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**Factors Associated With Risk of Body Image–Related Distress in Patients With Head and Neck Cancer**

David Macias, MD; Brittany N. Hand, PhD, OTR/L; Stacey Maurer, PhD; Wendy Balliet, PhD; Mark A. Ellis, MD; Patrik Pipkorn, MD, MSCI; Andrew T. Huang, MD; Marci L. Nilsen, PhD, RN; Kenneth J. Ruggiero, PhD; Amy M. Williams, PhD; Courtney H. Marsh, BS; Hong Li, PhD; Bethany A. Rhoten, PhD, RN; Katherine R. Sterba, PhD, MPH; Evan M. Graboyes, MD, MPH

**IMPORTANCE** Body image–related distress (BID) is common among head and neck cancer (HNC) survivors and associated with significant morbidity. Risk factors for HNC-related BID remain poorly characterized because prior research has used outcome measures that fail to fully capture BID as experienced by HNC survivors.

**OBJECTIVE** To assess the association of demographic and oncologic characteristics with HNC-related BID using the Inventory to Measure and Assess Image disturbance Head & Neck (IMAGE-HN), a validated, multidomain, patient-reported outcome measure of HNC-related BID.

**DESIGN, SETTING, AND PARTICIPANTS** This cross-sectional study assessed 301 adult survivors of surgically managed HNC at 4 academic medical centers.

**MAIN OUTCOMES AND MEASURES** The primary outcome measure was IMAGE-HN scores, for which higher scores reflect more severe HNC-related BID. Multivariable linear regression analyses were performed to evaluate the association of patient characteristics with IMAGE-HN global and 4 subdomain (other-oriented appearance concerns, personal dissatisfaction with appearance, distress with functional impairments, and social avoidance) scores.

**RESULTS** Of the 301 participants (212 [70.4%] male; mean [SD] age, 65.3 [11.7] years), 181 (60.1%) underwent free flap reconstruction. Graduation from college (β = −9.6; 95% CI, −17.5 to −1.7) or graduate school (β = −12.6; 95% CI, −21.2 to −3.8) was associated with lower IMAGE-HN social avoidance scores compared with less than a high school education. Compared with paid work, unemployment was associated with higher IMAGE-HN other-oriented appearance (β = 10.7; 95% CI, 2.0-19.3), personal dissatisfaction with appearance (β = 12.5; 95% CI, 1.2-23.7), and global (β = 8.0; 95% CI, 0.6-15.4) scores. Compared with no reconstruction, free flap reconstruction was associated with higher IMAGE-HN global scores (β = 11.5; 95% CI, 7.9-15.0) and all subdomain scores (other-oriented appearance: β = 13.1; 95% CI, 8.6-17.6; personal dissatisfaction with appearance: β = 15.4; 95% CI, 10.0-20.7; distress with functional impairment: β = 12.8; 95% CI, 8.1-17.4; and social avoidance and isolation: β = 10.2; 95% CI, 5.8-14.6). Higher IMAGE-HN distress with functional impairment scores were found in those who received surgery and adjuvant radiation (β = 7.8; 95% CI, 2.9-12.7) or chemoradiotherapy (β = 6.5; 95% CI, 1.8-11.3) compared with surgery alone. The multivariable regression model accounted for a modest proportion of variance in IMAGE-HN global (R² = 0.18) and subdomain scores (R² = 0.20) for other-oriented appearance, 0.14 for personal dissatisfaction with appearance, 0.21 for distress with functional impairment, and 0.13 for social avoidance and isolation.

