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The Maternal Health Study: study design update for a prospective cohort of first-time mothers and their first-born children from birth to age ten

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Synopsis

What's already known

Poor maternal mental and physical health are common in the first 12 months postpartum, with implications for health and wellbeing of mothers and children across the lifecourse.

Study Question

The Maternal Health Study was designed to investigate the contribution of social and obstetric risk factors to common maternal morbidities. Over time our focus has expanded to include investigation of intergenerational impacts of poor maternal health and exposure to family violence.

What this study adds

The study collected detailed data on maternal and child health from pregnancy to age ten, including information on exposure to physical and emotional intimate partner violence in the first, fourth and tenth year postpartum. These data provide unparalleled opportunities to examine intergenerational impacts of family violence and factors promoting resilience in the context of social adversity.

Abstract

Background: Maternal health is critical to the health and wellbeing of children and families, but is rarely the primary focus of pregnancy and birth cohort studies. Globally, poor maternal health and the exposure of women and children to family violence contribute to the perpetuation and persistence of intergenerational health inequalities.

Objectives: The Maternal Health Study was designed to investigate the contribution of social and obstetric risk factors to common maternal physical and psychological morbidities. Over time our focus has expanded to include mother-child pairs and investigation of intergenerational trauma and family violence.

Population A total of 1507 first-time mothers were recruited in early pregnancy from six public hospitals in Melbourne, Australia in 2003-2005.

Methods: Women completed questionnaires or telephone interviews in early pregnancy (≤ 24 weeks); at 32 weeks' gestation; at three, six, nine, 12 and 18 months postpartum; and at four and ten years. At ten years, women and children were invited to participate in face-to-face interviews, which included direct assessment of children's cognitive and language development. A wide range of obstetric, social, and contextual factors have been measured, including exposure to intimate partner violence (IPV) (1-year, 4-year and 10-year follow-up).

Results: 1507 eligible women were recruited at a mean gestation of 15 weeks. At one year, four years and ten years postpartum, 90.0%, 73.1% and 63.2% of the original cohort took part in follow-up. One in three women in the study (34.5%) reported exposure to IPV in the first ten years of motherhood: 19% in the first 12 months postpartum, 20% in the year prior to four-year follow-up and 18.3% in the year prior to ten-year follow-up.

Conclusion: The study affords a unique opportunity to examine patterns of maternal and child health and health service use associated with exposure to IPV.

Key words:

Maternal health; child health; mental health; intimate partner violence; public health; epidemiology;

1. Background

Maternal health has long been recognised as critical to the health and wellbeing of children and families. (1, 2) Globally, there is increasing recognition that poor maternal physical and mental health is linked to the perpetuation and persistence of health inequalities. (3) Despite this, maternal health is rarely the primary focus of longitudinal research studies. Most prospective pregnancy and birth cohort studies are designed principally with the health of children in mind. (4-6) With this lens, maternal physical and mental health and maternal behaviour are viewed as significant exposures with the potential to influence not

only child health, but also health across the lifecourse. In contrast, the Maternal Health Study was established to understand intergenerational health with the inherent strength of focusing on the health of both mothers and children.

While there is growing interest in a perspective that foregrounds the causes of the causes (i.e. upstream or distal factors influencing more proximal factors shaping health), the multifaceted social, biological and environmental factors influencing *maternal health outcomes and trajectories* have received far less attention in lifecourse research. The Maternal Health Study was designed to investigate the onset, severity, chronicity and recurrence of common maternal physical and psychological morbidities often missed in other pregnancy and birth cohort studies. Initially our goal was to understand the contributions of social and obstetric risk factors to maternal physical and psychological health during pregnancy and the first 18 months postpartum. The primary outcomes of interest specified in the study protocol were urinary and faecal incontinence, sexual health and persisting perineal pain. Maternal mental health was specified as a secondary outcome. At the time, there were a number of cross sectional studies documenting maternal health outcomes after childbirth, but few studies providing a longitudinal picture of factors shaping maternal health and patterns of morbidity subsequent to childbirth. (7) The study filled an important gap in the literature at the time and has continued to contribute vital knowledge about how maternal and child health progress over the lifecourse.

The lifecourse literature has drawn attention to the multiple social and contextual factors shaping health and wellbeing across generations bringing explicit focus to psychosocial and environmental influences, in addition to biological factors shaping health across the lifecourse. (3) In the early 2000s when the study was being planned, there was emergent evidence regarding the health consequences of intimate partner violence (IPV) for women and children. (8, 9) At the time most of the available evidence on women's experiences of IPV was from cross sectional and clinical studies (10-12), as few community cohorts included questions about IPV. Two notable exceptions are the Avon Longitudinal Study of Parents and Children and the Norwegian Mother and Child Cohort (MoBA) Study. (13, 14) However, neither of these studies employed a validated multidimensional measure of IPV. Our decision to incorporate a comprehensive validated 18-item measure of exposure to

physical, emotional and sexual IPV in the first phase of the study (15, 16) set the study apart from most cohorts underway at the time. The insight yielded regarding the high prevalence of IPV in this community cohort and associated patterns of poor maternal mental and physical health outlined in early publications from the study (14, 15) ultimately became the rationale for extending follow-up of mother-child pairs beyond 18 months postpartum. Follow-up has since been extended to age ten affording an unparalleled opportunity to track the health and wellbeing of mother-child pairs in the context of different patterns of exposure to IPV (e.g. exposure at a single time point, intermittent and persistent patterns of IPV exposure).

