EDITORIAL

Laryngoscope
Investigative Otolaryngology

Otolaryngology in the time of COVID: An overview of common open-source telemedicine platforms

While the practice of medicine has existed for centuries, it has been exceedingly resistant to change. Unlike a virus which is constantly changing from within, medicine has survived by changing its surroundings. Intellectual, diagnostic, and therapeutic advances have brought medicine out of the dark ages and into the modern era. But at its core, the physician-patient relationship had always started and ended with the proverbial handshake until now.

The year 2020 will forever be remembered in medicine. It is the year the handshake became feared, and the year that medicine was finally forced to change from within. For the first time, physicians and patients alike are seeking ways to rapidly restructure the time-honored physician-patient relationship. As the global severe acute respiratory syndrome coronavirus 2 (SARS CoV-2) pandemic made social distancing a necessity, patients began to question the safety of their surroundings. Where the doctor's office was once a place that patients visited to improve their health, it became feared by some as a source of potential disease.

But how does one take the doctor out of the doctor's office? The answer is simple, you take away the office. While telemedicine has allowed physicians unprecedented access to their patients, it represents a drastic shift in centuries worth of tradition. Physicians are now tasked with triaging, then potentially diagnosing and treating patients all without ever having performed a manual physical evaluation. This sudden shift in medical practice has forced many health care providers into using one of the numerous available telehealth platforms.

Here, we present an overview of the most commonly used electronic medical recored based (EMR-based) and non-EMR based options in telehealth video platforms. All options discussed are either compliant with the health insurance portability and accountability act (HIPAA) or HIPAA approved, and represent viable systems to rapidly begin instituting telemedicine services during the global pandemic. While some of the platforms discussed are short-time solutions only allowed as a result of waivers from the centers for medicare and

TABLE 1 Non HIPAA compliant telehealth platforms, although HIPAA approved during the COVID-19 pandemic

	Apple FaceTime	Facebook Messenger video chat	Google Hangouts	Zoom	Skype
Compatible with desktop devices?	Yes (only Apple devices)	Yes	Yes	Yes	Yes
Compatible desktop operating systems	macOS X 10.9 or later	Any desktop computer using Google Chrome, Opera, or Microsoft Edge	Mac OS X, Windows, Chrome, Ubuntu and other Debian-based Linux distributions	Mac OS X with Mac OS 10.6.8 (Snow Leopard) or later Windows XP with SP3 or later Ubuntu 12.04, Mint 17.1, Red Hat Enterprise Linux 6.4, Oracle Linux 6.4, CentOS 6.4, Fedora 21, OpenSUSE 13.2, and ArchLinux (64-bit only) or later iOS 8.0 or later iPadOS 13 or later Android 5.0x or later	Mac OS X 10.10 or later Windows 10 or later 64-bit Ubuntu 14.04+ 64-bit Debian 8.0+ 64-bit OpenSUSE 13.3+ 64-bit Fedora Linux 24+

(Continues)

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TABLE 1 (Continued)

