Poor Subjective Sleep Quality Among Patients with Cancer and Comorbid Depression: An Opportunity to Inform Screening and Intervention

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Objective: Sleep disturbances are under-identified and under-treated in oncology settings, especially for underserved populations and those with psychiatric comorbidities. This study examined the prevalence and correlates of poor subjective sleep quality as well as clinical sleep recommendations among a socioeconomically and ethnically diverse population of patients with cancer referred for depression management.

Methods: Participants were 140 adults with cancer who screened positive for depression through routine, practice-based assessment with the Patient Health Questionnaire (PHQ-9 $\geq$ 8) and were referred to a study of collaborative care for depression. Demographics, clinical characteristics, subjective sleep quality, and sleep recommendations received were self-reported by patients prior to intervention. Sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI), general health status was measured using the Patient-Reported Outcomes Measurement Information System (PROMIS) Global-10, and depressive symptoms were measured using the PHQ-9.

Results: Of 138 patients with complete data, 123 (89.1%) reported poor sleep quality, and 87 (63%) met the threshold for possible insomnia. The strongest correlates of poor subjective sleep were female gender (β=0.19, p=.02), greater depressive symptom severity (β=0.28, p=.001), and worse physical health (β=-0.19, p=.04). Of 118 patients reporting problems with sleep since their cancer diagnosis, 95 discussed the issue with a medical provider; medications were recommended most often (37; 38.9%); only 9 (9.5%) received recommendations for cognitive-behavioral therapy for insomnia (CBT-I) or other CBT.

Conclusions: Patients with cancer seeking treatment for depression report very high rates of poor subjective sleep quality and insomnia, underscoring the importance of providing and referring to guideline-concordant sleep interventions in oncology supportive care contexts.

Keywords: sleep quality, cancer, depression, patients, insomnia

INTRODUCTION:

Sleep disturbances (a broad range of complaints from difficulties initiating and maintaining sleep, to sleep-wake schedule disorders or excessive somnolence) are major concerns of adults with cancer, regardless of treatment status (Liu & Ancoli-Israel, 2008). Among cancer survivors (defined as anyone living after diagnosis; National Cancer Institute, 2021), difficulty initiating and maintaining sleep is the most common sleep complaint. Difficulty initiating sleep may be acute or chronic, rising to the level of clinical insomnia (lasting at least 3 nights per week for 3 months or more; Liu & Ancoli-Israel, 2008). Although some studies have found that rates of sleep disturbance (particularly insomnia) rise during the initial diagnosis and treatment initiation period and decline throughout and after treatment (Bean et al., 2021), longitudinal and cross-sectional studies demonstrate that insomnia is not just a transient response to cancer diagnosis and treatment and that a substantial minority of patients develop chronic sleep complaints that can persist months and years post-treatment (Gonzalez et al., 2021; Jim et al., 2018; Savard, Ivers, Villa, Caplette-Gingras, & Morin, 2011; Savard, Villa, Ivers, Simard, & Morin, 2009; Strollo, Fallon, Gapstur, & Smith, 2020). Sleep disturbance may be identified using a variety of measures, including objective measures such as polysomnography or actigraphy, or through subjective measures of global sleep quality such as the Pittsburgh Sleep Quality Index (PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989) or clinical insomnia such as the Insomnia Severity Index (ISI; Bastien, Vallières, & Morin, 2001). While exact rates of sleep disturbance vary depending on the patient population and measurement method, they are consistently high (up to 56%), even among those many years post-treatment with no evidence of disease (Gooneratne et al., 2007; Strollo et al., 2020). Among patients with cancer, sleep disturbance is associated with worse quality of life (George et al., 2016; Yennurajalingam et al.,

2017) more severe post-operative pain (Wang, Lu, Guo, Ren, & Zhang, 2019), worse treatment response (Innominato et al., 2015), increased risk for or exacerbation of depression (Accortt, Bower, Stanton, & Ganz, 2015; Collins et al., 2017; Yennurajalingam et al., 2017), and higher mortality rates (Collins et al., 2017; He et al., 2020; Innominato et al., 2015; Trudel-Fitzgerald et al., 2017). Causes of sleep disturbance among patients with cancer are multi-factorial (Irwin, 2013), including direct tumor effects, side effects of treatment, and co-occurring psychosocial concerns (Fleming, Gillespie, & Espie, 2010; Josée Savard, Ivers, Savard, & Morin, 2015).