This paper updates the original study protocol published in 2006. (17) The landscape of lifecourse research has changed immeasurably since the study began. There has been an exponential growth of research documenting early-life antecedents of adult chronic disease and mental health outcomes. (18) Against this background, the study has evolved in ways that could not have been anticipated in the early 2000s. We remain firmly committed to foregrounding women's health in the context of motherhood, and have expanded our horizon to examine social and environmental influences on the health of children as well as their mothers, with a particular focus on children's experiences of growing up in families where IPV is occurring.

The original aims of the Maternal Health Study were to: (i) describe the onset, severity, chronicity of maternal physical and psychological health problems of first-time mothers from early pregnancy to the period of late adolescence of their firstborn children; and (ii) assess the contribution of obstetric and social risk factors to maternal physical and psychological health after childbirth. These aims have now been extended to: (iii) assess the extent to which different types of IPV and patterns of exposure are associated with maternal and child health outcomes; (iv) identify mediating paths between IPV and maternal and child health outcomes and estimate the extent to which socio-environmental factors buffer the effects of IPV on women and children's health; and (v) examine patterns of health service use for common maternal morbidities and by women and children exposed to IPV.

2. Methods

2.1 Design and cohort selection

Women were recruited from April 2003 to December 2005 at six metropolitan public hospitals with a mix of high and low risk perinatal services located in the state of Victoria, Australia. Eligibility was restricted to women who were ≥ 18 years, nulliparous, ≤ 24 weeks' gestation, and sufficiently fluent in English to complete written questionnaires. Women were recruited via mailed and face-to-face invitation facilitated by the study hospitals. A total of 1507 eligible women enrolled in the study (mean gestation of 15.0 weeks). We conservatively estimate one in three eligible women ($\sim 33\%$) enrolled in the study. A precise response fraction could not be calculated as many women received invitations via more than one pathway. Participant characteristics at enrolment are described in Table 1. The original cohort was representative of women giving birth at public hospitals in Victoria during the study period in terms of method of birth, gestation and infant birthweight. The main sources of selection bias were related to social characteristics. Compared to women giving birth at Victorian public hospitals during the study period, the cohort includes fewer young women (18-24 years, 14.1% versus 29.8%) and fewer women born overseas of non-English speaking background (16.2% versus 21.5%). (19)

Including the most recent wave of follow-up at ten years postpartum, there have been nine waves of data collection for the whole cohort, with two additional waves for women having second and subsequent births. Data collection has involved eight questionnaires, two computer-assisted telephone interviews (CATIs) in late pregnancy and at nine months postpartum, and face-to-face assessments of children at age ten. Figure 1 shows the data collection waves and participant numbers. Table 1 lists participant baseline characteristics of those with complete versus missing data at 4 and 10-year follow-up. Women disproportionately lost to follow up are younger, socially disadvantaged and more likely to have had relationship transitions.

2.2 Data collection

Table 2 summarises key domains measured at each wave of data collection.

2.2.1 Family and social context

Data have been gathered on: maternal socio-economic status; education; country of birth; maternal height, weight and physical activity; and participation in paid work and study. We have also collected data on household composition, relationship status and transitions, practical and emotional support, maternal involvement in parenting, exposure to IPV, and maternal experiences of abuse in their own childhoods. Intimate partner violence was assessed using the Composite Abuse Scale (CAS) providing 12-month period prevalence of IPV at 1-year, 4-year and 10-year follow-up. (15, 16) The short 18-item version of the CAS (used at 12 months postpartum) and longer 30-item version (used at 4 and 10 years) include items asking about emotional abuse (e.g. 'blamed me for their violent behaviour', 'tried to keep me from seeing my family') and physical abuse (e.g. 'pushed, grabbed or shoved me', 'beat me up') by a current or former partner. Women are asked to indicate how often these actions have happened in the previous 12 months: *never, once, several times, once per month, once per week, or daily* (scored 0 to 5). Women were categorised as experiencing IPV if they scored ≥ 1 for physical abuse items and/or ≥ 3 for emotional abuse items.

Data on relationship transitions were collected at each follow-up, and a detailed relationship calendar covering length of relationships and timing of transitions was completed at 10-year follow-up.

2.2.2 Maternal health

Maternal physical and mental health was assessed at baseline and at every follow-up. Physical health measures included assessment of urinary and bowel symptoms using standardised measures matching criteria of the International Continence Society, (20-23) and single item measures assessing abdominal and perineal pain, (24, 25) sexual health, (25, 26) back pain and exhaustion (7, 27). Maternal mental health was assessed using the 10-item Edinburgh Postnatal Depression Scale at all questionnaire follow-ups, (28, 29) and the 20-item Center for Epidemiologic Studies Depression Scale, 21-item Beck Anxiety Inventory and the 17-item Posttraumatic Stress Disorder Checklist – Civilian version at 10-year follow-up. (30-32) In addition, we included the SF-36 as a measure of functional health status in early pregnancy, at six months, four years and ten years postpartum. (33)

