



BMJ Open Coached, Coordinated, Enhanced Neonatal Transition (CCENT): protocol for a multicentre pragmatic randomised controlled trial of transition-to-home support for parents of high-risk infants

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ABSTRACT

Introduction Having an infant admitted to the neonatal intensive care unit (NICU) is associated with increased parental stress, anxiety and depression. Enhanced support for parents may decrease parental stress and improve subsequent parent and child outcomes. The Coached, Coordinated, Enhanced Neonatal Transition (CCENT) programme is a novel bundled intervention of psychosocial support delivered by a nurse navigator that includes Acceptance and Commitment Therapy-based coaching, care coordination and anticipatory education for parents of high-risk infants in the NICU through the first year at home. The primary objective is to evaluate the impact of the intervention on parent stress at 12 months.

Methods and analysis This is a multicentre pragmatic randomised controlled superiority trial with 1:1 allocation to the CCENT model versus control (standard neonatal follow-up). Parents of high-risk infants (n=236) will be recruited from seven NICUs across three Canadian provinces. Intervention participants are assigned a nurse navigator who will provide the intervention for 12 months. Outcomes are measured at baseline, 6 weeks, 4, 12 and 18 months. The primary outcome measure is the total score of the Parenting Stress Index Fourth Edition Short Form at 12 months. Secondary outcomes include parental mental health, empowerment and health-related quality of life for calculation of quality-adjusted life years (QALYs). A cost-effectiveness analysis will examine the incremental cost of CCENT versus usual care per QALY gained. Qualitative interviews will explore parent and healthcare provider experiences with the intervention.

Ethics and dissemination Research ethics approval was obtained from Clinical Trials Ontario, Children's Hospital of Eastern Ontario Research Ethics Board (REB), The Hospital for Sick Children REB, UBC Children's and Women's REB and McGill University Health Centre REB. Results will be shared with Canadian level III NICUs, neonatal follow-up programmes and academic forums.

Trial registration number ClinicalTrials.gov Registry (NCT03350243).

Strengths and limitations of this study

- This is the first large-scale randomised controlled trial assessing a novel bundled intervention of support for parents beginning in the neonatal intensive care unit and continuing until the end of the first year at home, which includes psychosocial support and coaching within an Acceptance and Commitment Therapy framework, care coordination and education delivered by a nurse navigator.
- This study is multicentre, which increases generalisability, reduces the risk of bias and allows for broad national dissemination.
- A limitation of this study is that measures of parental stress, mental health, family empowerment, and health service delivery are self-reported and cannot be independently verified.
- The lack of blinding for participants and investigators due to the interpersonal nature of the intervention may contribute to bias. However, data analysts will be blinded to participant allocation.

INTRODUCTION

Medical and technological advances have led to increasing survival of infants born preterm¹ or with complex medical needs² who are admitted to the neonatal intensive care unit (NICU). These infants are at risk of medical, cognitive and developmental sequelae.²⁻⁵ Having an infant admitted to the NICU is associated with increased parental stress due to the NICU environment, alterations in parental role and limitations to caregiving,⁶⁻⁸ as well as anxiety^{9,10} and depression.¹¹⁻¹³ These emotions increase during the transition to home from hospital,¹⁴⁻¹⁶ depending on the child's condition and the parent's readiness

for discharge¹¹ and their medical caregiving role.^{17 18} Discharge is accompanied by a sense of loss as families leave the familiarity of the NICU while severing supportive relationships with healthcare providers (HCPs).¹⁹ A lack of continuity of care post-discharge can negatively impact patient outcomes and parent well-being.²⁰

In Canada, post-discharge care includes scheduled appointments with a primary care provider, and for high-risk infants, a neonatal follow-up (NFU) programme that focuses on neurodevelopmental assessment and outcomes.^{21 22} However, there is a lack of direct support for parent psychosocial (psychological and social) needs,²³ and limited research on this area.²⁴ A systematic review of interventions for NICU parents including psychosocial support, education, and/or developmental interventions reported positive effect on depression and anxiety, but limited effect on stress.¹⁴ Stress is a contributing factor to many mental disorders, and long-term stress increases the risk of depression and anxiety.²⁵ It is recommended that NICU-related parental stress be treated with immediate and tailored support provided to parents after the birth of a high-risk infant in order to reduce stress and improve well-being and infant neurodevelopmental outcomes.⁸ Families and HCPs have identified that the tools to address a family's medical and social needs must extend beyond the NICU to include the transition to home^{7 16–19 26–28} and first year of life.^{13 23 29}

