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SERVICES

Multimedia services

Accessibility of telehealth services

Recommendation ITU-T F.780.2

ITU-T



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Recommendation ITU-T F.780.2

Accessibility of telehealth services

Summary

Recommendation ITU-T F.780.2 defines accessibility requirements for technical features to be used and implemented by governments, healthcare providers and manufacturers of telehealth platforms to facilitate the access and use of telehealth services by persons with disabilities and specific needs, including older persons with age-related disabilities.

With the passage of the United Nations Convention on the Rights of Persons with Disabilities in 2006, and its ratification by numerous countries, persons with disabilities have the right to enjoy the highest attainable standard of health without discrimination on the basis of disability. Countries need to take all appropriate measures to ensure access for persons with disabilities to health services.

During the current Covid-19 pandemic, the use of telehealth services has increased substantially in many countries and telehealth has become a basic need for the general population, especially for those in quarantine, enabling patients in real time through contact with healthcare providers to access advice. However, due to the lack of global and comprehensive standards and guidelines for accessibility of telehealth services, many persons with disabilities experience difficulties accessing and using such services and are often forgotten. This Recommendation summarizes and defines those requirements and features that industries can implement to ensure accessible provision of telehealth services.

Technical requirements defined in this Recommendation are based on a comprehensive feedback collected from civil society on barriers that persons with disabilities experience when accessing and using telehealth services, as well as on the feedback from the industry. This is a first edition of the document.

This Recommendation was developed collaboratively by the World Health Organization (WHO) and ITU.

History

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FOREWORD

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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Introduction

The World Health Organization (WHO) defines telehealth as the "delivery of health care services, where patients and providers are separated by distance. Telehealth uses information communication technology for the exchange of information for the diagnosis and treatment of diseases and injuries, research and evaluation, and for the continuing education of health professionals" [b-WHO-Telehealth]. Telehealth is a service that has been widely applied in many countries for decades now. During the Covid-19 pandemic, the use of telehealth services increased substantially in many countries, becoming a basic need for the general population, enabling people to contact health care providers from home in real time. As such, telehealth contributes to achieving universal health coverage in countries by improving access to quality and cost-effective health services for patients regardless of their setting. It is particularly valuable for those who live in remote areas and for marginalized populations.

While telehealth provides the means for an equitable health service provision, in reality many persons with disabilities experience difficulties and challenges accessing and using telehealth services. There is more and more evidence that especially in low- and middle-income countries persons with disabilities cannot benefit from telehealth services due to highly inaccessible formats of delivery. For example, very often telehealth platforms are not compatible with devices such as screen readers that facilitate people with vision impairment to access information, or the lack of captioning or volume control in video conferencing impedes persons who are deaf or hard of hearing to interact with health professionals virtually. It is, therefore, critical to upscale efforts to address the "digital divide" faced by persons with disabilities, in order to ensure equitable access to telehealth services and address any structural inequalities.

This Recommendation provides a list of technical requirements that telehealth platforms must have to ensure accessible telehealth service provision for persons with disabilities. All requirements are based on the best available evidence, as well as the comprehensive feedback and input collected from civil society and the industry.

Specific requirements are provided for people with different types of impairments:

- 1) Requirements 1 to 6 for persons with vision impairment and blindness
- 2) Requirements 7 to 11 for deaf and hard of hearing persons
- 3) Requirement 12 for persons with speech difficulties
- 4) Requirements 13 to 15 for persons with mobility impairments
- 5) Requirements 16 to 20 for persons with mental health conditions and psychosocial disabilities
- 6) Requirements 21 to 23 for persons with developmental and intellectual disabilities
- 7) Requirements 24 and 25 for persons with learning disabilities

This Recommendation is a joint global standard of the World Health Organization (WHO) and the International Telecommunication Union (ITU) that is technically aligned with Recommendation ITU-T F.780.2 (Accessibility of telehealth services).

The requirements in this Recommendation are recommended for adoption by Member States as regulations or legislation and should also be voluntarily implemented by healthcare professionals and manufacturers.

Recommendation ITU-T F.780.2

Accessibility of telehealth services

1 Scope

Telehealth services have had a raised profile during the ongoing COVID-19 pandemic and their increased use has highlighted the need for standards that are inclusive of persons with disabilities and specific needs. The development of such standards for telehealth is important to help ensure accessible, effective and safe delivery of quality healthcare. This Recommendation is a WHO-ITU global standard for accessibility of telehealth services, which outlines some of the most common requirements on accessible telehealth services. More specifically, this Recommendation includes requirements on concrete accessibility features that healthcare providers and manufacturers of telehealth platforms need to ensure when delivering telehealth services. The standard can be used and implemented by governments, manufacturers of telehealth platforms and healthcare providers.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- [ITU-T K.127] Recommendation ITU-T K.127 (2017), *Immunity requirements for telecommunication equipment in close proximity use of wireless devices.*
- [ITU-T K.136] Recommendation ITU-T K.136 (2018), *Electromagnetic compatibility requirements for radio telecommunication equipment.*
- [ITU-T K.137] Recommendation ITU-T K.137 (2022), *Electromagnetic compatibility requirements and measurement methods for wire-line telecommunication network equipment.*
- [IEC 60601-1-2] IEC 60601-1-2:2014, *Medical electrical equipment – Part 1-2: General requirements for basic safety and essential performance – Collateral Standard: Electromagnetic disturbances – Requirements and tests.*
- [IEC 61000-2-2] IEC 61000-2-2:2002, *Electromagnetic compatibility (EMC) – Part 2-2: Environment – Compatibility levels for low-frequency conducted disturbances and signalling in public low-voltage power supply systems.*
- [NIST FIPS 197] National Institute of Standards and Technology NIST FIPS 197 (2001), *Advanced Encryption Standard (AES)*, <https://doi.org/10.6028/NIST.FIPS.197> (Accessed 30 May 2022).

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 telehealth [b-WHO-Telehealth]: Delivery of healthcare services, where patients and providers are separated by distance. Telehealth uses information and communication technologies (ICT) for the exchange of information for the diagnosis and treatment of diseases and injuries, research and evaluation, and for the continuing education of health professionals.

3.1.2 assistive technology [b-ISO 9999]: Any product (including devices, equipment, instruments and software), especially produced or generally available, used by or for persons with disability for participation; to protect, support, train, measure or substitute for body functions/structures and activities; or to prevent impairments, activity limitations or participation restrictions.

3.1.3 accessibility [b-ITU-T F.791]: The degree to which a product, device, service or environment (virtual or real) is available to as many people as possible.

3.1.4 accessibility feature [b-ITU-T F.791]: An additional content component that is intended to assist people hindered in their ability to perceive an aspect of the main content.

3.1.5 electromagnetic compatibility [ITU-T K.127]: The ability of electrical equipment and systems to function acceptably in their electromagnetic environment, by limiting the unintentional generation, propagation and reception of electromagnetic energy which may cause unwanted effects such as electromagnetic interference or even physical damage in operational equipment.

3.1.6 electromagnetic interference [b-ITU RR]: The effect of unwanted energy due to one or a combination of emissions, radiations, or inductions upon reception in a radiocommunication system, manifested by any performance degradation, misinterpretation, or loss of information which could be extracted in the absence of such unwanted energy.

3.2 Terms defined in this Recommendation

This Recommendation defines the following term:

3.2.1 disability: The result from the interaction between health conditions or impairments that a person experiences and environmental barriers that may hinder the person's full and effective participation in society on an equal basis with others.

NOTE – Adapted from [b-WHO ICF] and [b-ITU-T F.971].

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AES	Advanced Encryption Standard
AI	Artificial Intelligence
ASR	Automated Speech Recognition
ATAG	Authoring Tool Accessibility Guidelines
DPO	Disabled Persons Organization
DTLS	Datagram Transport Layer Security
EHR	Electronic Health Record
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference

HTML	Hypertext Markup Language
ICT	Information and Communication Technologies
LMS	Learning Management System
mHealth	Mobile Health
SMS	Short Message Service
SRTP	Secure Real-Time Transport Protocol
TTS	Text-to-speech
UHC	Universal Health Coverage
VRI	Video Remote Interpretation
WCAG	Web Content Accessibility Guidelines
WebRTC	Web Real Time Communication
W3C	World Wide Web Consortium (W3C)

5 Conventions

None.

