Virtual Hearing Aid

Care

Client

Provider

Western HealthSciences

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Emma Eccles Jones College of Education & Human Services UtahStateUniversity



Virtual Hearing Aid Care – Clinical Practice Guideline v2.0

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Author Contribution Statement

Following the Contributor Role Taxonomy (CRediT), authorship contributions were collated to provide visibility and recognition for all team members (Allen et al., 2019). For each of the following contributor roles, initials are provided to indicate authors that have contributed to that component: Conceptualization (DG, RO, STFM, KM, FR, IAC, CM, DP, CB), data curation (DG, RO, DD), formal analysis (DG, RO, DD), funding acquisition (DG, RO, STFM, KM, FR, IAC, CM, DP, CB), investigation (DG, RO, DD), methodology (DG, RO, DD, STFM, FR, IAC, CM, DP, CB), investigation (DG, RO, DD), methodology (DG, RO, DD, STFM, FR, IAC, CM, DP), project administration (DG, RO, DD), visualization (DG, RO, DD), supervision (DG, STFM), validation (DG, RO, DD), visualization (DG, RO, DD, KM, FR, KJ), writing of original draft (DG, RO, DD, STFM, KM, KJ), and revision and editing (DG, RO, DD, STFM, KM, FR, IAC, CM, DP, KJ, CB). The authors have no conflicts of interest to declare.

Disclaimer

Virtual care should be delivered in accordance with current professional standards and according to the provider's local regulatory body. Licensure to deliver virtual care applies to both the provider location and the location in which the client will be receiving services. This clinical practice guideline (CPG) relates to the provision of virtual care delivered by a licensed hearing healthcare provider. Standards documents relevant to various global practice contexts have been included to reflect the current landscape of guidelines relative to the provision of virtual hearing aid care. The authors do not take responsibility for the improper use of this CPG.

This CPG was created in London, Ontario, Canada, at the University of Western Ontario. Evidence-based recommendations cite local and global authorities, nationally recognized expert committees, and/or consensus panels (e.g., CPGs, protocols, consensus/position statements, standards documents). In the local context, this includes reference to professional standards specific to the delivery of virtual care according to the College of Audiologists and Speech-Language Pathologists of Ontario (CASLPO) and Ontario Health's Virtual Visit Solutions Standards (CASLPO, 2020; Ontario Health OTN, 2021).

Guideline Development and Version Tracking

The Virtual Hearing Aid Care CPG was first published in draft form (v1.9) in August 2020, including data collected as part of a grant-funded project. CPG v2.0 (released in 2022) includes both supplemental and new guidance based on external review recommendations and newly identified evidence gathered through systematic literature reviews (DiFabio et al., 2022; Glista et al., Submitted). CPG v2.0 includes modifications aimed at clarifying statements around the scope, purpose, authorship, and external review. Modifications to recommendations around the use of support personnel, optimization of communication within the virtual care context, and resources supporting team mobilization have also been added. To increase document accessibility features and text-reader functionality, alt text has been added to all graphics and text boxes have been assessed for compatibility.



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Abbreviations

CASLPO: College of Audiologists and Speech-Language Pathologists of Ontario

- COSI: Client Oriented Scale of Improvement
- CPG: Clinical practice guideline
- F2F: Face-to-face
- IOI-HA: International Outcome Inventory for Hearing Aids
- IT: Information Technology
- PHI: Personal health information
- RECD: Real-ear-to-coupler difference
- **REM: Real-ear measurements**
- S-REM: Simulated real-ear measurements



1. Scope

The objective of this CPG is to provide clinical practice guidance for hearing healthcare providers regarding virtual hearing aid fitting and management processes, including the technology and infrastructure required to deliver these services (herein referred to as *virtual hearing aid care*). This CPG may be used to support virtual hearing aid care implementation efforts, according to sustainable models of care, and across all ages. This document does not include guidance about client-directed care or hearing aid management applications that are not monitored by a provider (e.g., client-to-client virtual support groups, semi-user/user-led hearing aid fitting). Appendix A offers a summary of CPG objectives and content in the form of an infographic.

1.1 Key Terms and Definitions

Virtual hearing aid care can include services delivered directly to a client by a provider or using facilitator-supported services and specialized equipment; delivery options will depend on factors such as the age of the client, type of care, and the timepoint in the care process (e.g., initial versus follow-up appointments). This document will address virtual delivery of services including the following types of hearing aid care:

- □ Management (counselling and education)
- □ Validation
- □ Programming
- \Box Verification

Key terms and definitions important to the virtual care process are included in Table 1. In the context of hearing healthcare, virtual care may also be referred to by other commonly used terms such as teleaudiology, remote care, eAudiology, and connected hearing healthcare. Further evidence and technology advancement is needed to support direct-to-client virtual hearing aid care in initial appointments, unless using specialized equipment. Overall, virtual hearing aid care can improve access to hearing aid services delivered by qualified hearing healthcare providers when time, mobility, social distancing, or distance-related issues restrict access to in-person hearing healthcare.

Term	Definition
Client	A person with hearing loss who is receiving care.
Facilitator	A person, trained/supervised by the hearing healthcare provider, acting as a liaison between the provider and the client, and located in the remote location. Assists with the hands-on aspects of virtual appointments, including support-related tasks (e.g., technological support).
Face-to-Face (F2F)	Clinical interactions where the provider and client can view each other's faces, including videoconferencing using real-time audio and video, or inperson appointments.