Management of sleep disturbance in patients with cancer generally includes sleep hygiene education plus either pharmacologic and/or psychosocial intervention (Denlinger et al., 2014). To date, exploration of methods to manage sleep disturbance in patients with cancer is limited but growing, with much efficacy data extrapolated from non-cancer populations. Pharmacotherapy may include sedative-hypnotic medications such as non-benzodiazepines like eszopiclone and zolpidem, benzodiazepines, antidepressants (such as mirtazapine and trazodone) and antihistamines (such as diphenhydramine; Qaseem et al., 2016). Psychosocial interventions may include Cognitive Behavioral Therapy for Insomnia (CBT-I), Brief Behavioral Therapy for Insomnia (BBT-I), or exercise/mind-body interventions (such as yoga, Tai Chi, or Qigong; Denlinger et al., 2014). Although further research is needed, psychosocial intervention (specifically CBT-I) is generally recommended over pharmacotherapy for insomnia among both the general population and among patients with cancer given lower risk of harm (Denlinger et al., 2014; Qaseem et al., 2016).

To address sleep disturbance among patients with cancer currently in treatment or engaged in post-treatment survivorship care, it is important to gain a more nuanced understanding of sleep and risk factors for sleep disturbance among this population. While

existing studies using the PSQI to characterize sleep disturbance among different sub-populations of patients with cancer have been helpful in establishing poor quality sleep as a common complaint, their generalizability to higher-risk populations is limited. There is a need to better understand subjective sleep complaints among survivors of cancer from medically underserved populations (e.g. low socioeconomic status, racial/ethnic minority) and among those with depression. Although many studies of sleep quality among patients with cancer incorporate some measure of depressive symptoms, these samples typically include patients with mild or no depression and have not focused on patients with clinically-significant depression specifically, despite evidence that depression is especially common among survivors (Krebber et al., 2014) and that sleep disturbance is common among individuals with depression (Murphy & Peterson, 2015). Furthermore socioeconomic status (SES) represents a major risk factor for poor sleep quality (Jehan et al., 2018) and racial/ethnic minorities experience disproportionate risk factors for suboptimal sleep through structural disadvantages (Jackson, 2017).

The present study uses data from a collaborative care intervention tailored to the needs of medically underserved (e.g., low SES, Spanish-speaking) patients. Objectives of this study were threefold: 1) Determine and describe the extent to which a socioeconomically and ethnically diverse population of patients with cancer and comorbid depression experience significantly poor subjective sleep quality; 2) identify demographic and clinical correlates of poor sleep in this population; and 3) determine the extent to which patients with poor sleep discuss these issues with their oncology providers and receive evidence-based recommendations for sleep concerns. We hypothesized that, given overlapping risk factors, this population would experience a high degree of sleep disturbance (70% or greater reporting PSQI scores > 5) and that female gender, current receipt of chemotherapy or radiation treatment, more severe depression, and lower

income and educational attainment would be associated with poor sleep. We also predicted that patients who spoke with a healthcare provider would be more likely to receive recommendations for medications or supplements over CBT-I or other cognitive behavioral therapy.

METHODS:

Study Population:

The study population was gathered as part of a larger study of depression care management for underserved (e.g., low income, racial/ethnic minority, rural) patients with cancer at an NCI-designated cancer center in the Southwestern region of the United States. Briefly, the population included patients with cancer who screened positive for depression on the 9-item Patient Health Questionnaire (PHQ-9 $\geq$ 8; a recommended cut point for depression screening; Manea, Gilbody, & McMillan, 2012) and consented to a collaborative care depression management research study (delivered in English and Spanish). Patients could be at any point in their cancer treatment trajectory (pre-treatment, active anti-cancer treatment, between treatments, palliative care, or post-treatment survivorship care), the only requirement was that patients were scheduled for regular cancer center appointments (at minimum twice per year). All activities associated with the study were approved by the University of Arizona's Institutional Review Board (#0900000397). All participants provided written informed consent.

Measures:

This study used survey data, which was collected through self-report surveys administered at study baseline (prior to any aspects of the depression management intervention). Survey language (English or Spanish) and modality were flexible and based on patient

preference, including web-based surveys completed at home or on a tablet in clinic, or over the phone with a research assistant.

Demographic (e.g., age, gender, race/ethnicity) and clinical characteristics (e.g., tobacco and alcohol use, cancer type and stage, treatment history, medications) were collected by a combination of self-report and electronic medical records (in cases with missing self-report data or elements only accessible through record review).

