

**BREATHE EASY, THINK CLEARLY:
THE RELATIONSHIPS BETWEEN MATERNAL ASTHMA, MATERNAL
MENTAL HEALTH AND INFANT DEVELOPMENT**

Olivia M. Whalen B Psychology (Hons)(Newcastle)

*A thesis submitted in fulfilment of the requirements for the degree of
Doctor of Philosophy*

June 2019

*This research was supported by an Australian Government Research Training Program (RTP)
Scholarship.*

Declarations

STATEMENT OF ORIGINALITY

I hereby certify that the work embodied in the thesis is my own work, conducted under normal supervision. The thesis contains no material which has been accepted, or is being examined, for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made. I give consent to the final version of my thesis being made available worldwide when deposited in the University's Digital Repository, subject to the provisions of the Copyright Act 1968 and any approved embargo.

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ACKNOWLEDGMENT OF AUTHORSHIP

I hereby certify that the work embodied in this thesis contains published papers of which I am a joint author. I have included as part of the thesis a written declaration endorsed in writing by my supervisor, attesting to my contribution to the joint publications. By signing below I confirm that Olivia Whalen contributed to the conception and design of the research, the acquisition, analysis and interpretation of the research data and the drafting and critical revision of significant parts of the work to aid in interpretation to the publications entitled "The effects of maternal asthma during pregnancy on child cognitive and behavioral development: A systematic review", and "Observational study of mental health in asthmatic women during the prenatal and postnatal periods".

Professor Frini Karayanidis

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Publications and conferences

Publications included as part of thesis

Whalen, O. M., Karayanidis, F., Murphy, V. E., Lane, A. E., Mallise, C. A., & Campbell, L. E. (2019). The effects of maternal asthma during pregnancy on child cognitive and behavioral development: A systematic review. *Journal of Asthma*, 56(2), 130-141. doi: 10.1080/02770903.2018.1437174

Whalen, O.M., Campbell, L.E., Murphy, V.E., Lane, A.E., Gibson, P.G., Mattes, J., Collison, A., Mallise, C.A., Woolard, A. & Karayanidis, F. (2019). Observational study of mental health in asthmatic women during the prenatal and postnatal periods. *Journal of Asthma*, 1-13. doi: 10.1080/02770903.2019.1621888

Other publications not included as part of thesis

Woolard, A. J., Benders, B., Campbell, L. E., Karayanidis, F., Mattes, J., Murphy, V. E., **Whalen, O. M.**, Lane, A. E. (2016). Exploring the association of infant temperament on maternal fundamental frequency contours. In *Sixteenth Australasian International Conference on Speech Science and Technology* (pp. 229-232). Retrieved from http://www.assta.org/sst/2016/SST2016_Proceedings.pdf

Conference presentations arising from thesis

Whalen, O. M., Karayanidis, F., Lane, A., Campbell, L., (November, 2016). *The role of infant and maternal factors on the early development of infant cognition*. Presented at the Australasian Cognitive Neuroscience Society Conference, Shoal Bay, Australia.

Whalen, O. M., Lane, A., Campbell, L., Mallise, C., Woolard, A., Karayanidis, F. (August, 2017). *The relationship between temperament, sensory processing and attentional control development in early infancy*. Presented at the International Conference on Cognitive Neuroscience, Amsterdam, The Netherlands.

Whalen, O. M., Karayanidis, F., Mallise, C., Woolard, A., Lane, A., Campbell, L. (August, 2017). *The effect of infant and maternal factors on the early development of infant cognition*. Presented at the Lancaster Conference on Infant and Child Development, Lancaster, England.

Whalen, O. M., Karayanidis, F., Lane, A., Murphy, V., & Campbell, L. (June, 2018). *The effectiveness of a joint attention eye tracking paradigm in measuring social cognition in the first year of life*. Presented at the Australian Society for Social and Affective Neuroscience Conference, Brisbane, Australia.

Whalen, O. M., Karayanidis, F., Lane, A., Murphy, V., & Campbell, L. (June, 2019). *Investigating social cognition ability in infancy using a joint attention eye tracking paradigm*. Presented at the Australian Society for Social and Affective Neuroscience Conference, Newcastle, Australia.

Other conference presentations

Murphy, V. E., Gibson, P., Collison, A., Sly, P., Czovek, D., Robinson, P., Jensen, M. E., Campbell, L., Lane, A., Karayanidis, F., **Whalen, O. M.**, Mattes, J. (May, 2016). *Follow-up of infants from the Breathing for Life Trial – BLT Babies and BLT-Infant Development*. Presented at the Perinatal Society of Australia and New Zealand IMPACT Workshop, Townsville, Australia.

