Royal Commission into Aged Care Quality and Safety

Submission by the Australasian Sleep Association and Sleep Health Foundation

The Australasian Sleep Association (ASA) is the peak scientific body in Australia & New Zealand representing clinicians, scientists and researchers in the broad area of Sleep.

The Sleep Health Foundation (SHF) is Australia's leading advocate for healthy sleep, through promoting awareness of the benefits of good sleep to the community and advocacy to government and the community.

The ASA and SHF have worked together to identify three of the most pressing issues regarding the Quality and Safety of Aged Care and Sleep. The three issues being:

- Lighting to improve cognition, mood, sleep and health in aged care facilities
- Safe prescribing of sleeping medications and regular monitoring to determine need and desirability.
- Screening for sleep disorders, especially moderate to severe sleep apnea - particularly given research linking untreated OSA with risk of dementia.

Members of the two organisations with expertise in each area were co-opted to write a submission on each topic and these are combined within this document to form one submission on behalf of the ASA and SHF. We believe that sleep is a crucial issue in ensuring the well-being of the elderly, both in the home and in aged care facilities, and we urge the Royal Commission to consider these three important issues when reporting recommendations.

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Lighting to improve cognition, mood, sleep and health in aged care facilities

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Introduction

In 2016-2017, nearly 300,000 people in Australia lived in permanent or respite residential care (SCRGSP, 2018). With the percentage of people aged 65 years or over in Australia projected to increase from 15% in 2017 to between 21% and 23% in 2066 (Australian Bureau of Statistics, 2018), there will be a much greater demand for residential care in the future. Together with the need for more facilities, cost-effective strategies to improve health for this increasing population is needed to improve quality of life and reduce the burden on the healthcare system. In this submission, we highlight the manipulation of lighting as a safe and effective non-pharmacological strategy to improve cognition and health in older people.

In addition to allowing us to see, light has been shown to have a number of 'non-visual' benefits on our physiology including directly improving alertness and cognitive function, reducing depression and improving sleep. Lighting is a proven, non-invasive, non-pharmaceutical, safe, reversible and relatively inexpensive intervention that can help change the behavior, health, wellbeing and quality of life of individuals in aged care, and particularly those vulnerable individuals who may be relatively immobile and not have much access to natural light. Every nursing home will be faced with upgrading their lighting in the coming years, particularly with a view to improving energy efficiency and therefore it makes sense to provide lighting that can also benefit the health of residents – to do otherwise is an enormous missed opportunity. We can take advantage of the recent development in LED technology to provide lighting that is both more energy-efficient and health-promoting as aged care homes replace and upgrade the lighting in their facilities. Developing national policies to support this approach will have substantial cost-effective sustainable benefits on the health and wellbeing of Australian aged care residents.

'Non-visual' effects of light

The eye detects light for a range of physiological responses separate and apart from sight. Light exposure to the eyes stimulates a range of responses including alerting the brain and resetting the circadian (24-hour) body clock that controls daily rhythms of many aspects of our biology including sleep, hormones, temperature, and metabolism. Light also improves mood, elevates morning cortisol levels, suppresses night-time melatonin release, increases heart rate and temperature at night, and increasing alertness and performance during both day and night. These wide-ranging effects of light are collectively called 'non-visual', 'non-image forming' or circadian responses to light (for review, see Fisk et al., 2019).

Until 20 years ago, it was thought that all light responses by the eye were driven by the rods (night vision) and cones (colour vision) that are used to see. Studies in blind humans and animals have showed that damaging rods and cones does not always stop the 'non-visual' effects of light,

however. These 'non-visual' light responses are mediated primarily by a novel light-sensitive chemical (photopigment) called melanopsin that is located in the retinal ganglion cell layer of the eye, a part of the eye that was previously unknown to detect light. Melanopsin is most responsive to short-wavelength (blue) light, with a peak sensitivity around 480 nm. Based on these findings, new lighting products have been developed that increase the proportion of blue wavelengths in white light to improve alertness and performance (Fisk et al., 2019).

