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Obstructive Sleep Apnoea in Aotearoa/New Zealand

An objective and questionnaire-based approach to population prevalence estimation and clinical screening

A thesis presented in partial fulfilment of the requirements for the degree of

Doctor of Philosophy
in
Public Health

at Massey University, Wellington Campus
New Zealand.

Kara Mihaere
Ngāti Kahungunu ki Wairoa, Ngāti Rakaipaaka, Rangitāne ki Tamaki-nui-ā-Rua

2004
Grow up and thrive for the days destined to you.
Your hands to the tools of the Pākehā to provide physical sustenance,
Your heart to the treasures of your Māori ancestors as a diadem for your brow,
Your soul to God, to whom all things belong

Sir Apirana Ngata
ABSTRACT

The goals of this thesis were to objectively assess the prevalence of obstructive sleep apnoea syndrome (OSAS) among Māori and non-Māori adults in a community-based sample, and to develop a questionnaire-based multivariate predictive tool for OSAS, to help improve referral of patients to specialist sleep services, and prioritise waiting lists. This research was situated within the wider scope of ethnic inequalities in health between Māori and non-Māori, and was conducted within a Kaupapa Māori Research (KMR) framework.

Between August 1999 and June 2001 letters and information were progressively sent out to 1200 (600 Māori, 600 non-Māori) Wellington residents aged 30-60 years selected randomly from the electoral rolls. Participants were asked to wear a small sleep monitoring device (MESAM4) for one night in their own homes and to fill out a sleep questionnaire. Contemporaneously, sleep and questionnaire data were collected from 510 consecutive patients aged 30-60 years, who were referred to the regional sleep clinic for suspected OSAS.

In the community sample, OSA was found to be more prevalent among Māori. Among men, 21.98% of Māori had OSA (RDI ≥ 5) compared with 11.37% of non-Māori. Among women, 6.28% of Māori and 3.02% of non-Māori respectively had OSA (RDI ≥ 5). The higher risk among Māori appeared to be due to well-recognised risk factors such as higher body mass index (BMI) and larger neck circumference, rather than ethnicity per se.

Using the combined data from the community and clinical samples, two clinical prediction models were developed using logistic regression modelling. One model (Model 1a) included age, sex, observed apnoeas, self-reported habitual snoring, subjective excessive daytime sleepiness, and BMI. The second model (Model 2a) included neck circumference instead of BMI. Model 1a correctly classified 82.50% of participants (sensitivity 72%, specificity 87%). Model 2a correctly classified 81.10% of participants (sensitivity 80%, specificity 82%).

This research indicates that OSA is a common problem among New Zealand adults and that ethnic disparities exist. The results provide important guidance for planning to
meet population needs, by identifying differential needs of specific groups. The prediction models provided reliable estimates of *a priori* probability of OSA, and therefore may be useful tools for screening patients for OSAS.
ACKNOWLEDGEMENTS

As I look back at my life, I am both humbled and relieved to have reached this amazing milestone. There are a number of people who have assisted me through this journey, and I would like to take this opportunity to express my appreciation.

First and foremost I would like to thank the study participants, especially those from the community study and their families who welcomed me into their homes - without them this study would not have been possible.

I would like to acknowledge the fantastic support and guidance from my supervisors, especially my primary supervisor, Professor Philippa Gander, who sparked my interest in the area of sleep, and whose enthusiasm and encouragement has seen me through this journey. Thanks also to my other supervisors, Dr Papaarangi Reid, whose expertise in Māori health and Kaupapa Māori Research was fundamental to this study, and Dr Alister Neill, whose clinical perspective and experience was invaluable.

I am very grateful for the continual support from my colleagues at the Sleep/Wake Research Centre, who are an amazing group of individuals, and of whom I have developed many great friendships. To the other PhD students, Riz Firestone, Sarah-Jane Paine, Sandy Garden and Nat Marshall, I wish you all the best. I would also like to thank Dr Angela Campbell from Wellsleep Clinic and the staff from Te Rōpū Rangahau a Eru Pōmare for their input into this research.

To my family, you are my foundation and without your support this would not be possible. A special thanks to my parents, who have made many sacrifices in life for us (children). Finally, to my wonderful partner William, who has experienced both the good and not so good times (to put it mildly) of this journey – thank you for your unconditional support, encouragement, and understanding.

