Population Study on the Predictors of Sleeping Difficulties in Young Australian Women

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Abstract

Gender disparity in sleep difficulties in young adults may be driven by higher rates of affective disorders in women. This paper investigated a range of factors as potential predictors of 'difficulty sleeping' in 9061 women aged 24-30 years, using survey data. Regression analyses and odds ratios showed that depression and anxiety symptoms were indeed the greatest predictors of difficulty sleeping. However, four variables (binge drinking, lower qualifications, dissatisfaction with excessive weight and a history of abuse) also made significant contributions to sleep difficulty when a range of other variables (including depression and anxiety symptoms) were statistically controlled. Affective problems often predict sleep difficulties in young women, but other predictors are also significant and not necessarily intertwined with anxiety and depression.

Introduction

Young adult women are known to be particularly susceptible to poor sleep, with rates almost twice as high as in young males (Hale, Phuong Do, & Busurto-Davila, et al., 2009; Leger, Guilleminault, Dreyfus, Delahaye & Paillard, 2000; Lindberg, Janson, Gislason, Bjornsson, Hetta, Boman 1997). There are at least two hypotheses as to why this is the case. Firstly, recent research has suggested that the gender disparity in insomnia symptoms in young adults may be driven by the higher rates of *affective disorders* in women (Hale et al., 2009). Strong associations between depression, anxiety and poor sleep have been well documented for many years (e.g. Manber & Chambers, 2009; Taylor, Lichstein, Durrence, Reidel & Bush, 2005). Secondly, the possible role of *social and economic circumstances* in sleep difficulties is highlighted by findings of minimal or no gender differences in sleep problems once adjustments have been made for work and family or socio-economic status (SES) characteristics (Arber, Bote & Meadows, 2009; Sekine, Chandola, Martikainen, Marmot & Kagamimori, 2006). Correlations between SES and sleep disturbance have been documented in diverse mixed gender groups such as US community dwelling older adults (Hall, Buysse, & Nofzinger, et al., 2008) and New Zealand Maori and non-Maori adults (Paine, Gander, Harris, & Reid, 2004). Employment status was found to be associated with insomnia in Finnish men but not women (Talala, Huurre, Aro, Martelin & Prattala, 2008).

There is also an established link between poor sleep and a variety of *lifestyle factors*, most of which are not highly gender specific. Substance abuse (alcohol and illicit drugs) and sleep disturbance are associated, possibly bi-directionally (Bootzin & Stevens, 2005). Cigarette smoking has been independently linked with significant disturbances in sleep architecture (Zhang, Samet, Caffo & Punjabi, 2006), especially in women (Nakata, Takahashi, & Haratani, et al., 2008). Investigations have shown a positive relationship between sleep quality and being physically active (Steptoe, Wardle, & Fuller, et al., 1997), but the link between regular exercise and good

sleep in young adults is not yet well supported with scientific evidence (Youngstedt, 2005). Short sleep duration may be a risk factor for obesity, particularly in adults aged less than 34 years (Hasler, Buysse, & Klaghofer, et al., 2004). *Illness* also plays a possible role in poor sleep and for several decades clinicians found the classification of insomnia into primary insomnia and secondary insomnia a useful distinction (Stepanski, & Rybarczyk, 2006; American Psychiatric Association (APA), 2000). One variable that is more gendered is sexual *abuse* and violence, and the associated trauma has been found to predict sleep problems as well as depression, anxiety, suicidality and post traumatic stress disorder in women (Krakow, Germain, & Warner, et al., 2001; Astbury, Bruck & Loxton, 2011).

Clinicians often encounter sleep disturbance in the context of a wide variety of intertwining presenting problems that span social and economic circumstances, mental health and behavioral factors. Thus it is of clinical interest to know whether the above lifestyle, illness and abuse factors may be predictors of sleep difficulties in young women, even when (i) socio-economic status (SES) variables such as work, qualifications and income are adjusted for, and (ii) when the affective variables of depression and anxiety symptoms are controlled.

This study involves a broadly representative sample of Australian young women aged in their late 20s, and focuses on those who report they often had difficulty sleeping in the last 12 months. It provides an evidence-based evaluation of the relative importance of a range of factors reported in the literature as related to sleeping difficulties, with a number of different SES, lifestyle, illness, abuse history and affective variables included. Part 1 documents the help seeking behavior and prescription sleeping tablet use in the sample of young women who reported “often” having difficulty sleeping as well as the associations (using odds ratios) between a range of variables and being a good or poor sleeper. Part 2 compares two multinomial logistic regression models in terms of how well each model predicts the self report of difficulty sleeping. The key focus is on a

range of lifestyle, abuse history and illness variables and the first model also includes several SES variables. Variables relating to symptoms of depression and intense anxiety variables are added in the second model. Of special interest was the determination of which lifestyle, illness and abuse variables would show significant associations with difficulty sleeping once both SES and affective symptoms were added to the analyses.

