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## Sleep disturbance in cancer patients

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### Abstract

Sleep difficulty is a prominent concern of cancer patients, yet there has been no large study of the prevalence and nature of sleep disturbance in cancer patients. This cross-sectional survey study examined: (a) the prevalence of reported sleep problems in patients attending six clinics at a regional cancer centre; (b) sleep problem prevalence in relation to cancer treatment; and (c) the nature of reported insomnia (type, duration, and associated factors). For three months, all patients attending clinics for breast, gastrointestinal, genitourinary, gynecologic, lung, and non-melanoma skin cancers were offered a brief sleep questionnaire. Response rate was 87%; the final sample size was 982. Mean age of respondents was 64.9 years (SD 12.5). The most prevalent problems were excessive fatigue (44% of patients), leg restlessness (41%), insomnia (31%), and excessive sleepiness (28%). Chi square tests showed significant variation among clinics in the prevalence of most sleep problems. The lung clinic had the highest or second-highest prevalence of problems. The breast clinic had a high prevalence of insomnia and fatigue. Recent cancer treatment was associated with excessive fatigue and hypersomnolence. Insomnia commonly involved multiple awakenings (76% of cases) and duration  $\geq 6$  months (75% of cases). In 48% of cases, insomnia onset was reported to occur around the time of cancer diagnosis (falling within the period 6 months pre-diagnosis to 18 months post-diagnosis). The most frequently identified contributors to insomnia were thoughts, concerns, and pain/discomfort. In a multivariate logistic regression analysis, variables associated with increased odds of insomnia were fatigue, age (inverse relationship), leg restlessness, sedative/hypnotic use, low or variable mood, dreams, concerns, and recent cancer surgery. This study provides new information about sleep-related phenomena in cancer patients, information which will be useful in planning supportive care services for cancer patients. © 2002 Elsevier Science Ltd. All rights reserved.

**Keywords:** Cancer; Sleep; Insomnia; Fatigue; Sleepiness; Canada

### Introduction

Although sleep difficulty is associated with various medical conditions, including cardiovascular, respira-

tory, and painful musculoskeletal conditions (Foley et al., 1995; Gislason, Reynisdottir, Kristbjarnarson, & Benediktsdottir, 1993; Habte-Gabr et al., 1991; Katz & McHorney, 1998; Maggi et al., 1998; Moldofsky, 1986), little is known about sleep quality in people with cancer. It seems likely that the emotional and physical distress of cancer would be associated with sleep problems. Indeed, sleep difficulty is one of the most prominent concerns of cancer patients (Ginsburg, Quirt, Ginsburg, & Mackillop, 1995; Sarna, 1993; Whelan et al., 1997). In studies that focused specifically on sleep, Kaye, Kaye, and Madow (1983) found that 45% of 30 patients with

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advanced cancer reported difficulty staying asleep, and Silberfarb, Hauri, Oxman, and Schnurr (1993) found polysomnographic evidence of prolonged sleep latency and night-time wakefulness among 32 cancer patients. However, until now, there appears to have been no large survey study of the quality of sleep of cancer patients.

Knowledge of the nature and prevalence of sleep problems among cancer patients can provide the basis for new approaches to supportive care, because many sleep problems can be effectively treated. For example, given the effectiveness of psychological interventions for insomnia (Morin, Culbert, & Schwartz, 1994; Murtagh & Greenwood, 1995), quality of life stands to be improved substantially (within the limits imposed by illness) for cancer patients with insomnia. Improving sleep may have benefits for cancer patients beyond reversal of negative effects of insomnia on emotional, cognitive, and physical functioning. Evidence of links between sleep and natural killer cell activity (Dinges et al., 1994; Irwin et al., 1995; Irwin, Smith, & Gillin, 1992; Moldofsky, Lue, Davidson, & Gorczyński, 1989) raises the possibility that sound sleep may be important for immune defense against tumour cells.

This survey study was designed to gather sleep-related data that could ultimately inform the design of supportive care services at cancer centres. The primary objective was to examine the nature and prevalence of sleep problems in patients attending a regional cancer centre, with special attention to insomnia. The specific goals were to examine: (a) the prevalence of reported sleep problems in patients attending six clinics at a regional cancer centre; (b) the prevalence of reported sleep problems in relation to recent cancer treatment; and (c) the nature of reported insomnia, including type, duration, identified contributors, and associated variables.

## Methods

### *Study population*

Due to the suggestion that sleep difficulties or reporting of these problems vary by cancer type (Silberfarb et al., 1993), sleep problems were studied by diagnostic group (clinic). Patients attending the following clinics at the Kingston Regional Cancer Centre were surveyed: breast, gastrointestinal (GI), genitourinary (GU), gynecologic (Gyn), lung, or non-melanoma skin (skin). Non-melanoma skin cancers (mainly squamous and basal cell) are considered less severe than other cancers, as they rarely metastasize and are usually successfully treated (DeVita Jr., Hellman, & Rosenberg, 1997). Because of their non-threatening nature when treated early, they are generally managed as clinically benign entities. Thus, patients attending the non-melanoma skin clinic comprised an internal control

group, whose rates of sleep problems could be compared with those for other clinics.

