



# Problem alcohol and tobacco use in head and neck cancer patients at diagnosis: associations with health-related quality of life

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Received: 11 January 2022 / Accepted: 20 June 2022 / Published online: 1 July 2022

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## Abstract

**Purpose** Problem alcohol and tobacco use in patients with head and neck cancer (HNC) frequently co-occur and each are associated with poor outcomes including health-related quality of life (HRQOL). The purpose of this descriptive exploratory study was to identify the prevalence of these co-occurring behaviors and associations with HNC-specific HRQOL within the first year of diagnosis in a large sample of patients with HNC.

**Methods** Cross-sectional study examined prevalence of co-occurring problem alcohol and tobacco use at diagnosis in a large sample of patients with HNC ( $N = 1327$ ). Problem alcohol use was assessed using the Short Michigan Alcoholism Screening Test (SMAST); patients were classified as current/previous/never smokers based on self-reported tobacco use. HNC-specific HRQOL was assessed using the Head and Neck Cancer Inventory (HNCI), measured at diagnosis and 3 and 12 months postdiagnosis.

**Results** Three hundred twenty-five of 1327 (24.5%) scored 3+ on the SMAST at diagnosis, suggesting problem alcohol use and nearly 30% (28.4%) were current smokers. Of those with problem alcohol use, 173 (53.2%) were also current smokers. In total, 173 of 1327 (13.0%) exhibited both behaviors at diagnosis. Covariate-adjusted mean HNCI scores suggest that patients classified as both problem drinkers and current smokers have lower HRQOL scores during the first year postdiagnosis in multiple HNC-specific domains.

**Conclusion** HNC patients should be screened for alcohol and tobacco use at diagnosis. Multimodal behavioral health interventions may provide one avenue for improved access and outcomes, particularly for patients at distance, and deserve further study in HNC.

**Keywords** Alcohol consumption · Tobacco use · Cancer survivorship · Head and neck cancer · Health-related quality of life

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## Introduction

Approximately 66,000 Americans develop head and neck cancer (HNC) annually, which is defined as cancer of the oral cavity, pharynx (nasopharynx, oropharynx, hypopharynx), larynx, nasal cavity, paranasal sinus, and/or salivary glands [1, 2]. Treatment for HNC can have considerable impact on health-related quality of life (HRQOL) including side effects such as difficulties with swallowing, breathing, eating and speech, and may lead to disruption of essential daily functions, psychological distress, and family and other social activities [3].

Some evidence suggests that the trajectory of HRQOL in patients with HNC is lowest during and a short time after treatment because of treatment-related sequelae but gradually improves, eventually approaching baseline levels approximately one year after diagnosis in many survivors

[4–7]. This trajectory does not hold for a substantial number of survivors, however, who remain markedly impaired in various HNC-specific HRQOL domains 1 year postdiagnosis [7, 8]. Research indicates that this trajectory may be associated with numerous physical, psychosocial, and behavioral factors [7–13], thus making investigations of such factors important in order to identify which HRQOL domains require greater clinical attention over the course of treatment and recovery.

One of these factors is problem alcohol use, a known risk factor for the development of HNC; continued alcohol use after diagnosis is associated with several negative outcomes including cancer recurrence, significant physical comorbidities, and poor psychosocial outcomes including depression and reduced HNC-specific HRQOL [14–18]. Estimates suggest that upwards of thirty percent of HNC patients demonstrate problem alcohol use and many continue to consume alcohol into the survivorship period [19–21]. Similarly, tobacco use is an etiologic factor in HNC development and continued use after diagnosis is associated with second primary cancer, elevated risk of cancer recurrence, poor response to treatment, and negatively impacted HRQOL [22–25]. These two behaviors often co-occur and together act to multiply risk for a host of negative outcomes in HNC [26].

The present descriptive exploratory study examines the prevalence of co-occurring problem alcohol and tobacco use in a large sample of patients with HNC and associations with HNC-specific HRQOL in the subgroup exhibiting both behaviors during the first year of care. Better understanding of the rates of these co-occurring behaviors in HNC and their association with HRQOL at important points during the first year postdiagnosis, which is an important period in the survivorship trajectory, may help inform efforts to identify and connect such patients to important behavioral health treatment that can facilitate change to lessen side effects of treatment, improve functioning, and reduce the risk of additional cancer occurrence.