Subjective sleep quality was measured with the Pittsburgh Sleep Quality Index (PSQI; Buysse et al., 1989) a measure that has shown good reliability and validity in patients with cancer (Beck, Schwartz, Towsley, Dudley, & Barsevick, 2004; Carpenter & Andrykowski, 1998). The PSQI contains 19 items regarding sleep over the past month, which generates 7 component scores: sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, the use of sleep medications, and daytime dysfunction. Subscale scores range from 0-3 and are added into a global score ranging from 0-21, with higher scores representing worse sleep quality. The cutoff score of >5 has been used to distinguish good from poor sleepers and to identify patients with some degree of insomnia (Buysse et al., 1989), while a higher cutoff of >10 has been suggested to identify possible clinically significant insomnia (Okun et al., 2009) and for evaluating sleep problems in women with cancer (Clevenger et al., 2013; Reinsel, Starr, O'Sullivan, Passik, & Kavey, 2015). We refer to the PSQI > 10 cutoff here as suggestive of insomnia, with the understanding that insomnia represents a clinical diagnosis we did not directly measure and that an in-depth review of symptoms and consideration of other sleep disorders such as obstructive sleep apnea (OSA), restless leg syndrome (RLS), or periodic limb movement disorder (PLMD) are necessary to definitively make this diagnosis. We selected the PSQI over an insomnia-specific instrument to gain a more comprehensive understanding of the range of

sleep disturbances and difficulties faced by cancer survivors. Missing items were imputed in the case of partial data in a manner consistent with previous research (Beck et al., 2004). Items missing from the sleep disturbances questions were coded as not present, and if a minimum of 5/7 of the PSQI components were available, the remaining components were imputed using the mean from the non-missing components.

Global mental and physical health were measured using the Patient Reported Outcomes Measurement Information System Global Health Scale (PROMIS Global-10), a widely utilized, well-validated assessment (Cella et al., 2010; Hays, Bjorner, Revicki, Spritzer, & Cella, 2009).

Social isolation was measured using the PROMIS Social Isolation- 4a, a brief measure of loneliness (Hahn et al., 2014).

Depressive symptoms were measured using the PHQ-9 (Kroenke, Spitzer, & Williams, 2001; Löwe, Unützer, Callahan, Perkins, & Kroenke, 2004). The PHQ-9 can be used as a routine screening tool and is effective in assessing depression among diverse populations (Ell, Unützer, Aranda, Sanchez, & Lee, 2006). Each of 9 questions assess frequency of major depressive disorder symptoms and responses range from 0 (not at all) to 3 (nearly every day). Summary scores range from 0–27. Scores of 5-9, 10-14, 15-19, 20-27 refer to mild, moderate, moderately severe, and severe depression, respectively.

Sleep recommendations received were measured using a series of investigator-developed questions. If patients indicated sleep problems since their diagnosis, they were asked if they spoke with their health care provider about these issues. The question did not specify type of medical provider or their specialty. Those who indicated speaking with their provider about sleep were then prompted to select any recommendations they received from a list including healthy sleep habits, prescription or over-the-counter medications, relaxation techniques, and CBT-

I/other CBT. Patients could select multiple recommendations and could indicate other recommendations received using a free-response text box. Free-response text was then reviewed to determine if responses fell into pre-existing categories and could be re-coded (e.g., a mindfulness app falling under "relaxation/meditation"), and these responses were manually re-coded. If the text did not fit into any pre-existing categories, a new category was created.

Analyses were conducted using SPSS version 27 (SPSS, Chicago IL) and figures were generated using R version 5.3.1. Characteristics of the study population were described using frequencies, means, standard deviations, and ranges depending on the type of data. Correlates of global sleep quality were identified using bivariate correlations, t-tests, or analysis of variance (ANOVA) where appropriate. Some demographic variables were dichotomized for ease of interpretation or due to inadequate cell sizes. For example, due to limited representation of specific groups (e.g., American Indian/Alaska Native, Black/African American) a binary race/ethnicity variable (racial/ethnic minority vs. non-Hispanic white) was created based on evidence that despite substantial heterogeneity, racial and ethnic minorities in the United States experience shared sleep health disparities compared to non-Hispanic Whites (Jackson et al., 2020).

Based on significant findings in bivariate analyses (p's <.05), sociodemographic (age, gender, race/ethnicity, education) and psychosocial (distress intolerance, global mental and physical health, and depression severity) variables were entered into a hierarchical linear regression model, with sociodemographic characteristics entered in step 1 and psychosocial characteristics entered in step 2. Results are shown with both standardized and non-standardized regression coefficients as well as adjusted and unadjusted R^2.