Many controlled laboratory studies have shown that blue light or blue-enriched white light, and higher intensity light, can preferentially improve reaction time and other measures of performance, improve subjective measures of alertness and mood, decrease sleepiness based on brain activity measures, reset the circadian clock and suppress melatonin (e.g., Brainard et al., 2001; Thapan et al; 2001; Lockley et al., 2003; Cajochen et al., 2005; Lockley et al., 2006; Phipps-Nelson et al., 2009; Gooley et al., 2010) including in older people (e.g., Herljevic et al., 2005; Sletten et al., 2009; Münch et al., 2011; Scheuermaier et al., 2018). While most of this work has been performed for night-time exposures, blue-enriched and higher intensity light has also been shown to improve daytime alertness and performance (e.g., Phipps-Nelson et al., 2003; Rueger et al., 2006; Vandewalle et al., 2009; Rahman et al., 2014). Furthermore, blue and blue-enriched white light have been shown to be effective in treating winter depression (seasonal affective disorder, SAD), fatigue associated with a traumatic brain injury and fatigue ('chemobrain') due to chemotherapy (Glickman et al., 2006; Anderson et al., 2009; Ancoli-Israel et al., 2012; Sinclair et al., 2014).

In non-clinical populations, blue-enriched and higher intensity lighting has been used to improve office productivity and performance in schools. Office workers reported significant improvements in self-reported measures of alertness, positive mood, performance, evening fatigue, irritability, concentration and eye discomfort working in blue-enriched white light compared to standard (3000-4000K) lighting, without significant side-effects (Mills et al., 2008; Viola et al., 2008). In schools, a number of studies have shown that blue-enriched and higher intensity can improve measures of concentration and reading comprehension compared to current standard lighting (e.g., Barkmann et al., 2012; Mott et al. 2012; Sleegers et al., 2013; Keis et al., 2014). Similar benefits of blue-enriched white light have been shown in college-aged students (Rautkylä et al., 2010; Teixeira et al., Sleep Med 2013). In industrial settings, blue-enriched light has been shown to reduce memory errors, improve reaction time and improve subjective alertness (Lowden & Akerstedt, 2012; Motamedzadeh et al., 2017; Sletten et al., 2017) compared to standard lighting.

If higher intensity and blue-enriched light alert the brain, then it follows that reducing the light level and minimizing blue light exposure should increase sleepiness and promote sleep. A number of studies have shown that altering light level or blue-depleting light sources (particularly around ~480 nm) before bed will increase sleepiness, reduce the amount of time it takes to fall asleep and improve sleep depth and quality (e.g., Chellappa et al., 2011; Chang et al., 2012; Chellappa et al., 2013; Rahman et al., 2017). Lighting solutions in places where people sleep therefore need to be able to change the intensity and spectrum of light from day to night to maximize health.[1]

[1] Since these 'non-visual' responses peak at approximately 480 nm, standard photopic illumination measures such as lux or footcandles, which are calibrated for the human color vision (photopic) system (which peaks at 555 nm), do not accurately express the 'strength' of stimulus on non-visual responses. New standard international (SI) units have therefore been proposed by the CIE to define light for these purposes. While Correlated Colour Temperature (CCT) has been used as a shorthand to predict the non-visual effects of light (as higher CCT light sources tend to have more short wavelength [blue] light), CCT is also not sufficiently accurate to describe the health benefits of light. Lighting designers and architects can calculate the new SI units easily, however (CIE, 2018).

Light and aged care

In addition to the applied studies outlined briefly above, there are a number of specific studies demonstrating the benefits of improved lighting in an aged care setting. In a seminal randomized, placebo-controlled, double-blind clinical trial, Riemersma-van der Lek and colleagues studied 189 nursing home residents (mean 86 years old, 90% female, 87% with dementia), across 12 sites, who were randomized to receive bright light (1000 lux) in the common areas during the day (9am-6pm) or current lighting (control, 300 lux) combined with either evening melatonin treatment or placebo (Riemersma-van der Lek et al., 2008). Isolating the effects of light only (bright light and placebo vs dim light and placebo), over a period of up to 3.5 years (mean (SD) of 15 (12) months), light treatment caused a significant slowing of cognitive decline (0.9 points, or 5%, on the Mini Mental State Examination), significantly decreased depression by 19% (1.5 points on the Cornell Scale for Depression in Dementia [CSDD]), and significantly slowed the rate of functional limitations by half (53% or 1.8 points per year) according to the nurse-informant activity of daily living. These effects are clinically meaningful – for example, the 19% change in the CSDD represents a change from major to minor depression, or from minor depression to no depression. Notably, examination of the effects sizes of these responses showed that light therapy was at least as effective as prescription drugs (acetylcholinesterase inhibitors) in slowing cognitive decline but with a much reduced side effect profile. *These data provide strong evidence of the benefits of improved daytime lighting exposure to reduce cognitive decline and depression in individuals with dementia living in residential care homes.*

