State of the Art Review

Mobile Applications in Otolaryngology–Head and Neck Surgery

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Abstract

Objectives. To study the current selection of mobile applications (apps) relating to otolaryngology–head and neck surgery (OtoHNS). To conduct a review of the apps available in OtoHNS.

Data Sources. App Store, Google Play, BlackBerry World, Windows Store.

Methods. The Apple, Google, Windows, and Blackberry mobile app stores were searched for apps relating to OtoHNS. App information was analyzed based on in-store descriptions, and apps were downloaded and reviewed.

Conclusions and Implications for Practice. There is a rapidly expanding collection of apps with a wide variety of functions available in OtoHNS. There are several high-quality apps for education and clinical use, which have been highlighted in our review. Mobile apps have the potential to become widely incorporated into OtoHNS, although there is a need for appropriate guidance from the specialty to ensure app quality and accuracy of content.

Keywords

mobile applications, medical education, smartphones, apps

Introduction

Mobile devices have become ubiquitous in all aspects of today’s society, including medicine. Mobile devices are small, handheld computing devices and include smartphones and tablets. Currently, the most popular smartphones worldwide are Apple’s iPhone and Samsung’s Galaxy, while the most popular tablets are Apple’s iPad and Samsung’s Galaxy Tab.1 Mobile devices allow users to perform a variety of functions through third-party applications (apps), which can be downloaded from online app stores. The largest app stores are Apple’s App Store (iOS), Google Play (Android), Windows Store, and BlackBerry World.1

Mobile devices and apps are widely used by physicians, residents, and medical students and have become commonplace in hospitals, clinics, and medical classrooms. Recent studies have found that 83% of attendings, 88% of residents, and 85% of medical students use a smartphone.2,3 One study found that 56% of residents and attendings use medical apps in clinical practice.3 Medical apps have a broad range of functions, including finding drug interaction resources, performing medical calculations, and acting as tools for medical education.

Recent studies have examined the apps available in different specialties, including orthopedic surgery, infectious disease, colorectal disease, dermatology, pain management, radiology, neurosurgery, anesthesiology, urology, and plastic surgery.4-15 There has been very limited research conducted on apps in otolaryngology–head and neck surgery (OtoHNS). In 2010, an editorial by Pope et al described apps that may be useful for practicing otolaryngologists.16 Since then, the mobile app landscape has drastically changed. The purpose of this study is to provide an up-to-date review of the current selection of apps in OtoHNS and to provide a useful resource to help guide physicians and trainees through the apps available in the specialty.

Methods

The Apple (iOS App Store), Google (Google Play), Windows (Windows Phone Store), and BlackBerry (BlackBerry World) app stores were searched for apps relating to OtoHNS. The following search terms were used: otolaryngology–head and neck surgery, otolaryngology, ear nose throat, ENT, ear, nose, throat, otology, rhinology, laryngology, head and neck, facial plastics. Apps were selected based on app store descriptions. Apps were included if they related to the

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specialty of OtoHNS and the app store description was written in English. Apps were excluded if they had no relation to the specialty (Figure 1). Data were collected based on store descriptions, including app name, function, price, date published, frequency of updates, intended audience, user ratings, number of user reviews, and developer information. The top 10 user-rated apps were determined based on in-store user ratings, out of apps with at least 5 user ratings.

Results

The search of the app stores was carried out in January 2014. Seventy-five unique apps that met the inclusion criteria were identified. Sixty-two (83%) of all apps were available in the Apple store, 26 (35%) in the Google store, 4 (5%) in the BlackBerry store, and 1 (1%) in the Windows store. Seventeen (23%) of the apps were available in multiple stores. One (1%) of the apps was published in 2008, 5 (7%) in 2009, 7 (9%) in 2010, 13 (17%) in 2011, 19 (25%) in 2012, and 30 (40%) in 2013.