RESULTS:

From May 2018-February 2021, 140 eligible patients with cancer consented to participate and provided survey data at baseline. Participants' demographic and clinical characteristics are shown in **Table 1**. The study population was diverse in terms of age (Range=21-91, *M*=57.28, *SD*=14.90), race/ethnicity, and socioeconomic status. The majority identified as non-Hispanic white (88, 62.9%) or Hispanic/Latino (42, 30.0%). Among Hispanic/Latino participants, 80.5% reported Mexican heritage. Seventy-nine (56.4%) reported annual household incomes less than $50,000, 75 (53.6%) were married or living with a partner, and 48 (34.3%) reported educational attainment of 12th grade or less. At baseline, 16 (11.4%) had scores indicative of mild depression, 46 (32.9%) moderate, 54 (38.6%) moderately severe, and 24 (17.1%) had scores indicative of severe depression.

The population was also varied in terms of cancer type, treatment history, and stage. Eighty-six (61.1%) were diagnosed at an advanced stage (III-IV) and 27 (19.3%) were diagnosed with another type of cancer previously. Sixty-four (45.7%) were currently undergoing either chemotherapy, radiation, or anti-hormonal treatment, 82 (58.6%) completed at least one surgical procedure, and the remainder were either awaiting or between treatments, receiving palliative care, or receiving post-treatment survivorship care. At baseline, 36 (25.7%) were taking a sedative/hypnotic medication (either a hypnotic sleep medication (e.g., zolpidem) or a benzodiazepine (e.g., clonazepam, temazepam)), 70 (50.0%) were taking an antidepressant, and 8 (5.7%) were taking other psychiatric medications (e.g., anti-psychotics, stimulants, mood stabilizers; note: 34 participants were taking more than one medication, 28 (20.0%) were taking an antidepressant and a sedative/hypnotic medication).

Of the 138 patients providing complete or imputed PSQI data, 123 (89.1%) reported poor sleep quality (global scores >5) and 87 (63%) had scores potentially indicative of insomnia (global scores >10). PSQI scores ranged from 1-20 (*M*= 11.75, *SD*=4.45, *IQR*=8-15; see **Table 2** for subscale scores). On average, participants reported poor sleep efficiency (*M*=73.51%, *SD*=25.49%, *IQR*=57-86%) and 62.6% reported sleep efficiency below 80%. Among the 7 PSQI domains, the areas of greatest impairment were sleep latency (*M*=1.88, *SD*=1.02, *IQR*=1-3) and sleep disturbances (*M*=1.79, *SD*=0.64, *IQR*=1-3). Average sleep latency was 51.37 minutes (*SD*=54.53, *IQR*=15-60). The most common causes of sleep disturbance were waking up in the middle of the night (95.0%), having to get up to use the bathroom (87.2%), being unable to fall asleep within 30 minutes (80.9%) and having pain (69.5%). Eighty-four patients (60.9%) reported intake of any type of sleep medication (prescribed or over the counter) in the last month.

In bivariate analyses, several demographic and clinical correlates of poor sleep emerged, including female gender, younger age, educational attainment of 12th grade or less, racial/ethnic minority status, greater distress intolerance, greater depression severity, worse global physical health, and worse global mental health (see **Figure 1**). Global sleep quality did not differ significantly by chemotherapy status (current (*M*=11.95, *SD*=4.29), completed (*M*=11.71, *SD*=4.63), never received ((*M*=11.57, *SD*=4.58)), *F* (2, 135) =.08, *p*=.92). Cancer type was also not associated with global sleep quality (*F* (8, 129) =1.77, *p*=.09), with none of the specific contrasts significant (*p*'s >.1).

In a hierarchical linear regression model, gender (β=0.19, *p*=.02), depressive symptoms (β=0.28, *p*=.001), and global physical health β=-0.19, *p*=.04) remained significant predictors of global sleep quality (see **Table 3**). In this model, sociodemographic variables (age, gender, race/ethnicity, and education) accounted for 13% and psychosocial variables (distress

intolerance, depressive symptoms, global mental and physical health) accounted for 17% of the variance in global sleep quality.

In alignment with high rates of elevated PSQI scores, 118 (84.3%) of patients self-reported experiencing new or worsening sleep problems since their cancer diagnosis. Of this 118, 95 (81.2%) reported speaking with their medical provider about sleep concerns. Among those who did speak with a provider, antidepressants (37; 38.9%), sleep hygiene (30; 31.6%), and sedative/hypnotic sleep medications (20; 21.0%) were the most received recommendations; 9 (9.5%) were recommended CBT-I or another cognitive therapy (see **Figure 2**).

