Preventing early births in a regional tertiary maternity unit - evaluating preterm and early term birth rates before and after implementation of the Preterm Birth Prevention Initiative in the Australian Capital Territory: a pre and post interventional study

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Abstract

Objective To evaluate the Australian Capital Territory (ACT) Preterm Birth (PTB) Prevention Initiative and its effects on preterm and early term birth rates at the main tertiary hospital after 16 months of implementation. Design: A non-randomised before and after study, where the intervention was a multifaceted PTB prevention initiative. Setting: The main tertiary referral hospital in the ACT. Population: Women who birthed at the main tertiary hospital in the ACT in the pre and post intervention period. Methods: The PTB prevention initiative was implemented in 2019. Rates of early birth were assessed using run charts of bimonthly preterm and early term rates from 2014-2020. Main Outcomes measured: The main outcomes measured were rates of preterm and early term births before and after implementation of the PTB prevention initiative. Results: At the main tertiary hospital in the ACT, the rate of PTB was significantly reduced by 10% after 16 months of implementation of the initiative, corresponding to 45 averted or delayed PTBs. The number of iatrogenic early term births with no medical indication (NMI) was significantly reduced by 34.5% and resulted in 77 averted or delayed early term births. Conclusions: The multifaceted PTB prevention initiative safely lowered the rates of early birth in the ACT context. These results highlight the importance of prioritising early birth prevention, education, research and expanding the PTB Prevention Initiative nationwide.

Objective

To evaluate the Australian Capital Territory (ACT) Preterm Birth (PTB) Prevention Initiative and its effects on preterm and early term birth rates at the main tertiary hospital after 16 months of implementation.

Design: A non-randomised before and after study, where the intervention was a multifaceted PTB prevention initiative.

Setting: The main tertiary referral hospital in the ACT.

Population: Women who birthed at the main tertiary hospital in the ACT in the pre and post intervention period.

Methods: The PTB prevention initiative was implemented in 2019. Rates of early birth were assessed using run charts of bimonthly preterm and early term rates from 2014-2020.

Main Outcomes measured: The main outcomes measured were rates of preterm and early term births before and after implementation of the PTB prevention initiative.

Results: At the main tertiary hospital in the ACT, the rate of PTB was significantly reduced by 10% after 16 months of implementation of the initiative, corresponding to 45 averted or delayed PTBs. The number of iatrogenic early term births with no medical indication (NMI) was significantly reduced by 34.5% and resulted in 77 averted or delayed early term births.

Conclusions: The multifaceted PTB prevention initiative safely lowered the rates of early birth in the ACT context. These results highlight the importance of prioritising early birth prevention, education, research and expanding the PTB Prevention Initiative nationwide.

Introduction

PTB is defined as birth before 37 completed weeks of pregnancy and is associated with a range of adverse outcomes.[1-4] It is considered one of the most significant causes of perinatal morbidity and mortality worldwide.[5,6] Every year an estimated 15 million babies are born preterm, with approximately 1 million deaths attributed to preterm complications.[7] In 2018, 8.7% of Australian babies were born preterm, with the highest incidence in the Northern Territory (11.9%) and lowest in New South Wales (7.7%). Over the past 10 years there has been a small increase in the proportion of PTB across Australia (8.2% to 8.7%).[8]

There is growing evidence showing a proportion of spontaneous PTBs can be prevented.[9,10] There exists substantial evidence showing the efficacy of individual interventions for the prevention of spontaneous early birth including cervical cerclage,[11]vaginal progesterone pessary supplementation[12] and mid trimester ultrasound of the cervix.[13] Reducing these early births can result in significant health, social and economic impacts for families and significant economic benefits for health services.[14, 15] The importance of preventing early term births is also emerging. Research suggests that there can be adverse short- and long-term health effects for those born early term (37-38+6 weeks) compared to late term (39 weeks onwards), especially in the domains of neonatal admissions, respiratory distress and neurodevelopment.[16,17] Data shows that planned early term births are increasing across Australia and the beneficial effects of lengthening pregnancy is not often emphasised in clinical practice.[8,18]