6 Background

The World Health Organization (WHO) defines telehealth as the "delivery of healthcare services, where patients and providers are separated by distance. Telehealth uses ICT for the exchange of information for the diagnosis and treatment of diseases and injuries, research and evaluation, and for the continuing education of health professionals." [b-WHO-Telehealth]. Telehealth can contribute to achieving universal health coverage in countries by improving access to quality and cost-effective health services for patients regardless of their setting. It is particularly valuable for those who live in remote areas, for vulnerable groups and ageing populations.

Telehealth is a service that has been introduced and used in many countries for decades now. With the rapid evolution of technology, most families have at least one digital device that can provide the means for communication between a patient and a healthcare provider. During the Covid-19 pandemic, however, the use of telehealth services has increased substantially in many countries. Telehealth has become a basic need for the general population, especially for those in quarantine, enabling patients in real time through contact with healthcare providers to access advice on their health problems. In fact, a recent WHO report showed that telehealth is the most common modality adopted by countries for service provision during the pandemic [b-WHO-COVID19]. The report also shows that there is a trend of increasing utilization of telehealth as the income level increases, although even among low-income countries 42% of those with service disruptions during the COVID-19 crisis report utilizing this technology. However, due to the lack of standards and guidelines for access to telehealth services, many persons with disabilities and specific needs are experiencing difficulties and challenges in accessing and using such services. Their needs are often forgotten and not accommodated.

During the initial phase of the Covid-19 experience, the United Nations Under Secretary General convened an emergency time-bound working group on disability inclusive health response and recovery with the participation of several organizations, including the Economic and Social Commission for Western Asia, the Executive Office of the Secretary-General, the Office of the High Commission for Human Rights, UN Development Program, UN Entity for Gender Equality and the Empowerment of Women, International Disability Alliance, International Disability and Development Consortium, International Telecommunication Union (ITU), and World Health

Organization (WHO). One of the main outcomes of this working group was the development of a terms of reference document outlining the importance of telehealth and e-health guidance for persons with disabilities (Appendix I). These terms of reference served as a basis for the development of the current standard. The methodology and development process of the standard are described in clause I.4.

Most of the common challenges faced by persons with disabilities can be addressed through standardization and regulation. The development of standards for telehealth is an important and valuable process to help ensure accessible, effective and safe delivery of healthcare. There are examples of existing guidelines in different countries. For example, the American Telemedicine Association (ATA) has created practice guidelines that are being adopted by numerous professionals [b-Krupinski]. The Government of New South Wales has adopted a telehealth framework and implementation strategy for the 2016-2021 period [b-NSW]. The WCAG are universal guidelines used in many countries and practices [b-W3C WAI]. However, none of these guidelines and standards cover all the areas of accessibility which end-users with disability might experience. This current standard aims to fill this gap by providing a comprehensive set of requirements on concrete accessibility features that healthcare providers and manufacturers of telehealth platforms can implement when delivering telehealth services.

7 Challenges that persons with disabilities face in a telehealth environment

This clause outlines common challenges that persons with disabilities experience when accessing and using telehealth services. The clause is divided into six sub-clauses, outlining challenges that persons with vision impairment and blindness, persons who are deaf or hard of hearing, persons with speech difficulties, persons with mobility issues, persons with mental health conditions and psychosocial disabilities, and persons with developmental, intellectual or learning disabilities experience. Some of the challenges may overlap across different groups.

7.1 Persons with vision impairment and blindness

- Telehealth platforms are often not compatible with some specific assistive devices such as screen-readers or braille keyboards.
- Scanned documents, text images, infographics or diagrams have no alternative text.
- Background music interferes with audio voice-over.
- Colour contrast and screen magnification are also important elements of accessible virtual visits that, if missing, do not allow people to view images and text on the screen, also reducing access to their own medical records and lab results.
- The healthcare provider is not sensitized on the specific needs of people with vision impairment.
- A lack of fixed phone line means that there are less options for people with vision impairment when a digital platform is not accessible.
- Software providers of "Telehealth apps" may not consider accessibility for persons with disabilities.
- Smartphones tend to use touch screens which are not always as navigable as phones with larger buttons.

7.2 Persons who are deaf or hard of hearing

- Unstable connection over the phone presents barriers.
- Inadequate captioning or volume control in video conferencing.
- Unstable Internet interferes with the video signal (e.g., video/audio delay) making lip-reading and sign language less clear.

- Text messaging can be a solution when the video or audio are not working well, but it is often not available as an option in telehealth platforms.
- Background music during videos and background noise during consultations presents a barrier for people who are hard of hearing.
- Small screens of smartphones can make lip-reading and sign language less clear.
- Lack of speech-to-text generators.
- Bad signal-to-noise ratio does not allow for good communication.
- When captioning is available, no speech-to-text reporters and real time captioners are used.
- In the context of COVID-19, wearing masks during telehealth services can impede people relying on lip-reading to communicate.
- When the audio signal is not good, lack of an option to use a microphone to improve audio.
- Lack of options for scheduling sessions through text or email when audio phone systems are not accessible.
- No option to include accommodation requests in an online platform for scheduling.
- The size on screen for sign language interpretation is not appropriate.
- Lack of hearing loop on phone available.

NOTE – If a user decides to use a phone to participate in a telehealth session, it is the responsibility of the user to select a hearing aid compatible phone.

7.3 Persons with speech difficulties

- Voice synthesizers and text-to-speech generators are not available on telehealth platforms.
- Standard timetabling does not accommodate people who need more time for communication.
- Pace and tone and rhythm of voice being used when synthesizing might be a challenge.
- Telehealth services sometimes offer only phone numbers as the way to communicate with the healthcare providers.
- Unstable or poor audio quality can be a challenge for people who have speech difficulties who might be required to repeat the same sentences many times, causing fatigue and deteriorating speech.
- Services and platforms which do not allow video or have poor video quality limit the possibility to rely on non-verbal communication.

7.4 Persons with mobility impairments

- Platform's icons and navigation system are too restrictive in size or not structured in a way that is easy for people with fine motor movement difficulties to use (e.g., requiring people to double-click instead of single-click).
- Insufficient time limits to respond or to complete tasks, such as to fill out online forms.

7.5 Persons with mental health conditions and psychosocial disabilities

- Unexpected, irrelevant, and inappropriate content can be upsetting.
- Sufficient information is not provided on how the telehealth service ensures safety, privacy, and security, including the role of the user in achieving these goals, which can foster negative feelings and discourage usage.
- Sufficient guidance is not provided on how to use the telehealth service.
- Difficulty using complicated and unnecessarily effortful user interfaces on the platform and troubleshooting or overcoming system errors.

- Difficulty trusting resources with poor information quality and design.

7.6 Persons with developmental and intellectual disabilities

- Use of technical language by the provider or administrative personnel may be difficult to understand and lead to misinterpretation.
- Health information in the platforms is not simple and accessible, key documents are not in easy read formats.
- People who provide personal support to persons with intellectual disabilities are not included in the conversation.
- Simple educational material on how to use telehealth services is not available.

7.7 Persons with learning disabilities

- Text and documents on online platforms are sometimes difficult to follow for persons with dyslexia. For example, underlining and italics can make words 'run together', or flow charts, illustrations and diagrams can be too difficult to follow and understand.
- Complex navigation mechanisms and page layouts are difficult to understand and use.
- Complex sentences are difficult to read and long passages of text difficult to follow.
- Moving, blinking, or flickering content, and background audio cannot be turned off.

8 General technical requirements

This clause describes requirements on concrete accessibility features that healthcare providers and manufacturers of telehealth platforms need to ensure when delivering telehealth services. The requirements are based on the challenges identified and included in clause 7. Some of the requirements might overlap across different groups of persons with disabilities.

It is also recommended that telehealth services in general, and accessible telehealth services in particular, provide proper electromagnetic compatibility (EMC) as well as guidance on its application during their telehealth sessions, as described in Annex A.