Integrated healthcare models can support transition from hospital to home by decreasing parental stress, optimising family empowerment, and improving healthcare system efficiency³⁰ and costs.^{31 32} NICU parents may benefit from an integrated intervention during the NICU admission, transition to home and post-discharge period including a dedicated key worker,³³ care coordination with the infant's medical team,^{23 26 34} psychosocial support to cope with stress^{15 23 25} and education to prepare for parenting a medically complex infant.^{35–37} A bundled intervention was chosen based on research on care bundles, which contain several evidence-based practices delivered collectively and consistently with the aim of improving patient outcomes.³⁸ Complex interventions containing several interacting components may work best if tailored to individual circumstances,³⁹ thus the Coached, Coordinated, Enhanced Neonatal Transition (CCENT) intervention allows the key worker flexibility to tailor their interactions to the parents' transition needs, while adhering to the core components of the intervention. CCENT differs from previous interventions in the literature that focus primarily on mother–infant interactions⁴⁰ or collaborative family consultation⁴¹ in the NICU, as the focus is a long-term intervention to reduce stress via a novel bundled programme including psychosocial support.

The CCENT bundled intervention consists of three core elements delivered by a nurse navigator (NN) (key worker) that have been shown individually to be effective in similar parental populations. The role of key worker has been shown to improve health outcomes of high-risk infants,⁴² and has sustained benefits to parental mental health.⁴³ Care coordination is associated with more efficient healthcare

service use and cost savings for families and the healthcare system.⁴⁴ Enhanced psychosocial support for parents^{7 33 45–53} decreases stress, anxiety and depression,⁵⁴ and improves parent–infant attachment and developmental outcomes for preterm infants.^{14 55} Anticipatory guidance and education around development and behaviour in high-risk infants increases confidence in caregiving,⁵⁶ decreases parental stress and facilitates a safe transition to home.³⁷

Acceptance and Commitment Therapy (ACT) is an empirically based behavioural therapy involving acceptance, mindfulness and behaviour change strategies to foster psychological flexibility, which is the willingness to experience difficult events and choose actions in the present moment aligning with one's values.⁵⁷ ACT encourages people to embrace their difficult thoughts and feelings rather than avoiding them. Research has shown that increasing psychological flexibility through mindfulness therapies reduced maternal depression during the NICU admission and after discharge.⁵⁸ ACT interventions can be delivered by a variety of trained facilitators,²⁴ and demonstrate improved mental health outcomes for parents of children with life-threatening illness,⁵⁹ asthma⁶⁰ and autism.⁶¹ ACT may be more appropriate for parents in the NICU compared with interventions such as cognitive–behavioural therapy,²⁴ which demonstrates effectiveness in reducing depression but not anxiety for NICU mothers.⁶²

The CCENT programme is a novel bundled intervention for parents of high-risk infants delivered by an NN who provides (1) coaching and psychosocial support within an ACT framework, (2) care coordination, and (3) anticipatory education around the care for a medically complex infant during the NICU admission, transition to home and first year post-discharge.

Aims and objectives

The primary aim of this study is to compare the CCENT intervention with standard NFU care for parents of high-risk infants. The primary objective is a comparison of parental stress between the intervention and control groups using the Parenting Stress Index Fourth Edition Short Form (PSI-4-SF) at 12 months. The secondary objective is to evaluate the effect of the CCENT intervention on parent–infant interaction, parent empowerment, physical and mental health, psychological flexibility, family experience of care and infant development outcomes. The tertiary objective is to estimate the incremental cost per parental quality-adjusted life year (QALY) gained of the CCENT intervention compared with usual care, from both a public healthcare payer and societal perspective. Our outcomes are structured around the Triple Aim framework, which focuses on patient experience of care, population health and cost.⁶³

METHODS AND ANALYSIS

Design

CCENT is a multicentre pragmatic randomised controlled superiority trial. The trial will compare two parallel groups randomised with a 1:1 allocation ratio to the CCENT