	Apple FaceTime	Facebook Messenger video chat	Google Hangouts	Zoom	Skype
Compatible with mobile devices?	Only iPhone, iPod Touch, iPad	Yes	Yes	Yes	Yes
Compatible mobile operating systems	iOS 7 or later	iOS 8 or later Android 4 (Ice Cream Sandwich) or later	iOS 10.0 or later Android not specified	iOS 8.0 or later iPadOS 13 or later Android 5.0x or later	Android OS 4.0.4. or later iOS 10.0 or later
New software required for providers?	No, FaceTime is included in compatible Apple devices	On desktop Facebook Messenger can be accessed through compatible web browsers. Mobile devices require the Facebook Messenger app.	On desktop Hangouts can be accessed through supported web browsers (Google Chrome, Microsoft Internet Explorer, Safari, or Firefox). Mobile devices require the Google Hangouts app.	The Zoom app is required	On desktop Skype for Web can be used on Microsoft Edge and Google Chrome without needing the app For mobile devices the Skype app is required.
New software required for patients?	No, FaceTime is included in compatible Apple devices	Not for desktop devices. Mobile devices require the Facebook Messenger app.	Not for desktop devices. Mobile devices require the Google Hangouts app.	The Zoom app is required	On desktop Skype for Web can be used on Microsoft Edge and Google Chrome For mobile devices the Skype app is required.
Account required for providers?	No, FaceTime uses the Apple ID	A Facebook account is required	A Google account is required	A Zoom account is required	Yes a Skype account is required
Account required for patients?	No, FaceTime uses the Apple ID	A Facebook account is required	No	No	No
Caller ID protection?	Yes, it is possible to set up a preferred (work) caller ID	No	No	For Zoom Phone it is possible to hide the caller ID, not for Zoom video call	Yes, Skype allows caller ID protection for specific accounts.
Capacity for group calls	32 participants	50 participants	10 participants, 25 with a Google G Suite account	100 participants 1000 participants with the Large Meeting add-on	50 participants
Screen share option	Yes	Yes	Yes	Yes	Yes
Option to mute or hide other participants' video	No	No	Only muting other participants is available	Yes both options are available	Skype allows muting but not hiding other participants' video.
Costs	Free	Free	Free A Google G Suite account is available from $6–$25/month	Free Extension packages are available from $13.99/month	Free
Interpreter features (apart from the group call feature)	None	None	None	The "language interpretation" feature allows an interpreter to be included in the audio channel of a video call. Participants can select their preferred language	Skype Translator translates video calls and written text in real time. Not available for group calls.

TABLE 1 (Continued)

	Apple FaceTime	Facebook Messenger video chat	Google Hangouts	Zoom	Skype
				and will only hear the interpreter of the chosen language. Other participants will not hear the interpreters.	
Special features	Allows to control the other person's screen when "screen sharing" in settings is enabled.	-	-	-	Skype allows for calling other participants on their phone number.

Abbreviations: API, application programming interface; BAA, business associate agreement; CPU, central processing unit; DEB, installation package format used by all Debian based distributions; EHR, electronic health record; EMR, electronic medical record; HIPAA, health insurance portability and accountability act; ID, identification; PIPEDA, personal information protection and electronic documents act; PMS, medical practice management software; Q&A, questions and answers; RPM, installation package format used by Red Hat and its derivatives.

TABLE 2 HIPAA compliant telehealth platforms

	Skype for business	Microsoft teams (replacing Skype for business by August 2021)	Zoom for health care	Google G Suite Hangouts meet
Additional Business Associate Agreement (BAA) required for HIPAA compliance?	HIPAA compliant with the Enterprise E3 or E5 package	BAA required	HIPAA/PIPEDA plans required	BAA required
Compatible with desktop devices?	Yes	Yes	Yes	Yes
Compatible desktop operating systems	Windows 10 SAC, 8.1, Server 2016, or Server 2019 The latest three versions of macOS	Windows 8.1, 10, or Server 2012 R2+ Mac OS X 10.11 El Capitan or later Linux distributions capable of installing DEB or RPM	Mac OS X with Mac OS 10.6.8 (Snow Leopard) or later Windows XP with SP3 or later Ubuntu 12.04, Mint 17.1, Red Hat Enterprise Linux 6.4, Oracle Linux 6.4, CentOS 6.4, Fedora 21, OpenSUSE 13.2, ArchLinux (64-bit only) or later	The two most recent major releases of macOS, Windows, Chrome OS, Ubuntu and other Debian-based Linux distributions
Compatible with mobile devices?	Yes	Yes	Yes	Yes
Compatible mobile operating systems	iOS 6.0 or later Android 4.0 or later	Compatible with the four major Android versions and the two most recent iOS versions.	iOS 8.0 or later iPadOS 13 or later Android 5.0x or later	iOS 11.0 or later Android 5.0 or later
New software required for providers?	Yes, the software is often included or available in the Office 365 package Mobile devices require the Skype for Business app.	Not for desktop. Mobile devices require the Microsoft Teams app	Yes, the Zoom app is required for all devices	No Google Meet works entirely through supported browsers (Google Chrome, Mozilla Firefox, Microsoft Edge, Safari) Mobile devices require the Google Meet app
New software required for patients?	Yes, the Skype for Business Web app (add-on) is required	Not for desktop. Mobile devices require the Microsoft Teams app	Yes the Zoom app is required for all devices.	No Google Meet works entirely in supported browsers (Google

TABLE 2 (Continued)

