Title: The effects of 3 days of simulated wind farm infrasound, sham infrasound and traffic noise on health: A laboratory-based randomised, 3 way cross over study

Short title: Laboratory-based effects of infrasound

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This study will be performed at the Woolcock Institute of Medical Research, University of Sydney, Glebe, NSW, Australia and Royal Prince Alfred Hospital, Missenden Road, NSW, Australia.

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1. Introduction

Background and rationale

The drive to develop renewable energies to reduce fossil fuel consumption has resulted in increasing efforts to harvest wind power as a method of renewable energy delivery. This has resulted in the construction of multiple wind turbine clusters or "wind farms" in rural areas in Australia to generate power.

Health concerns

Implementation of wind power programs has been opposed by a number of communities, in part due to claims that wind farms pose a risk to health. Concerns have largely focused on audible or non-audible noise, such as infrasound, causing a range of negative effects on sleep, vestibular function and mood. Some people have referred to this constellation of symptoms as wind turbine syndrome (WTS).

Wind Turbine Syndrome (WTS)

WTS refers to a cluster of symptoms reported in case studies by Pierpont.[1] In that series individuals reported sleep disturbance, headache, tinnitus (ringing in the ears), a sensation of pressure in the ears, dizziness, vertigo, nausea, visual blurring, palpitations, irritability, problems with concentration and memory and panic episodes associated with sensations of internal pulsation or quivering when awake or asleep.[1] In this report, the symptoms typically improved during holidays or other withdrawal from the wind turbine environment and returned with re-exposure. There are case reports of WTS being present in one family member but not in another who lives in the same dwelling.[2] It has been proposed that people who are particularly 'sensitive' to noise may be at greatest risk. It has been argued that WTS is caused by infrasound generated by wind turbines.[1,3,4]

Alternative Explanations

Some experts have discounted the association between the symptoms of WTS and exposure to noise from wind turbines. They suggest the symptoms are the result of a nocebo effect, in which a patient can be convinced that something benign is making them sick. It is argued that the annoyance and health effects some people experience when unwanted turbines go up in their local areas are more strongly related to subjective factors such as the visual impact of the turbines, attitudes towards wind energy and whether there is economic benefit from turbines, rather than to noise itself, both audible and inaudible (i.e. infrasound).[4,5] This level of annoyance may be the primary mediating agent causing sleep disturbance and increased psychological distress.[6] Stress is considered another mechanism by which noise can impact on human health.[7] Where stress effects are present, they may be dependent on the level of annoyance induced by the noise.[8]

Noise from wind turbines

Wind turbine noise comprises the following range of spectra of relevance to this study:
i. Infrasound (frequencies less than 20 Hz),
ii. Low Frequency (LF) sound (frequencies 20-200 Hz)
iii. High Frequency (HF) sound (frequencies above 200 Hz).

Whilst infrasound is regarded as being below the audible range, if its level is high enough it can be "sensed". This sensation is best described as a sensation of pressure on the ears[9] or a sensation or sound of deep humming/rumbling.[2] There is no sense of pitch attributable to infrasound. In contrast, noise in both the LF and HF range is usually audible with a sense of pitch.

Wind turbine noise encompasses the whole of the sub-audible and audible frequency spectrum – infrasound, LF sound and HF sound including amplitude modulation ("swish") effects of the higher frequency sounds. It is not known which of those components contribute to annoyance and which contribute to the claimed health effects.

Infrasound

The nature of infrasound is now well understood[10] based on acoustical studies performed at Bluff Wind Farm (SA), Cape Bridgewater Wind Farm (VIC) and Shirley Wind Farm (USA).[11] The sound is comprised of the blade pass frequency (typically 0.7-0.8Hz) and its harmonics The maximum sound pressure level at these frequencies was 89.5dB Lin Peak (recorded at Shirley Wind farm).

Community concerns are focused on infrasound

The main community group advocating that wind farms have deleterious effects on health is the Waubra Foundation. The foundation's chair, Mr Peter Mitchell recently served as an observer on the NHMRC Wind Farms Health Effects Reference Group. The foundation recently published a statement "Acoustic Engineering Investigation into Airborne and Ground-Borne Pressure Pulses from Wind Turbines at Cape Bridgewater"[12] (Mr Peter Mitchell, personal communication to Prof Grunstein) which summarises their concerns. They state that although infrasound is only audible at very high levels, "it can be damaging to the human body at levels well below audibility". Moreover the document states that "Infrasound has long been known to be dangerous and harmful to humans, especially with chronic exposure. Infrasound persists for much greater distances than audible sound and, unlike audible sound, penetrates virtually all building structures (including double glazing) with ease; and often increases the impact by resonating with internal structures in the house". While infrasound is ubiquitous, anti-wind farm community groups state that wind turbines have a specific infrasound signature or profile that differs from common sources of infrasound such as ordinary wind, household appliances or waves on a beach. This profile is "a necessary tool for investigating noise from wind turbines anywhere".

In addition, the foundation recommended that research also measure subjective "sensation" of vibration related to infrasound by use of specific self-report scales, investigation be undertaken inside houses and continue over sufficient periods of time, such as 6 weeks. It is the infrasound component of the noise that is claimed by those suffering nausea, dizziness and other symptoms that is the primary cause of their symptoms.

Given these views from community groups and the lack of high quality research on health effects identified by the NHMRC Reference Group,[13] we argue that the correct approach to addressing the issue of wind farm noise and health effects is to focus on robustly assessing the effects of infrasound using a synthesised sound that matches the infrasound profile of wind farms.

Possible biological mechanism for vestibular effects

The following observations indicate that infrasound may be capable of producing audiovestibular disturbances, particularly in susceptible individuals.

1) At very low frequencies, the cochlear outer hair cells (innervated by type II afferents which do not participate in conscious hearing) are stimulated by sounds below the audible range.[14]
2) Structures involved in endolymph volume regulation are influenced by infrasound. In experimental animals, brief (1-2 min) exposures in the moderate to intense ranges of low frequency tones have induced endolymphatic hydrops.[15]
3) Humans, monkeys and guinea-pigs do not show evidence of vestibular activation by high levels of infrasound[16] but some inner ear pathologies lower the thresholds for vestibular activation due to the presence of an additional low resistance pathway or "third window": superior semicircular canal dehiscence, large vestibular aqueduct syndrome.[17,18] Further, endolymphatic hydrops and vestibular migraine, which are characterized by sound hypersensitivity, may also provide additional biologically plausible pathways by which infrasound may have health effects. Hence, there is a biologically plausible mechanism for physiological effects of infrasound. However, as yet there is no evidence that these effects actually occur. The study proposed here is designed to seek that evidence.

Noise sensitivity and annoyance

Noise sensitivity and annoyance are considered to be related but not identical concepts.[19] Noise sensitivity is a distinct psychological trait and refers to the predisposition to perceive noisy events. Annoyance is an attitudinal dimension indicating the extent to which noises are evaluated unfavourably.[20] About 20-30% of individuals are more sensitive to noise than average. Although noise sensitivity does not differ by sex, it tends to increase with age.[21] Noise-sensitive individuals have noise "annoyance thresholds" approximately 10 dB lower than noise tolerant individuals[22] and usually react to environmental sound more easily, evaluate it more negatively, and experience stronger emotional reactions compared to noise tolerant people.[23] People who are noise sensitive are more likely than others to report annoyance due to exposure to sound at low and moderate intensity.[24] Noise sensitivity and annoyance are usually measured by self-report questionnaires. In this study, we will selectively recruit subjects who report increased noise sensitivity and measure annoyance from study exposures in each study arm.

2. Study Objectives

This short-term, randomised, 3 period, crossover study, which will be conducted in our purpose-built, sound-isolated laboratory at the Woolcock Institute, will measure the impact of exposure to infrasound on multiple dimensions of human health in individuals who report increased noise sensitivity.

3. Experimental design

This is a randomised, cross-over study in noise sensitive participants who will be exposed during three 3-day continuous periods, in random order, to either:
1. wind farm simulated infrasound at 90dB Pk (test exposure)
2. no added sound (sham, negative control)
3. traffic noise (positive control).

During each test period the participants will be subject to the noise condition continuously from 10am on day 1 until noon on day 4. Each period will be separated by at least an 11-day washout period where people will live normally outside of the laboratory environment. Participants and study staff will be blinded to the test and negative control periods (as the infrasound is inaudible). The audible positive control (loud traffic noise) by its nature cannot be subject to either participant or investigator blinding. The study will be undertaken in our existing purpose built laboratory facility shielded from external sound. Outcomes will be measured overnight and throughout the day.

Participants will be provided three meals per day and snacks free of charge while in the laboratory (lunch and dinner only on the first day).

4. Methods: Participants, interventions, and outcomes

Study setting

This study will be performed wholly within the Australian Centre for Chronobiology, Endocrinology and Sleep Studies (ACCESS) in the Woolcock Institute of Medical Research, University of Sydney, 431 Glebe Point Rd, Glebe, NSW, Australia.

5. Eligibility criteria

5.1 Inclusion criteria

1. Aged 18 or above
2. Noise sensitive individuals -defined as Weinstein's Noise Sensitivity Scale (WNS) Score >58 (Appendix B)
3. Normal hearing on audiometry
4. Clinically normal 24-hr sleep-wake cycle, as assessed by actigraphy for at least 7 nights, with >5.5 hrs sleep/night on average and a sleep onset time between 9pm and 1am and a sleep offset time between 5am and 7am. (Section 12.3.2)
5. Fluent in English, to be able to answer computerised questionnaires and undergo neurocognitive assessments in English

5.2 Exclusion criteria

1. Any previous clinically evident and uncontrolled severe sleep disorders, including severe insomnia as assessed by the Insomnia Severity Index (moderate = >18 will be excluded)
2. No serious chronic illnesses
3. No major psychiatric disorders
4. Use of any hypnotic medications or other medications that interfere with sleep within the last month
5. Recent time-zone travel (more than 2 time zones in the last 2 weeks or 1 time zone in the past week)
6. Shift workers
7. Pregnant, expecting or breastfeeding women
8. Unable to remain in a sleep lab for 4 consecutive days
9. Unable to refrain from tobacco, alcohol or caffeine during study visits.

6. Study Interventions

Participants will be exposed during three 3-day continuous periods, in random order, to either:
1. wind farm simulated infrasound at 90dB Pk (test exposure)
2. no added sound (sham, negative control). Speaker boxes identical to the infrasound generating boxes used for the wind farm exposure will be placed in the participants' rooms
3. traffic noise at 40-50LAeq with breakthrough events at 60dB Pk (positive control).

6.1 Discontinuing

Withdrawal criteria

Participants will be informed that they have the right to withdraw from the study at any time, without prejudice to any medical care (such that might be required if we incidentally identify a medical condition), and are not obliged to state their reasons. Additionally the investigator may withdraw a participant at any time for the following reasons:

- If any of the study exclusion criteria are diagnosed
- Protocol violations
- Adverse events

Discontinuation of the study

The study may be discontinued at any time on the advice of the responsible principal investigators on the basis of new information regarding safety. Additionally, the study may be terminated if progress is unsatisfactory.

In the case of premature termination or suspension of the experiment, the investigator will inform the study participants and ensure appropriate follow up in the unlikely event this is required clinically. In addition, the appropriate ethics committee will be informed.

Procedure to withdraw

If a participant fails to return for follow-up or discontinues for personal reasons, attempts will be made to determine whether the reason for not returning is not an adverse event (bearing in mind that the participant is not obliged to state his/her reasons). Participants with clinically significant abnormalities requiring discontinuation will be followed until recovery from the abnormality, if possible. If the study is discontinued for safety reasons, the investigators will contact all affected participants within a reasonable time frame to inform them of the termination of their involvement in the study. Participants discontinuing from the study may be replaced. A new participant number must be issued for the new participant.

7. Outcomes

Primary outcome measure:

Changes in wake after sleep onset (WASO) as determined by 3 overnight polysomnograms using standard electroencephalography (EEG) based criteria. We will compare the effects of infrasound and traffic noise to sham infrasound. WASO is calculated from the first epoch of recorded sleep on the polysomnogram and either the last recorded epoch of sleep on the polysomnogram or the actigraphically estimated habitual rise time, whichever occurs last.

Secondary outcome measures:

EEG parameters from the overnight sleep studies - Sleep latency, sleep staging, sleep stage shifts, arousal frequency and power spectral analysis for sleep microarchitecture analysis

Tertiary Outcome Measures:

Karolinska Drowsiness Test

<u>Neurocognitive tests (Section 12.7):</u>

N-back
PVT
Tower of London

<u>Cardiovascular and stress measures (Section 12.9):</u>

24 hour pulse wave analysis, including blood pressure
Pulse wave velocity
Heart rate variability
Urinary catecholamines
Blood markers- blood cortisol, highly sensitive CRP, interleukin (IL)-6, TNF-alpha, fasting glucose and insulin Brain derived Neutrophic factor (BDNF)
Endothelial Function test

<u>Neurotological tests (Section 12.4):</u>

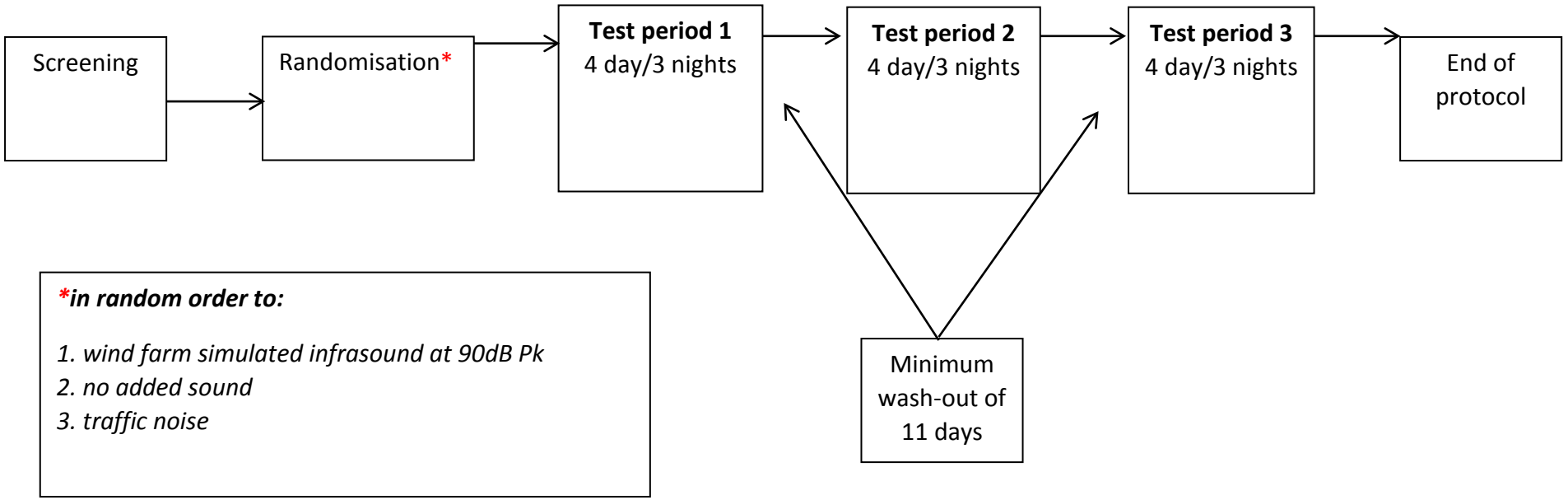
Vestibular Evoked Myogenic Potentials (VEMP)
Video Hit Impulse Tests (vHIT)
Audiometry
Otoacoustic Emissions (OAE)
Videonystagmography (VNG)
Matted Romberg test
Unterberger test

Screening, Phenotyping and Explanatory Questionnaires and measures (Appendix B & C):

Insomnia Severity Index (ISI) questionnaire
Weinstein's Noise Sensitivity Scale (WNS) score
Depression Anxiety and Stress Scale (DASS-21
Kessler 10 (K10)
Claustrophobia Questionnaire (CLQ)
Connor Davidson Resilience Scale
EYSENCK Personality Questionnaire-Revised
Noise Annoyance Scale
Symptom Visual Analogue Scales
Warwick Edinburgh Mental Wellbeing scale
Ethnicity
Medical history
Medication
Sleep Disorders and Patterns
Epworth Sleepiness Scale
Horne and Ostberg Morningness-Eveningness Composite Questionnaire
Health and Work Performance Questionnaire
Shiftwork questionnaire
Post Sleep Study questionnaire
Expectancy questionnaire

8. Participant timeline

Figure 1: Timeline for study protocol



8.1 Enrolment/screening

Screening of suitable participants will be undertaken in two phases. The first phase will be conducted via an online screening questionnaire. The second phase will combine a non-invasive technique (wrist actigraphy and sleep diary) for the at-home measurement of normal sleep/wake cycles and an on-site clinical interview with the study psychologist and a neurotological examination.