DISCUSSION:

Patients with cancer referred for treatment of depression in this ethnically and socioeconomically diverse sample showed a substantial degree of sleep disturbance, with nearly all indicating some degree of impairment and 63% reporting PSQI scores potentially indicative of insomnia or other sleep disorders such as obstructive sleep apnea (OSA). Although it is not necessarily surprising that survivors of cancer seeking treatment for depression would report high rates of disturbed sleep, the prevalence of insomnia in this population significantly exceeds other survivor samples (Gooneratne et al., 2007; Nock et al., 2020; Strollo et al., 2020), indicating a need to assess and address sleep disturbance as a part of depression management in the cancer care context with particular attention to underserved populations. Despite high antidepressant and prescription or over-the counter sleep aid use, more than half the sample reported low (<80%) sleep efficiency and high sleep latency, indicating need for further intervention. These findings also highlight the complex etiology of sleep disturbance among patients with cancer and align with previous literature identifying female gender (Savard et al.,

2009), depressive symptoms (Accortt et al., 2015; Helena R. Bean et al., 2021; Maguire, Drummond, Hanly, Gavin, & Sharp, 2019), and global physical health (Maguire et al., 2019) as correlates of insomnia in multivariate analyses. The effect of gender on sleep quality and overall high prevalence of poor sleep in this predominantly female (70%) population also align with previous research identifying greater risk for insomnia and depression among women (Salk, Hyde, & Abramson, 2017; Zhang & Wing, 2006). Surprisingly, neither smoking status nor alcohol use were associated with subjective sleep quality in this sample, despite well-established relationships between use of these substances and subjective and objective sleep disturbance in the general population (Cohrs et al., 2014; Colrain, Nicholas, & Baker, 2014; Jaehne et al., 2012; Roehrs & Roth, 2001) as well as potential bidirectional relationships between tobacco and alcohol use and depression (Boden & Fergusson, 2011; Fluharty, Taylor, Grabski, & Munafò, 2017). Non-replication of these findings in the present study may be due to the low rates of substance use overall; most of the patients who reported drinking alcohol did not do so daily and less than 10% of the population was currently smoking.

Regardless of etiology, sleep disturbance (especially insomnia) among cancer survivors with and without depression is treatable. Clinical practice guidelines from numerous organizations, including the American College of Physicians, recommend behavioral treatments (notably CBT-I) over medications as first-line treatment for insomnia (Qaseem et al., 2016). Although no studies to date specifically focus on treating insomnia in patients with both cancer and depression, a meta-analysis of CBT-I for various clinical populations (medical or psychiatric diagnoses) found CBT-I efficacious for both cancer and mood disorder populations (Wu, Appleman, Salazar, & Ong, 2015). Sleep treatment for cancer survivors with overlapping psychiatric risk factors may have the added benefit of improving both sleep and depression

simultaneously. Indeed, CBT-I for cancer survivors reduces depressive symptoms in addition to treating insomnia directly (Peoples et al., 2019) and adding insomnia interventions to depression treatment may improve medication response rate (Gebara et al., 2018). Sleep intervention may be especially effective for cancer survivors if it involves a combination of managing general and specific adverse effects of treatment (especially pain and discomfort) through techniques such as activity planning and exercise. Brief CBT-I using a stepped care approach (in which low-intensity treatment is delivered in a cost-effective, accessible format, with more intensive treatment offered only if needed) has shown promise as an effective and efficient strategy to address sleep disturbance among cancer survivors (Savard et al., 2021; Zhou, Michaud, & Recklitis, 2020) and selective prevention (in which brief intervention is offered to high-risk individuals) has recently been explored in patients with breast cancer prior to chemotherapy administration (Marion, Ivers, & Savard, 2019). These feasible and cost-effective approaches offer a lower-risk prophylactic alternative to medications and warrant further consideration, although more intensive intervention may be required for a population such as this one with significant comorbidity and complexity.

In addition to considerations of medical and psychiatric complexity, it is also important to consider the backgrounds represented among this sample (low SES, Hispanic/Latino) when introducing sleep treatment. Culturally adapting sleep interventions such as CBT-I (including incorporation of linguistically-appropriate care and cultural values) may enhance acceptability and outcomes for racial/ethnic minority populations (Johnson et al., 2019). Other interventions such as physical and mind-body exercise (yoga, Tai Chi, and Qigong) (Kreutz, Schmidt, & Steindorf, 2019) and multimodal/bright light therapy (Gentry et al., 2020; Johnson et al., 2018) also hold promise to meet the unique needs of survivors with significant psychosocial burden and

to potentially attenuate the negative circadian impact of cancer treatment. Indeed, both physical and mind-body exercise interventions were shown to yield positive effects on subjective (but not objective) sleep among patients with cancer in a recent systematic review (Kreutz et al., 2019) and bright light therapy has been shown to be feasible, acceptable, and effective in improving not only sleep, but also depression, quality of life, and fatigue among patients with cancer (Crabtree et al., 2021; Hung et al., 2021; Wu, Davis, & Chen, 2021) and is currently being explored in conjunction with CBT-I (Bean et al., 2020).