### *Sleep questionnaire*

A “Sleep Survey” questionnaire inquired about the presence or absence of various sleep phenomena over the previous four weeks. In addition it included questions about mood, general health, cancer, and personal (demographic) characteristics. For ease of completion, the questionnaire was designed to be answered quickly (in 5–10 min) and 37 of the 42 items were answered by ticking boxes. The sleep questions inquired about the presence, in the previous four weeks, of: insomnia, sleep-related breathing difficulty, restlessness in the legs while in bed, repetitive leg movements, dreaming more than usual, frightening or unpleasant dreams, excessive sleepiness, excessive fatigue, sleeping more than usual, naps, and use of tranquilizers or sleeping pills. The tranquilizer/sleeping pill question matched a question from the 1990 Ontario Health Survey to allow comparison of results with provincial data. The main sleep questions are shown in Appendix A. The full questionnaire can be obtained from the first author. To preserve anonymity, the questionnaire did not ask for name or other identifying information. The Sleep Survey was prefaced by an expression of the investigators’ interest in patients’ responses regardless of whether or not they slept well.

### *Definition of insomnia*

The respondent was identified as having insomnia if he or she did each of the following: (a) answered “yes” to the question “In the past 4 weeks, have you had any trouble sleeping?”; (b) indicated that the trouble occurred on at least seven of the previous 28 nights; and (c) indicated that the trouble sleeping interfered with daytime functioning, specifically affecting any of the following at least “some of the time”: ability to carry out usual activities, ability to concentrate, emotions, physical well being, or ability to cope with stress. The combination of a person’s perception of sleep difficulty with associated impairment of functioning is consistent with insomnia descriptions in standard diagnostic classification systems (American Psychiatric Association, 1994; American Sleep Disorders Association, 1997). The respondent specified whether the type of sleep trouble involved trouble falling asleep, waking up several times, waking up for a long time, or waking up too early. This manner of asking about insomnia is similar to items from a scale developed by Jenkins, Stanton, Niemcryk, and Rose (1988) who provided evidence of construct validity for these items with their data from cardiac surgery patients.

## Procedures

The Sleep Survey was offered by the clinic receptionist to all patients arriving for clinic appointments over a three-month period between July and October, 1996. This was the time necessary to collect a targeted minimum of 100 questionnaires from each clinic. This number allowed detection of a 20% difference in prevalence values between clinics ( $\alpha=0.05$ ) with 80% power. (This calculation assumes a 50% prevalence value in one group; the detection becomes finer as the prevalence moves away from 50%.) Patients answered the questionnaires as they waited for their appointments, and placed them in an identified custom-made box in the waiting area.

## Data analysis

A check was made of the match between the stated diagnosis on each questionnaire and the clinic attended by the patient (coded on the form). In cases where there was a conflict between the clinic attended and the type of cancer specified (3% of cases), the questionnaire was excluded, as these patients were likely seen in the clinic under unusual circumstances (e.g., urgent assessment) and probably do not represent clinic attendees. Exclusion of these cases also ensured that the clinic variable accurately reflected diagnostic group. In cases where the diagnosis was missing from the questionnaire, the diagnosis was assumed to be consistent with the clinic. The percent of questionnaires with missing information on diagnosis ranged from 3% (breast clinic) to 19% (Gyn clinic).

For demographic variables, cancer-related, and mood variables where answers were descriptive, missing values (0–8% of cases) were excluded from the prevalence computations and statistical analyses. For dichotomous variables including sleep variables and pain, missing values (4–13% of cases) were considered negative answers for prevalence computation and analyses. For data on recent cancer treatment, if a patient indicated having received more than one treatment in the past six months, the primary treatment was determined, based on the diagnosis and other questionnaire data by an oncologist (one of the authors). When asked to estimate the start date of their insomnia, 12 patients provided a written response, all indicating a lengthy duration (e.g. “many years”), rather than specifying a date. For these patients, the duration of insomnia was set at 10 years, allowing the information they had provided to be included in the computation of the median.

Basic descriptive statistics were used to summarize patient characteristics. Time spans were represented by medians. Prevalence of reported sleep problems were expressed as percentages and displayed with 95% confidence limits. Pearson chi square tests were used to determine whether sleep problem prevalence rates varied

by clinic or by cancer treatment categories. Observation of non-overlapping 95% confidence intervals allowed individual clinic rates to be compared visually (and conservatively; Goldstein & Healy, 1995). We performed logistic regression analyses in order to explore Sleep Survey variables (demographic, clinical, and sleep-related) associated with insomnia. The specific variables were the following: *demographic*: age, sex, partner category (married/living with a partner, separated/divorced, single, widowed), work category (working/homemaker, disability/unemployed, retired); *clinical*: clinic, time from cancer diagnosis (binned by year, after examination of the data in 6-month bins), treatment in previous six months (chemotherapy, radiotherapy, surgery, other, none); pain or discomfort (yes, no), concerns about health (yes, no), spirits (up most of the time, up and down, down, neither up nor down); *sleep-related* (all yes, no): naps, tranquilizers/sleeping pills, interruptions to breathing during sleep, restlessness in legs, repetitive leg movements, dreaming more than usual, frightening/unpleasant dreams, overly sleepy, overly fatigued.

The analysis had two parts. First, univariate logistic regression analyses were carried out for all the above variables, with insomnia as the dependent variable. A multivariate logistic regression was then performed using variables with  $p < 0.25$  (Hosmer & Lemeshow, 1989) from the univariate analyses. For the multivariate logistic regression, we used a backward elimination procedure, until the model contained only variables contributing significantly to the model, with  $\alpha$  set at 0.05. (The variable “repetitive leg movements” was excluded from the multivariate analysis, as this phenomenon is known to be strongly associated with restless legs, represented by the variable “restlessness in the legs”.) Potential effects of colinearity among the variables in the model were investigated by dropping and replacing one variable at a time, and observing the effects on the odds ratios of the remaining covariates and the standard errors of their coefficients (Hosmer & Lemeshow, 1989).

