available at www.sciencedirect.com

ScienceDirect

journal homepage: www.ejconline.com

Prevalence and predictors of insomnia in women with invasive ovarian cancer: Anxiety a major factor

Melanie A. Price[a,b,], Robert Zachariae[c,d], Phyllis N. Butow[a,b], Anna deFazio[e], Deepa Chauhan[a,b], Colin A. Espie[f], Michael Friedlander[g], Penelope M. Webb[h], The Australian Ovarian Cancer Study Group [e,h,i], The Australian Ovarian Cancer Study – Quality of Life Study Investigators*

[a]*Centre for Medical Psychology and Evidence-based Decision-making (CeMPED), School of Psychology, University of Sydney, Sydney, NSW, Australia*
[b]*School of Psychology, University of Sydney, Sydney, NSW, Australia*
[c]*The Psycho-oncology Research Unit (PRU), Department of Psychology, University of Aarhus, Aarhus, Denmark*
[d]*Department of Oncology, Aarhus University Hospital, Aarhus, Denmark*
[e]*Department of Gynaecological Oncology, Westmead Hospital and Westmead Institute for Cancer Research, University of Sydney at the Westmead Millennium Institute, Westmead, NSW, Australia*
[f]*University of Glasgow Sleep Centre, Sackler Institute of Psychobiological Research, Southern General Hospital, Glasgow, Scotland, United Kingdom*
[g]*Department of Medical Oncology, Prince of Wales Hospital, Randwick, NSW, Australia*
[h]*Cancer and Population Studies, Queensland Institute of Medical Research, Brisbane, QLD, Australia*
[i]*Peter MacCallum Cancer Centre, Melbourne, Victoria, Australia*

ARTICLE INFO

Article history:
Received 27 February 2009
Received in revised form 11 May 2009
Accepted 22 May 2009
Available online 18 June 2009

Keywords:
Insomnia
Ovarian cancer
Sleep disturbance
Anxiety
Stress psychological
Prevalence

ABSTRACT

The estimated prevalence of insomnia in cancer patients varies between 20% and 50%, which is substantially higher than the general population. To date, little is known about the risk factors for insomnia in patients with cancer. This study examines the prevalence and predictors of insomnia in a population-based sample of women with ovarian cancer.

Participants were 772 women participating in the Australian Ovarian Cancer Study – Quality of Life Study. Insomnia was assessed using the Insomnia Severity Index (ISI). Demographic, disease and treatment variables, and psychosocial variables, including anxiety and depression, support care needs and social support and coping, were investigated as potential predictors of insomnia. Twenty-seven percent of women reported sub-clinical symptoms of insomnia (ISI score 8–14) and 17% reported clinically significant insomnia (ISI score 15–28). Three variables were significant predictors of clinically significant insomnia: young age (<50 years: Odds Ratio (OR) = 2.36; Confidence Interval (CI) 1.06–5.26; 50–59 years: OR = 2.73; CI 1.33–5.64) relative to 70+ years; higher unmet needs in the physical/daily living domain (OR = 1.02; CI 1.01–1.03) and elevated anxiety (sub-clinical anxiety (Hospital Anxiety and Depression Scale (HADS) score 8–10): OR = 1.83; CI 1.04–3.24; clinical anxiety (HADS score 11–21): OR = 2.03; CI 1.08–3.85). In contrast to predictors of primary insomnia, women with cancer aged <60 years were more likely to report clinical levels of insomnia than women of 70+ years. Consistent with primary insomnia, elevated anxiety predicted

* *Corresponding author:* Address: Centre for Medical Psychology and Evidence-based Decision-making, School of Psychology, Brennan McCallum (A18), The University of Sydney, NSW, Australia. Tel.: +61 2 9351 3916; fax: +61 2 9036 5292.
E-mail address: melaniep@psych.usyd.edu.au (M.A. Price).
0959-8049/$ - see front matter
doi:10.1016/j.ejca.2009.05.030

insomnia in women with ovarian cancer. Given that both anxiety and insomnia are relatively common, and the relationship may potentially be bi-directional, the efficacy of interventions targeting insomnia and anxiety, rather than insomnia alone, is worthy of consideration.

1. Introduction

Sleep disturbance is both a common occurrence and a neglected problem in cancer patients.[1,2] Insomnia is the most common type of sleep disturbance and refers to a range of sleep-related symptoms. Symptoms include: difficulty in falling and staying asleep; early morning wakening with inability to resume sleep and non-restorative sleep. These symptoms can lead to increased levels of distress and impairment in daytime functioning.[1,3] Psychological and behavioural consequences include daytime fatigue, mood disturbance and psychiatric disorders, and difficulties in memory and concentration.[1,4] Physiological and physical consequences include, greater perception of pain, immunosuppression and may possibly adversely impact on survival.[1,5]