**CONCLUSIONS AND RELEVANCE** In this cross-sectional study, factors associated with risk of HNC-related BID included free flap reconstruction, lower educational attainment, unemployment, and multiple treatment modalities. These characteristics explain a modest proportion of variance in IMAGE-HN scores, suggesting that other characteristics may be the major risk factors for HNC-related BID and should be explored in future studies.
head and neck cancer (HNC) is the sixth most common
cancer worldwide, and the number of HNC survivors
is increasing sharply in the US.1,2 Both HNC and its
treatment result in highly visible disfigurement and function-
ally critical impairments, including challenges speaking, dif-
ficulty swallowing, and impaired smiling.3,4 When severe, these
impairments have significant negative effects on psycho-
social well-being and physical function and result in body im-
age-related distress (BID), a disorder characterized by self-
perceived displeasing change in appearance and/or function
and the resultant psychosocial distress.4–8 Body image-
related distress is common among HNC survivors because of
the visible nature of the head and neck and its association with
personal identity and communication3,9 and is an important
related distress is common among HNC survivors because of
its subjective nature and poor correlation with objec-
tive measures of disfigurement. Unfortunately, the PROMs
used in these studies5 were developed for non-HNC popula-
tions and are not yet fully validated for HNC-related
image–related distress.3,4,9 Body image–related distress (BID), a disorder characterized by self-
perceived displeasing change in appearance and/or function
and the resultant psychosocial distress.4–8 Body image-
related distress is common among HNC survivors because of
the visible nature of the head and neck and its association with
personal identity and communication3,9 and is an important
contributor to social isolation, stigmatization, depression, de-
creased intimacy, and worse quality of life.4,10–12

Multiple studies5 have sought to identify pretreatment risk
factors for HNC-related BID. These studies3,14 relied on patient-
reported outcome measures (PROMs) to assess HNC-related BID
because of its subjective nature and poor correlation with objec-
tive measures of disfigurement. Unfortunately, the PROMs
used in these studies5 were developed for non-HNC popula-
tions (eg, breast cancer) and do not fully capture the spectrum
of body image concerns experienced by HNC survivors. As a result, risk factors for HNC-related BID remain poorly
characterized. The Inventory to Measure and Assess imaGe
disturbancE-Head & Neck (IMAGE-HN) is a psychometrically
sound PROM of HNC-related BID that was validated in a multi-
institutional study.15 Through its comprehensive assessment
of key aspects of HNC-related BID using 4 individual do-
 mains and a global domain, the IMAGE-HN can more pre-
cisely identify factors associated with BID among HNC survi-
vors. Therefore, this study aims to assess the association
between sociodemographic and oncologic characteristics and
HNC-related BID using the IMAGE-HN.

Methods

Study Design and Participants

This cross-sectional study is a secondary analysis of data col-
lected for the IMAGE-HN validation. The description of the vali-
dation cohort and results of the psychometric validation have
been previously published.15 Individuals 18 years or older with
a history of surgically managed HNC and no known active dis-
 ease were included. Participants were enrolled from multidi-
 sciplinary HNC clinics at 4 academic medical centers (Medical
University of South Carolina, Baylor College of Medicine,
University of Pittsburgh Medical Center, and Washington Univer-
sity School of Medicine). After enrollment during a posttreat-
ment or survivorship clinic visit, participants completed the
IMAGE-HN and a self-reported sociodemographic and onco-
logic questionnaire using an electronic tablet. Of 309 patients
approached for participation, 4 declined, and 4 did not pro-
vide demographic or oncologic data, leaving a sample of 301 pa-
tients. The study was approved by the Medical University of
South Carolina institutional review board. The patients pro-
vided verbal consent, and a waiver of written informed con-
sent was granted for the study because the research involved
no more than minimal risk to the participants. Patient data were
deidentified. This study followed the Strengthening the Re-
porting of Observational Studies in Epidemiology (STROBE)
reporting guideline.

IMAGE-HN

Details regarding the development and validation of
IMAGE-HN have been previously published,15 and the instru-
ment and scoring manual are publicly available.16 In brief, the
IMAGE-HN is a psychometrically sound, 24-item, multido-
main PROM of HNC-related BID that consists of 4 subdo-
mains and a global domain. The 4 subdomains are (1) other-
oriented appearance concerns (perceived verbal and nonverbal
reactions by others to the appearance of patients with HNC),
(2) personal dissatisfaction with appearance (dissatisfaction
with their appearance by patients with HNC), (3) distress with
functional impairments (challenges related to speaking, swal-
lowing, oral competence, and so on), and (4) social avoidance
and isolation (avoidance of social interaction because of im-
ge image concerns). Raw IMAGE-HN scores for each subdomain
and the global domain can be converted to scaled scores rang-
ing from 0 to 100, with higher scores reflecting more severe
HNC-related BID.15

Variables

Self-reported sociodemographic characteristics included age,
sex, race/ethnicity, marital status, living situation, educa-
tional attainment, employment, rurality, and insurance cov-
 erage. Self-reported oncologic characteristics include tumor
 subsite, cancer treatment, and type of reconstructive sur-
gery. Time since completion of treatment was collected as a
categorical variable.