Phase 1: Online Screening

Online screening procedure is described in 12.3

All participants who attempt stage 1 of screening (i.e. receive a unique login, see 13.2.2) will be assigned with a sequential screening number (i.e. S1, S2 etc)

Phase 2: Clinical Screening

The clinical screening procedure is described in 12.3.1

If a potential participant is deemed suitable by the online screening procedure they will be contacted by the study coordinator and invited to a face-to-face screening at the Woolcock Institute. For 7 days preceding this appointment they will also wear an actigraph and asked to fill out a sleep diary. Participants will be sent instructions with the device and diary via courier. Actigraphy will be visually checked to ascertain whether the participant has a normal 24 sleep/wake cycle and biologically sufficient sleep (at least an average of 5.5 hours per 24 hours). Sleep diaries will also be kept to correlate with actigraphy data. Participants will be interviewed by the study psychologist to determine whether they will be able to tolerate being in a sleep laboratory for 72 hour periods where they will be shown the facility. Audiometry and a neurotological examination will be performed. Those with impaired hearing will be excluded.

If a participant is willing and eligible they will then have the study fully explained to them and will be given the opportunity to ask questions before they give written informed consent to enrol in the study at this visit. They may also make that decision later and return informed consent documents via email, post or in person

8.2 Laboratory Visit

Eligible Participants who have given informed consent will arrive at the sleep centre for a 4 day/3 night visit at approximately 10am of Day 1. Testing will occur as per the timeline in figure 2 and as per the descriptions of the procedures in section 12. Participants will be free to leave the laboratory at approximately noon on day 4.

Participants will not be allowed to go to sleep until 30 minutes before their habitual sleep time as identified on their screening actigraphy. Participants will be allowed to sleep no later than 30 minutes after their actigraphically estimated habitual rise time or 7:30am, whichever occurs first. This allows all participants sufficient sleep opportunity to achieve

sleep satiety.

There will be a minimum of 11 day washout period after each visit, after which participants will return to the laboratory on 2 further occasions and complete the protocol involving the other 2 arms for 4 days/3 nights each.

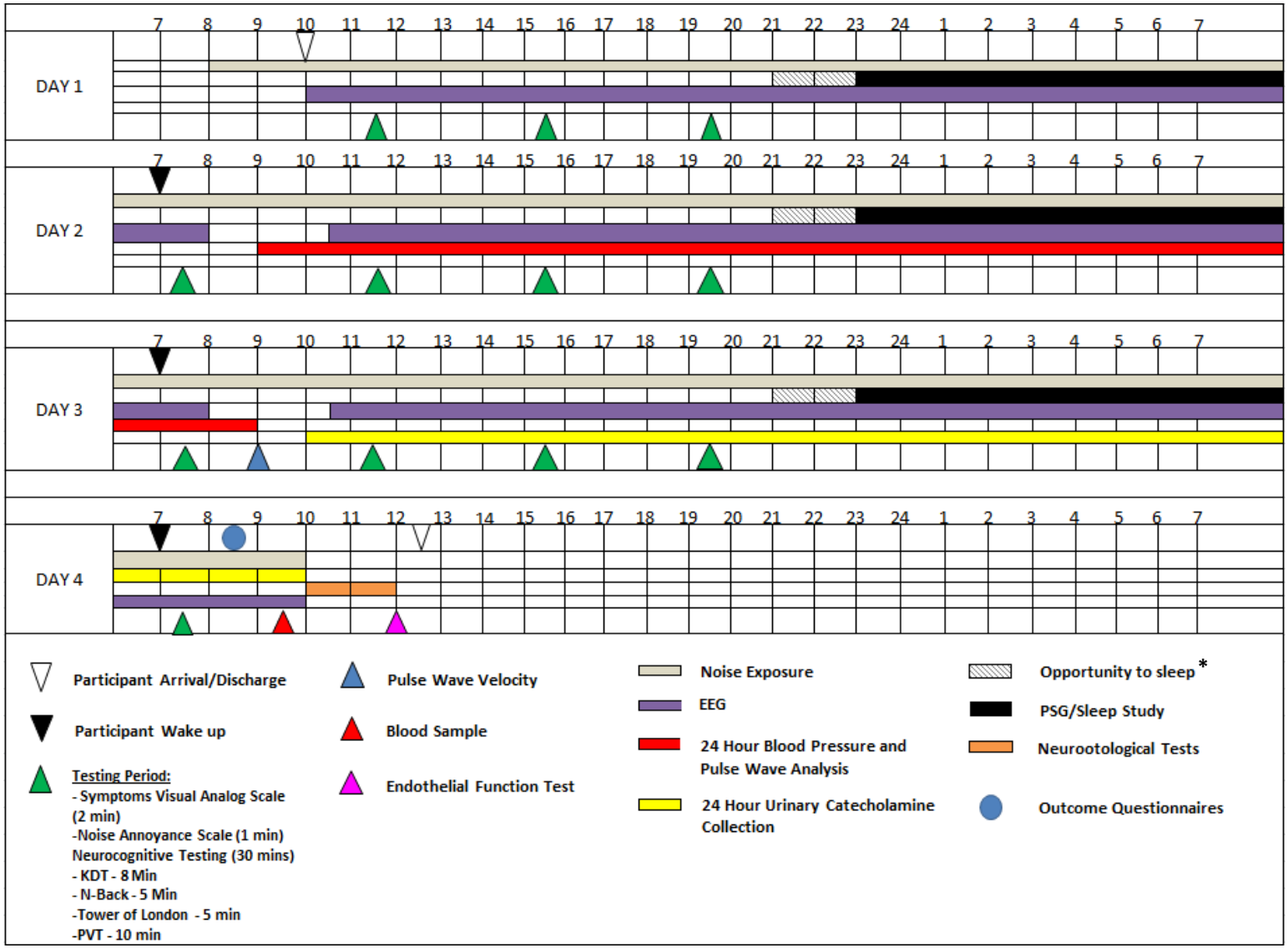


Figure 2: Study Visit timetable

***Sleep and wake periods will be determined by the habitual sleep and wake times shown in actigraphy**

8.3 Reimbursement

Taxi vouchers will be offered to participants for transport to and from the laboratory. Secure parking under the Woolcock building for participants will be offered and we will offer to reimburse both private and public transport costs. In addition we will organise food for 3 meals per day for all participants according to their tastes and bear the cost of this. We will also pay each participant $111 per day up to a maximum of $1000 per participant upon completion of the study (hourly rate of $4.63 for study visits).

9. Sample size

From previous studies, the within-subject standard deviation in wake after sleep onset (WASO) is conservatively estimated at 20 minutes. Most trials of treatments for insomnia, for instance, regard a change of 15 minutes or more in WASO as being clinically meaningful. A sample size of 40 participants (which includes allowance for 2 dropouts) will give more than 85% power to detect a difference in WASO of 15 minutes (Cohen's d=0.5).

10. Recruitment

Number and source of participants

The target number of participants is 40.
Participants will be found by public advertising in local newspapers, community radio, television media and social media through the Woolcock website and its database of research volunteers which will direct all volunteers to the online screening website (Appendix A).

11. Methods: Assignment of interventions

11.1 Randomisation

Participants will be randomised to undertake the 3 study periods in a random order. Participants will be enrolled sequentially according to the computer-generated randomisation list. Participants will be randomised by an investigator who will never meet any participant and plays no role in selection or testing of participants in order to maintain allocation concealment.

Secure randomisation will be achieved through Research Tools™ by entering secure participant data in order to access a unique participant randomisation number. by assigning a unique participant number in sequential, ascending chronological order. This number will be a two digit number prefixed by "R" (e.g. R01, R02 etc.) and will be used to identify the randomised study period order the participant undergoes.

11.2. Blinding

Expectations on the part of participants and investigators may influence the effect of the exposure (infrasound) and, more particularly, may influence the measurement of those effects, especially the subjective (self-reported) outcomes. To avoid the potential for this measurement bias, it is important that both participants and the investigators who are measuring outcomes are blinded to the intervention group. Fortunately, as infrasound is, by definition, inaudible, this is readily achieved by the use of a sham device that appears the same as the infrasound device, but which does not produce any sound. Only the unblinded acoustic engineer will have knowledge of the exposure and they will never meet a participant.

The study will also include a positive control arm. During this period, participants will be exposed to actual noise (traffic noise). The purpose of this arm is to demonstrate that both the participants and the tools used to measure outcomes are sensitive enough to be responsive to a sound-stimulus. It would be particularly important to demonstrate that this is the case if we fail to observe any effect of the test stimulus (infrasound) on the health outcomes that are being measured. As the positive control consists of actual sound, it will not be possible to blind participants or investigators to this exposure.

12. Methods: Description of study procedures

12.1 Informed consent

Each potentially eligible participant will be informed of the study's objectives and overall requirements by the lead study coordinator or one of the principal investigators using the participant information sheet and informed consent form, and they will be provided with a copy of the forms. If the participant is willing to participate in the study, they will be requested to give written, witnessed, informed consent.

12.2 Simulated infrasound waveform and sham infrasound

The infrasound attributable to wind turbines will be simulated using a 0.8 Hz trapezoidal-shaped waveform with 16 harmonics (Figure 3). Conventional audio systems are not capable of generating sound levels at 0.8 Hz. Therefore, a purpose built apparatus will be utilised (Figure 3).

Figure 3. The Walker Speaker Boxes and the Simulated Spectrum

The apparatus generates the required waveform using three 18” sub-woofer drivers in a timber enclosure. Four 18” JBL high power sub-woofers will be used, each constructed separately in timber boxes with integral power amplifiers. A pair of these loudspeaker enclosures will be mounted face-to-face with a separating gap of 25-50mm to form two cubes of approximate size 600mm x 600mm x 900mm. The separating gap between the enclosures is open on all four sides of each infrasound cube (i-cube) from which the infrasound pressure waveform will be emitted. The i-cubes will be placed in convenient corner locations within the testing space. The i-cubes will be electronically connected by cable to enable the infrasound waveform signature to be fed to both simultaneously. Sham units will be constructed to appear identical to the active (infrasound-emitting) i-cubes, but will not emit any audible sound or infrasound.

12.2.1 Monitoring infrasound exposure

Sound level in each room will be measured by a low frequency microphone type G.R.A.S. 40AZ which is a ½" Pre-polarised Free-Field Microphone connected to a G.R.A.S. Type 26CG ¼" Low Frequency CCP Preamplifier. The G.R.A.S. 40AZ microphone has a frequency response of 0.5Hz to 20 kHz (+/- 2dB) which encompasses the range of the study. As well, a G.R.A.S. 12AL 1-Channel CCP Power Module, custom built 50Hz low pass filter/amplifier and Graphtec GL220 data logger with USB hard drive will be utilised for data acquisition. The infrasound will be recorded on the USB hard drive for post processing. Peak sound levels will be measured for each 15 minute interval. All equipment will be certified as conforming to appropriate international standards at the NATacoustic NATA registered laboratory in Sydney. Only the unblinded acoustic engineer will have access to this data and they will never meet a participant.

12.2.2 Generating traffic noise

As part of the experiment involves exposure to traffic noise, this will be achieved using standard audio equipment. A very long traffic noise signal (12 hours loop playback) will be used to ensure the sound cannot be identified as repetitive. The noise level in the laboratory space will be monitored using a standard noise logger.

12.3 Online screening website

Through various recruitment strategies participants will be referred to an online website to register their interest (Appendix A) where they will be asked to register with their details (Name, Phone number, Email address and Postcode) and in return, participants will be sent a unique login and instructions to complete an online questionnaire for this study that will be used as a tool to help screen and phenotype participants. The online questionnaire is a series of questionnaires (Appendix B & C) asking about general health, medication use and medical history, lifestyle and sleeping patterns. Furthermore, participants will answer various questionnaires regarding their psychological wellbeing which will further assist in the decision determining the suitability for each participant. Some questionnaires will be automatically scored using standardised scoring algorithms that will help in excluding participants who are unsuitable and flagging participants who require a decision to be made by members of the research team. Participants will be asked to give consent before beginning the questionnaire (consent to be screened) and after completing the questionnaire (consent if eligible, to be contacted and screened through next stages of screening)

12.3.1 Clinical Screening review

If shown eligible on the online screening, participants will be contacted by a member of the research team to organise a face to face appointment with the study psychologist and an audiologist as well as sent an actiwatch and sleep diary (Section 12.3.2). Participants will go through various hearing tests (Section 12.4) and assessed by a study psychologist on whether they would be able to cope with the requirements of the study and thus decide on whether they would be a suitable participant.

12.3.2 Actiwatch and Consensus Sleep Diary (Appendix D)

Prior to seeing a clinician, participants who are eligible will be contacted and sent an actiwatch, a painless watch like device worn around the wrist to monitor sleep and wake cycles and activity patterns (body movement and ambient light). Accompanying the actiwatch, participants will be sent and asked to fill out a sleep diary self-assessing their sleep whilst at home. Participants will be asked to wear the actiwatch and complete the sleep diary for at least 7 days before coming in to their face-face appointment.

12.4 Neurotological assessment (Appendix E)

Neurotological testing will occur in the following order during the screening visit as well as at the end of each visit. Neurotological tests at the end of each visit require to be performed in a quiet room and therefore will not be occur during any experimental noise conditions.

12.4.1 Bedside Examination

Participants will firstly be asked some questions regarding their clinical history that may affect the neurotological examination (e.g. Do you experience vertigo?). This will be followed by two bedside tests .The matted Romberg test assesses a participant's ability to hold their balance whilst standing on a mat with their eyes closed. The second test, the Unterberger will require participants to walk along a line marked by the examiner with their eyes closed. This test will measure the angle of which drifts from the line marked.
Clinical ear examinations (Otoscopy and Tympanometry) will also be performed prior to any tests to ensure that there is not any obstruction in the ear canals and determining eardrum function.

i) Otoscopy: Examines if there are any structural changes in the tympanic membrane and ear canal using a device called a otoscope.

ii) Tympanometry: A probe like device will be inserted into the ear canals and play a tone to measure the movement in the eardrum in response to changes in pressure caused by the tone.

12.4.2 Videonystagmography (VNG)

Participants will be asked to wear a goggle-like device that is equipped with a camera to track the pupils of the eye. Participants will be instructed to keep their eyes wide open and gaze ahead or on a specific target. Following this, participants will then be asked to lie in a

supine position where they will be rolled to each side by the examiner whilst tracking the eye movements.

12.4.3 Audiometry

Formal testing of air and bone conduction hearing thresholds will be undertaken using a laptop-based audiometer. This test is designed to measure hearing acuity by a variation of tones in pitch and sound intensities played through a set of headphones. This test will be performed in a quiet room.

12.4.4 Otoacoustic Emissions test

Measures the otoacoustic emissions (OAEs) produced by the outer hair cells of cochlea as part of the pre-neural active process within the cochlea. Otoacoustic emissions can occur spontaneously or they can be elicited by presenting sound into the ear canal. The test is performed by inserting a foam earbud tip into the ear and a distortion product tone or broadband click will be played to elicit this response. Otoscopy and tympanometry will be performed before to test middle ear integrity as middle ear dysfunction is contraindicated in this test as it will not produce a response.

