Research Report: Research and Inform Standards for Next Generation 911

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# Introduction

In today's fast-paced world, access to emergency services is critical for all individuals, including those with disabilities. With the advent of new technologies and communication devices, traditional methods of accessing emergency services, such as dialing 911, may not be accessible or feasible for people with disabilities. Canada is in the process of making the transition to some of these next generation methods of contacting 911 (NG911). This study aims to explore alternative methods of accessing emergency services, specifically 911, through next generation technologies for individuals with disabilities. Through a survey of individuals with disabilities, this study seeks to understand the current landscape of alternative methods and identify opportunities for improvement in accessibility and ease of use.

The research focused on evaluating the awareness, use, and effectiveness of various alternative methods for accessing 911 among individuals with disabilities. The research was composed of an environmental scan, focus groups, a national survey and interviews with industry professionals that supplied insight into their concerns.

The findings of this study will provide valuable insights for policymakers, emergency services providers, and technology companies to improve emergency services for people with disabilities and more specifically, valuable insights into the development of more inclusive emergency services and inform the design of future technologies.

This research is supported by funding from Accessible Standards Canada through the Advancing Accessibility Standards Research program. This report will concentrate on the findings of the national survey and how it built on the results of the environmental scan.

# Methodology

A survey was used to collect data on attitudes and ranking of new methods for contacting 911 among individuals with disabilities. The survey was designed to assess awareness, use, and effectiveness of various alternative methods for accessing 911, such as text-to-911, video call-to-911, and smartphone apps for contacting emergency services. The survey was distributed to a convenience sample of individuals with disabilities who were recruited through disability organizations, support groups, and online platforms.

The survey consisted of both closed-ended and open-ended questions, and it was conducted online to ensure accessibility for individuals with disabilities. Participants were asked to rank the methods in order of preference and to provide reasons for their ranking. The survey data was analyzed using descriptive statistics and content analysis.

# Target participants

The researchers first identified the main disability groups they would reach out to for the research. This would make the content and questions more relatable to the target audience. They identified five main groups: vision loss, mobility loss, hearing loss, speech loss, and cognitive impairment. These groups are covered in more detail below.

## People with Vision Loss

People with vision loss represent a significant portion of the population with disabilities and can benefit greatly from alternative methods for accessing emergency services. This study aims to understand the attitudes and ranking of new methods for contacting 911 among individuals with vision loss. The study will focus on individuals with mild, moderate, and severe levels of vision loss, including those with partial or complete vision loss, and those who are blind.

## People with Mobility Loss

Individuals with mobility loss also represent a significant portion of the population with disabilities and face unique challenges when accessing emergency services. This study aims to evaluate the attitudes and ranking of new methods for contacting 911 among individuals with mobility loss, including those with mild, moderate, and severe levels of mobility loss. The study will focus on individuals with mobility impairments, such as those with limited mobility, wheelchair users, and those with physical disabilities. The focus will be on dexterity and arm movement.

## People with Hearing Loss

Individuals with hearing loss face unique challenges when accessing emergency services and are a target group of this study. The study aims to understand the attitudes and ranking of new methods for contacting 911 among individuals with hearing loss, including those with mild, moderate, and severe levels of hearing loss. The study will focus on individuals with hearing impairments, such as those who are hard-of-hearing or deaf.

## People with Speech Loss

Individuals with speech loss face challenges when accessing emergency services and are also a target group of this study. The study aims to evaluate the attitudes and ranking of new methods for contacting 911 among individuals with speech loss, including those with mild, moderate, and severe levels of speech loss. The study will focus on individuals with speech impairments, such as those with stutters, speech disabilities, or those who have lost their ability to speak.

## People with Cognitive Impairment and Intellectual Disability

Individuals with cognitive impairments and intellectual disabilities face unique challenges when accessing emergency services and are a target group of this study. The study aims to understand the attitudes and ranking of new methods for contacting 911 among individuals with cognitive impairments including those with mild, moderate, and severe levels of impairment. The study will focus on individuals with cognitive impairments, such as those with memory loss, attention deficits. It will also include people with intellectual disabilities.

The results of the study will provide valuable information for emergency services providers, technology companies, and policymakers to improve access to emergency services for individuals with all these disabilities and levels of ability.

# Severity Levels

We also split each disability group into mild, moderate, and severe levels of ability loss sub-groups to provide a more comprehensive understanding of the specific challenges faced by individuals with disabilities and the different levels of support that might be needed. Defining the specific levels of support required by individuals is crucial in developing effective solutions and allocating resources more efficiently to meet the unique needs of each group.

By utilizing this method of classification in a survey study, researchers can gain valuable insights into the experiences and attitudes of individuals with disabilities, helping to inform public policies and improve the lives of individuals with disabilities.

## Definition of Mild, Moderate, and Severe

The definitions of mild, moderate, and severe can vary slightly depending on the specific disability group being studied. For example, mild vision loss may refer to individuals who have some visual impairment but can still perform daily activities with the help of glasses or other devices, while moderate vision loss may refer to individuals who are unable to perform daily activities without assistance. Severe vision loss may refer to individuals who are completely blind. Similarly, mild mobility loss may refer to individuals who experience occasional difficulty with dexterity and arm movement, moderate mobility loss may refer to individuals who have no dexterity but still have arm movement and use wheelchair, and severe mobility loss may refer to individuals who no dexterity or arm movement and use an electric wheelchair.

## Importance of Defining Severity

Defining the level of support for each disability is crucial to understanding the unique challenges faced by each group. For example, individuals with mild vision loss may require alternative methods of accessing emergency services that are different from those required by individuals with severe vision loss. Understanding the specific needs of each group is essential in developing effective solutions that meet their needs. Additionally, defining the severity of each disability also allows for a more accurate representation of the disability community, as it provides a more nuanced understanding of the challenges faced by individuals with disabilities.

## Defining Mild, Moderate, and Severe Vision Loss

For individuals with vision loss, mild refers to those who have some vision loss but still have enough vision to perform daily activities with the aid of strong prescription glasses or other visual aids. Moderate vision loss refers to individuals who retain only a small portion of their vision. This includes people with a restricted field of view or who can only see objects when held extremely close to their eyes. These users typically require some form of high magnification to perform daily activities. Severe vision loss refers to individuals who are completely blind or are considered legally blind due to the degree of vision loss.

## Defining Mild, Moderate, and Severe Mobility Loss

For individuals with mobility loss, mild refer to those who experience occasional difficulty with mobility, specifically dexterity for this study, but still have the ability to perform daily activities independently though it may take them longer. Moderate mobility loss refers to individuals who have no dexterity but who may retain some use of their arms. This is often accompanied by a loss of mobility which requires the user to use a manual or electric wheelchair. Severe mobility loss may refer to individuals who have no dexterity or use of their arms. This usually is accompanied by a total loss of mobility and they need to use an electric wheelchair.

## Defining Mild, Moderate, and Severe Hearing Loss

For individuals with hearing loss, mild refers to those who have difficulty hearing certain sounds but are still able to hear speech in a quiet room. This group includes people who have problems separating out sounds in a crowded room or determining the direction of sound. Moderate hearing loss refers to individuals who require the use of a hearing aid to hear speech, but still have difficulty with certain sounds, while severe hearing loss may refer to individuals who are deaf and require alternative communication methods, such as sign language, to communicate.

## Defining Mild, Moderate, and Severe Speech Loss

For individuals with speech loss, mild refers to those who have difficulty with certain sounds but are still able to communicate verbally, while moderate speech loss refers to individuals who have difficulty with speech but are still able to communicate with the aid of speech therapy or other communication devices. Severe speech loss refers to individuals who are unable to communicate verbally and require alternative communication methods such as sign language or a communication device.