Methods

Participants

Participants were from the Australian Longitudinal Study of Women's Health (ALSWH) described in detail elsewhere (Lee, Dobson, & Brown, et al., 2005), who were originally randomly sampled from Medicare Australia files in 1996. This present analysis includes 9061 women aged between 25 and 30 (M= 27.14 years, SD=1.45) at the time of the third survey in 2003 and who had completed two earlier surveys in 1996 and 2000. The number of eligible women who received this third survey was 14,116 (return rate = 65.4%, with 28% being uncontactable). The women were broadly representative of the Australian population on marital status, country of birth, education and employment, with a slight bias towards higher SES. There was some under-representation of minority groups, including indigenous Australians and those who do not read English well (Lee et al., 2005). The survey deliberately sampled women living in rural and regional areas of Australia at twice the rate of urban women, in order to obtain a more viable sample of rural/regional participants. This over-sampling must be kept in mind when considering any prevalence figures, but is controlled for in the regression analyses. Most of the sample was in the paid workforce (81.2%), although not necessarily full time. Only 6.9% of the sample were studying more than 15 hours a week.

Questionnaire Variables and Data Analyses

All measures were derived from the ALSWH, third survey for young women. The actual survey questions can be viewed on the internet (ALSWH, 2003), along with details of where specific questions have been validated or used previously (ALSWH, 2011). The following outlines the basis for each variable used in the analyses. One question asked about the extent to which participants had experienced each of a list of 21 "common problems" in the last 12 months, of which one of the list was difficulty sleeping. Four choices were available; 'no, rarely, sometimes, often'. Descriptive analyses in Part 1 of the study focused on the following sleep issues for the women who reported "often" having difficulty sleeping. For each "common problem" participants marked whether they had sought help for that problem, and if so, if they were not satisfied with that help. Another question (yes/no) asked whether they had used prescription medication in the past four weeks to help them sleep (e.g. Temaze, Normison, Mogadon etc). One question was whether they were unemployed and actively seeking work (yes/no). Highest qualification level (or level of education) was categorised across 7 levels (no formal qualification, year 10, year 12, trade/apprenticeship, certificate/diploma, University degree, higher University degree) Household income level was made dichotomous around $1000 (Australian) per week. This level was chosen as it identified the approximate third of the sample (37.8%) with the lowest household income. Participants were asked if, during the last three years, they had been diagnosed with, or treated for, any of a list of 17 illnesses which covered physical illnesses (diabetes, cancer, hypertension etc), mental illness (depression, postnatal depression and anxiety disorder) and other major illness. The illness variable was made dichotomous on the basis of whether they marked none of these conditions or not. The overall survey asked many lifestyle questions and the issues selected for analysis were based on key health and lifestyle factors described in the literature as possibly being associated with sleep quality, that is, alcohol intake, illicit drug intake, smoking, activity level and bodyweight satisfaction. The frequency of binge drinking question asked how often they had five or more standard drinks of alcohol on one occasion and six options from never to more than once

a week were available. Three yes/no questions covered drug use, drug injection, or combining drugs with alcohol. The question ever combined drugs with alcohol was selected as it involved the largest number of women and focused particularly on more high risk and/or recreational drug related behaviours. Drug use included prescription or illicit drugs. Frequency of currently smoking cigarettes or any other tobacco products was split to be either a daily smoker or not. One activity question, reported hours per week of brisk walking, required participants to indicate all the hours and minutes that they had engaged in "walking briskly (for recreation or exercise, or to get from one place to another)". Another question included was bodyweight dissatisfaction. This asked " How much would you like to weigh NOW?" and the six options ranging across (i) Happy as I am, (ii) 1 - 5Kg more, (iii) over 5kg more, (iv) 1-5 Kg less, (v) 6-10 kg less and (vi) over 10 kg less. A dichotomous variable was obtained by combining the first five options into one category and the last option became a second category, thus this variable only related to dissatisfaction with being 10+ kg overweight. Women who marked that they had experienced one or more of several different forms of abuse in the last three years (physical, severe physical, emotional, sexual or harassment) formed one category, with women who said they had not experienced any of these abuses forming the other category. In the actual abuse question many descriptors of each type of abuse were listed (eg shoved, bullied, attempted rape, stalked). Included in the list of "common problems" over the last 12 months were two affective variables; one was included as depression symptoms while the other was episodes of intense anxiety (e.g. panic attacks) (both with four options).