The average app price was $4.81, with a range of $0 to $67.49; 40 (53%) of the apps were free. The average price of paid apps was $10.46, with a range of $0.99 to $67.49. There were several payment methods for paid apps. Most commonly, apps required full payment before downloading the app. Other apps had free trials available, whereby users can download and test limited content for free before deciding whether to pay to access full content. Although uncommon, some apps required monthly or yearly subscriptions to access content.

Developer Information

Developer information was collected based on store descriptions and in-app information. There were 62 unique developers for the 75 apps. Thirty-nine (52%) apps stated that physicians were involved in development. The remaining 36 (48%) apps had no clear statements of physician involvement. Only 7 (9%) apps contained references for in-app content.

Categories

Apps were organized into categories according to subspecialty: 51 (68%) of the apps related to general OtoHNS, 9 (12%) to otology, 7 (9%) to head and neck oncology, 3 (4%) to rhinology, 3 (4%) to laryngology, 1 (1%) to facial plastics, and 1 (1%) to allergy.

The apps were also organized into categories corresponding to app function (Figure 2). Apps in the education category are aimed at educating medical students, residents, physicians, and other health care professionals (n = 31, 41%). This category includes question banks, reference texts, and anatomy pictures and atlases. Apps containing abstracts and articles for journals and apps designed for conferences and meetings were placed into the journal/conference category (n = 14, 19%). Apps designed for use in clinical settings by physicians and other health care professionals were placed into the clinical category (n = 12, 16%). Apps in this category include clinical reference guides, cancer staging tools, and apps intended to aid in procedures. Apps designed for patient use were placed into the for patients category (n = 18, 24%). This category features specific clinic and hospital information, auditory tests, and apps designed for educating patients.

User Ratings/Reviews

The majority of apps had no user ratings (63%). Nine apps (12%) had 1 to 5 ratings, 6 (8%) had 6 to 10 ratings, and 13 (17%) had greater than 10 ratings. For the apps that had at least 1 rating, the average user rating was 3.2 out of 5, with a range of 0 to 5. The majority of apps also had no written user reviews (84%). Ten apps (13%) had 1 to 5 reviews, 1 (1%) had 6 to 10, and 1 (1%) had greater than 10 reviews.

Table 1 displays the top 10 user-rated apps, out of apps with at least 5 ratings. The top-rated journal/conference app was Otolaryngology–Head and Neck Surgery, which is the app for the journal of the same name. The app allows subscribers to access abstracts and full-text articles from recent issues from
Table 1. Top 10 User-Rated Otolaryngology–Head and Neck Surgery Apps.*

<table>
<thead>
<tr>
<th>App Name</th>
<th>Category</th>
<th>Platform</th>
<th>Price, $</th>
<th>User Rating, out of 5</th>
<th>No. of User Ratings</th>
<th>Physician Involvement with App Development</th>
<th>References for Content Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Otolaryngology–Head and Neck Surgery</td>
<td>Journal/conference</td>
<td>Apple</td>
<td>Free</td>
<td>5</td>
<td>19</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>ENT for Students</td>
<td>Education</td>
<td>Apple</td>
<td>4.99</td>
<td>5</td>
<td>7</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>ENT Surgery Handbook</td>
<td>Clinical</td>
<td>Android</td>
<td>Free</td>
<td>5</td>
<td>12</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>drawMD</td>
<td>Clinical</td>
<td>Android</td>
<td>Free b</td>
<td>4.5</td>
<td>85</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>AcademyQ: Otolaryngology Knowledge Self-assessment Tool</td>
<td>Education</td>
<td>Apple</td>
<td>49.99 c</td>
<td>4.5</td>
<td>22</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Advent MD</td>
<td>For patients</td>
<td>Apple</td>
<td>Free</td>
<td>4.5</td>
<td>12</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Laryngoscope</td>
<td>Journal/conference</td>
<td>Apple</td>
<td>Free</td>
<td>4.5</td>
<td>5</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Headache Diary (EcoHeadache)</td>
<td>For patients</td>
<td>Apple</td>
<td>1.99</td>
<td>4</td>
<td>51</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>ENT Handbook</td>
<td>Clinical</td>
<td>Apple</td>
<td>Free</td>
<td>4</td>
<td>6</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>TNM Head and Neck</td>
<td>Clinical</td>
<td>Android</td>
<td>4.99</td>
<td>4</td>
<td>5</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*Top 10 applications (apps) based on in-store user ratings, out of apps with at least 5 ratings.