## Results

The response rate for cancer patients was 87%, for a total of 1012 completed questionnaires. Thirty respondents specified diagnoses that were inconsistent with the clinic attended and these cases were excluded from the analyses, making the final sample size 982. The Gyn clinic was composed of patients with cervical, endometrial or ovarian cancer, in nearly equal proportions, although two patients had cancer of the vulva. The GU clinic was composed predominantly of patients with prostate cancer, but included patients with cancer of the testis (8 cases), kidney (4), or bladder (2). The GI clinic was composed primarily of patients with colorectal

Table 1  
Characteristics of cancer centre respondents, shown overall and by clinic<sup>a</sup>

	All cancer	Clinic					
		Breast	GI	GU	Gyn	Lung	Skin
<i>N</i>	982	302	108	155	180	114	123
Age (years)							
Mean	64.9	61.1	65.0	68.8	61.1	67.3	72.4
SD	12.5	12.0	11.8	9.5	13.8	10.5	12.1
Sex ratio (% female : % male)	62:38	99:1	40:60	0:100	100:0	38:62	35:65
Time from diagnosis (months)							
Median	34.0	36.7	32.2	39.6	34.2	11.0	73.1
Patients who received cancer treatment in previous 6 months (%)	32.8	31.7	33.7	27.1	24.3	52.7	35.8

<sup>a</sup> GI = gastrointestinal; GU = genitourinary; Gyn = gynecologic; Skin = non-melanoma skin.

cancer, although other types of GI cancer were represented: esophagus (6), pancreas (1), stomach (1), small bowel (1), and anal canal (1). Patients in the breast, lung, and skin clinics had breast, lung, and non-melanoma skin cancer, respectively.

#### Patient characteristics

Respondent characteristics are shown in Table 1. Overall, 41% of patients reported having received a cancer diagnosis within the previous two years, 26% were two to five years post-diagnosis, and 32% were five or more years post-diagnosis. Treatment received in the previous six months was given as radiotherapy in 7–15% of cases by clinic, surgery in 5–14%, chemotherapy for 0–10% (except for lung cancer where it was 30%) and “other” (biologic, hormonal, liquid nitrogen, or phototherapy) in 1–7%. More than half of patients (54.3%) indicated that they experienced pain or discomfort at least “some of the time”. Approximately two-thirds (67.2%) indicated that they had concerns or fears about their health or other issues. Most patients indicated that their mood was “up most of the time” (47.2%) or “up and down” (41.2%) as opposed to “down most of the time” (4.1%) or “neither up nor down” (7.5%).

#### Prevalence of sleep-related phenomena

Most patients (60.6%) indicated taking naps at least “some of the time”. The percentages of patients reporting insomnia and other sleep-related problems are shown in Table 2. This shows that for several phenomena there was significant variability among clinics ( $df=5$ ), and for these phenomena, high rates were observed in the lung and breast clinics. Lung cancer patients showed the highest, or second-highest ranking by prevalence for reported sleep problems. Not shown in Table 2 are the prevalence rates of dreaming

more than usual and having frightening/unpleasant dreams. For these variables, there was no significant variation among clinics; the overall rates were 19.8% and 18.3%, respectively.

Among those who reported having received recent cancer treatment (previous six months), the prevalence of most sleep problems<sup>2</sup> was similar across treatment types (chemotherapy, radiotherapy, and surgery); therefore, the data for these subgroups were combined. The combined data are shown in Table 3, in comparison with data from patients who reported no recent treatment. As shown, those who reported recent treatment had significantly higher prevalence of several problems, particularly problems of excessive sleepiness and fatigue.

Because of suggestions of associations between cranial radiation and hypersomnolence (Faithfull, 1991), the data from the 30 people who reported having radiation to the head were examined separately. Compared to patients who reported receiving recent treatment but *not* radiation to the head, those who reported radiation to the head were more likely to report excessive sleepiness (56.7% versus 34.9%;  $\chi^2 = 5.38$ ,  $df=1$ ,  $p = 0.020$ ) and sleeping more than usual (46.7% versus 28.5%;  $\chi^2 = 4.13$ ,  $df=1$ ,  $p = 0.042$ ). Prevalence of other sleep problems did not differ significantly between these two groups.

#### Nature of insomnia

Three hundred patients reported insomnia. Overall, waking several times was the most common type of insomnia, identified by 76% of patients with insomnia.

<sup>2</sup> Insomnia was an exception. The prevalence of insomnia was 45.0% in the surgery group, versus 34.5% for chemotherapy, and 29.5% for radiotherapy. This variation by treatment type did not reach statistical significance, however ( $\chi^2 = 5.10$ ,  $df=2$ ,  $p = 0.078$ ).