In their 2001 review, Savard and Morin[1] estimate that between 30% and 50% of newly diagnosed cancer patients report insomnia. Several years after treatment, 23–44% of cancer survivors were still reporting symptoms of insomnia, indicating that insomnia may become a chronic problem if left untreated.[2,6] Many of these studies assessed insomnia using a single item measure, with heterogeneous samples of cancer patients and/or small sample sizes. Using a single item to assess insomnia has been criticised as insufficient to capture the full symptomatology of insomnia and therefore to adequately distinguish between sub-clinical and clinically significant insomnia.[7]

More recent studies have used clinical interviews or validated questionnaires to assess and classify symptoms of insomnia. Savard and colleagues[2] reported that 51% of non-metastatic breast cancer survivors who received radiotherapy had symptoms of insomnia, with 19% meeting criteria for clinically significant insomnia. Davidson and colleagues[8] reported that 30% of cancer survivors attending out-patient clinics had clinical levels of insomnia. Insomnia was most common in breast (38%), lung (37%), gastrointestinal (32%) and gynaecological (29%) cancer patients. Similarly, Bardwell and colleagues[9] reported that 39% of women with stages I–IIIA breast cancer had clinically significant insomnia up to 4 years post-diagnosis. While definitions and measures vary, sleep disturbance and clinically significant insomnia are a substantial problem in cancer patients, and the prevalence of insomnia is greater than the 7.0–9.5% reported in general population studies.[10]

Three studies have reported data on sleeping difficulties in women with ovarian cancer. All three used a single item question among a list of symptoms. The estimates varied between 46% and 60% of ovarian cancer patients and survivors,[11,12] while Donovan and colleagues[13] found that current ovarian cancer patients reported sleep disturbance as the third most severe symptom from a list of 22 symptoms.

From the general insomnia literature, various risk factors have been identified, including older age, female gender, lower socio-economic status/education, divorced/single status, poorer physical health and physical symptoms such as pain, poorer mental health and life event stress.[10,14,15] Despite the high prevalence of insomnia in cancer patients, and the likely negative impact of this on quality of life,[5] few data are available regarding risk factors for insomnia in cancer patients, and none specifically for women with ovarian cancer.

In 300 non-metastatic breast cancer survivors, Savard and colleagues[2] identified sick leave, unemployment, widowhood, lumpectomy, chemotherapy and surprisingly, a lower stage of cancer that were associated with sub-clinical and clinically significant insomnia. Davidson and colleagues[8] reported that fatigue, younger age, leg restlessness, use of sleeping pills, low mood, frightening dreams, concerns and recent cancer surgery, were associated with insomnia in a heterogeneous group of cancer survivors. In patients registering for palliative care, Akechi and colleagues[16] reported younger age, diarrhoea and living alone as associated with current insomnia. Increased psychological distress between baseline and follow-up significantly predicted insomnia at follow-up, while increasing physical symptoms, declining physical functioning and use of new drugs potentially impacting on sleep, either positively or negatively, were not predictive.

Bardwell and colleagues[9] have undertaken the only comprehensive study of risk factors for insomnia in cancer patients. In 2645 early breast cancer survivors, cancer-related variables, personal characteristics, health behaviours, physical symptoms and psychosocial variables were examined as potential predictors. Several factors were associated with insomnia in univariate analyses, including lower education, less physical activity, more pain, vasomotor, genitourinary, gastrointestinal symptoms, less social support, more social strain, life events and depressive symptoms. However, in multivariate analysis, only depressive symptoms and vasomotor symptoms (night sweats in particular) were significant predictors of insomnia.

In summary, research to date indicates that insomnia is a significant problem for cancer patients and survivors, and suggests that the prevalence of insomnia is significantly greater than in the general population. We identified only four studies exploring predictors of insomnia, two in heterogeneous samples of cancer patients and two in women with early breast cancer. Younger age and low mood were the only significant predictors of insomnia in more than one study.

The aims of the current study were to:

1. Describe the prevalence of insomnia in a population-based sample of women with both early and late stage ovarian cancer.

2. Identify demographic, medical and psychological predictors of insomnia in women with ovarian cancer.

2. Methods

2.1. *Australian Ovarian Cancer Study Quality of Life Study (AOCS QoL Study)*

The Australian Ovarian Cancer Study (AOCS) is a population-based study, recruiting women aged 18–79 years with epithelial ovarian cancer (including fallopian tube and primary peritoneal cancers) between 2002 and 2006. Details of the study have been described elsewhere.[17] In short, women were recruited through major treatment centres (prior to surgery when possible) and state-based cancer registries. AOCS collects detailed behavioural, environmental and dietary data relating to the period ending one year prior to diagnosis, and on-going treatment and outcome data. The AOCS Quality of Life (QoL) study is a sub-study, which investigates the role of psychosocial factors, including psychological distress, social support and unmet supportive care needs, in predicting QoL, recurrence and survival in ovarian cancer.