12.4.5 Video head impulse test (VHIT)

Measures the vestibular function through testing the vestibulo-ocular reflex. The participants will wear lightweight goggles which will track eye and head movement concurrently using a high speed camera and a motion sensor in the goggles whilst the participant is viewing a target at eye level 1.5 metres away. The examiner firmly holds the participant's head and delivers brief, unpredictable, low amplitude (10-20 degrees) and high velocity (150-300 degrees/s) head movements in the plane of the 3 pairs of semicircular canals. Head and eye velocity are measured and displayed in real time. For each semicircular canal tested, in the presence of an intact vestibulo-ocular reflex (VOR), each head impulse generates an equal and opposite eye movement and the "gain" of the angular VOR in this canal plane (eye velocity/head velocity) is close to 1. Three dimensional video head impulse testing includes assessment of the angular VOR in all 6 semicircular canal planes. The VHIT quantifies dysfunction of semicircular canals.

12.4.6 Vestibular Evoked Myogenic Potential (VEMP)

Measures vestibular function through activating the otolith organs in the ear to elicit "vestibular evoked myogenic potentials". Cervical and ocular vestibular evoked myogenic potentials (cVEMP and oVEMP respectively) are two tests which will be performed together. The participant will have EMG electrodes placed on the face and the neck whilst in a supine position.

i) Cervical Vestibular evoked myogenic potential (cVEMP): Measures the functionality of the saccule by activating a myogenic potential through playing sound through headphones. To ensure proper contraction of the muscle participants will be instructed to lift their head and turn to each side. This produces a muscle reaction in the sternocleidomastoid muscle which is recorded through the EMG electrodes.

ii) Ocular Vestibular evoked myogenic potentials (oVEMP): Measures the functionality of the utricle which is activated through tone bursts/vibrations against the participant's forehead using a 'mini shaker' oscillator (like gentle tapping on centre of forehead). The participant will be asked to look up as far as possible with their eyes as the oscillator is vibrating against the forehead.

12.4.7 Psychological and psychiatric health

The following questionnaires will be measured at screening and after each exposure to measure stress and anxiety (see Appendix B)

Online Screening:
1. Kessler 10 (K10)
2. Claustrophobia Questionnaire (CLQ)
3. Connor Davidson Resilience Scale
4. EYSENCK Questionnaire
5.Depression Anxiety Stress Scale (DASS-21)

Whilst in lab:
1. Noise Annoyance Scale
2. Symptom Visual Analogue Scales

Post Exposure Outcome questionnaires:
1. Warwick Edinburgh Mental Wellbeing scale (WEMWB)
2. Depression Anxiety and Stress Scale (DASS-21)
3. Modified Insomnia Severity Index

12.5 General health assessment

Anthropometric measurements such as height, weight, waist circumference and the blood pressures of each arm will be taken at the screening visit and the beginning of each visit.

12.6 Electroencephalography (EEG) & Polysomnography (PSG) (Appendix F)

Sleep shall be monitored using standard polysomnography based on the American Academy of Sleep Medicine (AASM) 2015 v2.2 guidelines.[25] EEG leads will be attached to the subject's head, which will take measurements of the electrical activity in the brain, along with recordings of ECG, oxygen levels, body position and other standard measurements for PSG. They will sleep with these leads attached and there will be a technician monitoring their sleep in the adjacent room throughout the night. This procedure is non-invasive and the setup is not painful to wear. Sleep shall be scored using standard scoring techniques. Overnight sleep studies will be scored by a technician blinded to whether the participant was in either the infrasound or sham infrasound condition.

The EEG leads will also measure brain activity during wake and the leads shall be left on during the daytime to achieve this. Power spectral analysis (PSA) and other higher order quantitative EEG (qEEG) methodologies such as detrended fluctuation analysis (DFA) are well established techniques in our centre to measure sleep microstructure and will be utilised in these studies.[26]

12.7 Neurocognitive Assessments

The computerised neurocognitive test battery will be comprised of the N-back, the Tower of London, and the Psychomotor Vigilance Task. Neurocognitive tests will occur four times during wake periods each day as shown in Figure 2.

12.7.1 N-back (2-back) (5 mins)

This test involves the participant monitoring a series of stimuli and requires them to respond whenever a stimulus is presented that is the same location as the one presented n trials previously, where n is a pre-specified integer, usually 1, 2, or 3. The task requires on-line monitoring, updating, and manipulation of remembered information and is therefore assumed to place great demand on a number of key processes within working memory.

12.7.2 Tower of London (3-5min)

This computerised test involves the presentation of two different arrangements of coloured balls on the monitor. The subject's task is to rearrange the first array of balls so that it matches the second array of balls using the minimum number of moves possible with the mouse. The positioning of the balls is constrained to the location of three pegs in each display. This test demands that the sequence of moves is carefully planned in advance before attempting the first move. Failure to engage in advanced planning of the sequence will result in initial moves blocking subsequent ball moves. This test involves using "executive" function, specifically forward planning, to solve a problem. Accuracy, determined as the number of moves, and speed, using time, variables can be obtained.

12.7.3 Psychomotor Vigilance Task (PVT) (10min)

The PVT was developed to measure simple reaction time (RT). More specifically, to track changes induced by the interaction of the homeostatic drive for sleep and the endogenous circadian pacemaker. The physical device is a handheld box (20cm x 11cm x 5cm, weight 600g). Patients are instructed to either have the PVT unit resting comfortably in the palms of their hands or resting flat on a surface. The task is designed to test simple RT for 10 min. The box has two buttons, left and right, and two screens. The top screen is a red LED which randomly displays increasing reaction times (in milliseconds), which are terminated by pressing the right button as fast as possible. Following each reaction the screen then pauses for 1.5 seconds while the RT is displayed to give performance feedback. The time between each reaction test varies randomly between 2 and 10 seconds. If the patient fails to respond within 500ms of the stimulus being displayed then a 'Lapse' is recorded. In addition, if the patient presses the button before the stimulus is displayed then a 'False start' is recorded and FS is displayed on the screen. Each ten minute task generates approximately 80-100 RT values for analysis. Below the LED display is a black and white LCD display. This display is used to prompt, before and after each test, the patient with a question about their sleepiness. A 10 point likert scale is used anchored by word descriptors 'No' and 'Yes' with the question "Sleepy?" posed above the scale.

12.8 Karolinska Drowsiness Test (KDT) (7.5 mins)

EEG activity is recorded whilst the participant is sitting quietly and with eyes open for 2.5mins, eyes closed for 2.5 mins, then eyes open again for 2.5 mins to assess EEG markers of physiological sleepiness.

12.9 Cardiovascular and stress measures (Appendix H)

12.9.1 24 hour Pulse Wave Analysis

This will be measured by using an ambulatory blood pressure device for 24 hour on the 2nd day of each visit. The cuff will inflate every 30 minutes to measure and record brachial and central blood pressure.

12.9.2 Pulse wave Velocity (10-15 minutes)

Pulse Wave velocity is the gold standard for measuring for aortic stiffness. The measurement is a painless, non-invasive test and entails inflating a cuff around a fully clothed thigh whilst simultaneously placing a pressure probe on the carotid artery of the neck across the skin. The test will require the participant to maintain a resting period of 10 minutes and 5 minutes measuring periods. This measurement will be recorded whilst in the exposure of the experimental noise conditions.

12.9.3 Heart rate variability

This will be measured through ECG leads which are attached during routine overnight sleep study. This will be analysed using PRANA® Software Suite.

12.9.4 Endothelial Function tests (15 minutes)

This test will be conducted whilst the participant is not exposed to any experimental noise conditions and will be in a separate quiet room. Endothelial function is measured by occluding blood to the arm using an inflated cuff for 5 minutes. This is then followed by releasing the inflated cuff to allow blood to flow back into the arm. During this period, change in blood flow measured in the finger is used to quantify endothelial function. Participants may experience some pain whilst occluding the blood flow and will subside upon releasing the cuff.

12.9.5 Urinary catecholamines

24 hour excretion of catecholamines will be measured during the last 24 hours of each in-laboratory stay. All urine produced by participants will be collected and sent for analysis.

12.9.6 Blood test for inflammatory markers

A blood sample will be taken on the last morning of each lab stay using standard venepuncture technique to measure inflammatory markers including: cortisol, highly sensitive CRP, interleukin (IL)-6, TNF-alpha, fasting glucose, insulin (to measure HOMA- an indicator of insulin resistance) and Brain derived neutrophic factor (BDNF). Over the 3 visits (Approximately 6 weeks) a total blood volume of 130mL will be taken from each participant which is less than one routine blood donation (~400mL). Approximately, 40mL of blood will be taken from the arm at the end of each visit. Three 8.5mL gold serum separating tubes and one 4mL purple EDTA will be sent to a local pathology laboratory and an extra two 8.5mL gold serum separating tubes will be centrifuged and the serum will be extracted and stored at -80°C at the Woolcock Institute.

12.10 Insomnia Severity Index (ISI) questionnaire (see Appendix B)

The standard 2-week version will be used as a screening tool and a version modified to refer to the last 3 days only will be employed as an outcome measure on the last day of each study visit. It is a 7-item patient reported outcome measure that probes the severity of both the night time and daytime impact of insomnia and takes approximately 3 minutes to complete. Each item uses a 5-point Likert scale to capture a rating (0 = no problem; 4 = very severe problem) which add up to: no insomnia (0 – 7); sub-threshold insomnia (8 – 14); moderate insomnia (15 – 21); and severe insomnia (22 – 28).

13. Data Management

All data will be collected onsite at the sleep laboratory at the Woolcock Institute of Medical Research in written and computerised formats. Paper records shall be securely stored in locked cabinets for up to 15 years following the end of the study. Computerised data will be stored and backed-up on a secure cloud based, individual password protected database system (Research Tools^{TM}) which logs all access or changes to data back to individual users who will be given only access or change privileges to data which they require for their role. During data collection, only investigators named at the front of this protocol, the unblinded study statistician and the data safety monitoring committee will be allowed access to the study data under the supervision of the Principal Investigators. After study completion, a non-identifiable dataset (does not include information that could help identify a participant such as date of birth, address or ethnicity) may be published in an open access data repository. All data will be re-identifiable as, once randomised into the study, participants will be allocated an individual study code number. The master coding sheet will be kept in a password encrypted file and only investigators and research staff will have access to it. However, if needed, each individual will be able to be re-identified.

14. Statistical Methods

Generalised linear mixed models will be utilised for statistical analysis. WASO will be the dependent variable in the primary analysis. All other outcomes will be tested separately as dependent variables. Exposure (infrasound vs sham) will be the main fixed effect and its coefficient will be the estimate of difference in the outcome attributable to infrasound (vs sham) exposure. Participants will be included as a random effect, a period effect (first, second or third exposure period) will be included as an additional fixed effect and a term representing the sequence (or order) will be included as an additional random effect (nested within participants). As multiple outcome measures will be made (at baseline and at various follow-up times) a “time” fixed effect will also be included and exposure-by-time interactions will be tested. Also, the exposure-by-anxiety/stress interaction will be tested to establish whether this attribute modifies the propensity to experience WTS symptoms with exposure.

15. Methods: Monitoring

15.1 Data monitoring

Because infrasound like this has not been used in experiments of longer than 2 hours duration and because this laboratory-based study is informing the larger and longer field based study, it will be the responsibility of the Principal Investigators (Marshall & Grunstein in the lab and Marks & Toelle in the field) to convene a Data Safety Monitoring Board (DSMB) to oversee participant safety across both studies by reviewing unblinded accumulated safety data pertaining to infrasound.

The DSMB will include members with expertise in one or preferably more than one of the following fields: Randomised trials methodology; biostatistics; neurotology; environmental epidemiology (preferably in noise or acoustics); field-based and laboratory-based sleep research. Collectively the DSMB must have expertise in all of these fields and this is why the committee has some flexibility in the numbers of members.

16. Adverse Events Reporting

Collection of adverse events will occur during each visit.
Serious adverse events (SAE) are defined as any untoward medical occurrence that:

- Results in death
- Is an immediately life-threatening condition
- Requires hospitalisation or prolongs hospitalisation
- Results in persistent or significant disability/incapacity
- Is a congenital anomaly/birth defect
- Results in any other important medical condition.
  The Ethics Committee will be notified of any SAE within 72 hours.

17. Auditing

The study will not be externally audited

18. Ethics and dissemination

18.1 Study conduct/ethics approval

The study will be conducted under the ethical jurisdiction of the Sydney Local Health District (SLHD) Ethics Committee at Royal Prince Alfred Hospital (Protocol No X16-0073 & HREC/16/RPAH/91) and will be performed in accordance with the Declaration of Helsinki,[27] the Australian Good Clinical Research Practice Guidelines[28] (Commonwealth of Australia, 1991) and the guidelines of the National Health and Medical Research Council for human research.[29]

19. Protocol amendments

Any amendments to the protocol will be made in writing to the SLHD Ethics Committee after discussion with all co-investigators, and then be communicated to all participants, whereby further consent will be obtained for any protocol amendments.

20. Confidentiality

Participant data will be identified by a code number that will be allocated after the participant gives consent to participate in the study. The key linking the participant's identity to the relevant code will be stored in a password encrypted file that will not be accessible from the internet. Storage of the data collected will adhere to the University regulations & the Australian Code for the Responsible Conduct of Research. A dataset containing individual participant data will be published online in conjunction with the academic publication of these data. That dataset will be non-identifiable and will not contain any personal information about the participant that could be used to identify them (including age, gender, ethnicity, address or postcode).In any publication and/or presentation, information will be provided in such a way that participants cannot be identified, except with their written, informed permission. Any information obtained for the purpose of this research that could identify participants will be treated as confidential and securely stored.

21. Declaration of Interests

None of the investigators have any pecuniary interest or academic conflict of interests in the outcomes of this study.

22. Access to data

During the study only investigators and members of the study team will have access and control to any data collected from participants. There are no contractual agreements that would limit access or control of the study to the investigators. After the study, a non-identified dataset may be made available online in a data repository. Making data available in such a way is increasingly becoming an expectation of research teams who conduct publicly funded research.

23. Ancillary and post-trial care

As this is not a clinical trial for a medical condition and does not involve any treatment, no clinical follow up will be routinely offered to participants. If however any harm is caused during this protocol or a medical condition becomes apparent, then medical follow-up will be arranged with either a member of the clinical research team or the participant's normal medical practitioner.

24. Dissemination policy

Study results will be published in peer-reviewed journals and participants will be made aware of these following publication should they desire. The publication committee consists of Prof Marks & Grunstein, A/Prof Marshall and Drs Toelle and Tonin. They shall be responsible for the formulation and execution of publication plans. Authorship on any manuscripts will be at the discretion of the publication committee.

25. Appendix

A. Online Registration and Consent forms

I. www.windfarmstudy.com

Do Wind Farms cause health effects?

Do you find yourself easily annoyed with noise?

Not able to concentrate or operate properly in a noisy environment?

You may be eligible to participate in a research study that is being conducted at the **Woolcock institute of Medical Research in Glebe, Sydney.**

This study will be investigating the effects on sleep and various aspects of health when being exposed to the sound that comes from Windfarms (called infrasound) and traffic noise when compared to silence.

The study will take place over the course of 3 weekend stays in our sleep centre separated by at least 11 days in between each visit.

Click on ***'Register now'*** below to register your interest and fill the appropriate details.

After successfully filling our questionnaire we will be in contact with you shortly in regards to your eligibility for the study and guide you through the next steps of the process.

For more information, we encourage you to go on our **Frequently Asked Questions** page

Thank you for your interest and for taking the time to be involved.

Register now!

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II. Frequently Asked Questions

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Frequently Asked Questions

1. What is the Woolcock Institute of Medical Research

The Woolcock Institute is an inter-disciplinary research institute dedicated to understanding and treating respiratory and sleep disorders. With over 200 research and clinical professionals, we are a world leader in the area of research, clinical diagnosis and treatment. We are affiliated with the University of Sydney.

2. Where is the Woolcock Institute of Medical Research?

The Woolcock Institute is located at 431 Glebe Point Road in the Suburb of Glebe in Sydney, NSW, Australia. If you are enrolled in this research study, you will need to attend appointments at this location.

