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**Perinatal sleep and postnatal mood in New Zealand women:**

An investigation of the relationship and  
trial of a sleep education intervention

A thesis presented in partial fulfilment of the requirements for the degree of  
Doctor of Philosophy  
in  
Public Health

at Massey University, Sleep/Wake Research Centre  
Wellington Campus  
New Zealand

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2013



*This thesis is dedicated to all mothers.*

*Kia kaha e whae<sup>1</sup>*

*Be brave, O Mother*

*And especially to my own mother,*

Deirdre Bernadette Sweeney

*19 October 1929 to 21 March 2014*

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<sup>1</sup> Words of encouragement expressed by birth attendants to birthing Māori women, from *The Old-Time Māori*, by Makereti, 1938, Victor Gollancz Limited, London. Source: National Library of New Zealand.



# Abstract

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Changes to normal sleep are experienced by almost all women in pregnancy and the postnatal period. Little is known about the frequency, magnitude or chronicity of these changes, or the relationship between perinatal sleep and postnatal mood. Two studies were completed to investigate these relationships and to trial a sleep education intervention.

Study One involved 316 Māori and 635 non-Māori women. Women completed sleep and health surveys during the third trimester of pregnancy, at 4-6 weeks and 12 weeks postpartum. On average, sleep duration and quality were highest before pregnancy, lowest in late pregnancy and did not return to usual, non-pregnant levels by 3 months postpartum. Symptoms of minor and major depression, measured using the Edinburgh Postnatal Depression Scale, were more common in pregnancy (35.6% minor, 16.5% major depression) than at 3 months postpartum (16.3% minor, 7.8% major depression). Hierarchical regression models were used to investigate the relationship between sleep and postnatal mood. After controlling for demographics and known risk factors, both sleep quality and quantity were related to postnatal depression, especially when sleep continued to decline after birth and the magnitude of sleep change was large. Difficulty falling asleep, staying asleep, and restless legs syndrome were all also related to postnatal depression.

Study Two was a controlled trial of a behavioural-educational sleep intervention for first-time mothers. Control group mothers ( $n=20$ ) attended a prenatal, general information session and received two contact-only telephone calls at 2 and 4 weeks postpartum. Intervention group mothers, ( $n=20$ ) attended a prenatal sleep education session and received weekly support calls in the first 6 weeks postpartum. All mothers completed sleep and health questionnaires. Sleep was objectively measured in all mother-infant pairs at 6 and 12 weeks postpartum using actigraphy. Intervention group mothers experienced a greater increase in sleep at night than control mothers, and reported higher levels of confidence, but no other group differences were found. Replication of the intervention and extension of the study timeframe are recommended.

These findings indicate the importance of sleep for maternal health and have implications for the practice of health professionals and maternal health policy.



# Preface

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*E Moe, Māmā*: sleep mother, go to sleep mother

*Hapu Ora*: health in pregnancy

*Hauora Hinengaro*: mental health

*PIPIS*: Parent information on Parent and Infant Sleep

## **A play on words...**

*Pēpe*: baby

*Pipi*: a small edible clam, endemic to New Zealand

*Pipī*: a young chick

This thesis comprises two studies which sit within the scope of a multi-study Health Research Council of New Zealand funded research project known as *E Moe, Māmā: Maternal Sleep and Health in Aotearoa/New Zealand*, or *The E Moe, Māmā Project*. In total, 1,226 women (Māori = 424, non-Māori = 802) participated in various aspects of The E Moe, Māmā Project and the aims of the total project were:

1. To investigate the relationship between sleep duration and quality during the third trimester of pregnancy and labour and birth outcomes. That study, known as *E Moe, Māmā: Hapu Ora*, does not fall within the scope of the current thesis.
2. To investigate the relationship between sleep duration and quality during late pregnancy and early postpartum and changes in postpartum mood. This study, known as *E Moe, Māmā: Hauora Hinengaro*, forms Study One of the current thesis.
3. To trial a sleep education intervention aimed at improving the sleep of new mothers and their infants. This study is known as the *Parent Information on Parent and Infant Sleep* or *PIPIS Study*, and it forms Study Two of the current thesis.