Table 2  
Prevalence (%), and 95% confidence intervals (in parentheses), of reported sleep problems, overall and compared among clinics<sup>a</sup>

	All cancer	Breast	GI	GU	Gyn	Lung	Skin	$\chi^2$ (df=5)	<i>p</i>
Overly fatigued	44.3 (41.2–47.5)	<b>48.0</b> (42.3–53.8)	38.9 (29.7–48.8)	40.0 (32.2–48.2)	46.1 (38.7–53.7)	<b>56.1</b> (46.5–65.4)	31.7 (23.6–40.7)	18.8	<0.001
Restlessness in legs	40.8 (37.7–44.0)	42.7 (37.1–48.5)	37.0 (27.9–46.9)	37.4 (29.8–45.5)	42.8 (35.5–50.4)	46.5 (37.1–56.1)	35.8 (27.3–44.9)	4.9	0.424
Insomnia	30.5 (27.7–33.5)	<b>37.8</b> (32.3–43.9)	32.4 (23.7–42.1)	18.1 (12.4–25.0)	29.4 (22.9–36.7)	36.8 (28.0–46.4)	22.8 (16.2–30.6)	24.7	<0.001
Overly sleepy	28.0 (25.2–30.9)	26.5 (21.6–31.9)	21.3 (14.0–30.2)	30.3 (23.2–38.2)	31.7 (25.0–39.0)	<b>39.5</b> (30.5–49.1)	18.7 (12.2–26.7)	17.1	<0.001
Use of tranquilizers/ sleeping pills	21.5 (19.0–24.2)	20.5 (16.1–25.5)	19.4 (12.5–28.2)	14.8 (9.6–21.4)	22.8 (16.9–29.6)	<b>40.4</b> (31.3–50.0)	14.6 (8.9–22.1)	32.1	<0.001
Sleeping more than usual	18.3 (16.0–20.9)	13.6 (9.9–18.0)	15.7 (9.5–24.0)	15.5 (10.2–22.2)	20.0 (14.1–26.6)	34.2 (25.6–43.7)	18.7 (12.2–26.7)	25.4	<0.001
Repetitive leg movements	16.5 (14.2–19.0)	13.9 (10.2–18.3)	15.7 (9.5–24.0)	18.1 (12.4–25.0)	12.8 (8.3–18.6)	28.1 (20.1–37.3)	16.3 (10.2–24.0)	14.7	0.012
Interruptions to breathing during sleep	11.1 (9.2–13.2)	9.6 (6.5–13.5)	7.4 (3.3–14.1)	11.0 (6.5–17.0)	8.3 (4.7–13.4)	14.9 (8.9–22.8)	18.7 (12.2–26.7)	12.5	0.029

<sup>a</sup> Values in boldface are clinic values with 95% confidence intervals that do not overlap with those for corresponding values of the non-melanoma skin group.

Table 3  
Prevalence (%) of sleep problems in patients who received cancer treatment in the previous six months and those who did not

	Recent treatment <i>n</i> = 260	No recent treatment <i>n</i> = 612	$\chi^2$ (df=1)	<i>p</i>
Overly fatigued	54.2	41.3	12.24	<0.001
Restlessness in legs	42.7	41.5	0.11	0.745
Insomnia	35.4	29.6	2.86	0.091
Overly sleepy	36.9	25.7	11.25	<0.001
Use of tranquilizers or sleeping pills	32.3	18.0	21.67	<0.001
Sleeping more than usual	30.4	14.2	30.96	<0.001
Repetitive leg movements	17.3	17.0	0.01	0.910
Interruptions to breathing during sleep	12.7	9.6	1.80	0.180
Dreaming more than usual	25.4	18.8	4.82	0.028
Frightening or unpleasant dreams	20.8	18.0	0.93	0.334

This was followed by trouble falling asleep (44%), waking for a long time (35%), and waking up too early (33%). Most patients with insomnia (59%) indicated that they had some combination of these problems; 35% indicated having two types, 17% having three types, and 7% having all four types. The remainder indicated only one type of insomnia (39%) or did not specify the type (2%).

The median duration of insomnia was 18.9 months (range 1 day to 39 years). The reported duration was six

months or longer in 75.3% of cases. The reported month and year of insomnia onset was examined in relation to the reported month and year of cancer diagnosis. The median time from cancer diagnosis to onset of insomnia was zero months. As can be seen in Fig. 1, there was a preponderance of reports of insomnia onset coinciding with the time of cancer diagnosis. For 48.2% of patients with insomnia, the reported onset of sleep trouble fell within the period six months pre-diagnosis to 18 months post-diagnosis.