More recently, three clinical trials have examined the effects of implementation of blue-enriched white light exposure during the day (Figueiro et al., 2014; Hopkins et al., 2017; Figueiro et al., 2019). In the first study, 14 care home residents were studied for 8 weeks, 4 weeks with the light intervention and for 4 weeks with normal lighting, after a 4-week washout. The light intervention consisted of exposure to moderate intensity (~324 lux) blue-enriched white light (~9300K) from waketime until 6pm in the patients' rooms compared to more dim, standard light (66 lux). The light intervention resulted in ~30 mins more sleep per night, a significant improvement in the quality of sleep (measured using the Pittsburgh Sleep Quality Index [PSQI]), a significant reduction in depression systems according to the CSDD, and a significant reduction in the Cohen-Mansfield Agitation Inventory (CMAI). In the second study, 80 residents were studied for 8 weeks, 4 weeks with the light intervention and for 4 weeks with normal lighting, with a 3-week washout. The light intervention consisted of exposure to bright (~900 lux) blue-enriched white light in communal areas compared to standard lighting (200 lux). The light intervention resulted in reduced subjective anxiety and increased daytime activity but also reduced sleep efficiency and quality. The third study extended the first by studying 46 patients Alzheimer's disease and related dementias across 8 facilities with again two 4-week interventions and a wash-out. The light intervention consisted of higher intensity blue enriched light (350-750 lux, 5500-7000K) from waketime to 6pm as compared to standard lighting (100-200 lux, 2000-2700K) during the day. Standard lighting was used after 6pm throughout. Patients reported a significant improvement in sleep (PSQI), a reduction in depressive symptoms (CSDD) and a reduction in agitation (CMAI).

Finally, recently the US Department of Energy conducted a small observational study showing that introducing blue-enriched lighting during the day and blue-depleted light during the evening into two nursing home rooms (3 patients) and the corridor reduced the incidence of falls from 5 per 3 patients in the 3 months before the change (0.56 falls per patient per month) to 3 falls per 3

patients in the 5 months after the change (0.20 falls per patient per month), a reduction of 64% (Davis et al., 2016). While the study was small and has not published in a peer-reviewed journal, the potential for better lighting to reduce falls, even by a modest amount, would have enormous implications for health given the devastating impact of falls on aged care residents.

Rationale

Good lighting is essential to our health and wellbeing. It increases alertness and cognition, reduces depression and can help maintain a better sleep-wake cycle. While care home lighting may satisfy current visual lighting standards, in our experience many are poorly lit and are not optimized for health. Lighting choices are not neutral and, as the evidence above demonstrates, through installing better lighting, we can induce substantial improvements in resident cognitive and mental health at very little cost. Going forward many aged care facilities will choose to install LED lighting to improve energy efficiency, but if they do not optimise lighting in terms of intensity and spectrum, they fail to derive the significant benefits for resident health. Aged care residents are particularly vulnerable to reduced light exposure given potential limitations on mobility and less time spent outdoors, development of visual disorders such as cataracts, and the poor design of many older care homes. The scientific literature provides evidence that lighting is a safe and effective, non-invasive, non-pharmacological, relatively inexpensive intervention that is reversible that improves the behavior, health, wellbeing and quality of life of individuals in residential care. We suggest that attention needs to be paid to designing optimal lighting systems for aged care to promote cognitive and mental health.

These benefits depend on the intensity and spectrum of the light. In practical applications of non-visual lighting, the context of how the light will be used should be considered. There are two straightforward principles:

1) In spaces where individuals are not sleeping, for example in common areas (and in bedrooms during the daytime), a fixed spectrum, high intensity, blue-enriched light is indicated to enhance alertness and cognition directly, and by extension safety and productivity. There is no evidence to support the need for light to change intensity, wavelength or pattern during the daytime.