## Defining Mild, Moderate, and Severe Cognitive Impairment

The definitions of mild, moderate, and severe levels of cognitive impairment can vary depending on the specific context and the individual's abilities. However, in general, the following definitions can be used. A mild level of cognitive impairment is where an individual may experience some difficulties with memory, attention, or decision-making, but is still able to perform daily activities and maintain independence. A moderate level of cognitive impairment is where an individual may have more significant difficulties with memory, attention, decision-making, and other cognitive functions. They may need more assistance with daily activities and may be at risk of becoming dependent on a caregiver. A severe level of cognitive impairment is where an individual has significant limitations in cognitive functioning and may require constant assistance with daily activities. They may have difficulty with communication and may be dependent on others for their care. It's important to note that these levels are general guidelines, and the specific level of impairment can vary greatly from person to person. Additionally, it's important to consider that cognitive impairment can affect different aspects of an individual's functioning, and not just their intellectual abilities. For example, they may also have difficulties with emotional regulation, social interactions, and physical coordination.

# Focus Groups

Before creating the national survey, the researchers wanted to collect qualitative data on each next-generation 911 service to influence our multiple-choice answers, get feedback to make our content easier to understand, learn more about the technical difficulties faced by people with disabilities, and collect quotes of how this technology could help them in past or future emergencies.

## Focus Group Recruitment

The researchers distributed a recruitment survey among the deafblind, blind, deaf, mobility, and cognitive disability communities. The participants were screened to identify their disability, their level of ability, mobile phone usage, and history of contacting 911.

Eligible participants were grouped by disability and severity and scheduled to participate in a focus group of around four participants each. All the focus groups were held remotely via Zoom except for the deafblind one as it required tactile sign language interpreters to be present. There were 12 focus groups in total.

## Focus Group Methodology

In the focus group, the researchers asked people questions regarding their past experiences in contacting 911 as well as their familiarity with smartphones. This was asked because it can influence their opinions. Then attendees were shown videos of the new services that would be applicable for their disability. After each video, they asked them what their first impressions of the service were, the benefits of the service, the drawbacks of the service, and whether they thought they would use it in an emergency.

At the end, the researchers asked each participant to rank the services shown in the order they would most likely use to least likely use in an emergency. We then asked them why they ranked some services higher than others.

## Focus Group Content

We showed six next-generation services in the focus groups. Below is a short description of each service.

**Text messaging with attachments:** Text messaging with attachments allows users to include multimedia content such as sound, images, and videos in text messages. When adopted by 911 emergency services, users can utilize photos and videos rather than verbal descriptions to show the scene to emergency staff, thus accelerating their response time.

**Live video streaming:** Live Video is a service that allows users to record and broadcast what their phone camera sees in real time, but without the ability to see the operator like one would with a video call. When adopted by 911 services, users can show the emergency via video and let emergency staff assess the situation.

**Real-time text messaging:** Real-Time Text is a service that transmits text instantly as it is being typed, with the recipients having the ability to read the message as it is being written without waiting. When adopted by 911 services, users can text fast and silently, thus accelerating response time and reducing the probability of harm.

**Total Conversation:** Total Conversation is a concept that combines voice, video, and text into a simultaneous chat service that enables richer and more accessible experiences. People with disabilities can express themselves the way they are most comfortable with, such as Sign Language, Real-Time Text, or video-assisted Speech-to-Speech.

**Help app:** The Help App makes use of the Live Video service which allows users to record and broadcast what their phone camera sees in real-time, without the ability to see the operator like one would with a video call.

**Picture help app:** The Picture Help App is a service wherein users can utilize icons instead of spoken or written words to communicate with emergency staff. The Picture Help App also uses Geo-location data.

## Focus Group Findings

Across the disability groups, if the individual could communicate by speech, they preferred that method of primary communications to 911. It was familiar and it was efficient and effective at getting their needs communicated to the 911 operator.

Texting was perceived to be slower than speaking. This is especially true for those with mobility or vision loss as they rely on voice dictation. Texting only ranked highly for those with hearing loss or those who were Deaf.

Being able to send a picture or video to better explain the situation was considered a good and valuable enhancement to the process especially to people who were low vision or blind. People with cognitive conditions had some concerns about the complexity of the process of sending pictures and videos. The researchers hypothesize that many of these users did not have a lot of experience taking pictures and videos. It was similar for those who were Deaf-Blind in that they were concerned about the complexity of the process to take a picture and video. People who were Deaf-Blind, due to the lack of vision, were additionally concerned that they could not take relevant pictures and videos. Participants who were blind were less concerned about this as many already take pictures to use a service like “Be My Eyes”, which uses volunteers to identify labels and other visual cues for people with low vision or who are blind from pictures taken by the user. People with high level mobility impairments were additionally concerned about being able to position the camera so that they could take relevant photos and videos given that their phones are often mounted in a fixed way on their wheelchair.

In general, many participants liked the flexibility to choose their mode of communication through the Total Conversation service. People in the Cognitive and Deaf-Blind groups were concerned about the complexity of the interface but thought they would have a better ability to use it with training. People who were Deaf, Deaf-Blind, and with Cognitive conditions emphasized the need for training workshops and practice with any new methods. They said they learned better using visual or hands on presentations than through other teaching methods.

The icon help app was consistently ranked lowest across all the disability groups. This was because interpreting icons takes longer than sending photos or videos, especially if some of the pictures look similar. Many participants also agreed that regular training will be needed as they feel understanding pictograms in an emergency would make them more anxious.

# National Survey

The national survey closely followed the format of the focus groups except we collected information about each respondent’s disability, level of ability, and mobile phone usage before we showed videos of the next-generation 911 services.

Common responses from focus group questions were categorized to create multiple-choice answers for our national survey. This made it easier for people who have trouble typing and for us to analyze the results.

## Survey Results

We advertised our online survey through disability partner organizations and on social media for a month and a half. We then ran the survey for two months. From this, we collected 493 validated responses.

## Demographics

More than half of our survey respondents said they have a mobility or cognitive disability. Most mobility respondents are classified as severe. Most cognitive respondents are classified as mild. Of the 493 responses, 34% of respondents have mobility-loss, 30% have cognitive-loss, 18% have hearing-loss, 17% have vision-loss, and 1% are deafblind.

Most respondents are between the ages of 34 to 60. 28% of respondents are between 34 to 40, 31% of respondents are between 41 to 50, and 22% of respondents are between 51 to 60. The distribution of disability groups is around the same in every age group.

Of the 493 responses, 39.1% of the responses came from Ontario, 20% of responses came from British Columbia, 15% of responses came from Quebec, and 12% of responses came from Alberta. The distribution of disability groups is around the same for each province.

Most respondents said their highest level of education is after high school. 39% attended up to university, 34% attended up to college, and 17% attended up to high school. There is no correlation between the disability group and their highest level of education.

Seven participants were disqualified because they do not own or use a mobile device. The top three reasons for not owning a phone were that it is too expensive to buy these devices (36%), it is too hard to use or learn (27%), and that the data plan is too expensive (18%).

## Accessibility Aids Used

The researchers asked participants what accessibility aids they use, to help determine the severity level of their disabilities. This is helpful when they said they have multiple disabilities and the researchers wanted to determine the most appropriate video branch to show them.

### Mobility

For mild mobility loss participants, the top three accessibility aids used are walkers (62%), wheelchairs (14%), and speech-to-text (7%).

For moderate mobility loss participants, the top three accessibility aids used are walkers (37%), wheelchairs (22%), and speech-to-text systems (17%). 13% of moderate mobility loss participants said they do not use any accessibility aids.

For severe mobility loss participants, the top three accessibility aids used are alternative pointing devices (28%), intelligent personal assistants (22%), and wheelchairs (19%). 1% of severe mobility loss participants said they do not use any accessibility aids.

### Cognitive (Intellectual disability not included)

For mild cognitive loss participants, the top three accessibility aids used are walkers (25%), intelligent personal assistants (15%), and speech-to-text (13%). 20% of mild cognitive loss participants said they do not use any accessibility aids.