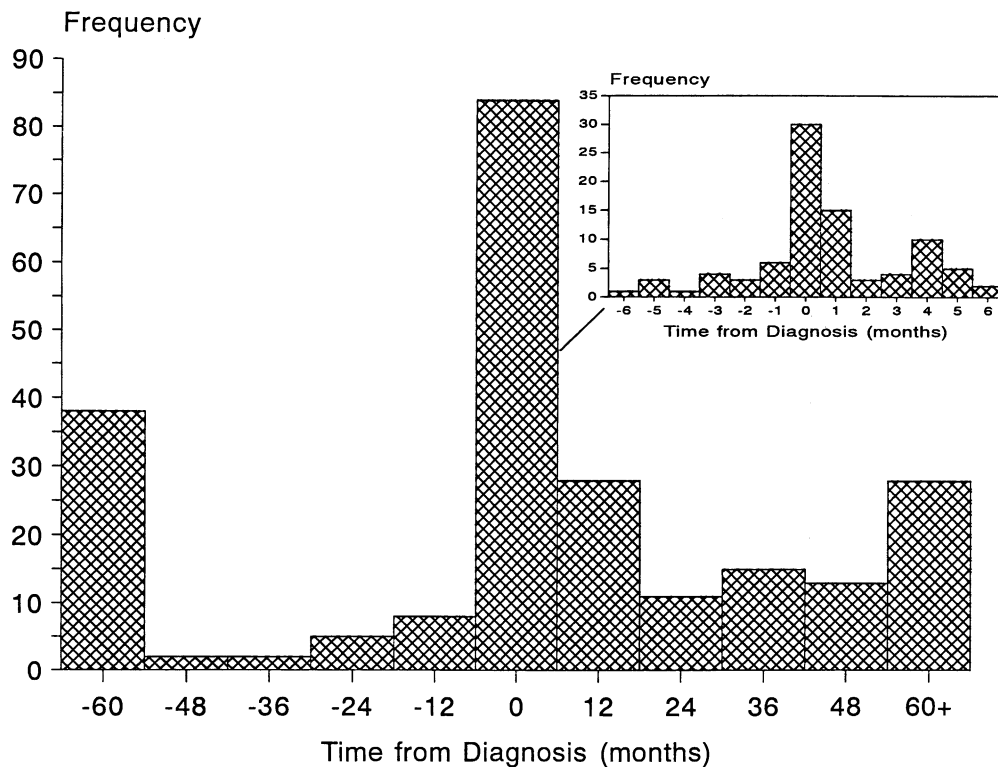


Fig. 1. Frequency distribution of time from cancer diagnosis to start of insomnia ( $N = 234$ ).

Table 4

Coefficients for covariates in the multiple logistic regression model with respective odds ratios for insomnia

Covariate	Regression coefficient	Standardized coefficient ( $\beta$ )	Odds ratio	95% confidence interval for odds ratio
Overly fatigued	0.911	0.250	2.49	1.75–3.55
Age (25–96 years)	–0.030	–0.210	0.97 <sup>a</sup>	0.96–0.98
Restlessness in legs	0.750	0.204	2.12	1.53–2.94
Sleeping pills or tranquilizers	0.696	0.160	2.01	1.38–2.91
Spirits down	1.386	0.149	4.00	1.69–9.50
Frightening or unpleasant dreams	0.660	0.143	1.94	1.26–2.96
Dreaming more than usual	0.573	0.128	1.77	1.17–2.68
Spirits up and down	0.408	0.110	1.50	1.06–2.13
Concerns	0.430	0.109	1.54	1.01–2.33
Cancer surgery in past 6 months	0.626	0.096	1.87	1.08–3.24

<sup>a</sup>Coefficients and odds ratios for age are shown for one-year units. For a 10-year increase in age, the odds ratio goes to 0.74.

The vast majority of patients with insomnia (89.0%) indicated that the sleep trouble affected how they felt physically; 76.3% indicated that it affected their ability to cope with stress; 72.3% that it affected their emotions; 65.0% that it affected their ability to carry out usual activities; and 64.7% that it affected their ability to concentrate. The majority of respondents (73.3%) indicated that they had experienced previous periods of troubled sleep in their life, although most of these

(57.3%) indicated “a few” such periods, as opposed to “some” (26.3%) or “many” (16.4%).

The most commonly identified attributions for insomnia were, in descending order of prevalence: thoughts (52.0% of patients with insomnia), pain or discomfort (45.0%), concerns about my health (38.7%), concerns about my family or friends (33.0%), cancer diagnosis (32.0%), physical effects of cancer (27.7%), and concerns about finances (22.7%). Factors identified

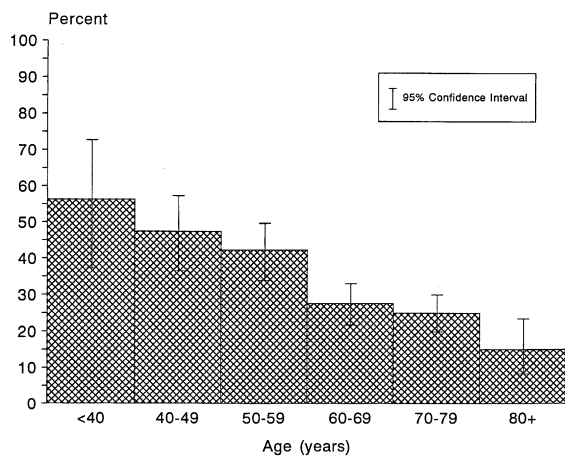


Fig. 2. Prevalence of insomnia by age category.

by 10–20% of patients included: concerns about various situations (carrying out usual activities, living situation, treatment effects, work), physical effects of other (non-cancer) disorders, feelings, noise or sounds, thoughts about my death, medication or treatment, relationship troubles, positive events (e.g., family celebration, travel), death of someone close, and weather. Factors identified by fewer than 10% of patients included: alcohol, caffeine, and concerns about appearance, my treatment decision, and arranging to come for treatment. Seven percent of those with insomnia indicated that they did not know what contributed to the problem.

Because of the preponderance of sleep problems among lung cancer patients, the attributions these patients made for insomnia were examined separately. The 40 lung cancer patients with insomnia were most likely to indicate the following contributors: cancer diagnosis (54.8%), concerns about my health (54.8%), pain/discomfort (54.8%), thoughts (52.4%), and physical effects of cancer (35.7%).

#### *Logistic regression for insomnia*

In the univariate analyses, the prevalence of insomnia varied significantly among levels of all demographic, clinical, and sleep-related variables ( $p < 0.0001$ ) except partner category, time from diagnosis, recent treatment, and naps. As these last four variables had  $p$  values less than 0.25, all variables were carried over to the multivariate logistic regression analysis. The final multivariate logistic model was based on data from 938 patients and contained 10 variables. The coefficients from the final model, and corresponding odds ratios for insomnia, are shown in Table 4. Age was found to be linearly and inversely related to insomnia prevalence. The prevalence of insomnia by age decade is shown in Fig. 2. According to the logistic regression model, with

an increase of 10 years of age, a patient was 26% less likely to report insomnia, all other covariates held constant. The overall model was found to be generally stable across clinics.