Table 1. Glossary of Key Terms and Definitions



Term	Definition
Hearing aid care	Hearing aid services including management, fitting, programming, troubleshooting, and/or services related to the verification and/or validation of hearing aids
Programming	Actions taken to ensure an appropriate hearing aid fitting, which can include device troubleshooting, programming, and physical adjustments.
Management	Hearing aid care related to ongoing device use and monitoring of client feedback, including counselling and education services.
Validation	Measures of hearing aid benefit and/or satisfaction using formal or informal scales, questionnaires, and/or interviews.
Verification	Objective measurement of hearing aid performance relative to prescribed settings and incorporating the use of probe microphone measurements and hearing aid analyzers.
Initial Fitting	An appointment for the first hearing aid fitting, usually incorporating measures to ensure the fitting aligns with a validated hearing aid prescription, such as probe microphone measures.
In-person care	Care provided directly to a client when the provider and client are in the same location.
Modality	The physical locations, personnel, tools, and technologies included in the virtual care appointment. Various tools and technologies such as secure messaging, videoconferencing, telemonitoring, and/or mobile applications can facilitate video and/or audio interaction.
Model of service delivery	The type of service delivery through real-time or store-and-foreword interaction; virtual service delivery models can include asynchronous, synchronous, or hybrid.
Asynchronous	Involves interaction using store-and-forward technologies, not occurring in real-time, where the client at the remote location and the provider at the provider location do not have to be present for the interaction at the same time. In the case of virtual hearing aid fitting, the flow of information is often bi-directional; incorporating a fitting interface and/or mobile application.
Synchronous	Includes real-time interaction, where the client and the provider are present for the interaction at the same time, but in separate locations.
Hybrid	Care combining asynchronous and synchronous service delivery models and/or the combination of in-person and virtual service delivery.
Provider	The hearing healthcare provider delivering service(s), such as an audiologist.
Provider location	The site where the provider is located.
Readiness	The degree to which those involved in the care process are individually and collectively primed, motived, and capable of executing the change (Holt et al., 2010).
Remote location	The site where the client and/or facilitator/support personnel included in the care process are located.
Support personnel	Family members, caregivers, or legal guardians (in the case where the client has given consent to their inclusion in the care process or when the client is incapable of consenting to services).



Terms	Definition
Virtual care	Any interaction between clients and/or members of their circle of care, occurring remotely, using any forms of communication or information technologies, with the aim of facilitating or maximizing the quality and effectiveness of patient care (lamieson et al. 2015; Shaw et al. 2018)
Clinic-based	Virtually connects the provider to a client at a distance and when the client is in a clinical, research, or other healthcare facility (e.g., community-based outpatient clinics).
Direct-to-client	Care provided directly from a provider to a client, without the use of a facilitator to support service delivery.
Home-based	Connects the provider to a client at a distance and when the client is in their home.

2. Professional Recommendations and Responsibilities

To ensure the effective delivery of virtual care, providers are expected to:

- □ Have the knowledge and skills to engage in the delivery of virtual care effectively and with consideration of the required technologies/equipment.
- □ Use professional judgement regarding the appropriateness of the service delivery model (e.g., in-person, virtual, or hybrid) for each client at all stages of the care process.
- □ Recognize that virtual care may not be appropriate for all clients, procedures, or circumstances, and should be based on the client's needs and preferences.

Virtual care providers must adhere to all relevant professional standards, including the code of ethics outlined by their local regulatory body. Table 2 describes key professional practice components for virtual care delivery. When selecting components to include in virtual care appointments, providers should take reasonable steps to ensure all technology is adequate, reliable, and safe. Providers should also aim to deliver person-centred care that aligns with all stakeholders' capabilities, opportunities, and motivations (DiFabio et al., 2022). As the modalities used in virtual care delivery will continue to rapidly evolve, providers should make efforts to remain current with all aspects of virtual care, including evidenced-based practice (e.g., technologies, security measures, and data collection). A list of virtual care resources is included in Appendix B.



Key components	Recommendations and responsibilities	Cited resources
2.1 Client Support	 Support and adapt to your client, where appropriate, by offering: Hybrid care and/or in-person supports Loaner devices to improve access to care Real-time captioning, interpretation, and/or translation services Training (e.g., step-by-step guides or in-person/video instructions) Accessible information resources Support/encourage the use of: IT support Trained/untrained support personnel 	Accreditation Canada & HSO, (2020), Alberta College of Speech-Language Pathologists and Audiologists (ACSLPA, 2011), American Speech-Language-Hearing Association (ASHA, n.db), Audiology Australia (2022), Empowered Kids Ontario (EKO, 2020), Indian Speech- Language & Hearing Association (ISLHA, n.d.), Jeffrey et al. (2020), Ontario Health OTN (2021), Ontario Health Quality (2020) Rehabilitative Care Alliance (RCA, 2021)
2.2 Data Storage	 Personal health information (PHI) stored on a device or server must follow reasonable security protocols (e.g., strong access controls such as multi-factor authentication, a virtual private network with end-to-end encryption, strong passwords) Ensure client information/data is deidentified 	ACSLPA (2011), College of Audiologists and Speech- Language Pathologists of Ontario (CASLPO, 2020), ISLHA (n.d.), Jeffrey et al. (2020 (Ontario Health Quality, (2020)
2.3 Informed Consent	 The informed consent process is: Separate from consent for treatment Needed for all services provided virtually Needed when others are virtually joining an appointment Includes information such as alternative service options and plans in the event of technology failure Tailored to client population and context (e.g., caregiver in separate location from client) 	Accreditation Canada & HSO (2020), ACSLPA (2011), Audiology Australia (2022), CASLPO (2020), College of Speech and Hearing Health Professionals of British Columbia (CSHPBC, 2019), ISLHA (n.d.), Ontario Health Quality (2020), Speech- Language and Audiology Canada (SAC, 2022)