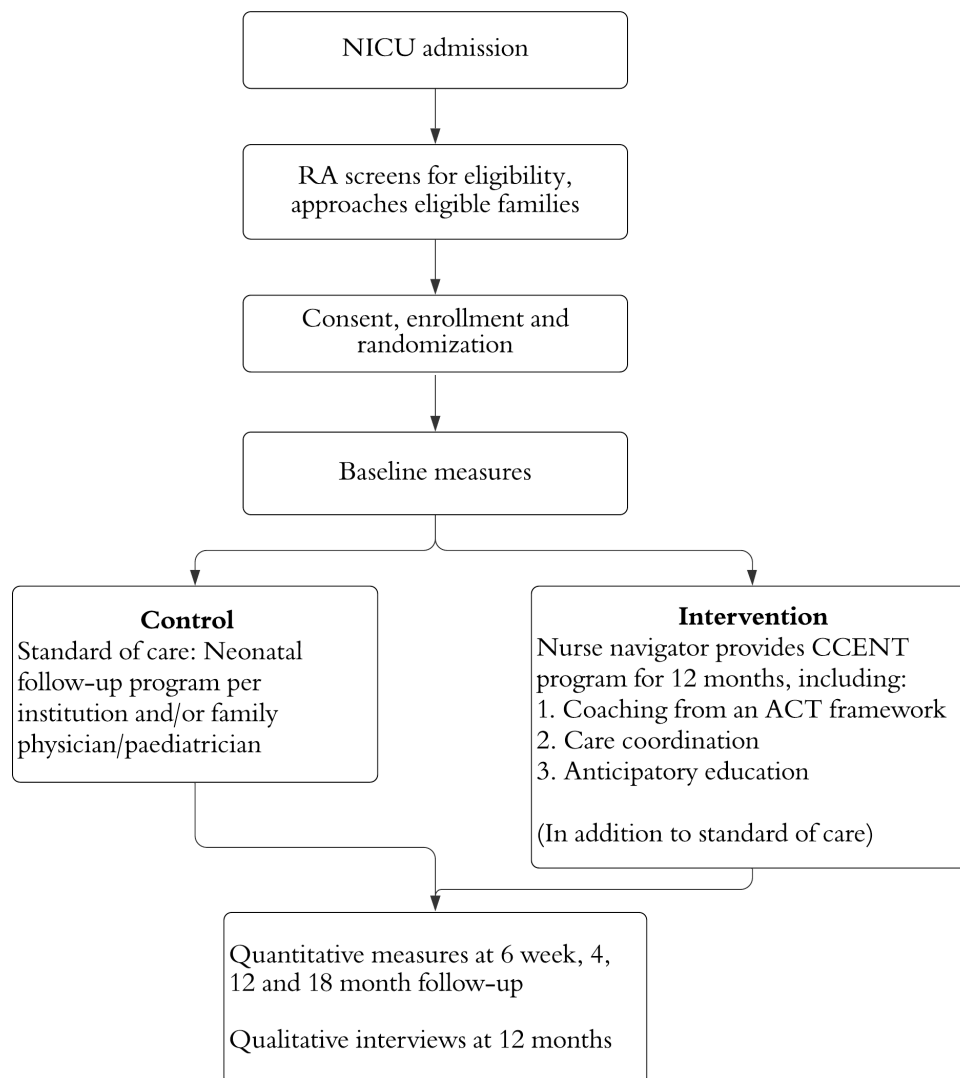


Figure 1 Study flow diagram. ACT, Acceptance and Commitment Therapy; CCENT, Coached, Coordinated, Enhanced Neonatal Transition; NICU, neonatal intensive care unit; RA, research assistant.

programme versus standard of care (figure 1). Concurrent qualitative methods will be used to assess experiences with the programme. This protocol has been designed according to the Standard Protocol Items: Recommendations for Interventional Trials reporting guidelines.⁶⁴

Setting

CCENT will be conducted in the level III NICUs of seven hospitals in Ontario, Quebec and British Columbia.

Participants

The target population are parents of high-risk infants, defined as having risk factors predictive of neurodevelopmental delay or impairment, medical complexity and parent–infant attachment impairment. Both parents will be invited to participate, however, primary analyses will be conducted on the individual identified as the primary caregiver.