2.2. *Participants*

AOCS participants with invasive cancer who were alive in May 2005 or recruited after this date were invited to participate in the QoL study. Women were initially contacted by a member of the AOCS team at the Queensland Institute of Medical Research to preserve confidentiality. Initial contact via mail outlined the study and provided an opt-in/opt-out card, and sought permission for their name and contact details to be forwarded to the QoL study team. Non-responders were contacted by telephone by the AOCS team within seven days to confirm interest. Women consenting to be contacted by the QoL team were mailed an information statement, consent form, questionnaire booklet and a reply paid envelope. Women were given the option of declining participation or seeking more information by contacting the QoL study research co-ordinator.

Participants were specifically asked to check for missing answers before returning the questionnaire. Generally, if more than one item on any questionnaire was missing, the participant was contacted to complete the missing item. Missing data on the psychological questionnaires were therefore minimal.

Approval for the study was obtained from The University of Sydney and Queensland Institute of Medical Research Human Research Ethics Committees and all participating sites.

2.3. *Measures*

2.3.1. *Primary outcome measure*

Insomnia was measured using the 7-item Insomnia Severity Index (ISI).[18] This questionnaire asks about problems concerning: sleep onset; sleep maintenance; early morning awakenings; sleep satisfaction; perceived interference of sleep difficulties with daytime functioning; noticeability of sleep problems by others and distress caused by sleep difficulties. The response options for each item are scored 0–4, and are summed to give a range of possible scores between 0 and 28. A score between 0 and 7 indicated no sleep impairment; 8 and 14 sub-threshold sleep impairment; 15 and 21 moderate sleep impairment; and 22 and 28, severe sleep impairment. In this study, an ISI score between 8 and 14 was classified as subclinical insomnia, and an ISI score between 15 and 28 was classified as clinically significant insomnia. The ISI has been validated in patients with sleep disorders and cancer patients, has good internal consistency (Cronbach's alpha 0.65–0.78), test–retest reliability ($R = 0.73$–0.83) and convergent validity when compared with sleep diary data.[19] The ISI is recommended as a standard assessment for the evaluation of insomnia in clinical populations.

2.3.2. *Predictor variables*

1. *Socio-demographics*: *Education*, *work status* and *marital status* were accessed via AOCS. *Regional area* (metropolitan and regional/remote) was calculated using the postcode of residential addresses. *Age* was calculated using date of birth and date of QoL questionnaire completion.
2. *Disease and treatment*: *Time elapsed between initial diagnosis and completion of questionnaire, surgical stages* (I–IV) (FIGO, International Federation of Gynecology and Obstetric classification), primary *tumour site* (ovary, peritoneal and fallopian tube) and *tumour type* (epithelial and non-epithelial) were accessed through AOCS. *Current treatment* (chemotherapy, radiotherapy and hormonal treatment) was collected via questionnaire, or from AOCS if missing.
3. *Unmet needs* were assessed with the 34-item Supportive Care Needs Survey (SCNS-34).[20] This survey measures the level of unmet needs across five domains: psychological; health information; physical and daily living; patient care and sexuality. Scores on each domain are scaled to range between 0 and 100, with higher scores reflecting higher unmet needs.
4. Psychological:
   (a) *Anxiety and depression* were assessed using the 14-item Hospital Anxiety and Depression Scale (HADS),[21] which is a commonly used measure of emotional disturbance, widely used in cancer patients. Two sub-scales distinguish between anxiety and depression. Within each sub-scale, scores distinguish between 'normal' (0–7), 'sub-clinical' (8–10) and 'clinical' (11–21) anxiety and depression.
   (b) *Social support* was assessed using the 8-item Duke UNC Functional Social Support Questionnaire[22] which measures a person's satisfaction with the functional and affective aspects of their social support. Scores range between 8 and 40, with higher scores indicating greater support.
   (c) *Psychological adjustment to cancer* was measured using the helplessness/hopelessness and minimisation sub-scales of the Mental Adjustment to Cancer (MAC) Scale.[23] The MAC sub-scales are reliable and widely validated, and measure particular styles of coping or adjustment to cancer that have been linked to cancer outcome. Helplessness/hopelessness scores range between 6 and 24, with higher

scores reflecting greater helplessness/hopelessness. Minimisation scores range between 5 and 20, with higher scores reflecting higher minimisation.

(d) *Current treatment for mental health problems:* Patients were asked: In the last three months have you been taking any medication, or having other treatment, for mental health problems? Patients were classified as currently having treatment if they responded Yes.

2.4. Statistical analyses

Data were analysed using SPSS 15.0 for windows (SPSS Inc., Chicago). The response rate was calculated. Descriptive statistics included frequencies and means with standard deviations. When relevant, if there were small numbers of respondents in a category or based on theoretical considerations, responses were collapsed into fewer categories. Binary logistic regression was conducted in five steps with the aim of identifying independent predictors of clinically significant insomnia, and the relative importance of specific predictors of clinically significant insomnia. The associations between insomnia and (1) demographics, (2) disease and treatment variables, (3) unmet needs and (4) psychological adjustment, psychological consequences and current treatment for mental health problems were assessed. As the majority of predictors were associated with age, the analyses were age adjusted. Significance was set at $p < 0.05$. Significant predictors of clinical insomnia in Steps 1–4 were included in the final fully adjusted model (Step 5).