## Methods

### Participants and procedure

The present article details a descriptive exploratory substudy of a larger longitudinal study of patients 18+ years of age diagnosed with upper aerodigestive tract carcinomas from the Department of Otolaryngology's head and neck oncology clinic at The University of Iowa Hospitals and Clinics (UIHC). Eligible patients were offered participation in the Outcomes Assessment Project (OAP), a longitudinal study

of oncologic treatment outcomes in HNC. The OAP parent study successfully recruited > 75% of all eligible patients with HNC seen at UIHC from November 1998 through December 2014, the period including the sample of patients described below. Information regarding site and stage of cancer, comorbidities, treatment, survival outcome, demographics (age, race, sex), and other clinical and psychosocial characteristics were collected as part of the OAP via self-report or abstracted from the patient's medical record, as appropriate. If interested in participation, patients were consented and enrolled at the time of diagnosis. Demographic, disease, and treatment information were collected at this time. Based on UIHC care team recommendations, patients are seen at three-month intervals after diagnosis (i.e., 3, 6, 9, and 12 months) during the first year of treatment and follow-up. Research assessments corresponded with these follow-up care intervals in OAP. Subsequent research assessments were completed at regular intervals beyond 12 months, beginning annually through year 5, then at year 10 and 15 if applicable.

Descriptive statistics for demographic, disease, and treatment characteristics are presented for the full sample and those exhibiting both problem behaviors, respectively, followed by covariate-adjusted mean scores and 95% confidence intervals (CIs) for HNC-specific HRQOL measured at diagnosis, 3-, and 12-month follow-up. Covariates selected a priori which are known to be clinically relevant in this population were age, site, stage, and single vs multimodal treatment. Analyses were conducted using SPSS, version 27. All procedures were approved by The University of Iowa's IRB (#199412746).

### Measurement of key variables

#### Problem alcohol use

The Short Michigan Alcoholism Screening Test is a self-report screening tool designed to detect problem drinking and alcohol use disorder [27]. The SMAST has been used in numerous patient populations, including previous studies of patients with HNC [15, 28]. Items include, "Do you feel that you are a normal drinker?", "Are you able to stop drinking when you want to?" Adequate reliability and validity have been reported [29]. Items are presented in yes/no format, with scores ranging from 0 to 13. A score of 2 suggests possible alcohol abuse and a score of 3 or higher suggests probable alcohol abuse [27, 29]. For the purposes of these analyses, the more conservative cut-off score of 3+ was used to classify problem alcohol use. The SMAST was collected at study enrollment, which coincides with the time of diagnosis, for those patients indicating current or previous use of alcohol.

## Tobacco use and other key variables

Tobacco use was captured via self-report at the initial research assessment upon parent study enrollment. Patients were classified as current/previous/never smokers or unknown. Demographic variables including age, marital status, race, and sex were also collected via self-report at the initial research assessment. Cancer site, stage, and treatment modality were abstracted from the patient medical record. Cancer site was categorized as oral cavity, oropharynx, hypopharynx, larynx, or other and cancer stage using the American Joint Committee on Cancer (AJCC) classification, stages 0–IV. Treatment modality was classified as surgery/chemotherapy/radiotherapy only, combination (i.e., multimodal), or other/unknown. Depressive symptoms were assessed using the Beck Depression Inventory (BDI), a widely utilized and well validated measure of depressive symptomatology with scores ranging from 0 to 63, which has been used in previous studies of HNC [11, 13].

## Health-related quality of life

Health-related quality of life was measured using the Head and Neck Cancer Inventory (HNCI) [6], a well-validated 30-item instrument which captures HNC-specific outcomes including speech, eating, and aesthetics as well as social disruption. Scores transformed into a scale ranging from 0 to 100 may be classified into low (0–30), intermediate (31–69), and high (70–100) functioning, with higher scores indicating better HRQOL [30]. Patients with scores in the high category have relatively normal functioning, and those in the intermediate and low ranges have abnormal or severely compromised functioning, respectively. The HNCI has been used in many HNC studies [11–13] and has good reliability and validity [6].

