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

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*E tipu e rea mo ngā rā o tou ao
Ko te ringa ki ngā rākau a te Pākehā, hei oranga mo tou tinana
Ko to ngākau ki ngā taonga a o tipuna, hei tikitiki mo to mähunga
Ko to wairua ki te Atua, nāna nei ngā mea katoa*

*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 ($RDI \geq 5$) compared with 11.37% of non-Māori. Among women, 6.28% of Māori and 3.02% of non-Māori respectively had OSA ($RDI \geq 5$). 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.

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GLOSSARY OF TECHNICAL TERMS AND ABBREVIATIONS

%	Percentage
AIC	Akaike Information Criterion
ALAC	Alcohol Advisory Council of New Zealand
Apnoea	Cessation of airflow
Apnoea Hypopnoea Index (AHI)	the number of apnoeic events plus hypopnoeas per hours of sleep as determined by polysomnography.
AUC (Area under the curve)	A measure of accuracy of the ROC curve
BMI (Body Mass Index)	Weight in kilograms divided by height in metres squared (kg/m^2).
BP	Blood Pressure
CI	Confidence Interval
CSA	Central Sleep Apnoea
CSC	Community services card
CVD	Cardiovascular disease
DF	Degrees of freedom
DHB (District Health Board)	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.
ECG	Electrocardiogram
EDS	Excessive daytime sleepiness
EEG	Electroencephalogram
EMG	Electromyogram
EOG	Electrooculogram
Epoch	a measure of duration of a sleep recording
ESS	Epworth Sleepiness Scale

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

SaO₂	Level of oxygen saturation in blood
SAS	Sleep Apnoea Syndrome
SD	Standard Deviation
SDB	Sleep disordered breathing
SE	Standard Error
Sensitivity	The ratio of correctly classified events over the total number of events
SNZ	Statistics New Zealand
Specificity	The ratio of correctly classified non-events over the total number of non-events
TRRHAEP	Te Rōpū Rangahau a Eru Pōmare
UPPP	Uvulopalatopharyngoplasty
US	United States

GLOSSARY OF MĀORI TERMS

Aotearoa	Māori name for New Zealand often translated as "land of the long white cloud"
Whānau	Family, extended family
Iwi	Tribe
Hapu	sub-tribe
Tino rangatiratanga	Māori self-determination; sovereignty
Pākehā	Person of predominately European descent; not Māori
Māori	The indigenous people of New Zealand
Mauri	Māori vitality; life force