My approach to undertaking this work has been informed, in part, by 20 years' experience as a childbirth and parent educator, and this explains the anecdotal comments and evidence which are put forward from time to time in the text.



My involvement in this programme of research at the Sleep/Wake Research Centre, Massey University, began six years ago, firstly as an honours student and latterly as a doctoral candidate. The current project was preceded by a successful feasibility study to trial the survey instruments and research processes used in the large-scale survey study.

Data for the E Moe, Māmā: Hapu Ora and E Moe, Māmā: Hauora Hinengaro studies were collected in a single, large-scale, longitudinal survey study, which is described in more detail in the Methods section of Study One. I was involved in almost every aspect of the large-scale study. Specifically I contributed to the funding and ethics applications, questionnaire design, development and production, relationship building with recruitment sites, direct participant recruitment, database construction, data collection and entry, as well as a range of activities aimed at building and maintaining networks and providing education about perinatal sleep. A list of outputs and activities carried out during my doctoral candidature can be found in Appendix 1. While I have contributed at every level to the whole E Moe, Māmā Project, my role was within a wider team who also contributed in similar ways to this complex project. However, the analyses, findings and discussion which follow are my own work.

Study Two describes the PIPIS Study, which was a small-scale trial of a behavioural-educational intervention for first-time mothers, aimed at improving their own and their infant's sleep during the first three months postpartum. Responsibility for design and implementation of the PIPIS study was my own.

Statistical guidance was sought in relation to a range of potential approaches to modelling the data in this study and assistance was given to prepare some of the data for analyses and to write some of the programming code used, however, I completed all statistical analyses and modelling reported here.

## **The cultural context of this research**

New Zealand is a bicultural society (founded on a Treaty between indigenous Maori and English settlers) and health research reflects this duality—drawing on both Western and indigenous methodologies. New Zealand does not have a constitution bound together in a single document. The constitution by which New Zealand is governed comprises a number of pieces of legislation and constitutional elements which include the Treaty of Waitangi (Department of the Prime Minister and Cabinet, 2008; New Zealand Government, n.d.). The Treaty of Waitangi is a treaty of cessation, signed in 1840 by Māori and the British Crown who wished to establish a government in New Zealand. Since it was signed, much debate has ensued about both the original intent of the document (broadly

described as to uphold the interests of both parties) and neglect by successive governments to materialise the treaty expectations of Māori, including for their health (Kingi, 2007). Attempts to bring redress to this situation began for the health sector in 2000 when new health and disability legislation (New Zealand Public Health and Disability Act, 2000) came into being. This Act is the first piece of social policy legislation to reference the Treaty of Waitangi.

A number of principles underpin The Treaty of Waitangi, and Government departments, such as the Ministry of Health, directly reference these principles in their strategic plans. Though by no means an exclusive list, three common principles regularly referenced are: Partnership—working together with Māori communities to develop strategies for Māori health gain and appropriate health and disability services; Participation—involving Māori at all levels of the sector, in decision-making, planning, development and delivery of health and disability services; and Protection—working to ensure that Māori have at least the same level of health as non-Māori as well as safeguarding Māori cultural concepts, values and practices (Ministry of Health, 2002a).

Ethnic disparities in health are widely reported in the literature (e.g. Baker et al., 2012; Williams, 2002). It has been argued that although disparities are seen to exist, understanding the mechanisms that lead to differences, as well as inconsistencies in the research methodologies applied, means such disparities are poorly understood (Paine & Gander, 2013). Māori make up 15.4% of this country's total population of approximately 4.5 million people. Māori are one of the faster growing populations groups in New Zealand, with projected population growth of 1.3% per year, compared to the 'European or other' population group, which has a growth rate 0.4% per year (Statistics New Zealand, 2010).