Inclusion criteria

Parents of an infant:

1. Born $\leq 26+6$ weeks' gestational age (GA) (30 days old at recruitment to ensure viability).
2. Born 27–29+6 weeks' GA with ≥ 1 of the following risk factors: (a) \geq grade III intraventricular haemorrhage with post-haemorrhagic hydrocephalus; (b) retinopathy of prematurity requiring intraocular bevacizumab/anti-vascular endothelial growth factor or laser surgery therapy; (c) requires invasive (eg, intubation) or non-invasive (eg, continuous positive airway pressure) respiratory support at ≥ 34 weeks' GA or supplemental oxygen at ≥ 37 weeks' GA; (d) requires surgery for management of stage 3 necrotising enterocolitis.
3. With two or more major congenital anomalies as defined by the European Registration of Congenital Anomalies and Twins (eg, atrial septal defect, hypospadias) and length of stay (LOS) in recruiting institution ≥ 14 days.
4. With hypoxic ischaemic encephalopathy requiring therapeutic hypothermia and LOS in recruiting institution ≥ 14 days.

Exclusion criteria

Parent:

1. Does not speak English or French.
2. Is not involved with child's care during the study period (eg, adoption).

Infant:

1. Is followed by an out-of-province NFU programme.
2. Has previously been discharged home from the hospital.
3. Decision or high likelihood of withdrawal of care.

Control arm

The control arm will receive routine primary paediatric care and NFU with a multidisciplinary team (including neonatologists, paediatricians, nurses, occupational therapists and physiotherapists). Participating sites' NFU programmes provide a standardised schedule of 5–7 visits,²² typically at 4–8 weeks, 4, 8, 12, 18 and 36 months.⁶⁵ The visits consist of neurodevelopmental assessment and diagnosis, medical assessment and referrals to needed services.²² Online supplemental appendix A highlights team members and schedule of NFU visits at each site.

Intervention arm: CCENT

In addition to standard NFU care, participants randomised to the CCENT intervention arm will receive (1) coaching and psychosocial support within an ACT framework, (2) care coordination, and (3) anticipatory education around the care of a medically complex infant, delivered by a trained NN during the NICU admission and in the year post-discharge. The NN will provide goal-oriented, client-centred coaching that is health focused,⁶⁶ and will guide parents to problem-solving challenges.⁶⁷ Each site will have one NN.

NNs deliver the intervention over a 12-month period for a minimum of 21 sessions; five in the NICU and six weekly sessions followed by monthly sessions for months 2–12 post-NICU discharge. Post-discharge support sessions will occur via phone contact with supplemental emails.

Coaching and psychosocial support

NNs deliver five in-person sessions (a 20-minute pre-session and four 1-hour sessions) of ACT-based coaching to parents in the NICU, guided by an ACT manual (details in online supplemental appendix B). Additional coaching may occur via phone based on need. Key themes in the ACT curriculum include coping with stress, promoting psychological flexibility, cultivating mindfulness and values-based goal setting. If infants are transferred or discharged before completing in-person sessions, parents can continue virtually.

Care coordination

NNs deliver care coordination activities grounded in patient-centred and family-centred care, partnership and empowerment strategies to address health-related needs. These activities include focused relationship building, medical and social problem-solving (eg, discussions on baby care, emotional well-being and child health) and

navigation with community resources post-discharge. Activities are tailored to participant need and may occur in hospital or virtually throughout the 12-month intervention period.

Anticipatory education

NNs provide proactive education targeting typical challenges in caring for high-risk infants' healthcare and developmental needs. A 30-page toolkit and a website of resources were developed by the study team, expert HCPs and a parent advisory committee to ensure consistent intervention content across sites. Toolkit resources include a transition checklist, guide to the first days at home, and links to provincial community resources for infant and parent health and well-being. NNs provide connection to mental health services as needed.

NN training

NN training includes a 3-day experiential training programme on ACT core processes and coaching methods provided by two clinical psychologists and a social worker (SW) (standardised across sites). The ACT manual, a five-session NICU-specific manual of objectives and exercises, was developed in consultation with ACT therapists and psychologists and was reviewed during training. Additionally, NNs undergo 1-day training on care coordination and anticipatory education methods provided by a nurse practitioner. Throughout the study, NNs attend biweekly facilitated peer support and ACT practice/feedback sessions with an SW.