One pair of variables for the odds ratio (OR) calculations (Part 1) was always poor versus good sleeper. The *poor sleepers* were those who said they 'often' had difficulty sleeping while *the good sleepers* were those who responded 'no' or 'rarely' to the difficulty sleeping question. Those who said they 'sometimes' had difficulty sleeping were omitted from these two groups as a marked differentiation between the good and poor sleeper groups was desired. The other

dichotomous variable in each pair analysed related to each of the variables as described above, with variables being converted to being dichotomous where necessary The highest qualification variable was converted to be either a university qualification or not. Binge drink had two alternatives; 'once a week or more' versus 'less than once a week'. Brisk walking was either 'no hours per week' versus 'one or more hours per week'. Reports of either depression symptoms or episodes of intense anxiety in the last 12 months were split as either 'often' versus 'no', 'rarely' and 'sometimes' as the focus was on those with more severe affective symptoms compared to all others. Questions about diagnosis or treatment for postnatal depression, depression (not postnatal) or anxiety disorder over the last three years (yes/no) were also included.

For the multinominal logistic regressions (Part 2) a covariate of area weighting (a continuous variable) was applied to correct for the deliberate over-sampling of rural/regional women versus urban women. (This covariate was not significant in either model.) The data was checked to see whether the required assumptions for logistic regression were met. Multi-collinearity was not violated. Note that the variables converted to be dichotomous for Part 1 remained as interval variables in Part 2, with the exception of *brisk walking*. *Hours of brisk walking per week* was the only variable which showed a high skewness (>7.0) and an elevated kurtosis statistic (75). It was found that 31% did zero hours and the range was from 0 to 90 hours. This variable was thus transformed into a dichotomous variable of 'no hours' versus 'some hours'. All analyses were conducted using PASW Statistics 18, with alpha set at 0.05. Ethics approval for the conduct of the Australian Longitudinal Study on Women's Health was provided by The University of Newcastle Human Experimentation Ethics Committee.

Results

Part 1

The first analysis determined how many of the sample of 9,061 women responded that they 'often' had difficulty sleeping in the last 12 months and it was found that 834 (9.2%) women replied this way. A much larger group of 6,276 (68.5%) women replied that they 'never' or 'rarely' had difficulty sleeping. Interestingly, of the 6,276 women who reported 'never' or 'rarely' having difficulty sleeping in the last 12 months, 3.3% (n=58) had sought help during this time for difficulty sleeping and 1.1% (n=71) reported that they had taken prescription medication for sleep in the last four weeks. Only 2.5% (n= 226) of the total sample reported taking prescription medication for sleep in the last month. However, this may be an underestimation as an additional 1.14 % (n=98) reported taking prescription medication for nerves and a further 5.4% (n=467) of young women reported taking medication for depression.

Table 1 presents odds ratios where all the listed dichotomous variables were compared with "often" having difficulty sleeping in the last 12 months. Odds ratios showed that women reporting difficulty sleeping 'often' had a 17.2 fold odds of reporting *symptoms of intense anxiety* 'often' (versus all other possible responses) than women reporting difficulty sleeping 'rarely' or 'not at all'. For *depression symptoms* the odds ratio was 11.51.

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Insert Table 1 about here

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Figure 1 shows the same variables in relation to the percentages reporting different levels of difficulty sleeping. Both this figure and Table 1 clearly show that having symptoms of *depression* or episodes of *intense anxiety* 'often' in the last 12 months is the variable most strongly associated with 'often' having difficulty sleeping in the last 12 months. Figure 1 shows that 40-50% of those reporting intense anxiety episodes or depression symptoms 'often' in the last year also reported

"often" having difficulty sleeping. When the group reporting affective symptoms "sometimes" is also included these percentages climb to 64% for depression and 76% for anxiety. Having *diagnosed depression or anxiety* in the last 3 years are the variables next most closely associated with 'often' having difficulty sleeping. The lower percentages for those with diagnosed depression or anxiety within the last 3 years may reflect successful treatment with medication, with resultant improvements in sleep. The non-affective variable associated with the most people reporting sleeping difficulties 'often' was a *history of abuse*.