Effective interventions are meaningless, however, if they do not reach the patients with greatest need. Although most patients in this sample reported experiencing sleep disturbance since their cancer diagnosis and discussing these issues with a medical provider, most were recommended antidepressants or sleep medications; very few were referred for CBT-I (first-line therapy for insomnia). These findings also align with a growing body of literature pointing to limited dissemination and implementation of evidence-based insomnia treatment in cancer care settings (Zhou, Partridge, Syrjala, Michaud, & Recklitis, 2017), despite clinical practice guidelines emphasizing the importance of insomnia assessment and treatment (Baker et al., 2020). The NCI encourages cancer survivors to discuss chronic sleep disruptions with their medical team during the course of routine survivorship care (National Cancer Institute, 2019), but more systemic interventions, including evidence-based screening, are likely needed beyond patient education. There is some evidence that although racial/ethnic minority patients experience a disproportionate burden of poor sleep, they may be less likely to consult with medical providers about these issues than non-Hispanic whites, necessitating thoughtful and equitable screening practices (Jackson et al., 2020).

Despite the importance of proper sleep evaluation and treatment referrals, few clinicians are well-prepared to do so; this study found that sleep hygiene and pharmacotherapy were more commonly recommended than CBT-I, aligning with previous research investigating sleep interventions offered in oncology settings (Zhou et al., 2017) and studies demonstrating that sleep receives minimal attention in medical training (Mindell et al., 2011; Sullivan & Cao, 2021). Thus, coupled with issues of access to these interventions, it is perhaps unsurprising that evidence-based treatments such as CBT-I and bright light therapy were not frequently recommended by medical providers treating patients with cancer, and that only one patient reported discussing continuous positive airway pressure (CPAP) therapy with a medical provider. Although strong conclusions cannot be drawn about relative popularity of these specific recommendations given overall low prevalence rates, medical cannabis was recommended to more patients in this sample than either bright light or CPAP therapy, despite mixed evidence for cannabinoids for aiding sleep and the need for continued research in this area (Babson, Sottile, & Morabito, 2017).

Providers would benefit from education about insomnia and related sleep disorders adapted to the specific needs of cancer survivors, while increasing the perceived importance of treating these conditions, since evidence from general medical practice settings shows that clinicians tend to de-prioritize insomnia treatment and to incorrectly view sleep disturbance as a symptom of depression rather than an independent condition requiring targeted treatment (Koffel, Bramoweth, & Ulmer, 2018). In cancer care settings, insomnia is also overlooked because it is believed by clinicians to be a transient response to cancer diagnosis and treatment (Fleming & MacMahon, 2015). Other provider barriers include a lack of time, and lack of knowledge about insomnia and nonpharmacological treatments, necessitating innovative

approaches that take these barriers into consideration (Koffel et al., 2018). Given the substantial prevalence of sleep disturbance and insomnia among cancer survivors and the limited accessibility of guideline-concordant sleep assessment and treatment in cancer care settings, future research should focus on implementation of CBT-I principles and sleep psychoeducation as part of general psychological care within oncology settings.

Although this study points to a need to address sleep health within the context of oncology-based depression care, our results must be considered within the context of the study's limitations. Although oncology patients in this study were asked about sleep recommendations received from their health care provider, the question did not specify the type of medical provider or their specialty. To better inform provider-level interventions for improving sleep among patients with cancer, a more nuanced assessment of clinician training and readiness to assess sleep disturbance and provide appropriate referrals is likely needed. Additionally, while the heterogeneity of the population is generally a strength, because of the smaller sample size and cross-sectional design, we were unable to draw strong conclusions about the potential interaction between sociodemographic characteristics and disease and treatment factors in producing sleep disturbance. The population was also heterogeneous in terms of treatment status (approximately half undergoing chemotherapy or radiation at the time of the baseline assessment), and we did not collect data on dosing of treatment or proximity of treatment administration to the assessment, factors which likely influenced PSQI scores given evidence that cancer treatments, especially chemotherapy, impair sleep-wake activity rhythms (Savard et al., 2009; Savard et al., 2015).

