Objective: To assess the knowledge of first- (M1) and fourth- (M4) year medical students regarding head and neck cancer (HNC) risk factors, signs, symptoms, and frequency; designated oral screening recommendations; head and neck physical examination techniques; and medical school curriculum on this subject.

Design: Cross-sectional cohort study using a survey questionnaire.

Setting: Two metropolitan-area medical schools in Chicago, Illinois.

Participants: Of 601 M1 and M4 medical students, 304 completed the survey.

Main Outcome Measures: Percentage of medical students from 2 classes at 2 different universities who knew baseline knowledge about HNC.

Results: The response rate was approximately 50% for each class from each university. The M1 students from the 2 institutions differed on identifying a lump in the neck and voice changes among the signs and symptoms associated with HNC and American Cancer Society examination recommendations. The M4 students did not differ between the 2 schools and were more knowledgeable than the M1 students on risk factors, signs, symptoms, most frequent histologic type, American Cancer Society recommendations, and common subsites of HNC. Curricular experiences, as expected, varied between M1 and M4 students.

Conclusions: This study demonstrates an increase in knowledge about HNC in M4 students compared with M1 students. Yet, graduating students are still deficient regarding certain risk factors, oral screening guidelines, head and neck examination techniques, and medical school curriculum. Further efforts should be aimed at expanding head and neck education for medical students.


According to the American Cancer Society (ACS), there are an estimated 40,000 new cases and more than 11,000 deaths from oral cavity, pharyngeal, and laryngeal cancers annually. Worldwide, oral cancer is fast becoming an epidemic, with an annual incidence of 274,000 cases and 127,500 deaths. More than 90% of these malignant neoplasms are squamous cell carcinoma (SCC). It is well known that tobacco and alcohol synergistically contribute to the development of SCC. Early detection of these lesions, especially in the oral cavity, where visualization and palpation are accessible, has been proved to result in improved locoregional and distant control, with survival of 60% to 90% for early-stage malignant neoplasms that declines dramatically to 30% for advanced-stage disease.

The ACS recommends that people older than 40 years, especially high-risk individuals, should have an annual oral cavity screening examination. This can be performed by a variety of trained health care professionals, including primary care physicians, dentists, dental hygienists, oral surgeons, and otolaryngologists. However, the actual number of health care providers who do perform this examination is low, especially among physicians.

The information and skills taught in medical school, during the preclinical and clinical years, are critical in affecting the practice habits of physicians. The objective of this study was to assess the knowledge level of first- (M1) and fourth- (M4) year medical students regarding head and neck cancer (HNC) risk factors, signs, symptoms, and frequency; designated oral screening recommendations; physical examination techniques; and medical school curriculum on this subject.

**METHODS**

This is a cross-sectional cohort study that used a survey questionnaire. The survey was dis-
distributed to M1 and M4 medical students at the University of Illinois–Chicago College of Medicine (UIC), a public institution, and the University of Chicago–Pritzker School of Medicine (Pritzker), a private academic center. Institutional review board approval was obtained from both universities. The survey was available in hard copy (paper version) and electronically using a universally accessible Web address. Student participation was voluntary, and their responses were processed anonymously. In the paper and electronic versions, no personal identifiable data were collected; therefore, the tests were blinded as to which individuals actually completed the survey. For M1 students, the questionnaire was distributed initially in paper format immediately before the beginning of their head and neck anatomy course during the beginning of the second semester of their first medical school year. These students also had the option of completing the survey electronically if they chose to do so. The M4 students were contacted via electronic mail on 2 separate occasions immediately before Match Day— in March. They were given the online version of the survey questionnaire. The contents of the paper and electronic questionnaire were identical. All of the students were given 2 weeks to complete the survey, after which time access to the electronic format was terminated. By approaching M1 medical students before the beginning of their head and neck anatomy course, it was believed that their responses would reflect a baseline knowledge level of head and neck pathologic conditions that had not been affected by medical didactics. On the contrary, M4 students were approached near Match Day—close to the end of their formal medical school education—thus, their answers would more accurately reflect their training regarding head and neck abnormalities.