8.1 Requirements for persons with vision impairment and blindness

- **Requirement 1:** The functioning of the telehealth platform should be compatible with screen readers or assistive devices like Braille keyboards, removing barriers for people who are blind or visually impaired.
 - Screen readers are considered one of the most basic accessibility tools for people with vision impairment, enabling them to "see" their screen. The assistive device communicates what a person without a visual impairment can see through non-visual methods such as sound icons and text-to-speech. The screen reader can also translate the information on the screen and display it in Braille. This means users can navigate the screen, type, read and edit text more efficiently and accurately. It is considered the most basic accessibility feature a platform can have for people with vision impairment.
- **Requirement 2:** Colour contrast and screen magnification shall be available to allow people to view images and text on the screen during virtual visits.
 - Colour contrast means that there is enough contrast between the text or image and its background for people with vision impairments to be able to read the text or see the image even if they cannot access all the colours. The Web Content Accessibility Guidelines (WCAG) provide specific guidance on the ratios of contrast.
Screen magnification enlarges text and images on the screen up to 20 times their display size which makes the content more visible for people with poor vision. The magnification follows the user's activity on the screen from typing to moving their

cursor. The size of the cursor can also be increased which enables it to be found more easily on the screen.

- Alternative text needs to be provided for any non-text content so that it can be changed into other forms people need, such as large print, braille, speech, symbols or simpler language. The web content accessibility guidelines (WCAG) provide specific guidance on how alt text can be added.
- The same applies also for telehealth patient portals that store online medical charts, images, and messages that allow patients to access their medical history and lab results.

– **Requirement 3:** Services using telephone calls shall be accessible for a person with vision impairment who cannot access the digital platform (even though many users may not have a fixed line at home).

- Services must be accessible to people with vision impairment. Thus, if the digital platform is inaccessible, telephone calls are another suitable option. Using a phone can present some challenges but certain laws such as the Telecommunications Act of 1996 in the US ensures that all telephone devices are accessible to people with vision impairment.

– **Requirement 4:** "Telehealth apps" should avoid processes that require downloading specific software onto devices, specific platforms, different passwords and variable software development or support when possible.

- "Telehealth apps" that require downloading place further barriers for people with vision impairment. People with vision impairment already face more challenges when accessing products and navigating telehealth platforms. The steps in the process to getting the service they need be the bare minimum.

– **Requirement 5:** Videos included on telehealth platforms should not include background music as it makes it difficult to listen to relevant information.

- People with vision impairment depend on information being communicated through sound, such as through their screen reader, or touch, such as through their Braille keyboard. Background noise of any kind can make it hard for users with vision impairment to focus on the relevant information that is being conveyed as they might have no other means of accessing the information unlike people without vision impairment.

– **Requirement 6:** Ambiguous wording and inaccurate descriptions in videos should be avoided.

- People with vision impairment depend on descriptions when they are not able to visualize content such as videos and images. Ambiguous or inaccurate wording can be confusing or convey incorrect information. It is critical that the descriptions provide the same information with or without the visual aspect.

8.2 Requirements for deaf and hard of hearing persons

– **Requirement 7:** Video conferencing shall provide captioning and a monitored chat box that has volume control provisions along separate windows.

- Real time captioning allows persons who are deaf and hard of hearing to access video and spoken content. This is especially important for persons who are hard of hearing if the audio is not clear and vital for persons who are deaf and who need captioning. If there is a background noise, all participants may not understand what is being said. This also solves the problem of speakers mumbling or having strong accents. Captioning is vitally important for all if the speaker is not visible because without visual representation of the speaker, there is no possibility of lip-reading.

- It is recommended to use professional human captioners, preferably specialized in medical/health related captioning, and only use automated speech recognition (ASR) captioning when the former is not possible, as it is still not accurate enough regarding accented speech and extraneous noise. If ASR is used, it needs monitoring for accuracy by the healthcare provider to avoid miscommunication. A chat box is essential to recap diagnosis and treatment plans, it is also required to type correct wording if ASR fails to pick up voice correctly for accurate real time captioning.
 - Use of ASR in telehealth appointments: Some video conferencing platforms already offer an automated captioning feature which is often based on artificial intelligence (AI) that can recognize continuous speech using speech-to-text software to deliver live captioning. Artificial intelligence, as part of the speech recognition process, will try to match what it recognizes as speech against a vocabulary list of terms. ASR and their accuracy and usefulness also depend on Wi-Fi, quality of audio in the call, speaker voice, accent and acoustics.
 - It is advisable for accuracy of medical treatment prescribed that professionals providing captioning are supporting communication. If this is not possible, healthcare professionals need to monitor text output and provide correct information in the chat box.
 - For mental health assessments, automated speech recognition apps shall not be used as they can provide confusing information.
- **Requirement 8:** Text messaging shall be included as a service to be used when the video or audio are not working well along with the chat box. Text messaging shall be set up to allow text communication to and from patients.
- For persons who are deaf or hard of hearing, the use of text messaging when video or audio are not accessible is important. Most people already use and understand how text messaging works as most are users of smartphones and familiar with this technology. This will help users of telehealth services to communicate with their health providers and the other way around.
- **Requirement 9:** Remote sign language interpretation or a video remote interpretation (VRI) system should be implemented and made available to persons who are deaf and hard of hearing as a standard part of telehealth services.
- A VRI client needs to call the VRI service and start the VRI session. It is assumed that the health service provider has a communication environment capable of receiving the communication requests (voice/video invitation) from the VRI agent. The VRI client terminal must be able to display and play two sets of audio and video signals: the VRI agent and the medical personnel. Also, it is desirable that the image of the VRI agent is at least as large as that of the medical personnel so that the sign language can be easily read. As not all hard of hearing and deaf people use sign language, a speech-to-text software should be available as an option on the platform.
- **Requirement 10:** Videos on telehealth platforms should include clear subtitles (easy to read and large font size) and avoid background music as it makes it difficult to listen to relevant information.

Guidance on developing subtitles is available elsewhere, for example in [b-ISO/IEC 20071-23].

- **Requirement 11:** The screen used for telehealth should be large enough for lip-reading.¹
 - Lip-reading allows someone to better understand what is being verbally communicated. This is done through observing the movement the speaker's lips as well as their facial expressions and body language, especially when using a hearing aid and in noisy situations. Therefore, to visualize the movements of someone's face, the screen must be large enough to provide enough detail.

8.3 Requirements for persons with speech difficulties

- **Requirement 12:** Platforms should include voice synthesizers and/or text-to-speech generators which can translate what people with speech impairment say.
 - Adaptive technology option should be available for people with speech difficulties. If those people cannot use their voice or their words are garbled, they can benefit from using a text-to-speech app or feature on the telehealth platform or a voice synthesizer that, using software technology, will communicate what they are saying. Text-to-speech (TTS) is a type of assistive technology that reads digital text aloud. With a click of a button or the touch of a finger, TTS can take words or sentences on a computer or other digital device and convert them into audio. A voice synthesizer is a type of TTS that allows a computer or other machine to read words out loud in a real or simulated voice played through a loudspeaker.

8.4 Requirements for persons with mobility issues

- **Requirement 13:** The controls of virtual visit applications should not be too restrictive in size, so that users with physical challenges will not have difficulty using the fine motor movements required to operate the platform.
 - People with mobility issues find it difficult to control the small muscles in their hands. Therefore, activities such as controlling the cursor, writing, or typing may be challenging. Larger controls of virtual visit applications will allow people with mobility issues to navigate the telehealth platform more easily.
- **Requirement 14:** The telehealth platform shall not explicitly require fine motor coordination (e.g., double-clicking which is difficult instead of single-clicking).
 - People with mobility issues find it difficult to control the small muscles in their hand. Therefore, an activity such as double-clicking becomes a barrier to these users and renders activities on the telehealth platform inaccessible.
- **Requirement 15:** The telehealth platform should avoid scrolling or using menu options to access information as much as possible.
 - People with mobility issues find it difficult to control the small muscles in their hand. Therefore, controlling the cursor or using specific keys to navigate the screen become more challenging and mean that users may not be able to access all the information they need.
 - Sufficient time needs to be provided to people with mobility issues to respond or to complete tasks, such as to fill out online forms.

