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The definitive publisher version is available online at

[\*\*https://doi.org/10.1016/j.aimed.2019.02.002\*\*](https://doi.org/10.1016/j.aimed.2019.02.002)

1 **The prevalence and characteristics of complementary medicine use by**  
2 **Australians living with sleep disorders – results of a cross-sectional study**

3 **ABSTRACT**

4 Objectives: To report the prevalence and characteristics of complementary medicine use and  
5 product utilization by Australians living with sleep disorders.

6 Design: A cross-sectional study

7 Methods: 2,025 adults representative of the Australian population by age, gender and state/territory  
8 of residence completed a survey consisting of 50 items including demographic, health services and  
9 complementary product/service utilization and health status items. The sociodemographic  
10 characteristics, prevalence and frequency of complementary medicine (CM) use, and out of pocket  
11 CM expenses were compared between those reporting a sleep disorder to those without a sleep  
12 disorder.

13 Results: Of the 2019 respondents completing the online survey, 265 (13%) reported sleep  
14 disorders. Of these 265 respondents, the median age bracket was 40-50 years; 54.7% were females.  
15 The mean health-related quality of life score in this group was  $44.8 \pm 23.3$ ; the group had a higher  
16 level of comorbid conditions compared to those without sleep disorders ( $p < 0.001$ ). Two thirds  
17 (63.8%) of participants with a sleep disorder used complementary medicine compared to 52% of  
18 those without a sleep disorder ( $p < 0.001$ ). Massage therapists and chiropractors were the main  
19 complementary medicine practitioners consulted by the group with sleep disorders; the average  
20 annual amount spent on visits to complementary medicine practitioners was significantly higher  
21 in this group (Australian dollars, AUD  $160.0 \pm 545.0$ ) than in participants without sleep disorders  
22 (AUD  $62.8 \pm 251.0$ ),  $p < 0.001$ . There were no significant differences in spending on complementary  
23 medicine products annually - those with a sleep disorder spent on average AUD  $59.73 \pm 266.38$

24 annually, whilst those without spent AUD 62.8±251.0 (p=0.42). Of those with a sleep disorder,  
25 97% reported consulting a general practitioner compared with 89.3% in the non-sleep disorders  
26 group (p<0.001).

27 Conclusion. Both complementary medicine and conventional services/medicines use is more  
28 prevalent in Australians with sleep disorders compared to those not reporting a sleep disorder. This  
29 raises a number of clinical and safety considerations including accommodating patient preferences.

30 **Keywords:**

31 Complementary medicine, convenience sampling, dietary supplements, food supplements,  
32 insomnia, online survey, prevalence, sleep disorders

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51 **INTRODUCTION**

52 Sleep disorders including insomnia, obstructive sleep apnea (OSA) and restless legs syndrome are  
53 prevalent throughout the modern world [1-3] . In 2010, 1.5 million Australians (8.9% of the  
54 population) were estimated to be living with a sleep disorder [4]. The acute effects of sleep  
55 disorders include daytime fatigue, decrements in executive dysfunction, psychomotor skills as well  
56 as mood disturbances [1]. Sleep disorders at a chronic level are also associated with  
57 cardiometabolic disease, obesity [2, 3] depression and anxiety [5, 6] with both short and long-term  
58 sequelae leading to substantial economic burden, lost productivity and accidents. In Australia, the  
59 total estimated costs for all sleep disorders was AUD 36.4 billion in 2010 [4]. Therefore, the  
60 importance of a timely diagnosis and effective treatment of sleep disorders has been proposed as  
61 a health priority by various professional associations in Australia [4].

62

63 Despite the substantial impact of untreated sleep disorders, many individuals do not engage with  
64 conventional health care systems to seek treatment and those seeking care frequently do not adhere  
65 to recommended treatments. A number of reasons have been proposed to explain this, which  
66 include a poor understanding of the consequences of untreated sleep disorders, a belief that the  
67 condition is non-serious/self-limiting, preferences for alternative treatments, dissatisfaction with  
68 conventional treatment and effective product marketing strategies [7-9]. Self-treatment of sleep  
69 disorders is common as demonstrated by a study involving older people ( $\geq 50$  years) in the US, of  
70 which 32% reported self-selecting sleep medications [10].