ACT intervention fidelity

NNs will complete the ACT Fidelity Measure (ACT-FM)⁶⁸ after every ACT session as a self-assessment of their ACT consistency. To ensure intervention fidelity, all ACT sessions will be audio-recorded and 10% of the sessions will be randomly selected and reviewed by a behaviour analyst (BA) and SW using the ACT-FM. The ACT-FM scores of the NN's ACT consistent versus ACT inconsistent responses for each session as determined by the BA and SW will be compared with the NN's self-assessment.

Outcomes and measures

Outcome measures were selected based on their content applicability, reliability and validity. In the case of multiple births, if multiple infants per family are eligible, parents will complete the child-related measures for each eligible infant. Corrected age is used for infants born <37 weeks' GA. **Table 1** summarises the timeline in which measures are collected.

Primary outcome

The primary outcome is parenting stress measured by the self-reported PSI-4-SF (36 items, Cronbach's alpha=0.91).^{69–74} The PSI-4-SF evaluates the magnitude of stress in the parent–child relationship, and has three subscales: Parental Distress, Parent–Child Dysfunctional Interaction and Difficult Child.⁷⁵ Studies of the test–retest reliability of the PSI-4-SF demonstrate high correlation

Table 1 Measures timeline

| Measure* | Time to administer | Baseline | Preterm infants | | | |
|-------------------------------------------------------|------------------------|-------------------------|--------------------------|--------------------------|--------------------------------|------------------------------------|
| | | | 6 weeks' corrected age | 4 months' corrected age | 12 months' corrected age | 18 months' corrected age |
| | | | Term infants (>37 weeks) | | | |
| | 6 weeks post-enrolment | 4 months post-enrolment | 12 months post-enrolment | 18 months post-enrolment | | |
| Participant Information and Demographic Questionnaire | 5 min | ✓ | | | | |
| Social Support Questionnaire-6 | <5 min | ✓ | | | | |
| Parenting Stress Index-4-SF | 5 min | ✓† | ✓ | ✓† | | ✓ |
| Acceptance and Action Questionnaire II | <5 min | ✓ | ✓ | ✓ | | ✓ |
| Edinburgh Postnatal Depression Scale | 5 min | ✓ | ✓ | ✓ | | |
| Health Utilities Index | 5 min | ✓ | ✓ | ✓ | | |
| State-Trait Anxiety Inventory SF | <5 min | ✓ | ✓ | ✓ | | |
| Medical Indicators Form (chart review)‡ | 15 min | ✓ | ✓ | ✓ | | |
| Family Empowerment Scale | 5 min | ✓ | ✓ | ✓ | | |
| Measure of Processes of Care-20 | 5 min | ✓ | ✓ | ✓ | | |
| Pediatric Transition Experience Measure | <5 min | | ✓ | ✓ | (if not discharged at 6 weeks) | |
| Resource Use Questionnaire | 5–10 min | | ✓ | ✓ | | |
| NCAST-PCI Teaching Scale‡ | 10 min | | | ✓ | In-person/virtual | |
| BITSEA‡ | 10 min | | | ✓ | | |
| Mindfulness Exposure Form (control only) | <5 min | | | ✓ | | |
| Qualitative interviews (intervention only) | 45 min | | | | To be invited | |
| BSID-III‡ | 60 min | | | | | ✓ In-person at NFU clinic visit |
| Ages and Stages Questionnaire-18‡ | 10 min | | | | | ✓ |

*Participants will be given a window of ± 1 month to complete each set of measures.

†The second parent will also complete this measure, if enrolled.

‡Per infant in the study.