Woolard, A., Benders, T., Campbell, L. E., Karayanidis, F., Mattes, J., Murphy, V. E., **Whalen, O. M.**, Lane, A. E. (2016). *Exploring the Association of Infant Temperament on Maternal Fundamental Frequency Contours*. Presented at the Speech, Science and Technology Conference, Sydney, Australia.

Woolard, A., Benders, T., Campbell, L., Karayanidis, F., Murphy, V., Mallise, C., **Whalen, O. M.**, Lane, A. (August, 2017). *The Effect of Infant Temperament on Maternal Infant-Directed Speech*. Presented at the Lancaster Conference on Infant and Child Development, Lancaster, England.

Murphy, V., **Whalen, O. M.**, Karayanidis, F., Lane, A., Campbell, L. (November, 2017). *The mental health characteristics of women with asthma in the antenatal and postnatal period*. Presented at the Asian Pacific Society of Respirology Conference, Sydney, Australia.

Mallise, C., Lane, A., Karayanidis, F., Murphy, V., Woolard, A., **Whalen, O. M.**, Campbell, L. (May, 2018). *The Trajectory of Maternal Parenting Stress and Infant Temperament across the First Year of Life*. Presented at the World Association for Infant Mental Health Conference, Rome, Italy.

Woolard, A., Benders, T., Armstrong, T., Karayanidis, F., Murphy, V., Mallise, C., **Whalen, O. M.**, Campbell, L., Lane, A. (May, 2018). *The Relationship Between Infant Temperament and Behaviour, and Maternal Infant-Directed Speech*. Presented at the World Association for Infant Mental Health Conference, Rome, Italy.

Woolard, A., Benders, T., Karayanidis, F., Murphy, V.E., Mallise, M., **Whalen, O. M.**, Campbell, L., Lane, A. (May, 2018). *The Characteristics of F0 Contours in Speech Directed at Infants at-Risk for Autism*. Presented at the International Society for Autism Research conference, Rotterdam, The Netherlands.

Woolard, A., Benders, T., Campbell, L., Karayanidis, F., Murphy, V., Lane, S., Barker, D., Mallise, C., **Whalen, O. M.**, Mattes, J., Lane, A. (May, 2019). *The relationship between pitch contours*

in infant-directed speech and infant risk for autism. Poster session presented at the International Society for Autism Research 2019 Annual Meeting, Montreal, Canada.

Woolard, A., Benders, T., Swaab, L., **Whalen, O. M.**, Lane, A. (May, 2019). *The relationship between pitch contours in infant-directed speech and infant risk for autism*. Poster session presented at the International Society for Autism Research 2019 Annual Meeting, Montreal, Canada.

Lane, AE, Van Aswegen, M, Turner-Presker, M, Tait, J, Karayanidis, F, Woolard, A, Mallise, C, **Whalen, O**, Mattes, J, Gibson, P, Korostenski, L, Lane, SJ, Murphy, V & Campbell, L. (2019). Sensory correlates of autism risk in the first year of life: a multi-cohort study. Poster presented at the International Society for Autism Research Annual Meeting, Montreal, Canada

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Acknowledgements

I'd firstly like to thank my Principal Supervisor, Professor Frini Karayanidis, for your guidance and support. Thank you for reading my drafts, encouraging me, giving me a push when I needed it and your gentle reminders that I am smart enough to do this. It's been an honour to be able to work with someone who is so passionate about her research, and I thank you for the opportunity to have been part of your lab and for you having 'talked' me into this PhD all those years ago. To my co-supervisors, Dr. Linda Campbell, Dr. Vanessa Murphy and Associate Professor Alison Lane, working with each of you was a remarkable opportunity. Your experience as researchers and clinicians in such vastly different fields inspires me and it was such a blessing to learn from each of you. Your unwavering kindness, grace and encouragement did not go unnoticed. It has been a privilege to have learnt from such a strong team of women and I look forward to future collaborations.

Thank you to the team of researchers on the baby studies – fellow PhD students Alix and Carly, and countless Honours and Masters students who helped with data collection (particularly Jordan). Without all of you this thesis would have taken many more years to complete. I'd also like to thank Gavin Cooper for his technical advice and patience in answering all my questions.

To my wonderful lab members who are now very dear friends, thank you. To Patrick and Alex, thank you for showing me that science can be fun and for inspiring me to take on a PhD. To my fellow companions on this PhD journey (particularly Montana), thank you for listening, for ice cream, for lunches and for our group chat – a constant source of encouragement and amusement.