The survey was divided into 4 sections. In the first part, students were asked to provide their year in medical school (M1 or M4) and medical university affiliation (UIC or Pritzker). The second portion of the survey included several multiple-choice questions that assess objective information about HNC. The topics included identifying HNC risk factors, clinical signs, and symptoms; pertinent head and neck anatomy; and common tumor locations. In addition, students were asked to identify which histologic type—lymphoma, sarcoma, SCC, or adenocarcinoma—was most common for HNC. The survey also assessed whether students knew the designated screening recommendations for oral cancer as outlined by the ACS. Students were also asked to determine the goal of cancer surveillance regarding temporal relevance for tumor recurrence. The third area of the questionnaire inquired about the individual school’s curriculum as it pertains to HNC education, clinical rotations that involve HNC patient care, and student exposure to otolaryngology. The final section of the survey asked students to assess their own head and neck examination habits, including oral cavity inspection. A complete copy of the survey is available on request from the corresponding author.

Every question on the survey was in a multiple-choice format. For the objective portion, a single point value was assigned to the correct answer. For some questions there was more than 1 correct answer, each worth 1 point, and students were instructed to “check all that apply.” Students were assessed based on the number of points they earned for this portion of the questionnaire. Individual responses were recorded, and trends were identified. The results for each student were entered into a computerized spreadsheet format, with STATA 7 software (StataCorp, College Station, Texas) used to analyze the data. Students were compared with their peers in the same class, between classes, and between universities using the unpaired t test and chi-square analyses.

The total number of medical students during the 2005-2006 school year at both institutions was 601, and 304 (50.6%) completed the survey. On average, there was an approximately 50% response rate for each class at each university (109 of 216 M1 students at UIC, 51 of 104 M1 students at Pritzker, 91 of 177 M4 students at UIC, and 53 of 104 M4 students at Pritzker).

General knowledge about the signs and symptoms of and risk factors for HNC by academic year and institution are listed in Table 1. Almost all the M4 students (≥96.7%) at both universities correctly identified voice changes, difficulty chewing or swallowing, a lump in the neck, smoking tobacco, and chewing tobacco to be associated with SCC. Comparatively, approximately 60% of the M1 students knew this information. There was a significant difference between M4 and M1 students (P < .001). However, fewer students in either class at both institutions knew the increased association of alcohol consumption and the presence of a nonhealing oral sore with

<table>
<thead>
<tr>
<th>Knowledge Category</th>
<th>M1 Students, %</th>
<th>M4 Students, %</th>
<th>P Value, UIC vs Pritzker</th>
<th>P Value, M1 vs M4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk factors</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chewing tobacco</td>
<td>82.6</td>
<td>70.6</td>
<td>.08</td>
<td>96.7</td>
</tr>
<tr>
<td>Smoking tobacco</td>
<td>67.0</td>
<td>72.6</td>
<td>.48</td>
<td>97.8</td>
</tr>
<tr>
<td>Use of alcohol</td>
<td>26.6</td>
<td>17.7</td>
<td>.22</td>
<td>86.8</td>
</tr>
<tr>
<td>Signs and symptoms</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Difficulty chewing or swallowing</td>
<td>62.4</td>
<td>51.0</td>
<td>.17</td>
<td>98.9</td>
</tr>
<tr>
<td>Lump in neck</td>
<td>70.6</td>
<td>52.9</td>
<td>.03</td>
<td>96.7</td>
</tr>
<tr>
<td>Voice changes</td>
<td>65.1</td>
<td>45.1</td>
<td>.01</td>
<td>97.8</td>
</tr>
<tr>
<td>Nonhealing sore</td>
<td>45.9</td>
<td>29.4</td>
<td>.05</td>
<td>83.5</td>
</tr>
</tbody>
</table>