A team in Western Australia (WA) implemented a comprehensive state-wide PTB prevention initiative in 2014, incorporating a range of interventions aimed at reducing early births across the state. One year after implementation of the program there was a significant reduction in the incidence of PTB, with 7.6% reduction in singleton PTBs statewide and 20.3% at the main tertiary level referral hospital. This WA study was the first of its kind in assessing integrated PTB prevention strategies across a population.[2]

Following WA success, the Centenary Hospital for Women and Children (CHWC) in the ACT introduced the ACT PTB prevention initiative in 2019. The aim of the initiative was to safely lower the rate of early births, following the WA model. The objective of this study was to evaluate the ACT PTB prevention initiative and its effects on PTBs and early term births at the main tertiary hospital and to assess whether the initiative achieved similar results in the ACT context.

Methods:

The study was approved by the Human Research Ethics Committee in the ACT (reference number 2019/ETH12446; approved 17 July 2019). The intervention was the PTB prevention initiative and the main outcomes measured were rates of PTB and early term birth before and after implementation of the initiative.

The PTB prevention initiative was a multifaceted initiative. Initially a guideline on the prevention and management of PTB was developed and a three-month program of outreach education and dissemination of the new clinical guidelines took place with sonographers, obstetricians, midwives and general practitioners across the territory and surrounding southern New South Wales (NSW) areas. The initiative was officially launched on 28 February 2019 and received philanthropic support to establish the service and Ministerial endorsement.

The key interventions in the new clinical guidelines for the ACT were based on the WA initiative.

These included:

- universal screening of cervical length at all routine 18-20 week fetal anomaly ultrasound scans
- prescription of vaginal progesterone pessary for women who have a shortened cervix ([?]25mm) on ultrasound (between 16-24 weeks)
- prescription of vaginal progesterone pessary for all women with a history of spontaneous preterm birth (24-34 weeks) or spontaneous loss (16-24 weeks)
- consideration of cervical cerclage for cervical length <10mm
- avoidance of early planned birth unless medically indicated
- implementation of a structured smoking cessation program
- implementation of a dedicated preterm birth prevention clinic.

After the launch, further multidisciplinary education sessions were organised for sonographers, general practitioners, midwives and obstetricians throughout the ACT and hospitals in the southern NSW and Murrumbidgee districts.

The new PTB prevention clinic was established within the Fetal Medicine Unit (FMU) at CHWC. CHWC is the sole tertiary level centre for referral of high-risk pregnancies for the ACT and surrounding NSW areas. Thus, the initiative aimed to capture all women with an increased risk of PTB. Referrals were made through the FMU and were triaged as a priority. The clinic is staffed by an Obstetrician, a Fetal Medicine Fellow, a midwife, a sonologist and sonographers. Continuity of care was offered to all women or they could refer back to their original care provider once the early risk of PTB had passed.

A pre and post intervention study was conducted to examine the association between the PTB prevention initiative and preterm and early term birth rates. Our analysis included women who gave birth at the CHWC in the pre intervention period from 1 January 2014 to 31 December 2018 and the post intervention period from 1 January 2019 to 30 April 2020. Inclusion criteria included women who had a singleton birth between 20-39 weeks gestation within the study period. Rates of PTB and early term birth before (2014-2018) and after 16 months of implementation of the initiative were evaluated. Rates of early birth were assessed using run charts of bimonthly preterm and early term rates from 2014-2020. Run charts show patterns of change over time and can identify trends, runs and how an intervention is performing.

Data was collected from the Central Birth Outcome System electronic medical record. This system collects all births from 20 weeks of pregnancy at the CHWC. Retrospective collection of existing records occurred for both the pre intervention and post intervention groups. Data included demographic information, gestational age at birth, plurality, birth outcomes and whether births were spontaneous or iatrogenic. All data was de-identified and the study did not require patient involvement. Discrete data were reported as number and percent and compared using Chi Square tests. A p-value of 0.05 was considered significant.

Results

The number of births at the CHWC in both the pre and post intervention period is summarised in Table 1. The number of singleton births in the pre intervention period was 17355 and the number of births in the post intervention period was 4592. The annual rates of preterm and early term births including iatrogenic births with no medical indication (NMI) are shown in Table 2. The trends for preterm and early term births including iatrogenic births with NMI are shown in Figure 1. The average rates pre intervention are illustrated with the black horizontal bar and noted in the attached text box and the initiation of the intervention is illustrated with a red vertical bar. Table 3 demonstrates the differences between pre and post intervention with respect to preterm and early term births.