3. Results

3.1. Participant demographic and disease characteristics

Between May 2005 and December 2006, 1204 eligible AOCS participants were invited into the QoL study. Of these women, 293 women declined and a further 115 did not complete the questionnaire. A total of 796 women completed the baseline questionnaire (66%). Clinical and histopathological characteristics of the cohort are displayed in Table 1. Responders and non-responders (including refusals, deaths and loss of contact) were similar in terms of age and marital status. Responders were more likely to have a university education (16%) than non-responders (10%), and not surprisingly, responders were less likely to have advanced-stage disease at diagnosis (70%) than non-responders (77%).

Participating women had a mean age of 60 years (range 22–82) and the majority married. Approximately 70% were diagnosed with stage III/IV disease, an average 19 (SD 10) months previously. Twenty-two percent are currently having treatment. Further demographic, disease and treatment details and the relationship with clinically significant insomnia are displayed in Table 2. Among these variables, only younger age significantly predicted insomnia in univariate analyses.

3.2. Insomnia

Data from the Insomnia Severity Index were available for 772 participants. Over half (56.3%) reported no sleep impairment, 26.8% reported sub-clinical insomnia and 16.8% reported clinically significant insomnia. Table 3 displays the mean total ISI score, the mean score and the percentage for each item response. The most common symptoms reported were dissatisfaction with sleep pattern, difficulty in staying asleep, waking early and interference with daily functioning.

Table 1 – Clinical and histopathological characteristics of the ovarian cancer cohort.

Characteristic	Number of patients	%
Patient characteristics (n = 796)		
Age, years		
Median	60.5	
Range	22–82	
Stage		
I	153	19.7
II	81	10.4
III	486	62.6
IV	56	7.2
Primary site		
Ovary	667	83.8
Peritoneum	74	9.3
Fallopian tube	31	3.9
Ovary/peritoneal	24	3.0
Histology		
Epithelial		
Serous	520	65.3
Mucinous	27	3.4
Endometrioid	92	11.6
Clear cell	47	5.9
Other	89	11.2
Other – sub-type not known[a]	15	1.9
Non-epithelial		
Germ cell	3	0.4
Granulosa cell	3	0.4

a Including adenosarcoma, adenocarcinoma and carcinoma (undifferentiated or not otherwise specified).

3.3. Psychological variables

Descriptives and results of the univariate analyses for potential psychological predictors are displayed in Table 4. Higher unmet needs, higher helplessness/hopelessness, lower minimisation, lower social support, higher anxiety, higher depression and currently having treatment for mental health problems were all significantly associated with clinically significant insomnia.

3.4. Predictors of insomnia

Using clinically significant insomnia as the outcome variable, binary logistic regression analyses were undertaken to determine the relative importance of demographic, biomedical, unmet needs and psychological variables as predictors (see Table 5). The final model included the significant predictors of insomnia identified in Steps 1–4. Individual variables contributing to the variance in insomnia included: younger age (<50 years: Odds Ratio (OR) = 2.36 (95% Confidence Interval (CI) 1.06–5.26); 50–59 years: OR = 2.73 (CI 1.33–5.64), compared

Table 2 – Descriptives for demographic, disease, and treatment characteristics and univariate Odds Ratios (ORs) and 95% Confidence Intervals (95% CIs) for clinically significant insomnia.

	N (772)	% (100)	OR[a]	CI (95%)	p
Age (years)					
<50	115	14.9	3.54	1.71–7.34	0.04
50–59	239	31.0	3.21	1.65–6.24	0.001
60–69	274	35.5	1.66	0.84–3.31	0.001
70+ (reference)	144	18.7	1	–	
Education					
School (⩽12 years)	373	48.3	1.83	0.98–3.42	0.18
TAFE/college	256	33.2	1.97	1.07–3.63	0.03
University (reference)	129	16.3	1	–	
Work status					
Full time (reference)	189	24.5	1	–	
Part time	123	15.9	1.32	0.72–2.43	0.41
Not employed	486	50.0	1.72	1.00–2.94	0.13
Regional area					
Major city (reference)	494	64.0	1	–	
Regional/remote area	278	36.0	1.04	0.69–1.55	0.64
Marital status					
Married/defacto (reference)	546	70.7	1	–	
Widowed/divorced/separated	154	19.9	1.34	0.81–2.20	0.17
Never married	46	6.0	0.61	0.24–1.50	0.51
Disease stage at diagnosis					
Early (stage I/II) (reference)	223	29.7	1	–	
Late (stage III/IV)	529	68.5	1.09	0.71–1.67	0.81
Primary tumour site					
Ovary (reference)	646	83.7	1	–	
Peritoneal/fallopian tube/multiple	126	16.3	1.49	0.90–2.48	0.09
Tumour type					
Epithelial (reference)	752	97.4	1	–	
Non-epithelial/unknown sub-type	20	2.6	2.56	0.98–6.80	0.054
Months post-diagnosis (mean (SD)	18.7	10.3	1.00	0.98–1.02	0.87
Current treatment for cancer					
No (reference)	564	73.1	1	–	
Yes	167	21.6	1.21	0.76–1.91	0.51

a Adjusted for age.