The Woolcock Institute can be reached on the 431 bus from the Sydney CBD. This service stops directly outside the Woolcock. The 433 and 370 buses also stop a short distance away as does the light rail (Jubilee Park Stop)

Alternatively, if you wish to drive to the Woolcock, we can arrange a free car park in our secure under the institute

3. What is the Purpose of this study?

Communities living near wind turbines have presented with a cluster of health symptoms sometimes called "Wind Turbine Syndrome". The National Health and Medical Research Council of Australia (NHMRC) have recently conducted a thorough review and did not find any scientifically robust studies that could definitively prove or disprove whether wind turbine noise causes human ill-health. Wind turbines generate noise that is below the audible range for humans (called infrasound) and nobody has yet conducted a scientific study in a laboratory to determine whether it has any effects on humans. The purpose of this study is to investigate whether 72 of wind turbine noise has effects on human health measures when compared to silence and to traffic noise.

4. Am I eligible to participate in this study?

Eligible participants are adults with normal hearing who report they are at least somewhat sensitive to noise and are willing to stay in our sleep centre for 3 weeks. Our online screening questionnaire will determine whether you meet the full eligibility criteria.

5. What will the research involve?

This study will consist of 3 visit which will be separated by at least 11 days; each visit will consis of 4 consecutive days (i.e. 10am Friday to Noon Monday) where we will undertake a range of health-related measurements (sleep, brain activity, reaction time, memory, heart rate and blood samples etc.) whilst in the background we will play 3 types of noise to you.

The 3 types of noise are loud traffic noise which will probably interrupt your sleep, simulated wind turbine noise (infrasound - which you will not be able to hear) and silence.

6. Will I get paid for participating in this research?

We will reimburse all your travel costs and we will pay for all your meals while you are with us. In addition, at the end of the study we will reimburse you a small amount for your time.

7. What are the benefits of this study?

There are no direct benefits to you by participating in this study. You may learn some interesting things about your sleep and other health measurements which you will be able to see on request. Your participation in this study will help in guiding future public policy about the health effects of wind turbines and and traffic noise.

If you have any other questions, please contact
Windfarmstudy@woolcock.org.au

III. Online Screening Consent Forms

Consent

select a partcipant... Remove

Dear Sir/Madam,

This questionnaire was developed by the Woolcock Institute of Medical Research.

The Wind Farm study is exclusively funded by the Australian Commonwealth through the National Health and Medical Research Council (NHMRC) and aims to study the impact of noise exposures on sleep and health including the inaudible sound that is produced by wind turbines called 'infrasound'

This important research is impossible without the generous contributions from volunteers and such we would like to invite you to contribute to this research effort designed to better understand the effects of Wind farms on health including sleep. We would be grateful if you would complete the following questionnaires that will take up to 30 minutes. Please complete all sections unless it states that you are not required to do so.

Taking part in this research is completely voluntary and all information obtained in this questionnaire will be kept confidential and de-identified prior to any research use. Any research information will be de-identified and stored completely anonymously and separate from your personal information on a Wind Farms database with same high level of security as your personal medical record. Your information will not be provided to any third party unless required by law.

If you have any concerns or questions we encourage you to contact our research team on Windfarmstudy@woolcock.org.au

I have read and understood the above information and:

Please select

- ( ) Yes, I agree to participate in this research study and I understand that I may be contacted and invited to participate in future stages of screening if suitable
- ( ) No, I do not wish to take part in this or future research

By selecting 'Yes', you are stating that you understand the information provided and give consent for your de-identified responses to be used for research purposes.

- *You understand that your participation in this research study is entirely voluntary*
- *You are under no obligation to participate and you can withdraw at any time*
- *You also understand that all data collected under this research study is strictly confidential.*

Save & Back

Consent

select a partcipant... Remove

Thank you for completing our questionnaires for the Wind Farms study at the Woolcock Institute of Medical Research.

If you are eligible to continue to the next stages of the study, a member from the research team will be in contact with you to organise for you to come in for a 4 hour face-to-face appointment to see a sleep psychologist and an audiologist at the Woolcock Institute of Medical Research in Glebe, Sydney. The Psychologist will assess whether you will be able to cope with 3 weekends in our sleep laboratory and the audiologist will measure your hearing.

Prior to this visit, a watch like device called an actiwatch and a sleep diary will be sent to you which we will require you to wear 14 days before your appointments with the psychologist and audiologist. All tests during the screening visit are safe and non-invasive, although unlikely, some tests may feel uncomfortable at times

You will be reimbursed for any of your transport costs in getting to the Woolcock and we have undercover parking free of charge. You will not be charged any money for seeing these health professionals as part of this study

If you have any questions, please send an email to **windfarmstudy@woolcock.org.au**

Actiwatch

Sleep Diary

WOOLCOCK

Neurotology tests with Audiologist:

Matted Romberg: You will be asked to stand with eyes open and eyes closed to observe your ability to hold the position
Unterberger: You will be asked to walk along straight line with your eyes closed and the angle of how much you drift from the line will be measured
Audiometry: Responding to tones or words being played through headphones by pressing a button or repeating the word respectively.
Otoacoustic Emissions: Will test cochlear function by eliciting a response by playing a tone through an earbud that is placed in the ear
Vestibular Evoked Myogenic Potentials (VEMP): Electrodes will be placed on various places on the face, neck and chest and you will be asked to turn your head or gaze a specific point whilst a clicking sound will be played through headphones or a tapping against your forehead
Otoscopy: Using a device that looks into the ear called an otoscope, will determine ear canal structure and whether it is clear of wax.
Tympanometry: Will test the eardrums integrity by placing pressure on the eardrums and measuring its response.
Video Head Impulse Test: You will be fitted with a pair of goggles with a high speed camera to track eye movements as the examiner moves your heads in a random pattern in different planes.

◯ Yes, I hereby agree if eligible for the next stages to be contacted by a member of the research team to arrange an appointment to see the audiologist and psychologist and be sent an actiwatch and a sleep diary to wear before attending this appointment

◯ No, I do not wish to take part in this research study

B. Questionnaires

I. Weinstein's Noise Sensitivity (WNS) Scale

II. Insomnia Severity Index (ISI) questionnaire

Insomnia Severity Index

select a partcipant... Remove

For each question, please click on the number that best describes your answer.

1. Please rate the CURRENT (i.e. LAST 2 WEEKS) SEVERITY of your insomnia problem(s).

	None	Mild	Moderate	Severe	Very Severe
a. Difficulty falling asleep	0	1	2	3	4
b. Difficulty staying asleep	0	1	2	3	4
c. Problem waking up too early	0	1	2	3	4

2. How SATISFIED/DISSATISFIED are you with your CURRENT sleep pattern?

	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied
	0	1	2	3	4

3. To what extent do you consider your sleep problem to INTERFERE with your daily functioning (e.g. daytime fatigue, mood, ability to function at work/daily chores, concentration, memory, mood, etc.) CURRENTLY?

	Not at all Interfering	A Little	Somewhat	Much	Very Much Interfering
	0	1	2	3	4

4.How NOTICEABLE to others do you think your sleep problem is in terms of impairing the quality of your life?

	Not at all Noticeable	A Little	Somewhat	Much	Very Much Noticeable
	0	1	2	3	4

5. How WORRIED/DISTRESSED are you about your current sleep problem?

	Not at all Worried	A Little	Somewhat	Much	Very Much Worried
	0	1	2	3	4

Save & Back

III. Depression Anxiety and Stress Scale (DASS-21)

DASS - 21

select a partcipant... Remove

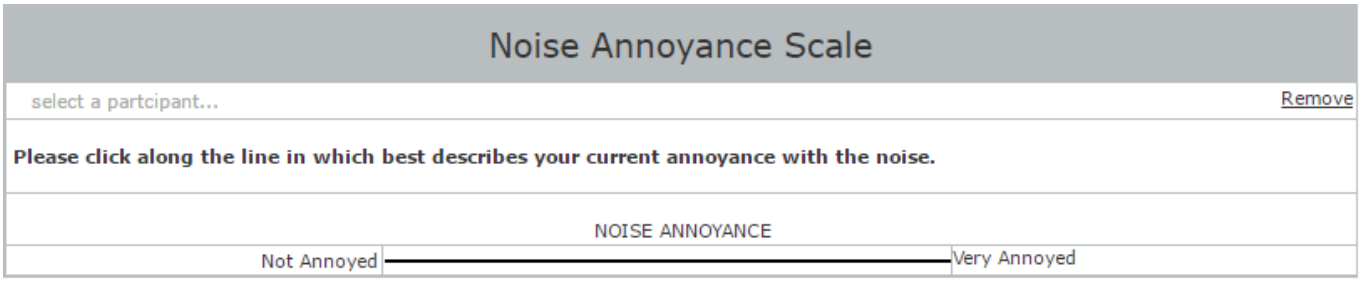
Please read each statement and click on a number 0, 1, 2 or 3 which indicates how much the statement applied to you *over the past week*. There are no right or wrong answers. Do not spend too much time on any statement.

	Did not apply to me at all	*Applied to me to some degree, or some of the time*	*Applied to me to a considerable degree, or a good part of time*	*Applied to me very much, or most of the time*
1. I found it hard to wind down	0	1	2	3
2. I was aware of dryness of my mouth	0	1	2	3
3. I couldn't seem to experience any positive feeling at all	0	1	2	3
4. I experienced breathing difficulty (eg, excessively rapid breathing, breathlessness in the absence of physical exertion)	0	1	2	3
5. I found it difficult to work up the initiative to do things	0	1	2	3
6. I tended to over-react to situations	0	1	2	3
7. I experienced trembling (eg, in the hands)	0	1	2	3
8. I felt that I was using a lot of nervous energy	0	1	2	3
9. I was worried about situations in which I might panic and make a fool of myself	0	1	2	3
10. I felt that I had nothing to look forward to	0	1	2	3
11. I found myself getting agitated	0	1	2	3
12. I found it difficult to relax	0	1	2	3
13. I felt down-hearted and blue	0	1	2	3
14. I was intolerant of anything that kept me from getting on with what I was doing	0	1	2	3
15. I felt I was close to panic	0	1	2	3
16. I was unable to become enthusiastic about anything	0	1	2	3
17. I felt I wasn't worth much as a person	0	1	2	3
18. I felt that I was rather touchy	0	1	2	3
19. I was aware of the action of my heart in the absence of physical exertion (eg, sense of heart rate increase, heart missing a beat)	0	1	2	3
20. I felt scared without any good reason	0	1	2	3
21. I felt that life was meaningless	0	1	2	3

Save & Back

IV. Visual Analogue Scale for Symptom

V. Noise Annoyance Scale



Noise Annoyance Scale

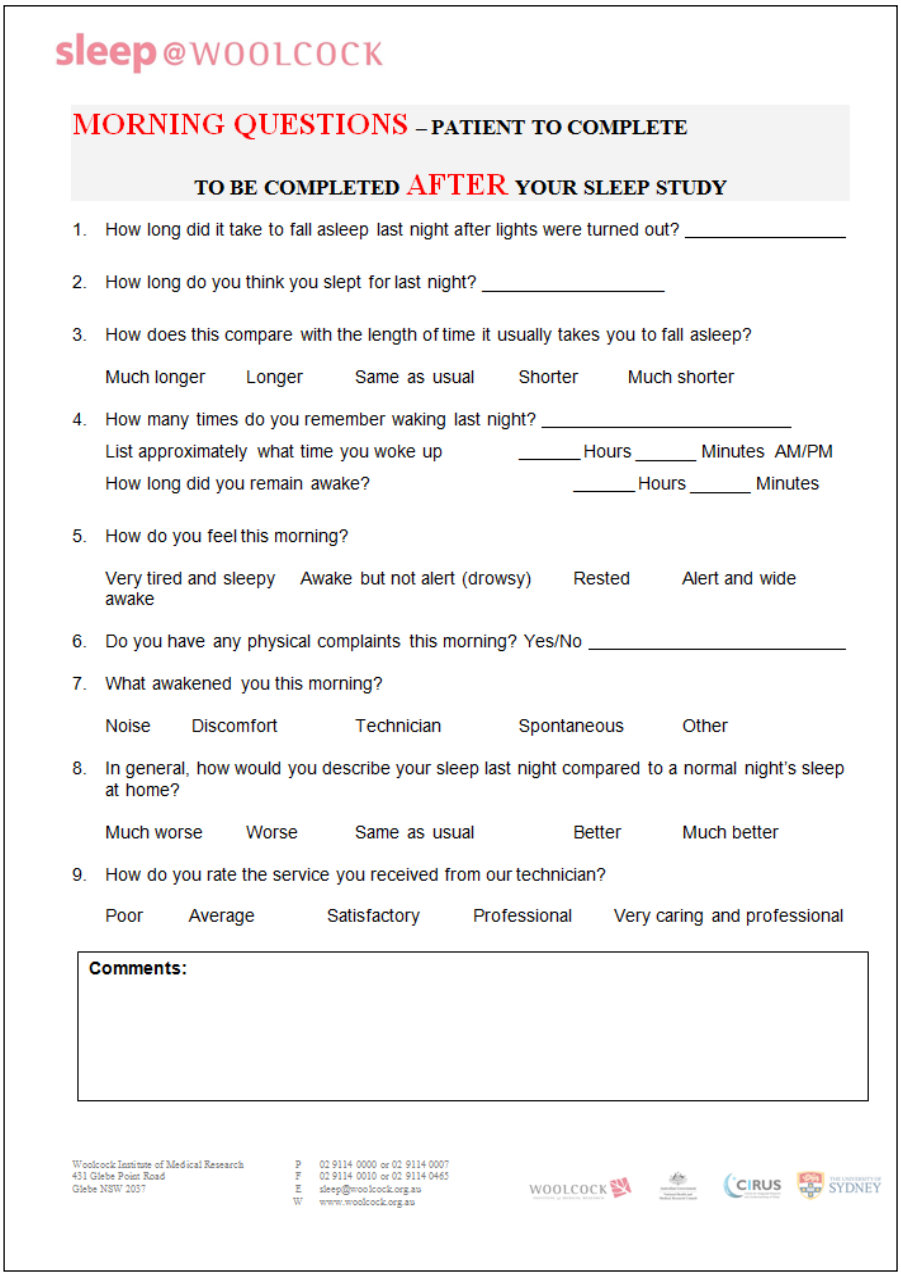
select a partcipant... Remove

Please click along the line in which best describes your current annoyance with the noise.

NOISE ANNOYANCE

Not Annoyed —— Very Annoyed

VI. Post-Sleep Study Questionnaire



sleep@WOOLCOCK

MORNING QUESTIONS – PATIENT TO COMPLETE

TO BE COMPLETED AFTER YOUR SLEEP STUDY

1. How long did it take to fall asleep last night after lights were turned out? _____
2. How long do you think you slept for last night? _____
3. How does this compare with the length of time it usually takes you to fall asleep?

   Much longer Longer Same as usual Shorter Much shorter
4. How many times do you remember waking last night? _____

   List approximately what time you woke up _____Hours _____ Minutes AM/PM

   How long did you remain awake? _____Hours _____ Minutes
5. How do you feel this morning?

   Very tired and sleepy Awake but not alert (drowsy) Rested Alert and wide awake
6. Do you have any physical complaints this morning? Yes/No _____
7. What awakened you this morning?

   Noise Discomfort Technician Spontaneous Other
8. In general, how would you describe your sleep last night compared to a normal night's sleep at home?

   Much worse Worse Same as usual Better Much better
9. How do you rate the service you received from our technician?

   Poor Average Satisfactory Professional Very caring and professional

Comments:

Woolcock Institute of Medical Research
431 Glebe Point Road
Glebe NSW 2037

P 02 9114 0000 or 02 9114 0007
F 02 9114 0010 or 02 9114 0465
E sleep@woolcock.org.au
W www.woolcock.org.au

WOOLCOCK CIRUS THE UNIVERSITY OF SYDNEY

VII. Warwick Edinburgh Mental Wellbeing Scale

The Warwick-Edinburgh Mental Well-being Scale (WEMWBS)

select a partcipant... Remove

Below are some statements about feelings and thoughts.