Statistical Analysis

Descriptive statistics (eg, frequencies for categorical vari-
ables and mean [SD] or median [range] for continuous vari-
bles) were used to characterize the sample. Multivariable lin-
ear regression was used to identify characteristics associated

Key Points

Question What are the factors associated with risk of body
image-related distress (BID) among survivors of head and neck
cancer (HNC)?

Findings In this cross-sectional study of 301 adult HNC survivors,
lower educational attainment, unemployment, complex
reconstructive surgery, and higher number of treatment
modalities were associated with more severe HNC-related BID as
measured by a validated patient-reported outcome measure of
HNC-related BID. However, these associations explained only a
modest proportion of variance in scores on the Inventory to
Measure and Assess imaGe disturbedancE-Head & Neck.

Meaning These findings suggest that although certain
demographic and oncologic characteristics are associated
with HNC-related BID, other risk factors appear to exist and should be
explored in future studies.

Findings and Meaning

Findings and Meaning

Findings and Meaning

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with scores on the IMAGE-HN global domain and 4 subdomains. Patient characteristics were considered for inclusion in the multivariable linear regression models on the basis of bivariate analyses assessing the association with each of the 4 subdomains and global domain. The associations between categorical variables and IMAGE-HN domain scores were analyzed with 1-way analyses of variance, whereas continuous variables were examined with correlations. Categorical variables were included in the multivariable regression model if analysis of variance revealed \( P < .10 \) for the association with IMAGE-HN domain scores; continuous variables were included in the multivariable model if there was a linear correlation of at least 0.1 with IMAGE-HN domain scores. To evaluate the presence of multicollinearity among tumor location, reconstructive surgery type, and cancer treatment, we evaluated all possible 2-way associations. All correlations were weak to moderate (Cohen \( d = 0.12-0.43 \)), suggesting no significant degree of multicollinearity among any of these 3 variables. We then included interaction terms for these variables in the multivariable regression models when any of the main effects were significant; none of the interaction terms were significant (\( P > .05 \) for each). The final multivariable models were identified using backward elimination. A 2-sided \( P < .05 \) was considered statistically significant for all variables and interaction terms. Statistical analyses were performed using SAS statistical software (SAS Institute Inc).

Results

Sample Characteristics
A total of 301 participants (212 [70.4%] male; mean [SD] age, 65.3 [11.7] years) with sociodemographic and oncologic information were included in the study (Table 1). The most common HNC subsites were oral cavity (129 [42.9%]), oropharynx (50 [16.6%]), and facial cutaneous (50 [16.6%]); 186 patients (61.8%) underwent adjuvant therapy, and 181 patients (60.1%) underwent free flap reconstruction.

Associations of Demographic Characteristics With HNC-Related BID
Table 2 gives the results of the multivariable linear regression models, demonstrating the association of demographic characteristics with HNC-related BID. Higher educational attainment was associated with lower social avoidance and isolation subdomain scores. Graduation from college (\( \beta = -9.6; 95\% \text{ CI}, -17.5 \) to \(-1.7 \)) or graduate school (\( \beta = -12.6; 95\% \text{ CI}, -21.2 \) to \(-3.8 \)) was associated with 9.6-point and 12.6-point lower IMAGE-HN social avoidance and isolation subdomain scores compared with non–high school graduates.