Another significant limitation of this study is the lack of a measure of OSA or OSA risk factors such as body mass index (BMI), which prevents us from understanding the degree to

which other sleep issues may be driving the high rate of sleep disturbance in this population. Since the present study involved patients identified as socially disadvantaged, and low SES has been identified as a predictor of OSA (Guglielmi, Lanteri, & Garbarino, 2019), it is possible that rates of OSA were elevated in this population. Further work is needed to understand identification and management of OSA among populations such as this one. Our use of the PSQI and lack of objective sleep measures is also a limitation. The PSQI, while a widely used and validated self-report sleep measure, does not directly measure insomnia, although it has the advantage of assessing other causes of sleep disturbance, including pain and nocturia, common complaints among cancer survivors. Subjective sleep measures like the PSQI are also prone to measurement errors and limited by recall bias, as natural fluctuations in bed and wake up times and variance between weekdays and weekends make it difficult to report "typical" bedtimes and sleep durations (Kreutz, Müller, Schmidt, & Steindorf, 2020). It is also possible that the elevated rates of poor subjective sleep quality are more reflective of general distress than actual disturbance, since patients with depression often report significantly poorer perceptions of sleep quality compared to controls despite similar levels of objective sleep disturbance (Dubrovsky et al., 2017). There is also limited agreement between subjective and objective sleep measures among patients with cancer (Jakobsen et al., 2020; Reinsel et al., 2015). When assessing sleep among survivors of cancer, researchers recommend using subjective and objective measures in a complementary manner, since the PSQI appears better at assessing sleep latency and problems such as falling asleep and waking up too early, while actigraphy is better at assessing number and duration of awakenings (Kreutz et al., 2020). Nevertheless, the results of this study point to a significant unmet need based on patient self-report collected in the context of a real-world implementation study of collaborative depression care.

These study findings build the case for screening of sleep disturbance broadly and insomnia and other sleep disorders specifically, along with integration of evidence-based treatment principles (as appropriate) and proper referrals into existing depression care. In the absence of screening in oncology settings more broadly, targeting individuals triaged to mental health care for significant distress would help to provide sleep treatment to those with especially high need, since depression screening is implemented more widely and consistently than screening for sleep disturbance. Implementation research targeting specific interventions to increase routine training and use of evidence-based treatments (e.g., CBT-I) in medical settings is needed (Koffel et al., 2018), with special attention given to those at especially high risk due to multiple comorbidities.

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Data Availability Statement: Due to the nature of this research, participants of this study did not agree for their data to be shared publicly, so supporting data is not available.

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Table 1. Patient Characteristics (N=140)

	Mean, SD or N(%)
Age	57.28, 14.90
Baseline PHQ-9	15.03, 4.26
Gender	
Female	99 (70.7)
Male	41 (29.3)
Race/Ethnicity*	
Non-Hispanic White	88 (62.9)
Hispanic (any race)	42 (30.0)
Non-Hispanic Black/African American	3 (2.1)
American Indian or Alaska Native	2 (0.7)
Asian	4 (2.9)
Bi-racial/Multi-Racial	2 (1.4)
Preferred Language	
English	122 (87.1)
Spanish	14 (10.0)
Marital Status	
Single	25 (17.9)
Married/Cohabitating	75 (53.6)
Divorced/separated	28 (20.0)
Widowed	12 (8.6)
Education*	
Less than 11th grade	8 (5.7)
High School degree/GED	40 (28.6)
Some college	5 (3.6)
Associates Degree/2-year degree	36 (25.7)
Bachelor's/4-year degree	28 (20.0)
Graduate Degree	21 (15.0)
Employment*	
Retired	50 (35.7)
Full-time Employed	17 (12.1)

Part-time Employed	9 (6.4)
Student	2 (1.4)
Homemaker	3 (2.1)
Disabled, Unable to Work	46 (32.9)
Unemployed	13 (9.3)
Income*	
Less than $50,000/year	79 (56.4)
$50-100,000/year	28 (20.0)
$75,100,000/year	13 (9.3)
$100,000+/year	9 (6.4)
Insurance	
None	5 (3.6)
Private/Employer-Based	50 (35.7)
MEDICAID	47 (33.6)
MEDICARE	35 (25.0)
Military (Tricare/Champus)	3 (2.1)
Cancer Stage	
Stage I	14 (10.0)
Stage II	25 (17.9)
Stage III	29 (20.0)
Stage IV	57 (40.7)
Unknown or Not Applicable	16 (11.4)
Cancer Type	
Leukemia, Lymphoma, or Myeloma	29 (20.7)
Gastrointestinal	49 (35.0)
Breast	13 (9.3)
Genitourinary	12 (8.6)
Thoracic	6 (4.3)
Melanoma or other skin cancer	4 (2.9)
Head and neck	11 (7.9)
Gynecologic	10 (7.1)