to women aged 70+ years; higher levels of unmet needs in the physical/ daily living domain (OR = 1.02, CI 1.01–1.03); and greater anxiety (sub-clinical anxiety: OR = 1.83, CI 1.04–3.24; clinical anxiety: OR = 2.03, 1.08–3.85). Psychological unmet needs, helplessness/hopelessness and treatment for mental health problems, were no longer statistically significant.

In an attempt to better understand the relationship between unmet needs in the physical and daily living domain and insomnia, a binary logistic regression was conducted including the individual items as predictors. A single item, namely lack of energy and tiredness, was significantly associated with insomnia (OR = 1.68; CI 1.30–2.17).

4. Discussion

In this large and representative sample of women with ovarian cancer, insomnia was reported by 44% of the sample, with 17% (130/772) experiencing clinically significant insomnia. This result is similar to the earlier studies of cancer patients, in which 20–50% have sub-clinical symptoms of insomnia and about 20% with clinically significant insomnia.[1,2,8,9,16,24] Previous studies of women with ovarian cancer have not focused specifically on insomnia but have reported rates of sleeping difficulties between 40% and 60%.[11–13]

The most prevalent concerns reported in the present study were dissatisfaction with sleep quality, and difficulty in remaining asleep, with 29% of women reporting that their insomnia interferes with their daily function. The focus of interventions such as Cognitive Behaviour Therapy (CBT) tends to be upon eliminating maintaining factors and reinstating more normal sleep. Understanding the triggers and maintainers of insomnia in these women is critical to allow effective intervention.[25]

In this sample three variables were linked to a higher risk of insomnia: younger age, a general lack of energy and raised levels of anxiety. The first is somewhat surprising, given that older age is usually associated with insomnia.[10] Bardwell and colleagues[9] found that older age was associated with insomnia in women with early breast cancer. Two significant differences between the Bardwell and

Table 3 – Impairment of sleep in women with ovarian cancer as measured by the Insomnia Severity Index (ISI): Mean scores, item responses and number of patients with scores indicating no sleep impairment, sub-threshold, moderate and severe sleep impairment (N = 772).

ISI total score mean (SD) ISI item responses and scores	Item responses (%) (range 0–4)					6.6 (7.3) Mean (SD)
	0	1	2	3	4	
1. Difficulty in falling asleep[a]	56.6	14.2	18.3	8.0	2.8	0.86 (1.1)
2. Difficulty in staying asleep[a]	50.9	11.5	21.8	13.3	3.6	1.06 (1.2)
3. Waking up too early[a]	56.1	10.9	17.6	10.3	4.9	0.97 (1.3)
4. Satisfaction with sleep pattern[b]	46.3	5.9	13.0	28.5	6.4	1.43 (1.5)
5. Interferes with daily function[c]	50.8	20.0	18.2	7.3	3.6	0.93 (1.1)
6. Noticeable by others[c]	63.8	19.2	12.1	3.5	1.3	0.59 (0.9)
7. Worried about sleep problem[c]	57.8	20.9	13.9	4.7	2.7	0.74 (1.0)

Sleep impairment categorical	N	%
None (0–7)	435	56.3
Sub-threshold (sub-clinical insomnia) (8–14)	207	26.8
Moderate (15–21)	105	13.6
Severe (22–28)	25	3.2
Moderate – severe (clinically significant insomnia) (15–28)	130	16.8

a 0 – 'none', 1 – 'mild', 2 – 'moderate', 3 – 'severe' and 4 – 'very severe'.
b 0 – 'very satisfied', 1 – 'satisfied', 2 – 'neutral', 3 – 'dissatisfied' and 4 – 'very dissatisfied'.
c 0 – 'not at all', 1 – 'a little', 2 – 'somewhat', 3 – 'much' and 4 – 'very much'.

colleagues study and the present study are important to be noted; namely the substantially better survival rate in early breast cancer compared with ovarian cancer, and the different measures of insomnia used by Bardwell and colleagues (WHI-IRS) which does not include items related to sleep dissatisfaction and daytime dysfunction. However, both

Table 4 – Descriptives for psychosocial variables, univariate Odds Ratios (ORs) and 95% Confidence Intervals (95% CIs) for associations with clinically significant insomnia.