	Skype for business	Microsoft teams (replacing Skype for business by August 2021)	Zoom for health care	Google G Suite Hangouts meet
				Chrome, Firefox, Microsoft Edge, Safari). Mobile devices require the Google Meet app
Account required for providers?	Yes, a Skype for Business account is required	Yes, providers need to sign up with Microsoft Teams	Yes, a Zoom account is required	Yes, a G Suite account is necessary
Account required for patients?	No	Yes, patients need to sign up with Microsoft Teams.	No	No
Caller ID protection?	Yes, it is possible to deactivate a caller ID	No	No, but for Zoom Phone caller ID protection is possible	No
Capacity for group calls	250 participants	250 participants, for online events 10.000 participants	100 participants, 1000 participants for webinars	100 participants for G Suite Education, Basic, and Business 250 participants for G Suite Enterprise and Enterprise of Education.
Screen share option	Yes	Yes	Yes	Yes
Option to mute or hide other participants' video	Yes, allows both	Only allows muting others	Yes, allows both	Only muting others is available. Hiding videos is available as a add-on.
Costs	Depending on Office 365 package. A free version with limited features is available.	Free, the paid version ($5.00–$12.50 per month) offers extended features such as scheduled calls and online events.	Prices start from $200/month for 10 hosts	Free
Interpreter features (apart from the group call feature)	Only for Skype Meeting Broadcast (webinars) Microsoft provides real-time computer generated translations in text as the speaker is talking. 40 languages are supported.	Teams offers "inline message translation" creating real-time computer generated translations in text as the speaker is talking.	With the "language interpretation" feature an interpreter can be included in a video or conference call. Participants can select their preferred language and will only hear the interpreter of the chosen language. Other participants will not hear the interpreters	None
Special features	Allows calling participants on their phone number	-	Can integrate with Epic. The same feature can be used by developers to integrate other EHRs	Allows Q&A polling during presentations and captions in video meetings (English only)

	Doxy.me	Updox	VSee	Doximity Dialer Video Calling
Additional Business Associate Agreement (BAA) required for HIPAA compliance?	BAA is provided for all accounts	BAA is included	BAA are available	BAA is included
Compatible with desktop devices?	Yes	Yes	Yes	Yes

TABLE 2   (Continued)

	Doxy.me	Updox	VSee	Doximity Dialer Video Calling
Compatible desktop operating systems	The latest versions of Mac, Windows, Linux, and Chromebook	The most up-to-date operating systems (unspecified)	Windows 7 or later Mac OS X 10.11 or later	macOS and Windows (unspecified)
Compatible with mobile devices?	Yes	Yes	Yes	Yes
Compatible mobile operating systems	The latest versions of iOS and Android	The most up-to-date versions of iOS and Android	iOS 11 or later Android 5.0 or later	iOS 11.0 or later Android 6.0 or later
New software required for providers?	No, Doxy.me works entirely through compatible web browsers (latest versions of Google Chrome, Mozilla Firefox, Safari)	No, Updox works entirely through compatible web browsers (Google Chrome, Microsoft Edge, Mozilla Firefox, Safari, and Samsung internet browser)	The VSee Messenger app is required	For desktop Video calling works through web browsers (Google Chrome, Safari, Mozilla Firefox) For mobile devices the Doximity app is required
New software required for patients?	No, Doxy.me works entirely through compatible web browsers (latest versions of Google Chrome, Mozilla Firefox, Safari)	No, Updox works entirely through compatible web browsers (Google Chrome, Microsoft Edge, Mozilla Firefox, Safari, and Samsung internet browser)	VSee Clinic 4.0 allows in-browser video calling. Older versions may still require the app.	No
Account required for providers?	Yes, a Doxy.me account is required	Yes, an Updox account is required	Yes, a VSee account is required	Providers need to complete the physician verification process.
Account required for patients?	No	No	Yes, a VSee account is required	No
Caller ID protection?	Not applicable, patients are invited through a link	Not applicable, patients are invited through a link	Not applicable, patients are invited through a link	Yes
Capacity for group calls	10 participants, only available in the Clinic Doxy.me upgrade	Updox does not support group calls, only one-on-one calls	32 participants, however in reality due to network and CPU limitations quality issues occur from group calls with six participants	Three participants. Caller ID protection is not available when adding the third person.
Screen share option	Yes	No, but allows sharing files	Yes, including annotation	Yes, only on desktop
Option to mute or hide other participants' video	No	Yes, allows both (currently only for desktop)	No	No
Costs	The free version includes unlimited minutes and one-on-one sessions Professional Doxy.me ($35/month) offers SD- and HD-video and audio-only for one-on-one calls Clinic Doxy.me ($50/month) allows group	On request	From $49/month	Free