For moderate cognitive loss participants, the top three accessibility aids used are speech-to-text (18%), intelligent personal assistants (14%), and text-to-speech (14%). 2% of moderate cognitive loss participants said they do not use any accessibility aids.

### Hearing

For mild hearing loss participants, the top three accessibility aids used are hearing aids that do not have a telecoil (44%), speech-to-text (21%), and hearing aids with a telecoil (11%). 12% of mild hearing loss participants said they do not use any accessibility aids.

For moderate hearing loss participants, the top three accessibility aids used are speech-to-text (29%), teletypewriters (21%), and hearing aids with a telecoil (21%).

For severe hearing loss participants, the top three accessibility aids used are speech-to-text (39%), teletypewriters (32%), and cochlear implants (20%).

### Vision

For mild vision loss participants, the top three accessibility aids used are screen magnifiers (35%), text-to-speech (31%), and intelligent personal assistants (20%). 2% of mild vision loss participants said they do not use any accessibility aids.

For moderate vision loss participants, the top three accessibility aids used are intelligent personal assistants (29%), screen readers (21%), and speech-to-text (13%). 4% of moderate vision loss participants said they do not use any accessibility aids.

For severe vision loss participants, the top three accessibility aids used are screen readers (38%), intelligent personal assistants (35%), and speech-to-text (7%).

### Deafblind

For deafblind participants, the top three accessibility aids used are screen readers (67%), intelligent personal assistants (42%), and hearing aids with a telecoil (25%).

# Overall Service Ranking

The service rankings are determined by subtracting the number of people who ranked a 911 service as their top two choices from the number of people who ranked a service as their bottom two choices.

Since some groups did not watch some videos, some of the service rankings have been scaled up. This prevents services that ranked highly with some groups to be ranked low overall. The adjusted values are suffixed by “ratio”. The formula to adjust these values is “(<# of people who said yes> \* <# of respondents>) / <# of people who watched the video>”.

Overall, total conversation ranks the highest with the score of 287, followed by live video streaming at 229, then the help app at 151. This ranking makes sense as these services allow the use of voice in addition to video. Many participants felt that having video allowed them to better show the emergency with less words. Many people liked the help app because it automatically gives the operator information about the caller’s name, location, and medical information. This allows them to skip to showing the video. Total conversation ranks the highest as it also allows the use of real-time text. This gives more ways for people to communicate regardless of their disability.

The traditional phone sits in the middle at -15 as the tried-and-true option. This score was brought down by the hearing-loss group that prefers text or video-based communication methods. Following that is MMS at -96 and RTT at -143. These two services are ranked low by the mobility, vision, and deafblind groups. One major advantage of MMS and RTT is the ability to communicate silently, but this is not feasible with their assistive technologies. Many mobility-loss and vision-loss participants said it was impractical for them to type without using voice dictation or they cannot use the service without the screen reader.

MMS tends to rank higher than RTT because more people are familiar with how to use it and it allows for photo and video attachments. RTT is less preferred, even among the moderate and severe hearing-loss groups due to the higher learning curve of enabling RTT on the phone and choosing the RTT call option. This may change though when the service is rolled out across Canada and awareness of this feature grows.

Following that is STS (Speech-to-Speech relay) at -184, VUTE at -211, and VRS (Video Relay Service) at -477. Respondents classified as expert users tend to dislike VUTE more probably because they feel their ability will allow them to use other options to get help faster. VRS is ranked low because most hearing-loss respondents do not know sign language.

# Per-Service Ranking

The researchers showed participants a video of each NG911 service. The video shows how they can use the service to get help. After the video, we asked them how the service can make it easier or harder for them to get help. We also asked them how it could help them in a past or future emergency.

The videos are specially made for each disability group to help participants relate to the situations. Some groups did not watch some NG911 service videos as the researchers felt it did not apply to them.

## VUTE, Picture Help App

This service was only shown to mild and moderate cognitive participants.

Participants liked that the app will tell the operator where they are (39%), they can get help even if they do not know words or speak (33%), and that the pictures can help them make sentences (28%). All the participants, regardless of disability group, were evenly split on the benefits of the service.

Participants were most concerned that there may not be a picture to explain the emergency (34%), it takes longer to know what the pictures mean (23%), and there are too many steps and picture choices (18%). All the participants, regardless of disability group, were evenly split on the benefits of the service.

## MMS, Text Message with Attachments

This service was shown to all groups except for moderate cognitive.

Participants liked that MMS can be used in places where phone calls drop (16%), it can be used in places where it is hard to hear (14%), and photos or videos can be used to show what is happening without words (14%).

The hearing-loss group felt that MMS is particularly helpful to them because they can use it even if they have trouble hearing or speaking and also get help without talking. Participants who have hearing-loss or are deafblind did not feel they can use this service with voice-to-text.

Participants are most concerned about getting close to a dangerous situation to take a photo or video (12%), the need to register first before texting to 911 (12%), and the need to take another photo or video if the situation has changed (11%).

Participants with mobility loss are particularly concerned about voice dictation getting some words wrong (9%), the difficulty of taking a photo or video and adding to a message (8%), the difficulty of pointing the camera at the subject and keeping still (7%), and the need for training to learn how to use MMS (7%).

Participants with cognitive impairment are particularly concerned about slow Internet upload speeds (13%), not having mobile data to send attachments (10%), battery drain from taking and sending videos (6%), the inability to use MMS when they need to stay quiet (3%), and the risk of being misunderstood due to a language barrier (3%).

Participants with vision loss are particularly concerned about the need for training to learn how to use MMS (11%), the difficulty of taking a photo or video and adding to a message (10%), and the inability to use MMS when they need to stay quiet (5%).

## VID, Phone Call with Live Video Website

This service is only shown to mobility and vision loss participants.

Participants liked that the website allows them to use video to show what is happening without words (19%), they can use this without installing an app first (19%), and the operator can see what is happening so they ask less questions (18%). All the participants, regardless of disability group, were evenly split on the benefits of the service.

Participants are most concerned about the additional time and steps to start the video (23%), getting close to a dangerous situation to take a video (21%), and making a mistake when trying to start the video (18%). More vision-loss participants felt they would need training on how to use this service as compared to mobility (14% vs. 17%).

## RTT, Phone Call with Live Text Message

This service was shown to all groups except for moderate cognitive.

Participants liked that RTT allows people to read their unfinished message if they type slowly or the call is dropped (20%), it allows the operator to start asking the next question before they are finished (19%), and they can get help without talking (16%).

The deafblind group felt that RTT is particularly helpful to them because the operator can hear sounds to check things (33%). However, none felt that this service can be used in noisy places where it is hard to hear.

Participants are most concerned about the additional time and steps to start the text chat (36%), the need for additional training to learn how to use this (27%), and the slow speed of typing without voice-to-text (16%).

Participants with cognitive loss are particularly concerned about the anxiety of seeing new messages before they are finished (18%), and the risk of being misunderstood due to a language barrier (9%).

## APP, Phone Call with Live Video

This service was only shown to the moderate cognitive group.

Participants liked that the app allows them to use video to show what is happening without words (18%), the operator can see what is happening so they ask less questions (18%), and the operator knows more about them from their medical information (16%). Few participants felt that they can use both hands to help the other person during the phone call (4%).

Participants are most concerned about the difficulty of pointing the camera at the subject and keeping still (31%), slow Internet speeds (27%), and the need for additional training to learn how to use this (24%).

## TC, Phone Call with Video & Live Text Message

This service is shown to all groups except for people with moderate cognitive impairments.

Participants liked that the app allows them to choose the best way to show and tell the emergency depending on their ability and situation (21%), they can use video to show what is happening without words (21%), and the operator can see what is happening so they ask less questions (20%).