Table 2. Key Professional Practice Components in the Provision of Virtual Care



Key components	Recommendations and responsibilities Cited resources				
	 Must outline: The nature, benefits, risks, limitations, and alternatives to virtual care The collection, use, disclosure, and retention of PHI when using virtual care platforms, products, and services The client's right to revert to inperson services at any time Agreement for individual management plans 				
2.4 Record Keeping	 Must be kept to the same standard as in-person care Each session must contain a record of information about the virtual appointment (i.e., an audit trail), including appointment date and time If using a client management system, records should be moved in a timely manner Providers should record: Technologies and tools used Appointment attendees Client location Method of consent (e.g., verbal) Technical issues Adaptations to in-person care 	Accreditation Canada & HSO (2020), ASHA (n.db), Audiology Australia (2022), CASLPO (2020), EKO (2020), ISLHA (n.d.), Jeffrey et al. (2020), NHS England & NHS Improvement (2020), Ontario Health OTN (2021), Ontario Health Quality (2020), SAC (2022)			
2.5 Security and Confidentiality	 Identification and Personal Health Information (PHI): Ensure transmission, storage, and management is secure and confidential Use current industry standard safety mechanisms to encrypt and safeguard data Ensure accurate client identification (confirm client's identity with a valid photo ID) for initial virtual encounters Identify everyone present (both in the provider and remote location) and state their role in the session 	Accreditation Canada & HSO (2020), ACSLPA (2011), ASHA (n.db), Audiology Australia (2022), CASLPO (2020), CSHPB (2019), EKO (2020), ISLHA (n.d.), Jeffrey et al. (2020), Ontario Health OTN (2021), Ontario Health Quality (2020), SAC (2022)			



Key components	Recommendations and responsibilities	Cited resources
	 Providers should withhold or mask their caller ID if using a personal device Technologies and tools: Ensure compliance with governing bodies' regulations Ensure comprehension of security features and activation, as needed Provider should consult licensing agreements for: Handling and protection of PHI and privacy rights Publicly accessible contact information A privacy policy outlining rules governing the collection, use, disclosure, retention, accuracy, security and disposal of PHI, breach management, information security, business continuity, disaster recovery, access, correction, and complaint practices 	
2.6 Services	 Service delivery should consider: Access to technology and/or infrastructure (e.g., family support) Client needs, preferences, and capabilities Access to an optimal virtual communication environment Knowledge and skills to effectively integrate virtual services Virtual etiquette Identify a contingency plan if technical difficulties develop during a virtual care session (e.g., phone call instead of video call) Follow relevant infection control policies and procedures 	Accreditation Canada & HSO (2020), ASHA (n.db), British Academy of Audiology [BAA] Service Quality Committee & British Society of Audiology [BSA] Adult Rehabilitation Interest Group (2021), CASLPO (2020), EKO (2020), ISLHA (n.d.), Jeffrey et al. (2020), NHS England & NHS Improvement (2020), Ontario Health Quality (2020), RCA (2021), SAC (2022)



2.7 Technology S and Tools	Select to ensure:	Audiology Australia (2022),
F a s E c	 Effectiveness and security in provider and remote locations Access to IT support (in-house or contract) for set-up, maintenance, and training Calibration, compatibility, and maintenance for optimal function Familiarize and test technology, tools, and connection prior to a virtual session: Acknowledge equipment capabilities and limitations and the potential impact it may have on service delivery Ensure optimal audio and video quality: Videoconferencing solutions should maintain high resolution Optimal internet upload/ download speeds when sharing a video source should be no less than 5 MB Sufficient internet bandwidth for optimal interaction (bandwidth can be affected by the number of users on the network) Provider use of microphone and webcam (e.g., microphone to reduce distortion; high-resolution webcam to facilitate lip-reading and visualisation of hearing aid when displayed) Provider and client use of headphones to limit feedback and background noise: 	CASLPO (2020), EKO (2020), ISLHA, n.d.), NHS England & NHS Improvement (2020), Ontario Health Quality (2020), RCA (2021)
	participants can be muted when not speaking	



3. Ready, Set, Mobilize! Integrating Virtual Hearing Aid Care

There are many factors to consider when attempting virtual care for the first time in clinical practice or aligning with a team of providers within your organization. As a first step, providers should consider doing a needs assessment to identify and address gaps in the current practice context related to readiness to provide virtual care. A 5W1H worksheet is an example of a resource that can assist providers in determining contextual readiness factors that may pose as barriers/facilitators to the implementation of virtual care (Resource 1).



This question-based exercise elicits problem-solving around key contextual factors that will lead to action items in support of successful implementation. For example, you might first consider "who" in your practice will be responsible for scheduling virtual care appointments, sending appointment links to videoconferencing software, discussing alternative communication options, and communicating the basic needs of a virtual care appointment. These action items can be the start of a virtual care implementation plan that will require integration with many different factors related to the delivery of virtual care, including consideration around mobilizing the plan to facilitate change within an organization.



3.1 Virtual Care Readiness

The term "readiness" applies to all people involved in the care process and considers the degree to which they are individually and collectively primed, motived, and capable of executing the change; it includes a multitude of factors within and beyond the clinical and broader healthcare contexts. Figure 1 illustrates key readiness variables important to the uptake of virtual hearing aid care (Glista, O'Hagan, et al., 2021; Glista, Perez Velez, et al., 2021); these can be identified as part of a comprehensive implementation plan and will assist in determining the barriers and facilitators to uptake. Providers should exercise caution when making assumptions around who is best suited to virtual care to avoid unconscious biases that can influence care delivery decisions; case-by-case assessment of individual ability to participate in a virtual appointment is also recommended. Each of the readiness variables for virtual hearing aid care are outlined below. A secondary resource (Appendix C) provides a list of "tips and tricks" to consider when preparing to participate in provider-directed virtual hearing aid care.



Access: Technology and infrastructure requirements include basic and specialized equipment, tools, and support that can vary according to delivery model, care type, and intervention location. Optional technologies can assist in improving the quality of a virtual care appointment and/or may facilitate alternate delivery models (DiFabio et al., 2022). Consideration should be given to the potential for disparity in clients'/providers' access to technology, also referred to as the digital divide, that may exist due to geographic location, sociodemographic status, technology and infrastructure limitations, or other (Dorsey & Topol, 2016; Haque et al., 2021).

Aptitude: Relates to one's desires, abilities, and competence to integrate virtual care into practice. Training and education around the use and maintenance of required technologies and care will support critical skills for effective care delivery. In addition to operational and practical training, communication-based facets of virtual care remain



integral to aptitude development. The aptitude of all people involved in the care process influences the success of virtual care appointments.