Employment status was also associated with IMAGE-HN scores. Disability was associated with an increased IMAGE-HN global (\( \beta = 5.1; 95\% \text{ CI}, 0.1-10.0 \)) score compared with part-time or full-time paid work. Unemployment had a positive association with IMAGE-HN global (\( \beta = 8.0; 95\% \text{ CI}, 0.6-15.4 \)) scores as well as other-oriented appearance concerns (\( \beta = 10.7; 95\% \text{ CI}, 2.0-19.3 \)) and personal dissatisfaction with appearance (\( \beta = 12.5; 95\% \text{ CI}, 1.2-23.7 \)) subdomain scores.
when compared with paid employment. IMAGE-HN scores were not associated with the remainder of the demographic characteristics (age, sex, race/ethnicity, marital status, rurality, or insurance), and there were no significant interaction terms.

Associations of Oncologic Characteristics With HNC-Related BID
Table 2 gives the results of the multivariable linear regression models, demonstrating the association of oncologic characteristics with HNC-related BID. Compared with patients with oral cavity cancer, patients with laryngeal/hypopharyngeal cancer had increased scores on the other-oriented appearance concerns subdomain (β = 9.6; 95% CI, 3.3-15.8). Patients with facial cutaneous malignant tumors had lower distress with functional impairments subdomain scores (β = −14.5; 95% CI, −20.1 to −8.9).

Microvascular free flap surgery had a large, positive association with the IMAGE-HN global domain and all 4 subdomains. Compared with no reconstructive surgery, free flap surgery was associated with an 11.5-point higher IMAGE-HN global score (β = 11.5; 95% CI, 7.9-15.0) and elevated scores across all subdomains (other-oriented appearance: β = 13.1; 95% CI, 8.6-17.6; personal dissatisfaction with appearance: β = 15.4; 95% CI, 10.0-20.7; distress with functional impairment: β = 12.8; 95% CI, 8.1-17.4; and social avoidance and isolation: β = 10.2; 95% CI, 5.8-14.6). IMAGE-HN scores were not associated with time since completion of treatment as a categorical variable or osseous flap reconstruction compared with nonosseous reconstruction. An example, some studies have found that patients undergoing osseous free flap reconstruction are at higher risk for BID compared with those undergoing a nonosseous reconstruction, although other studies, including the current one, have not. This discrepancy could be explained by a number of factors, including small sample size or differences in measures of BID. It is nevertheless clear that much work remains to be done to understand the mechanisms by which free flap reconstructions are associated with HNC-related BID.

Reconstructive Surgery
Patients undergoing microvascular free flap surgery appear to be at very high risk for developing HNC-related BID. Free flap reconstructions are the standard of care for complex ablative defects in HNC in terms of functional and cosmetic outcomes, yet the use of a free flap does not appear to mitigate BID induced by the associated surgical resection. The finding of a strong association between extent of reconstructive surgery and HNC-related BID is in accordance with prior studies. This association between free flap reconstruction and HNC-related BID, although not surprising, is potentially confounded by a complex association among cancer stage, extent of surgical resection, need for adjuvant therapy, and free flap reconstruction. Although these associations may be difficult to disentangle because of challenges quantifying the extent of surgical resection and nonrandom allocation of patients to type of reconstruction, future studies could consider exploring the interplay between these variables and HNC-related BID. Further complicating this association is that free flaps are a heterogeneous group that consists of different types of flaps (eg, osseous or nonosseous), tissue characteristics, donor sites, and other characteristics that vary widely. For example, some studies have found that patients undergoing osseous free flap reconstruction are at higher risk for BID compared with those undergoing a nonosseous reconstruction, although other studies, including the current one, have not. This discrepancy could be explained by a number of factors, including small sample size or differences in measures of BID. It is nevertheless clear that much work remains to be done to understand the mechanisms by which free flap reconstructions are associated with HNC-related BID.

Table 1. Participant Characteristics (continued)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Finding (N = 301)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reconstructive surgery</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>102 (33.9)</td>
</tr>
<tr>
<td>Other (including local or regional flap)</td>
<td>18 (6.0)</td>
</tr>
<tr>
<td>Microvascular free flap</td>
<td>181 (60.1)</td>
</tr>
<tr>
<td>Osseous microvascular free flap reconstruction</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>259 (86.0)</td>
</tr>
<tr>
<td>Yes</td>
<td>42 (14.0)</td>
</tr>
<tr>
<td>Time since completion of treatment, mo</td>
<td></td>
</tr>
<tr>
<td>0-6</td>
<td>119 (39.5)</td>
</tr>
<tr>
<td>6-12</td>
<td>49 (16.3)</td>
</tr>
<tr>
<td>12-24</td>
<td>52 (17.3)</td>
</tr>
<tr>
<td>&gt;24</td>
<td>81 (26.9)</td>
</tr>
</tbody>
</table>

* Data are presented as number (percentage) of patients unless otherwise indicated. Some sample sizes are smaller because of missing information.