Continuous variables	Mean	SD	OR[a]	CI (95%)	*p*
Unmet needs (SCNS-34)					
Physical and daily living (0–100)	24.7	24.7	1.03[b]	1.03–1.04	0.001
Psychological (0–100)	30.5	25.5	1.04[b]	1.03–1.04	0.001
Sexual (0–100)	18.7	25.9	1.02[b]	1.01–1.02	0.001
Care-related (0–100)	17.3	19.7	1.03[b]	1.02–1.04	0.001
Informational (0–100)	23.1	22.6	1.02[b]	1.02–1.03	0.001
Total unmet needs	113.8	92.0	1.01[b]	1.01–1.01	0.001
Adjustment to cancer (MAC)					
Helplessness/hopelessness (6–24)	9.3	3.4	1.22	1.15–1.28	0.001
Minimisation (5–20)	16.1	2.8	0.92	0.86–0.98	0.009
Social support (Duke UNC) (8–40)	34.6	6.2	0.93	0.90–0.96	0.001
Categorical variables	N	%	OR[a]	CI (95%)	
Anxiety (HADS)					
Normal (0–7) (reference)	545	68.5	1	–	
Sub-clinical (8–10)	129	16.3	2.99	1.81–4.94	0.001
Clinical (11+)	118	14.9	6.33	3.92–10.23	0.001
Depression (HADS)					
Normal (0–7) (reference)	676	84.9	1	–	
Sub-clinical (8–10)	70	8.8	3.78	2.16–6.63	0.001
Clinical (11+)	46	5.8	7.13	3.75–13.54	0.001
Current treatment for mental health problems					
No (reference)	637	80.0	1	–	
Yes	144	18.1	3.20	2.10–4.86	0.001

a Age adjusted.
b Odds ratio per one point change.

Table 5 – Predictors of clinically significant insomnia: Final fully adjusted logistic regression model.

	OR (95% CI)	*p*
Age (reference: 70+ years)	1	
60–69	1.24 (0.59–2.60)	0.57
50–59	2.73 (1.33–5.64)	<0.01
<50	2.36 (1.06–5.26)	0.04
Unmet needs (continuous)		
Physical and daily living	1.02 (1.01–1.03)	<0.01
Psychological	1.01 (1.00–1.02)	0.15
Adjustment to cancer (MAC) (continuous)		
Helplessness/hopelessness	1.07 (0.99–1.15)	0.08
	–	–
Anxiety (HADS) (reference: normal)	1	
Sub-clinical	1.83 (1.04–3.24)	0.04
Clinical	2.03 (1.08–3.85)	0.03
Current treatment for mental health (reference: yes)	1	
	1.41 (0.86–2.32)	0.17
		$\chi^2 = 131.5$
		$p < 0.001$

Davidson and colleagues.[8] and Akechi and colleagues[16] also found that younger age was predictive of insomnia in cancer patients. We split the sample into those under and over age 60, with the majority of those being under 60 in the 50–59 age bracket. Perhaps this group was most likely to be experiencing peri-menopausal symptoms, which are known to increase insomnia, while even the younger women are likely to have been pushed into menopause by the surgery and chemotherapy they were experiencing. Lamberg[26] report that 50% of women 55–64 years of age report dissatisfaction with sleeping poorly. Sleep dissatisfaction (as reported on the ISI items 3 and 4) was high in our sample, and this has been shown to increase the likelihood of individuals presenting with a mental health disorder.[27] Alternatively, younger age is known to be correlated with greater distress in cancer patients,[28] and this may have contributed to their higher number of insomnia symptoms.

Unsurprisingly, a lack of energy was related to insomnia: however, it is difficult to know which symptom comes first. If a lack of energy discourages physical activity, this may contribute to insomnia, but equally, poor sleep will produce low energy. Other physical issues in this study, such as pain, were not related to insomnia. Most women reported low levels of unmet need in these areas, suggesting that pain and symptom control were effective. Thus improving palliative care will be unlikely to solve the sleep problems of these women.

Surprisingly, disease-related variables such as stage, time since diagnosis and current treatment status were also unrelated to insomnia. We had thought that women with more advanced disease and/or those currently on treatment would be suffering more, both physically and emotionally, and would be more vulnerable to insomnia. Unfortunately, we did not ask women how long they had been experiencing sleep difficulties prior to diagnosis, and as this analysis was cross-sectional, we cannot comment on the persistence of symptoms at this time. We intend to analyse our longitudinal data once this is available, and further studies to answer these important questions.

Women who were even moderately anxious had a higher risk of insomnia, but depression was unrelated to insomnia in the multivariate analysis. It is not surprising that 31% of our sample reported moderate to severe anxiety–perhaps it is more surprising that depression rates were relatively low (14%). However, this is a common finding in studies of psychological morbidity in cancer patients.[29] It has been suggested that resilience in cancer patients is high, perhaps because the perspective on life has shifted.[30] Nevertheless the link between anxiety and insomnia suggests a potential avenue for intervention.