BITSEA, Brief Infant-Toddler Social Emotional Assessment; BSID-III, Bayley Scales of Infant and Toddler Development Third Edition; NCAST-PCI, Nursing Child Assessment Satellite Training Parent-Child Interaction Teaching Scale; NFU, neonatal follow-up; SF, Short Form.

coefficients, supporting the general stability of the test over time and its ability to detect change in stress.⁷⁶

Parent-focused secondary outcomes

1. Health-related quality of life
The Health Utilities Index (HUI) provides indicators of multiple attributes of health status for use in economic evaluations of healthcare programmes. It has well-established validity and reliability in many clinical contexts (test–retest reliability of 0.767 intraclass correlation coefficient).^{77 78}
2. Empowerment
The Family Empowerment Scale^{79 80} measures empowerment in families with children who have emotional, behavioural or mental disorders (34 items, Cronbach's alpha=0.87–0.88).⁷⁹
3. Mental health
The Edinburgh Postnatal Depression Scale (EPDS) assesses for symptoms of depression and anxiety during pregnancy and the year following birth (10 items, Cronbach's alpha=0.87).^{81 82} The State-Trait Anxiety Inventory Short Form measures state anxiety (how one feels at the moment) and trait anxiety (how one generally feels) (6 items, Cronbach's alpha >0.90).^{83 84}
4. Healthcare and service delivery
The Measure of Processes of Care-20 is a validated, reliable self-report measure of parent's perception of the extent to which health services are family centred (20 items, Cronbach's alpha=0.63–0.90).^{85 86}
5. Transition experience
The Pediatric Transition Experience Measure is a self-report measure of a parent's perception of transition preparation and support from the hospital (11 items).⁸⁷ McDonald's coefficient omega to examine internal consistency reliability was 0.84.⁸⁸
6. Health resource use
The Resource Use Questionnaire measures resource use relating to the infant's medical needs post-discharge and will be summed over the study interval.⁸⁹
The child–parent dyad is the unit of measurement.
7. Psychological flexibility
The Acceptance and Action Questionnaire II measures psychological flexibility, and is an internally consistent measure of ACT's model of mental health and behavioural effectiveness (Cronbach's alpha=0.84).⁹⁰

Child-focused secondary outcomes

1. Infant health and development
Medical indicators are collected via chart review. The Brief Infant-Toddler Social Emotional Assessment is a parent-report screener to identify children at risk of or currently experiencing social-emotional/behavioural problems or delays in competence (42 items, Cronbach's alpha for problem scale=0.79, competence scale=0.65).^{91–93} The Bayley Scales of Infant and Toddler Development Third Edition (BSID-III) assesses infant development with good to strong validity and reliability (Cronbach's alpha=0.57–0.87).^{94 95} The

BSID-III will be completed at the NFU clinic 18-month visit. The 18-month Ages and Stages Questionnaire Third Edition is a validated questionnaire in which parents rate their child's current skills and development (Cronbach's alpha=0.60–0.75).^{96 97}

2. Infant–parent interaction
The Nursing Child Assessment Satellite Training Parent–Child Interaction Teaching Scale (NCAST-PCI) assesses caregiver and infant behaviours observed during a structured teaching task (Cronbach's alpha=0.84).^{98 99} The NCAST-PCI may be completed virtually by some participants due to COVID-19 pandemic restrictions.

Additional measures

Participant demographic characteristics are collected by survey. Social support, a potential effect modifier, is measured using the Social Support Questionnaire-Short Form (Cronbach's alpha=0.97).^{100 101} Participants in the control group complete a form listing any mindfulness programmes they participated in over the last year to examine potential contamination bias. To capture intervention engagement, the duration and content of all NN–parent interactions are recorded by the NN in a log.

Parent and NN experience outcomes

Experience outcomes are captured through purposive sampling and semistructured qualitative interviews with a subset^{15–20} of intervention participants at 12 months and HCPs^{7–15} including all NNs at study end. The objective of the qualitative component is to ensure an in-depth understanding of the intervention, especially (1) the most valuable components, (2) facilitators and barriers, and (3) impact on parent stress and mental health.

Sample size

With 200 families, there is 80% power to declare significance (with a two-sided test of the null hypothesis at alpha=0.05) if the intervention decreases the mean total stress score on the PSI-4-SF at 12 months by at least 0.4 of an SD. To allow for up to 15% attrition, a total of 236 families will be recruited. Former studies have not identified a minimal clinically important difference (MCID) for the PSI-4-SF that could be used to estimate sample size calculation. It was assumed that participants would have a mean total stress score of 64⁴⁵ and estimates of the SD vary from 15¹⁰² to 19.⁴⁵ Therefore, the MCID for which there is sufficient power lies between 6 and 7.6. Differences less than 6.5 points (about 10%) would not be considered clinically important. The range used for the SD^{15–19} was confirmed using the data from the first 60 patients.