Abbreviations: M1 and M4, first- and fourth-year medical students; Pritzker, University of Chicago–Pritzker School of Medicine; UIC, University of Illinois–Chicago College of Medicine.

a Data reflect yes responses. Don’t know responses were equivalent to no responses for statistical analysis purposes.

b No statistical significance was appreciated between M4 students.
SCC. Of the M4 students, 73.6% could identify both of these variables compared with only 15.0% of the M1 students. This, too, was significant between M4 and M1 students (P < .001). There was no statistically significant difference in general knowledge between M4 students from the 2 universities, and, except for 2 of the categories, there was also no difference between M1 students (Table 1). Overall, 70.8% of M4 students and 11.9% of M1 students correctly identified all 7 of the signs, symptoms, and risk factors included in the questionnaire.

From the various histologic types of HNC listed in the survey question (SCC, lymphoma, sarcoma, and adenocarcinoma), 87.5% of M4 students correctly chose SCC to be the most common compared with only 27.5% of M1 students (P < .001). There was no difference between the universities for each class.

When asked about the current oral cancer screening recommendations as outlined by the ACS, all the students did poorly. Only 43.8% of M4 students and 32.5% of M1 students knew that this examination should take place annually (P < .001). Significantly more M1 students at UIC (43.1%) compared with Pritzker (9.8%) knew these guidelines (P < .001), yet there was no statistically significant difference between M4 students.

Students were asked to arrange the most common sub-sites of HNC in order from most to least frequent. The correct answer was tongue, tonsil, and then true vocal cord. The students did poorly, with only 34.0% and 6.9% of M4 and M1 students, respectively, correctly arranging the anatomical locations. This was significant between the classes but not between the universities (P < .001).

The responses for the remainder of the survey questions addressed the medical school curriculum on HNC (Table 2). Most graduating students stated that they have had lectures about HNC and have taken care of such patients. Furthermore, more than 95% of M4 students say that they conduct a head and neck examination on their patients as part of their routine physical examination habits, yet only 10% routinely palpate the oral cavity. Only at UIC is otolaryngology a mandatory clinical rotation. Although this did not result in M4 students from UIC having a statistically significant advantage over Pritzker M4 students regarding the tested topics of the survey questionnaire. In addition, when analyzing M4 students from Pritzker alone, 10 of the 53 responders (18.9%) had taken an elective in otolaryngology. However, there was no knowledge or clinical examination technique difference between the 2 subgroups of M4 students. Both institutions required a head and neck examination section as part of the mandatory physical examination course.

## Table 2. M1 and M4 Medical Students Characterizing Personal Physical Examination Skills and Medical Education

<table>
<thead>
<tr>
<th>Curriculum and Examination Skills and Habits</th>
<th>M1 Students, % (n = 160)</th>
<th>M4 Students, % (n = 144)</th>
<th>P Value, M1 vs M4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Had a lecture about HNC during medical school (yes)</td>
<td>10 (6.3%)</td>
<td>70.8 (49.1%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Had cared for a patient with HNC in medical school (yes)</td>
<td>1.9 (1.2%)</td>
<td>66 (45.8%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Frequency of head and neck examination as part of routine physical examination&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never seen it</td>
<td>20.6 (12.8%)</td>
<td>3.5 (2.5%)</td>
<td>&lt;.001&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Seen it but have never performed it</td>
<td>10 (6.3%)</td>
<td>2.8 (2.0%)</td>
<td>&lt;.001&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Once</td>
<td>1.3 (0.8%)</td>
<td>2.1 (1.5%)</td>
<td>.57</td>
</tr>
<tr>
<td>Perform it occasionally</td>
<td>1.9 (1.2%)</td>
<td>66 (45.8%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Always perform it</td>
<td>1.3 (0.8%)</td>
<td>28.5 (20.0%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Not applicable</td>
<td>60.6 (38.5%)</td>
<td>0 (0%)</td>
<td>&lt;.001&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Frequency of oral cavity palpation with head and neck examination&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>9.4 (5.9%)</td>
<td>48.6 (34.0%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Rarely</td>
<td>1.9 (1.2%)</td>
<td>43.1 (30.0%)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Occasionally</td>
<td>1.3 (0.8%)</td>
<td>4.9 (3.4%)</td>
<td>.06</td>
</tr>
<tr>
<td>Most of the time</td>
<td>0.6 (0.4%)</td>
<td>4.9 (3.4%)</td>
<td>.02</td>
</tr>
<tr>
<td>All the time</td>
<td>2.5 (1.6%)</td>
<td>0 (0%)</td>
<td>.06</td>
</tr>
<tr>
<td>Not applicable</td>
<td>77.5 (48.5%)</td>
<td>0 (0%)</td>
<td>&lt;.001&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Abbreviations: HNC, head and neck cancer; M1 and M4, first- and fourth-year medical students.