With respect to unmet needs and insomnia, while higher unmet needs in the physical and daily living domain were statistically significant predictors, the odds ratio was modest (1.02) and it is difficult to determine the clinical significance of this. Examination of the individual items of the unmet needs data in this sample reveals that the highest levels of unmet needs reported are: help in dealing with fear of recurrence (48%), help with dealing with their concern about the worries of those around them (44%) and with living with uncertainty (43%). The evidence for the efficacy of Cognitive Behaviour Therapy (CBT) in treating insomnia is well established. However, in this context, CBT alone may not be sufficient to target these anxieties and fears which are unfortunately realistic. Recently, methods such as mindfulness-based stress reduction training[31] have been utilised to assist women to focus on the moment and increase relaxation, and may be useful here, either alone or in combination with cognitive behaviour therapy.[32] The fact that women who coped by minimising the impact of cancer on their lives were less prone to insomnia in this sample (at least in the univariate analysis) suggests that assisting women in this fashion may be helpful.

4.1. *Limitations of the study and conclusions*

Although the study sample was recruited from a population-based study sample, the 66% response rate means that the findings may not be relevant for all women with ovarian

cancer. Furthermore, only women with ovarian cancer were recruited and the results may not be generalisable to people with cancer at other sites. This was a cross-sectional study, so causation can only be inferred. A large-scale prospective study, such as that conducted by Akechi and colleagues,[16] with multiple strategies to ensure a high retention rate, is required. Nevertheless, this study has highlighted the extent of insomnia as a problem in people with cancer, and some potential avenues for clinical intervention which should be further explored. Interventions that target anxiety and insomnia together may be most efficacious.

Ethics statement

The work has been approved by the appropriate ethical committees related to the institutions in which it was performed, and participants have given informed consent.

Role of funding source

No involvement in study.

Funding

This study was funded by The Cancer Council New South Wales and The Queensland Cancer Fund (RG 36/05). Financial support for the parent study was provided by the US Army Medical Research and Materiel Command under DAMD17-01-1-0729, the National Health and Medical Research Council of Australia (400413 and 400281) and the Cancer Councils of New South Wales, Queensland, South Australia, Tasmania and Victoria and the Cancer Foundation of Western Australia. Additional recruitment was conducted under the Australian Cancer Study (Ovarian Cancer), funded by the National Health and Medical Research Council of Australia (199600). P. Butow is supported by the National Health and Medical Research Council of Australia Principal Research Fellowship (211199 and 457093). P.W. is supported by a Senior Research Fellowship from the National Health and Medical Research Council of Australia.

Conflict of interest statement

None declared.

Acknowledgements

Full membership of the AOCS Group is listed at http://www.aocstudy.org/. We gratefully acknowledge the contribution of all our clinical and scientific collaborators and the cooperation of the following institutions: New South Wales: John Hunter Hospital, North Shore Private Hospital, Royal Hospital for Women, Royal North Shore Hospital, Royal Prince Alfred Hospital, Westmead Hospital and New South Wales Cancer Registry; Queensland: Mater Misericordiae Hospital, Royal Brisbane and Women's Hospital, Townsville Hospital, Wesley Hospital and Queensland Cancer Registry; South Australia: Flinders Medical Centre, Queen Elizabeth II, Royal Adelaide Hospital and South Australian Cancer Registry; Tasmania: Royal Hobart Hospital; Victoria: Freemasons Hospital, Mercy Hospital For Women, Royal Women's Hospital and Victorian Cancer Registry; Western Australia: King Edward Memorial Hospital, St John of God Hospitals Subiaco, Sir Charles Gairdner Hospital, Western Australia Research Tissue Network (WARTN) and Western Australia Cancer Registry. We also acknowledge the contribution of the study nurses and research assistants and would like to thank all the women who participated in the study.

