Georgia Tech Center for Advanced Communications Policy
500 10th Street, NW
Atlanta, Georgia 30332

VIA ECFS

August 8, 2022

Marlene H. Dortch, Secretary
Office of the Secretary
Federal Communications Commission
445 12th Street, S.W.
TW-A325
Washington D.C. 20554

Re: Consumer And Governmental Affairs Bureau Seeks Comment On The On Tentative Findings For The 2022 Twenty-First Century Communications And Video Accessibility Act Biennial Report [CG Docket No. 10-213]

Dear Ms. Dortch:

Enclosed for filing in the above-referenced Public Notice are Georgia Tech's Center for Advanced Communications Policy (CACP) comments.

Should you have any questions concerning this filing, please do not hesitate to contact me via email at salimah@cacp.gatech.edu.

Respectfully submitted,

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Enclosure

Before the
Federal Communications Commission
Washington, D.C. 20554

CONSUMER AND GOVERNMENTAL AFFAIRS BUREAU SEEKS COMMENT ON TENTATIVE FINDINGS FOR THE 2022 TWENTY-FIRST CENTURY COMMUNICATIONS AND VIDEO ACCESSIBILITY ACT BIENNIAL REPORT

CG Docket No. 10-213

COMMENTS OF
GEORGIA INSTITUTE OF TECHNOLOGY (GEORGIA TECH), CENTER FOR ADVANCED COMMUNICATIONS POLICY (CACP)

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Introduction

The Georgia Institute of Technology's Center for Advanced Communications Policy (CACP) hereby submits comments to the above-referenced Public Notice seeking comment on the accessibility of communications services. CACP is recognized at the state and national levels as a neutral authority that monitors and assesses technical developments, identifies future options, and provides insights into legislative and regulatory issues. A key overarching objective of CACP is to understand the social impact of digital technologies, domestically and internationally, by conducting objective, evidence-based research. Center activities provide the foundation for assessing and analyzing issues that inform our contribution to federal rulemaking, input into public sector policy-making processes, and generation of technical guidance for business and industry.

Research activities range from foundational social science research, providing evidence-based input for policy formation and regulatory filings, to applied policy research analysis and studies to inform the development, implementation, and adoption of a wide range of information and communication technologies. Lab-based studies focus on the intersection of technology and the user: accessibility and usability studies, user testing, and human factors analysis, all of which help industry and policymakers better understand the needs of a wide range of users, especially the older adults and people with disabilities.

Regarding the latter, over the past 20 years, subject matter experts at CACP have been involved with research and regulatory issues concerning accessible technologies and services, conducting research and development in the domain of communications access, equity, and inclusion. CACP researchers have commented on and been cited in the FCC's Congressional Reports to Congress concerning compliance with the Twenty-First Century Communications and Video Accessibility Act of 2010 (CVAA) going as far back as the 2014 report. In large part, our comments have been informed by our Biennial Reviews of Mobile Phone Accessibility (Accessibility Review), conducted specifically for this proceeding. The comments respectfully submitted herein are based on the results of the 2022 Accessibility Review.

This 2022 Accessibility Review included mobile phone models available from the top four wireless carriers, one prepaid carrier, and five randomly selected Lifeline Carriers.[1] Through the evaluation of mobile phone manuals, online resources, and carrier informational pages, researchers identified 153 mobile phones for evaluation. Data were collected on the presence of 54 features that impact accessibility and/or were designed to provide access to people with vision, hearing, cognitive and mobility disabilities in each phone model. Sources of accessibility feature data included the Mobile Manufacturers Forum Global Accessibility Reporting Initiative (GARI) database,[2] user manuals from several different sites,[3] and phonescoop.com. The Wireless RERC continues to collect data on the presence of the wireless emergency alert (WEA) message feature and the FM Radio feature to inform our ongoing mobile emergency communications research. Apart from FM Radio and WEA capabilities, the features identified for the study include those that are used to access the phone, the content displayed on the phone, *or* to connect to external assistive technology (AT) or other smart devices that can be controlled via the phone.

The Accessibility Review results support of the FCC's tentative findings that:

- "There have been some improvements to enhance the accessibility of telecommunications and advanced communications services and equipment. However, not all people with disabilities can access these improvements, and some accessibility gaps exist with regard to these services and equipment."
- "While usability has improved for some covered services and equipment, there is still room for improvement."