¹ Whenever the telehealth service is provided from a healthcare facility to the house of the user, quality issues that might appear at user's side like sound quality, use of quality microphone or headset, or control of screen size are outside the scope of this Recommendation. The implementer of the telehealth service might provide advice to the user in this regard. When the telehealth service is provided from a healthcare facility to another facility or clinic, then the platform provider is responsible for the quality of the service at user's end.

8.5 Requirements for persons with mental health conditions and psychosocial disabilities

- **Requirement 16:** The telehealth platform should avoid unexpected, irrelevant, and inappropriate content that can be upsetting and trigger negative feelings and reactions.
 - People with mental health conditions and psychosocial disabilities may be negatively affected and impacted by exposure to personally sensitive content. If anticipated, it is important to avoid any such information. If it is necessary to convey personally sensitive content, there must be a trigger warning to make users aware of the potentially upsetting content ahead of time. Users should also be provided with a choice in information format, such as text instead of images or video with audio, that conveys meaning in a less emotionally immersive way.
- **Requirement 17:** The telehealth platform shall explain the measures implemented to ensure that usage and data remain safe, private, and secure in an effort to avoid negative thinking regarding the possibility of related undesirable consequences.
 - Ensuring safety, privacy and security remains a critical challenge for some telehealth platforms. Unfortunately, persons with mental health conditions and psychosocial disabilities may also feel uncomfortable using telehealth platforms due to a fear of undesirable consequences such as a data breach, problematic use and threats to privacy. It is crucial that telehealth services clearly state their stance on the safety, privacy and security of personally identifiable information that is being shared online and misused. This will help make persons with mental health conditions and psychosocial disabilities more comfortable when considering and using telehealth services.
- **Requirement 18:** The telehealth platform should avoid using complicated user interfaces and language that is difficult to understand and providing inadequate guidance on how to complete tasks.
 - Complicated and difficult to understand user interfaces can create barriers for persons with mental health conditions and psychosocial disabilities. The struggle to navigate the platform may be upsetting and cause users to avoid using the telehealth service.
 - The telehealth platforms should use simple language and be easy to use and navigate. Platforms should also provide adequate support to help users quickly recover from user-generated errors. This increases the accessibility of the service to people with mental health disorders who may already be apprehensive about telehealth.
- **Requirement 19:** The telehealth platform should avoid unnecessarily effortful tasks and allowing malfunctioning features to persist.
 - The telehealth platform should be simple and easy to use as intended. This increases the accessibility of the service to persons with mental health conditions and psychosocial disabilities who may already be apprehensive about telehealth. Increasing the ease of use by minimizing the mental effort to access information is critical. However, the effort to perform a task must allow for adequate deliberation.
 - Malfunctioning platforms can trigger catastrophic thinking and a reduced willingness to troubleshoot. The telehealth platform should ensure that the platform is constantly monitored for system errors and that identified errors are swiftly communicated to users when necessary and resolved.
- **Requirement 20:** The telehealth platform should avoid presenting low-quality information as this contributes to distrust.
 - Information on telehealth platforms must be up-to-date, relevant, credibly sourced, balanced and easily perceived and understood by persons with mental health conditions and psychosocial disabilities. Using an appropriate writing style and tone, easy to read language, pictograms and sound files can help ensure that the content is clear and

accessible. Platforms that feature a simple information structure, layout and design can also be useful in achieving this aim.

8.6 Requirements for persons with developmental and intellectual disabilities

- **Requirement 21:** Key documents and information provided by healthcare providers should be provided in accessible formats, such as in easy read formats.
 - Persons with intellectual disabilities experience limitations in adaptive behaviour such as conceptual skills which include language, literacy and number concepts. Information needs to thus be made easier to read and process. This means avoiding jargon, complicated words, abbreviations or symbols. It is good to summarize the most important points that need to be conveyed. Complex information should be simplified by explaining it using examples from everyday life. It is good to break information down into smaller sections using short sentences, bullet points and sub-headings. The text needs to be minimum 14 pt with extra space between the lines. Including pictures that illustrate the content of the text can also help. Even for persons without intellectual disabilities, this easy-to-read text will be more accessible for everyone.
- **Requirement 22:** The telehealth platforms shall allow for more than two people to participate in a meeting, e.g., people who provide personal support to persons with developmental and intellectual disabilities should be able to attend their meetings with healthcare providers.
 - People who provide personal support promote well-being and enhance individual functioning for persons with intellectual disabilities. This includes making information easier to understand and ensuring it is communicated directly to persons with intellectual disabilities. Communication difficulties between persons with intellectual difficulties and healthcare providers may lead to inaccuracies in the understanding or reporting of concerns, symptoms and history. Personal support can be required to access and participate in meetings and follow through on the recommendations.
- **Requirement 23:** Simple educational material on how to use telehealth services should be made available on the telehealth platform.
 - People with intellectual disabilities may have trouble using telehealth services due to the complexity of the systems or lack of digital literacy. Educational material that is easy to read allows persons with intellectual disabilities to use the platform. The material should explain what telehealth is, how to schedule telehealth, how to prepare for telehealth and how to participate in telehealth. This material could also come in the form of videos using both images and language that is simple and easy to understand.

8.7 Requirements for persons with learning disabilities

- **Requirement 24:** The layout of the text, instructions, documents and worksheets on the telehealth platform should be easily accessible for persons with dyslexia and other learning disabilities.
 - Persons with dyslexia can have difficulties following the text or graphs if these are not easily accessible. For example, the use of underlining or italics may make words 'run together', whereas bold text for titles and sub-headings or to draw attention to important information or key vocabulary is very important. Text boxes or borders for headings, as well as highlighting important text is instrumental. Including logical and easy-to-follow flow charts, illustrations and diagrams to break down large sections of text or to demonstrate a particular procedure is also important. Keeping paragraphs short and sentences simple is also helpful. More information on potential solutions can be found in the WCAG.

- **Requirement 25:** The text content should be made readable and understandable, and users need to be provided enough time to read and use content.
 - Some persons with learning disabilities experience great difficulty in recognizing written words, or inferring the meaning of a word or phrase from context, especially when the word or phrase is used in an unusual way or has been given a specialized meaning. Therefore, the text included on the platform should be presented in a readable way, and if needed, specific definitions or the expanded forms of acronyms or abbreviations should be available.
 - Many persons with learning disabilities need more time to complete tasks than the majority of users: they may take longer to physically respond, to read things, to find things or they may be accessing content through an assistive technology that requires more time. Therefore, if certain tasks are to be completed through the platform, enough time should be allocated, or if healthcare providers request patients to undertake tasks, they should provide sufficient time.
 - More information and concrete solutions can be found in W3C Accessibility standards.

9 Technical requirements during the planning phase

The healthcare service providers and manufacturers of telehealth platforms should develop a system to facilitate administrative advance planning for persons with disabilities. This system should provide easy to use communication techniques and ensure that these are in place so that healthcare professionals can anticipate users' specific needs when setting up telehealth appointments. The administrators should:

- Provide accessible ways and means to make the initial appointment via email, SMS and online booking system.
- Allocate enough time for telehealth appointments with persons with disabilities and specific needs.
- Develop robust and transparent registration processes to identify if an individual has any communication/information needs relating to a disability or sensory loss:
 - Record these needs in a clear, unambiguous and standardized way – electronically or using paper records (administrative systems or documents).
 - Ensure recorded needs are 'highly visible' by means of highlights, alerts or flagging up in the system. Whenever a service user's record is accessed by other staff members, they should be prompted to take action to communicate appropriately with the service user.
 - Share information about a service user's communication needs as part of existing data sharing processes, after obtaining patient permission and in accordance with existing information governance frameworks.
 - Take steps to ensure the service user receives information they can access and are able to understand, because it has been delivered in the way that was requested.
- Brief training/sensitization of healthcare providers on how to use telehealth services when communicating with persons with disabilities should be provided. This can be done through a short tutorial included on the telehealth platform or through other means. For example, healthcare providers should know to use a microphone close to their mouth, e.g., headset with close talk microphone, or microphone alone; speak slowly and articulate, reformulate sentences with simple words, etc.