Recruitment

Research staff screen admissions to participating level III NICUs for eligibility. A member of the NICU clinical team asks if parents are interested in participating in research. If interested, research staff speak with parents to discuss study procedures and consent. Research staff will obtain written informed consent from all participants

for participation in the trial, audio-recording, secondary data access and qualitative interviews (model consent form in online supplemental appendix C).

Randomisation

Consented participants are enrolled and randomised using Research Electronic Data Capture (REDCap).^{103 104} Randomisation is stratified by site and the generation of the allocation sequence is concealed from research staff. Blinding of participants and NNs is not feasible due to the in-person nature of the intervention, however data analysts will be blinded to allocation.

Data collection

Participants are assigned an identification number to ensure confidentiality. Quantitative study data are collected and managed using REDCap. Participants can complete questionnaires online via REDCap, on paper or via telephone as needed. Participants receive a \$10 honorarium at the completion of each set of questionnaires (\$20 at 12 months), the NCAST visit and the qualitative interview.

Participants are deemed lost to follow-up after no response to two telephone and two email contact attempts. If an infant dies after enrolment or a participant withdraws from the study, no further data collection will occur and they will be analysed according to the intention-to-treat principle.

Data management

The Women and Children's Health Research Institute (WCHRI) at the University of Alberta will perform system management functions and data cleaning. Missing data and potential sources of bias will be examined and appropriate correction methods determined before data analysis. Data analysis will be performed by the WCHRI in collaboration with the research team. There is no data monitoring committee due to the low-risk nature of the intervention.

Statistical analysis

The intention-to-treat principle will be used for all analyses. Continuous data will be summarised by the mean and SD for approximately normally distributed variables; median and quartiles (first and third quartiles) will be used for other distributions. Categorical data will be presented by absolute and relative frequencies (n and %). The unit of analysis for outcomes measured at the family level will be the self-identified primary caregiver. The unit of analysis for outcomes measured at the infant level will be the individual infant. A two-sided p value of ≤ 0.05 will be considered statistically significant. All statistical analyses will be performed by SAS V.9.4 or later (SAS Institute).

Primary analysis

The primary analysis will be based on the PSI-4-SF mean total stress score measurement taken at 12 months. Linear mixed models with sites as a random effect and group

assignment as a fixed effect will be used for the analysis. Baseline PSI-4-SF value will be included as a covariate in the model.

Secondary analyses

Similar linear mixed models will be used to analyse secondary outcomes. For those outcomes with a measurement taken at baseline, the corresponding baseline measurement will be included as a covariate in the model. To account for multiple births for outcomes measured on infants, the linear mixed model for the analysis will include a random effect for family.

For those outcomes with measurements in addition to that taken at 12 months, a linear mixed model accounting for repeated measures will be performed to examine the effect of group allocation and time. Effects of sites and of individual participants will be added as random effects to the model. The effects of the intervention will also be assessed on PSI-4-SF subscale scores. In a subgroup analysis, we will examine the effects of potential mediating variables, such as infant health status (eg, prematurity), parental mental health (eg, baseline depressive symptoms), level of intervention engagement and family factors (eg, sociodemographic factors), on PSI-4-SF total score. Measures that cannot be completed in person due to COVID-19 pandemic restrictions (ie, BSID-III) will not be included in the final analysis if there are incomplete data.

Cost-effectiveness analyses

A cost-effectiveness analysis will be performed to determine the incremental cost of the CCENT intervention compared with standard of care among high-risk infants per QALY gained. Utility weights derived from the HUI will be multiplied by the life expectancy of each parent to determine their QALYs. Both a healthcare system and societal perspective will be used with a 12-month time horizon. All costs and outcomes will be assigned to the family as the unit of analysis. Those families that have more than one eligible child may be analysed separately to preserve independence of observations. In addition to the infant's resource use captured on the Resource Use Questionnaire, the CCENT intervention will be micro-costed in terms of labour and supplies. As the study is randomised, patient-level regression will be used to determine mean costs and outcomes per family for the comparators over the 12-month time horizon. Results will be summarised in an incremental cost-effectiveness ratio—the ratio of the difference between groups in mean cost per family to the difference in mean QALYs. Extensive sensitivity analyses that examine the effects of varying uncertain parameters on the results will be conducted. Secondary cost-effectiveness analyses that model the incremental cost of CCENT per unit of improvement in other parental outcomes measures will also be conducted. All post-discharge resource use will be costed using provincial public payer sources.