To my partner, James, I cannot put into words how thankful I am for your love, happiness and constant reassurance throughout this process. You were always there. I know you're as happy as I am to see this PhD submitted and I couldn't have done it without you. To my parents, my brother and sister, thank you for your love and encouragement. Although I was the first to go to university, it has been fun to navigate this new world with you all and to constantly explain what a PhD is and why it took so long to finish. To my mum, thank you for giving me every opportunity to succeed and to be able to do the things that you couldn't. To the teachers at home who gave me free tutoring when you could see I wanted to learn, thank you. Together, this is as much your achievement as it is mine.

Finally, to all of the mothers and babies who participated in the studies, I am indebted to you for trusting me and allowing me into your lives for the briefest moment in time. It was a privilege to watch your children learn and grow right in front of me. Meeting you all was the best part of this PhD, and without you, this research would not have happened.

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Preface

It is becoming increasingly evident that our mental and physical health, including our immune function, are interconnected. Therefore, explanatory models are becoming more biobehavioural. This thesis focuses on the nature, course and relationship of maternal asthma and maternal mental health in women during pregnancy and in the first few months postpartum, and the subsequent implications for child development. I explore these relationships by way of a systematic review, two cross-sectional studies and one longitudinal, observational study.

The thesis is organised as follows: In Chapter 1, the mechanisms underlying the association between mental and physical health are reviewed and discussed, with an emphasis on the role of immune and inflammatory factors. Then, these factors are contextualised specifically in terms of the association between mental health and asthma. Chapter 2 provides a review of the literature on the nature and course of asthma during pregnancy, including exacerbations and medication use, and discusses the mechanisms underlying the adverse effects that asthma has on pregnancy and vice versa.

In Chapter 3, I outline the prenatal foundations of child development and how environmental influences and birth complications can shape later, healthy development in children. I provide more detail on the early learning and perceptual skills of young infants, as well as their cognitive, language, motor and social-emotional development. I also outline how early experiences in the first year of life and prior to birth have lifelong consequences. In this chapter, I also briefly outline common developmental disorders and their etiologies. To our knowledge, there was no systematic review of the literature relating to maternal asthma and infant developmental outcomes. This research question is answered in Chapter 4.

The first study of the thesis – a systematic review (Chapter 4) – examines the cognitive and behavioural development of children born to mothers with asthma. In this review, based on available literature up until January 2018, I report that there is weak evidence for a relationship between maternal asthma during pregnancy and poor developmental outcomes in children. Some studies reported that maternal asthma is associated with an increased risk for autism (Croen, Grether,

Yoshida, Odouli & Van de Water, 2005) and intellectual disability (Langridge et al., 2013; Leonard, de Klerk, Bourke & Bower, 2006), however, these small effects disappeared after controlling for confounders. Other studies found no associations (Flannery & Liederman, 1994; Micali, Chakrabarti & Fombonne, 2004; Mouridsen, Rich, Isager & Nedergaard, 2007), while the only prospective study found that if asthma is well-managed during pregnancy, infants have similar developmental trajectories to those of healthy mothers (Schatz, Harden, Kagnoff, Zeiger & Chilingar, 2001). These findings suggest that while there may be an association between maternal asthma during pregnancy and adverse cognitive and developmental outcomes for the child, optimal asthma management in pregnancy is important for long-term developmental benefits in children. These findings also indicate that more detailed information about cognitive outcomes of children born to mothers with asthma is needed. This is addressed in studies 3 and 4 of this thesis (Chapters 8 and 9) using eye tracking methodologies.

In Chapter 5, I review literature on mental health in women during the postpartum period, and its implications for child development. For women, pregnancy and new motherhood presents a vulnerable time for the onset or relapse of a mood disorder (O'Hara & McCabe, 2013). Poor mental health, including disorders such as depression and anxiety, can interfere with a mother's capacity to care for her baby and can negatively affect her close relationships (Priest & Barnett, 2008). Poor postpartum mental health in mothers is a known risk factor for adverse developmental outcomes in infancy, with studies consistently linking maternal postpartum depression with poorer cognitive, language and socioemotional development in children and adolescents (Alvarez, Meltzer-Brody, Mandel & Beeber, 2015; Brand & Brennan, 2009; Grace, Evindar & Stewart, 2003; Sohr-Preston & Scaramella, 2006; Stein et al., 2014), and with increased rates of internalizing and externalizing disorders in childhood and adolescence (Conroy et al., 2012; Naicker, Wickham & Colman, 2012; Verbeek et al., 2012).