2) In spaces where individuals will sleep, then the ability to change the intensity, wavelength and pattern of light from day to night is needed. During the daytime, the same high intensity, blue-enriched light is indicated. Following dusk, however, for as long as possible before bedtime, the lighting should be low intensity and blue-depleted to reduce the alerting effect of light and its negative impact on sleep. This change in lighting condition can be achieved in many ways, from simple approaches (e.g., different lamp types in ceiling versus table lamps), to complex hardware and software (e.g., lamps that are programmed to change their emissions by time of day).

Recommendations

The evidence–base on the non-visual effects of lighting strongly suggests that a recommendation from the Inquiry, such as lighting installations that meet recommendations in current academic literature as outlined below would, if implemented, deliver significant quality of life, health and safety benefits for residents in aged care homes.

While Government regulations are developed, we recommend a call for targeted research evaluating: (1) current illumination levels in a representative sample of residential aged care facilities; and (2) the impact of the proposed lighting recommendations in a multi-centre study, with outcomes including clinical assessment of patient symptoms (e.g., depression, agitation, sleep); objective clinical outcomes such as resident fall rates and medication use; cognitive function, mood and sleep of residents; alertness, productivity and safety of staff; visual function of residents and staff; and energy use by the facility. While international bodies are developing a consensus for lighting recommendations for the non-visual benefits of light (CIE, 2018; IES, 2019) there are as yet no state or national level standards specifically for enhancing the non-visual health benefits of light in aged care settings. Development and implementation of such standards in Australia would therefore be world-leading.

We recommend the following principles for lighting in residential aged care facilities:

- Daytime. Blue-enriched white light is more beneficial, compared to sources that are less blue-enriched, on daytime alertness, cognition and mood. Daylight is an excellent source of this light and therefore where available, aged care residents should maximize natural daylight exposure by being outside or close to windows. Access to windows is particularly important for less mobile residents.

  When daylight is not available, or does not penetrate an indoor space well, we recommend the use of blue-enriched white light sources with a high proportion of light in the ~480 nm range. This will generally be achieved with 5000K or higher CCT light sources but, given the spectral differences between sources with similar CCTs, measurement of the actual melanopic content (lux) of the light and relationship to photopic lux is recommended (see footnote). We anticipate that peak international bodies (International Commission on Illumination [CIE] and Illuminating Engineering Society [IES]) will publish lighting standards in the near future with a more specific Recommended Practice but in the meantime, maintaining the current required light intensity for vision but substituting a more blue-enriched light source will achieve improvements. Increasing light intensity beyond the minimal vision requirements will achieve further enhance the benefits of light.

- Evening. For as long as possible before bedtime, we recommend the use of blue-depleted white light sources with a low proportion of light in the ~480 nm range. This will generally be achieved with 2700K or lower CCT light sources (but see footnote). The light level should also be as dim as possible while maintaining sufficient light to meet vision and safety requirements. While this evening light setting should be scheduled for at least 3 hours before the desired bedtime, even as little as beginning 30 minutes before bed is likely to achieve some minimal benefit – the longer the better.

- Nighttime. Sleep should occur in darkness where possible and the use of blackout shades and individual eyemasks is encouraged, if safe to do so. If light is required for vision and safety purposes at night, however, the light should be as dim as practically possible, and blue-depleted, i.e., 2700K or lower CCT white light or amber/red nightlights. Lighting used to outline visual cues to aid orientation, such as doorways and paths (or example to the bathroom) should also be dim and blue-depleted.

- Light timing. Exposure to a more stable and regular daily light-dark cycle is also likely to reinforce good alignment of circadian rhythms, which may further benefit sleep, cognition

and health. These recommendations should therefore be applied at the same time each day as much as possible, taking into account the light-dark schedule described above.

- Visual function and safety. Lighting designers should continue to ensure that all designs provide sufficient light to meet visual requirements and then consider the impact of lighting physiological response in addition. The non-visual lighting recommendation is an additional level of consideration, essentially the choice of light spectrum, once the visual standards have been met.

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Safe prescribing of sleeping medications and regular monitoring to determine need and desirability.