Qualitative analysis

Interviews will be transcribed verbatim and reviewed for accuracy. Two researchers will independently code transcripts with NVivo V.12,¹⁰⁵ using content analysis to identify key concepts, cluster key concepts into categories and revisit categories to refine them.¹⁰⁶ Content analysis allows for the construction of categories containing data that represent similar meanings to provide insight into the phenomenon of interest.¹⁰⁶ Authors with expertise in qualitative analysis methods will review the coding scheme and findings at interim meetings. Data collection will continue until saturation is reached.

DISCUSSION

Recognition of the importance of parental support in the NICU and during the transition to home has been noted in the literature.^{15 23 26 35 36} There is a need for a high-quality clinical trial of this scope and nature. We anticipate that the CCENT programme will reduce parental stress for parents of high-risk infants. We expect a positive impact on family empowerment, parent–infant interaction, psychological flexibility, child development and transition experience. We also expect parents to experience better care coordination and more efficient healthcare utilisation. In turn, we propose this study will lead to a shift in focus of NFU across Canada to embed a model of parent support that is longitudinal and includes the transition to home.

Several aspects of this trial are novel or innovative. The CCENT programme addresses gaps in the literature regarding parental support by delivering a model that is proactive, long-term and encompasses the transition from hospital to home. In order to address the lack of evidence-based interventions supporting fathers of high-risk infants,^{9 14} we have included both fathers and mothers in our study. The qualitative interviews will allow us to identify what aspects of the CCENT programme are more or less effective, for whom, and in what contexts.

The study's use of an NN delivering an integrated care bundle including ACT coaching is innovative.^{24 107} NNs were chosen due to the versatility, clinical expertise and social support skills of the nursing role.¹⁰⁸ Engaging nurses present in the NICU ensures guidance begins in the NICU and continues to outpatient care.³³

Limitations include the risk of refusal or attrition due to the time commitment required. To minimise losses due to hospital transfer prior to completion of the ACT sessions, virtual options are available.

Intervention development

The intervention was developed through eight teleconferences over a 1-year period with key stakeholders (including parent-partners) to determine the inclusion criteria and elements of the intervention, including the content of the ACT sessions and the resource toolkit.

Patient and public involvement

CCENT is embedded within the CHILD-BRIGHT Network, which is supported by the Canadian Institutes

of Health Research under Canada's Strategy for Patient-Oriented Research.^{109 110} CCENT was created based on priorities set by Canadian patients, families and investigators to increase the likelihood of a transformative impact for children and families. CCENT actively involves graduate NICU families in developing the study design, intervention content and knowledge translation (KT) activities. A parent representative is a member of the author team, and a parent advisory group meets biannually, with quarterly email conversations with the research team to receive input on study decisions.

Ethics and dissemination

Informed consent will be obtained from all participants by the research staff. Study data are kept confidential by removing identifying information, and all study files are maintained on a password-protected secure server.

Adverse event reporting

A parent may be identified as having significant mental health concerns through NN interactions or the EPDS. A safety protocol is in place to ensure parents receive appropriate primary care or emergency services support as needed. All adverse events will be reported to the site research ethics board and primary investigator.

Dissemination

Study team members have direct integration and expertise in neonatal care and follow-up locally and nationally, allowing for KT to embed key findings into practise, including the use of an NN and the ACT framework. Executive summaries and presentations will be shared with Canadian NICUs. Academic KT will occur through presentation at academic conferences and publications in high-impact, peer-reviewed journals. Collaboration with organisations such as the Provincial Council for Maternal and Child Health and Canadian Premature Babies Foundation provides further dissemination opportunities.

Trial status

Recruitment began March 2018 at two sites and June 2019 at all other sites. Two hundred thirty-six participants are enrolled as of January 2021. Data collection is anticipated to be complete by July 2022. Full-length protocol available on request.

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