71

72 In the past decade, the use of complementary approaches to manage sleep disorders has become  
73 more common [11]. The National Centre for Complementary and Integrative Health (US) defines

74 complementary approaches as “*a group of diverse medical and health care systems, practices and*  
75 *products that are not generally practiced/prescribed by allopathic physicians and allied health*  
76 *professionals* (nccih.nih.gov).” For the purposes of this paper, the term complementary medicines  
77 (CM) will be used to describe complementary medicine products and complementary medicine  
78 services. CMs are currently the fastest growing segment of the Australian health care system [9,  
79 12]. Most Australian users appear to integrate the use of CMs with conventional therapy rather  
80 than using them as alternative treatments [13]. Despite this integrated approach by patients,  
81 disclosure about CM use to physicians has been reported as poor [11] raising concerns about the  
82 potential for poor treatment outcomes associated with non-adherence to physician-prescribed  
83 treatments and/or drug-CM interactions [14]. Australians with sleep disorders are likely to consider  
84 CM use in self-treatment paradigms by purchasing products through retail outlets, or through  
85 consultation with a diverse range of CM practitioners. However, little is known about the  
86 prevalence and characteristics of Australians with sleep disorders currently using CM products  
87 and services.

88

89 Therefore, the aim of this study is to describe the prevalence, characteristics, and predictors of CM  
90 use by Australians with sleep disorders. Such data can be used to inform clinical discussions that  
91 incorporate the patient’s preferences for treatments to assist with appropriate, safe and effective  
92 treatment strategies.

93

94

## 95 **METHODS**

### 96 **Study design**

97 A sub-study analysis was conducted on data obtained from a cross-sectional online survey that  
98 involved 2019 Australians whose demographic profile was representative of the Australian adult  
99 population.

100

### 101 **Setting**

102 Participants completed the survey via the online platform Qualtrics [15]. The recruitment and  
103 collection of data took place between 26 July and 28 August 2017. Although recruitment and data  
104 collection were limited to this one-month period, all relevant survey items directed participants to  
105 reflect on their experience of CM product/service use across the previous 12 months.

106

### 107 **Participants**

108 Australian adults aged 18 years and over were recruited using purposive convenience sampling.  
109 The study sample was obtained from a database of people who had registered their interest in  
110 research participation with Qualtrics (a research recruitment company). An invitation containing  
111 a link to the study information statement and online survey questionnaire was sent by email to  
112 eligible members. Consent was assumed if participants completed the survey. The survey took 15  
113 minutes to complete on average. ). Participants in the overall survey received a minimal financial  
114 incentive as token recompense for their time (approximately AUD\$1/15 minutes).

115

116 For purposes of clarity, participants who completed the survey and reported being medically  
117 diagnosed with or being treated with a sleep disorder (SD) in the last three years will be referred  
118 to as the SD group (n=265) whilst those not reporting being diagnosed with or undergoing  
119 treatment for sleep disorders will be referred to as the non-sleep disorder or Non-SD group

120 (n=1754). Similarly, those in the SD group (n=265) reporting CM use in the previous 12 month  
121 period will be referred to as SD-CM (n=169) group whilst those in this group not using CMs will  
122 be referred to as the SD Non-CM group (n=96). Those who completed the survey who reported  
123 CM use but did not report a sleep disorder will be referred to as the Non-SD CM group (n=888).

124

## 125 **Measures**

126 The survey consisted of 50 items related to demographics, health service utilization (including the  
127 use of CM), health status, health literacy, and health communication. Demographic items included  
128 age, gender, residential postcode, employment, marital status, level of education, household  
129 income, financial manageability, health care card coverage, private health insurance coverage, and  
130 marital status. Participants were asked if, in the previous three years, they were being treated for  
131 or had been diagnosed with a range of health conditions, including sleep disorders (Yes/No  
132 response). Participants were further asked to provide information about their health service  
133 utilization over the previous 12 months including visits to complementary medicine health  
134 practitioners and use of complementary medicine products. Items related to services and products  
135 were based on the International Complementary and Alternative Medicine Questionnaire (I-CAM-  
136 Q), which is a measure of complementary medicine use that has been validated for use in adult  
137 populations [16, 17]. Current health status was measured using a statement with a 5-point Likert  
138 scale and health-related quality of life (HRQOL) was measured using the SF-20 [18]. Participants  
139 were asked if they had been diagnosed or treated in the last three years for a range of conditions  
140 within the Australian National Health Priority Areas (including sleep disorders).