## **Discussion**

### *The most prevalent problems*

#### *Fatigue*

Fatigue is now recognized as a significant quality of life issue in cancer care (Howell, 1998; Longman, Braden, & Mishel, 1996; Pater, Zee, Palmer, Johnston, & Osoba, 1997) and has been linked to numerous factors: radiation, chemotherapy, surgery, weight loss, anemia, biochemical or endocrine changes, stress, depression, anxiety, pain, and sleep quality (Faithfull, 1998; Gall, 1996; Irvine, Vincent, Graydon, & Bubela, 1998; Richardson & Ream, 1996; Smets et al., 1998a, b; Stone, Richards, & Hardy, 1998). In this study, patients who reported being overly fatigued were 2.5 times more likely to have insomnia than others. The contribution of insomnia to cancer-related fatigue has been largely overlooked, and this area warrants further investigation.

#### *Leg restlessness*

Restlessness in the legs had a fairly uniform prevalence across clinics and cancer treatment categories. Leg restlessness, itself, can delay or disrupt sleep but it also predicts the presence of periodic limb movement disorder (PLMD; American Sleep Disorders Association, 1997), a related problem which can disrupt sleep more profoundly, inducing insomnia or daytime sleepiness. Individuals may be unaware of periodic leg movements during sleep, and our data show that only 16% of patients noted having sleep-related repetitive leg movements. A higher rate than this (53%) was reported by Silberfarb et al. (1993), in 32 lung and breast cancer patients, using polysomnography and standard diagnostic criteria for PLMD.

#### *Insomnia*

There are more than 25 published reports from Europe, Australia, and North America with estimates of insomnia prevalence for various populations, based on surveys of large samples ( $N \geq 1000$ ) of adults. Prevalence estimates range widely across these studies, and this is perhaps largely attributable to wide variations in ways of asking about insomnia. Insomnia questions vary in extent of inquiry into type of sleep trouble (sleep onset, sleep maintenance, or combination), the time period asked about, and perceived frequency or severity. Very few (10%) survey studies ask about effects of sleep trouble on functioning,

although impaired functioning is part of standard clinical criteria for insomnia (American Psychiatric Association, 1994; American Sleep Disorders Association, 1997). Three large studies used insomnia questions roughly similar to those in this study (albeit without functioning criteria) and this allows some comparison of results. Brabbins et al. (1993) interviewed patients aged 65 or over who were registered at family practices in Liverpool, UK, and found an insomnia prevalence of 35%; the National Sleep Foundation and the Gallup Organization (Ancoli-Israel & Roth, 1999) conducted a telephone survey of American adults and found that 36% of respondents had chronic or occasional insomnia; Katz and McHorney (1998) in a survey study of people with chronic medical illness or depression in three large US cities found an overall insomnia prevalence of 50%. Thus, insomnia prevalence in cancer centre patients appears to be similar to that in community samples and somewhat lower than that in other chronic conditions (especially depression, cardio-pulmonary disease, and painful rheumatic conditions; Katz & McHorney, 1998).

The insomnia of cancer patients in this study was not short-lived, as three quarters of those with insomnia indicated having had the sleep trouble for at least six months, which would qualify as “chronic” insomnia, under the criteria of the International Classification of Sleep Disorders (American Sleep Disorders Association, 1997). Many patients link the onset of their insomnia to a point within the first 18 months after diagnosis. Receiving a diagnosis of cancer might be expected to precipitate a short-term or “reactive” insomnia. However, it appears that for many patients, insomnia persists. This observation is consistent with longitudinal studies of non-patient populations (Klink, Quan, Kaltenborn, & Lebowitz, 1992; Vollrath, Wicki, & Angst, 1989) and patients with chronic illness (Katz & McHorney, 1998). Cancer patients may need assistance in reversing chronic insomnia, or preventing acute insomnia from becoming chronic. Psychological interventions have been useful for treating insomnia in the general population (Morin et al., 1994; Murtagh & Greenwood, 1995), elderly populations (Engle-Friedman, Bootzin, Hazlewood, & Tsao, 1992; Morin & Azrin, 1988; Morin, Colecchi, Stone, Sood, & Brink, 1999; Morin, Kowatch, Barry, & Walton, 1993), patients with chronic pain (Currie, Wilson, Pontefract, & deLaplante, 2000), and patients with cancer (Cannici, Malcolm, & Peek, 1983; Stam & Bultz, 1986).

Patients’ attributions for insomnia point to thoughts, pain or discomfort, and concerns as the most important contributors. These data suggest that insomnia treatments aimed at reducing cognitive-emotional arousal and pain would be appropriate for cancer patients with insomnia. Relatively few patients indicated that environmental factors, caffeine, or alcohol contributed to

their sleep trouble, suggesting that either patients are not aware of these factors as sleep disturbers, or are already using practices that minimize sleep disturbance from external sources. Several breast cancer patients noted tamoxifen as a contributor to insomnia, a relationship that deserves investigation. One possibility is that sleep disruption occurs with hot flashes or other side effects of tamoxifen therapy.

#### *Sleepiness*

Sleepiness in cancer patients has seldom been studied. The current study shows that sleepiness is prevalent, especially in those who have recently received cancer treatment. Faithfull (1991) noted that severe, unexpected sleepiness following treatment can be distressing for patients. Thus, treatment-related sleepiness requires further investigation.