Attitudes: Preferences and feelings can influence willingness to participate in virtual care and are often shaped by previous experiences and/or one's perceptions around perceived benefits. Allowing clients to make informed decisions regarding care delivery method(s) can facilitate personalized choices made by individuals and their families (Audiology Australia, 2022).

Client-Provider Relationship: The client-provider relationship is unique and relies on trust, honesty, and a mutual desire to improve health outcomes. Perceptions around the influence of virtual care on this relationship dynamic will influence readiness and adoption. An integral component when providing virtual care includes the maintenance and further development of client-provider rapport. Providers should incorporate time for rapport building at the start of virtual care appointments to maintain interpersonal relationships (Daczewitz et al., 2020).

Organizational support: Includes colleagues, managers, administration, and others involved within an organization. To achieve multi-level buy-in and support, it is important to prepare for, manage, and reinforce the virtual care process that will be used within your organization.

Professional standards: Access to policies, procedures, or protocols to guide the implementation of virtual hearing aid care into clinical practice remain integral to evidence-based practice. Organizational leaders and managers can assist in making these types of documents available, in developing them when needed, and should strive to encourage consistent use by all providers.

Social capital: Shared values in the service delivery model by all people involved in the care process can lead to a sustainable model of virtual care. This relies on support beyond the provider-client dyad and can extend to peers, communities, and families and may be guided by cultural considerations (e.g., access to technology and use patterns).

Virtual care context: Contextual factors that support effective virtual communication should consider how to create an optimal virtual environment utilizing appropriate virtual etiquette (Table 3). For example, scheduling may accommodate existing clinical routines or provide options that improve access and/or convenience for clients and others involved in the care process. Providers should conduct a comprehensive environmental scan and consider how virtual appointments can be effectively incorporated into clinical workflow.



Environment	Etiquette
 Free from distractions: Consider what will be visible in your background Remove clutter from workspace Remove noise from pets and/or people Limit the numbers of applications running on computer Optimal lighting: Avoid backlighting (e.g., window/lighting from behind) 	 Effective verbal communication: Speak clearly and at a slower rate Ensure virtual understanding and adequate interaction quality Intentional pausing can guard against communication interruptions (e.g., internet delays) Clarify off-screen actions not apparent to the client (e.g., taking notes and using equipment)
 Ensure face is visible and front lit Quiet: Reduce/remove background noise (e.g., use a headset and microphone) Mute audio/microphone when not speaking Mute system sounds on your computer & phone (e.g., alerts) and limit other applications in use 	 Non-verbal cues: Camera at eye level Maintain eye contact, when possible Acknowledge client when they are speaking (e.g., head nod) Be mindful of facial cues and body language Use clear, intentional, and visible gestures Maintain virtual professionalism (e.g., attire)

Table 3. Facilitating Virtual Communication

3.2 Support Personnel in Virtual Care

The technology-enabled aspect of virtual care offers opportunities to include different people (including other professionals) in the care process by supporting interaction at a distance; this can lead to improved interdisciplinary collaboration for clients with complex needs (ACSLPA, 2011; Mohan et al., 2017; SAC, 2022). These individuals, known as support personnel, can work with an audiologist synchronously and/or asynchronously to assist with services that require in-person touch aspects of the care process (Figure 2). Providers should use professional/clinical judgement regarding when and how to involve support personnel to ensure that services are delivered in a manner that is both effective and safe for the client. Discussion around a plan to include support personnel should be initiated prior to an appointment and may evolve as the client's needs and preferences change; this should include discussion specific to the roles and responsibilities of all included personnel.





Support personnel (non-trained): In the remote location, support personnel such as parents, family members, and caregivers are often integral to virtual hearing aid services and can offer emotional support or practical assistance as necessary for continuity of care. For example, non-trained support personnel can assist with equipment set-up and troubleshooting prior to and during virtual care appointments. When considering early intervention with children, caregivers may have greater opportunity to participate in virtual care, when compared to in-person appointments (McCarthy et al., 2022).

Communication support: Additional personnel such as interpreters, translators, and real-time closed captioners may be incorporated into virtual appointments to facilitate communication between the client, the provider, and other members of the care process. These support personnel may be located at the provider site, remote site, or at a separate site such as a community-based clinic. When interpretation services are required, it is not recommended to use family members as interpreters; this may affect the reliability of the information being translated as a result of limited training and/or conflicts of interest (ASHA, n.d.-a).

Professional/organizational support: Providers are encouraged to connect with peers and other professionals for support (e.g., early adopters and those integral to the virtual care process). A client's first point of contact may be administrative personnel; this person often provides the information necessary to facilitate appointments (e.g., video-conferencing links, technological and/or infrastructure requirements). Professional support personnel can also facilitate appointment triaging in hybrid care models (refer to Figures 3 & 5). In some scenarios, advanced technical support services from hearing



aid manufacturers and/or at the organizational level can help facilitate the delivery of virtual care.

Facilitators (trained support personnel): Facilitators can be integrated into virtual care as an intermediary to extend provider care to the client in the remote location; this is often the case for regulated acts that include the use of specialized equipment. It is the provider's obligation to ensure that adequate training and supervision are provided to facilitators when delegating roles. Facilitator training should also include cultural and linguistic sensitivity training to understand how these differences may influence participation in virtual hearing aid care (ASHA, n.d.-b). The provider should adhere with all local professional standards documents regarding the use of support personnel and/or delegation of controlled acts¹.

3.3 Mobilizing a Virtual Care Team: Gears of Change

Uptake within an organization can be slow when personnel are resistant to change. It is important to acknowledge barriers and facilitators to change that ultimately define the success of an implementation plan. Key action items can assist with the preparation, management, and reinforcement of a virtual care plan, leading to mobilization. The Gears of Change model (Resource 2), adapted from Kho and colleagues (2020), describes change management practices and processes in the implementation of virtual services. It incorporates key change management practices, recognized in the telemedicine literature, as essential to successful and sustained change; these are specific to a comprehensive process-based, researched-informed organizing framework to guide the implementation.