Outside of the results of our 2022 Accessibility Review quantifying the accessibility levels of smart and non-smartphones on the market, our interpretation of the results inform specific recommendations made on pages 32-35.

[1] Lifeline Carriers that did not include a list of available phones were excluded.

[2] The GARI is a project of the Mobile & Wireless Forum (MWF). Some of the data referred to in this paper was sourced from the information available from the GARI website www.gari.info and used with permission of the MWF, although all views and conclusions are the authors alone.

[3] These sites include the carrier's webpage and the phone's manufacturer.

Methodology

This Accessibility Review of mobile phones employed a nonexperimental quantitative methodology where the data was comprised of mobile phone documents. Thereafter, we utilized quantitative approach to evaluating the dataset through a coding process, which allowed us to "transform collected information [in]to a set of meaningful, cohesive categories"[4]. Except for hearing aid compatibility (HAC) rating, the presence of accessibility features were coded as either 1 = "yes," 0 = "no," or 2 = "information not available." A summary and comparative analyses were produced using Microsoft Excel.

Changes in Data Collection from 2020 to 2022

There are some minor differences between 2020 and 2022's accessibility features list. Some features (such as color contrast and contrast adjustment) are not individually reflected in the 2022 accessibility list because they were all placed under "Contrast Adjustment," as we have had challenges in the past accurately capturing the extent to which each of these features is present (e.g., some phones would describe grayscale but not *explicitly* mention color contrast (despite having it). However, these features are interconnected. Moreover, in the spirit of consistency and reliability of results, we elected to capture these features under one label because all phone manuals do not discuss the components of *contrast* with similar language. This approach mitigates the likelihood that future researchers would yield vastly different results from the ones presented herein due to differences in interpretation of phone manual nomenclature.

As it relates to Physical Keypad and Physical QWERTY, in previous years, we have captured these features separately and have found "differences" in their presence on mobile phones Although, it was a perplexing finding, it can likely be attributed to how phone manuals discuss these features. While some manuals will explicitly denote the presence of Physical QWERTY, others will simply mention a physical interface. This year, researchers decided to improve our approach ***beyond*** the phone manuals and would search these phone models on the manufacturer's website, watch release videos of the device, and if this didn't yield results, then go to the specific carrier's page (primarily an issue with Lifeline phones) input a relevant zip code

[4] Sun, Y. (2022) Coding of Data. In Allen, M. (Ed.). (2022). *The SAGE encyclopedia of communication research methods*. SAGE publications.

and see how the phone appears for someone searching it within that range. We found a one-to-one association between physical keyboard and physical QWERTY. Perhaps there are phones that do not use QWERTY, but the phones within this dataset that had Physical keypads/boards also had QWERTY keyboards, thus these categories were collapsed in this year's round of coding analysis.

Finally, in prior years, we measured customizable volume as a broad term. However, we considered GARI's framework for this feature and elected to adopt it, which raises the bar for how it is measured and ensures that we do not overstate the accessibility of the phone. The new feature, configurable audio, is measured by this definition through GARI, "allows users to configure or customize specific audio parameters by allowing to adjust frequencies and sound from their headphones."[5]

Data Collection Limitation

As this research relies on publicly available information, it is plausible that accessibility features may exist that were not captured due to phone manual description or lack of information online. In this year's carrier evaluation, we noted that many Lifeline providers ***do not*** publicly offer a list of their available phones, which made it difficult to evaluate whether these mobile devices, mostly non-smartphones, had these features. Furthermore, our sampling of Lifeline mobile phones was predicated on publicly available information.

Results

Phone Type

Of the 153 mobile phones included in the sample, 89% were smartphones, and 11% were non-smartphones (Figure 1). Figure 2 shows that there is a slight increase of smartphones from 2019/20 (88%) to 2022 (89%). While the presence of non-smartphones decreased a bit from 12% in 2019/20 to 11% in 2022.