CNS	1 (0.7)
Soft tissue sarcoma	2 (1.4)
Endocrine	2 (1.4)
Unknown Primary	1 (0.7)
Cancer Treatment*	
Radiation	
Never	84 (60.0)
Current	5 (3.6)
Completed	50 (35.7)
Chemotherapy	
Never	44 (31.4)
Current	45 (32.1)
Completed	51 (36.4)
Anti-hormonal treatment	
Never	121 (86.4)
Current	19 (13.6)
Surgery	
Never	48 (34.3)
Completed	82 (58.6)
Scheduled	10 (7.1)
Substance Use and Medications	
Alcohol Use	
Not current	89 (63.6)
Current	51 (36.4)
Smoking Status	
Current	12 (8.6)
Former	39 (27.9)
Never	89 (63.6)
Benzodiazepine and Sedative/Hypnotic Medications	
Currently Taking	36 (25.7)
Not Currently Taking	104 (74.3)
Antidepressant Medications	
Currently Taking	70 (50.0)
Not Currently Taking	70 (50.0)

*Not all percentages = 100% due to missing data

Table 2. Sleep Quality Characteristics of Patients (N=140)

	Mean, SD	IQR
PSQI Total Score	11.75, 4.45	8-15
PSQI Subscales		
Subjective sleep quality	1.65, 0.93	1-3
Sleep latency	1.88, 1.02	1-3
Sleep duration	1.64, 1.22	0-3
Habitual Sleep efficiency	1.60, 1.20	0-3
Sleep Disturbances	1.79, 0.64	1-3
Use of Sleeping Medication	1.57, 1.38	0-3
Daytime dysfunction	1.60, 0.81	1-3

Note. SD= Standard Deviation, IQR=interquartile range
All Subscale scores range from 0-3, with higher scores indicating worse self-reported sleep in each domain

Figure 1. Demographic and Clinical Correlates of Overall Subjective Sleep Quality (Global PSQI score; N=138)

Note. Numbers correspond to correlation coefficient (*r*) values, correlations with *p*-values <.05 are shown in color, with blues corresponding to positive correlations and reds corresponding to negative correlations; Reference group for gender= male; reference group for race/ethnicity= non-Hispanic White; reference group for employment= not currently employed; reference group for primary language= English; reference group for education=high school equivalent or less, reference group for income= <50,000 annually; reference group for cancer stage= early stage; reference group for chemotherapy= not current; reference group for radiation= not current; reference group for hormone therapy= not current; reference group for insurance=not MEDICAID; reference group for antidepressants= not taking; reference group for sedative-hypnotic medications= not taking; reference group for smoking status= never smoker; reference group for alcohol use=not current

Figure 2. Types of Patient-Reported Sleep Recommendations from Medical Providers (N=95 patients)

Note. CBT-I= Cognitive Behavioral Therapy for Insomnia; CPAP= Continuous positive airway pressure therapy
Patients could note more than one recommendation received

Table 3. Linear Regression Model Predicting Global Subjective Sleep Quality (N=138)

Variable	*B* [95% CI]	*SE*	*β*	*t*	*p*	*R*	R^2	Adj. R^2	ΔR^2
Step 1						.36	.13	.10	.13
Gender	2.39 [0.74, 4.04]	0.83	0.24	2.86	0.005**				
Race/ethnicity	-0.93 [-2.60, 0.75]	0.85	-0.10	-1.10	0.28				
Education	-1.67 [-3.24, -0.10]	0.79	-0.18	-2.11	0.04*				
Age	-0.02 [-0.07, 0.03]	0.03	-0.07	-0.79	0.43				
Step 2						.55	.30	.25	.17
Gender	1.85 [0.30, 3.41]	0.79	0.19	2.36	0.02*				
Race/ethnicity	-1.31 [-2.85, 0.24]	0.78	-0.14	-1.67	0.10				
Education	-0.81 [-2.30, 0.68]	0.75	-0.09	-1.07	0.29				
Age	-0.02 [-0.06, 0.30]	0.03	-0.05	-0.59	0.56				
Distress Intolerance	0.03 [-0.12, 0.19]	0.08	0.04	0.44	0.66				
Depressive Symptoms	0.3 [0.13, 0.47]	0.09	0.28	3.43	0.001**				
Global Mental Health	-0.13 [-0.53, 0.27]	0.20	-0.06	-0.64	0.52				
Global Physical Health	-0.27 [-0.53, -0.01]	0.13	-0.19	-2.07	0.04*				

Note. B= unstandardized regression coefficient; SE= standard error of the estimate; *β*= standardized regression coefficient
Reference group for gender= male; reference group for race/ethnicity= non-Hispanic White; reference group for education=high school equivalent or less

*p<.05. **p<.01. ***p<.001