¹ Controlled acts are actions that pose a high risk to the person if they are not performed correctly, or in alignment with the regulated manner (CASLPO, 2014)





4 Navigating Hearing Aid Care Delivery Models

The *Virtual Hearing Aid Care Pathways* diagram (Figure 3) outlines care types that can be delivered virtually, according to variables such as support personnel, time-point, or type of care. For care requiring contact services (e.g., ear impressions or probemicrophone measurements), a hybrid model of care will allow for a mix of in-person and virtual services to take place across different timepoints of the care journey.

A virtual care decision framework is presented below (Figure 4) to help guide clinical decision-making as part of a shared process between the provider and the client. The framework includes several layers encompassing readiness, care goals, triaging, health and/or safety, and patient-appropriate virtual modalities. The layers are presented sequentially to help the reader consider each layer clearly but may also be considered simultaneously in a dynamic care process. Monitoring of client health and/or safety through in-person appointments should continue when virtual care presents the risk of an appointment no-show. Alternatively, virtual appointments can be prioritized in the case that health and/or safety are at risk by attending an in-person appointment. The decision framework highlights the ability to provide a hybrid of virtual and in-person care according to individual care needs and preferences.

Virtual Hearing Aid Care Modalities According to Care Type 5.

The following section outlines virtual hearing aid care modalities according to care type. A virtual communication pathway should first consider the use of videoconferencing, as the gold standard, pairing both audio and visual sources. Modalities enabling real-time care (synchronous), such as videoconferencing, are best used for direct-to-patient appointments. When compared to asynchronous communication options (e.g., textbased communication) or audio-only tools (e.g., telephone), videoconferencing tools better allow for interpretation of non-verbal cues, sharing and/or demonstration of

illustration(s) or equipment, and the inclusion of support personnel and other professionals (Duncan & Macleod, 2020). When quality or delivery of care is limited through videoconferencing, alternative delivery options, such as phone calls, can facilitate remote interactions. However, this guidance document does not cover the use of telephone calls as part of the routine virtual care process, instead includes the use of a phone as a communication backup in the case of technical/accessibility issues with videoconferencing modalities and/or client preference.

Virtual care modalities will vary according to patient population, technology experience, type(s) and time course of care, location, and technology/support requirements; low-tech versus high-tech requirements may be used to guide virtual hearing care triaging efforts (DiFabio et al., 2022). Optional tools can be incorporated into virtual care on an as-needed basis (Table 4). For example, asynchronous modalities such as email may be appropriate for appointment reminders, brief status updates, check-ins, and providing time-sensitive information (Accreditation Canada & HSO, 2020; Ontario Health Quality, 2020). Alternatively, secure messaging, such as those included in manufacturer-specific remote hearing aid fitting software, can be used for back-and-forth communication and simple requests. Hybrid modalities (a combination of synchronous, asynchronous, and/or in-person care) may improve accommodation of client needs, available equipment, service set-up, and/or staff skills and training opportunities.

Tools	Real-world application
Applications (apps)	Can be integrated in computer and mobile technologies to enable
for remote access	remote hearing aid care.
Audio streaming/	An external microphone, Bluetooth streaming paired to hearing aids,
headsets	or the use of a headset can reduce communication complications
	resulting from low-quality microphones or noisy environments. Noise- cancelling headphones can improve audibility without adding
	additional volume (Goad, 2020).
Captioning	Enabling closed-captioning or live-captioning can improve
	comprehension during videoconferencing for hearing impaired clients.
Internet access	Wireless access devices, such as internet hubs and USBs provide
(Wi-Fi alternative)	remote internet access where internet services may be unavailable or
	poor quality. To assess internet quality, upload/download speed may
	be measured before a virtual appointment using online speed tests.
Supplemental	Paper or electronic handouts and video-based instructions may be
resources	given to clients to provide additional information during appointments.
Videoconferencing	External videoconferencing software may be used when virtual
software	hearing aid fitting software does not have built-in videoconferencing.
Webcams and	External devices may be necessary for some older computers or
microphones	mobile devices that do not have built-in microphones or webcams.

Table 4. Optional Tools for Virtual Care Success

5.1 Management

The implementation of virtual hearing aid management can be facilitated using minimal technology (e.g., videoconferencing) and can be a good starting place for first-time providers of virtual care. Virtual hearing aid management, including counselling and education sessions, requires both the provider and client to have access to a computer with videoconferencing software, a webcam, and a microphone, if not built-in (Figure 5). Providers may offer supplemental materials to support families of children participating in virtual care, such as written information, videos, online support or internet resources; existing literature has identified these materials as beneficial in supporting families in making informed decisions, helping address information needs, increasing patient knowledge and improving information recall (De Looper et al., 2020; Elliott et al., 2022; Fitzpatrick et al., 2008; Malmberg et al., 2022; Porter & Edirippulige, 2007; Scarinci et al., 2018; Zaidman-Zait & Jamieson, 2007).

Literature around the provision of virtual hearing aid management provides evidence supporting effective service delivery to both adults and children, in direct-to-client and facilitator-supported care models (Angley et al., 2017; Campos & Ferrari, 2012; Jedlicka, 2021; Muñoz et al., 2017; Novak et al., 2016; Pearce et al., 2009; Penteado et al., 2014; Tao, Moreira, et al., 2021). Studies including virtual hearing aid management

have largely focused on the provision of informational and coaching-based hearing aid counselling.

Virtual Hearing Aid Management Scenario: The provider and client attend a scheduled virtual care appointment at which the provider provides a video-based, instructional demonstration on how to replace the client's hearing aid receiver dome and wax filter. Face-to-face (F2F) interaction is facilitated through videoconferencing using a PHIPA-compliant software program.