Insert Figure 1 about here

Part 2

Model 1 - without depression & anxiety factors

All the SES, lifestyle, illness, and abuse history variables were entered in the first model as predictors with difficulty sleeping as the dependent variable (n=5,456). The variables and the results of the regression are shown in Table 2. The total amount of variance explained by this model was only 6.9%. It can be seen that the significant predictors of sleeping difficulties were - the SES variable of *qualification* level (with less qualified women having more sleep difficulties); *household income*; the two lifestyle variables of *bodyweight dissatisfaction* and having *ever combined drugs with alcohol*; *having had a major illness* in the last three years and the report of *any abuse* in the last three years.

Insert Table 2 about here

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Model 2 - with depression & anxiety factors

Table 3 shows the independent variables that were entered in the second model as predictors with difficulty sleeping as the dependent variable, together with the regression results. It can be seen that the second model explained a greater amount of the variance within the data, with model 2 Pseudo R-Square yielding 21.6%, just over three times as much as variance as model 1.

Insert Table 3 about here

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There were a number of key differences between the two models. Firstly, the association of three variables with the dependent variable (difficulty sleeping) changed from significant to non-significant once the two affective variables were entered into model 2. These were *household income, no major illness* and *ever combined drugs with alcohol*. Thus, once depression and anxiety symptoms were controlled for, these three factors no longer exerted a significant influence on sleeping difficulty. Secondly, the association of three variables with the dependent variable (difficulty sleeping) remained significant even once the two affective variables were entered into the model. These were *highest qualification, bodyweight dissatisfaction* and *any abuse* in the last 3 years. Thus these three factors were predictors of difficulty sleeping even when the effects of the self reported depression and anxiety symptoms were controlled for. *Frequency of binge drinking* was interesting in that it was not significant (p=.112) in model 1 but then became significant (p=.046) in model 2.

Discussion

The findings clearly show that difficulty sleeping in this cohort of young women was most strongly associated with a greater likelihood of reporting symptoms of intense anxiety episodes and depression. The amount of variance explained by the regression analyses more than tripled when affective symptoms were added in as predictors. The odds ratio found for anxiety symptoms in relation to difficulty sleeping (17) is the same as that noted by others (Taylor, Lichstein, Durrence, Reidel, & Bush, 2005). Diagnosed anxiety or depression in the last three years yielded lower odds ratios, which were nevertheless significant.

In contrast, SES variables were less important contributors to sleeping difficulties. While Arber, Bote and Meadows (2009) noted the primacy of socio-economic inequalities in predicting sleep disruption in women, the current findings argue much more strongly for the primacy of affective problems in predicting sleep disruption. The current findings may differ from those of Arber and colleagues as the spread of ages of the samples surveyed was different, with the present sample having a much more restricted age range. Odds ratios for affective issues in relation to difficulty sleeping were generally two to eight times as high as odds ratios for socio-economic variables. Nevertheless, the current study shows that lower *qualification* levels (in contrast to the other SES variables of *household income* and *unemployment*) were still predictive of sleeping difficulties even when affective problems were controlled. This finding of the importance of education is consistent with a study of older women which found that years of education strongly predicted objectively determined sleep latency and, to a lesser extent, sleep efficiency (Friedman, Love, & Rosenkranz, et al., 2007). Interestingly, Baker, Wolfson and Lee (2009) noted that less education was associated with more reported daytime sleepiness (but not poorer sleep quality) in a population sample of US women aged from 18 to 64.

Regression analyses further showed that four variables were significant predictors of difficulty sleeping, even when controlling for depression and anxiety symptoms. *Binge drinking* predicted difficulty sleeping, independent of affective variables, suggesting that frequency of alcohol binging exerts an independent effect on sleep quality. This is supported by studies that show the architecture of sleep is altered by alcohol consumption (Landolt, Roth, Dijk, & Borbely, 1996) and that such effects may be present beyond a single night of sleep, possibly mediated by alcohol's influence on melatonin secretion patterns (Rupp, Acebo, & Carskadon, 2007). *Bodyweight dissatisfaction*, reflecting a desire to weight 10+kg less, was also independently associated with difficulty sleeping. It is not know to what extent this reflects a genuine level of being overweight or a distorted perception of bodyweight, possibly arising from an eating disorder such as anorexia nervosa. For the overweight women, their difficulty sleeping may be, at least partially, influenced by sleep disordered breathing/sleep apnoea, although this sleep disorder is more prevalent in males than females (American Academy of Sleep Medicine (AASM), 2005). There is evidence of an association between shorter sleep duration and a tendency to obesity (Marshall, Glozier, & Grunstein, 2008) and such an association (with uncertain causation factors) may be relevant here. A *history of abuse* in the last three years (sexual, emotional and/or physical abuse as well as harassment) was also associated with difficulty sleeping in the last year, even when depression and anxiety symptoms were controlled for. This is consistent with other evidence of the pervasive and lasting effects of abuse on women's well being (Krakow et al., 2001), such that abuse can continue to exert psychosomatic effects, including on sleep quality, even in the absence of self reported depression or anxiety symptoms. It is not known how many women were in ongoing abusive relationships at the time of completing the survey. While young adult males may also be victims of abuse (notably physical abuse), rates of sexual abuse are significantly higher in females in community samples (Briere & Elliot 2003). Interestingly, a different analysis of this same cohort of young women reported an (unadjusted) lifetime