2.2.3 Reproductive and obstetric history

Data on pregnancy complications (e.g. gestational diabetes) were collected in questionnaires and CATIs during pregnancy, and data on birth events (e.g. obstructed labour, method of birth, genital tract trauma) in questionnaires at three and six months postpartum. At enrolment and at each follow-up, women were asked to report on miscarriages and terminations. Data on reproductive history and events in the index pregnancy and birth were also abstracted from hospital medical records for women who gave written consent (95% of the cohort). (34)

2.2.4 Child development and physical health

Mothers reported on infant birthweight and gestation, admission to neonatal intensive care/special care nursery, infant feeding, and genetic/developmental conditions apparent in the year after birth. These data were also abstracted from hospital records using a detailed data abstraction protocol and data abstraction sheet. Data on significant childhood illnesses (e.g. asthma) and developmental conditions (e.g. autism) were collected at each wave of follow-up. Direct assessments of child height, weight and blood pressure were obtained at 10-year follow-up.

2.2.5 Child mental health and wellbeing

Child emotional and behavioural difficulties were assessed at four years and ten years using the Strengths and Difficulties Questionnaire. (35) At ten years, mothers completed a structured diagnostic interview for identifying probable clinical diagnoses of mental health disorders in children, (36) the Spence Anxiety Scale (37) and a modified version of the Adolescent Resilience Questionnaire. (38)

2.2.6 Child cognitive and language development

At 10-year follow-up, children completed assessments of: verbal and non-verbal IQ, executive functioning and receptive vocabulary. (39, 40) In addition, mothers attending face-to-face interviews completed the Children's Communication Checklist Short form (CCC2-S) and the CCC-2 pragmatic subscales. (41)

2.2.7 Health service use

Mothers reported on health service use related to their own health and to the health of their child at every wave. This included use of primary care, specialist and allied health services.

2.3 Sample size and study power

Power calculations were undertaken at the time of 4-year follow-up to assess study power to undertake meaningful comparisons of maternal and child outcomes associated with different patterns of exposure to IPV from birth to 10 years. Based on the assumption that 1035 women would complete 10 year follow-up, and 262 (25%) would report IPV, we estimated that the study would provide 80% power to detect a minimum difference of 0.2 standard deviations (SD) in child outcome measures. For a dichotomised child outcome with 10% prevalence (e.g. behaviour difficulties) there would be 80% power to detect a minimum odds ratio of 1.9 and 85% power to detect a minimum odds ratio of 2. For analyses focusing on different patterns of exposure to IPV, comparison of a subgroup of 106 women experiencing persisting IPV to 773 never experiencing IPV provides 80% power to detect a minimum difference of 0.30 SD in child outcome measures. For a smaller sub-group of 70 women experiencing IPV for the first time at 10 years postpartum, we anticipated 80% power to detect a minimum difference of 0.35 SD.

2.4 Data access

The co-ordinating centre for the study is based in the Intergenerational Health group at the Murdoch Children's Research Institute, Melbourne, Australia. Additional information about the study and study measures can be obtained from the LifeCourse website (42). The investigator team welcome inquiries about the data and proposals for collaboration. The conditions of ethics approval preclude data access via a public repository. Data sharing is subject to approval by the investigator team. Applications will be considered in context of papers in progress, and compliance with conditions of ethics approval and consent. Interested researchers are invited to contact the Principal Investigator, Professor Stephanie Brown (stephanie.brown@mcri.edu.au).

2.4 Ethics approval

Ethics approval was granted by ethics committees at recruiting hospitals, the Royal Children's Hospital and La Trobe University.

3. Results

3.1 Principal findings

A summary of key findings reported to date related to aims one to four is presented below. Analysis of data collected at 10-year follow-up and data on health service use is in progress.

3.1.1 Maternal physical and mental health during and after pregnancy (aims 1 and 2)

In early pregnancy, two-thirds of women (68%) reported three or more physical health issues, the most common being exhaustion (87%), nausea (64%), back pain (46%), constipation (44%) and severe headaches or migraines (30%).(43) Almost one in ten women (8.7%) reported depressive symptoms and 7.3% reported anxiety.(19, 43) Sexual health issues and urinary incontinence were also common, particularly as pregnancy progressed.(44-46) Women under 25 years at the time of having their first baby reported a greater number of symptoms and poorer physical and mental health status during pregnancy than older women.(47)

In the first three months after childbirth, the most common physical health issues were: extreme tiredness (66%), backpain (47%), post-operative pain (89% of women who had a caesarean section), perineal pain (73% of women who had a vaginal birth), dyspareunia (47% of those who had resumed vaginal sex by three months postpartum), breast problems (36%) and urinary incontinence (29%). (48) Women who had a caesarean birth were less likely to experience urinary and faecal incontinence than women who had a spontaneous vaginal birth, but had very similar symptom trajectories for other common morbidities.(48-50)

Mental health issues were also common. At three, six, 12 and 18 months postpartum, the prevalence of depressive symptoms was 6.8%, 8.8%, 7.8% and 11.3% respectively. (51, 52) Overall, one in five women (22.5%) reported depressive symptoms in the perinatal period (pregnancy to 12 months postpartum), and one in six women (16%) reported depressive

symptoms in the first 12 months postpartum.(53) More than half (57.6%) of women experiencing depressive symptoms in the first 12 months postpartum reported the onset of symptoms *after* three months postpartum.(51) Risk factors for depressive symptoms during pregnancy included: poor physical health, fear of an intimate partner, being under 25 years, not having a partner and unemployment during pregnancy. (19) (43) After the birth, poor physical health and exposure to IPV were strongly associated with depressive symptoms. (44)