5.2 Validation

Virtual hearing aid validation can be completed using many of the same outcome measurement tools available for traditional in-person appointments. Depending on the tool(s) selected, virtual modalities allow for measurement to take place in a remote location, often as part of real-world scenarios. Common modalities include interviewing via videoconferencing, online/mobile surveys, and email delivery of measurements. A variety of tools have been used in adult-focused virtual hearing aid intervention studies to assess speech recognition, hearing aid benefit/satisfaction, psychosocial ability, hearing aid usage, and the perceived quality of a fitting (Campos & Ferrari, 2012; Novak et al., 2016; Penteado et al., 2014; Tao, Moreira, et al., 2021); these include:

- International Outcome Inventory for Hearing Aids (IOI-HA)
- Client Oriented Scale of Improvement (COSI)
- Glasgow Hearing Aid Benefit Profile (GHABP)
- Hearing Handicap Inventory for the Elderly (HHIE-S)
- Psychosocial Impact of Assistive Devices Scales (PIADS)
- Hearing in Noise Test (HINT)
- Satisfaction with Amplification in Daily Living (SADL)
- Hearing Aid Issues Instrument (HAII)

Of these, the IOI-HA and COSI have been judged as suitable for use in virtual care with individual hearing aid users and across a comprehensive set of patients and/or service domains. Additional tools deemed to be partially suitable for use in virtual hearing aid validation, covering many important outcome domains, include The Hearing Aid User's Questionnaire (HAUQ); Hearing Aid Skills and Knowledge (HASK) and the Dynamic Assessment of Hearing Aids (DAHA) (Tao, Brennan-Jones, et al., 2021).

There is growing evidence to support the use of pediatric-focused questionnaires administered via support personnel (e.g., parent or teacher) to assess hearing aid outcomes remotely. Common examples include the Parent Evaluation of Aural/Oral Performance of Children's Hearing (PEACH), the Teacher Evaluation of Aural/Oral Performance of Children's Hearing (TEACH), and the LittlEARS Auditory Questionnaire. Validated outcome measurement tools have the potential to be included in virtual care, with modification to the delivery model/modalities used. Further research is needed to determine the effectiveness of outcomes used in a direct-to-client virtual care model, especially when considering pediatric-focused tools.

The delivery of virtual validation care may require the use of a facilitator; this may increase the number of remote care validation options, beyond questionnaires/surveys, to include sound field testing (requiring remote specialized equipment). Various sound level meter mobile apps have been reported as accurate options in obtaining quick measurements of a given testing environment (Murphy & King, 2016); these can assist the facilitator in controlling testing conditions and may help improve the clinical value of virtual validation. Further consideration around efficient and practical tools enabling realtime, direct-to-patient virtual outcome measurement is needed to expand recommendations around virtual hearing aid validation care. All adaptations made to the delivery of standardized assessment materials during virtual care should be documented by the provider (SAC, 2022).

Figure 6. Virtual Hearing Aid Validation Infrastructure

Example Validation Scenario: As a follow-up session to an initial hearing aid fitting, the provider has requested a validation session with the client. The client and facilitator are present at the same time in the remote location, with the provider at the provider location. The facilitator completes all technical setup and acts as the provider's hands during the validation appointment. The provider initiates the validation session through videoconferencing (using a PHIIPA-compliant software program) and according to clinical best practices. The provider initiates the Client Orientated Scale of Improvement (COSI) validation test to assess the extent of changes in audibility over time.

5.3 Programming

Virtual hearing aid programming can be used to facilitate direct-to-client remote adjustments and/or to troubleshoot fitting issues virtually. Current technologies enable virtual hearing aid adjustment to the physical fit, volume, frequency-gain response, programs, and features/settings (e.g., frequency lowering, occlusion compensation, and noise management). Virtual programming technology currently excludes direct-to-client real-ear measurements ([REM]; refer to section 6). Figure 7 illustrates common virtual hearing aid programming technology requirements, including wired (in combination with a facilitator) or wireless (Bluetooth) fitting interface options at the remote location. Evidence to support the implementation and delivery of virtual hearing aid programming describes care scenarios involving both direct-to-patient care or the use of a facilitator to program devices, under the direct supervision of a regulated provider (Angley et al., 2017; Campos & Ferrari, 2012; Convery et al., 2020; Novak et al., 2016; Pearce et al., 2009; Penteado et al., 2012, 2014; Pross et al., 2016; Tao, Moreira, et al., 2021). In the case of initial hearing aid programming, evidence supports the use of specialized equipment and a facilitator in the remote location (e.g., REM and hearing aid fitting verification equipment). The application of virtual hearing aid programming with pediatric hearing aid users warrants further consideration and is limited to appointments in which best practice hearing aid fitting procedures can be followed. Currently, recommendations are provided around the use of virtual hearing aid programming with pediatric clients in follow-up appointments, with special attention paid to potential risk factors (Section 6).

Virtual Hearing Aid Programming Scenario: The provider and client attend a scheduled virtual care appointment to make a real-time modification to the client's hearing aid fitting. Adjustments are facilitated through provider use of the manufacturer fitting software on a computer with remote access capabilities; programming adjustments are transferred to the client's hearing aids over Wi-Fi and using a Bluetooth connection to the client's mobile app (on a Smartphone). Videoconferencing enables F2F discussion of programming needs/outcomes through videoconferencing within the manufacturer software and the mobile app. This virtual appointment enables the addition of a listening program for noisy environments, to meet the client's needs in listening situations with background noise.