141

## 142 **Data Analysis**

143 Using methods described in the literature [19], data was screened for disengaged and missing  
144 responses. This was identified by using descriptive data analysis for all items and mapping these  
145 to check for discrepancies between responses, text responses incongruous with the corresponding  
146 question or for invariance (e.g. acquiescence bias/extreme responses). Where  
147 individual cases varied from the norm, item by item comparisons of data from such participants  
148 were made and data removed if it was deemed to be compromised.

149 Statistical analysis was conducted using the statistical software IBM SPSS Statistics Premium  
150 Edition Version 22. Binary variables were created from categorical variables that related to  
151 complementary medicine use and sleep disorders, as well as confounders, such as diagnosed with  
152 chronic illnesses. Descriptive statistics were conducted to determine the percentages and  
153 frequencies of those reporting a sleep disorder and those not reporting a sleep disorder. Chi-square  
154 analysis was used to assess the associations between categorical demographic and health-related  
155 variables between those with and without a sleep disorder. A binary logistic regression analysis  
156 (using the Enter method) was conducted to explore factors predictive of CM use in those with and  
157 without sleep disorders. Statistical significance was set as  $p < 0.05$ .

158

## 159 **Ethics**

160 Ethical approval of this study was received (EC00358) from The Human Research Ethics  
161 Committee at the Endeavour College of Natural Health.

162

## 163 **RESULTS**

164 A total of 2019 participants, representative of the Australian population in age, gender, and state  
165 of residence completed the online survey. No cases were removed due to missing data. Six cases

166 were removed due to disengaged/problematic responses as described in the method section. Of  
167 these, 1057 (52.3%) participants reported using CM in the previous 12 months. Of the 2019  
168 participants, 265 (13%) reported being diagnosed with or being treated for a sleep disorder within  
169 the last three years; of these 169 (63.7%) used CM.

170

### 171 *Sociodemographic characteristics of participants with and without sleep disorders (SD group)*

172 Table 1 presents the sociodemographic and health-related characteristics of participants in the SD  
173 group (n=265) compared with those in the Non-SD group (n=1754). INSERT TABLE1

174 In the SD group, a higher proportion of participants were female (54.7%), 28% were >60 years of  
175 age, and 49.4% were not in a relationship. There were significant differences in the marital status,  
176 socioeconomic status between the SD and Non-SD groups; less than half of those in the SD group  
177 (43.3%) were in the paid work force compared to 58.8% in the Non-SD group ( $p < 0.001$ ). A  
178 significantly greater proportion of participants in the SD group reported financial difficulty (74%  
179 vs 57% in the Non-SD group,  $p < 0.001$ ). Despite the extent of financial difficulty, just over half of  
180 the SD group held private health insurance (57.3% in SD vs 49.9% in the Non-SD group,  $p = 0.02$ ).  
181 The SD group also reported a higher prevalence of key comorbid conditions ( $p < 0.001$ ) and a  
182 significantly lower HRQOL score ( $44.8 \pm 23.4$  vs  $70.9 \pm 20.6$  in the Non-SD group,  $p < 0.001$ ). The  
183 most prevalent comorbidity amongst the SD group was a mood disorder (57.4%) followed by  
184 anxiety disorder (56.6%). A statistically significant difference was observed between SD-CM vs  
185 Non SD-CM groups for health-related quality of life ( $70.99 \pm 20.57$  in the Non SD-CM group vs  
186  $44.82 \pm 23.35$  in the SD-CM group,  $p < .001$ )