<sup>a</sup>Analysis was performed using the χ² test.

<sup>b</sup>Some students may have chosen none or more than 1 answer.

<sup>c</sup>M4 vs M1.

### COMMENT

This study aimed to better understand the knowledge level of medical students regarding HNC during their pre-clinical and clinical years. These results indicate an increase in the proportion of correct responses by year of training in medical school. The M4 students at both universities demonstrated a similar pattern of knowledge and were comparable on all levels of testing. It can also be concluded that the mandatory otolaryngology rotation for UIC students during the clinical years did not result in a statistically significant HNC knowledge variation between M4 students. Except for 3 areas, there was also no statistically significant difference in knowledge level between M1 students at the 2 universities. Categories in which statistical significance was found had to do with the association of a lump in the neck and voice changes with HNC and the yearly screening guidelines. It is possible that these differences are because of variations in the preclinical curricula between the schools before the head and neck anatomy course. In addition, there may be bias among the responders whereby only students who believed that they knew the answers correctly com-
completed the survey compared with those who were simply guessing.

There are several limitations to this survey-based study. The most obvious limitation is the poor response rate: only approximately 50% of the students in each tested class at each university responded to the survey. The questionnaire format (ie, paper vs electronic) had no bearing on the individual class or the overall response rates. This poor turnout on the questionnaire may have an effect on interpretation of the results. It could be that only those who felt that they had knowledge about HNC were willing to complete the survey. Therefore, these results may exclude the true baseline knowledge of each of the tested medical school classes, which could be significantly lower than what the present data suggest. If more surveys were completed, it is possible that there would be an even lower proportion of HNC-knowledgeable students.

Another limitation is that this survey is not designed to assess at which point in training HNC education is provided. Most graduating students who responded to the questionnaire did have lectures on HNC and did take care of such patients. Without having direct access to the actual syllabi of each class from each of the 2 universities, it is difficult to determine which class or rotation provided an increase in knowledge.

The survey questions may introduce bias. The questions concerning physical examination techniques are subjective. There is no true objective measure that was used to assess exactly how the students examine their patients in this questionnaire. From their responses, however, it seems that their extent of head and neck examination is limited, particularly as it pertains to the oral cavity. The study questions assessing knowledge of HNC are not validated. However, these questions are similar to those used in other surveys of medical and dental students and practitioners. Despite these limitations, the results of the survey correlate with other studies.

In a study similar to this one, Reed et al8 assessed baseline knowledge of oral cavity cancer (OCC) in South Carolina medical students in the preclinical and clinical years. Most students knew that tobacco products are a major risk factor, whereas significantly fewer students knew the contribution of alcohol to OCC. This holds true for the students tested in the present study as well, in which less than 27% of M1 students chose alcohol to be leading factors for OCC. In development. In addition, Reed et al8 found that only 3.2% of M1 students knew that the tongue and the floor of the mouth are the most common sites for OCC. Statistically significantly more M4 students identified these sites, but this reached a high of only 42%. Furthermore, only 18.6% of M4 students felt adequately trained to examine a patient for this malignant neoplasm. The questions used in the study by Reed et al8 are similar to those in the present study and address a similar issue about medical student knowledge of HNC.