3.1.2 Longer-term patterns of maternal physical and psychological morbidity (aims 1 and 2)

Follow-up at four and ten years postpartum showed that tiredness, backpain, incontinence and sexual health issues (e.g. dyspareunia) continue to be common experiences throughout the first ten years of motherhood. There is no evidence that urinary or faecal incontinence decrease over this period, although symptoms were more often intermittent rather than persistent.(54, 55)

Obstetric risk factors such as prolonged labour, method of birth and genital tract trauma appear to play a limited role in persisting or recurring postpartum physical health problems including incontinence and sexual health issues.(45, 50, 54, 56) No association was found between parity and urinary and faecal incontinence at four years postpartum, but older maternal age (≥ 35 at time of first birth) and higher current BMI were independently associated with both urinary and faecal incontinence.(54)

At four years and ten years postpartum, depressive and anxiety symptoms were reported by 15% and 25.3% of women respectively.(52, 57, 58) The prevalence of depressive symptoms at 4-year follow-up (14.5%) and 10-year follow-up (18.5%) was higher than at any time point in the first 12 months postpartum and was not explained by subsequent pregnancies or births.(52, 57) Over time, there has been an increase in the proportions of women reporting psychotropic medication use (18.9% at ten years compared with 13.9% at four years) and thoughts of self-harm (8.9% at ten years, 5.4% at four years and 4.8% at one year postpartum).(57-59)

Risk factors for poor maternal mental health extending beyond the perinatal period included: prior mental health symptoms reported during pregnancy or postpartum, being under 25 years at the time of having a first baby, a history of childhood physical or sexual abuse, not working or studying during the index pregnancy, recent or past exposure to IPV, stressful life events/social adversity, poor maternal physical health, being single and/or experiencing relationship transitions and having a low income.(52, 57, 60) Risk factors for subclinical and persistently high depressive symptoms from pregnancy to four years postpartum were: non-English speaking background, not being in paid employment during pregnancy, a history of childhood physical abuse, partner relationship problems, exhaustion, sexual health problems and experiencing fear of an intimate partner since the birth.(61)

3.1.3 Exposure to intimate partner violence and maternal health (aim 3)

Overall, one in three women (34.5%) reported exposure to IPV in the first ten years of motherhood: 19.0% in the first 12 months postpartum, 20.0% in the year prior to 4-year follow-up, and 18.3% in the year prior to 10-year follow-up (Figure 2). (51, 52, 57, 62) Women experiencing IPV at one, four or ten years postpartum had higher prevalence of depressive and anxiety symptoms at every follow-up compared with those never reporting IPV. (51, 52, 57) At 10-year follow-up, women who had experienced *recent IPV* (in the previous 12 months) had odds of depressive, anxiety and posttraumatic stress symptoms that were three to five times higher than women *never* reporting IPV after accounting for maternal age at first birth, relationship status at ten years and prior mental health symptoms.(57) *Recent IPV* was also associated with higher odds of poor functional health status, back pain and urinary incontinence. (55) Women with past IPV at one and/or four years (15.7% of the cohort) also had higher odds of physical and mental health problems. There was evidence of a gradient in health outcomes by recency of exposure to IPV.(55)

3.1.4 Health consequences of exposure to different types of IPV (aim 3)

Women reporting IPV at 1-year, 4-year and 10-year follow-up were categorised as experiencing *emotional IPV alone*, *physical IPV alone* or *concurrent emotional and physical IPV*. Emotional IPV (alone or in combination with physical IPV) was the most common type of IPV reported. (58, 63). One strand of current work is seeking to assess the relationship between exposure to different types of IPV and maternal physical and mental health

outcomes. Analyses completed for the first 12 months postpartum show that health outcomes of women experiencing *emotional IPV alone* were similar to the health outcomes of those experiencing *emotional and physical IPV*, in both cases reflecting poorer health when compared to outcomes of women not reporting IPV.(63) The much higher prevalence of *emotional IPV* means that important opportunities for improving maternal and child health outcomes are being missed when programs focus primarily or solely on women and children exposed to *physical IPV*.

3.1.5 Exposure to intimate partner violence and child health (aim 3)

Children exposed to *recent IPV* experienced greater emotional and behavioural difficulties at four and ten years. (53, 64, 65) Any exposure to IPV in the first 10 years of life was associated with twice the odds of a probable psychiatric diagnosis (assessed using the DAWBA), emotional/behavioural difficulties, impaired language skills (general and pragmatic), asthma and sleep problems at age ten. (65) *Recent IPV* exposure at age ten was associated with two to three times higher adjusted odds of all mental health outcomes, elevated blood pressure, and consulting a health professional about sleep problems. Early life exposure alone (one and/or four years) was associated with three times higher odds of a general language impairment and consulting a health professional about asthma at age ten. No associations were observed with measures of cognitive development at age ten. (65)