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# Glossary of Technical Terms and Abbreviations

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<th>Abbreviation</th>
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<tr>
<td>%</td>
<td>Percentage</td>
</tr>
<tr>
<td>AIC</td>
<td>Akaike Information Criterion</td>
</tr>
<tr>
<td>ALAC</td>
<td>Alcohol Advisory Council of New Zealand</td>
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<tr>
<td>Apnoea</td>
<td>Cessation of airflow</td>
</tr>
<tr>
<td>Apnoea Hypopnoea Index (AHI)</td>
<td>the number of apnoeic events plus hypopnoeas per hours of sleep as determined by polysomnography.</td>
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<tr>
<td>AUC (Area under the curve)</td>
<td>A measure of accuracy of the ROC curve</td>
</tr>
<tr>
<td>BMI (Body Mass Index)</td>
<td>Weight in kilograms divided by height in metres squared (kg/m²).</td>
</tr>
<tr>
<td>BP</td>
<td>Blood Pressure</td>
</tr>
<tr>
<td>CI</td>
<td>Confidence Interval</td>
</tr>
<tr>
<td>CSA</td>
<td>Central Sleep Apnoea</td>
</tr>
<tr>
<td>CSC</td>
<td>Community services card</td>
</tr>
<tr>
<td>CVD</td>
<td>Cardiovascular disease</td>
</tr>
<tr>
<td>DF</td>
<td>Degrees of freedom</td>
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<tr>
<td>DHB (District Health Board)</td>
<td>Organisations established to protect, promote and improve the health and independence of a geographically defined population. Each District Health Board will fund, provide or ensure the provision or services for its population.</td>
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<tr>
<td>ECG</td>
<td>Electrocardiogram</td>
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<td>EDS</td>
<td>Excessive daytime sleepiness</td>
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<tr>
<td>EEG</td>
<td>Electroencephalogram</td>
</tr>
<tr>
<td>EMG</td>
<td>Electromyogram</td>
</tr>
<tr>
<td>EOG</td>
<td>Electrooculogram</td>
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<tr>
<td>Epoch</td>
<td>a measure of duration of a sleep recording</td>
</tr>
<tr>
<td>ESS</td>
<td>Epworth Sleepiness Scale</td>
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False Negative
The ratio of the number of events incorrectly classified as non-events over the sum of all observations classified as non-events

False Positive
The ratio of the number of non-events incorrectly classified as events over the sum of all observations classified as events

First night effect
the effect of the environment and sleep recording equipment on the quality of the subject's sleep during the first night of recording

GHQ
General health questionnaire

HR
Heart Rate

HRI
Heart Rate Variation Index

IRI
International Research Institute for Māori and Indigenous Education

KMR
Kaupapa Māori Research

MESAM4
Madaus Electronic Sleep Apnoea Monitor 4

MSLT
Multiple sleep latency test

MOH
Ministry of Health

MVA
Motor vehicle accident

nCPAP
Nasal continuous positive airway pressure

NPV (Negative Predictive Value)
The probability of not having the disease when the test result is negative

NZDEP
New Zealand Deprivation Index

ODI
Oxygen Desaturation Index

OR
Odds Ratio

OSA
Obstructive Sleep Apnoea

OSAS
Obstructive Sleep Apnoea Syndrome

OSAHS
Obstructive Sleep Apnoea-Hypopnoea Syndrome

Polysomnography (PSG)
Gold standard for measuring sleep

PPV (Positive Predictive Value)
The probability of disease in a person with an abnormal/positive test result

Prevalence
The number of instances of a given disease or occurrence in a given population at a specific point in time

P-value
A statement of the probability that the difference observed could have occurred by chance, reflecting the statistical significance of the result

RDI
Respiratory Disturbance Index

REM
Rapid eye movement sleep

RERA
Respiratory Effort Related Arousal

ROC (Receiver Operator Characteristic) Curve
Non-parametric plot of the true positive (sensitivity) and false positive rates (1-specificity)

RR
Relative Risk

RTS
Return to sender
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>Sa02</td>
<td>Level of oxygen saturation in blood</td>
</tr>
<tr>
<td>SAS</td>
<td>Sleep Apnoea Syndrome</td>
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<tr>
<td>SD</td>
<td>Standard Deviation</td>
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<tr>
<td>SDB</td>
<td>Sleep disordered breathing</td>
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<tr>
<td>SE</td>
<td>Standard Error</td>
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<tr>
<td>Sensitivity</td>
<td>The ratio of correctly classified events over the total number of events</td>
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<tr>
<td>SNZ</td>
<td>Statistics New Zealand</td>
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<tr>
<td>Specificity</td>
<td>The ratio of correctly classified non-events over the total number of non-events</td>
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<tr>
<td>TRRHAEP</td>
<td>Te Rōpū Rangahau a Eru Pōmare</td>
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<tr>
<td>UPPP</td>
<td>Uvulopalatopharyngoplasty</td>
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<tr>
<td>US</td>
<td>United States</td>
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# GLOSSARY OF MĀORI TERMS

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Aotearoa</td>
<td>Māori name for New Zealand often translated as &quot;land of the long white cloud&quot;</td>
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<tr>
<td>Whānau</td>
<td>Family, extended family</td>
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<tr>
<td>Iwi</td>
<td>Tribe</td>
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<tr>
<td>Hapu</td>
<td>sub-tribe</td>
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<tr>
<td>Tino rangatiratanga</td>
<td>Māori self-determination; sovereignty</td>
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<tr>
<td>Pākehā</td>
<td>Person of predominately European descent; not Māori</td>
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<tr>
<td>Māori</td>
<td>The indigenous people of New Zealand</td>
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<tr>
<td>Mauri</td>
<td>Māori vitality; life force</td>
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