This is followed by a general methods chapter (Chapter 6) detailing the protocols for the experimental work conducted in this thesis. This work consisted of three studies: two cross-sectional studies and one longitudinal, observational study. Participants for the studies were sourced from three

larger investigations. First, pregnant women with asthma were recruited from the Breathing for Life Trial (Murphy et al., 2016), which is an ongoing, large, randomised controlled trial assessing the effects of a novel asthma intervention during pregnancy on infant and maternal perinatal health. Women were randomised to either the intervention or the treatment-as-usual group. Second, Breathing for Life Trial (BLT) participants and their infants were invited to participate in a nested, postnatal follow-up study, the Breathing for Life Trial – Infant Development (BLT-ID) study. This study assessed the developmental outcomes of infants born to mothers with well-managed and treatment-as-usual asthma. Third, mother and infant pairs were recruited from the local community as part of the BabyMinds study. This study had a largely identical protocol to the BLT-ID study and provided a control cohort of mothers without asthma and their infants.

In the second study of this thesis (Chapter 7), I report the results of the cross-sectional study examining the prevalence and severity of psychological distress in women with asthma during the pre- and post-partum periods. I also investigated whether the self-management, medications knowledge and symptoms of asthma differed between women with and without psychological distress. Asthma symptoms and severity were assessed via lung function (using spirometry) and self-report. Data on pre-natal psychological distress was measured using the Edinburgh Postnatal Depression Scale (EPDS; obtained from medical records), and postnatal psychological distress was measured by the EPDS and the Achenbach System of Empirically Based Assessment (ASEBA) Adult Self-Report scales at 6 weeks postpartum. Twenty percent of our sample had a diagnosed mental health condition, e.g. depression, 14% were currently receiving mental health care, while 47% of participants had received mental health care in the past. Our sample also reported more aggressive behaviour, and showed elevated symptoms of avoidant personality and attention deficit/hyperactivity, however odds ratio analyses were not significant. Poorer self-reported postnatal asthma control was strongly associated with elevated somatic complaints, externalising problems, antisocial personality problems and greater withdrawal. Surprisingly, prenatal, objective measures of asthma severity and control were largely not associated with measures of psychopathology. These findings indicate that pregnant women with asthma frequently report issues with psychological distress during the pre- and

post-natal periods, and that a woman's subjective perception of their asthma control may be more related to psychopathology than objective asthma measures.

In the third study (Chapter 8), I report on the development of infants born to mothers with and without asthma in the first year of life. General, global development was measured in 6 and 12 month old infants with the Bayley Scales of Infant and Toddler Development – Third edition (BSID-III), which is a broad, clinical measure of development and developmental delay. Further, I measured the social-cognitive construct of joint attention and habituation ability in more detail using eye tracking methodology. Infants of mothers with asthma performed similarly on both the BSID-III and eye tracking tasks to infants born to healthy mothers. In a secondary finding, the social cognition and habituation constructs of infant cognition, measured by the eye tracking tasks, were weakly related to the cognitive and other subscales of the BSID-III. This indicates that while the BSID-III is a good clinical measure of broad infant development, eye tracking tasks may give different insights about specific infant cognitive processes.

Finally, in the fourth study (Chapter 9), I report on whether child development and cognition vary as a function of maternal mental health or asthma control and severity. Maternal mental health was measured at six weeks postpartum using the EPDS and ASEBA ASR scales. Maternal prenatal asthma control and severity were classified using the GINA guidelines. General infant development was measured by the BSID-III at 6- and 12-months of age. Infant cognition was measured by habituation and social cognition eye tracking tasks administered at 6- and 12-months of age. Infant development and cognition did not vary as a function of maternal asthma or mental health status, indicating that, in our study, these maternal factors did not appear to adversely impact infant development in the first year of life.

In Chapter 10, I summarise the key findings of the thesis related to the association of maternal asthma and maternal mental health in the pre- and post-natal periods, and their implications for child developmental outcomes in the first year of life. Based on the findings of the systematic review (Chapter 4), there is weak evidence suggesting that while children of mothers with asthma may have slightly increased odds of developing autism or an intellectual disability, infants of mothers with well-

managed asthma during pregnancy fare equally in terms of their development as infants of mothers without asthma (Whalen et al., 2018). This conclusion is supported by the findings in the fourth study (Chapter 9), which showed that infants of mothers with well-managed and treatment-as-usual asthma performed similarly on the BSID-III and on the habituation and joint attention eye tracking tasks. In the second study (Chapter 7), women with asthma frequently reported psychological distress during pregnancy and in the early post-partum period. Further, the results suggest that psychological distress may be related to mothers' subjective perception of asthma control. In my fourth study (Chapter 9), I showed that, in the current sample, neither a woman's asthma nor her mental health status had any adverse impacts on child development or cognition, in the first year of life.