3.1.6 Clustering of risk and intergenerational pathways (aim 3)

Another strand of recent work seeks to delineate complex exposures and intergenerational pathways in order to understand the contribution of individual risk and protective factors to maternal and child health outcomes. Family violence, mental health problems and social adversity commonly co-occur and may be thought of as 'syndemic'. (66) For example, women who began childbearing with a history of childhood physical and/or sexual abuse (41% of mothers) were two to four times more likely to experience IPV and to report poor physical and mental health after childbirth compared to women who did not have a history of childhood abuse. (67) Women reporting both IPV and a history of childhood abuse had the highest odds of reporting poor mental and physical health. (67) Children's outcomes largely mirrored these patterns. Children of mothers reporting a history of childhood abuse who were also exposed to IPV in their first four years of life had the highest odds of

emotional and behavioural difficulties. In contrast, children of mothers who reported a history of childhood abuse but were not exposed to IPV in early childhood had similar outcomes to children not exposed to either type of family violence, suggesting resilient outcomes where violence is not repeated in the next generation. (67)

3.1.7 Mediating pathways between exposure to IPV and maternal and child outcomes (aim 4)

Understanding what enables some mothers and children to display resilience in the face of IPV and other social adversity is a major focus of current analyses. (68-70) Another key focus is to build understanding of mediating pathways between exposure to different types of family violence and child outcomes. A recent paper found that the association between maternal childhood abuse and children's emotional-behavioural difficulties at age 10 years was mediated by maternal depressive symptoms and exposure of mothers to IPV in the first postnatal year (71)

3.2 Strengths of the study

Major strengths of the study include the capacity to identify the incidence and co-morbidity of physical and mental health problems in both mothers and children. The collection of comprehensive and well-validated exposure and outcome measures via questionnaires and CATIs has been enhanced with data on obstetric events abstracted from hospital medical records, and direct assessments of child cognitive and language outcomes at age ten years. The sample has enabled identification of clinically important differences in maternal and child health outcomes associated with key exposures, including method of birth and other obstetric events, and exposure to social determinants, such as IPV.

The decision to include a validated, comprehensive measure of exposure to physical and emotional IPV at one, four and ten years postpartum has been central to the new knowledge and translational impacts of the study. The study is one of the few pregnancy or birth cohort studies include *repeated measurement of exposure to IPV* over multiple waves of data collection.^{5,13} To our knowledge, only one small study (n=70 mother-child dyads) apart from our study reports longitudinal data on exposure to IPV beyond age 3. (72) No studies to date have administered *repeated prospective measures* of exposure from

childhood through to adolescence/young adulthood when critical foundations are being laid for healthy intimate partner relationships in adult life. With this in mind, we are currently seeking funding to enable follow-up of the cohort as the study children reach the age of 18.

3.3 Limitations of the data

Data are limited by the relatively low initial response fraction and under-representation of younger women and women of non-English speaking background. Barriers to recruitment included the sensitive nature of questions regarding bowel symptoms and sexual health; the intensive follow-up schedule beginning early in pregnancy when many women experience extreme tiredness and nausea; and our inability to tailor study methods to be inclusive of women with low-English proficiency due to funding constraints. (17) The fact that the sample was found to be representative in terms of important obstetric characteristics such as method of birth and infant birthweight is reassuring, however selective attrition has contributed to lower representation of younger and more socially disadvantaged women. These limitations necessitate caution in interpreting prevalence estimates for health conditions and exposures including IPV, but are unlikely to compromise the validity of aetiological analyses assessing risk factors. (73, 74) Statistical techniques to account for missing data due to incomplete measurement and loss to follow-up have been used where applicable. These approaches include multiple imputation (57, 58, 67) and integrated estimation methods within statistical modelling techniques such as latent class analysis and structural equation modelling. (59, 61, 71, 75-78)

3.4 What's happening now

We are currently implementing a nested sub-study following up mothers and adolescent children in the study at age 15 to 17 years to examine social impacts of the COVID-19 pandemic on maternal and adolescent mental health and wellbeing. In 2021, we hope to commence follow-up of the whole cohort as the children reach 18 years of age. The transition to young adult life is a critical period in the life course. It is well established that most mental health disorders begin before the age of 25.(79) If not adequately addressed, mental health disorders may hinder young people's transition to adulthood, including their ability to participate in education, employment or training; develop healthy relationships and engage with the broader community.(80) The current generation faces an added layer

of challenges associated with the social, psychological and economic impact of the COVID-19 pandemic. This extra burden of heightened economic and social uncertainty; restrictions on social interaction; disruption to school, work and tertiary study environments; and resultant pressures on young people and families is likely to be felt most acutely by the generation currently transitioning late secondary school. In the next decade, the under-recognised costs of exposure to IPV and other forms of childhood adversity will become more apparent as the current generation of young people navigate the post-pandemic environment. We have a time-critical opportunity to follow up young people at this pivotal life stage, and to situate their experiences within the context of detailed epidemiological data already collected for this cohort.

Knowledge translation has been a primary focus of the study right from the start. (3) Initially findings on maternal physical and mental health were shared with participating hospitals and professional colleges involved in the care of women during and after childbirth. Recently our focus has turned to longer term maternal and child health outcomes. Table 3 provides a snapshot of key findings regarding maternal mental health and IPV, implications for policy and services, and strategies that are being used to promote research impact.