#### *Use of sleeping pills*

Data from the 1990 Ontario Health Survey (Ontario Ministry of Health, 1990) showed that 18.6% of people with cancer, and 6.7% of people without cancer, reported having used tranquilizers or sleeping pills within the past four weeks. The prevalence of tranquilizer/sleeping pill use found in this study (21.5%) is, therefore, similar to that of a wider population of people who have cancer. It is also similar to data from Mant and Eyland (1988) showing that 24% of consecutive general practice patients had taken a prescription hypnotic in the previous four weeks. In the present study, it is unclear what proportion of patients used anxiolytics versus hypnotics, but it is clear that a substantial proportion of cancer patients use such medications.

#### *Lung cancer patients*

Lung cancer patients had relatively high levels of all sleep-related problems. Why were they especially badly off in terms of sleep? Compared to patients in other clinics, the lung clinic patients, on average, had received their cancer diagnosis and treatment more recently. Their attributions for insomnia show that concerns about their diagnosis and state of ill health contributed to their poor sleep. The survival curve for lung cancer declines more sharply than for any other cancer type, barring pancreatic (National Cancer Institute of Canada, 1995). Thus, these patients, on the whole, were more likely to have been stressed—physically and psychologically—than other diagnostic groups, which may partly explain their high rate of sleep problems. Patients with lung cancer may also be more likely than patients in other clinics to have comorbidities such as chronic obstructive pulmonary disease, a disorder associated with sleep difficulty and daytime sleepiness (Cormick,



Olson, Hensley, & Saunders, 1986). Poor sleep with lung cancer was found by Silberfarb et al. (1993): using polysomnography, lung cancer patients were found to have longer sleep latencies, more difficulty remaining asleep, and more sleep fragmentation than either breast cancer patients or people without cancer who were “normal” sleepers.

#### *Recent treatment*

There was a general association between recent cancer treatment and sleep problems, particularly problems of fatigue and sleepiness. There was also evidence for an enhanced association between radiation to the head and hypersomnolence, in agreement with a report by Faithfull (1991). It is unknown whether this latter finding is related to brain metastases, radiation effects, or other effects. To understand the relationships between specific cancer treatments and the symptoms of fatigue and sleepiness, more research is required.

#### *Association of variables with insomnia*

The results of the multivariate logistic regression show that, in describing factors associated with insomnia in cancer patients, the type of cancer is less important than age, and certain sleep-related and emotional factors. The findings that “spirits down”, concerns, restlessness in the legs, and sleeping pill use were associated with increased odds of insomnia are similar to reported findings with non-cancer populations (Coleman et al., 1983; Maggi et al., 1998; Middelkoop, Smilde-van den Doel, Neven, Kamphuisen, & Springer, 1996; Soldatos, 1994; Watts, Coyle, & East, 1994). Many surveys have observed a relationship between depressive feelings and insomnia (Brabbins et al., 1993; Foley et al., 1995; Ford & Kamerow, 1989; Hohagen et al., 1994; Maggi et al., 1998; Mant & Eyland, 1988; Mellinger, Balter, & Uhlenhuth, 1985). The present study also shows that the many patients who reported that their mood was “up and down” were prone to insomnia, suggesting that mood variability is also associated with insomnia.

Epidemiologic studies of insomnia in community samples of adults consistently find that insomnia prevalence increases with age (Bixler, Kales, Soldatos, Kales, & Healey, 1979; Ford & Kamerow, 1989; Karacan et al., 1976; Lugaresi et al., 1983; McGhie & Russell, 1962; Mellinger et al., 1985; Moffitt, Kalucy, Kalucy, Baum, & Cooke, 1991). However, studies of sleep in older populations have not always found an age effect (Brabbins et al., 1993; Foley et al., 1995; Gislason et al., 1993; Mant & Eyland, 1988; Seppala, Hyypa, Impivaara, Knuts, & Sourander, 1997). The age data from this study are unusual in that they show a *decrease* in insomnia with age. It is conceivable that higher levels of distress exist in younger individuals who are

diagnosed with cancer, and this is reflected in higher levels of insomnia, compared to older groups. Indeed, people with cancer who are under 55 years have been identified as having a great number of unmet needs for emotional and practical support (Canadian Cancer Society, 1992). It is also possible that older members of this sample were relatively healthier. Patients with poorer health and sleep may be less likely to survive to the older age categories, and demographic data from Ontario cancer centres suggest that elderly cancer patients with advanced disease are less likely than younger patients to be referred to cancer centres (Tyldesley et al., 2000).

The observed relations of dreaming and nightmares to insomnia are consistent with reported associations between dreaming awareness and poor sleep (Baekeland & Hoy, 1971; Lugaresi et al., 1983) and between bad dreams and wakefulness (Saletu, 1975). It is unclear why those with recent surgery had higher odds of insomnia. It is possible that hospitalization contributes to insomnia in these cases; of the cancer treatments asked about in this study, surgery was the one most likely to involve a stay in hospital. Bixler et al. (1979) and Habte-Gabr et al. (1991) noted associations between hospitalization and insomnia. Because hospitalization involves adaptation to a new environment, and disruption of the usual sleep–wake routine, it is conceivable that it contributes to the surgery–insomnia association.