REFERENCES

1. Savard J, Morin CM. Insomnia in the context of cancer: a review of a neglected problem. *J Clin Oncol* 2001;**19**:895–908.
2. Savard J, Simard S, Blanchet J, Ivers H, Morin CM. Prevalence, clinical characteristics, and risk factors for insomnia in the context of breast cancer. *Sleep* 2001;**24**:583–90.
3. Buysse DJ, Ancoli-Israel S, Edinger JD, et al. Recommendations for a standard research assessment of insomnia. *Sleep* 2006;**29**:1155–73.
4. Roscoe JA, Kaufman ME, Matteson-Rusby SE, et al. Cancer-related fatigue and sleep disorders. *Oncologist* 2007;**12**(Suppl. 1): 35–42.
5. Berger AM, Sankaranarayanan J, Watanabe-Galloway S. Current methodological approaches to the study of sleep disturbances and quality of life in adults with cancer: a systematic review. *Psychooncology* 2007;**16**:401–20.
6. Savard J, Simard S, Ivers H, Morin CM. Randomized study on the efficacy of cognitive-behavioral therapy for insomnia secondary to breast cancer, part II: Immunologic effects. *J Clin Oncol* 2005;**23**:6097–106.
7. Lee KA, Ward TM. Critical components of a sleep assessment for clinical practice settings. *Issues Mental Health Nurs* 2005;**26**:739–50.
8. Davidson JR, MacLean AW, Brundage MD, Schulze K. Sleep disturbance in cancer patients. *Soc Sci Med* 2002:541309–21.
9. Bardwell WA, Profant J, Casden DR, et al. Women's Healthy Eating Living Study Group. The relative importance of specific risk factors for insomnia in women treated for early-stage breast cancer. *Psychooncology* 2008;**17**:9–18.
10. Morin C, LeBlanc M, Daley M, Gregoire JP, Merette C. Epidemiology of insomnia: prevalence, self-help treatments, consultations, and determinants of help-seeking behaviors. *Sleep Med* 2006;**7**:123–30.
11. Fitch MI, Gray RE, DePetrillo D, Franssen E, Howell D. Canadian women's perspective on ovarian cancer. *Cancer Prev Control* 1999;**3**:52–60.
12. Portenoy RK, Thaler HT, Kornblith AB, et al. Symptom prevalence, characteristics and distress in a cancer population. *Qual Life Res* 1994:3183–9.
13. Donovan HS, Hartenbach EM, Method MW. Patient–provider communication and perceived control for women experiencing multiple symptoms associated with ovarian cancer. *Gynecol Oncol* 2005;**99**:404–11.
14. Taylor D, Lichstein KL, Durrence H, Riedel BW, Bush AJ. Epidemiology of insomnia, depression and anxiety. *Sleep* 2005;**28**:1457–64.
15. LeBlanc M, Beaulieu-Bonneau S, Merette C, Savard J, Ivers H, Morin CM. Psychological and health-related quality of life factors associated with insomnia in a population-based sample. *J Psychosom Res* 2007;**63**:157–66.

16. Akechi T, Okuyama T, Akizuki N, et al. Associated and predictive factors of sleep disturbance in advanced cancer patients. *Psychooncology* 2007;**16**:888–94.
17. Jordan SJ, Green AC, Whiteman DC, et al. Serous ovarian, fallopian tube and primary peritoneal cancers: A comparative epidemiological analysis. *Int J Cancer* 2008;**122**:1598–603.
18. Morin C. *Insomnia: psychological assessment and management*. New York: Guildford Press; 1993.
19. Morin CM, Beaulieu-Bonneau S, LeBlanc M, Savard J. Self-help treatment for insomnia: a randomized controlled trial. *Sleep* 2005;**28**:1319–27.
20. Centre for Health Research & Psycho-oncology. Supportive Care Needs Survey – Short Form 34. CHERP: Newcastle; 2003.
21. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand* 1983;**67**:361–70.
22. Broadhead WE, Gehbach SH, de Gruy FV, Kaplan BH. The Duke-UNC functional social support questionnaire. *Med Care* 1988;**26**:709–23.
23. Watson M, Greer S, Young J, Inayat Q, Burgess C, Robertson B. Development of a questionnaire measure of adjustment to cancer: the MAC scale. *Psychol Med* 1988;**18**:203–9.
24. Savard J, Simard S, Ivers H, et al. Randomized study on the efficacy of cognitive-behavioral therapy for insomnia secondary to breast cancer. Part I: Sleep and psychological effects. *J Clin Oncol* 2005;**23**:6083–96.
25. Espie CA, Broomfield NM, MacMahon KM, Macphee LM, Taylor LM. The attention-intention-effort pathway in the development of psychophysiologic insomnia: a theoretical review. *Sleep Med Rev* 2006;**10**:215–45.
26. Lamberg L. Menopause not always to blame for sleep problems in midlife women. *JAMA* 2007;**297**:1865–6.
27. Ohayon MM. Epidemiology of insomnia: what we know and what we still need to learn. *Sleep Med Rev* 2002;**6**:97–111.
28. Norton TR, Manne SL, Rubin S, et al. Prevalence and predictors of psychological distress among women with ovarian cancer. *J Clin Oncol* 2004;**22**:919–26.
29. Kissane DW, Grabsch B, Love A, et al. Psychiatric disorder in women with early stage and advanced breast cancer: a comparative analysis. *Aust NZ J Psychiatr* 2004;**38**:320–6.
30. Sharpe L, Butow P, Smith C, McConnell D, Clarke S. Changes in quality of life in patients with advanced cancer: evidence of response shift and response restriction. *J Psychosom Res* 2005;**58**:497–504.
31. Carlson LE, Garland SN. Impact of mindfulness-based stress reduction (MBSR) on sleep, mood, stress and fatigue symptoms in cancer outpatients. *Int J Behav Med* 2005;**12**:278–85.
32. Espie CA, Fleming L, Cassidy J, et al. Randomized controlled clinical effectiveness trial of cognitive behaviour therapy compared with treatment as usual for persistent insomnia in patients with cancer. *J Clin Oncol* 2008;**26**:4651–8.