The rate of PTB (20-36 weeks) within the post intervention period was 8.75% which was significantly lower than the preceding 5 years with an average of 9.74 % (OR 0.88 95% CI 0.79-0.99 p= 0.05). This resulted in a 10% reduction in rates of PTB. When the rates of PTB were separated into grouped gestational ages there was a significant reduction in the 20-23+6 weeks gestation group, 0.82% v 0.52% (OR 0.63 95% CI 0.41 – 0.97 p=0.03), a non-significant reduction for the 24-27+6 week gestation group, 0.79% v 0.67% (OR

0.84 95% CI 0.57 –1.25 p = 0.40), a significant reduction for the 28-31+6 weeks gestational group, 1.46% v 0.73% (OR 0.73 95% CI 0.54 – 1.00 p=0.05) and a non-significant increase for the 32-36 weeks gestational group, 4.47% v 4.5% (OR 1.00 95% CI 0.86 – 1.17 p=0.92).

The rates of early term births (37-38+6 weeks) within the post intervention period was 25.78% which was a significant increase in births compared to the preceding five years with an average of 23.95% (OR 1.10 95% CI 1.02 – 1.18 p=0.009). When further analysed, there was a significant reduction in iatrogenic early term births with NMI, 18.84% v 12.33% (OR 0.73 95% CI 0.61 – 0.87 p=0.0001) which equated to a 34% reduction in iatrogenic early term births with NMI.

Table 4 displays the estimated number of PTB and iatrogenic early term births with NMI averted or delayed post intervention. The estimated number of averted or delayed PTBs based on the 10% reduction was 45 and the estimated number of iatrogenic early term births with no medical indication that were averted or delayed based on the 34% reduction was 77.

Discussion

Main findings

The introduction of a multifaceted PTB prevention initiative was associated with a significant 10% reduction in the overall rate of PTB compared to the average for the previous 5 years at the main tertiary referral hospital in the ACT. Rates of PTB after the introduction of the initiative were lower than any of the preceding 5 years. These findings were consistent with the successful results from the WA experience.[2, 19] Once PTBs were separated in to grouped gestational ages the greatest reduction in preterm birth were observed in the 20-23+6 and 28-31+6 gestation age groups. Non-significant reductions were found for the 24-27+6 gestational age group, however, there was a slight increase in this group 32-36 weeks. The run chart data shows that the majority of the effect appears to occur soon after the implementation of the initiative in early 2019, most likely due to increased awareness and momentum from the initiative. This highlights the need for sustained outreach education for health professionals and the community.

Rates of iatrogenic early term births with NMI were significantly reduced by 34.5% (12.33% from 18.84%) and this was sustained over the whole year of the post intervention period. This highlights the success of the hospital's policy encouraging judicious decision making for early term births and the receptiveness by staff to this change. We have included early term births in this analysis as we believe interventions aimed at reducing rates early term births should be considered alongside preterm birth prevention strategies due to the emerging research on the adverse effects of the early term birth. We hypothesise that the overall increase in early term births is due to a delay in preterm births, shifting the distribution curve to the right.

This study focussed on the effect of early birth in singleton pregnancies for two main reasons. We aimed to offer consistency in the literature by assessing singleton births similar to the previous study in Western Australia. We are also aware the mechanism for pre term birth in singletons and multiples may vary and the majority of the interventions in this initiative were focussed on singleton pregnancies.

The economic impact of averted or delayed early births is an important aspect that is outside of the scope of this study but would be the basis of valuable follow up research. With the resource rich, and expensive neonatal intensive care bed spaces costing in excess of $1000 per day to run [20], the reduction of these bed numbers would have significant fiscal benefits.