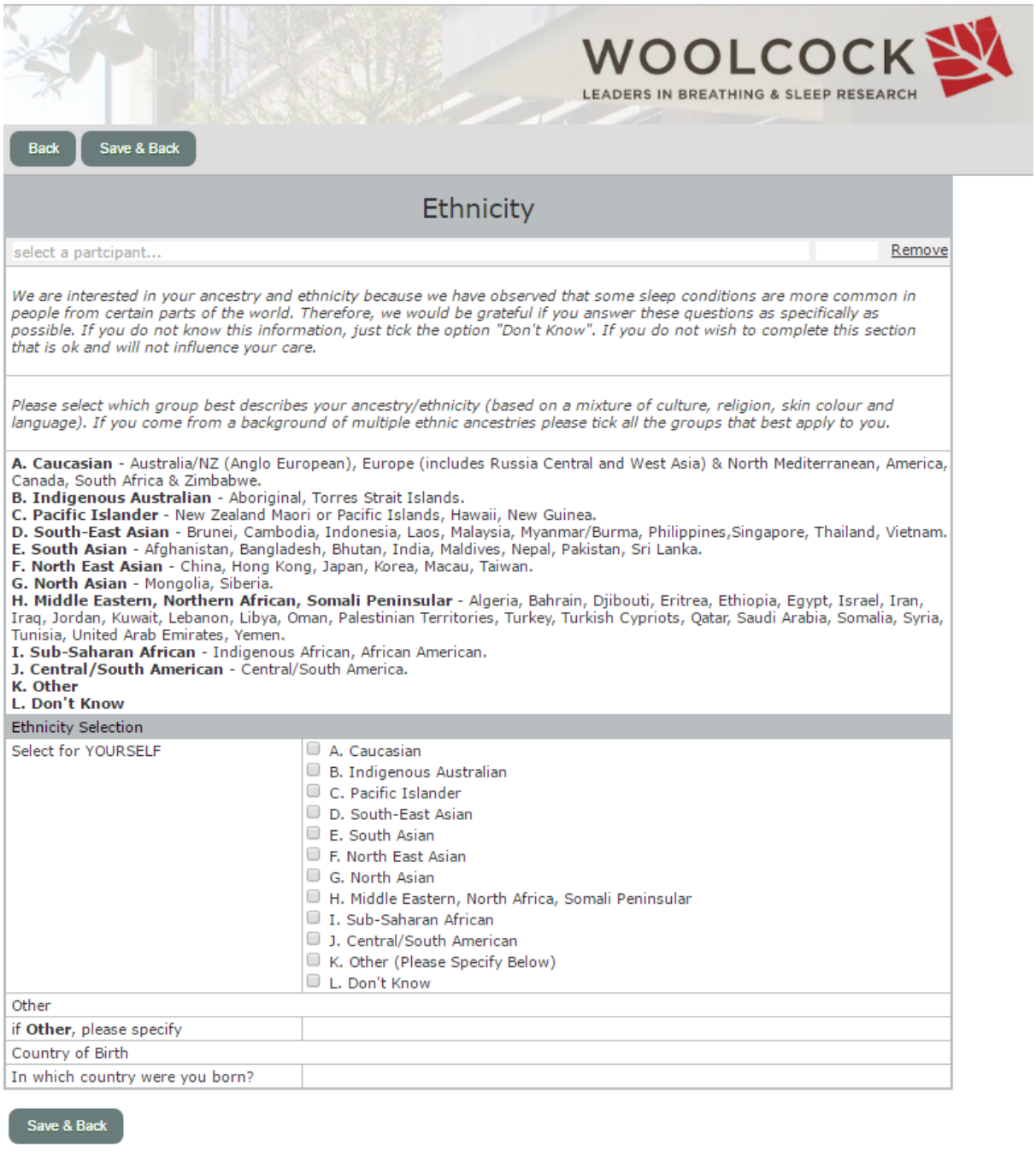
Please tick the box that best describes your experience of each over the last 2 weeks

	None of the time	*Rarely*	*Some of the time*	*Often*	*All the time*
1. I've been feeling optimistic about the future	1	2	3	4	5
2. I've been feeling useful	1	2	3	4	5
3. I've been feeling relaxed	1	2	3	4	5
4. I've been feeling interested in other people	1	2	3	4	5
5. I've had energy to spare	1	2	3	4	5
6. I've been dealing with problems well	1	2	3	4	5
7. I've been thinking clearly	1	2	3	4	5
8. I've been feeling good about myself	1	2	3	4	5
9. I've been feeling close to other people	1	2	3	4	5
10. I've been feeling confident	1	2	3	4	5
11. I've been able to make up my own mind about things	1	2	3	4	5
12. I've been feeling loved	1	2	3	4	5
13. I've been interested in new things	1	2	3	4	5
14. I've been feeling cheerful	1	2	3	4	5

Save & Back

C. Online Screening- Ethnicity, Lifestyle, Medical History, Medication, Sleep disorders and patterns and Attitudes on Wind farms.

I. Ethnicity



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Ethnicity

select a partcipant... Remove

We are interested in your ancestry and ethnicity because we have observed that some sleep conditions are more common in people from certain parts of the world. Therefore, we would be grateful if you answer these questions as specifically as possible. If you do not know this information, just tick the option "Don't Know". If you do not wish to complete this section that is ok and will not influence your care.

Please select which group best describes your ancestry/ethnicity (based on a mixture of culture, religion, skin colour and language). If you come from a background of multiple ethnic ancestries please tick all the groups that best apply to you.

A. Caucasian - Australia/NZ (Anglo European), Europe (includes Russia Central and West Asia) & North Mediterranean, America, Canada, South Africa & Zimbabwe.
B. Indigenous Australian - Aboriginal, Torres Strait Islands.
C. Pacific Islander - New Zealand Maori or Pacific Islands, Hawaii, New Guinea.
D. South-East Asian - Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar/Burma, Philippines,Singapore, Thailand, Vietnam.
E. South Asian - Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, Sri Lanka.
F. North East Asian - China, Hong Kong, Japan, Korea, Macau, Taiwan.
G. North Asian - Mongolia, Siberia.
H. Middle Eastern, Northern African, Somali Peninsular - Algeria, Bahrain, Djibouti, Eritrea, Ethiopia, Egypt, Israel, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Oman, Palestinian Territories, Turkey, Turkish Cypriots, Qatar, Saudi Arabia, Somalia, Syria, Tunisia, United Arab Emirates, Yemen.
I. Sub-Saharan African - Indigenous African, African American.
J. Central/South American - Central/South America.
K. Other
L. Don't Know

Ethnicity Selection	
Select for YOURSELF	☐ A. Caucasian ☐ B. Indigenous Australian ☐ C. Pacific Islander ☐ D. South-East Asian ☐ E. South Asian ☐ F. North East Asian ☐ G. North Asian ☐ H. Middle Eastern, North Africa, Somali Peninsular ☐ I. Sub-Saharan African ☐ J. Central/South American ☐ K. Other (Please Specify Below) ☐ L. Don't Know
Other	
if **Other**, please specify	
Country of Birth	
In which country were you born?	

Save & Back

II. Lifestyle

Lifestyle

select a partcipant... Remove

General Health	
How would you describe your general health?	☐ Excellent ☐ Very Good ☐ Good ☐ Fair ☐ Poor
Physical Activity	
How often, on average, do you do at least 30 minutes of moderate physical activity - like walking?	☐ Never ☐ Sometimes ☐ A couple of days a week ☐ Most days a week ☐ Everyday
Smoke	
Do you think you will be able to go 3 weekends without smoking?	☐ No ☐ Yes
Have you ever smoked?	☐ No ☐ Yes
Do you or did you smoke regularly? *("No" means less than 20 packs in a lifetime or less than 1 cigarette per day for 1 year).*	☐ No ☐ Yes
If you previously smoked but have stopped, in which year did you last smoke?	
How old were you when you first started regular cigarette smoking?	
On average, over the entire time you smoked, how many cigarettes did you smoke each day?	
Alcohol	
Do you think you will be able to go 3 weekends without alcohol?	☐ No ☐ Yes
In a typical week during the past year, on how many days did you consume an alcoholic drink of any type? Please check the appropriate answer.	☐ 0 days / do not drink alcohol ☐ 1 day ☐ 2 days ☐ 3 days ☐ 4 days ☐ 5 days ☐ 6 days ☐ 7 days
On days when you drink alcohol, how many standard drinks of beer, wine / or other type of alcohol would you have? *(Click here for list of standard drinks)* Please check the appropriate answer.	Workday(s) ☐ None ☐ 1-2 drinks ☐ 3-5 drinks ☐ 6-9 drinks ☐ 10 or more drinks
	Non-workday(s) ☐ None ☐ 1-2 drinks ☐ 3-5 drinks ☐ 6-9 drinks ☐ 10 or more drinks

Caffeine	
Do you think you will be able to go 3 weekends without caffeine?	☐ No ☐ Yes
In a typical day during the past week, how many caffeinated drinks did you have e.g. coffee, tea, coca cola, hot chocolate, energy drinks, soft drinks, ice teas? *(If you're unsure whether your drink contains caffeine click here to find out.)* Please check the appropriate answer.	☐ 0 drinks / I do not drink caffeine
	Workday(s) ☐ None ☐ 1-2 drinks ☐ 3-5 drinks ☐ 6-9 drinks ☐ 10 or more drinks
	Non-workday(s) ☐ None ☐ 1-2 drinks ☐ 3-5 drinks ☐ 6-9 drinks ☐ 10 or more drinks
How many hours before bedtime would you normally have your last drink containing caffeine?	Workday(s)
	Non-workday(s)

Save & Back

III. Medical history

Medical History

select a partcipant... Remove

1. Have you ever had any of these doctor-diagnosed illnesses or procedures?
If yes, how **old were you** when **first** diagnosed?

Please read through the list of medical conditions in the table below and tick only those conditions that you were diagnosed with and your age at the time of diagnosis.

Illness or Proceedure	Tick if diagnosed	Age of diagnosis
Adenoidectomy (adenoids surgically removed)		
Alcohol abuse		
Anaemia		
Angina or chest pain from a heart condition		
Anxiety disorder		
Arthritis		
Atrial fibrillation		
Attention deficit disorder		
Asthma		
Auditory defects or hearing impairments		
Bipolar Disorder		
Cancer *Please specify:*		
Carotid surgery (either endarterectomy or stent)		
Chronic back or neck pain		
Chronic bronchitis		
Chronic fatigue syndrome		
Cirrhosis of the liver		
Colour blindness		
Coronary bypass		
Coronary angioplasty or stent insertion		
Congestive heart failure		
Depression		
Diabetes		
Elevated cholesterol		
Emphysema or Chronic Obstructive Pulmonary Disease (COPD)		
Erectile dysfunction		
Eye disorder or disease		
Gastric or duodenal ulcer		
Gastro-oesophageal reflux (heartburn)		
Gout		
Hay fever		
Hepatitis		
High blood pressure (hypertension)		
Implant of cardiac pacemaker		
Inflammatory bowel disease (including Crohn's Disease and Ulcerative Colitis)		
Kidney failure		
Kidney stones		
Liver disease		
Motor neurone disease		
Multiple sclerosis		
Muscular dystrophy		
Myocardial infarction (heart attack)		
Nose with a deviated septum		
Osteoporosis		
Parkinson's disease		
Peripheral vascular disease of legs or claudication		
Pneumonia		
Polycystic ovarian syndrome		
Poliomyelitis		
Post-Traumatic Stress Disorder		
Sinus disease		
Stroke (CVA)		
Thyroid disease		
Transient ischemic attack (TIA)		
Tonsillectomy		
Other psychiatric disease *Please specify:*		
Other heart disease *Please specify:*		
Any history of a loss of consciousness *Please specify:*		
Other major surgery *Please specify:*		

Medications

Medication

select a partcipant... Remove

1. Do you take prescribed medications to help you sleep?

- not at all
- occasionally (1-2 times per month)
- sometimes (3-4 times per month)
- often (1-2 times per week)
- frequently (3 or more times per week)

2. Do you take other medications (including herbal or other supplements) to help you sleep?

- not at all
- occasionally (1-2 times per month)
- sometimes (3-4 times per month)
- often (1-2 times per week)
- frequently (3 or more times per week)

3. Please tick any medications that you currently take. If any of your medications are not listed below please list these medications in the last section of this question

Pain Killers and others

Taken in the past 6 months	Currently taken	Name
☐	☐	Aspirin (e.g. Solprin, Aspro, Disprin)
☐	☐	Fentanyl (e.g. Actiq Lozenge, Durogesic Patches)
☐	☐	Hydromorphone (e.g. Dilaudid)
☐	☐	Ibuprofen (e.g. Nurofen, Advil)
☐	☐	Ibuprofen–codeine (e.g. Chemists' Own Ibuprofen Plus Codeine, Nurofen Plus)
☐	☐	Morphine (e.g. Anamorph, Kapanol, MS Contin, MS Mono)
☐	☐	Oxycodone (e.g. Endone, OxyContin, OxyNorm, Targin)
☐	☐	Paracetamol (e.g. Panadol, Panamax)
☐	☐	Paracetamol–codeine (e.g. Codalgin, Mersyndol, Panadeine, Chemists' Own Pain Relief)
☐	☐	Tramadol (e.g. Lodam, Tramal, Zydol)

Cold and Flu medications

Taken in the past 6 months	Currently taken	Name
☐	☐	Antihistamine
☐	☐	Pseudoephedrine (e.g. Benadryl, Chemists' Own Cold & Flu, Codral, Demazin, Sudafed Sinus)

Anti-inflammatory medication

☐	☐	Betamethasone (e.g. Antroquoril)
☐	☐	Celecoxib (e.g. Celebrex)
☐	☐	Diclofenac (e.g. Voltaren)
☐	☐	Indomethacin (e.g. Indocid)
☐	☐	Meloxicam (e.g. Melox, Movalis, Mobic)
☐	☐	Naproxen (e.g. Anaprox, Inza, Naprogesic)
☐	☐	Prednisolone (e.g. Panafcortelone)
☐	☐	Prednisone (e.g. Panafcort)

Sleep and Anti-anxiety medications

Taken in the past 6 months	Currently taken	Name
☐	☐	Alprazolam (e.g. Xanax, Kalma)
☐	☐	Clonazepam (e.g. Rivotril, Paxam)
☐	☐	Diazepam (e.g. Valium, Antenex, Ducene)
☐	☐	Flunitrazepam (e.g. Hypnodorm)
☐	☐	Lorazepam (e.g. Ativan)
☐	☐	Melatonin (e.g. Circadin)
☐	☐	Nitrazepam (e.g. Mogadon, Alodorm)
☐	☐	Oxazepam (e.g. Serepax, Alepam, Murelax)
☐	☐	Temazepam (e.g. Normison, Temaze, Temtabs, Euhypnos)
☐	☐	Zopiclone (e.g. Imovane)
☐	☐	Zolpidem (e.g. Stilnox)

Anti-depressants

Taken in the past 6 months	Currently taken	Name
☐	☐	Agomelatine (e.g. Valdoxan)
☐	☐	Citalopram (e.g. Cipramil, Talam)
☐	☐	Escitalopram (e.g. Lexapro, Lexam)
☐	☐	Fluoxetine (e.g. Prozac, Lovan)
☐	☐	Lithium (e.g. Lithicarb, Quilonum)
☐	☐	Mirtazapine (e.g. Avanza, Axit)
☐	☐	Paroxetine (e.g. Aropax)
☐	☐	Sertraline (e.g. Zoloft)
☐	☐	Venlafaxine (e.g. Efexor)

Stimulants or Weight Reducing medications		
Taken in the past 6 months	Currently taken	Name
☐	☐	Dexamphetamine
☐	☐	Methylphenidate (e.g. Ritalin, Concerta)
☐	☐	Modafinil (e.g. Modavigil, Provigil)
☐	☐	Phentermine (e.g. Duromine, Metermine)