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Educational Attainment
This study found that higher levels of educational attainment are protective against image-related social avoidance and isolation among HNC survivors. Although the findings of this study are consistent with numerous prior studies,5,20,25 a recent study26 in a Chinese cohort describes that higher education is associated with more severe BID among surgically treated patients with HNC. Potential explanations for their divergent results may be (1) differences in oncologic characteristics, (2) the categorization of education, or (3) cultural differences in how BID among patients with HNC in China may be internalized compared with patients with HNC in the US. Although the mechanism by which more education offers protection against HNC-related BID is not known, it is hypothesized that more education provides patients with improved coping abilities, psychological insight, and a better understanding of their cancer and its effects, thus allowing for healthier responses to changes in appearance and function.27,28

Employment
The HNC survivors with an employment status of disability or unemployed had higher IMAGE-HN scores. Employment may protect against BID through social support in the workplace and a sense of normalcy and routine.29 However, the temporal association between employment and HNC-related BID may be reversed, and unemployment is possibly the consequence of more severe BID among HNC survivors. After HNC and its treatment, survivors struggling with body image concerns may feel unable to return to the workforce because of negative reactions or avoidance by others to changes in appearance or function.4,30 Furthermore, HNC survivors are potentially unable to retire because of the substantial financial burden of HNC treatment31 coupled with negative reactions to disfigurement by potential employers.32 Half of HNC survivors do not return to work after treatment,33,34 and appearance is one of the most common reasons. Future studies that longitudinally track employment and HNC-related BID from diagnosis through survivorship are necessary to dis-

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### Table 2. Association of Demographic and Oncologic Characteristics With the 4 Subdomains and Global Domain of the IMAGE-HN