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The Medicines Subcommittee of the ASA would like to raise the need for increased vigilance around the use psychotropics (both on and off-label) that are frequently used in older people to induce sedation, often inappropriately and without regards to guidelines or indeed even the issue of changed drug disposition in older populations (1, 2).
One of the common drugs implicated as inappropriately used in residential and community dwelling older people are **benzodiazepines (BZDs).**
Dr Danijela Gnjidic (Sydney Pharmacy School, Faculty of Medicine and Health, The University of Sydney, Member of the Australian Deprescribing Network and President Elect, ASCEPT) was invited for comment on benzodiazepine use by the Medicines Subcommittee. She states that "Benzodiazepines (BZDs) are effective pharmacological treatments; however, there is concern about long-term use, which, despite heterogeneity in the quality of the existing evidence, has been associated with harms such as drug dependence, falls and fractures. Prolonged use of BZDs is of particular concern in the older population as older adults are at higher risk of medication related harms due to age-related pharmacokinetic and pharmacodynamic changes, multi-morbidity (≥2 chronic medical conditions) and polypharmacy (≥5 medications) (3). It is clear from recent reports that older people have a higher use of hypnotic medications than younger individuals with insomnia and anxiety (4-6)."
Dr Gnjidic further notes "that treatment guidelines recommend that BZDs should be used intermittently for less than two weeks in the treatment of insomnia and should not be used for more than six weeks (including tapering before withdrawal) in the treatment of anxiety (7,8). In Australia, 15% to 42% of all older adults use BZDs long-term (4, 5). Recent studies in fact report that 16.6% of the community-dwelling participants aged 75 years and over were using BZDs for at least 4.5 years (9). Therefore, to minimise drug-related harm and mitigate the impact of medication burden on quality of life, long-term use of BZDs should be regularly reviewed, tapered and/or ceased (deprescribed) when appropriate. (10)."

Another set of medications implicated as being inappropriately used in older people are antipsychotics especially as some of these are used off-label for inducing sleep. A particular case-in-point that has been observed by clinician members of the Medicines Sub Committee is quetiapine. Quetiapine is not indicated for use in insomnia and evidence of its efficacy in insomnia are lacking (11). Increased off label utilisation particularly for insomnia has been noted in several countries such as New Zealand (12), Canada (13,14) Netherlands (15), Norway (16), and also in Australia (17). In Australia, increases in overdose, misuse and mortality from quetiapine have also been documented (18). As described by a Canadian research team, quetiapine is considered the "lesser of the two evils" when physicians compare benzodiazepines versus quetiapine for insomnia (12). **Dr John Sweica**, a sleep specialist at the Melbourne Sleep Disorders Centre

states that he is “increasingly seeing patients on quetiapine in primary care, the doses the patients are on are not justifiable for use for the labelled indication; clearly these are being prescribed because of sedative side effect as a substitute of benzodiazepines given the latter have had a bad rap in the medical press.”
Ms Karalyn Huxhagen, a consultant pharmacist from Mackay, Queensland who is also an expert on quality use of medicines mentioned that “I have certainly seen a rise in the use of Quetiapine in aged care, normally at a dose of 100mg at night, to help with reduction of behaviour and to help with sleep. Some of these patients also tend to be on low dose mirtazapine to help sleep.”

Melatonin, which is a medication that is effective in older people and helps correct age-related circadian imbalances such as advancement of the circadian clock can be an effective and safe alternative to sedatives/antipsychotics, but as mentioned by Ms Karalyn Huxhagen, “Melatonin is rarely used in this cohort as it is too expensive for both community and aged care residents.” This cost issue clearly needs to be addressed.

Dr Gnjidic suggests that one of the strategies that can be used to counter this could be deprescribing. This approach may be defined as the “withdrawal of an inappropriate medication, supervised by a health care professional with the goal of managing polypharmacy and improving outcomes” (19).”A number of clinical trials have been conducted to assess the effects of deprescribing benzodiazepines in older patients and have yielded success rates between 27% and 80% using patient education with tapering, pharmacological substitution with melatonin and mixed interventions (20).

