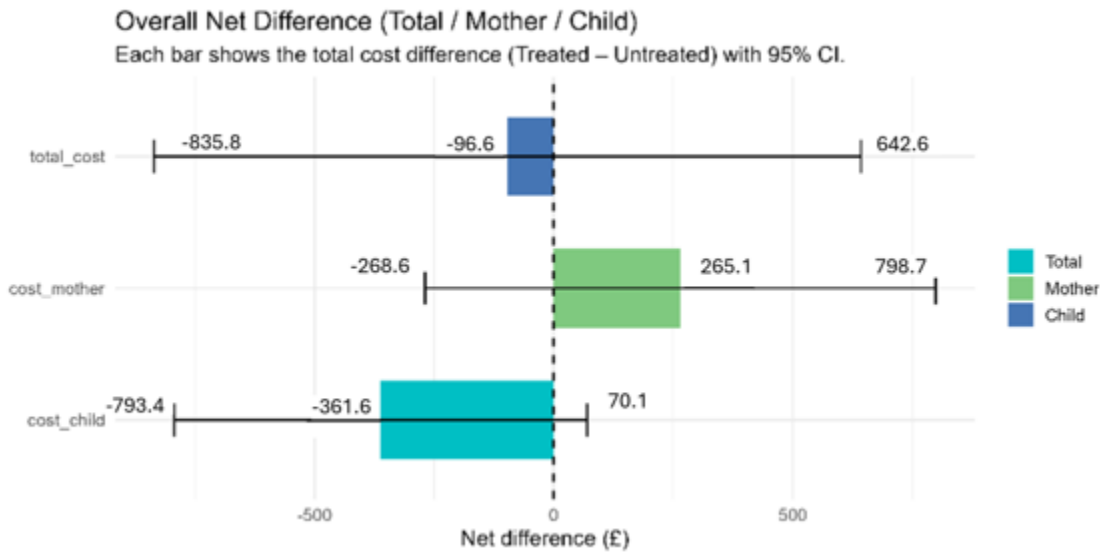


Figure 3

Weighted net difference in total NHS resource use costs, excluding programme delivery costs

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