Abstract

We are beginning to realise just how interconnected our mental and physical health are, and explanatory models are becoming more biobehavioural. The nature of these interactions during pregnancy and the implications for child development are less well known. As such, this thesis aimed to characterise the nature, course and relationships of maternal asthma and maternal mental health in women during pregnancy and in the first few weeks post-partum, and the implications of each on infant development in the first year of life. In this thesis, these relationships were explored by way of a systematic review, two cross-sectional studies and one longitudinal, observational study. The systematic review examined the available literature on the cognitive and behavioural development of children born to mothers with asthma, and showed that there is weak evidence for a relationship between maternal asthma during pregnancy and poor developmental outcomes in children. To further investigate the relationships between maternal asthma, mental health and child development, we prospectively followed up cohorts of mothers with and without asthma. Both populations were followed up at 6 weeks, 6 months and 12 months postpartum. This thesis showed that pregnant women with asthma frequently report issues with psychological distress during the pre- and post-natal periods, and that subjective perception of asthma control may be more closely related to psychopathology than objective asthma measures. To investigate infant development in more detail, we assessed the cognitive, linguistic and motor development of 6- and 12-month old infants with the Bayley Scales of Infant and Toddler Development, and examined habituation and joint attention ability using eye tracking paradigms. It was found that maternal asthma during pregnancy and maternal mental health during and after pregnancy were largely not associated with atypical infant cognitive, linguistic or motor development. Together, these findings send a positive message regarding the implications of maternal asthma and mental health on child development, particularly as the worldwide prevalence of asthma and mental health conditions are increasing.

Abbreviations

Experimental	
FDR	False discovery rate
RCT	Randomised controlled trial
OR	Odds ratio
RR	Relative risk
IRR	Incident rate ratio
HR	Hazard ratio
aHR	Adjusted hazard ratio
CI	Confidence interval
BLT	Breathing for Life Trial
BLT-ID	Breathing for Life Trial – Infant Development Study
AoI	Area of Interest
Anatomical/chemical	
HPA	Hypothalamic pituitary adrenal
TNF	Tumour necrosis factor
IL	Interleukin
PG	Prostaglandin
CRP	C-reactive protein
CSF	Cerebral spinal fluid
LPS	Lipopolysaccharide
IFN	Interferon
IDO	Indolamine 2,3-dioxygenase
CRH	Corticotrophin releasing hormone
ACTH	Adrenocorticotrophic hormone
ANS	Autonomic nervous system
11 β -HSD	11 β -Hydroxysteroid dehydrogenase
Developmental/diagnostic	
ADHD	Attention-deficit/hyperactivity disorder
ASD	Autism spectrum disorder
PDD	Pervasive developmental disorder
PDD-NOS	Pervasive developmental disorder-Not otherwise specified
DD	Developmental delay
ID	Intellectual disability
FASD	Fetal alcohol spectrum disorder
APGAR	Score on appearance, pulse, grimace, activity and respiration
Asthma	
FENO	Fractional exhaled nitric oxide
ICS	Inhaled corticosteroid
LABA	Long acting beta agonist
SABA	Slow/short acting beta agonist
OCS	Oral corticosteroid
GINA	Global Initiative for Asthma
FEV ₁	Forced expiratory volume in 1 second
FVC	Forced vital capacity
NHANES III	National Health and Nutrition Examination Survey
Psychometric	
BRIEF	Behaviour Rating Inventory of Executive Function

ASEBA-ASR	Achenbach System of Empirically Based Assessment – Adult self-report
EPDS	Edinburgh Post-Natal Depression Scale
PSI-SF	Parenting Stress Index – short form
CTS	Carey Temperament Scales
ISP	Infant Sensory Profile
TSP	Toddler Sensory Profile
SEABQ	Social-Emotional and Adaptive Behaviour Questionnaire
OZI	Australian English Developmental Inventory
FYI	First Year Inventory
ACQ	Asthma Control Questionnaire
BSID-III	The Bayley Scales of Infant and Toddler Development – Third Edition
TSMI	Test of Sensory Function in Infants

Other

ms	Millisecond(s)
IQ	Intelligence quotient
SES	Socio-economic status
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
SIGN	Scottish Intercollegiate Guidelines Network
DSM-V	Diagnostic and Statistical Manual of Mental Disorders – Fifth Edition
M	Mean
SD	Standard deviation