Strengths

The success of the initiative was multifactorial. Firstly, the study was conducted in a well-resourced country, with a universal health care system. This allowed for the key interventions to be implemented with minimal issues around dissemination of information, access to care or health care costs. Cost of progesterone pessaries were initially subsidised by the Canberra Health Services to minimise barriers to use as it was recognised that the higher cost of this medication could results in unequal access to an effective intervention.[21] This medication is now available under the Pharmaceutical Benefits Scheme, further removing the barriers to ac-

cessibility of this treatment. The establishment of a dedicated preterm birth prevention clinic was key to the initiative and provided a consistent central point for information, education, referrals and reviews. CHWC is the sole tertiary level referral centre for high risk cases for the ACT and NSW surrounding areas and this assisted in identifying and offering interventions for all women at risk of PTB. The benefits of continuity of care especially for reducing preterm birth[22] was recognised and all women were offered continuity in pregnancy with a dedicated PTB prevention midwife and obstetrician. Additional staff training was undertaken in nicotine addiction and smoking cessation to support the implementation of a structured smoking cessation program. Outreach education also played a key role in the initiative's success. A widespread education program that included tertiary and regional hospitals in the ACT and NSW that refer to the CHWC was conducted. Almost a quarter of women who gave birth in the ACT are non-ACT residents and data from 2018 showed that the proportion of PTB for ACT residents who gave birth in the ACT was 8.1% whereas 17.3% of non-ACT residents had PTBs in ACT hospitals.[8] Including NSW surrounding hospitals, therefore, was crucial for the program's success.

A before and after study was the best study design for our research purpose. We wanted to evaluate an intervention by assessing trends over time across a population. We did not identify any extraneous variables that may have influenced the rates of early births across the ACT during the study period. We included multiple measurement over many years to strengthen the evidence of the effect of the initiative. The data for the study was sourced from a highly reliable perinatal database meaning our results are likely to be accurate which strengthens the study's results.

Limitations:

There are limitations to this study. We have not included data from other public and private hospitals in the ACT and NSW surrounds. The ACT and surrounding areas do not have a centrally linked birthing data collection system, so it was difficult to access this information. CHWC is the sole tertiary level hospital for high risk women for ACT and NSW surrounds so it is likely that most high-risk cases were referred to CHWC, however, including trends from other hospitals would strengthen the results. In addition, the study did not include mid trimester losses prior to 20 weeks as the Birth Outcomes System at the CHWC does not record births prior to this period. We also did not include births beyond 39 weeks. This information may be useful when analysing PTB trends and patterns and would further strengthen the study's results. Lastly, the study was conducted in a well-resourced country and different health systems and societies may require different approaches.

Conclusion

Early birth is not inevitable. Gestational age at birth can be a key determinant for an individual's health and wellbeing throughout life.[23] Our findings are consistent with those from WA and we propose that the study may assist in implementation of similar initiatives across Australia. The overall significant results for reduction of PTBs and reduction in early term births (iatrogenic with no medical indication) indicate the multifaceted PTB prevention initiative can lower the rates of early birth. These results highlight the importance of prioritising preterm birth prevention, education, research and expanding the PTB Prevention Initiative nationwide.

Ethics

The study was approved by the Human Research Ethics Committee in the ACT - reference number 2019/ETH12446; approved 17 July 2019.

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Discloser of interests

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Contribution to authorship

RO, JS and BL designed the study. RO and DD collected and analysed the data. JS and RO drafted the manuscript and BL contributed to editorial changes and supervised the study.

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`Table 1. Number of singleton and multiple births.docx` available at https://authorea.com/users/339236/articles/465470-preventing-early-births-in-a-regional-tertiary-maternity-unit-evaluating-preterm-and-early-term-birth-rates-before-and-after-implementation-of-the-preterm-birth-prevention-initiative-in-the-australian-capital-territory-a-pre-and-post-interventional-study

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`Figure 1 - Rates of pre term birth (run charts).docx` available at https://authorea.com/users/339236/articles/465470-preventing-early-births-in-a-regional-tertiary-maternity-unit-evaluating-preterm-and-early-term-birth-rates-before-and-after-implementation-of-the-preterm-birth-prevention-initiative-in-the-australian-capital-territory-a-pre-and-post-interventional-study

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Table 4 Estimated number of averted delayed births.docx available at https://authorea.com/users/339236/articles/465470-preventing-early-births-in-a-regional-tertiary-maternity-unit-evaluating-preterm-and-early-term-birth-rates-before-and-after-implementation-of-the-preterm-birth-prevention-initiative-in-the-australian-capital-territory-a-pre-and-post-interventional-study