5.4 Verification

Virtual hearing aid verification requires the use of specialized equipment (verification equipment) in the provider location and/or may require the use of a facilitator when equipment is situated in the remote location. In addition, the provider should consider the timepoint of care (i.e., initial versus follow-up) and the availability of the following (BAA Service Quality Committee & BSA Adult Rehabilitation Interest Group, 2021):

- Current audiometric information (including transducer type)
- Previous REM

- Verification equipment
- Type of device and features being fitted
- Earpiece venting and tubing

Figure 8 outlines additional requirements to complete a virtual verification appointment. It may be possible to verify a virtual fitting using simulated-real-ear measurements (S-REM) incorporating previous thresholds and RECD values (or predicted RECD values) in follow-up appointments where fittings have been updated or modified and assuming the client's middle ear status is the same. This can be accomplished in the clinic using verification equipment, S-REM procedures, and stock hearing aids, with the potential to inform the outcome of real-time hearing aid programming modifications. Pediatric services should consider the accuracy of using previously measured RECDs versus age appropriate, predicted RECDs (Bagatto et al., 2002). In the case where S-REM are used, venting choices should be considered in the measurement whenever possible (Scollie et al., 2022).

Literature incorporating virtual hearing aid verification procedures have focused on adult listeners and the use of specialized equipment and a facilitator situated in the remote location (Ferrari & Bernardez-Braga, 2009; Novak et al., 2016; Pearce et al., 2009). For example, a provider may use remote desktop access connected to probe microphone measurement equipment in the remote location (with a facilitator) to collect REM, thereby ensuring appropriate amplification targets are met and maximum power output settings across the frequency range of the hearing aid accommodates patient loudness comfort (Novak et al., 2016). However, in the absence of specialized equipment and/or a facilitator in the remote location, a clinical workaround could include the use of specialized equipment in the provider location. For example, a provider could replicate hearing aid programming changes completed in a follow-up appointment by performing electroacoustic measurements using stock hearing aids (i.e., identical hearing aids available in the clinic) and S-REM. This workaround assumes that up-to-date measures of hearing thresholds and/or probe microphone measures are available to the provider.

Example Verification Scenario: The provider and client attend a scheduled virtual care appointment to discuss changes to a hearing aid program fitting in real-time. Adjustments are facilitated through provider access to the manufacturer fitting software, remotely connected to the client's mobile hearing aid application. F2F interaction is facilitated through videoconferencing within the manufacturer software and the mobile application. As part of the appointment, the clinician connects an identical pair of hearing aids available in the clinic to complete verification measures for the adjusted hearing aid program to ensure fitting adequacy following remote programming.

6. Potential Risks in Virtual Hearing Aid Care

In some scenarios, the provision of virtual hearing aid care may be accompanied by potential risks to the client and others involved in the care process. These risks can relate to privacy or security (such as data breaches and/or cyber security threats), technology risks, and limited access. In the case where the provider does not have access to equipment to confirm hearing thresholds virtually, or to perform verification measures following virtual programming modifications, the following risks to the client should be considered:

- Under amplification, overamplification, or a poor frequency gain response: resulting in feedback, poor sound quality, or reduced benefit;
- *Reduced daily hearing aid use time* and/or *increased isolation:* related to poorly fitted hearing aid devices.

Additional risks may arise when there is an unidentified need for medical attention, such as an ear infection or when clients are unaware of potential blockages in their ear canal that affect hearing aid use.

There are also risks related to communication failures that can occur because of technology difficulties at critical points of interaction. The following suggestions may address these potential risks. In all cases, the provider should:

- Assess the client's hearing aid experience: Providers can assess experiences with the client directly, or using a facilitator at a remote location, following virtual hearing aid programming. This can be completed using interview-style techniques or standardized questionnaires. If the provider suspects there has been a change in the client's hearing, the provider should consider the urgency of the next in-person clinic appointment.
- 2. Verify changes made to the hearing aids: Following virtual programming changes to the frequency gain response of hearing aids, verification measures using a facilitator or S-REM (and stock hearing aids) should be completed when possible. When these cannot be achieved, verification measures should be completed at an in-person appointment. If significant changes are made to the hearing aid programming, the provider should consider the virtual validation options available to enable them to assess the impact of these changes. In addition, virtual hearing

aid validation can help determine whether hearing aid programming changes are beneficial to the listener.

3. *Incorporate RECDs and REM*: Previously measured RECDs and REM can be incorporated into the virtual fitting, when available and deemed appropriate and accurate.

Client-related risks may be associated with fluctuating hearing thresholds and the need for significant modification to the hearing aid's frequency gain response through virtual service delivery. Some clients will have undergone etiological investigations and have a known cause of their hearing loss. Consideration should be given to cases presenting with a risk for progressive hearing loss prior to conducting virtual hearing aid care, particularly if the client is unlikely or unable to reliably self-report changes in hearing. In some cases, traditional in-person appointments may be the best model of care, depending on the risk factors, the client's needs and preferences, and the remote capabilities of the hearing aid technology. Providers are responsible for having a comprehensive risk management procedure to identify, manage, and mitigate clinical risk.

Evidence-based guidance around the magnitude of programming changes in which virtual hearing aid care would be deemed unacceptable is not available at this time. Providers should use professional judgement and proceed with caution in all cases. Providers must consider the risks associated with delivering virtual hearing aid care and each provider location should conduct risk assessments. When implemented effectively and appropriately, the benefits of virtual hearing aid care can be significant and may increase service equity when time, mobility, social distancing, or distance-related issues restrict access to audiological services.

More evidence is needed to improve the uptake of virtual care in routine clinical practice, especially considering pediatric care. Researchers and providers should work together to ensure well-designed studies are undertaken to quickly advance evidence into practice. The inclusion of a comprehensive description of technology and infrastructure requirements in future research, as well as all corresponding implementation considerations to facilitate virtual hearing aid care, would better direct all stakeholders involved in the care process.