The cognitive group felt that the app is particularly helpful to them because they can use sign language to explain things (7%). Less people in the deafblind group felt that the operator can use the video to guide them out of danger (11%).

Participants are most concerned about getting close to a dangerous situation for the video (32%), slow Internet speeds (26%), and the need for additional training to learn how to use this (24%).

Participants in the deafblind group are particularly concerned about the need for additional training (33%) and the difficulty in pointing the camera at the subject (27%). Participants with cognitive loss are particularly concerned about slow Internet speeds (42%).

## STS, Speech Interpreter

This service is shown to anyone who said that they have trouble understanding the way they talk or noted they use an Augmentative and Alternative Communication (AAC) device. 38 participants watched the video. 26 have cognitive loss, 10 have mobility loss, and 2 have hearing loss

Participants liked that the service allows them to get help even if they have a hard time speaking or being understood (82%). A few of them said that it is the only way for people to understand what they say (18%).

Participants are most concerned about the additional time needed to explain the emergency (31%), the need to repeat themselves if the speech helper misunderstood them (31%), and the need to wait longer to get a speech helper and emergency operator (27%).

## VRS, Sign Language Interpreter

This service is only shown to hearing-loss participants. Only 10 of the 90 participants felt that this service applied to them. Two of them noted they need sign language captions.

Participants liked that the service allows them to get help even if they cannot speak or cannot speak well (53%). They also like that it allows them to communicate with people who do not know sign language (47%).

Participants are most concerned about the additional time needed to explain the emergency (19%), the inability to help the victim while signing (16%), the risk of the sign language interpreter misunderstanding them (16%), and the need for training on how to use the service (16%).

# Discussion

The following discussion covers issues identified during the environmental scan and validate through the survey. The next generation 911 (NG911), emergency contact system, is made up of 3 parts: the access terminal (made up of hardware and programs/Apps) used by the caller, the network over which the caller connects with the emergency operator, and the emergency call centre (Public Safety Access Point (PSAP)) where the operator receives the calls. Each of these three component parts need to be accessible or support the accessible services that need to be delivered.

The Next Generation 911 (NG911) system is a modernized emergency response platform that enables the receipt of voice, text, and multimedia messages from individuals in need of emergency services. The system is composed of three main components: the access terminal, the network, and the Public Safety Access Point (PSAP) also called the Emergency Call Centre. Each component plays a crucial role in ensuring that the NG911 system is accessible for people with disabilities.

The first component, the access terminal, is the user's interface to the NG911 system. It refers to any device or application that allows individuals to contact emergency services, such as smartphones, landline phones, or voice-over-Internet-Protocol (VoIP) devices. The access terminal must be designed to support assistive technologies, such as screen readers, Braille displays, and alternative input devices, to ensure that people with disabilities can use them. For example, a deaf or hard-of-hearing individual may use a text messaging application or a video relay service to contact the emergency services, while a person with a speech disability may use a speech-to-text application or a per-recorded messages to communicate.

The second component, the network, is the backbone of the NG911 system, which transports emergency communications between the access terminal and the Emergency Call Centre. The NG911 network is an Internet Protocol (IP)-based network that supports multimedia communications, including voice, text, images, and video. The network must be designed to ensure that emergency messages from individuals with disabilities are prioritized, delivered quickly, and reliably. Additionally, the NG911 network must support Quality of Service (QoS) mechanisms to ensure that real-time communications, such as voice and video, are not delayed or dropped.

The third component, the Emergency Call Centre, is the emergency dispatch center that receives and processes emergency communications. The Centre must be staffed by trained professionals who can handle emergency calls from individuals with disabilities in a respectful, knowledgeable, and timely manner. The Centre must also have access to specialized tools and technologies that can assist in communication with individuals with disabilities, such as video relay services, text-to-speech software, and TTY devices. Additionally, the NG911 system must be able to provide the PSAP with accurate information about the location and type of emergency, as well as any relevant medical information about the individual with a disability.

It is worth noting that the NG911 system is a significant improvement over the legacy 911 system, which primarily relied on voice communication over the phone. The legacy system was not always accessible to people with disabilities, particularly those with hearing or speech impairments. The NG911 system's ability to support various communication modes, including text messages, photos, videos, and other multimedia formats, enables people with disabilities to contact emergency services in a manner that is most convenient and accessible for them.

Furthermore, the NG911 system's ability to support accessibility features ensures that people with disabilities have equal access to emergency services. These features enable people with disabilities to communicate with emergency services without the need for a third part in some cases, which is a significant improvement over the legacy system, where people with disabilities often needed assistance from family members or friends to contact emergency services.

It is also worth noting that the accessibility of the NG911 system is not limited to people with disabilities. The NG911 system's ability to support various communication modes and accessibility features makes it easier for non-English speakers, people in noisy environments, and individuals experiencing a medical emergency, such as a stroke, to communicate with emergency services.

## Access Terminal

The access terminal is a critical component of an accessible Next Generation 911 (NG911) system. It enables users to contact emergency services through the system and is the first point of contact for people in distress. In an accessible NG911 system, the access terminal must be designed to accommodate the needs of people with disabilities. This paper will discuss the accessibility considerations for the access terminal component of an accessible NG911 system for people with disabilities.

### Compatibility with assistive technologies

Assistive technologies such as screen readers, magnification tools, alternative input devices, and speech recognition software are essential for people with disabilities to use the access terminal. Access terminals must be compatible with these technologies to ensure that people with disabilities can access emergency services. Compatibility with assistive technologies also means that the access terminal must have an application programming interface (API) that allows developers to create accessible apps and interfaces that meet the needs of people with disabilities.

### Text-to-speech and speech-to-text capabilities

People with hearing or speech impairments require the ability to communicate with emergency services through text-to-speech and speech-to-text capabilities. These features convert text to audio or audio to text, enabling people with hearing or speech impairments to communicate with emergency services effectively. The access terminal must support these features to ensure that people with disabilities can access emergency services in an accessible and convenient way.

### Voice recognition

Voice recognition is another essential feature that enables people with disabilities to communicate with the access terminal. Voice recognition allows people with mobility or dexterity impairments to navigate the access terminal's interface and initiate a call to emergency services. The access terminal must support voice recognition to ensure that people with disabilities can access emergency services without the need for a third party's assistance.

### Visual accessibility features

People with visual impairments require visual accessibility features such as high contrast mode, text-to-speech, screen magnification, and large fonts. These features enable people with visual impairments to access the access terminal's interface and initiate a call to emergency services. The access terminal must support visual accessibility features to ensure that people with visual impairments can access emergency services in an accessible and convenient way.

### Emergency contact information

The access terminal should also have emergency contact information readily available for people with disabilities. This information should include contact numbers for emergency services, including TTY/TDD support for people who are deaf or hard of hearing and a relay service for people with speech impairments. Additionally, the access terminal should provide information about accessibility features and assistive technologies that people with disabilities can use to access emergency services.

### Clear and good information

The access terminal must be easy to use for people with disabilities. The interface should be intuitive and straightforward, with clear labels and instructions. The layout should be consistent, and controls should be easy to locate and activate. The use of multimedia, such as images and videos, can also be helpful in providing additional information and instructions in an accessible way.

### Language accessibility

The access terminal must be designed to accommodate non-English speakers. The system should be able to support different languages, including American Sign Language (ASL). Providing access to translation services or offering multilingual interfaces can also be helpful in ensuring that non-English speakers can access emergency services.

### Privacy and security

The access terminal must ensure the privacy and security of users, particularly for people with disabilities who may require additional accommodations to access the system. The system should incorporate privacy and security features, such as encryption and authentication, to protect users' personal information.

### Testing and feedback

Finally, it is essential to test the accessibility of the access terminal with people with disabilities to ensure that it meets their needs. User feedback can be used to identify areas for improvement and to make necessary modifications. The system should also be periodically tested to ensure that it remains accessible and functional.