10 Security

Consistent with the guidelines on web-based remote sign language interpretation or video remote interpretation (VRI) systems in [b-FSTP.ACC-WebVRI], real time communication through the web (WebRTC) must be protected according to the following WebRTC standards:

10.1 Datagram transport layer security (DTLS)

Datagram transport layer security (DTLS) is a communication protocol designed to protect the privacy of data and prevent eavesdropping and tampering, as defined by [b-IETF RFC 4347] and [b-IETF RFC 6347].

10.2 Secure real-time transport protocol (SRTP)

Secure real-time transport protocol (SRTP) is an encrypted RTP that is used to send and receive encrypted audio and video. SRTP is defined in [b-IETF RFC 3711].

10.3 Encryption

In the case of encryption, web real time communication (WebRTC) uses the standard encryption algorithm, which is widely used internationally. Accordingly, advanced encryption standard (AES) shall be used [NIST FIPS 197].

Annex A

Electromagnetic compatibility for accessible telehealth

(This annex forms a normative part of this Recommendation.)

Electromagnetic compatibility (EMC) is the ability of electrical equipment and systems to function acceptably in their electromagnetic environment, by limiting the unintentional generation, propagation and reception of electromagnetic energy which may cause unwanted effects such as electromagnetic interference (EMI) or even physical damage in operational equipment [IEC 61000-2-2].

Since much, if not most, of telehealth requires information communication technology (ICT) and electromagnetic equipment, EMC becomes an essential part of telehealth for its successful and effective deployment. This is especially true for accessible telehealth, as it is expected that parties under telehealth care must involve persons with disabilities and specific needs, and that the party will be extremely vulnerable if the requirements of EMC are not correctly met. This is also true in the case of home telehealth, where the patient receives service in their home.

Therefore, the practitioner of telehealth is expected to develop an appropriate EMC management plan that meets the requirements of relevant standards that will support the proper use of ICT in telehealth. This annex gives some guidelines on EMC for accessible telehealth.

The telehealth provider is required to be aware of the needs of EMC and provide appropriate set-ups according to the established relevant standards, in the following ways:

For the case of medical equipment, it is expected that [IEC 60601-1-2] has been consulted and implemented.

For other types of equipment used in telehealth, [ITU-T K.127] and [ITU-T K.136] (for wireless communication) and [ITU-T K.137] (for wired communication) are to be used. Further details are for future study.

Appendix I

Background information on accessibility of telehealth and e-health services

(This appendix does not form an integral part of this Recommendation.)

This appendix was developed as terms of reference for the preparation of this Recommendation and its sole purpose is to describe some key terms such as telehealth, digital information, e-health, m-health and accessibility, and to provide a list of resources.

I.1 Introduction

E-health has been a priority for the World Health Organization (WHO) since 2005, when the World Health Assembly resolution WHA58.28 was adopted: "e-health is the cost-effective and secure use of information communication technologies (ICT) in support of health and health related fields, including health-care services, health surveillance, health literature, and health education, knowledge and research".

By e-health we are referring to the use of information and communication technologies (ICT) for health and health related fields. The health sector like every other sector of the economy is being digitally transformed. Technologies have the advantage of being scalable and can serve remote populations and underserved communities.

Universal Health Coverage (UHC), is part of the post 2015 agenda geared to meeting the Sustainable Development Goals. Goal 3 "Ensure healthy lives and promote wellbeing for all at all ages" and its target 8 UHC cannot be achieved without the support of e-health.

Today, 85% of WHO Member States report having at least one mobile health or mHealth initiative.

Many mHealth initiatives are delivered through mobile platforms (mobile phones, smartphones, or tablets). The increase in mobile device penetration is a key enabler of the mHealth solutions and their expansion.

The growth of mobile-cellular telephone subscriptions is greater than the global population. The growth in active mobile-broadband subscriptions has been very strong, with penetration rates increasing from 4.0 subscriptions per 100 inhabitants in 2007 to 69.3 in 2018. The number of active mobile-broadband subscriptions have increased from 268 million in 2007 to 5.3 billion in 2018.

Developing countries are registering much faster growth in mobile broadband subscriptions compared to developed countries. In developing countries, penetration rates have reached 61 per 100 inhabitants in 2018 and are expected to keep growing in coming years. In least developed countries (LDCs), penetration rates went up from virtually zero in 2007 to 28.4 subscriptions per 100 in 2018. Nearly the entire world population, or 96 per cent, now lives within reach of a mobile cellular network.

E-health solutions need to reflect the needs of health professionals and all citizens. If these platforms are not accessible, they will increase the digital divide and inequalities creating a barrier for attaining Universal Health Coverage.

ICT should be available, affordable and accessible. An accessible ICT is different to an available ICT. mHealth applications should be available for everyone, affordable if they are meant to be used by underserved communities and persons with low levels of income and accessible to be used by persons with disabilities, older adults, persons with a temporary disability, immigrants, or in countries where more than one language is spoken.

In today's world situation more than ever it is important to guarantee that the digital information and digital platforms are accessible to everyone. Effective digital communication is imperative to reach everyone.

The mHealth market was worth USD 86.4 billion in 2018 and is expected to be USD 504.4 billion by 2025. Governments, mHealth solutions developers, disabled persons organizations DPOs, and academia, should work together to guarantee that these e-solutions are developed considering universal design principles.

The 2020 pandemic forced citizens all over the world to respect physical distancing. In this situation most information received was through electronic and digital formats. Mobile apps were developed for monitoring and tracking outbreaks. Non accessible digital information or apps left persons with disabilities, older adults, immigrants, and other vulnerable groups in a precarious situation that put their lives at risk.

I.1.1 Communication channels

All over the world governments are informing citizens through digital platforms and in many cases informing through these channels could become critical to save lives. The WHO Strategic Communications Framework for effective communications emphasizes that "*audiences rely on their ability to access the information they need to protect and improve their health. Communicators should identify all channels available and map their capacities to reach priority audiences. Using the right mix of channels helps empower audiences with the information they need to make informed decisions*". Communicators must consider the accessibility requirements of these communications channels to ensure all citizens are included and nobody is left behind.

In the digital world we are living in accessibility is fundamental to insure inclusion. Within the WHO key audiences there are **individuals** who make decisions about their own health and the health of their families, **healthcare providers** who make decision about screening diagnostics treatments and recommendations for patients, **communities** who make decisions about shared space activities and services with health consequences, **international organizations** who make decisions about funding and implementing health programs, **policy makers** with responsibility for their residents health, and there are persons with disabilities, older adults, immigrants and other vulnerable groups that are entitled to receive the digital communications. Accessibility is a cross topic that must be considered in every principle for effective communications.

According to the WHO, communication channels tend to fall into three main categories:

Mass media. These channels have broad reach and include television, radio, newspapers, magazines, outdoor and transit advertising, direct mail, and websites. Placement through these channels may be free through public service announcements or may incur a cost if placement on certain platforms or at specific times is important.

80% of countries reported that healthcare organizations use social media for the promotion of health messages. These guidelines will provide the main requirements that need to be considered to make mass media communications inclusive.

Organization and community. These channels reach specific groups of individuals based on geography (for example, a specific village) or a common interest, such as occupational status. Channels may include community-based media, such as local radio talk shows, organization newsletters; community-based activities, such as health fairs; and meetings at schools, workplaces, and places of worship.

Capacity building is important to communicators so they can reach everyone in the communities.

Interpersonal. People seeking advice or sharing information about health risks often turn to family, friends, healthcare practitioners, co-workers, teachers, counsellors, and faith leaders. These one-on-one discussions are often the most trusted channels for health information.

Effective leadership training is important to community leaders so they can reach everyone in the communities.