Other approaches that may be suggested focus on patients and enhancing their medication literacy around appropriate use of sedative/hypnotics. For example, providing evidence-based information to patients in an appropriate format is important. **Dr Gnjidic** suggests that “this may act as a driving force towards deprescribing as it can address patients’ knowledge about appropriateness and alleviate concerns, overcoming the barrier of fear (21,22). To investigate this, Tannenbaum and colleagues developed a patient-education intervention booklet (Eliminating Medications Through Patient Ownership of End Results, EMPOWER brochure) about benzodiazepines and found that provision of the EMPOWER brochure to community pharmacy patients in Canada resulted in 62% of intervention participants initiating discussions to reduce the use of benzodiazepines with their doctor or pharmacist. Additionally, 27% of intervention participants managed to completely stop the use of their benzodiazepine versus 5% in the control group (22). The inclusion of patients in the deprescribing process is essential and should be considered in future studies aiming to optimize pharmacological therapies. In the case of older people residing in aged care facilities, this is particularly important.” Dispensing data base audits with prescriber feedback have also been effective in reducing benzodiazepine use, for example in a Tasmanian pilot study 23).

Further approaches include the use of understanding patients and carer’s (e.g. nursing home staff) risk perception and using effective risk communication about medications. In recent studies conducted by **Associate Professor Bandana Saini** and her team, it was clear that often patients underestimate the risk of long-term benzodiazepine risk. Chronic users also tend to overestimate the benefits of use. Health professionals such as General Practitioners, community pharmacists, practice nurses/pharmacists need to engage with and educate patients and carers in residential aged care facilities about benzodiazepine use using effective risk communication strategies (24,25).

Other issues that need to be raised are that behavioural strategies such as Cognitive behavioural therapy insomnia are first line treatments for sleep health issues such as insomnia (27), rather than pharmacological treatments. The Medicines Subcommittee clinicians believe that lower capacity or non-reimbursed nature of psychology consults for insomnia are clear barriers to improved insomnia care in older people, both of these issues have been brought to light in published Australian Research (28-30) conducted with adults with insomnia or primary care providers.

Further, linked with the parliamentary inquiry on sleep health awareness, it is the opinion of this group that better sleep health related education is needed, not only for health professional staff but also for non-health professionals managing the care of older people, particularly in residential aged care facilities. In terms of health professionals, greater heed to prescribing guidelines, considering prescribing behavioural treatments for patients and general awareness of best practice sleep health care in older people would be key starting points.

Health professional led programs to manage sleep health can also be effective (e.g. nurse led sleep health programs) (31). Pharmacists that supply medication to nursing homes or those that conduct medication reviews can clearly play a role, for example by planned deprescribing of medications, but also exploring medications/side effects that disrupt sleep and facilitating dosing regimens to minimise these (31). **Ms Karlyn Huxhagen** comments that "I think the aged care industry for residential clients has excellent offerings to help reduce sleep issues in residents. Raising the awareness of the issues faced by aged community residents is badly needed. This body of work should utilise the findings of the community nursing bodies as these professionals see these aged care residents more than pharmacy does. In my HMR (Home Medicines Review) work I try very hard to raise the awareness of the issues of toileting at night, falls risk, loneliness and social issues with the patients' GP."

Well designed stakeholder designed programs are needed to improve the sleep health of residents in aged care facilities in Australia and a shift away from reliance on sedatives need to occur (32).

Older people and their carers too need to be aware of proactive sleep health behaviours and be able to self-initiate strategies that can help rectify sleep health problems, A key example may, be for example, ensuring exposure to light in the early morning which may help re-align the circadian clock, which in many older people is advanced from baseline. Similarly nursing home carer staff need to be well educated about basic ways of ensuring health sleep – such as opening heavy curtains during the morning, improving light exposure e.g. through appropriate lamps, helping older people maintain regular sleep wake schedules, appropriate napping, avoidance of caffeine containing beverages after mid-afternoon (33,34). Ms Huxhagen comments about her aged care patients in whose cases she has worked hard to reduce inappropriate benzodiazepine use: "There is still a small amount of BDZ use but we are trying very hard to use interventions to determine the cause of the sleep issues e.g. patient comfort, are they in pain, is their environment calm and restful, nutrition, is something causing hallucinations /nightmares/restlessness. I see a large body of work being done to ensure the residents needs are being met – use of warmth, warm drink before bed, no extra stimulation in the sundowner hours, outings/exercise/activities/music/pet therapy/visits by groups or school children during the day to help tire the residents. The upsurge in the use of diversional therapists in aged care has been a major benefit in this area."