On average, Māori have the poorest health status, including sleep health and mental health, of any ethnic group in New Zealand (Ministry of Health, 2002a, 2006). For instance, large scale epidemiological studies have shown that Māori are more likely than non-Māori to obtain insufficient sleep, report higher rates of excessive daytime sleepiness and symptoms of insomnia (Paine & Gander, 2013) and be at increased risk of developing a sleep related breathing disorder (Mihaere et al., 2009). Evidence of differences in the occurrence of mental health disorders between Māori and non-Māori are also unequivocal, with the twelve month prevalence of any mental health disorder for Māori being 29.5% compared to 19.3% for non-Māori (Ministry of Health, 2006). Anxiety disorders are the most commonly reported (19.4% for Māori, 14.1% for non-Māori) followed by any mood disorders (11.6% for Māori, 7.5% for non-Māori). The lifetime prevalence of any mental health disorder is highest in Māori aged 25-44 years (58.1%), and females (52.7%); thus it

is Māori women of childbearing age who carry the highest burden of mental health disease (Ministry of Health, 2006).

For more than a decade, the Sleep/Wake Research Centre has worked in collaboration with researchers from Te Rōpū Rangahau Hauora a Eru Pōmare (University of Otago, Wellington) on a programme of epidemiological sleep research, with a particular focus on identifying disparities in the prevalence of sleep problems between Māori and non-Māori. The rationale for the approach taken to this work is three-fold, as explained by Paine and Gander (2013). First, health, in the fullest sense of the word, is an inalienable right of all people in Aotearoa/New Zealand. Second, the inequities in health observed in our population are not inevitable, nor are they considered fair, just or irreversible. The factors contributing to the poor health status observed in various social groups, and in particular for Māori, are interwoven and complex and research must include inspection of the broader psychosocial determinants of health, including access to the resources necessary to obtain and maintain optimal health. For this reason socioeconomic status and ethnicity are always included in analytic models. The distribution of age differs between the Māori and non-Māori populations, and on average Māori also have a shorter life expectancy than non-Māori—76.5 years for Māori females compared with 83.7 years for non-Māori females (Statistics New Zealand, 2013b). Age is therefore another requisite variable in analytic models. Third, the research approach has been grounded in an indigenous approach to research termed Kaupapa Māori research, which provides a philosophy that guides the work (Bishop, 1999; Cram, 2001; Smith, 1999). Proceeding with research in this way attempts to contribute to an on-going process of monitoring the Crown in respect of its Treaty obligations.

The E Moe, Māmā project was guided by three key principles from the Kaupapa Māori research approach to sleep epidemiology, as described by Paine and Gander (2013, p. 693)

“First, there must be Māori participation and control at all stages of the research. Second, ethnicity data must be collected appropriately. Third, studies must seek to achieve equal explanatory and analytical power.”

These three Kaupapa Māori research principles were embraced in the following ways in the E Moe, Māmā study:

(1) *Māori participation and control at all stages of the research.* To support the principle of participation in the E Moe, Māmā study, two principal investigators co-lead the project, one Māori and one non-Māori. A senior Māori health researcher also sat on an advisory group established to give expert input and support to the entire research team

and project. Māori researchers were responsible for building and maintaining relationships with Māori communities and groups, as well as give leadership to Māori recruitment and retention processes. The Māori co-principal investigator also held the role of kaitiaki (guardian) of Māori participants and their information. A junior Māori health researcher assisted in this role, and community based Māori women acted as local ‘champions’ of the study, providing face-to-face contact and networking. Recruitment strategies were tailored for Māori and non-Māori recruitment, for instance some posters were just in English and others were in English and te reo Māori (the Māori language).