I.1.2 e-health services

The World Health Assembly of the World Health Organization adopted several resolutions on e-health: the use of information and communication technology (ICT) for health. The implementation of these resolutions will contribute to the achievement of Universal Health Coverage, an integral pillar to delivering the Sustainable Development Goals. e-health has been perceived as reducing the cost of healthcare, improving quality and equitable access to health services. Resolution WHA71.1 urge member States to prioritize the development and greater use of digital technologies in health to promote Universal Health Coverage. As a result, today more than half of the WHO Member States have an e-health strategy.

The Executive Board in January 2018 updated the report on mHealth recognizing that digital technologies are becoming an important resource for health services delivery and public health. Also, in collaboration with ITU, the WHO Secretariat is working to raise awareness, record trends, build capacity, establish guidance, and generate and document evidence on digital health, including mHealth, as a tool to promote user-centric, integrated service delivery. This strategy will consider ICT accessibility to ensure equity in the provision of digital services.

E-health solutions must be evaluated and mapped according to the services needed as well as the target audience. Solutions should be user-centric reflecting the demands of health professionals and citizens.

E-health solutions could be grouped in four main categories:

- a) **e-learning platforms:** healthcare systems worldwide face a severe health workforce shortage. Scaling-up of the health workforce is contingent on high-quality, relevant, and up-to-date health science education, aimed at building the knowledge, skills, attitudes, behaviours, and core values of health workers. The use of ICT for education, is increasingly recognized as one of the key strategies for health workforce training.
- b) **Health information systems:** these would include software to manage health information, process reviews, statistics, medical records, etc. This information systems include the adoption of electronic health records (EHR) defined as real-time, patient-centred records that provide immediate and secure information to authorized users. Some examples of health information systems include:
 - Management systems (appointments and patients' information)
 - Patients records
 - Patient monitoring
 - Health surveys
 - Treatment adherence
 - Surveillance
 - Decision support systems
- c) **mHealth:** mobile phone-based applications. They are normally used to take surveys, inform citizens, and for monitoring and tracking out outbreaks. In the 2015 Global Survey on e-health, mHealth was defined as the use of mobile devices – such as mobile phones, tablets, patient monitoring devices, and wireless devices – for medical and public health practice. Examples of mHealth applications provided in the survey covered a broad list from telephone helplines and text message appointment reminders, to mobile telehealth and mobile access to electronic patient information. Some examples of mHealth applications are:
 - Toll-free emergency numbers
 - Healthcare centre helplines
 - Appointment reminders

- Community mobilization
 - Information
 - Mobile telehealth
- d) **Telemedicine or telehealth** are digital platforms used to exchange medical knowledge through distance consultation group discussions. The practice of distance medicine involves an interaction between a healthcare provider and a patient when the two are separated by distance. That interaction may take place in real time (synchronously), for example by telephone or by use of a video link. However, it may also take place asynchronously (store-and-forward), when a query is submitted, and an answer provided later; (secure) email is an example of this technique. Some examples of telehealth uses are:
- Transmit information for the purpose of diagnosis or consultation:
 - Teleradiology
 - Teledermatology
 - Telepathology
 - Interaction between health provider and patient:
 - Telepsychiatry
 - Remote patient monitoring

I.1.3 ICT accessibility

In line with global commitments of inclusiveness and the Convention on the Rights of Persons with Disabilities (CRPD), ITU also addresses the digital inclusion of persons with disabilities. ITU's membership is fully committed to advancing ICT accessibility implementation in their counties and regions. This is also reflected in ITU's engagements and contribution towards inclusiveness in several Resolutions adopted by our members to support implementation of digitally inclusive societies. Moreover, ITU Strategic Goal nr. 2 "inclusiveness" and its Target 2.9 calls on ITU Members to ensure that *"By 2023, enabling environments ensuring accessible telecommunications/ICTs for persons with disabilities should be established in all countries"*. This is reflected in our work on ICT /digital accessibility for persons with disabilities and persons with specific needs aiming at ensuring that everyone, regardless gender, age, ability, or location equally and equitably can benefit of and be empowered by ICTs.

ITU work is fundamental to ensure that of e-health applications can be used by all. Digital accessibility enables digital inclusion and ensures inclusive communication for all people – regardless of their gender, age, ability, or location.

To achieve digital accessibility, ICTs should be not only be available and affordable, but also accessible, which means, designed to meet the needs and abilities of as many people as possible – including those with disabilities.

Accessibility of information and communication technology (ICT) is key given that ICTs have become the primary medium for communications, information, transactions, education, entertainment, and healthcare worldwide. Its implementation by legislators and policy makers in all countries is essential to ensure respect for all people rights to communicate in the connected world.

The recognition of the human right of access information and the joint efforts of many stakeholders have resulted in the development of accessible mainstream software and hardware. ICT accessibility procurement policies by government took a major role in creating a market for inclusive technologies as well as the development of harmonized accessibility standards all over the world.

While the use of e-health solutions is increasing in every country to achieve universal health coverage, it is imperative to ensure that no one is left behind.

I.2 How do people consume digital information?

As a result of the joint effort from different stakeholders to ensure that no one is left behind in the digital economy, today an important number of mainstream ICT devices and software are accessible. This means that these ICTs have embedded functionalities that eliminate barriers enabling different persons to use the services and products in equal circumstances.

Not only persons with disabilities, older adults, immigrants, and other vulnerable groups are the ones using special ICT features. There are many everyday life situations where everyone uses and benefits from the embedded accessibility features of mainstream ICTs; some examples are shown in Table I.1.

Table I.1 – Accessibility aspects for some everyday situations and potential beneficiaries

Situation	Accessibility feature	Beneficiaries
Checking your smartphone in bright sunlight	Changing the contrast of your mobile phone	<ul style="list-style-type: none"> – Everyone – Persons with low vision – Older adults – Colour blind persons
Very small font size	Increase font size	<ul style="list-style-type: none"> – Everyone – Persons with low vision – Older adults
Sending a text message while moving	Use voice message functionality, voice to text	<ul style="list-style-type: none"> – Everyone – Blind persons – Persons with a permanent or temporary motor impairment – Illiterate persons
Unable to read an information	Use embedded screen reader	<ul style="list-style-type: none"> – Everyone – Blind and visually impaired persons – Illiterate persons – Persons with cognitive or learning disabilities
Unable to reach your device	Use of voice assistance software	<ul style="list-style-type: none"> – Everyone – Blind and visually impaired persons – Illiterate persons – Persons with cognitive or learning disability – Persons with a permanent or temporary motor impairment
Unable to listen to your content (very noisy environments)	Captioning	<ul style="list-style-type: none"> – Everyone – Persons who are deaf or hard of hearing – Illiterate persons – Persons with cognitive or learning disability
Unable to understand the language the content is in	Use subtitles translated in other languages, automatic translation software	<ul style="list-style-type: none"> – Everyone – Persons who are deaf or hard of hearing – Immigrants

Table I.1 – Accessibility aspects for some everyday situations and potential beneficiaries

Situation	Accessibility feature	Beneficiaries
Need to interview someone from a distance	Use video calls, extra visual windows for sign language and chat boxes	<ul style="list-style-type: none"> – Everyone – Persons who are deaf or hard of hearing who lipread or need sign language interpretation
Need to receive silent alerts	Use vibration options or light options	<ul style="list-style-type: none"> – Everyone – Persons who are deaf or hard of hearing

These functionalities enhance the usability of the products and services are being utilized by everyone. Persons with more severe disabilities will use these functionalities alongside or instead of assistive technologies.

When creating digital content or developing software, accessibility requirements should be considered to ensure the information can be consumed by the vast majority of persons. Making healthcare information available to anyone needing it is both a human right and a responsibility.

Building capacity and engaging stakeholders are essential steps to ensure e-healthcare services are designed for everyone.

I.3 Accessibility guidelines for telehealth and e-health applications

The accessibility guidelines for telehealth and e-health applications have the objective to describe the criteria that any stakeholder must consider guaranteeing the accessibility of the information and communication technologies used in healthcare services.

The web content accessibility guidelines (WCAG) developed by the World Wide Web Consortium (W3C) are the international reference to ICT accessibility functionalities.