### Customization options

The design of next generation 911 services should provide customization options to allow users to tailor the services to their specific needs and preferences. This can include the ability to adjust the font size, contrast, and color of the user interface, or to select specific communication methods.

### Real-time feedback

The design of next generation 911 services should provide real-time feedback to users with disabilities, such as confirming that their message has been received or providing status updates on the emergency response.

### Consideration of situational disabilities

The design of next generation 911 services should also take into account situational disabilities, which can affect anyone at any time. This can include temporary mobility impairments, vision or hearing loss, or cognitive impairments due to stress or trauma. The services should be designed to be flexible and adaptable to meet the needs of users with situational disabilities.

### Multi-modal Interfaces

Next-generation 911 apps should support multi-modal interfaces that enable users to interact with the app through multiple channels. For example, people with speech or hearing loss may prefer to use sign language, while others may prefer to use voice commands or touch-based interfaces. By providing multiple modes of interaction, the app can accommodate the diverse needs and preferences of its users.

### Personalization

The app should support personalization features that enable users to customize the app to their individual needs and preferences. For example, users may want to set their preferred language, font size, or color scheme. By enabling users to personalize the app, it can become more accessible and easier to use.

### Training and support

The 911 services should be accompanied by training and support for users with disabilities, as well as emergency responders and dispatchers, to ensure that everyone is able to use the services effectively and safely. Training for users should be done in plain language. Responders should be trained in plain language so that they are better able to support people’s communication needs.

### Alternative communication methods

The design of next generation 911 services should also take into account alternative communication methods for people with disabilities who may have difficulty communicating via traditional phone call or text message. This can include video relay services, video remote interpreting, or other communication methods that support American Sign Language (ASL) and other forms of visual communication.

### Location and mapping features

The design of the 911 services should also take into account the needs of people with disabilities who may have difficulty navigating or identifying their location, such as people with cognitive or vision impairments. The services should include accurate mapping and location features, and should be able to support indoor and outdoor location tracking.

### Data privacy and security

The design of the 911 services should also prioritize data privacy and security, especially for users with disabilities who may have sensitive personal or medical information. The services should comply with data protection regulations and should use encryption and other security measures to protect user data.

### Collaborative design

The design of next generation 911 services should be a collaborative effort between emergency responders, technology developers, disability advocates, and people with disabilities themselves. This can help ensure that the services meet the needs and preferences of all stakeholders, and that they are accessible, effective, and inclusive for everyone.

## Standards, Guidelines and More Specific Design Principles

The access terminal is currently made up of hardware and software (programs and Apps) in the form of smartphone, cellphones, tablets and computers. Several standards and guidelines exist to cover the design of the hardware and the applications and programs for people with disabilities. These standards and guidelines aim to ensure that the design of these are accessible, usable, and effective for people with a range of disabilities. The following are some of the most widely recognized and accepted standards:

* Web Content Accessibility Guidelines (WCAG): Developed by the World Wide Web Consortium (W3C), WCAG provides a set of technical standards for web accessibility. WCAG is organized around four key principles: perceivable, operable, understandable, and robust. WCAG is widely used by designers and developers to create accessible web content for people with disabilities. [[1]](#footnote-1)
* Mobile Accessibility Guidelines: The Mobile Accessibility Guidelines provide guidelines for the design of mobile applications that are accessible to people with disabilities. The guidelines cover a range of design factors, including visual and auditory accessibility, keyboard accessibility, and navigation. [[2]](#footnote-2) The guidelines are an extension of the WCAG guidelines specifically to mobile applications.

The Mobile Accessibility Guidelines are a set of guidelines for designing accessible mobile applications. The guidelines aim to provide mobile app developers with practical and technical advice on how to design and develop mobile apps that are accessible to people with disabilities.

The Mobile Accessibility Guidelines were developed by the Mobile Accessibility Working Group, which is part of the Web Accessibility Initiative (WAI) of the World Wide Web Consortium (W3C). The guidelines are based on the Web Content Accessibility Guidelines (WCAG) and provide guidance on how to apply WCAG to the unique context of mobile apps.

The guidelines cover a range of design factors, including visual and auditory accessibility, touch and gesture accessibility, keyboard accessibility, and navigation. The guidelines also provide information on how to test for accessibility and how to ensure that mobile apps are accessible to people with a range of disabilities.

Some of the key recommendations of the Mobile Accessibility Guidelines include:

* Design for different screen sizes and resolutions to ensure that text and visual elements are easy to read and understand.
* Use color contrast to make sure that text and visual elements are distinguishable by people with visual impairments.
* Provide alternative text for all images and icons to ensure that people with visual impairments can understand the content.
* Use captions and transcripts for all audio and video content to ensure that people with hearing impairments can access the content.
* Provide an easy-to-use and consistent interface that is compatible with assistive technology and that works well with different input methods.
* Test your app with a range of assistive technologies to ensure that it is accessible to people with disabilities.

By following the Mobile Accessibility Guidelines, mobile app developers can create apps that are accessible, usable, and effective for people with disabilities. This can help to ensure that people with disabilities have equal access to mobile technology and can benefit from the many advantages that mobile apps offer.

* Apple Accessibility Guidelines: Apple Accessibility Guidelines provide guidelines for the design of accessible applications for Apple's iOS platform. The guidelines cover a range of design factors, including accessibility features of iOS, designing for specific disabilities, and testing for accessibility.
* Android Accessibility Guidelines: Android Accessibility Guidelines provide guidelines for the design of accessible applications for the Android platform. The guidelines cover a range of design factors, including accessibility features of Android, designing for specific disabilities, and testing for accessibility.
* Section 508: Section 508 is a US. federal law that requires electronic and information technology (EIT) to be accessible to people with disabilities. Section 508 sets forth technical standards that apply to EIT procured by the federal government. These standards cover a wide range of EIT, including software, web applications, and multimedia. [[3]](#footnote-3)
* Public Safety Considerations for Smartphone App Developer: The National Emergency Number Association has some guidelines for designing Apps for mobile devices: “Public Safety Considerations for Smartphone App Developers”. [[4]](#footnote-4) Apps are seen as an enhancement to calling or texting 911.

The guidelines provide information on how to limit the impact of Apps on the 911 services. No relying on friends and family to notify 911 for examples. A service promoted by many Apps that are intended to allow family members to keep in touch with older adults.

* EN 301 549: EN 301 549 is a European standard that provides guidelines for the accessibility of ICT products and services. EN 301 549 is based on the WCAG and provides technical requirements for web content, software, and other forms of electronic communication. [[5]](#footnote-5)
* ISO 9241-171: ISO 9241-171 is an international standard that provides guidelines for the design of accessible software. ISO 9241-171 covers a range of design factors, including perceptibility, operability, understandability, and robustness. [[6]](#footnote-6)

In addition to these standards, there are also several best practices and guidelines available for designing accessible applications and programs, including the Accessible Rich Internet Applications (ARIA) standard [[7]](#footnote-7) , and the Design for All (DfA) approach. [[8]](#footnote-8) By following these standards and best practices, designers can create applications and programs that are accessible, usable, and effective for people with disabilities. There is also a draft by the Neil Squire Society that is a variation of the EN 301 549 standard that was designed to focus on the accessibility of mobile devices. [[9]](#footnote-9)

As can be seen there are several standards, guidelines, and best practices available for the design of accessible applications and programs for people with disabilities. These resources provide technical standards, guidelines, and best practices to ensure that applications and programs are accessible, usable, and effective for people with a range of disabilities. By following these standards and best practices, designers can create applications and programs that provide equal access to electronic and information technology for people with disabilities.

## Gaps in the Standards and Guidelines

The new NG911 services examined in the research also highlighted a number of gaps in the standards and guidelines. A quick overview of these issues will be described below. They cover a broad range of topics. The gaps below specifically address the issues with access terminals. Changes and gaps for the Emergency Call Centre to support the services are covered below in the section on Emergency Call Centres.