### 187 *Sociodemographic characteristics of participants reporting CM use with and without a sleep* 188 *disorder*

189 Table 2 presents the sociodemographic and health-related characteristics of the SD-CM group  
190 (n=169) in comparison with the Non-SD CM, group (n = 888). INSERT TABLE 2  
191 There was a significantly ( $p<.001$ ) higher proportion of CM users in the group with sleep disorders  
192 compared to the group without sleep disorders. Although not statistically significant, a higher  
193 proportion of CM users with sleep disorders were female. A statistically significant difference in  
194 the probabilities between groups was also evident for employment status ( $p=0.04$ ), marital status  
195 ( $p=0.001$ ), and financial management ( $p<0.001$ ). There was a significantly ( $p<.001$ ) greater  
196 proportion of all reported comorbid conditions in the SD-CM group ( $p<0.001$  for all conditions,  
197 for hypertension,  $p=0.03$ ). Of note, CM use by those with sleep disorders was most prevalent  
198 amongst patients reporting a comorbid mood disorder or anxiety disorder (91% and 94% of the  
199 SD group used CMs if they also reported anxiety or depression, respectively). A statistically  
200 significant difference was observed between SD-CM vs Non SD-CM groups for health-related  
201 quality of life ( $68.3\pm7.5$  in the Non SD-CM group vs  $44.7\pm24.3$  in the SD-CM group,  $p=0.002$ ).

202

### 203 *Sociodemographic characteristics of sleep participants using and not using CM*

204 The sociodemographic and health characteristics of participants with a sleep disorder using or  
205 not using CMs are highlighted in Table 3. INSERT TABLE 3

206 A significantly higher proportion of CM users within the SD group were female (62.7% in the  
207 SD-CM vs 40.6% in the SD-Non CM group,  $p=0.01$ ) and had a tertiary education (29.6% in SD-  
208 CM vs 15.6% in the SD-Non CM group,  $p=0.03$ ). Comorbid musculoskeletal disorders were  
209 more common in the SD-CM group compared to the SD-Non CM group,  $p=0.02$ .

### 210 *Prevalence of conventional medicine and CM health services and products utilization by people* 211 *reporting sleep disorders*

212 Table 4 presents the conventional and complementary medicine health services utilized by  
213 participants reporting a sleep disorder (SD group) as compared to those with no sleep disorder  
214 (Non-SD group). INSERT TABLE 4

215 The results indicate that 97% of participants in the SD group had consulted a general practitioner  
216 in the previous 12 months compared to 85.5% in the Non-SD group,  $p < 0.001$ . Amongst allied  
217 health practitioners, 89% of the SD group participants reported consulting community pharmacists  
218 for support compared to 74.6% in the Non-SD group,  $p < 0.001$ . Of the various CM practitioners,  
219 the SD group consulted, massage therapists (28.3%) and chiropractors (23.4%) were the most often  
220 consulted followed by acupuncturists (13.6%) and yoga teachers (12.6%). In terms of CM  
221 products, 92.5% of SD participants reported using prescription medicines followed by vitamins  
222 and mineral supplements (60.4%) levels. The level of usage of these products was significantly  
223 higher than in the Non-SD group. ( $p < 0.001$ ). The concurrent use of both CM products and  
224 conventional drugs was lower in the SD group (62.2%) compared to Non-SD group (96.7%).  
225 Those with a sleep disorder reported a significantly ( $p < .001$ ) higher average annual amount spent  
226 on visits to complementary medicine practitioners (AUD  $160.0 \pm 545.0$ ) compared to those without  
227 a sleep disorder (AUD  $62.8 \pm 251.0$ ). In contrast, there was no significant difference between groups  
228 on the average annual amount spent on the use of complementary medicine products (AUD  $59.73$   
229  $\pm 266.38$  spent by those with a sleep disorder compared to AUD  $62.8 \pm 251.0$  spent by those without  
230 a sleep disorder,  $p = 0.42$ ).

231 Table 5 presents a summary of the reasons for which participants in the SD and Non SD groups  
232 consulted CM practitioners. INSERT TABLE 5

233 *Predictors of CM use in participants with and without a sleep disorder*

234 Logistic regression analysis was conducted to predict the use of CM products in those with a SD  
235 compared to those without a SD. The results indicated that participants with a SD who had higher  
236 qualifications were 1.4 times more likely to use CM compared to those without a SD. In addition,  
237 those with or without a SD were less likely to use CM if they were male. Age and employment  
238 status did not predict CM use in the SD group as it did in the Non-SD group. The top ten co morbid  
239 conditions were analyzed separately as individual variables revealing that mental health disorders  
240 alone were the only significant predictor of CM use.