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Sleep apnoea in the residential aged care setting

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Sleep is important for brain health

Sleep disturbance is common in older adults, and in older people with cognitive decline over 60% complain of poor sleep quality (McKinnon, Terpening et al. 2014). There is a strong bidirectional relationship between sleep and dementia. That is, while some data shows that brain degeneration causes sleep problems, it is now becoming clear that sleep disturbance also contributes to dementia onset and progression. Importantly, research now shows that sleep plays a critical role in clearing the brain of toxins, in particular those crucially implicated in Alzheimer's Disease; beta-amyloid (β-amyloid) and tau (Xie, Kang et al. 2013).

Obstructive sleep apnoea is associated with increased risk of dementia

A major source of sleep disruption in older adults is obstructive sleep apnoea (OSA), a disorder characterised by frequent pauses in breathing due to partial (hypopnoea) or complete (apnoea) upper airway closure during sleep. **Moderate and severe OSA** (at least 15 apnoea or hypopnea events/hour, a.k.a. AHI) **is common,** occurring in 50% of older, community-dwelling, non-obese men and 23% of women (Heinzer, Vat et al. 2015). Of major concern, a recent meta-analysis of 4 million people with 7 year follow-up has shown that people with sleep apnoea are 26-36% times more likely to develop cognitive impairment or dementia than those without OSA (Leng, McEvoy et al. 2017).

Obstructive sleep apnoea causes damage to the brain

Obstructive sleep apnoea results in severe sleep fragmentation and loss of oxygen during sleep leading to brain shrinkage, damage to the vasculature of the brain and the accumulation of pathological proteins that are involved in dementia (Cross, Memarian et al. 2018, Sharma, Varga et al. 2018). These disturbances occur at a time when the brain should be relatively metabolically inactive, e.g. during restorative, slow wave sleep. In this way, OSA provides a "double blow" effect. Overall, given that OSA is common in older people, causes damage to the brain and is associated with cognitive decline and increased risk for dementia, it should be **identified, and treated as early as possible**.

Sleep-wake disturbance in aged care

While the exact figures documenting OSA in residential aged care facilities is unknown, this is likely to be high given the majority of people living in aged care facilities are also living with cognitive decline or dementia. Certainly there is evidence that elderly people living in aged care are more

likely to have poorer sleep and quality of life than those living with in-home assistance (Olsen, Pedersen et al. 2016). Untreated OSA can lead to excessive daytime sleepiness, daytime napping and poor night time sleep, which in turn is linked with poor mental health and wellbeing including depression, physical inactivity as well as increased agitation, challenging behaviours, falls risk, staff distress and cognitive decline (Haesler 2004).

Awareness, detection and effective management of OSA is an area of unmet need in residential aged care facilities. Given that individuals with these behaviours are likely to be prescribed benzodiazepines and other sedative medications (which should not be used in older people due to risk of falls, confusion, cognitive decline and other side effects), it is imperative that key stakeholders including health care professionals and residential aged care facility management are appropriately trained to address sleep wake disturbance in this setting including stepped-care screening and management decision-support systems for OSA. However there is currently no suitable and scalable program available to address this major cause of resident and staff distress (Westbury, Gee et al. 2019).

The use of non-pharmacological solutions to sleep-wake disorders is required

Importantly, therapies are available for OSA and should be utilised wherever possible. Currently, Continuous Positive Airway Pressure (CPAP) is considered the gold standard treatment for OSA. With full adherence, it is highly successful at lowering AHI and ODI to the normal range (Monasterio, Vidal et al. 2001, Barnes, McEvoy et al. 2004). Importantly, a body of evidence shows that CPAP has a positive effect on memory in those with OSA. Treatment of OSA improves cognition in established Alzheimer's Disease (Ancoli-Israel, Palmer et al. 2008) and positively modifies Alzheimer's Disease markers (Liguori, Mercuri et al. 2017). Emerging data also shows that in people with mild cognitive impairment (i.e. in prodromal or 'at risk' stages of dementia), cognitive decline could be slowed by using CPAP (Richards, Gooneratne et al. 2019). Treating OSA in the general population reduces daytime sleepiness and improves mood, both factors which lead to improvements in quality of life (McEvoy, Antic et al. 2016). While it is likely that these improvements would also be seen in the elderly and those in aged care, there is limited evidence from randomised controlled trials regarding the use of treatment for sleep disorders in these groups. Additionally, there may be particular barriers and facilitators of using device therapies such as CPAP in the aged care setting, which need to be fully established.