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Title	Year	Authority	Link
A guide to remote working in audiology services during Covid-	2020	BAA	https://www.baaudiology.org/app/uploads/2020/05/2
19 and beyond: Practical guidance for remote hearing care			Remote-Working-Practical-Guidance-Remote-Care.pdf
Adopting and integrating virtual visits into care: draft clinical	2020	OHQ	https://quorum.hqontario.ca/Portals/0/Users/170/54/10154/
guidance			ating%20virtual%20visits%20into%20care V1.pdf?ver=202
			0-03-13-091936-370
American Academy of Audiology position statement: The use	2021	AAA	https://www.audiology.org/wp-content/uploads/2021/10/
of telehealth for the delivery of audiological services			COMM21-Position_Statement-Telehealth_10.2021-FNL.pdf
Audiology and otology guidance during Covid-19: From the	2021	AIHHP,	https://www.baaudiology.org/app/uploads/2021/01/Audiolog
or s audiology professional bodies		& BSHAA	2021.pdf
Clinical guide for the management of remote consultations	2020	NHS-E	https://www.rcslt.org/wp-content/uploads/2021/10/NHS-
and remote working in secondary care during the coronavirus			England-clinical-guide-for-the-management-of-remote-
pandemic			consultations-and-remote-working-in-secondary-care-
Considerations for the evaluation of virtual rehabilitation	2021	RCA	http://rehabcarealliance.ca/uploads/File/COVID-19/
			Evaluation_Considerations_for_Virtual_RehabENG
			_Final.pdf
COVID-19 toolkit virtual care V: 2.0	2020	AC & HSO	http://www.phsa.ca/health-professionals-site/Documents/
Desition statement: Telesudialery	2020	A A	Office%2001%20Virtual%20Health/VirtualCareToolkitv2.pdf
Position statement. Teleaudiology	2020	AA	niips.//audiology.asn.au/Tenani/C0000015/AudA%20Posiii on%20Statement%20Teleaudiology%202020%20Final(1) n
			df
Setting and verifying the frequency response of a hearing aid	2021	BAA, BSA	https://www.baaudiology.org/app/uploads/2021/02/BAA-
remotely for adults during periods of restricted service delivery			BSA-remote-fitting-guidance_Publish.pdf
Standards for virtual care in Ontario by CASLPO audiologists	2020	CASLPO	https://caslpo.com/sites/default/uploads/files/PS_EN_Stand
l eleaudiology guidelines	2022	AA	https://teleaudiologyguidelines.org.au/wp-content/uploads/ 2022/06/Australian-Teleaudiology-Guidelines-2022.pdf
Telemedicine in audiology. Best practice recommendations	2021	SFA &	https://www.sciencedirect.com/science/article/pii/S1879729
from the French Society of Audiology (SFA) and the French		SFORL	620302441
Society of Otorhinolaryngology- Head and Neck Surgery (SFORL)			
Telepractice (Practice Portal)	n.d.	ASHA	https://www.asha.org/practice-portal/professional-issues/
			telepractice/

Appendix B. Table of Professional Resources

Telepractice	2011	ACSLPA	https://www.acslpa.ca/wp-content/uploads/2019/05/ Telepractice.pdf
Telepractice guidelines for audiology and speech, language pathology services in India	2020	ISHA	https://www.ishaindia.org.in/downloads/TELEPRACTICE- GUIDELINES.pdf
SAC position paper on: The use of virtual care in speech language pathology and audiology services	2022	SAC	https://www.sac-oac.ca/sites/default/files/Virtual_Care _Position_Paper_EN.pdf
Virtual care resource guide	2020	EKO	https://empoweredkidsontario.ca/uploads/About%20OACR S/EKO%20Virtual%20Care%20Resource%20Guide%20Fin al.pdf
Virtual care: standards of practice	2019 **	CSHBC	https://www.cshbc.ca/wp-content/uploads/2019/06/CSHBC- SOP-PRAC-03-Virtual-Care.pdf
Virtual visits: solution requirements v1.2	2021	OTN	https://otn.ca/wp-content/uploads/2020/03/Virtual-Visits- Solution-Standard-v1.2.pdf

Note. *Abbreviations for authorities included the following (listed alphabetically): **AA**- Audiology Australia, **AAA**- American Academy of Audiology, **AC**- Accreditation Canada, **ACSLPA**- Alberta College of Speech-Language Pathologists and Audiologists, **AIHHP**- Association of Independent Hearing Healthcare Professionals, **ASHA**- American Speech and Hearing Association, **BAA**- British Academy of Audiology, **BSA**- British Society of Audiology, **BSHAA**- The British Society of Hearing Aid Audiologists, **CASLPO**- College of Audiologists and Speech-Language Pathologists of Ontario, **CSHBC**- College of Speech and Hearing Health Professionals of British Columbia, **EKO**- Empowered Kids Ontario, **HSO**- Health Standards Organization, **ISHA**- Indian Speech-Language & Hearing Association, **NHS-E**- National Health Service- England, **OHQ**- Ontario Health Quality, **OTN**- Ontario Telemedicine Network, **RCA**- Rehabilitative Care Alliance, **SAC**- Speech-Language and Audiology Canada, **SFA**- French Society of Audiology, **SFORL**- French Society of Otorhinolaryngology- Head and Neck Surgery. ** Revised in March 2021.

TIPS & TOOLS PROVIDER-DIRECTED Western VIRTUAL CARE Set-up & Connectivity Internet robustness Back-up connection (e.g., telephone) • Microphone/headset (close to mouth for clear speech) Download/connect all applicable technologies/apps Charge/plug in devices Piloting for Success Replicate appointment set-up Trial the appointment sequence (including technology) Offer in-person set-up Accessible Resources/Supports Direct connectivity via streaming/t-coil (if available) Enable speech-to-text or auto-captioning • Technical and family support personnel • Ensure adequate language access (e.g., interpreter) Loaner technology (access/troubleshooting) Staff Training Specialized equipment & personnel for all care types Provide technology/software-specific resources • Virtual etiquette including clear, jargon-free speech Listening Environment Reduce background noise and distractions Ensure well-lit/visible faces (optimal speech reading) Professional attire/backdrop (visually unobtrusive) Family-Centred Communication Turn taking to facilitate multi-person communication Encourage meaningful engagement Seek feedback and encourage self-advocacy

Appendix C. Tips & Tools Reference Sheet