## Results

Table 1 summarizes the demographic and clinical characteristics of the full study sample ( $N = 1327$ ). The mean age was 60.2 (SD = 12.5) and the majority of patients were married or living with a partner (64.9%) and diagnosed with advanced disease stage (i.e., III or IV; 55.7%). The most common site was oral cavity (35.0%) and the most common treatment modality was combination (i.e., multimodal) therapy (46.0%). The mean BDI score was 8.61 (SD = 7.28). The percentage of patients scoring 3+ on the SMAST suggesting problem alcohol use was 24.5% and nearly thirty percent (28.4%) were current smokers. Of those scoring 3+ on the SMAST ( $n = 325$ ) indicating problem alcohol use, over half ( $n = 173$ , 53.2%) were also current smokers. In total, 173 of 1327 (13.0%) exhibited both behaviors at diagnosis.

**Table 1** Patient, disease, and treatment characteristics of full sample at diagnosis

	$N = 1327$
Age	
Mean (SD)	60.2 (12.5)
Sex	
Male	909 (68.5%)
Female	418 (31.5%)
Race	
White	1223 (92.2%)
Black	21 (1.6%)
Other	29 (2.2%)
Unknown	54 (4.0%)
Marital status	
Married/living with partner	861 (64.9%)
Unmarried/divorced/widowed	466 (35.1%)
Stage	
Early (0–II)	510 (38.4%)
Advanced (III–IV)	739 (55.7%)
Not stageable/unknown	78 (5.9%)
Site	
Oral cavity	464 (35.0%)
Oropharynx	316 (23.8%)
Hypopharynx	48 (3.6%)
Larynx	294 (22.1%)
Else/unknown	205 (15.4%)
Treatment	
Surgery only	457 (34.4%)
Chemotherapy only	4 (0.3%)
Radiotherapy only	156 (11.7%)
Combination	611 (46.0%)
Other/unknown	99 (7.5%)
BDI score	
Mean (SD)/range	8.61 (7.23)/0–46
SMAST score	
0–1	846 (63.7%)
2	156 (11.8%)
3+	325 (24.5%)
Tobacco use	
Current smoker	377 (28.4%)
Previous smoker	556 (41.9%)
Never smoker	268 (20.2%)
Unknown	126 (9.5%)

Note: BDI = Beck Depression Inventory, SMAST = Short Michigan Alcoholism Screening Test

Demographic and clinical characteristics of patients in the subgroup exhibiting both behaviors are presented in Table 2. The mean age was 55.3 (SD = 8.6) and fewer patients were married or living with a partner (43.7%). The majority were diagnosed with advanced disease stage (i.e., III or IV;

**Table 2** Patient, disease, and treatment characteristics of subgroup exhibiting problem alcohol and tobacco use at diagnosis

	<i>N</i> = 173
<b>Age</b>	
Mean (SD)	55.3 (8.61)
<b>Sex</b>	
Male	139 (80.3%)
Female	34 (19.7%)
<b>Race</b>	
White	161 (93.1%)
Black	5 (2.9%)
Other	3 (1.7%)
Unknown	4 (2.3%)
<b>Marital status</b>	
Married/living with partner	73 (43.7%)
Unmarried/divorced/widowed	100 (56.3%)
<b>Stage</b>	
Early (0–II)	55 (31.8%)
Advanced (III–IV)	105 (60.7%)
Not stageable/unknown	13 (7.5%)
<b>Site</b>	
Oral cavity	49 (28.3%)
Oropharynx	47 (27.2%)
Hypopharynx	7 (4.0%)
Larynx	49 (28.3%)
Else/unknown	21 (12.1%)
<b>Treatment</b>	
Surgery only	41 (23.7%)
Chemotherapy only	0 (0%)
Radiotherapy only	25 (14.5%)
Combination	90 (52.0%)
Other/unknown	17 (9.8%)
<b>BDI score</b>	
Mean (SD)/range	12.97 (8.99)/0–44

Note: BDI = Beck Depression Inventory

60.7%), cancer site was evenly distributed across oral cavity (28.3%), oropharynx (27.2%), and larynx (28.3%) and the most common treatment modality was combination (i.e., multimodal) therapy (52.0%). Mean depressive symptoms were higher in this subgroup, 12.97 (SD = 8.99).