241

## 242 **DISCUSSION**

243 Our study represents the first descriptive evaluation of CM use by the Australians living with sleep  
244 disorders. The results clearly indicate that Australians with sleep disorders have a high prevalence  
245 of CM use, which is higher than in people without sleep disorders. CM users with sleep disorders  
246 also had a different profile to CM users without sleep disorders in being less likely to be in the  
247 paid workforce or being in a relationship and more likely to report financial stress and comorbid  
248 conditions. Also, CM users with sleep disorders were more likely to be female and tertiary  
249 educated. The financial component is in contrast to earlier reports in literature wherein less  
250 financially stressed individuals used more relaxation techniques and CMs [11]. The finding that  
251 people reporting to have a sleep disorder had a significantly lower HRQOL than those without  
252 sleep disorders raises important clinical considerations for those caring for this patient population.

253 Findings about the overall health and demography of Australian CM product/services users who  
254 have sleep disorders in our study are reasonably consistent with extant literature. A significantly  
255 higher prevalence of several comorbid conditions in those with sleep disorders was evident in our  
256 study (Table 1). In those with sleep disorders, mood and anxiety problems were commonly

257 comorbid, which was not found in those not reporting sleep disorders. Bidirectional relationships  
258 between sleep and mental health disorders are well established [20, 21]. Similarly, the  
259 cardiometabolic consequences of disturbed sleep (e.g. as a consequence of sleep apnoea or  
260 insomnia), have also been well described in the literature [21, 22]. The level of comorbidity  
261 indicated by those reporting a sleep disorder in our sample is therefore not surprising. We also  
262 found that people with a sleep disorder, females and those with tertiary education were  
263 significantly more likely to be using CM products/services. This has also been reported previously;  
264 for example, in The US National Health Interview Study (N=23,000 adults), the same pattern of  
265 CM use was observed in those with insomnia [11]. Additionally, this phenomena of gender and  
266 education as key factors influencing CM use have been observed in several other Australian studies  
267 [24-26, 34]. The pattern of CM use is observable generally (i.e. not just in the case of sleep  
268 disorders) in studies globally indicating that females are higher users of CM regardless of whether  
269 this is explored in developing or developed countries [27-31]. Interestingly, while those with high  
270 educational attainment are more likely to use CM in developed countries, in middle income  
271 countries this pattern is reversed, with those of lower socio-economic status or living in rural areas  
272 being more likely to use CM [33].

273 Collectively, financial stress, the presence of comorbid conditions, and a low HRQOL suggest that  
274 CM users with sleep disorders are in fact a more vulnerable group compared to general CM users  
275 without sleep disorders. Participants with sleep disorders using CMs also appeared to have a higher  
276 rate of consultation with conventional practitioners and spent more on **a combination of CM**  
277 products/services as well as prescription products. In some cases, the concomitant use of both types  
278 of treatment may pose risks in terms of drug-herb interactions. Despite several challenges  
279 associated with integrated treatment model, considering the ever-increasing awareness and use of

280 CM, it is time to explore, acknowledge and integrate patient preferred treatment modalities in  
281 treatment plans [34]. It is also important to ensure that naturopathic/complementary treatment  
282 providers have adequate up to date clinical knowledge of sleep disorders and open  
283 referral/communication pathways so that patients at ‘high risk’ are referred back to their  
284 conventional medical practitioner. In patient consultations with conventional health care  
285 professionals, limited time is a crucial factor, perhaps exploring CM use in patients with typical  
286 user profiles can be a strategy which can yield patient disclosure about CM use, allowing a medical  
287 review of potential risk in CM users also trialing conventional medicines.

288

289 The use of CM practitioner services such as acupuncture and naturopathy by over a quarter of  
290 those with sleep disorders is noteworthy and suggests that these practitioners may be contributing  
291 to the non-pharmacologic management of the broader complex issues in patients with sleep  
292 disorders such as chronic pain associated with musculoskeletal conditions and/or chronic stress  
293 [35, 36]. A previous study reported that CM use including cognitive behavior therapy may  
294 contribute to “relaxation” in patients with insomnia. Previous research from the US indicates that  
295 people with insomnia, for example, are 1.5 times more likely to use relaxation techniques (e.g.  
296 massage therapy) compared to adults without insomnia [11]. There is also a growing body of  
297 literature suggesting benefits of mindfulness-based management stress in conditions such as  
298 insomnia [37]. Given the frequent usage of such techniques and promising preliminary evidence,  
299 it may be timely to conduct well designed robust trials to test the effectiveness of such techniques  
300 in insomnia management and overall sleep health. Randomised controlled trials represent the gold  
301 standard in efficacy studies; however, in the case of CM it is important to trial integrated models  
302 offering patients integrated (convention and CM based) treatment approaches, which may include

303 pragmatic trial designs such as: controlled clinical trials, controlled before and after series,  
304 interrupted time series, effectiveness-implementation hybrid designs, or sequential multiple  
305 assignment randomized trials (SMARTs). Such research should necessarily use participatory co-  
306 designed paradigms and use both qualitative and quantitative data mapping to obtain a richer  
307 tapestry of measured outcomes [39-40].