prevalence of forced sex of 9.3% (Astbury, Bruck & Loxton, 2011) with regression analyses showing significant associations between forced sex and recurrent sleeping difficulties, even when affective variables were controlled. Reporting a *major illness* in the last three years did not predict difficulty sleeping when affective symptom variables were controlled, suggesting that clinicians should be alert to the possibility that poor sleep that is presented as relating to a physical illness may actually have depression and/or anxiety symptoms as a co-existing influential factor. Similarly, having *ever combined drugs and alcohol* did not predict difficulty sleeping once affective symptoms were controlled for.

This study provided no evidence of a relationship between sleep and *unemployment*; sleep and *brisk walking*; or sleep and *daily smoking*. However, caution is needed, especially for the latter two relationships, as rather gross measures of the dichotomous variables of brisk walking (none versus one or more hours per week) and smoking (at least one cigarette per day versus none) were used.

Other findings were that almost 1 in 10 young women reported 'often' having difficulty sleeping with a third of these having sought help for their sleep difficulties. Less than half of those who sought help were satisfied with that help, while within the sleeping difficulty group only 11% were taking prescription medication for sleep. In comparison, a ALSWH survey involving women aged 70-75 years found that a higher percentage (17%) of older women reported sleeping difficulty often, sought help from doctors for sleep at over twice the rate of the younger women and were five times more likely to use prescription medication within the last month (Byles, Mishra, & Harris, 2005; Hasan, Byles, Mishra, & Harris, 2001).

The key limitations of this study arise from the cross-sectional nature of the data, the total reliance on self-report, the slight bias in the sample to women of higher SES and the under-representation of minority groups. In Part 1 there is a sampling bias towards women living in rural

and regional areas compared to urban areas. The narrow age range of the young women in this study means that the results cannot be generalised to women of other ages. Further, this study has not attempted to evaluate variables in the context of insomnia and no information is available on the extent to which the self-reported difficulties sleeping may fit with a formal definition of insomnia (APA, 2000; AASM, 2005).

Given the very strong relationship found in this study between affective variables and sleep difficulties in young women, the current data provides indirect support for the notion that the gender disparity in sleep difficulties in young adults may indeed be driven by the known higher rates of affective symptoms in women (Hale, Phuong Do, & Busurto-Davila, et al., 2009). Further, the possible contribution of a history of abuse to the higher rates of sleep problems in young women should not be overlooked. The SES variable of qualification level was also consistently associated with sleep difficulties and may play an important but possibly more minor role as a predictor. Definitive conclusions across gender lines require the examination of these same predictors in a population that also included young adult males.

The clinical implications of these findings, taken as a whole, are that for young women presenting with difficulty sleeping, probing for symptoms of anxiety and depression is recommended. This should occur even if their poor sleep is attributed to other factors. However, also of clinical relevance is the finding that binge drinking, bodyweight dissatisfaction, lower qualification level and history of abuse were predictors of sleeping difficulty in young women even when depression and anxiety symptoms were controlled. Sensitive questioning regarding binge drinking or a history of abuse may be appropriate. These lifestyle and abuse factors may be associated with sleeping difficulties in ways that are not necessarily intertwined with anxiety and depression. On the other hand having a lower household income, a recent major illness, and ever having

combined alcohol and drugs appear to only predict sleeping difficulty in this sample via a co-existing relationship with depression and anxiety.

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Figure Legend:

Figure 1: Percentages of young women (24-30 years) reporting different levels of difficulty sleeping (often, sometimes or no/rarely) as a function of a range of dichotomous independent variables