(2) *Appropriate collection of ethnicity data.* Historically, Māori have been undercounted in health datasets because of a number of mechanisms such as identifying being ‘Māori’ using biological or ancestry approaches, or in situations where the individual or their family do not have the opportunity to record ethnicity Te Ropu Rangahau Hauora a Eru Pomare (2000). An example of this was the undercounting of Māori babies in the sudden infant death statistics for New Zealand. Parents completed birth certificate documents and had the opportunity to state ethnicity, however, death certificates were completed by health professionals who may make assumptions about ethnicity Te Ropu Rangahau Hauora a Eru Pomare (2000). This finding exposed a similar issue in recording of ethnicity on death certificates (and other morbidity datasets) at all ages. In recent times, how Government defines Māori has changed from an approach based on quantum of blood, to one of self-identified ethnic affiliation (Robson & Reid, 2001). In the present studies, if a woman identified as being Māori as their sole choice, or one of many ethnicity choices, she was classified as Māori and everyone else was classified as non-Māori.

(3) *Achieving equal explanatory and analytical power.* New Zealand health agencies are obligated to reduce the disparities that exist in Māori and non-Māori health (Ministry of Health, 2002c). Addressing these disparities requires investigation of both the size of the difference and explanations for the difference. The epidemiological statistical strategy of ‘equal explanatory power’ is recommended to facilitate both goals in New Zealand health research (TRRH a EP, 2002). Data is collected for equal numbers of Māori and non-Māori to facilitate the same level of enquiry and analysis for Māori as for non-Māori. The E Moe, Māmā study aimed to recruit 500 Māori and 500 non-Māori women.

I am a first generation New Zealander and my ethnicity is New Zealand European. This thesis is by no means an attempt to undertake or present my efforts from a Kaupapa Māori perspective, which would include analysis and discussion focused on understanding and explaining any differences observed between Māori and non-Maori. The data in the E Moe, Māmā Study was collected according to this kaupapa (set of guiding principles),

which I believe to be respectful of all participants, and a grounded approach for any researcher. Descriptive data will therefore be presented for Māori, non-Māori and the total study sample, and analyses will include ethnicity (Māori vs. non-Māori), maternal age and a measure of socioeconomic position (NZDep2006) as potential explanatory factors (covariates). The focus of the PIPIS Study was to trial an intervention and study processes, conducted with a small group of women who were attending childbirth education classes offered by the same provider group. This was done in order to present the intervention within an existing community education setting and to allow greater control of some demographic variables. Equal numbers of Māori and non-Māori women were not sought. Therefore, Kaupapa Māori principles 1 and 3 were not followed in the PIPIS Study and, this being the case, a Māori/non-Māori analytic framework was not appropriate.

Finally, the scope of this work crosses several disciplines including public health, sleep science, psychology and anthropology. The Publication Manual of the American Psychological Association (American Psychological Association, 2010) was used to guide many aspects of presentation. However, the order or presentation of data in this thesis was also informed by the conventions of the other disciplines listed. The terms 'postnatal' and 'postpartum', 'antenatal' and 'prenatal', and 'perinatal' and 'peripartum' are used interchangeably throughout the text.

# Acknowledgements

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*He aha te mea nui o te ao?*

*He tangata! He tangata! He tangata!*

What is the most important thing in the world?

It is people! It is people! It is people!

No one is more surprised than me that I find myself in the happy position of sharing my deepest gratitude to many people for their assistance in my journey through doctoral travail. When my parents emigrated to New Zealand in the 1950s, in search of a better quality of life for their future family, I don't expect it ever occurred to them to envisage not one, but all three of their children completing postgraduate education. Thank you Mum and Dad for being brave enough to venture to new lands, far from your family and friends, in pursuit of more. I hope this work in some way vindicates your choices. I promise I will get a proper job now. My two brothers, Mark and Sean (and their wives and families), have resolutely offered me their unwavering belief, encouragement and support, over the past 10-years of academic study. How could I not aspire to be like you both? ... and now it's time for a beer. *Sláinte!*

It is a tall order to ask a woman who is pregnant or has a brand new baby to participate in research, especially when that research includes home visits, technical equipment and regularly keeping track of activities in a diary. *Thank you* to all of the women and families who participated in this research. Your contributions are already making a difference.