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>OOA (95% CI)</th>
<th>PDA (95% CI)</th>
<th>DFI (95% CI)</th>
<th>SA (95% CI)</th>
<th>Global (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Educational attainment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than high school</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>1 [Reference]</td>
<td>NA</td>
</tr>
<tr>
<td>High school graduate</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>−2.1 (−9.7 to 5.6)</td>
<td>NA</td>
</tr>
<tr>
<td>Some college</td>
<td>NA</td>
<td>NA</td>
<td>−5.4 (−13.1 to 2.4)</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>College graduate</td>
<td>NA</td>
<td>NA</td>
<td>−9.6 (−17.5 to −1.7)</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Graduate school</td>
<td>NA</td>
<td>NA</td>
<td>−12.6 (−21.2 to −3.8)</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td><strong>Employment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part-time or full-time paid work</td>
<td>1 [Reference]</td>
<td>1 [Reference]</td>
<td>NA</td>
<td>NA</td>
<td>1 [Reference]</td>
</tr>
<tr>
<td>Disability</td>
<td>5.3 (−0.5 to 11.2)</td>
<td>5.0 (−2.6 to 12.5)</td>
<td>NA</td>
<td>NA</td>
<td>5.1 (0.1 to 10.0)</td>
</tr>
<tr>
<td>Retired</td>
<td>−1.4 (−6.0 to 3.1)</td>
<td>−3.1 (−9.0 to 2.8)</td>
<td>NA</td>
<td>NA</td>
<td>−2.4 (−6.3 to 1.4)</td>
</tr>
<tr>
<td>Unemployed</td>
<td>10.7 (2.0 to 19.3)</td>
<td>12.5 (1.2 to 23.7)</td>
<td>NA</td>
<td>NA</td>
<td>8.0 (0.6 to 15.4)</td>
</tr>
<tr>
<td><strong>Tumor location</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oral cavity</td>
<td>1 [Reference]</td>
<td>NA</td>
<td>1 [Reference]</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Oropharynx</td>
<td>−2.3 (−8.0 to 3.5)</td>
<td>NA</td>
<td>−0.2 (−6.2 to 5.9)</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Larynx/hypopharynx</td>
<td>9.6 (3.3 to 15.8)</td>
<td>NA</td>
<td>1.3 (−5.1 to 7.7)</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Unknown/other</td>
<td>12.0 (2.8 to 21.2)</td>
<td>NA</td>
<td>2.2 (−7.7 to 12.0)</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Major salivary gland</td>
<td>6.5 (−1.4 to 14.4)</td>
<td>NA</td>
<td>−4.1 (−12.3 to 4.1)</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Facial cutaneous</td>
<td>3.9 (−1.5 to 9.2)</td>
<td>NA</td>
<td>−14.5 (−20.1 to −8.9)</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Cancer treatment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgery</td>
<td>NA</td>
<td>NA</td>
<td>1 [Reference]</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Surgery and RT</td>
<td>NA</td>
<td>7.8 (2.9 to 12.7)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Surgery and CRT</td>
<td>NA</td>
<td>6.5 (1.8 to 11.3)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Reconstructive surgery</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Microvascular free flap</td>
<td>13.1 (6.8 to 17.6)</td>
<td>15.4 (10.0 to 20.7)</td>
<td>12.8 (8.1 to 17.4)</td>
<td>10.2 (5.8 to 14.6)</td>
<td>11.5 (7.9 to 15.0)</td>
</tr>
<tr>
<td>Other</td>
<td>1.5 (−6.2 to 9.2)</td>
<td>1.9 (−7.9 to 11.8)</td>
<td>5.1 (−2.9 to 13.2)</td>
<td>0.3 (−7.9 to 8.5)</td>
<td>1.1 (−5.5 to 7.6)</td>
</tr>
<tr>
<td><strong>Model R²</strong></td>
<td>0.20</td>
<td>0.14</td>
<td>0.21</td>
<td>0.13</td>
<td>0.18</td>
</tr>
</tbody>
</table>

Abbreviations: CRT, chemoradiotherapy; DFI, distress with functional impairments; IMAGE-HN, Inventory to Measure and Assess image disturbance-Head & Neck; OOA, other-oriented appearance concerns; PDA, personal dissatisfaction with appearance; RT, radiotherapy; SA, social avoidance and isolation.

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entangle the association between employment and HNC-related BID and determine whether unemployment is a cause or effect of BID among HNC survivors.

**Tumor Subsite**

No associations were found between tumor location and higher BID except for the larynx/hypopharynx and other/unknown subsites, which were associated with the other-oriented appearance concerns subdomain only. A reasonable assumption is that facial cutaneous cancers would have a strong association with higher appearance-related concerns, but the findings of this study do not support this conclusion, perhaps in part because the study was not powered to detect subtle differences among subsites. The only tumor location reported as having an association with higher BID in the literature is the oral cavity, yet prior research is limited by use of BID measurement tools not validated for the HNC population and low numbers of patients with facial cutaneous tumors. Two studies composed of large numbers of patients with facial cutaneous cancer did not find an association with this subsite and increased BID compared with the oral cavity subsite. In fact, 1 study describes how patients with functional difficulties (eg, speech and swallowing) reported equal or even greater BID compared with those with exclusively appearance-related concerns. These findings point to the multidimensionality of BID. Because objective measures of disfigurement are poorly associated with patient-reported measures of BID, inferences by practitioners on how HNC and its treatment affects BID can be misleading.