Blood Pressure and Heart medications		
Taken in the past 6 months	Currently taken	Name
☐	☐	Aldomet (e.g. Methyldopa)
☐	☐	Amiodarone (e.g. Aratac, Cordarone)
☐	☐	Amlodipine (e.g. Caduet, Norvasc)
☐	☐	Atenolol (e.g. Noten, Tenormin)
☐	☐	Candesartan (e.g. Atacand)
☐	☐	Captopril (e.g. Acenorm, Capoten)
☐	☐	Carvedilol (e.g. Kredex)
☐	☐	Diltiazem (e.g. Cardizem)
☐	☐	Disopyramide (e.g. Rythmodan)
☐	☐	Enalapril (e.g. Renitec)
☐	☐	Felodipine (e.g. Plendil, Felodur)
☐	☐	Fosinopril (e.g. Monace)
☐	☐	Irbesartan (e.g. Avapro, Karvea)
☐	☐	Lisinopril (e.g. Zestril)
☐	☐	Metoprolol (e.g. Betaloc, Lopresor)
☐	☐	Nifedipine (e.g. Adalat, Adefin, Addos)
☐	☐	Olmesartan (e.g. Olmetec)
☐	☐	Perindopril (e.g. Coversyl, Coveram)
☐	☐	Propranolol (e.g. Deralin, Inderal)
☐	☐	Ramipril (e.g. Prilace, Ramipril, Tryzan)
☐	☐	Telmisartan (e.g. Micardis)
☐	☐	Warfarin sodium (e.g. Coumadin, Marevan)

Cholesterol medications		
Taken in the past 6 months	Currently taken	Name
☐	☐	Atorvastatin (e.g. Lipitor)
☐	☐	Ezetimibe / Atorvastatin (e.g. Atozet)
☐	☐	Ezetimibe (e.g. Ezetrol)
☐	☐	Pravastatin (e.g. Pravachol)
☐	☐	Rosuvastatin (e.g. Crestor)
☐	☐	Simvastatin (e.g. Zocor)
☐	☐	Simvastatin / Ezetimibe (e.g. Vytorin)

Asthma and Airway medication		
Taken in the past 6 months	Currently taken	Name
☐	☐	Aclidinium (e.g. Bretaris)
☐	☐	Budesonide (e.g. Pulmicort)
☐	☐	Budesonide / Eformoterol (e.g. Symbicort)
☐	☐	Ciclesonide (e.g. Alvesco)
☐	☐	Fluticasone (e.g. Flixotide)
☐	☐	Fluticasone / Eformoterol (e.g. Flutiform)
☐	☐	Fluticasone / Salmeterol (e.g. Seretide)
☐	☐	Glycopyrronium (e.g. Seebri)
☐	☐	Indacaterol (e.g. Onbrez)
☐	☐	Salbutamol (e.g. Ventolin, Asmol)
☐	☐	Tiotropium (e.g. Spiriva)

Anti-psychotics		
Taken in the past 6 months	Currently taken	Name
☐	☐	Chlorpromazine (e.g. Largactil)
☐	☐	Haloperidol (e.g. Serenace)
☐	☐	Olanzapine (e.g. Zyprexa, Zydis)
☐	☐	Quetiapine (e.g. Seroquel)
☐	☐	Risperidone (e.g. Risperdal)

Restless Legs or Parkinson's Disease medications

Taken in the past 6 months	Currently taken	Name
☐	☐	Benztropine (e.g. Benztrop, Cogentin)
☐	☐	Bromocriptine (e.g. Kripton, Parlodel)
☐	☐	Cabergoline (e.g. Cabaser, Bergoline)
☐	☐	Gabapentin (e.g. Gabatine, Neurontin, Gabahexol)
☐	☐	Hyoscyamine (e.g. Donnatab)
☐	☐	Levodopa (e.g. Madopar, Sinemet)
☐	☐	Phenytoin (e.g. Dilantin)
☐	☐	Pramipexole (e.g. Sifrol)
☐	☐	Ropinirole (e.g. Repreve, Appese)
☐	☐	Other Restless Legs or Parkinson's disease medications cont.
☐	☐	Selegiline (e.g. Eldepryl)

Epilepsy medications (some also used for pain)

Taken in the past 6 months	Currently taken	Name
☐	☐	Carbamazepine (e.g. Tegretol)
☐	☐	Ethosuximide (e.g. Zarontin)
☐	☐	Phenobarbitone
☐	☐	Gabapentin (e.g. Gabatine, Neurontin, Gabahexol)
☐	☐	Lamotrigine (e.g. Lamictal, Lamogine)
☐	☐	Phenytoin (e.g. Dilantin)
☐	☐	Pregabalin (e.g. Lyrica)
☐	☐	Primidone (e.g. Mysoline)
☐	☐	Sodium valproate (e.g. Epilim, Valpro)
☐	☐	Tiagabine (e.g. Gabitril)

Thyroid Deficiency medication

Taken in the past 6 months	Currently taken	Name
☐	☐	Thyroxine (e.g. Eutroxsig, Oroxine)

Antibiotic medications

Taken in the past 6 months	Currently taken	Name
☐	☐	Amoxycillin (e.g. Amoxil, Alphamox)
☐	☐	Amoxycillin / Clavulanic Acid (e.g. Augmentin Duo)
☐	☐	Cephalexin (e.g. Keflex, Cilex)
☐	☐	Chloramphenicol eye (e.g. Chlorsing eye drops)
☐	☐	Roxithromycin (e.g. Biaxsig, Roxar, Roximycin)

Gastrointestinal System medications

Taken in the past 6 months	Currently taken	Name
☐	☐	Esomeprazole (e.g. Nexium)
☐	☐	Omeprazole (e.g. Losec, Acimax)
☐	☐	Pantoprazole (e.g. Somac)
☐	☐	Rabeprazole (e.g. Pariet)
☐	☐	Ranitidine (e.g. Zantac)

Blood glucose lowering medication

Taken in the past 6 months	Currently taken	Name
☐	☐	Gliclazide (e.g. Diamicron)
☐	☐	Insulin (e.g. Novorapid, Humalog, Actrapid, Humulin, Mixtard, Novomix, Levemir, Lantus)
☐	☐	Metformin (e.g. Diabex, Diaformin)
☐	☐	Metformin / Glibenclamide (e.g. Glucovance)
☐	☐	Pioglitazone (e.g. Actos)
☐	☐	Rosiglitazone (e.g. Avandia)

Oral Contraception (for women only)

Taken in the past 6 months	Currently taken	Name
☐	☐	Cyproterone / Ethinyloestradiol (e.g. Brenda, Diane, Estelle, Juliet)
☐	☐	Drospirenone / Ethinyloestradiol (e.g. Yasmin, Yaz)
☐	☐	Levonorgestrel / Ethinyloestradiol (e.g. Levlen, Microgynon, Logynon, Trifeme, Triphasil)

Other medications

Taken in the past 6 months	Currently taken	Name
☐	☐	Topical steroids
☐	☐	Other hormonal contraception
☐	☐	Sex steroids (for males only)
☐	☐	Any health food supplements or herbal remedies

If you take any medications which are not listed above, please specify these below.

Save & Back

IV. Sleep Disorders and Patterns

Sleep Disorders & Patterns

select a partcipant... Remove

1. Have you been diagnosed with any of the following sleep conditions by a doctor?.

Please tick all that apply.

- ☐ Sleep Apnea
- ☐ Insomnia
- ☐ Narcolepsy
- ☐ Restless Legs or Periodic Leg Movements during Sleep
- ☐ Bruxism (teeth grinding)
- ☐ REM Behavioural Disorder
- ☐ Parasomnias (sleep walking, sleep talking, night terrors)
- ☐ Obesity Hypoventilation Syndrome
- ☐ Delayed Sleep Phase Disorder
- ☐ I have not been diagnosed with any sleep condition

Sleep Apnea

2. If you selected 'Sleep Apnea' as a diagnosed condition for question 1, were any of the following treatments recommended or prescribed for your sleep apnea? (multiple selections allowed)

If you select any of following treatments, please also indicate if you are still using this treatment on a regular basis.

		Are you still using this treatment on a regular basis?		
	Tick	Yes	No	Why Not
Continuous positive airway pressure (CPAP) machine	☐	☐	☐	
Mandibular advancement splint, dental device or oral appliance	☐	☐	☐	
Lifestyle advice (e.g. diet, exercise, weight loss program)	☐	☐	☐	
Medications prescribed by your doctor that help you stay awake (e.g. modafinil (Provigil, Modavigil), Ritalin, Amphetamine)	☐	☐	☐	
Over the counter treatments or drugs not prescribed by your doctor (e.g. snore strips, snore sprays, snore rings)	☐	☐	☐	
Positional treatments (e.g. tennis ball, something to stop you rolling on your back)	☐	☐	☐	
Other	☐	☐	☐	
Surgery	☐			
Waiting for treatment	☐			
No treatment	☐			

i. If you selected the 'Surgery' option in question 2, please specify the type and year of surgery:

	Tick	Year	
Palatal surgery	☐		
Tonsillectomy	☐		
Nose surgery	☐		
Laser treatment	☐		
Surgery for weight loss	☐		
Other	☐		Please specify

Insomnia

3. If you selected 'Insomnia' as a diagnosed condition for question 1, were any of the following treatments recommended or prescribed for your insomnia? (multiple selections allowed)

If you select any of following treatments, please also indicate if you are still using this treatment on a regular basis.

		Are you still using this treatment on a regular basis?		
	Tick	Yes	No	Why Not
Referral to psychologist / cognitive behavioural therapy (CBT) program	☐	☐	☐	
Referral to a psychiatrist	☐	☐	☐	
Lifestyle advice (e.g. diet, exercise, weight loss program)	☐	☐	☐	
Medications prescribed by your doctor that help you sleep	☐	☐	☐	
Over the counter treatments / drugs not prescribed by your doctor (e.g. valerian, herbal remedies, magnesium, melatonin)	☐	☐	☐	
Acupuncture or hypnotherapy	☐	☐	☐	
Meditation, yoga, and / or relaxation techniques	☐	☐	☐	
Other	☐	☐	☐	
Waiting for treatment	☐			
No treatment	☐			

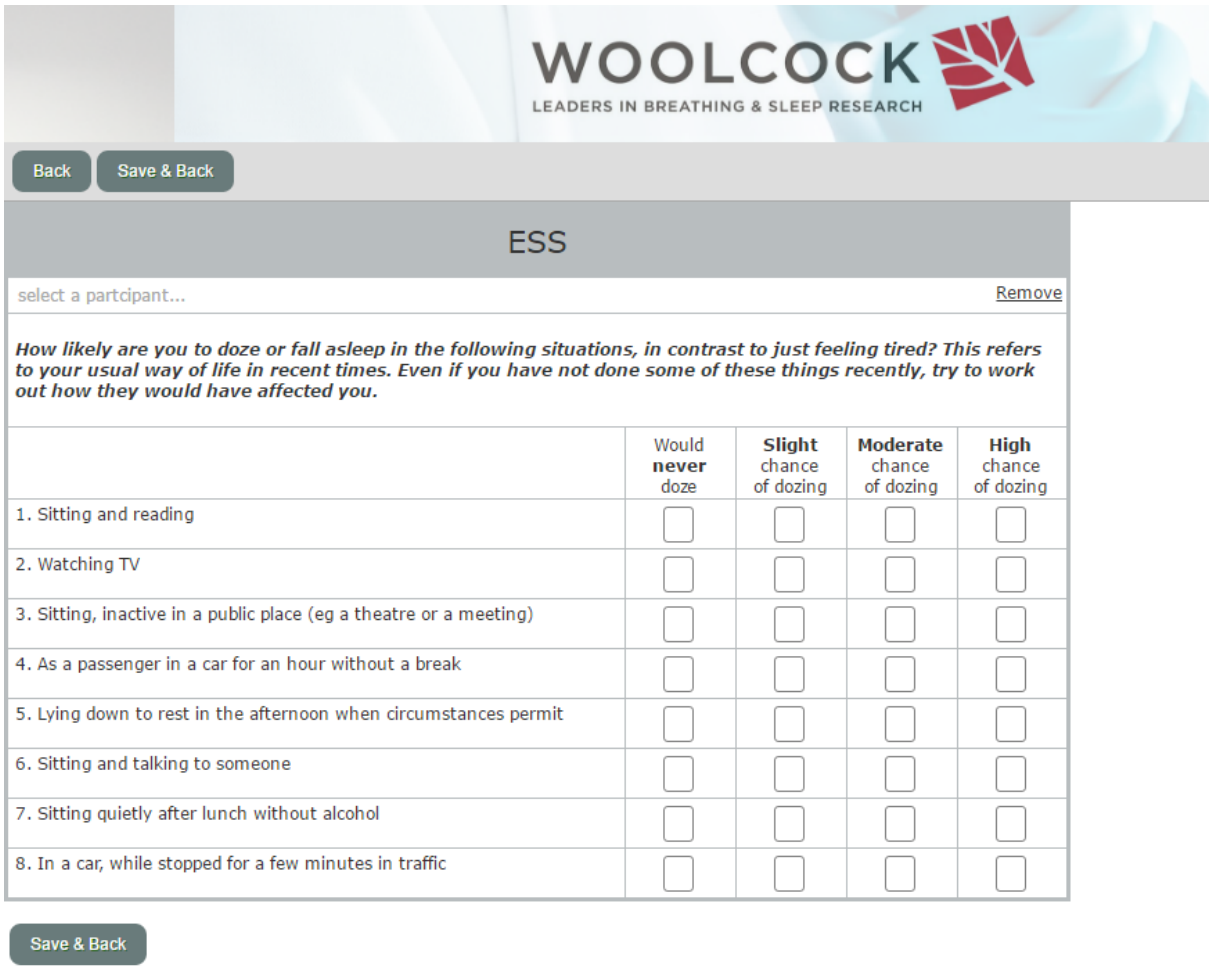
Other diagnosed condition

4. For any other diagnosed condition, were any of the following treatments recommended or prescribed for your condition? (multiple selections allowed)

If you select any of following treatments, please also indicate if you are still using this treatment on a regular basis.