The wider E Moe, Māmā Project represents the collective efforts of many people including our epic project team: Principal Investigators Leigh Signal and Sarah-Jane Paine with Dee Muller, Monique Priston, Philippa Gander, Mark Huthwaite, Kathy Lee, Alexander Smith, Kara Mihaere, Larine Sluggett, Meg Thompson, Perrine Boy and Francesca Kliffen. What a joy and a privilege it has been to work with you all. Thank you everyone.

Our project team was also supported by an expert reference group, thank you for your support, enthusiasm and sharing of knowledge: Michel Sangalli, Bridget Robson, Kristie Carter, Rosie Smith, Cheryl Benn, Dawn Elder and Robyn Maude. Thanks also to Makere Jordan for translating the study information and consent documents. To Keith Fisher from CCDHB, and Laura Neilson and Melissa Field from the Ministry of Health for providing all the clinical data we requested—thanks!

We wouldn't have been introduced to all of the mamas in these studies without the help of a wide network of people assisting with recruitment. To all the midwives—especially Domino midwives, the childbirth educators, the local champions—Irene Popata, Marnie Reinfelds and Monique McLeod, and the business and not-for-profit groups who put up posters and handed out study packs—*thanks!*

The project also received enthusiastic support from community organisations including: the Wellington Post and Ante-natal Distress Support Group and The Perinatal Mental Health Trust of New Zealand—especially the amazing Rosie Smith; Wellington North and Wellington South Parents Centres; Plunket, Wellington Region—especially Esther Read; The Royal New Zealand Plunket Society—especially Anne Hodren and Anne Norton for their wise and thoughtful input when I was developing the education programme. And most recently, Anne Marie Morris and the PlunketLine nurses who deal with these issues every hour of the day. Sarah Romans at CCDHB generously lent me Actiwatches for use with the babies and Penny Wyatt, also at CCDHB, let me interrupt many of her antenatal breastfeeding classes to promote the study. Thanks!

There is a saying that “it takes a village to raise a child”, and I think it also takes a village to complete any great undertaking. I am blessed that my village is more like a small city, starting with my colleagues at the Sleep/Wake Research Centre. Philippa Gander's knowledge and passion for the field seems to know no bounds and she has created an environment where students are encouraged and thrive and where families really do matter. How lucky I was to have knocked on your door as a 3<sup>rd</sup> year undergraduate looking for a research project! Sarah-Jane Paine—colleague, friend and guide, blessings SJ. Together with Rosie Gibson, our little Breakfast Club was a sanity saver and you so often had just the right words to say or article to refer to. Rosie! Who could ask for a better PhD office buddy—you'll probably get some work done now I'm gone. Margo van den Berg, Karyn O'Keeffe, Sarah Jay, Alex Smith, Hannah Mulrine, Laura Howe and Kanch Pathirana—you guys have all helped enormously with my learning about sleep, physiology, research, statistics, and life, but more than that, you've laughed with and encouraged me along the way. And to Dee Muller, my own personal “just keep swimming” coach. Thanks for all the treats, coffees, rants, practical help and hugs. You really did make a difference. *Kia ora, te whānau!*

My village also includes our own antenatal class of '91. Thanks you crazy mamas for your support and tolerance these last few years. You keep me grounded. Special thanks to June Rout and Alana Wilson for proof-reading a lot of words. Big ups also go to the Forest Frolickers (especially Johnny K.)—I'm looking forward to spending the *whole* weekend with you next time we go to the bach.

From the world of childbirth education there is my dear friend, and colleague, Mary O’Keeffe. Thank you, good woman, for letting me interrupt so many of your classes to promote the study, thank you for also bouncing ideas around with me, proofreading, coffees and most of all, your friendship.