Table 3 shows covariate-adjusted (estimated marginal) mean scores and 95% CIs for each of the four HNCI domains by self-reported problem drinking and tobacco use status at diagnosis and 3- and 12-month postdiagnosis follow-up time points. As noted, covariates selected a priori were age, site, stage, and single vs multimodal treatment. Overall, HNCI domain scores were lower for those scoring 3+ on the SMAST and also currently smoking as compared to all other individuals in the sample. These patients were also slower to return to (near) baseline levels of HNC-specific

HRQOL by 12 months postdiagnosis. At diagnosis, mean HNCI scores were 75.59 (SE = 2.97) vs 87.21 (SE = 0.96) for aesthetics, 65.29 (SE = 3.11) vs 72.29 (SE = 0.99) for eating, 71.64 (SE = 2.83) vs 76.49 (SE = 0.92) for speech, and 79.02 (SE = 2.49) vs 81.50 (SE = 0.80) for social disruption. At 3-month follow-up, mean HNCI scores were 68.20 (SE = 3.51) vs 73.90 (SE = 1.15) for aesthetics, 43.58 (SE = 3.10) vs 50.85 (SE = 1.01) for eating, 64.31 (SE = 3.06) vs 63.70 (SE = 0.99) for speech, and 67.77 (SE = 2.61) vs 71.91 (SE = 0.85) for social disruption. Finally, at 12-month follow-up, mean HNCI scores were 71.55 (SE = 3.17) vs 80.39 (SE = 0.92) for aesthetics, 50.06 (SE = 2.89) vs 61.48 (SE = 0.88) for eating, 64.45 (SE = 2.69) vs 73.82 (SE = 0.79) for speech, and 74.12 (SE = 2.27) vs 83.95 (SE = 0.68) for social disruption. None of the 95% CIs overlapped across groups at 12-month follow-up in any HNCI domain (Table 3).

## Discussion

The present study examining the co-occurrence of two adverse health behaviors in patients with HNC indicated that those exhibiting both problem alcohol and tobacco use also reported deficits in HNC-specific HRQOL during the first year postdiagnosis, which appears particularly pronounced at 12-month follow-up when compared to all others in this sample. Overall, HRQOL in this sample improved over time in a similar fashion to that found in previous studies [4–7] but those who were problem drinkers and smokers often reported lower HRQOL at diagnosis and showed less improvement by 12 months postdiagnosis. Over 1 in 10 patients (13.0%) in this sample reported both behaviors, underscoring the need to identify and provide treatment options for this subgroup of patients. Previous research has shown that continuing these behaviors after diagnosis contributes to reduced rates of survival and increased rates of recurrence among other negative outcomes noted above [14, 31].

Screening at diagnosis for alcohol use and smoking status is prudent in HNC settings, particularly if there are evidence-based support services within a given cancer care facility or known outside referral options available. There are several brief screening tools which can be readily incorporated into the clinic environment to ascertain the need for more in-depth evaluation and possible referral for problem alcohol use and/or smoking cessation treatment. For example, the commonly used Alcohol Use Disorders Identification Test (AUDIT, or brief version, AUDIT-C [32, 33]) or the Tobacco, Alcohol, Prescription Medication, and other Substance Use (TAPS) tool [34], which captures both smoking status and alcohol use in the same brief measure, may be considered. Although research shows that a considerable

**Table 3** Covariate-adjusted mean HNCI domain scores by problem alcohol and tobacco use status

Outcome	Problem alcohol (SMAST 3+) and tobacco use Mean (SE), 95% CI N = 173	All other patients Mean (SE), 95% CI N = 1154
<b>Aesthetics</b>		
Diagnosis	75.59 (2.97), 69.75–81.43	87.21 (.96), 85.33–89.09
3-month f/u	68.20 (3.51), 61.32–75.08	73.90 (1.15), 71.64–76.17
12-month f/u	71.55 (3.17), 65.34–77.76	80.39 (.92), 78.58–82.19
<b>Eating</b>		
Diagnosis	65.29 (3.11), 59.18–71.40	72.29 (.99), 70.33–74.25
3-month f/u	43.58 (3.10), 37.49–49.67	50.85 (1.01), 48.85–52.84
12-month f/u	50.06 (2.89), 44.38–55.74	61.48 (.88), 59.75–63.21
<b>Speech</b>		
Diagnosis	71.64 (2.83), 66.09–77.19	76.49 (.92), 74.68–78.31
3-month f/u	64.31 (3.06), 58.29–70.32	63.70 (.99), 61.76–65.64
12-month f/u	64.45 (2.69), 59.17–69.73	73.82 (.79), 72.26–75.38
<b>Social disruption</b>		
Diagnosis	79.02 (2.49), 74.13–83.90	81.50 (.80), 79.92–83.07
3-month f/u	67.77 (2.61), 62.65–72.89	71.91 (.85), 70.24–73.58
12-month f/u	74.12 (2.27), 69.66–78.58	83.95 (.68), 82.61–85.29