There may be other options for those who do not tolerate CPAP. Mandibular advancement splints (MAS) are intra-oral devices that are used widely in OSA management and in younger people have been associated with improvements in mood and cognition (Naismith, Winter et al. 2005). MAS is a viable alternative for dentulous patients with equivalent outcomes to CPAP therapy and with better compliance (Phillips, Grunstein et al. 2013). If CPAP or MAS treatment is unsuccessful, oxygen therapy (i.e. the use of supplementary oxygen to reduce the effects of transient hypoxemia) can be trialled. This has been shown to be effective for improving the AHI and nocturnal oxygen desaturation during apnoeic episodes (Mehta, Vasu et al. 2013). Automated positional therapy to minimise supine posture is also an option in a common OSA phenotype, supine-predominant OSA, and often results in marked reduction in AHI (Barnes, Edwards et al. 2017). Strategies to promote behavior change: In addition to offering personalised OSA treatment, longer-term behavioural change should ideally be underpinned by sufficient clinical support, practical instruction and consideration of individual motivations (Gardner, Lally et al. 2012). For those with cognitive impairment, collaborative approaches utilising individualised and structured goal-setting in

combination with motivational interviewing may further facilitate adherence, engagement and maximal outcomes (Clare, Bayer et al. 2013).

Summary:
Given that OSA appears to be a risk factor for dementia, and is linked to wellbeing and mental health, greater efforts should be directed towards screening for OSA and targeting treatment in aged care. Our National Health and Medical Research Council-funded Centre of Research Excellence to Optimise Sleep in Brain Ageing and Neurodegeneration (CogSleep) has been working closely with Dementia Training Australia to develop resources and training for this important issue, but further audit and implementation work is urgently required.

Strategies:
Gathering evidence: There is limited randomised, controlled trial evidence on the diagnosis and treatment of sleep disorders wholly within elderly and aged care populations and further research is required that is targeted and tailored for these populations. This research should focus on streamlined screening for sleep disorders, in particular sleep apnoea, in the aged care setting, and sleep should form a part of the assessment of health in individuals living in residential care.

1. *Screening:* There are multiple options available for screening of OSA in older people that do not necessarily require an overnight sleep study (polysomnography). Such assessments are often logistically difficult for older people, lack ecological validity and are associated with long waiting lists and expenses. Current options include a range of devices that can be fitted under the mattress and also worn overnight on the wrist. A feasibility trial of the use of such devices in residential aged care settings should be conducted.

2. *Treatment:* The use of CPAP therapy in aged care facilities should be supported by health care workers who should be adequately trained in the use of such devices. Barriers to use of device-based therapies for sleep apnoea in the aged care setting should be established. Alternative approaches should be available for those who do not tolerate CPAP well. In addition, staff and residents should have access to sleep experts (eg. sleep psychologists) to reduce daytime sleepiness and napping.

3. *Research:* There is a dearth of randomised controlled trial evidence or other high-quality data targeting sleep generally and OSA specifically within the aged care sector. This work is urgently required and could include co-designed staff training programs that are sustainable.

4. *Training and Clinical Guidelines:* There is a current lack of training for medical and allied health professionals in sleep and ageing diagnostics and treatment. As these health care professionals are the key to translating research findings into practice, training programs that are linked to Clinical Practice Guidelines should be developed for GPs, psychologists, and the aged care workforce on the role of sleep in the overall health of the ageing population. Widespread core-skills training needs to be made available face-to-face and online and requires dedicated funding. This training should incorporate screening for sleep disorders, as well as facilitating treatment.

Conclusion:

Sleep health is integral to overall health and wellbeing, in particular in elderly populations. Sleep disorders should be screened for and managed within aged care settings and continued research funding and training of health care professionals within this sector should facilitate this change. We recommend a national strategy that increases research funding to address the problem of sleep disturbance in Australia's ageing population, grows the evidence base, and develops a national accredited health workforce that can recognise and diagnose sleep disturbance in ageing populations.

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