### Need for Video Handling

There is currently no established method for sending videos to an Emergency Call Centre. Some of the systems that exist in the United States are setup around text messaging and browser-based web Apps. The Emergency Operator sends a text message with a link to the caller. The caller clicks the link which launches a browser App. The caller then has to allow the browser App to use the mobile devices camera. This method removes the need for the user to install an App on the phone. If a specific App was developed there would be a need for coordination to ensure a consist user experience for people with disabilities across the country. Ease of use and low barriers to entry (i.e. no need to install an App or make other changes to the mobile device) are important.

A quality of service specification for relay services needs to be established in Canada. Currently Video Relay Services (VRS) is not recommended to be used in an emergency. [[10]](#footnote-10) Timely access to video relay services are still an issue here in Canada unlike the United States. Similarly, Speech to Speech (STS) Relay does not exist here in Canada. Often people with speech disabilities cannot communicate by telephone because the parties they are calling cannot understand their speech. People with cerebral palsy, multiple sclerosis, muscular dystrophy, Parkinson's disease and those who are coping with limitations from a stroke or traumatic brain injury may have speech disabilities. People who stutter or have had a laryngectomy may also have difficulty being understood. In general, anyone with a speech disability or anyone who wishes to call someone with a speech disability should be able to use STS.

In the United States, a person can make an STS call from any telephone. Dial 711 to call the relay center and indicate you wish to make an STS call. You are then connected to an STS Call Assistant (CA) who will repeat your spoken words, making the spoken words clear to the other party. Persons with speech disabilities may also receive STS calls. The calling party calls the relay center by dialing 711 and asks the CA to call the person with a speech disability. STS users have the option of muting their voices during an STS call (so that the party to whom they are speaking hears only the voice of the STS CA, and not the voice of the STS user). If they wish to use this option, they need to inform the STS CA to mute your voice for the other party to the call. If you choose this option, the STS CA will still be able to hear what you are saying, and will re-voice what you say to the other party.

The FCC imposes mandatory minimum standards on providers of all forms of TRS, such as ensuring user confidentiality, making service available 24 hours a day, seven days a week, and answering 85 percent of calls within 10 seconds. They also impose certain additional requirements on STS providers. For example, for each STS call lasting 20 minutes or longer, an STS CA must remain with a call for a minimum of 20 minutes before transferring the call to another CA. This allows for more effective communication for the STS user because the same CA stays on the call for a longer time.

An STS CA may, at the request of the user, retain information from a particular call in order to facilitate the completion of consecutive calls. The user may ask the TRS CA to retain such information, or the CA may ask the user if he or she wants the CA to repeat the same information during subsequent calls. The STS CA may retain the information only for as long as it takes to complete the subsequent calls. STS providers must offer STS users the option to maintain a list of names and telephone numbers that the STS user commonly calls at the relay center. When the STS user requests one of these names, the CA must repeat the name and state the telephone number to the STS user. This information must be transferred to any new STS provider.

STS providers must have emergency call procedures in case an STS user calls 911.

The Total Conversation App needs a high level of integration with any relay services to be successful. The ability to have translators added to a call is critical to the success of any NG911 services that include people with hearing or speech related disabilities. The lack of availability of sign language interpreters and in the case of speech to speech relay the absence of such a service needs to be addressed.

### Need for Standardized Symbols

In regards to the symbol-based application shown during the survey, there is a lack of standardized symbols for special service. Though there is a set of symbols being worked on by a NENA working group, that set of symbols has not been released yet and those symbols, though currently a step forward, were not intended to cover all situations that need to be communicated to Emergency Operators. Even when a formalized set of symbols is released, it will take time and effort to socialize them and make people aware of what they are and what they stand for. This is only necessary for the creation of symbolic Apps. Though the Symbolic App can benefit people with cognitive impairments and people with literacy in English or French it did no rank highly overall.

### Personalization

Not having to explain that they have a disability and describing their limitations to an Emergency Operator was identified as an important feature in enhancing and making the process more efficient for people with disabilities during the focus groups and survey. The caller needs to be able to exchange that information with the Emergency Operator automatically when they initiate the call. There are currently no standards on how that information is to be exchanged. The goal is to allow the Emergency Operator to be aware of the way the interaction needs to be conducted, whether through a technical accommodation such as TTY or video call or through an accommodation on the way the Emergency Operator interacts with the caller (talking slower due to a cognitive impairment or realizing the caller cannot see the situation due to vision loss for example).

One existing system currently available from an Emergency Call Centre equipment supplier utilizes a centralized registry. The caller can register ahead of time and voluntarily disclose information about their disabilities. In the case of the system currently on the market, the caller can also disclose pre-existing medical conditions and medications. Note that there is a level of privacy that needs to be taken into consideration in regards to medical information and how it is handled and shared with other parties. This will be discussed more below in the section for Emergency Call Centre accommodations. The Emergency Call Centre needs to subscribe to the service but they can access the information based on the caller's phone number. Alternatively, the user can store that information locally on their access terminal and that information is sent via Text Message or other electronic transfer mode to the Emergency Call Centre. While technically feasible, some standardized transfer method needs to be established and the Emergency Call Centre needs to have the equipment and procedures to support this method. There is no current standard around this though the existence of commercial systems shows the value of this technology not only for people with disabilities but all Canadians.

### Training and Awareness

For people with cognitive impairments, vision loss and hearing loss, additional training was brought up as an important factor in learning to use one of the new methods of contacting 911. In the case of cognitive impairment and hearing loss visual training in combination with hands on training was identified as a key way they learn new technology. For people with vision loss they identified hands-on training as the most effective way for them to learn new tasks. Training materials should be in plain language to be clear and easy to understand.

As new methods are rolled out, whether it be Real Time Text, Help Apps and a Total Conversation App, it is important to accompany that with public awareness and training. Training and awareness need to be a part of any strategy of launching a new service especially for people with disabilities.

### Cost of Data

As these next generation services are launched it is important to realize many of these services require large amounts of data. Many people with disabilities have low incomes. They should not be prevented from using these services due to the cost or availability of data. The data required to connect to NG911 should not count towards the subscriber’s monthly data limit for their mobile devices.

### Quality of Service

Net Neutrality is important for these new services. Network neutrality ensures that all data on the internet is treated equally by ISPs and governments, regardless of content, user, platform, application, or device. Net neutrality policy discussions target issues such as blocking or filtering online content, and preferential internet speeds based on business agreements. A caller should not be limited to a low speed of connectivity due to a restriction on the speed of the connection of their wireless or internet services (called throttling).

## The Network

The network component must be designed to handle the transmission of emergency calls and data in an accessible way. The network must be able to support real-time text, video, and audio communications and ensure that these features are available to people with disabilities. Additionally, the network must be reliable, secure, and redundant, ensuring that emergency calls can be made and received even during network outages or failures. Historically, 911 calls were routed to emergency call centres using the telephone lines for plain old telephones. In the last decade telecommunications companies under directives from the Canadian Radio-Television and Telecommunications Commission (CRTC) have been upgrading their network to support wireless voice traffic in addition to internet protocol traffic from smartphones and computers. This allows emergency call centres to offer more advanced services than the plain old telephone contact of the past. The network is a secure, high-speed, Internet Protocol based network that enables emergency service providers to exchange data and voice communications with the caller. The network provides a platform for NG911 services, such as call routing, location information transfer, and priority handling of emergency calls. It can also handle services such as real time texting and video calls. This document will not cover the network in detail. More information on the network can be found on the National Emergency Number Association website [[11]](#footnote-11), at Canadian NG911 Coalition [[12]](#footnote-12) and the CRTC website [[13]](#footnote-13).