Note.  $N = 1327$ . Analysis adjusted for age, site, stage, and single vs multimodal treatment;  $CI$  = confidence interval;  $HNCI$  = Head and Neck Cancer Inventory,  $SE$  = standard error;  $SMAST$  = Short Michigan Alcoholism Screening Test

number of psychosocial and other support services are offered in cancer care settings, those for smoking cessation are typically brief, nurse/physician delivered interventions and are often ineffective for patients dealing with a high degree of nicotine addiction [35]. Research indicates that more intensive interventions may be needed to establish longer-term change for such patients [36, 37]. For example, a recent randomized clinical trial compared intensive telephone-based smoking cessation counseling delivered over a 6-month period plus medication provision vs short-term counseling and medication advice in patients recently diagnosed with cancer, including HNC. Patients in both conditions received four weekly counseling sessions and medication advice but those in the intensive intervention also received four additional biweekly and three additional monthly sessions plus 12 weeks of smoking cessation medication at no cost. The study found that those in the intensive intervention condition exhibited significantly greater biochemically verified abstinence at 6-month follow-up compared to those in the standard treatment condition [38].

For those with excessive alcohol use, brief interventions may assist in reducing binge drinking and high weekly intake [39], or referral to substance use treatment services may be required for highly problematic cases. Screening and Brief Intervention (SBI) for alcohol has been advocated for some time in primary care settings [40] but uptake is less than ideal despite evidence that it may help patients whose use is excessive but not reaching the level of dependence.

Compared to tobacco use in patients with cancer, there has been less attention given to alcohol use and fewer may be screened for it in cancer care settings [14, 39, 41]. Additionally, few studies have tested interventions to reduce alcohol use in HNC [14]. Recent research reported that patients with cancer who hold negative perceptions of the consequences of continued alcohol use after diagnosis, including its effect on HRQOL and survival, may be more likely to reduce or quit suggesting that education around these impacts may facilitate acceptance of screening and treatment for those demonstrating problematic use [41].

Aside from brief interventions that may mesh well with current practice and be woven into existing clinic flow, treating patients for problem drinking and smoking in the cancer care context may be difficult for those in need of more intensive, long-term intervention. Because these behaviors are often addressed by different specialty care services, it may be challenging for patients to manage and attend multiple appointments in addition to their primary cancer care even if such services are readily available in a large comprehensive care center. Compounding this, both behaviors are associated with depressed mood in HNC [19] which may add another layer of complexity to timely, coordinated care. Multimodal interventions for complex behavioral health cases, such as those with concomitant alcohol and smoking issues, may therefore be relevant dependent on the individual patient's needs. Interventions addressing multiple concerns at once have been tested with some success,

including those dealing with smoking and drinking and in patients with HNC [21, 42]. For example, Duffy and colleagues developed a tailored, multimodal intervention in which patients with HNC were treated for smoking, problem alcohol use, or probable depression, whether alone or in combination as indicated [21]. The intervention combined pharmacotherapy for depression and/or smoking and CBT-based behavioral counseling for all three issues delivered by telephone for 9 to 11 sessions. The authors reported several positive improvements in smoking and alcohol cessation rates, particularly for those with co-occurring issues. Vander Weg and colleagues [42] also developed a tailored, telephone-based multicomponent intervention primarily addressing smoking cessation using pharmacotherapy and 6 sessions of behavioral counseling in a small sample of rural-residing military veterans. Assistance for risky alcohol use, depressive symptomatology, and weight concerns was also provided. While not specifically focused on individuals with cancer, the authors aimed to address multiple problems for patients in need of health behavior change in part to reduce access challenges for those living at distance. In a randomized pilot study, the authors reported their multicomponent intervention to be feasible in practice and highly acceptable to patients; although not statistically significant likely due to sample size considerations, they also reported promising results for smoking cessation, reduced alcohol intake, and decreased depressive symptoms. These examples are important because traditional tobacco cessation interventions are not designed to address concomitant concerns that many smokers experience and may impact cessation efforts, such as risky alcohol use. Moreover, coordination with other behavioral health services is often difficult across healthcare organizations or altogether lacking. Interventions like the ones developed by Duffy et al. [21] and Vander Weg et al. [42] hold promise in HNC care settings to address multiple behavioral health needs known to particularly impact treatment and recovery, but further study is needed. Comparative effectiveness research examining practical implementation in the otolaryngology setting or in conjunction with outside services is also warranted.