Conclusions

The study affords an important opportunity for prospective examination of patterns of maternal and child health and health service use associated with exposure to IPV in the first ten years after the birth of a first child. It remains one of the few pregnancy cohort studies with prospectively collected data on common maternal morbidities and repeated measurement of exposure to IPV spanning the period from early pregnancy to ten years postpartum. Evidence from the study has already highlighted the importance on ongoing primary care and support for mothers tailored to social context and extending well beyond the perinatal period. Building on these findings, our continuing goals are to: inform maternal and child health policy; provide evidence to strengthen intervention targets and strategies; and work collaboratively with health services and other stakeholders to strengthen health system capacity and responses to issues affecting the health of women and children.

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Table 1. Comparison of baseline characteristics for responders and non-responders at 1-year, 4-year and 10-year follow-up

		Baseline	1-year follow-up		4-year follow-up		10-year follow-up	
		During pregnancy	Responders	Non-responders	Responders	Non-responders	Responders	Non-responders
		n=1507	n=1353	n=154	n=1101	n=406	n=952	n=555
Mother in early pregnancy								
Age (years)	M (SD)	30.1 (5.0)	30.4 (5.0)	27.7 (5.3)	30.8 (4.7)	28.3 (5.2)	30.9 (4.6)	28.8 (5.4)
Born in Australia	n %	1115 74.4%	1026 76.2%	89 58.2%	851 77.6%	264 65.7%	744 78.3%	371 67.6%
Highest education (secondary school)	n %	141 9.4%	132 9.8%	9 5.9%	108 9.8%	33 8.2%	91 9.6%	50 9.1%
Relationship status (partnered)	n %	1436 95.3%	1293 95.6%	143 92.9%	1054 95.7%	382 94.1%	916 96.2%	520 93.7%
Health care card	n %	119 8.0%	88 6.6%	31 20.3%	61 5.6%	58 14.5%	42 4.5%	77 14.1%
First born child	(n= 1431)							

Gender (female)	n %	681 47.6%	636 47.7%	45 45.5%	520 48.0%	161 46.4%	445 47.2%	236 48.3%
Birthweight (grams)	M (SD)	3389.6 (578.5)	3396.5 (567.6)	3303.3 (698.9)	3396.0 (574.6)	3370.2 (590.7)	3397.7 (580.4)	3374 (575.1)
Low birthweight (<2500 grams)	n %	83 5.8%	71 5.4%	12 11.4%	60 5.6%	23 6.5%	54 5.8%	29 5.9%
Preterm (<37 weeks)	n %	96 6.7%	89 6.7%	7 7.1%	73 6.7%	23 6.6%	66 7.0%	30 6.1%
Mode of birth (spontaneous vaginal)	n %	999 69.8%	934 70.1%	65 65.7%	756 69.7%	243 70.0%	664 70.5%	335 68.5%

Table 2. Key Domains assessed by wave of the Maternal Health Study

Study phase	Pregnancy		Early Postpartum					Childhood	
	<24 weeks	30-32 weeks	3 months	6 months	9 months	12 months	18 months	4 years	10 years
Wave	1	2	3	4	5	6	7	8	9
Assessment mode	MQ	CATI	MQ Medical Records	MQ	CATI	MQ	MQ	MQ	MQ Child assessments
Mother									

<i>Mental health</i>									
Depression and anxiety: EPDS (28, 29); CES-D (30, 81) & BAI (32) (Waves 8, 9)	◆		◆	◆		◆	◆	◆	◆
Posttraumatic stress symptoms: PCL-C (82)									◆
Psychotropic medication use ¹	◆		◆	◆		◆	◆	◆	◆
Thoughts of self-harm: EPDS item 10 (28)	◆		◆	◆		◆	◆	◆	◆
<i>Physical health</i>									
Common physical health problems: e.g. back pain, exhaustion, ¹ incontinence (83, 84)	◆	◆	◆	◆	◆	◆	◆	◆	◆
Functional health status: SF-36 (85, 86)				◆		◆		◆	◆
<i>Sexual health</i>									
Resumption of sex after childbirth (25)			◆	◆	◆	◆	◆		
Common sexual health issues e.g. dyspareunia, loss of interest in sex (25, 87)	◆	◆	◆	◆	◆	◆	◆	◆	◆
<i>Relationships</i>									
Relationship difficulties ¹	◆	◆	◆	◆	◆	◆	◆	◆	◆
Relationship transitions ¹	◆	◆	◆	◆	◆	◆	◆	◆	◆
Intimate partner violence: CAS (15, 16)						◆		◆	◆

Fear of intimate partner: CAS (15, 16)	◆	◆	◆	◆	◆	◆	◆	◆	◆
<i>Health behaviours</i>									
Physical activity: Active Australia Survey (88)				◆			◆	◆	
Tobacco use (89)	◆	◆	◆	◆	◆	◆	◆	◆	◆
Height and weight, BMI	◆		◆	◆		◆	◆	◆	◆
<i>Reproductive/obstetric history</i>									
Method of birth for index child			◆						
Miscarriages, terminations	◆			◆	◆	◆	◆	◆	◆
Subsequent pregnancies						◆	◆	◆	◆
<i>Social and contextual factors</i>									
Paid employment and study	◆	◆	◆	◆	◆	◆	◆	◆	◆
Income	◆	◆	◆	◆	◆	◆	◆	◆	◆
Household composition	◆	◆	◆	◆	◆	◆	◆	◆	◆
Country of birth	◆								
Life events, social health issues: Modified PRAMS (90)								◆	◆
History of childhood abuse (91, 92)								◆	
Social support ¹	◆	◆	◆	◆	◆	◆	◆	◆	◆
Work-life balance: LSAC (93, 94)								◆	◆