		Are you still using this treatment on a regular basis?		
	Tick	Yes	No	Why Not
Lifestyle advice (e.g. developing good sleep habits, avoiding sleep deprivation)	☐	☐	☐	
Referral to a psychiatrist	☐	☐	☐	
Medications prescribed by your doctor	☐	☐	☐	
Other	☐	☐	☐	
Waiting for treatment	☐			
No treatment	☐			

V. Epworth Sleepiness Scale (ESS)



VI. Horne & Ostberg Morningness-Eveningness Composite Questionnaire

Horne and Ostberg Morningness-Eveningness Composite Questionnaire

select a partcipant... Remove

1. Considering only your own "feeling best" rhythm, at what time of day would you get up if you were entirely free to plan your day?	☐ 5:00am-6:30am (5) ☐ 6:30am-7:45am (4) ☐ 7:45am-9:45am (3) ☐ 9:45am-11:00am (2) ☐ 11:00am-12:00 noon (1)
2. Consider your only "feeling best" rhythm, at what time would you go to bed if you were entirely free to plan your evening?	☐ 8:00pm-9:00pm (5) ☐ 9:00pm-10:15pm (4) ☐ 10:15pm-12:30am (3) ☐ 12:30am-1:45am (2) ☐ 1:45am-3:00am (1)
3. Assuming normal circumstance, how easy do you find getting up in the morning?	☐ Not at all easy (1) ☐ Slightly easy (2) ☐ Fairly easy (3) ☐ Very easy (4)
4. How alert do you feel during the first half an hour after having awakened in the morning?	☐ Not at all alert (1) ☐ Slightly alert (2) ☐ Fairly alert (3) ☐ Very alert (4)
5. During the first half hour after having awakened in the morning, how tired do you feel?	☐ Very tired (1) ☐ Fairly tired (2) ☐ Fairly refreshed (3) ☐ Very refreshed (4)
6. You have decided to engage in some physical exercise. A friend suggests that you do this one hour twice a week and the best time for him is 7:00am-8:00am. Bearing in mind nothing else but your own "feeling best" rhythm, how do you think you will perform?	☐ Would be in good form (4) ☐ Would be in reasonable form (3) ☐ Would find it difficult (2) ☐ Would find it very difficult (1)
7. At what time in the evening do you feel tired and, as a result, in need of sleep?	☐ 8:00pm-9:00pm (5) ☐ 9:00pm-10:15pm (4) ☐ 10:15pm-12:30am (3) ☐ 12:30am-1:45am (2) ☐ 1:45am-3:00am (1)
8. You wish to be at your peak performance for a test which you know is going to be mentally exhausting and lasting for two hours. You are entirely free to plan your day, and consider only your "feeling best" rhythm, which ONE of the four testing times would you choose?	☐ 8:00am-10:00am (4) ☐ 11:00am-1:00pm (3) ☐ 3:00pm-5:00pm (2) ☐ 7:00pm-9:00pm (1)
9. One hears about "morning" and "evening" types of people. Which ONE of these types do you consider yourself to be?	☐ Definitely a "morning" type (4) ☐ More a "morning" than an "evening" type (3) ☐ More an "evening" than a "morning" type (2) ☐ Definitely an "evening" type (1)
10. When would you prefer to rise (provided you have a full day's work of 8hours) if you were totally free to arrange your time?	☐ Before 6:30am (4) ☐ 6:30-7:30am (3) ☐ 7:30-8:30am (2) ☐ 8:30am or later (1)
11. If you always had to rise at 6:00am, what do you think it would be like?	☐ Very difficult and unpleasant (1) ☐ Rather difficult and unpleasant (2) ☐ A little unpleasant but no great problem (3) ☐ Easy and not unpleasant (4)
12. How long a time does it usually take before you "recover your senses" in the morning after rising from a night's sleep?	☐ 0-10 minutes (4) ☐ 11-20 minutes (3) ☐ 21-40 minutes (2) ☐ More than 40 minutes (1)
13. Please indicate to what extent you are a morning or evening active individual?	☐ Pronounced morning active (morning alert and evening tired) (4) ☐ To some extent, morning active (3) ☐ To some extent, evening active (2) ☐ Pronounced evening active (morning tired and evening alert) (1)

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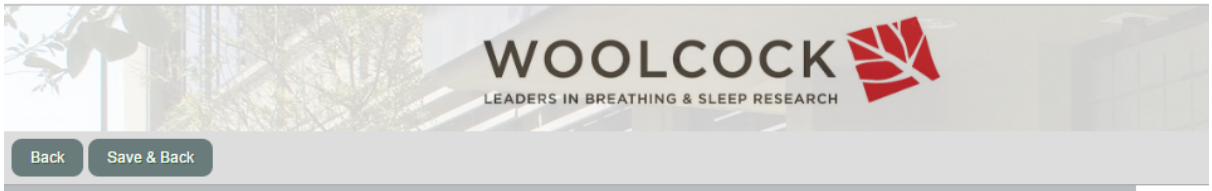
VII. Claustrophobia Questionnaire – Restriction Subscale



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Restriction subscale of Claustrophobia Questionnaire

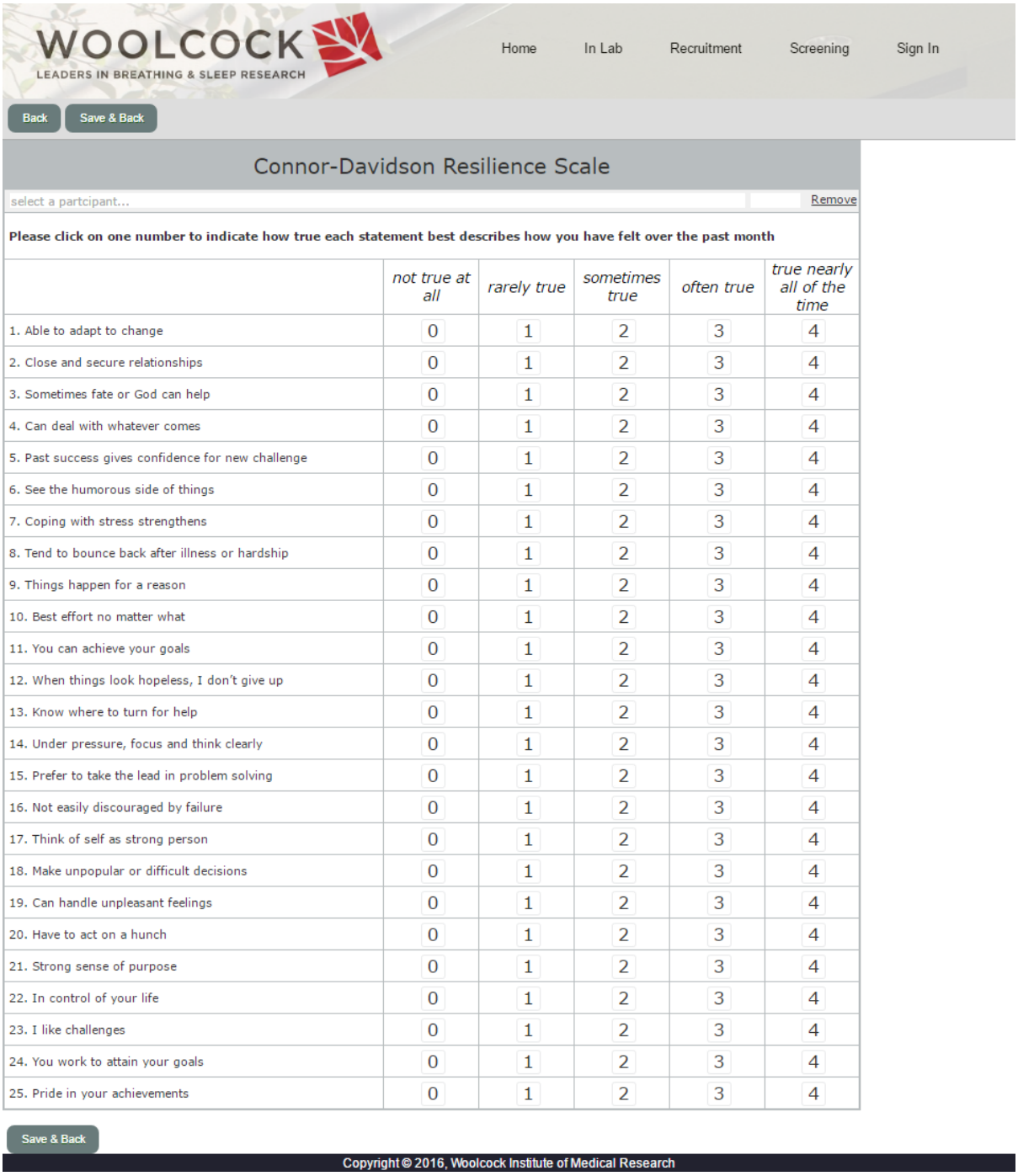
select a partcipant... Remove

How anxious would you feel in these places or situations?

	Not at all anxious	*Slightly anoxious*	*Moderately anxious*	*Very anxious*	*Extremely anxious*
1. Locked in a small DARK room without windows for 15 min	0	1	2	3	4
2. Locked in a small WELL-LIT room without windows for 15 min	0	1	2	3	4
3. Handcuffed for 15 min	0	1	2	3	4
4. Tied up with hands behind back for 15 min	0	1	2	3	4
5. Caught in tight clothing and unable to remove it	0	1	2	3	4
6. Standing for 15 min in a straitjacket	0	1	2	3	4
7. Lying in a tight sleeping bag enclosing legs and arms, tied at the neck, unable to get out for 15 min	0	1	2	3	4
8. Head first into a zipped up sleeping bag, able to leave whenever you wish	0	1	2	3	4
9. Lying in the trunk of a car with air flowing through freely for 15 min	0	1	2	3	4
10. Having your legs tied to an immovable chair	0	1	2	3	4
11. In a public washroom and the lock jams	0	1	2	3	4
12. In a crowded train which stops between stations	0	1	2	3	4
13. Standing in an elevator on the ground floor with the doors closed	0	1	2	3	4
14. Having a bad cold and finding it difficult to breathe through your nose	0	1	2	3	4

Save & Back

VIII. Connor Davidson Resilience Scale



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Connor-Davidson Resilience Scale

select a partcipant... Remove

Please click on one number to indicate how true each statement best describes how you have felt over the past month

	not true at all	*rarely true*	*sometimes true*	*often true*	*true nearly all of the time*
1. Able to adapt to change	0	1	2	3	4
2. Close and secure relationships	0	1	2	3	4
3. Sometimes fate or God can help	0	1	2	3	4
4. Can deal with whatever comes	0	1	2	3	4
5. Past success gives confidence for new challenge	0	1	2	3	4
6. See the humorous side of things	0	1	2	3	4
7. Coping with stress strengthens	0	1	2	3	4
8. Tend to bounce back after illness or hardship	0	1	2	3	4
9. Things happen for a reason	0	1	2	3	4
10. Best effort no matter what	0	1	2	3	4
11. You can achieve your goals	0	1	2	3	4
12. When things look hopeless, I don't give up	0	1	2	3	4
13. Know where to turn for help	0	1	2	3	4
14. Under pressure, focus and think clearly	0	1	2	3	4
15. Prefer to take the lead in problem solving	0	1	2	3	4
16. Not easily discouraged by failure	0	1	2	3	4
17. Think of self as strong person	0	1	2	3	4
18. Make unpopular or difficult decisions	0	1	2	3	4
19. Can handle unpleasant feelings	0	1	2	3	4
20. Have to act on a hunch	0	1	2	3	4
21. Strong sense of purpose	0	1	2	3	4
22. In control of your life	0	1	2	3	4
23. I like challenges	0	1	2	3	4
24. You work to attain your goals	0	1	2	3	4
25. Pride in your achievements	0	1	2	3	4

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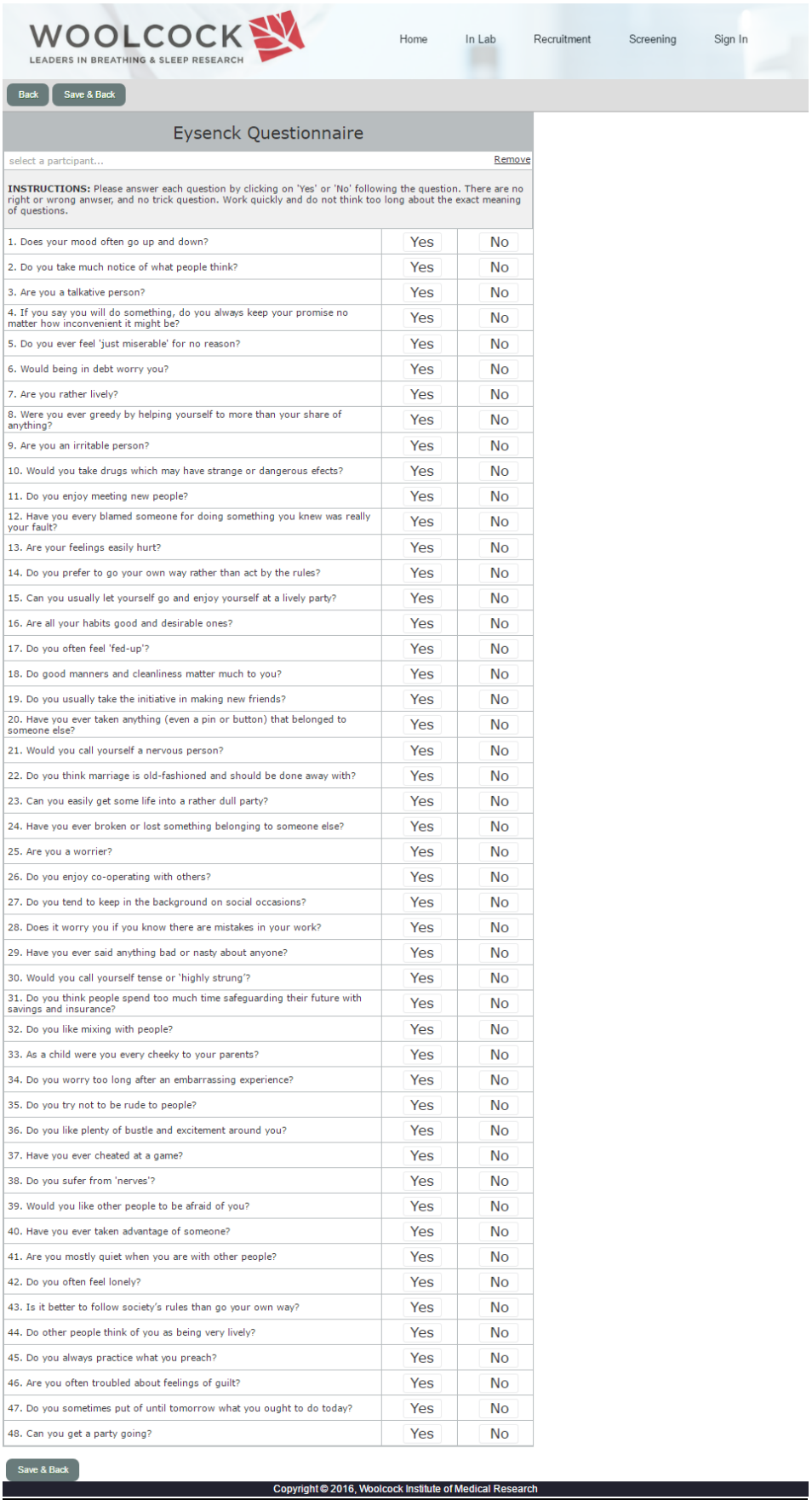
IX. EYSENCK Personality Questionnaire Revised (EPQ-R)



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Eysenck Questionnaire

select a partcipant... Remove

INSTRUCTIONS: Please answer each question by clicking on 'Yes' or 'No' following the question. There are no right or wrong anwser, and no trick question. Work quickly and do not think too long about the exact meaning of questions.

1. Does your mood often go up and down?	Yes	No
2. Do you take much notice of what people think?	Yes	No
3. Are you a talkative person?	Yes	No
4. If you say you will do something, do you always keep your promise no matter how inconvenient it might be?	Yes	No
5. Do you ever feel 'just miserable' for no reason?	Yes	No
6. Would being in debt worry you?	Yes	No
7. Are you rather lively?	Yes	No
8. Were you ever greedy by helping yourself to more than your share of anything?	Yes	No
9. Are you an irritable person?	Yes	No
10. Would you take drugs which may have strange or dangerous efects?	Yes	No
11. Do you enjoy meeting new people?	Yes	No
12. Have you every blamed someone for doing something you knew was really your fault?	Yes	No
13. Are your feelings easily hurt?	Yes	No
14. Do you prefer to go your own way rather than act by the rules?	Yes	No
15. Can you usually let yourself go and enjoy yourself at a lively party?	Yes	No
16. Are all your habits good and desirable ones?	Yes	No
17. Do you often feel 'fed-up'?	Yes	No
18. Do good manners and cleanliness matter much to you?	Yes	No
19. Do you usually take the initiative in making new friends?	Yes	No
20. Have you ever taken anything (even a pin or button) that belonged to someone else?	Yes	No
21. Would you call yourself a nervous person?	Yes	No
22. Do you think marriage is old-fashioned and should be done away with?	Yes	No
23. Can you easily get some life into a rather dull party?	Yes	No
24. Have you ever broken or lost something belonging to someone else?	Yes	No
25. Are you a worrier?	Yes	No
26. Do you enjoy co-operating with others?	Yes	No
27. Do you tend to keep in the background on social occasions?	Yes	No
28. Does it worry you if you know there are mistakes in your work?	Yes	No
29. Have you ever said anything bad or nasty about anyone?	Yes	No
30. Would you call yourself tense or 'highly strung'?	Yes	No
31. Do you think people spend too much time safeguarding their future with savings and insurance?	Yes	No
32. Do you like mixing with people?	Yes	No
33. As a child were you every cheeky to your parents?	Yes	No
34. Do you worry too long after an embarrassing experience?	Yes	No
35. Do you try not to be rude to people?	Yes	No
36. Do you like plenty of bustle and excitement around you?	Yes	No
37. Have you ever cheated at a game?	Yes	No
38. Do you sufer from 'nerves'?	Yes	No
39. Would you like other people to be afraid of you?	Yes	No
40. Have you ever taken advantage of someone?	Yes	No
41. Are you mostly quiet when you are with other people?	Yes	No
42. Do you often feel lonely?	Yes	No
43. Is it better to follow society's rules than go your own way?	Yes	No
44. Do other people think of you as being very lively?	Yes	No
45. Do you always practice what you preach?	Yes	No
46. Are you often troubled about feelings of guilt?	Yes	No
47. Do you sometimes put of until tomorrow what you ought to do today?	Yes	No
48. Can you get a party going?	Yes	No

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X. Attitudes on Wind Farms

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Attitudes on Wind Farms

select a partcipant... Remove

How concerned are you about the health effects of infrasound generated from Wind Farms?