ICT accessibility procurement standards all over the world describe the functional performance expected by an ICT to be accessible. Inclusion in ICT has to do with alternatives, with the availability of different ways to access and consume information and to interact with the technology.

The following accessibility guidelines are based on international standards and should be considered in the development, procurement and dissemination of e-health services and products.

I.3.1 Communication channels

Stakeholders will use different communications channels to provide information, advice, and guidance to decision-makers (key audiences) to prompt action that will protect the health of individuals, families, communities, and nations. It is fundamental that when this content is delivered in digital format, that it should be accessible for everyone.

To ensure that everyone can have access to information through different digital channels, the following aspects must be considered:

- 1) **Public information in audio and visual formats** delivered through electronic displays in public spaces such as railway platforms, retail stores, parks and other public areas may not be available for persons that do not have access to personal ICT devices. When possible, graphics and images should be displayed in addition to text. Sound alarms and/or sirens used during the emergency situations must be accompanied by flashing lights to indicate the nature and level of threat.

- 2) **Radios** should offer the possibility to be used with attached devices or with special features to enable its use by people who are deaf or hard of hearing, e.g., devices that can transmit broadcasts through vibrations, flashing lights and simple texts. Online live radio or podcasts should include the possibility of providing a transcription of the content.
- 3) **Television news casts must provide** closed captioning/ or subtitling in local languages to make audio commentary accessible to people who are deaf or hard of hearing, or who do not understand the language. In addition, sign language interpreters should be used when providing televised information about an emergency situation, for instance, a pandemic like Covid-19.
- 4) **SMS:** people who need non-visual inputs and do not have access to smartphones that can convert text to other output formats such as audio will be excluded. Hence, warnings and alerts should also be issued in multiple formats across different dissemination channels. All images attached to messages must include alternative descriptions.
- 5) **If instant messaging applications** are used, it is necessary to ensure that the one chosen is accessible and is supported by screen readers embedded in mainstream smartphone operating systems. Voice assistants enable users to read instant messages aloud and dictate messages. Avoid using emojis when using **instant messaging applications like**.
- 6) **E-mail** notifications should be provided in multiple languages. The email management software chosen should be designed following accessibility guidelines so that it can operate seamlessly on different devices and with a variety of assistive technologies. Some desktop alerting systems can ensure that pop-up messages are delivered in different formats in addition to just texts and audio beeps. Use of graphics may assist people who have trouble understanding text. All images must include alternative descriptions.
- 7) **Social networks** are becoming increasingly accessible. Facebook, Instagram, Twitter, YouTube have been offering accessibility features for some time. It is important that the medical services and information agencies publishing information on these platforms are aware of digital content accessibility to ensure that the messages are accessible to all citizens.
- 8) **Websites** must be tested for accessibility to ensure that persons with disabilities do not face barriers in accessing the important information shared on them. Screen reader users may not be able to access the information on digital documents (Word, PDF) provided through websites in case they are created in non-accessible formats, such as JPEG files or image-based PDF documents (e.g., scanned images). On the other hand, images and graphics are excellent ways to depict content for people with cognitive disabilities, or people with linguistic differences; however, these must be supplemented with textual information to ensure that persons with visual impairments using voice or braille display output screen reading software are able to receive and understand the information. Links to external websites should be descriptive. Every element of the website should be keyboard accessible for persons that do not use a mouse.

I.3.2 E-learning

Online learning has shown significant growth over the last decade, as combining the Internet and education can provide individuals with the opportunity to gain new skills. The healthcare sector is no stranger to this trend.

There is an increasingly large number of e-learning platforms and it is important to ensure the accessibility of both the platform and the learning content beforehand, so that all students can use them including those with disabilities and to prevent discrimination:

- 1) **Universal access:** e-learning platforms must be supported by the device used by the student including built-in HTML with no requirements for add-ins. To achieve this, the platform should be designed and developed according to the W3C Web content accessibility

guidelines (WCAG) 2.1 and the authoring tool accessibility guidelines (ATAG) 2.0. When a learning management system (LMS) includes accessibility features students can navigate throughout its options, functionalities, courses and communication tools through the keyboard or a screen reader.

2) **Accessible eLearning content:** See the main body of text.

I.3.3 Health information systems

Health information system platforms are used to manage health information, processing reviews, statistics, and medical records.

Either for scheduling appointments or to manage information, these platforms should be accessible. Doctors with disabilities should be able to use these platforms as well as patients that need to interact with the technology.

ICTs have an enormous impact in the sector processing information and making data available that eventually is processed and used to offer better services for everyone. The inclusion of persons with disabilities is fundamental to ensure that they are not left behind in this statistic.

Online health information systems for public use through a website be developed according to the Web content accessibility guidelines WCAG 2.1. Images and graphics are excellent ways to depict and convey content to persons with cognitive disabilities, or people who do not speak the local language; however, these must be supplemented with alternative text information to ensure that persons with visual impairments using voice or braille display output screen reading software are able to receive and understand the information depicted through the images and graphics.

Every element of a website, including forms, schedules, maps should be accessed with the keyboard for persons that do not use a mouse.

Finally, to protect the right of full access to information, these systems need to ensure they provide individuals secure access to their personal medical records in accessible electronic formats.

Electronic documents (Word, PDF, etc.) provided through these systems may be inaccessible by persons using assistive technologies such as screen readers if they are provided in formats that are not compatible with them, such as JPEG image files or scanned image PDFs (e.g., scanned images).

I.3.4 Mobile health (mHealth)

The introduction of mobile devices (smartphones, tablets, etc.) has greatly impacted many fields, including medicine. Healthcare professionals now use mobile devices like smartphones or tablets to carry out numerous tasks that were not possible some years ago. Smartphones and tablets combine both computing power and communication features in a single device that can be held in a hand or carried in a pocket, allowing easy access and use at the point of care. In addition to voice and text, new mobile device models offer more advanced features, such as web searching, global positioning systems (GPS), high-quality cameras, and sound recorders. With these features, as well as powerful processors and operating systems, large storage capacity, and high-resolution screens, mobile devices have essentially become handheld computers.

It is essential that mobile apps developed for iOS or Android are accessible. Smartphones and tablets come with built-in accessibility features; however, to make the most of them, application user interfaces must be compatible with these functionalities. Even though there are not specific technical standards for mobile applications, the same accessibility principles that apply to web apply to mobile apps.

Here are some guidelines to consider ensuring mobile apps are perceivable, operable, and understandable.

- a) Alternative text descriptions for non-text content: images and charts should have an alternative text that describes them. This text is not apparent to the view but is tagged in the code of the app so that certain voice output assistive technologies (built-in or installed) can detect and read them aloud.
- b) Videos and audio content should also have captions made available. Video players should display an accessible indication informing that captions are available alongside an accessible button next to the video screen that allows to turn captions on or off.
- c) Visible focus indicator. Persons with mobility or dexterity disabilities often rely on custom gestures to use their mobile devices. When doing so, it is necessary there is a clear indication of where focus is so that they know what element will be activated.
- d) Applications should display text in large font.
- e) If speech output is used, it must be possible to specify speech rate and volume.
- f) Some users find it easier to read and understand the content of an app by changing the style. For instance, presenting information in yellow on a black background, or highlighting text in blue. The user should be able to override the author's stylesheets to always display text in the needed colour scheme.
- g) Apps should provide full keyboard access for persons that use simple gestures to move between elements of the app.
- h) App should avoid using flashing content that could trigger photosensitive seizures.
- i) Apps must help users avoid and correct mistakes
- j) Apps must provide persons with learning disabilities with adjustable time to carry out actions.
- k) Content should not be restricted to a single orientation.
- l) Apps must have a title, and content must follow a hierarchical structure by means of headings.

I.4 Methodology and development process

For the development of the Recommendation, ITU and WHO adopted an inclusive stepwise approach, involving closely civil society including persons with disabilities and their representative organizations, as well as the industry. The starting point in the development of the Recommendation was the identification of challenges and barriers that persons with disabilities experience when accessing telehealth services. For the purpose, firstly, a scoping literature review searching for evidence on barriers to telehealth services was carried out in relevant medical databases such as PubMed, and in a grey literature search. Search terms relevant to telehealth (e.g., telehealth, telemedicine, digital health, e-health services), disability (e.g., disability, persons with disabilities, people with disabilities) and barriers (e.g., barriers, access, inequality, gaps, challenges) were used to identify studies relevant to the topic.