First born child									
<i>Physical health</i>									
Birth outcomes			◆						
Feeding, sleeping patterns			◆	◆	◆	◆			
Physical health problems			◆	◆	◆	◆	◆	◆	◆
Birthweight			◆						
Height, weight, blood pressure									◆
<i>Emotional development</i>									
Emotional and behavioural difficulties: SDQ (95)								◆	◆
Depressive and anxiety symptoms: DAWBA (95), Spence Children's Anxiety Scale-P (96)									◆
Attention deficit/hyperactivity/conduct: DAWBA (36)									◆
<i>Child cognitive, speech and language development</i>									
Speech and language: CCC2 (41, 97)									◆
Cognitive development: WASI (98) NIH toolbox (99)									◆
<i>Social development</i>									
Resilience: ARQ (38)									◆

School engagement: ARQ (38)										◆
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¹ Study designed

ARQ Adolescent Resilience Questionnaire, BAI Beck Anxiety Inventory, CAS Composite Abuse Scale, CATI Computer Assisted Telephone Interview, CES-D Center for Epidemiological Studies – Depression, DAWBA Development and Wellbeing Assessment, EPDS Edingburgh Postnatal Depression Scale, LSAC Longitudinal Study of Australian Children, MQ Mothers Questionnaire, NIH National Institutes of Health, SDQ Strengths and Difficulties Questionnaire, PCL-C Post Traumatic Stress Disorder Checklist – Civilian version, WASI Weschler Abbreviated Scale of Intelligence

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Table 3. Summary of key findings related to maternal mental health and intimate partner violence

Findings from the study	Implications of results	Strategies to promote research impact
<p>Maternal depression is more common at 4 years and 10 years postpartum than at any stage in the first 12 months after the birth of a first child.</p>	<p>The need for surveillance and support of maternal mental health is not restricted to the first year after birth. Systems changes to public health and primary health care services are required to bring stronger focus to maternal mental health throughout the childbearing years.</p>	<p>Policy briefs and research snapshots have been produced to make research findings accessible to policy makers and the general public.</p> <p>Findings have informed:</p> <ul style="list-style-type: none"> • Australian National Pregnancy Guidelines, 2019 (100) • Victorian Royal Commission into Family Violence, 2016 (101) • Australian Institute of Health and Welfare Report on Domestic Violence, 2019 (102) • Council of Australian Governments Strategic Directions Paper for Maternity Care (103)
<p>Two out of every five women experiencing depression are survivors of intimate partner violence.</p>	<p>It is important for health professionals to be aware of potential role of intimate partner violence in maternal mental health, and for health care to be tailored accordingly.</p>	
<p>More than one in three women and children are exposed to intimate partner violence during the period from birth to age ten. Mothers and children exposed to intimate partner violence experience poorer mental and</p>	<p>Increased recognition and engagement by the health sector with families affected by intimate partner violence is critical to optimise the safety of the large number of women and children affected, to reduce longer term</p>	

physical health than mothers and children not
exposed to intimate partner violence

impacts, and to promote healing and recovery.