## Systematic Design Principles for the Call Centres

Emergency call centres, also known as Public Safety Access Points (PSAP), is the location where all the emergency calls come into the emergency operator. The call centres are responsible for receiving emergency calls from the public and dispatching the appropriate emergency services to the scene of the incident. Centres are critical components of the emergency response system, serving as the first point of contact for people in need of emergency assistance. When someone calls 911 or another emergency number, the call is routed to the Centre serving the caller's geographic location. The emergency operator who answers the call will gather information about the emergency and then determine which emergency services are needed, such as police, fire, or medical personnel. The operator will then dispatch the appropriate services to the scene of the incident.

The emergency centres are staffed by trained professionals who are able to handle emergency situations and provide assistance to callers. They may also have specialized equipment and resources to assist with emergency response. This in the past has been computer systems that track the location of emergency vehicles and personnel, or communication systems that enable coordination between different emergency response agencies. The emergency call centres play a critical role in ensuring public safety by providing a rapid and effective emergency response to those in need.

The next generation of emergency terminal devices implement new services that require new equipment, policies and training for emergency operators. Most of the policies and training are covered in standards and guidelines created and published by the National Emergency Number Association. Though originally drafted in the United States, modified and unmodified versions of the standards are being adopted by Canada. These are standards that create a model standing operating procedure (SOP) for the handling of calls received by Public Safety Answering Points (PSAPs) and ensure consistency in the processing of emergency and non-emergency calls across jurisdictional boundaries. [[14]](#footnote-14) While there are a number of accessibility related standards the next generation services are still evolving.

The current accessibility standards are APCO/NENA ANS 3.105.1-2015, NENA-STA-035.2-2018, NENA 52-501, NENA-INF-013.2-2015, and the PSAP Readiness for Real-Time Text (RTT) Information Document.

### APCO/NENA ANS 3.105.1-2015 (originally NENA 52-001 & 52-003)

The Minimum Training Standard for TDD/TTY Use in the Public Safety Communications Center (ANSI Accredited NENA Standard) [[15]](#footnote-15) identifies the minimum training requirements for Emergency Operators specific to providing direct and equal access to public safety services to people who use a TTY/TDD to communicate, in accordance with the Americans with Disabilities Act and Department of Justice requirements. This document seeks to define the knowledge, skills, competencies, and minimum training requirements of individuals who receive emergency telephone calls from the public as well as the agency’s responsibilities for providing training, written directives, and testing in this critical function.

### NENA-STA-035.2-2018 (originally 52-002)

The Managers Guide to the ADA Title II: Direct Access [[16]](#footnote-16) describes the call centre equipment, training, call handling procedures and security for handling people with disabilities with the existing technology in the United States (mainly phone calls, Short Messaging System (SMS), video relay and Real Time Texting (RTT)). It does not cover video calls from callers in need of streamed video.

The standard is designed to enhance the quality of service provided to the public, including people who have hearing loss. The elements within this standard are to be viewed as "minimum standards'' and agencies are encouraged to seek additional information or advice, in addition to this standard. The standard requires call centres to conduct periodic self-evaluations of programs, policies, and services to ensure equal access to citizens with disabilities. The Manager's Guide to the ADA: Title II, Direct Access standard is a valuable tool to facilitate this by providing information on the following elements:

* Self-Evaluation
* Equipment and Network
* Operations
* Communication Officer Training
* Outreach to people with disabilities

### 52-501 TTY Phone Pals Program Operational Information Document

This standard identifies the minimum training requirements for Emergency Operators specific to providing direct and equal access to public safety services to people who use a TTY/TDD to communicate, in accordance with the Americans with Disabilities Act and Department of Justice requirements. This document seeks to define the knowledge, skills, competencies, and minimum training requirements of individuals who receive emergency telephone calls from the public as well as the agency’s responsibilities for providing training, written directives, and testing in this critical function.

### NENA-INF-013.2-2015 (originally 52-502)

The NENA Video Relay Service (VRS) and Internet Protocol Relay Service (IP Relay) PSAP Interaction Information Document is intended to provide guidelines for PSAPs and recommendations to the FCC regarding:

* Emergency calls to 9-1-1 via Video Relay and IP Relay Services (or similar third-party entity)
* Effective relay of such calls to the appropriate Emergency Call Centre
* Interaction between the caller, the Communication Assistants (CAs) and the Emergency Operators

The intent is to assist all parties involved in emergency communication necessitating the involvement of third parties to become more seamless and successful.

New technology offers many communication options, which individuals who are deaf, deaf-blind, and hard of hearing and individuals with speech disabilities enjoy along with the general public. Many people have migrated from traditional TTY to Internet based telecommunications, and have terminated landline telephone services altogether. Just as many in the general population rely solely on mobile telephony, individuals who are deaf, deaf-blind, hard of hearing or have a speech disability often rely exclusively on Internet based (Video Relay and/or IP Relay) services for communication access. This standard also covers the issues created by Voice over Internet Protocol (VoIP) telephony. VoIP telephony is generally full of challenges for the emergency services. These challenges are further complicated when adding the nature of relayed calls involving a third party (and sometimes a fourth) in the call flow. Developing uniform operational guidelines for Emergency Call Centres and offering recommendations for relay or other third-party providers, along with suggestions for the FCC, is very important. [[17]](#footnote-17)

### PSAP Readiness for Real-Time Text (RTT) Information Document

The PSAP Readiness for Real-Time Text (RTT) Information Document [[18]](#footnote-18) defines a recommendation to establish guidelines for the call handling procedures and identifies areas of training that may be needed with the introduction of RTT.

It should be noted that these are minimum standards that are required for Emergency Call Centres to implement to support NG911 services. Though RTT and SMS to 911 are in principle available to emergency call centres the phase in period has been extended in the United States and there is an accommodation for call centres to transition. Emergency call centers can install software to route SMS and RTT messages to the existing TTY infrastructure. As a result, SMS and RTT interactions show up as TTY interactions in many call centres in the United States.

In Canada, Emergency Call Centres implement a modified version of text to 911. It is only available to people who are Deaf, hard of hearing and speech impaired and register ahead of time, as opposed to everyone as in the United States. It requires the user to place a phone call to 911 first and then the emergency operator will identify the caller as someone who has registered and self-identified as someone who is Deaf. The operator then will send a text to the caller to start the interaction. The phone call allows the Emergency Operator to get access to the location data of the caller if they are using a smartphone or cellular phone. RTT was originally intended to be fully supported on the Canadian telecommunication networks by December of 2020 but has been delayed by the pandemic. A new phase in deadline has not been set for the telecommunication carriers to have a fully tested and implemented system. There is currently no phase in period required by the Emergency Call Centres to implement the service.

In considering the design and implementation of NG911 systems and training for Emergency Call Centres the following factors need to be considered:

* **Interoperability with other emergency services:** The design of next generation 911 services should also consider interoperability with other emergency services, such as fire departments, police departments, and hospitals, to ensure that users with disabilities receive a coordinated and comprehensive emergency response.
* **Inclusivity in emergency response teams:** The design of next generation 911 services should consider the inclusivity of emergency response teams, such as 911 call centers, and work to ensure that these teams are diverse and inclusive of people with disabilities. This can help ensure that emergency responders have a better understanding of the needs and preferences of people with disabilities, and can provide a more effective and sensitive emergency response.
* **Accessibility testing and certification:** The design of next generation 911 services should include rigorous accessibility testing and certification to ensure that the services meet or exceed accessibility standards and best practices. This can help ensure that the services are usable and effective for people with disabilities, and that they comply with legal requirements.
* **Public education and outreach:** The design of next generation 911 services should include public education and outreach efforts to raise awareness of the services and to promote their use among people with disabilities. This can help ensure that people with disabilities know about the services and are able to use them effectively when they need them.
* **Continuous improvement:** The design of next generation 911 services should prioritize continuous improvement through ongoing feedback and evaluation from users with disabilities, emergency responders, and other stakeholders. This can help ensure that the services continue to meet the evolving needs and preferences of people with disabilities, and that they remain accessible, effective, and inclusive.
* **Scalability:** The app must be designed to handle a large volume of users and emergency situations. This may include features such as load balancing and failover capabilities to ensure that the app remains operational during times of high demand.