A set of barriers was identified, which served as a basis for discussion in a seminar organized by WHO and ITU in March 2021, where the input and perspective of civil society was sought. More than one hundred participants provided an additional list of challenges that were incorporated in the then draft Recommendation. In addition, an online survey was circulated among participants and other organizations of persons with disabilities that could not attend the seminar, seeking their additional contributions. After a complete set of challenges was defined, the corresponding requirements to address these barriers were determined. A workshop organized by ITU with the participation of representatives from the industry was held in June 2021 to obtain their perspective and input on the Recommendation. All these contributions enriched the Recommendation immensely.

This Recommendation outlines the most important requirements on concrete accessibility features for equitable delivery of telehealth services. As such these requirements need to be adopted by governments when planning and implementing telehealth services, by manufacturers when designing the telehealth platforms to ensure a universal design, and lastly by healthcare providers when delivering healthcare services. The current Recommendation includes the necessary requirements that will help ensure equitable, accessible, effective and safe delivery of telehealth. However, the methods of implementation of these requirements may vary depending on resources available or technological advancements. Therefore, an implementation guide that contains practical and concrete solutions on how each of these requirements can be met to ensure compliance with the current Recommendation will be issued in the future.

The recommendations included in this Recommendation are built around groups of persons with disabilities with different impairments. There are three main reasons why this approach has been taken.

Firstly, the starting point in the development of the Recommendation were the challenges that persons with disabilities experience when using telehealth services. As persons with disabilities are a diverse group of individuals, the challenges, hence also the corresponding requirements vary substantially and cannot be grouped into one category. Secondly, the Recommendation contains specific requirements for features that need to be incorporated in the design of the telehealth platforms. These features will then enable healthcare providers to adapt their services to the different needs and priorities of persons with disabilities. For example, an available feature that provides the option of changing size and font of text will allow healthcare providers to select the most appropriate font and size of text depending on the patient. As such, a list of requirements structured around types of disabilities will facilitate practitioners to have information on the specific needs of different populations, e.g., persons with hearing loss or persons with psychosocial disabilities. Finally, this Recommendation aims to standardize a whole sector. As many countries provide specialized teleservices such as tele-audiology focusing on a specific subpopulation, it is important to outline the requirements that persons who are deaf or hard of hearing have in this Recommendation.

Even though this Recommendation is the result of a comprehensive evidence-based and consultative process, it does not pretend to be exhaustive. Future updates of the Recommendation will be issued if and when required.

I.5 Important resources

- 1 ITU, *National E-Health Strategy Toolkit*, (2012), available at <https://www.itu.int/en/ITU-D/ICT-Applications/Pages/e-health-strategies.aspx>
- 2 ITU Digital Inclusion – ICT/digital accessibility website and resources (including trainings and tutorials, guidelines, policies and strategies,) available at:
 - <https://www.itu.int/en/ITU-D/Digital-Inclusion/Persons-with-Disabilities/Pages/Persons-with-Disabilities.aspx>
 - [ITU-D Creation and remediation of accessible digital contents](#) (video tutorials)
 - ITU-D [ICT Accessibility: the Key to Inclusive Communication](#) (self-paced online course)
 - ITU-D [Web Accessibility: the Cornerstone of an Inclusive Digital Society](#) (self-paced online course)
 - [Toolkit and Global Standard for safe listening devices and systems](#) (2019)
 - [Artificial Intelligence and Information Communication Technology Accessibility](#) (2019)
 - [Standards in the Procurement of Accessible Products and Services](#) (2019)

- [Future of Accessible Audiovisual Media Services, TV and Video Programming](#) (2019)
 - [Report to WTDC 2017 on Question 7/1: Access to telecommunication/ICT services by persons with disabilities and with specific needs](#) (2017)
 - [Model ICT Accessibility Policy Report](#) (2014)
 - [Universal Service Funds and Digital Inclusion for All](#) (2013)
 - [Making Mobile Phones and Services Accessible for Persons with Disabilities](#) (2012)
 - [Making Television Accessible](#) (2011)
- 3 WHO, *Resolution WHA71.1*, (2018), available at https://apps.who.int/gb/ebwha/pdf_files/WHA71/A71_R7-en.pdf?ua=1
- 4 WHO, *mHealth Use of appropriate digital technologies for public health*, (2018) available at https://apps.who.int/gb/ebwha/pdf_files/WHA71/A71_20-en.pdf
- 5 WHO, *mHealth New horizons for health through mobile technologies*, (2011), Global Observatory for eHealth series – Volume 3, available at <http://apps.who.int/iris/handle/10665/44607>
- 6 WHO, *WHO Strategic Communications Framework for effective communications*, (2017), available at <https://www.who.int/docs/default-source/documents/communicating-for-health/communication-framework.pdf>.
- 7 WHO, *Be He@lthy Be Mobile Annual Report*, (2016), available at <https://www.who.int/publications/m/item/be-healthy-be-mobile-annual-report-2016>
- 8 WHO, *Global diffusion of eHealth: making universal health coverage achievable, Report of the third global survey on eHealth*, (2016), Global Observatory for eHealth, available at <https://www.who.int/publications/i/item/9789241511780>.
- 9 WFD / IFHOH statement on use of ASR <http://wfdeaf.org/news/resources/27-march-2019-wfd-ifhoh-joint-statement-automatic-speech-recognition-telephone-relay-services-captioning-services/>
- 10 NHS Accessible Information Standard <https://www.england.nhs.uk/wp-content/uploads/2017/10/accessible-info-standard-overview-2017-18.pdf>

Bibliography

- [b-ITU-T F.791] Recommendation ITU-T F.791 (2018), *Accessibility terms and definitions*.
- [b-FSTP.ACC-WebVRI] Technical paper ITU-T FSTP.ACC-WebVRI (2020), *Guideline on web-based remote sign language interpretation or video remote interpretation (VRI) system*.
<https://www.itu.int/pub/T-TUT-FSTP-2020-ACC.WEBVRI>
- [b-ITU RR] ITU Radio Regulations, *Section IV. Radio Stations and Systems – Article 1.166*.
- [b-IETF RFC 3711] IETF RFC 3711 (2004), *The Secure Real-time Transport Protocol (SRTP)*.
- [b-IETF RFC 4347] IETF RFC 4347 (2006), *Datagram Transport Layer Security*.
- [b-IETF RFC 6347] IETF RFC 6347 (2012), *Datagram Transport Layer Security Version 1.2*.
- [b-ISO 9999] ISO 9999:2016, *Assistive products for persons with disability – Classification and terminology*.
- [b-ISO/IEC 20071-23] ISO/IEC 20071-23:2018, *Information technology – User interface component accessibility – Part 23: Visual presentation of audio information (including captions and subtitles)*.
<https://www.iso.org/standard/70722.html>
- [b-Krupinski] Krupinski, E.A. and Bernard, J., 2014, March. *Standards and guidelines in telemedicine and telehealth*. In Healthcare (Vol. 2, No. 1, pp. 74-93). Multidisciplinary Digital Publishing Institute.
- [b-NSW] NSW Health. 2016. *Telehealth framework and implementation strategy 2016-2021*.
- [b-W3C WAI] W3C, Web Content Accessibility Guidelines (WCAG) Overview.
<https://www.w3.org/WAI/standards-guidelines/wcag/>
- [b-WHO-COVID19] World Health Organization. 2020. *The impact of the Covid-19 pandemic on noncommunicable disease resources and services: results of a rapid assessment*.
- [b-WHO ICF] World Health Organization (2001), *International Classification of Functioning, Disability and Health*.
<https://apps.who.int/iris/bitstream/handle/10665/42407/9241545429.pdf?sequence=1>
- [b-WHO-Telehealth] World Health Organization. 2016. *Telehealth: Analysis of third global survey on eHealth based on the reported data by countries*.

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