TABLE 2 (Continued)

	Doxy.me	Updox	VSee	Doximity Dialer Video Calling
	calls, simultaneous calls, and Teleconsent			
Interpreter features (apart from the group call feature)	None	None	None	None
Special features	Very user friendly. Allows patients to wait in the provider's waiting room.	Updox can be integrated with most EMRs and PMS. Allows immediate documentation of e-consults.	Allows sharing only a region of the desktop, has integrated billing and consent form features, and allows integration of health devices (eg, Fitbit, iHealth).	Allows placing calls through the EPIC Haiku app.

Abbreviations: API, application programming interface; BAA, business associate agreement; CPU, central processing unit; DEB, installation package format used by all Debian based distributions; EHR, electronic health record; EMR, electronic medical record; HIPAA, health insurance portability and accountability act; ID, identification; PIPEDA, personal information protection and electronic documents act; PMS, medical practice management software; Q&A, questions and answers; RPM, installation package format used by Red Hat and its derivatives.

TABLE 3 HIPAA compliant, comprehensive EMR-based telehealth platforms

	Epic	VA-CPRS	Meditech	CPSI	AllScripts
Telehealth options	MyChart Video Visit or one of the Epic APIs integrated with Epic and/or MyChart such as Vidyo, Zoom, or Cisco Webex.	VA Video Connect	Meditech offers integrated virtual visits	Does not have an integrated telehealth option, but came out with a open-to-all EMR-agnostic platform TalkWithYourDoc	FollowMyHealth
Compatible with desktop devices?	Yes	Yes	Yes	Yes	Yes
Compatible desktop operating systems	Any system with the latest versions Internet Explorer, Chrome, Firefox or Safari	Windows and macOS	Any system. Browser compatibility depends on patient portal of the health care organization	Any system with the latest version web browser	Windows 7.0 or later, macOS 10.0 or later
Compatible with mobile devices?	Yes, with Android, iPhone and iPad	Yes, with Android, iPhone and iPad	Yes, with Android, iPhone and iPad	Yes, with iPhone and iPad	Yes, with Android, iPhone and iPad, but only for patients
Compatible mobile operating systems	The latest versions of iOS or Android	Any Android version or iOS 11.0 or later	Android version 5.0 or later and iOS 10.0 or later	iOS 11.0 or later	Android version 6.0 or later and iOS 11.0 or later
New software required for patients?	The MyChart app is required for Video Visits. If using an Epic API additional software may be required.	The app is only required for iOS-users. All other devices can access VA Video Connect through a web browser.	Patients can either use the web-based patient portal or the MHealth app.	iOS-users need the app. All other devices can access TalkWithYourDoc through a web browser.	Yes, the FollowMyHealth app
Group call feature	Most Epic APIs offer this, MyChart does not.	Yes	Not yet, feature is in development	Unknown	No

TABLE 3 (Continued)

	Epic	VA-CPRS	Meditech	CPSI	AllScripts
Screen share feature	MyChart and most Epic APIs offer this	Yes	Not yet, feature is in development	Unknown	No
Interpreter features	A number of Epic APIs offer this, MyChart does not.	An interpreter can be added to the call	Not yet, feature is in development	Unknown	No

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medicaid services (CMS) and HIPPA, others are more formal long-term solutions (Tables 1-3).

While there are no perfect telemedicine platforms currently available, there are many existing options that can be easily adapted to suit the needs of the otolaryngologist. Potential options span the range of large electronic medical record-based platforms to simple application-based platforms that can be used on a smart phone or tablet device.

We encourage otolaryngologists to keep an open mind about which telemedicine platform they embrace, as short-term needs and long-term goals for a telemedicine interface may differ. In addition, regional basis may influence which software patients are most familiar with and/or comfortable with.

CONFLICT OF INTEREST

The authors declare no potential conflict of interest.

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