bAvailable Only for iPad devices.

cFree trial available. Price is for full content.
their mobile devices. The app also allows users to quickly access links, including author guidelines and reviewer guidelines, and to listen to AAO-HNSF podcasts. The Laryngoscope is another top-rated journal/conference app and is the official app of the journal of the same name. The app allows subscribers to access abstracts and full-text articles. This app enables users to easily jump to figures or tables, search articles, and e-mail articles or citations.

Two of the top user-rated apps were education apps. ENT for Students is an app designed to educate medical students and residents through text and multiple-choice questions. The questions are organized by category, with a small number of questions per category. After answering, the correct answer is displayed, although there are no explanations or references provided. AcademyQ: Otolaryngology Knowledge Self-assessment Tool was developed by the American Academy of Otolaryngology—Head and Neck Surgery Foundation and is a self-assessment and learning tool designed for residents and physicians. The app is a paid question bank that contains more than 400 questions with answers, explanations, and references for further reading. The user can save favorite questions and make in-app text or audio notes.

Several of the top-rated apps were in the clinical category. ENT Surgery Handbook was developed by a group from the East Lancashire Hospitals NHS Trust and is intended to be used as a clinical guide for the management of common emergencies seen in OtoHNS. The content is in point form and focuses on management but also includes pictures, etiologies, and other considerations. The app also contains doses for commonly used medications and a section titled “ENT Consent Aide Memoire,” which contains complications for common surgeries. drawMD ENT is an iPad-only app that aims to enhance physician-patient communication by allowing clinicians to illustrate and modify medical images to share with patients. The app provides anatomical images that a physician can modify to indicate pathologies or describe surgical procedures. Images can be saved and e-mailed to patients. ENT Handbook was developed by a group of physicians from Royal Melbourne Hospital and is intended to be an in-hospital guide for residents. The app has sections on airway concerns, resident duties, common operations, and common emergencies. The content is in bullet form and focuses on management. TNM Head and Neck is a cancer staging app based on the seventh edition of the American Joint Committee on Cancer Staging Manual. The app provides a quick TNM staging tool with explanations for many head and neck cancers.

Two of the top apps were designed for patient use. Advent MD aims to help patients and family members understand sinus conditions, snoring, and hearing loss. The app contains a hearing test, a snoring simulator, and a section that simulates noises as heard by individuals with hearing loss. Headache Diary (EcoHeadache) helps patients track “headache, migraine, and ENT pain.” It enables patients to create a log of information about pain, including onset, duration, quality, severity, and treatment used. This information can be graphed, and the app encourages patients to present the information to a physician.

Discussion

The advent of mobile technology has allowed access to virtually unlimited amount of information at our fingertips. Mobile devices and apps have already become widespread in medicine and are expected to become more prevalent in the future.17,18 Despite the extensive use of mobile devices and apps in medicine, there has been limited research on apps in the specialty of OtoHNS. In our study, we analyze and review the current selection of apps available in OtoHNS.

Seventy-five unique apps relating to OtoHNS were found at the time the search was conducted. This number is comparable to other specialties, with recent studies finding 39 apps in neurosurgery, 79 in dermatology, 108 in pain management, 66 in orthopedic surgery, and 63 relating to colorectal disease.6,7,10-12 The number of apps published per year in OtoHNS has increased each year, which is consistent with the continuing expansion of the mobile app market. The app market is projected to continue growing in the near future, and as a result, it seems likely that the number of apps in OtoHNS will continue to grow as well.1

The majority of apps were available in the Apple App Store (83%), followed by the Google store (35%), with the BlackBerry and Windows stores having a very limited selection. All of the top 10 user-rated apps were available in the Apple Store, 4 in the Google store, and none in the Windows or BlackBerry stores. Apple is the most popular platform for apps in OtoHNS, and it is the most popular platform among physicians and trainees. One study found that 83% of smartphones owned by physicians, residents, and medical students were iPhones.2 Interestingly, this is not reflective of the current US smartphone market, where Google (Android) owns a 53% market share followed by Apple at 42%.19