Additional factors that need to be considered and standards and guidelines developed for are:

* The way Emergency Call Centres can access personalized data about the caller.

Data exchange between the caller is currently covered by the National Emergency Number Association's (NENA) NG911 Data Standard. [[19]](#footnote-19) This standard covers access to the phone number of the caller and the Geo-location or geographic information system (GIS) data of the caller if a caller is calling from a telephone landline or a smartphone or cellphone. Though not common, currently equipment and system providers make systems that allow callers to pre-register and disclose preferences related to their disability and/or disclose medical information. Disclosure and collection of this information requires standards to cover privacy and security as it relates to the information. The issues around how to handle medical information are outside the scope of the discussion in this document. Disclosing the high-level nature of a potential caller’s disability has fewer requirements and according to the focus group data most people with disabilities have few problems disclosing basic information about their disability if they get quicker and more efficient access to emergency services.

* Access to video feeds

As shown in the survey data, the ability to send video information to the Emergency Operators is considered a highly rated and valuable service. It lets the Emergency Operator better access the situation and provide instructions to the caller if necessary and appropriate. Currently no Canadian Emergency Call Centre will allow video information through the systems that exist. Video streaming is in operation in the United States in selected Emergency Call Centres and internationally in other countries. In interviews with members of the Emergency Number community here in Canada, video and MMS (multimedia messaging Service) data would be rejected by the Emergency Call Centre systems. There are security concerns about receiving files from outside sources that might corrupt the Emergency Call Centre systems. In addition, there are some concerns about the mental stress on operators, of seeing in videos from crime or accident sites. Initial feedback from some Emergency Call Centres that are already using video in their call centres (New Orleans and Aspen Colorado) indicates the perceived issues for staff might be overstated. Similar issues related to the need to re-train staff significantly were expressed before the launch of text to 911 in Canada but it turned out to be overly cautious. The initial feedback seems to indicate that might be the same case as live video. There were additionally some privacy concerns on the part of the Emergency Operator. The initial feedback seems to suggest that most Operators are reluctant to show their face in video conversations.

Overall, the design of next generation 911 services for people with disabilities requires a comprehensive and inclusive approach that considers the needs and preferences of all stakeholders. By taking into account the factors outlined above, next generation 911 services can be designed to be more accessible, effective, and inclusive for people with disabilities, ensuring that they have equal access to emergency services and support when they need it.

# Conclusions & Recommendations

A survey on Next Generation 911 was completed by 493 individuals with disabilities, representing a diverse range of disabilities, including mobility, cognitive, hearing, vision, and deafblind impairments.

The results of the survey indicated that Total Conversation (phone call with video and live text message) was the most preferred method for accessing emergency services, followed by live video streaming (phone call with live video website) and the help app (phone call with live video).

Participants like Total Conversation because they can choose the best way to show and tell the emergency, whether it is through voice, video, or text. Live video streaming is a close second because while it only has support for voice and video, it can be used without installing an app first. The help app comes in third because you need to install an app first. However, in addition to voice and video, it gives the operator the caller's name, phone number, location, and medical information so they can skip straight to showing the video.

Interestingly, the focus group and survey results show that MMS ranks higher than RTT because the ability to attach photos or videos outweighs the ability to read text as it is typed. Despite this difference, neither option ranks highly because silent communication is not feasible with assistive technologies like voice dictation and screen readers.

The VUTE picture help app ranked very low. However, this is not surprising as this app was never commercialized by NTT Network Innovation Laboratories after the original study concluded in 2009. The app may have ranked higher if each screen had a question with text labels under picture choice instead of only relying on pictures. The number of steps could also be reduced.

Although the speech relay and video relay services were ranked low, this does not mean the services are not useful. We did not get enough participants to get opinions on these services. We recommend further research on this.

This report also talked about the factors that affect the design of component parts of the NG911 system: Access Terminal, Network and the Emergency Call Centre. The design of next generation 911 services for people with disabilities requires a comprehensive and inclusive approach that considers a wide range of factors, including interoperability, inclusivity, accessibility testing and certification, public education and outreach, and continuous improvement. By taking into account these factors, next generation 911 services can be designed to be more accessible, effective, and inclusive for people with disabilities, ensuring that they have equal access to emergency services and support when they need it. There are standards and guidelines that cover the accessibility of the parts of the system but there is work to be done to fill the gaps identified in this research.

Outside of the technical gaps noted the key findings are:

* The new services require an appropriate awareness to let people know these new services are coming or exist.
* There needs to be a low barrier to entry to access these new services. As a result, every device distributed in Canada needs to come with the capabilities built in and not require the user install them after the fact.
* The range of services need to be consistent across the country. It cannot be a patch work where only some services are available in some regions.
* Training programs are required to teach people with disabilities how to use these new services.
* The cost of data should not prevent a caller from using a particular service that is more efficient and effective for them. Data used to access a NG911 service should be free and not count towards the user's monthly data cap.
* The process needs to be personalized so that information about the basic nature of the caller’s disability is automatically conveyed to the Emergency Operator.

These findings can be used to inform the development and implementation of new technologies for accessing emergency services, ensuring that they are accessible and effective for individuals with disabilities. It is recommended that future studies be conducted to assess the actual effectiveness of these alternative methods in real-world emergency situations.

1. <https://www.w3.org/WAI/standards-guidelines/wcag/glance/> [↑](#footnote-ref-1)
2. <https://www.w3.org/WAI/standards-guidelines/mobile/> [↑](#footnote-ref-2)
3. <https://www.section508.gov/> [↑](#footnote-ref-3)
4. <https://www.nena.org/page/SmartphoneApps> [↑](#footnote-ref-4)
5. <https://www.etsi.org/deliver/etsi_en/301500_301599/301549/03.02.01_60/en_301549v030201p.pdf> [↑](#footnote-ref-5)
6. <https://www.iso.org/standard/86308.html> [↑](#footnote-ref-6)
7. <https://www.w3.org/WAI/standards-guidelines/aria/> [↑](#footnote-ref-7)
8. <https://www.cencenelec.eu/areas-of-work/cen-cenelec-topics/accessibility/design-for-all/> [↑](#footnote-ref-8)
9. <https://www.neilsquire.ca/wp-content/uploads/2023/02/V6B-Cumulative-Checklist-Procurement-of-Accessible-Mobile-Devices.docx> [↑](#footnote-ref-9)
10. <https://crtc.gc.ca/eng/publications/reports/rp130307.htm#k1> [↑](#footnote-ref-10)
11. <https://www.nena.org/page/IP_Network_NG911> [↑](#footnote-ref-11)
12. <https://cdn.ymaws.com/apco.ca/resource/resmgr/pdf_files/ng911roadmap.pdf> [↑](#footnote-ref-12)
13. <https://crtc.gc.ca/eng/phone/911/gen.htm> [↑](#footnote-ref-13)
14. <https://cdn.ymaws.com/www.nena.org/resource/resmgr/standards/nena-sta-020.1-2020_911_call.pdf> [↑](#footnote-ref-14)
15. <https://www.nena.org/page/TTY_TrainingStandard> [↑](#footnote-ref-15)
16. <https://www.nena.org/page/Guide_to_ADA> [↑](#footnote-ref-16)
17. <https://www.nena.org/page/VideoIP_Relay911> [↑](#footnote-ref-17)
18. <https://www.nena.org/page/RTT> [↑](#footnote-ref-18)
19. <https://cdn.ymaws.com/www.nena.org/resource/resmgr/standards/nena-sta-043.1-2021_ng_data_.pdf> [↑](#footnote-ref-19)