Duncan Babbage has been a mighty fine supervisor. You always brought a fresh and considered view to whatever I was grappling with at the time. Your ‘pastoral care’ as I was juggling doctoral research and clinical training was especially valued, as were your flexibility, enthusiasm and humour. Thank you db.

To my primary supervisor, Leigh Signal, thank you a thousand fold. Leigh is an internationally acclaimed expert in the field of sleep science, an accomplished researcher and a skilled educator. But what sets Leigh apart is her unique capacity for leadership. Believe me, I never set out to start a PhD, or speak at international conferences, but somehow Leigh engendered belief and confidence in me and I never quite knew how it happened. She shares her knowledge generously and knows just how far to push people—then sometimes gets away with nudging (dragging?) them a little further. On top of that she is a fine friend, a fabulous mum and a mean water skier.

A special mention must go to all the SWRC pēpe born during the projects: Samuel, Piata, Angus, William, Hamish, George & Ellie (Adelaide), Lyla, Alexander (Canada) and Leon. Sleep well, grow big and have fun!

Villages always have people in them who keep life ticking along—the quiet ones, working away in the background, not asking for recognition and not making a fuss. My husband, Simon, is that person for me. We both strive hard in our work and usually this just happens. But sometimes the demands are a bit excessive and out of balance—like the last year or so! You, more than anyone, understand the significance of this achievement, and I share it all with you. It *must* be my turn to cook, and this summer we *will* be watching *a lot* of tennis together.

Finally, it was becoming a mother that set me on this path in the first place. To my daughters, Meg and Bridie, you were beautiful little girls when I started this journey and now you are beautiful young women. You inspire me every day. Remember the poem by e.e. cummings, *i carry you in my heart?* It describes love so deep that it can keep the stars apart, just like a mother’s love... just like your mama’s love.

*This research was funded by the Health Research Council of New Zealand (HRC 09/233) who also supported me with a Doctoral scholarship. Thanks HRC.*





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# List of terms

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Actigraphy	A method of assessing rest and activity, using a non-invasive technique, over a period of time—usually several days to several weeks.
Actiwatch	A wrist-watch like device, containing an accelerometer, used to collect actigraphy data.
Antenatal	Before childbirth
BMWS	Brief Measure of Worry Severity
Dream feed	See focal feed.
EEG	Electroencephalogram
E Moe, Māmā	“Go to sleep, mothers”
EPDS	Edinburgh Postnatal Depression Scale
Focal feed	Waking an infant at night (usually before midnight), so as to feed them at a prescribed time, with the goal of minimising infant waking later in the night. Also called a dream feed.
GNS	Good night’s sleep
GSDS	General Sleep Disturbance Scale
Hauora Hinengaro	Mental health
Kaitiaki	Guardian
Kaitiakitanga	Guardianship
Kaupapa	A set of values, principles and plans which people have agreed on as a foundation for their actions.
Koha	A gift, contribution, or act of reciprocity.
Manaakitanga	Hospitality
Perinatal	Around childbirth
Perinatal distress	The occurrence of depression, anxiety, worry and/or stress in the perinatal period.
Perinatal period	The period of time surrounding conception, pregnancy, childbirth and the first postpartum year.
Peripartum	Around childbirth
PIPIS	Parent Information on Parent and Infant Sleep
Postnatal	After childbirth
Postpartum	After childbirth
Prenatal	Before childbirth
PSG	Polysomnography
PVT	The psychomotor vigilance task

REM	Rapid eye movement
nREM	Non rapid eye movement
SIDS	Sudden infant death syndrome
SUDI	Sudden unexpected death in infancy
Te Reo Māori	The Māori language
Tikanga Māori	Māori customs and practices
TST	Total sleep time
Wahakura	A woven, flax basket intended for infant sleep up to the age of about 5-6 months. Wahakura provide a safe sleeping space for infants and can be used in or out of the parental bed.
Whānaungatanga	Kinship, relationship