308 The significantly higher annual combined expenditure on CM products and CM services by those  
309 with sleep disorders compared to those without is also interesting, especially in light of the fact  
310 that the group with sleep disorders generally perceived a high degree of financial stress, as did  
311 those within this group using **combined** CM services/product compared to CM users without sleep  
312 disorders (Table 1 and 2). This indicates perhaps the burden that sleep disorders place on  
313 individuals, so they seek non-conventional treatments requiring out of pocket spending despite  
314 perceived financial stress; conventional treatments are not satisfactory for sleep disorders. The  
315 high level of comorbidity seen with the sleep disorders group (and sleep disorders group using  
316 CMs) and lower quality of life scores also suggest a higher burden of disease. What actually drives  
317 high CM use in the population group experiencing sleep disorders cannot be ascertained from this  
318 study but may also relate to patient concerns about the safety and efficacy of pharmaceutical  
319 treatment options or failure of conventional treatment interventions to manage their sleep disorders  
320 [9]. Conversely, as identified in other studies, a common perception is that CM is ‘natural’ and  
321 therefore poses fewer safety concerns [17]. Regardless of the drivers of CM use, the use of CM  
322 products and services by people with sleep disorders is likely to be part of a complex clinical  
323 picture which may pose a number of risks related to the quality, efficacy, and safety of the patient  
324 treatment. It may also provide insights into an under-researched area where complementary  
325 medicine treatment approaches for sleep disorders is worthy of closer examination. Despite the

326 apparent integration and self-selection of CM health services and products by those living with  
327 sleep disorders observed in this study, there largely remains little evidence that describes the  
328 integration of patient preferences within the current health care construct in Australia. Therefore,  
329 research that seeks to understand more about the interface, interaction, and effects of CM on  
330 conventional health care, and conventional health care on CM in this population is needed.

331 Our study sample was representative of the general Australian population as tested by statistically  
332 comparing with the current Australian Census data [35]; however, we acknowledge that there may  
333 be selection bias given the recruitment strategy utilised (i.e. the use of a panel from an online  
334 research company). Participants in the overall survey received a minimal financial incentive as  
335 token recompense for their time (approximately AUD\$1/15 minutes) and were people who had  
336 access to and familiarity with using the Internet; leading to a possibility of selection bias. A  
337 limitation often associated with the type of data collected in this study relates to the reliance on  
338 self-reporting by participants. Self-reporting is associated with an increased risk of responder and  
339 recall bias. To ensure the integrity of the data, the risk of recall bias was minimized by specifying  
340 a 12 month recall period for symptoms and conditions within the survey instrument [38]. Despite  
341 this potential limitation, the nationally-representative sample importantly lends generalizability to  
342 the findings for those with sleep disorders and provides important insights that can inform the  
343 development of further research and their clinical care provided by both conventional health  
344 professionals and complementary medicine practitioners. To minimize participant fatigue,  
345 participants were not asked to specify which sleep disorder they had or list/select names of CM  
346 medicines used. These limitations in our study offer further research opportunities for exploring  
347 commonly used CM products used by Australians with specific sleep disorders.

## 348 **CONCLUSION**

349 CM use in those with sleep disorders is high. The high level of comorbidity perceived financial  
350 stress and lower quality of life in people with sleep disorders, and those using CMs suggest that  
351 this population is vulnerable. It is clear that integrative strategies that encompass patient beliefs  
352 and evidence-based treatment provision are required. Reciprocal awareness of roles and treatment  
353 ideologies by conventional and non-conventional health providers is needed and models that use  
354 approaches that best benefit patients need to be developed and tested in Australian sleep health  
355 care.

356

## 357 **ACKNOWLEDGMENTS**

358

## 359 **FUNDING**

360 This research did not receive any specific grant from funding agencies in the public, commercial,  
361 or not-for-profit sectors.

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