Ahlawalia et al10 looked at health history and physical diagnosis course curricula in medical schools in the United States and Puerto Rico for relevant content regarding OCC education. The investigators and expert panel members created an itemized standard criteria list of pertinent information that should be included in the course syllabi. The optimal score for the standard was 24. Of the 86 schools that responded, the average score was 10 of 24 (41.7%), where most schools scored 75% or less of the optimum. Their results emphasize the lack of adequate and comprehensive oral cancer training in medical schools regarding medical history taking and physical assessment.

The public health initiative Healthy People 2010: Understanding and Improving Health and Objectives for Improving Health11 prioritizes cancer and oral health among the 28 focus areas. Of the several objectives outlined, they propose that the number of early-stage OCCs (stages I and II) detected should increase from 30% to 50%. Increasing the number of medical professionals who perform accurate oral examinations is one way to meet this goal and, in the long run, improve outcomes for this disease.

The National Center for Health Statistics showed that only 14% of their surveyed population reported ever having an examination for oral cancer despite the annual recommendations from the ACS.12,13 They concluded that clinical health care providers do not conduct oral examinations routinely partially based on not having received appropriate training on how to perform a complete oral examination. Several other studies14-17 demonstrate similar findings, where primary care physicians and dentists feel inadequately trained to appropriately examine the oral cavity, detect premalignant or malignant lesions, and counsel patients about the risk factors associated with HNC.

In a recent publication from North Carolina, Patton et al18 surveyed 4 different groups of health care providers—dentists, dental hygienists, family physicians, and nurse practitioners—on their self-reported adequacy of training in oral and pharyngeal cancer intervention, assessment of risk factors, competency of tobacco and alcohol cessation counseling, and physical examination capabilities. They noted that 71% of dentists and only 31% of family physicians believed that their knowledge of oral cancer was current. Although most physicians felt adequately trained to examine the neck for lymphadenopathy, significantly fewer felt confident in their ability to accurately examine their patients for oral cancer (98% and 61%, respectively). Except for physicians, the other health care providers felt significantly less prepared to provide their patients with tobacco and alcohol cessation education. In a similar study, Carter and Ogden19 from England noted that general medical practitioners were less likely than dentists to routinely examine their patients’ oral mucosa and confidently detect oral cancer based on clinical appearance. These studies14-19 further emphasize the need for better oral cancer screening education among all medical professionals, particularly general medical practitioners.

The US 5-year survival for early-stage HNC reaches upward of 80%, but it dramatically decreases to only 30% in those diagnosed as having advanced-stage disease.6,4 The detection of early-stage disease requires the astute eye of a well-trained health professional. This training must start soon in the course of medical school to affect the career habits of physicians. This study demonstrates

an increase in knowledge between M4 and M1 students. Yet, graduating (M4) students are still deficient regarding certain risk factors, oral screening guidelines, head and neck examination techniques, and medical school curriculum. Further efforts should be aimed at expanding head and neck education for medical students.

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Author Contributions: Dr Pytynia had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Mohyuddin, Langerman, LeHew, and Pytynia. Acquisition of data: Mohyuddin, Langerman, LeHew, and Pytynia. Analysis and interpretation of data: Mohyuddin, LeHew, Kaste, and Pytynia. Drafting of the manuscript: Mohyuddin and LeHew. Critical revision of the manuscript for important intellectual content: Mohyuddin, Langerman, Kaste, and Pytynia. Statistical analysis: Mohyuddin, Kaste, and Pytynia. Administrative, technical, and material support: Mohyuddin. Study supervision: Pytynia.

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REFERENCES