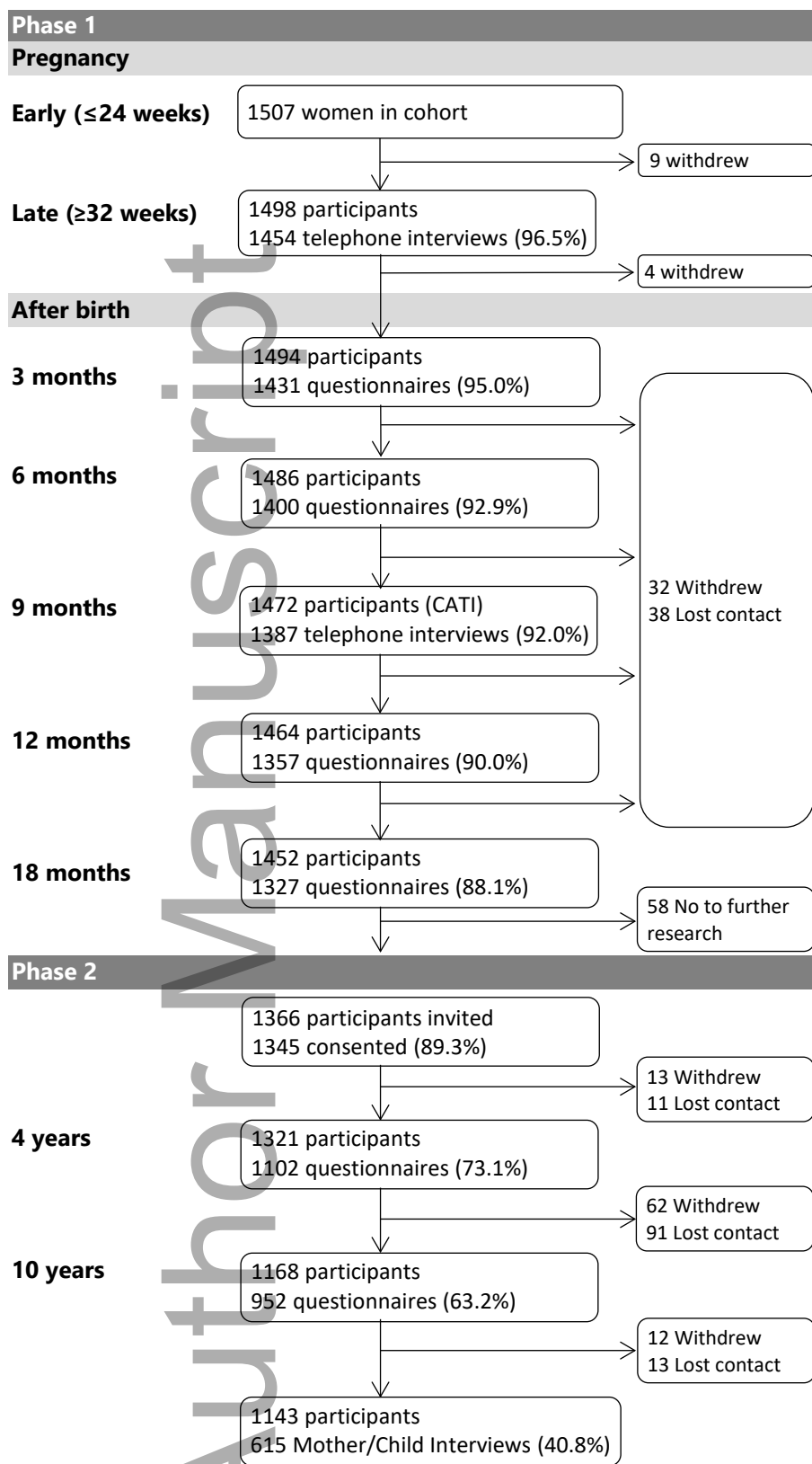
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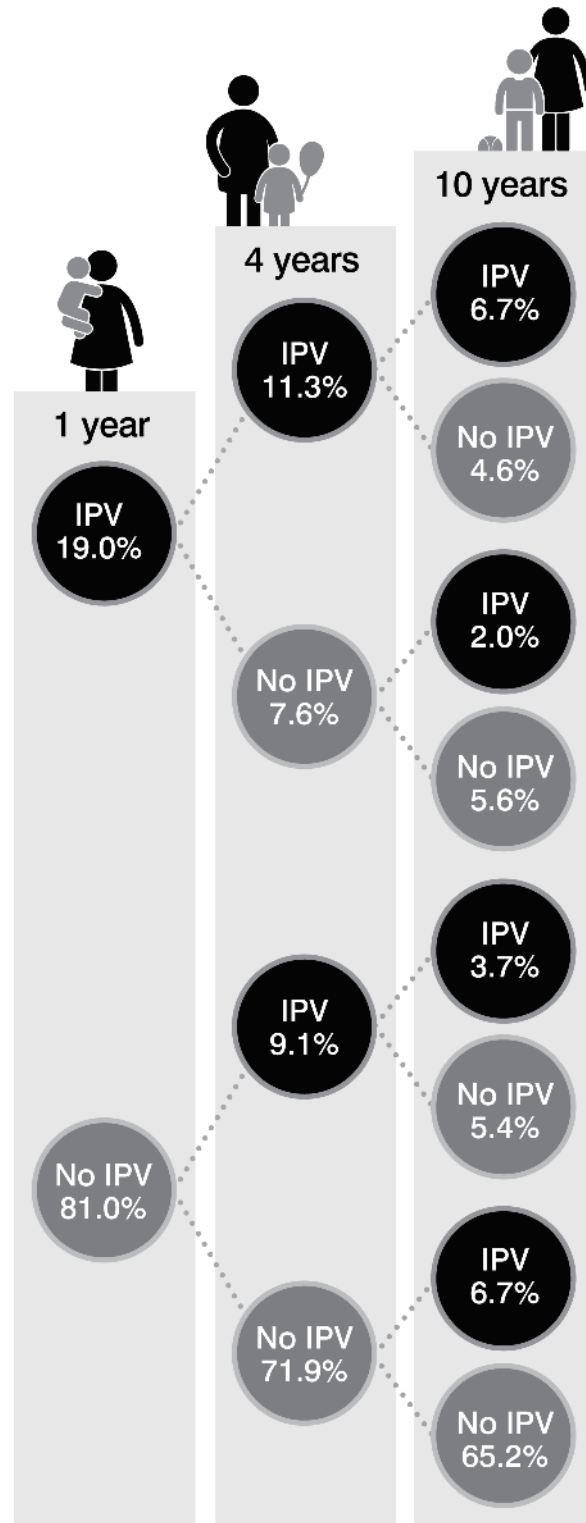
Figure legends:

Figure 1. Participant flowchart from baseline (early pregnancy) to 10 years (denominator for percentages is number participating at baseline, n=1507).

Figure 2. Patterns of exposure to intimate partner violence (IPV) for mothers and firstborn children birth to age ten.

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