Completely Unconcerned	*Unconcerned*	*Somewhat unconcerned*	*Neither unconcerned or concerned*	*Somewhat concerned*	*Concerned*	*Extremely Concerned*
0	1	2	3	4	5	6

D. Actiwatch and Sleep Diary

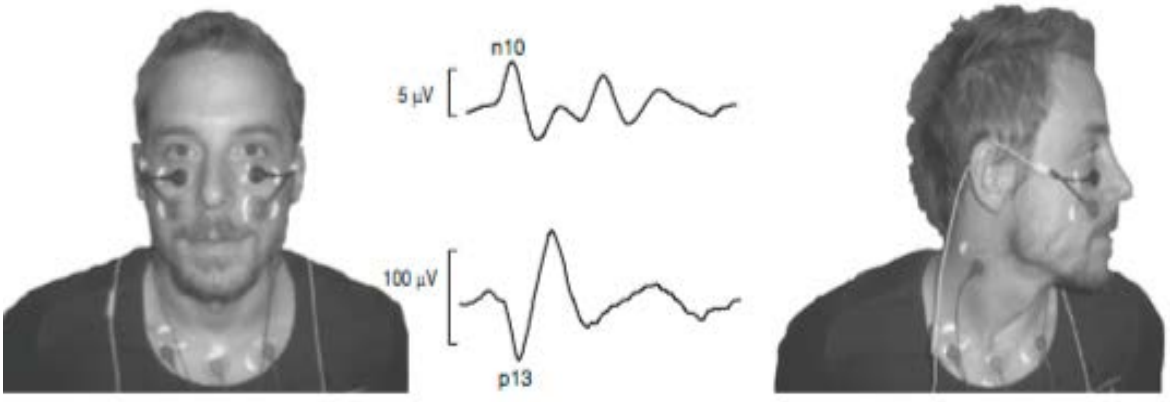
I. Actiwatch

II. Sleep Diary

	Day 1
S1. Today's Date (dd/mm/yy)	
S2. Time	_____ h_____min
S3. What time did you go to bed?	_____ h_____min
S4. What time did you attempt to fall asleep?	_____ h_____min
S5. How long did it take you to fall asleep?	_____ h_____min
S6. What time did you finally	_____ h_____min
S7. How long did you sleep?	_____ h_____min
S8. How long did you stay in bed before getting up?	_____ h_____min
S9. How many times did you awaken? List each: approximately when you woke and for how long.	Number of times: When? _____ h_____min Length? _____ h_____min
S10. Did anything disturb your sleep? **[Yes / No] (check all that apply)**	☐ Noise ☐ Work Duties ☐ Thoughts on mind ☐ Toilet (#) ☐ Light ☐ Aches/Pains/Physical Discomfort ☐ Air Temperature ☐ Electronic Media (Phone/Email/SMS) ☐ Other: _____
S11. How would you rate your quality of sleep?	1= Best Sleep ever 2 3 4 5 = Neither best nor worst sleep 6 7 8 9 = Worst Sleep ever
S12. Please indicate the number which best describes how sleepy you have felt in the preceding 5 minutes	1 – extremely alert 2 – very alert 3 – alert 4 – rather alert 5 – neither alert nor sleepy 6 – some signs of sleepiness 7 – sleepy but no effort to stay awake 8 – sleepy but some effort to stay awake 9 – very sleepy, fighting sleep, great effort to stay awake
S13. Did you have any caffeine yesterday? [Yes / No] (indicate how much)	coffee_____ cups tea _____cups caffeinated soft drinks _____ cans caffeine pills _____(100mg) _____(200mg
S14. Did you have any alcohol yesterday? [Yes / No] (indicate how much)	beer _____ (375 ml glasses/bottles/cans) wine _____ (150 ml glasses) spirits _____ (30 ml nip)
S15. Did you exercise in the last 24 hours?	[Yes/No] How many times? When? _____ h_____min For how long? _____ h_____min How strenuous? (low, medium, high)
S16. Did you nap yesterday? [Yes / No] **How many times?** **List each: when the nap started and when it ended**	[Yes / No] Nap start _____ h_____min Nap end _____ h_____min
S17. Did you take sleeping pills to help you sleep?	[Yes/No] Was it ☐ Prescribed ☐ Over-the-counter Please provide details:
S18. How many times did you remove your activatch?	Number: Activatch removed at: _____ h_____min Put back on at: _____ h_____min
Comments	

E. Neurotological Assessment

I. Vestibular Evoked Myogenic Potentials – Setup and Equipment



Mini Shaker Oscillator:

II. Video Head Impulse Test (VHIT)

III. Otoacoustic Emissions

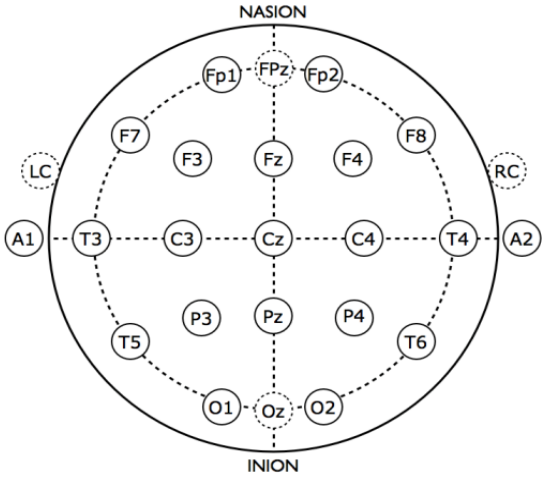
IV. Pure tone Audiometer

V. Videonystagmography

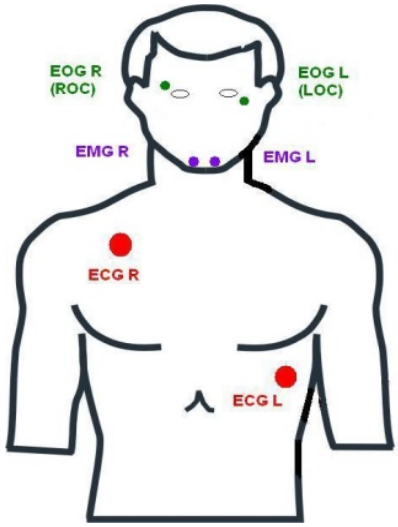
VI. Tympanometer

F. Electroencephalography (EEG) and Polysomnography (PSG) setup

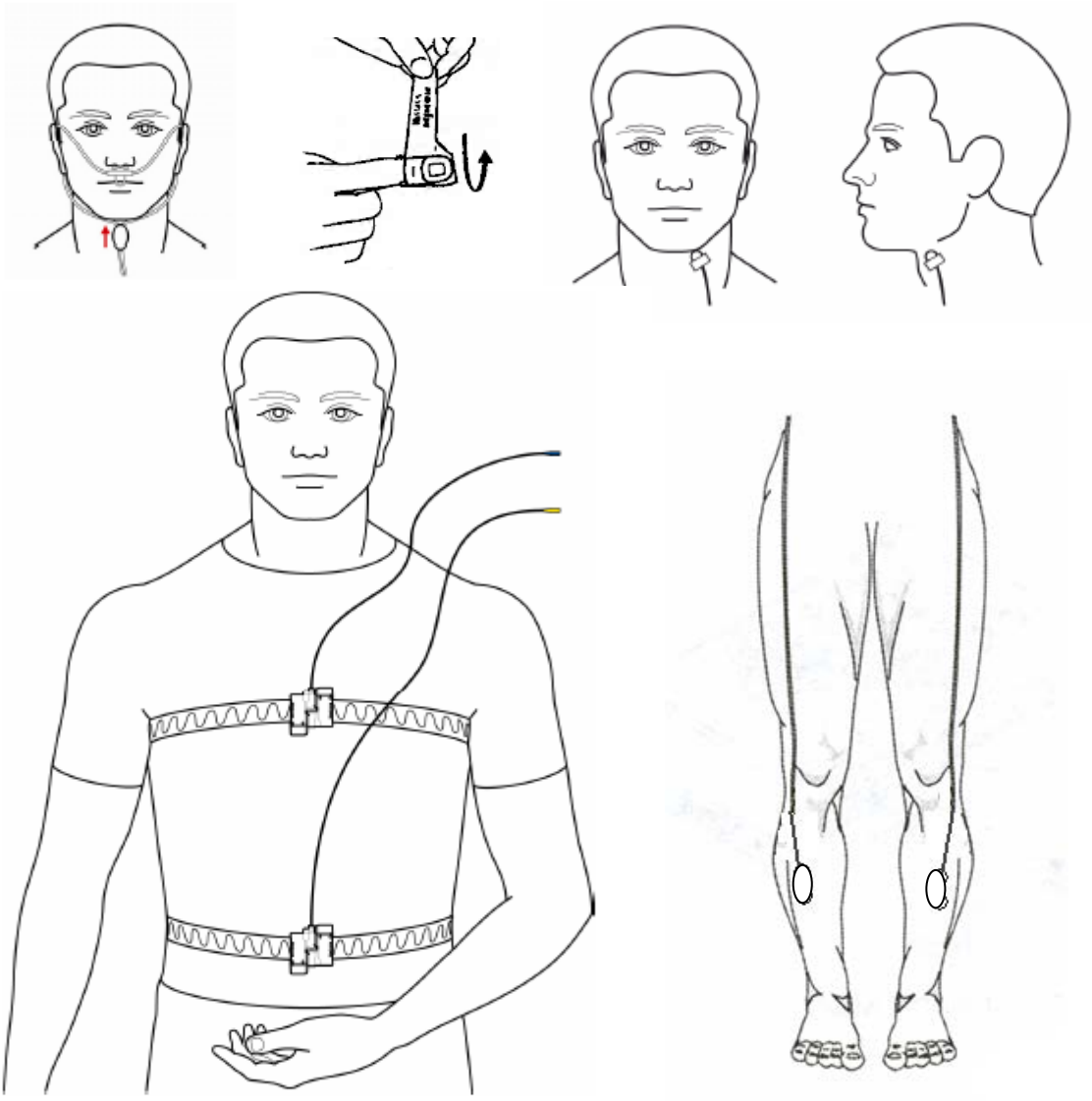
I. EEG setup



II. Additional ECG, EOG and EMG Chin electrode placements.

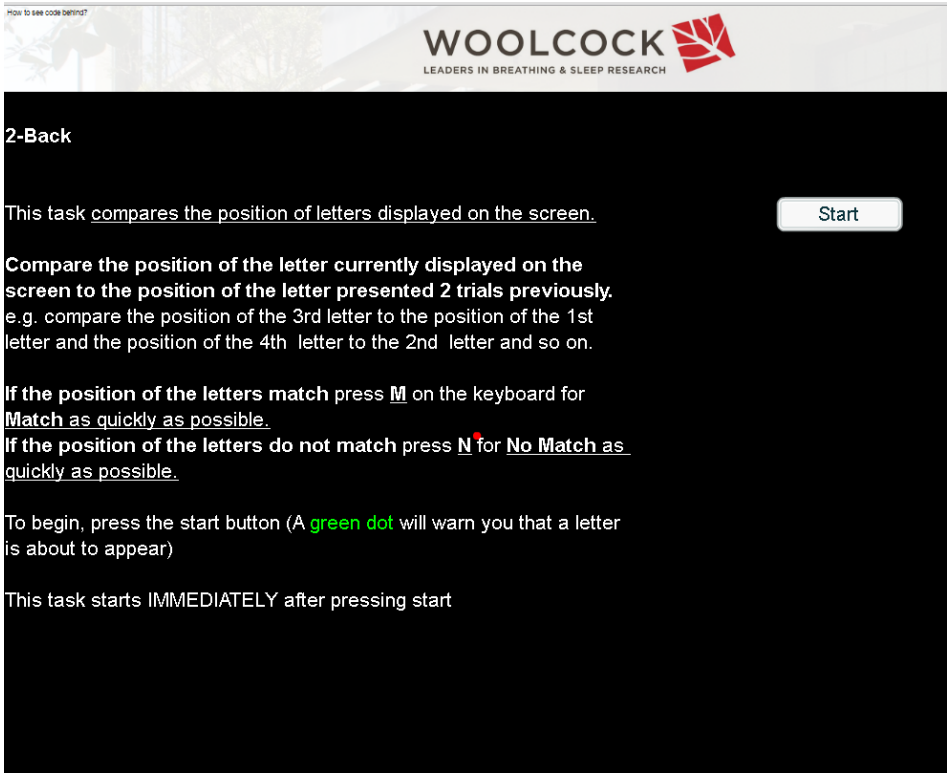


III. Additional PSG electrodes

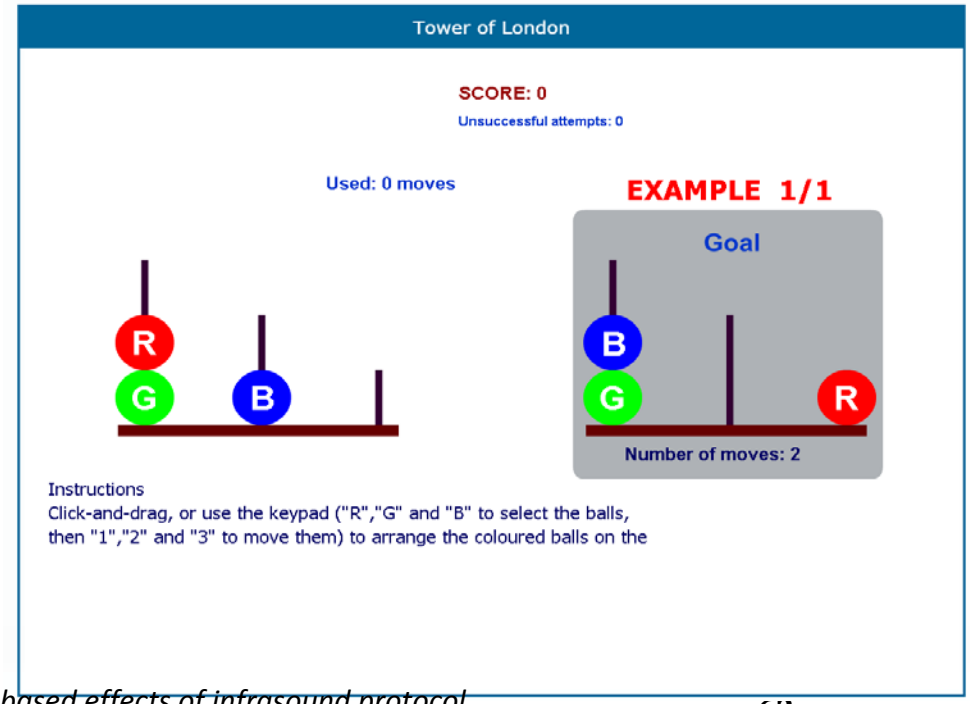


G. Neurocognitive Test

I. N-back (2-Back)



II. Tower of London



III. Psychomotor Vigilance Task

H. Cardiovascular and stress measures

I. Oscar 2 Device (24 Hour Blood pressure and Pulse Wave analysis device)

II. EndoPAT device (Endothelial function test)

III. SphygmaCor Xcel Device (Pulse Wave Velocity) and Tonometer

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