As noted by Vander Weg et al. [42], access to adjunctive behavioral health treatments may be problematic for many patients who live in rural areas and are at considerable distance to cancer care facilities, which are often centralized in large urban areas. Therefore, even when offered as part of comprehensive cancer care, consideration should be given to the existence of treatment options close to the patient if specialty treatment referral is in order and/or alternative modes of delivery for those services that are not nearby. Recent studies have shown rural-residing patients with HNC may be more likely to report problem drinking behavior and, of those, many exhibit at least mild to moderate depressive symptomatology [13, 43]. This suggests that

behavioral health connections may be especially valuable for this important subgroup. Opportunities to connect rural patients to behavioral health services via telehealth should be explored and the recent expansion of such services due to the COVID-19 pandemic may make connections more easily accessible. Notably, all three studies reviewed above were telephone-based, making distance a non-factor in care receipt [21, 38, 42]. Previous research suggests that distance to care is associated with numerous poor outcomes in patients with cancer, such as worse prognosis and HRQOL [44]. This aligns with research in multiple chronic disease populations indicating that poor access—exacerbated by factors such as distance—may in part explain why patients in rural settings face a so-called "rural disadvantage", making connections to care especially important [45].

The present study included a large sample of patients with HNC and accrued a high number of patients during the study period. It is not without limitations, however. First, the study sample was racially homogenous as greater than 90% of the sample was White and included patients from one Midwestern healthcare system, making generalizability an issue. Second, while over 75% of eligible patients were recruited into the parent study, there is some concern about self-selection bias. We have no information about the approximately 25% of those choosing not to enroll and it is possible that some of those patients exhibited co-occurring problem alcohol and tobacco use and/or generally poor HRQOL. Third, other measures may better capture problem drinking behavior in this population even though the SMAST has been administered in several studies of HNC. Fourth, we had no information about corresponding diagnoses of alcohol use disorder or other indication of problematic use to corroborate patient self-report of this behavior. Fifth, we have no information regarding HPV status in this sample despite increasing research exploring outcomes related to HPV + cancers of the head and neck.

In conclusion, the present results suggest that patients with HNC who exhibit problem drinking and smoking behavior at diagnosis may have worse HNC-specific HRQOL during the first year after diagnosis. In this sample, over 10% endorsed both problem behaviors, which are known to increase rates of recurrence in addition to complicating treatment and recovery. Numerous organizations have called for the incorporation of behavioral health screening and evidence-based treatments in clinical settings [38, 39]. The present results underscore the implications and impact of these behaviors in HNC which should be considered at diagnosis via increased screening and connection to behavioral health resources as needed. Future research should address access to and incorporation of care services, including acknowledgement that distance could be an issue to gaining access for some patients. Such efforts may contribute to improved outcomes during the periods of treatment and survivorship and ensure multiple important needs are met over the survivorship trajectory.

**Authors' contributions** All authors contributed to the study conception and design. M. Bryant Howren performed the data analysis. The first draft of the manuscript was written by M. Bryant Howren and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

**Funding** This work was primarily supported by an award from the VA Office of Rural Health, Veterans Rural Health Resource Center—Iowa City (VRHRC-IC), Iowa City VA Health Care System, Iowa City, IA (Award #14381, PI Howren). This work was also supported by the National Cancer Institute and University of Iowa Holden Comprehensive Cancer Center (Award #P30 CA086862). The views expressed in this article are those of the authors and do not necessarily represent the position or policy of the Department of Veterans Affairs or United States Government.

**Data availability** The data that support the findings of this article are available from the corresponding author upon reasonable request.

**Code availability** N/A.

## Declarations

**Ethics approval** This study was approved by The University of Iowa's IRB (#199412746).

**Consent to participate.** Informed consent was obtained from all individual participants included in the study.

**Consent for publication.** This manuscript contains no individual data in any form (including any individual details, images, or videos), thus consent for publication does not apply.

**Competing interests** The authors declare that they have no competing interests.

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