**Practical Implications**

One practical implication of this study is that the demographic and oncologic characteristics associated with HNC-related BID may be used to help counsel patients about their risk of developing HNC-related BID after treatment. High-risk patients are those with lower educational attainment who are unemployed or have disabilities and will be expected to undergo surgery with free flap reconstruction and adjuvant therapy. Whether these patients will benefit from preemptive discussions about expectations associated with posttreatment BID is unknown and should be explored in future studies. In addition to targeted counseling, these risk factors could also help identify patients at risk for HNC-related BID for preventive interventions implemented in the pretreatment period. Unfortunately, pretreatment interventions to prevent posttreatment BID among patients with cancer are poorly characterized. Although no such treatments have been described specifically for patients with HNC, a prehysterectomy educational intervention appeared to protect against the development of BID in a small pilot study. The lack of a preventive intervention for patients at risk for HNC-related BID represents a major gap in clinical care and a potentially significant opportunity to minimize long-term psychosocial toxic effects. For preventive interventions to be effective before treatment, highly predictive risk tools must be available; however, such tools remain elusive because many risk factors for developing HNC-related BID remain unknown. The value of effective early posttreatment interventions should be emphasized as well. Although research on specific interventions targeting BID in HNC survivors is limited, 2 recent studies have produced mixed results. One study used an expressive writing activity based on self-compassion to reduce BID in HNC survivors. Despite this method’s success in breast cancer survivors, it was not efficacious in the HNC population. Another intervention using a telemedicine-based cognitive-behavioral intervention to manage BID in HNC survivors showed promise in a small cohort. Ultimately, it is hoped that the data from the current study can inform the development of patient-centered interventions in the pretreatment and posttreatment settings targeted to those at highest risk of developing BID.

Although this study identified a number of demographic and oncologic characteristics associated with HNC-related BID, the models explained only a modest proportion of the overall variance in IMAGE-HN scores, suggesting that additional variables explain differences in the risk of developing BID after HNC treatment. The finding that most of the variability in IMAGE-HN scores is not explained by oncologic characteristics agrees with prior literature suggesting poor correlation between disfigurement and BID. Other potentially important characteristics that may explain variability in BID among HNC survivors but were not analyzed in this study include functional outcomes (eg, swallowing impairment and speech production or intelligibility), psychosocial factors (eg, image investment; body image coping strategies; social support; and mental health history, including pretreatment depression and/or anxiety), and neurobiological factors (eg, attentional networks and). Future research on risk factors for HNC-related BID should explore these characteristics using validated PROMs of HNC-related BID.

**Strengths and Limitations**

This study has strengths and limitations. It is a rigorously conducted study with a large number of patients from across 4 diverse academic medical centers, giving the results robust external validity in a population of a typical academic HNC practice. This is also the first study, to our knowledge, to describe the associations between patient characteristics and HNC-related BID using a PROM specific to HNC-related BID. Despite these strengths, the study possesses a number of important limitations. The study used a cross-sectional design, which prevents evaluation of how the severity of HNC-related BID changes after treatment. Because the study cohort was composed entirely of patients treated with a primary surgical paradigm, it was not possible to evaluate whether surgical approaches result in higher HNC-related BID than nonsurgical paradigms. The association of surgical-based approaches with HNC-related BID should thus be explored in future studies that include nonsurgical patients. This study relies on self-reported oncologic data, and although the administered questionnaires used patient-appropriate language complexity, the data are subject to recall or response bias. Significantly larger sample sizes are required to detect interaction effects compared with main effects, and the study was not powered to detect interaction terms; therefore, it is possible that an interaction between certain variables with a priori relevance to HNC-related BID (eg, subsite and treatment or subsite and reconstruction) exists and the study was underpow-
erected to detect it. In addition, the clinical relevance of a specific IMAGE-HN score remains unknown, preventing us from accurately identifying patients with HNC with clinically meaningful BID and determining the prevalence of HNC-related BID among different at-risk populations. Future research should define the utility of the IMAGE-HN by describing cutoff points and score ranges to better characterize the disorder.

Conclusions

This multi-institutional study using a validated, multidomain PROM of HNC-related BID identified a number of demographic and oncologic characteristics associated with HNC-related BID, including educational attainment, employment, tumor subsite, free flap reconstruction, and adjuvant therapy. These demographic and oncologic characteristics, which are likely known in the pretreatment setting, may be used to identify those at greatest risk of HNC-related BID. However, these associations explain a modest proportion of variance in IMAGE-HN scores, suggesting that other patient-specific characteristics contribute to HNC-related BID as well. Future studies should continue to explore other factors associated with HNC-related BID that were not accounted for in the current study using a validated BID PROM specific to patients with HNC.

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