There are several high-quality apps that could potentially be integrated into everyday clinical use. Several useful clinical guides and handbooks were highlighted in Table 1 in the top user-rated apps. These apps provide a quick reference for management of conditions or cancer staging, among other functions. One particular clinical app that stands out is drawMD ENT, which allows physicians to interact with patients in a new and unique way. It is feasible that surgeons could modify and edit a patient’s own computed tomography or magnetic resonance imaging scan to describe a surgery or use this app to describe and obtain consent for surgery from patients. There are also apps emerging that allow smartphones to function as high-definition cameras for endoscopy with the use of an adapter. There are already multiple apps that can be integrated into clinical use, and apps have the potential to significantly change clinical practice in OtoHNS in the future.

There are also useful apps for education in OtoHNS. AcademyQ and ENT for Students were outlined and provide question banks that students can use for learning on the go. Another notable app is learnENT, an interactive educational
app for medical students that contains text, images, videos, and quizzes. The app was developed by the Canadian Society of Otolaryngology–Head and Neck Surgery Undergraduate Medical Education Working Group and contains references for content. Although these apps provide information that can be found in textbooks or online, the value of mobile apps is in portability, ease of access, and the combination of text, multimedia, and interactive interface that are unique to mobile apps.

The majority of the apps in our study had no in-store user ratings or user reviews. This provides difficulty for users trying to assess the quality of apps in stores. There are several external resources that can aid users in determining app quality. iMedicalApps.com is an independent Web site run by physicians and health care professionals. The Web site provides analysis and commentary on mobile technology in medicine and includes in-depth reviews for many medical apps.20 MedicalAppJournal.com is another useful Web site that aims to provide a database of unbiased reviews for medical apps.21

Only 52% of the apps stated that physicians were involved in development. This low level of physician involvement in app development raises quality assurance issues and concerns regarding the accuracy of app content. Furthermore, the vast majority of apps did not have in-app references for content. These issues are not unique to OtoHNS, as studies have raised similar concerns about unregulated app content in other specialties.7,10,22-24 These quality assurance issues make it difficult to determine the accuracy of app content and provide barriers to apps becoming incorporated into clinical use and medical education. We believe that steps should be taken to regulate app development and to ensure quality and accuracy of content. In the short term, we envision a peer-review process whereby a body of physicians reviews apps and creates a bank of “approved apps.” Ultimately, we believe a review process is required that involves physician evaluation of apps during app development. Apps would have to be approved before being classified as a “medical app.” As apps become more prevalent in OtoHNS, guidance from otolaryngologists is required to assess app quality, validity, and effectiveness before they can be fully incorporated into clinical practice and medical education.25

This study had some limitations. Our study includes apps specific to OtoHNS; many general medical apps that may be useful for otolaryngologists were omitted due to the search criteria used. Other studies have outlined general medical apps that physicians and trainees in otolaryngology may find useful.1,26 We were also limited by the information available in the app stores. We were unable to determine the most downloaded OtoHNS apps as several of the stores do not make these data available. Although new apps and devices will soon emerge as technology continues to rapidly evolve, our study provides an up-to-date review of the apps currently available in OtoHNS.

**Conclusion**

Our study reviewed the current selection of apps available in OtoHNS. We found a rapidly expanding collection of apps with a wide variety of functions. Several high-quality, affordable apps for education and everyday clinical use have been highlighted in our review. Mobile apps have the potential to be widely incorporated into OtoHNS, although there is a need for appropriate guidance from the specialty to ensure app quality and accuracy of content.

**Author Contributions**

Matthew C. Wong, study conception and design, acquisition and analysis of data, drafting the manuscript; Kevin Fung, study conception and design, drafting the manuscript, critical revision of manuscript.

**Disclosures**

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**References**