#### *Generalizability and limitations*

The patients in this study were at various points—months or years—after diagnosis. Although we did not inquire about stage of disease on the questionnaire (because patients would not necessarily know), the patients attending these clinics are typically heterogeneous with respect to stage of disease, and some may no longer have active disease. We cannot assume that the profile of sleep problems found in this study generalizes to other populations of people with cancer, such as children and adolescents, inpatients, those who do not attend a cancer centre, those whose cancer has been newly diagnosed, those who have other types of cancer (not surveyed here), or those who are currently receiving active treatment.

This study has several limitations. First, the data are based on patients’ self-reported experience of sleep problems over the previous four weeks, and do not imply clinical diagnoses, nor reflect sleep laboratory measures. Self-reports of medical status and medication use generally have acceptable concordance with physician or medical records (Bush, Miller, Golden, & Hale, 1989; Harlow & Linet, 1989; Kehoe, Wu, Leske, & Chylack, 1994). Akerstedt, Hume, Minors, and Waterhouse (1997) have found that, in experimental conditions with normal sleepers, subjective ratings of sleep

generally reflect physiological measures. In the present study, because only definite affirmative answers to questions are represented in the sleep problem prevalence figures, these figures are conservative estimates. For problems such as interruptions to breathing and repetitive leg movements during sleep, of which patients may be unaware, the prevalence figures are especially likely to be underestimates.

Second, the cross-sectional survey design does not provide direct information about the course of sleep problems over time, which would require a longitudinal study. Third, it is possible that the forced-choice format of most questions failed to represent all patients' experience. Fourth, the logistic regression model helps to describe associations between variables of interest and insomnia, but does not identify causal relations or temporal associations between covariates and insomnia. Fifth, we do not know the extent to which severity of illness or performance status (i.e., level of physical functioning) relates to sleep quality.

#### *Recommendations*

Sleep problems in cancer patients have received very little attention, even though quality of sleep would seem to be part of quality of life. This study provides basic information on the nature and prevalence of sleep problems, which will be helpful for describing more completely the quality of life of cancer patients, and for planning supportive services. The most common sleep-related problems are excessive fatigue, restless legs, insomnia, and excessive sleepiness. The needs of lung and breast cancer patients deserve special attention, as these patients seem especially prone to sleep problems.

It needs to be determined how best to assist patients with fatigue. Although naps, exercise, recreation, and psychological support have been proposed as methods for reducing fatigue, few approaches have been adequately evaluated (Stone et al., 1998). Investigation of the role that insomnia plays in fatigue may be helpful in understanding cancer-related fatigue and developing new ways of reducing it. Further examination of the relationships between specific cancer treatments and excessive fatigue and sleepiness is necessary so that patients can be informed prior to treatment. For patients bothered by leg restlessness, clinical investiga-

tion of this problem is warranted, as a variety of behavioural and pharmacologic approaches exist for managing cases that meet criteria for restless legs syndrome or PLMD (Chesson et al., 1999; Hening et al., 1999).

Insomnia affects the lives of a substantial proportion of cancer patients over a considerable period. Younger patients, and those who are excessively fatigued, or feeling down, are especially likely to have insomnia. Given the nature of the insomnia and the reasons identified by patients, insomnia treatments designed to reduce cognitive-emotional arousal and pain would be appropriate (such as relaxation training), as would behavioural interventions that reduce multiple awakenings (such as stimulus control therapy; Morin et al., 1994). In some cases short-term pharmacologic interventions may be useful (Mendelson, 1987). How, when, and where to offer such assistance needs to be determined, with special attention to preventing acute insomnia from becoming chronic. As chronic insomnia is associated with diminished quality of life (Kupperman et al., 1995; Roth & Ancoli-Israel, 1999; Zammit, Weiner, Damato, Sillup, & McMillan, 1998), neuropsychological impairment (Bowler, Sankary, Hartney, Smith, & Johnson, 1997), and possible reduced immunity (Irwin et al., 1995), cancer patients can little afford to be troubled by prolonged sleep disturbance.

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#### **Appendix A. Main sleep items from the Sleep Survey**

2. In the PAST 4 WEEKS,  
have you had any trouble sleeping?

YES       NO      *If NO, then skip to #9*  
*If YES, please continue...*

3. Approximately how many nights have you had trouble sleeping in the PAST 4 WEEKS (28 days)?  
 1–3                       4–6                       7–13                       14–20                       21–28

4. What has your trouble sleeping involved? *Please choose as many as apply.*  
 trouble falling asleep  
 waking up during the night several times  
 waking up during the night for a long time  
 waking up too early  
 other, specify.....

5. In the PAST 4 WEEKS, has your trouble sleeping interfered with: *Please answer each part.*

	None of the time	Some of the time	Most of the time	All of the time
your ability to do your usual activities?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
your ability to concentrate?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
your emotions?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
how you feel physically?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
your ability to cope with stress?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

10. In the PAST 4 WEEKS, have you:  
 had any interruptions to your breathing during sleep?                       YES                       NO  
 had any restlessness in your legs when in bed?                       YES                       NO  
 had any repetitive leg movements during sleep?                       YES                       NO  
 been aware of dreaming more than usual?                       YES                       NO  
 had any frightening or unpleasant dreams?                       YES                       NO

11. In the PAST 4 WEEKS, generally have you:  
 been overly sleepy ?                       YES                       NO  
 been overly fatigued (physically)?                       YES                       NO  
 been sleeping more than usual?                       YES                       NO

//  
 16. In the PAST 4 WEEKS, did you take:  
 tranquilizers or sleeping pills?                       YES                       NO

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