[5] GARI. (2022).Advanced Find Phones by Accessibility Features. Retrieved from: https://www.gari.info/findphones-advanced.cfm

Figure 1: 2022 Phone Type

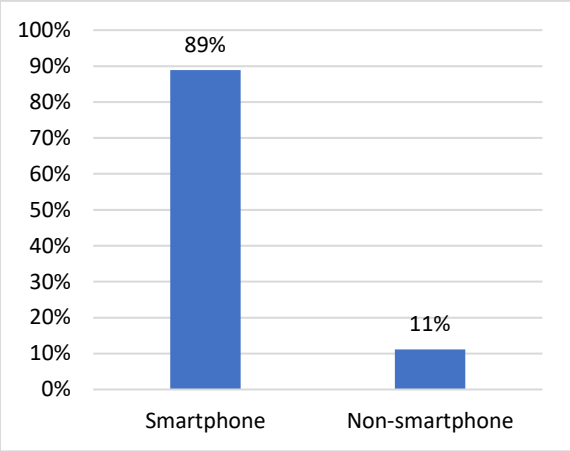
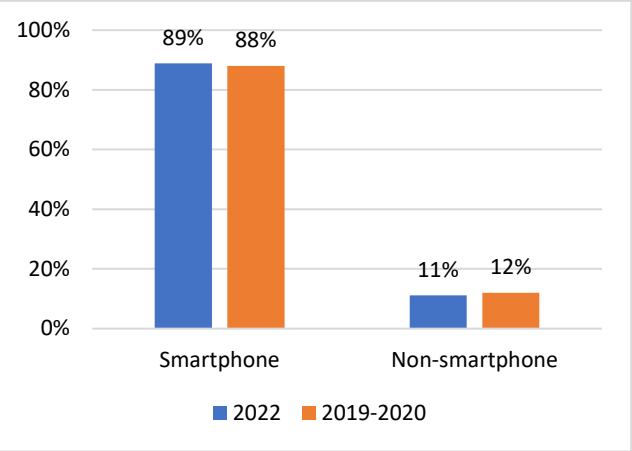
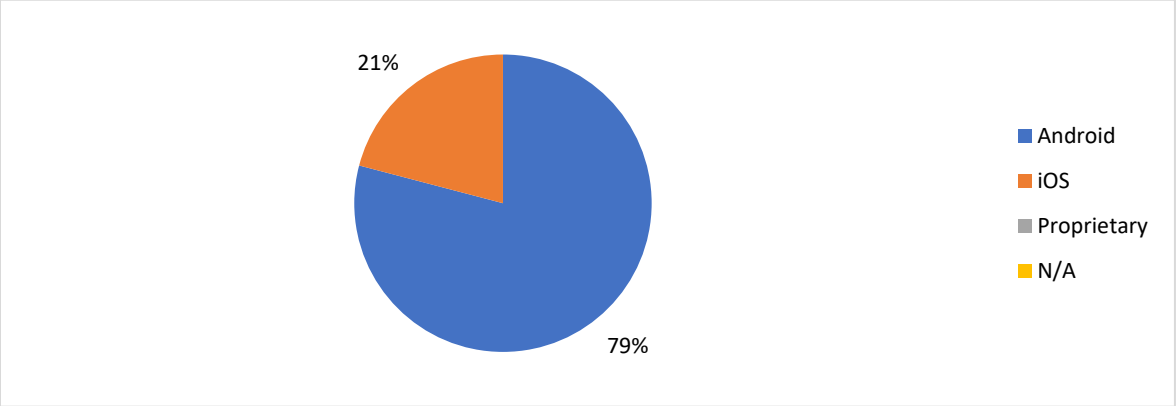


Figure 2: 2019-2020 & 2022 Phone Type



After the identification of the phone type, mobile phones were categorized by the operating system (OS). Seventy-nine percent (79%) of the mobile phones in the sample had an Android OS, and 21% were iOS, while none of the phones had proprietary operating systems or unavailable information. This result illustrates a decrease in proprietary OS' from 2019-2022 (7%) revealing a shift to a more uniform OS across carriers (Figure 3).

Figure 3: 2022 Operating System



Accessibility Features

This 2022 accessibility review evaluated 54 features, which is an increase of 19 features from 2019-2020's accessibility feature list (n = 35), and an increase from 2022's review (n =25). With the exception of HAC rating, Table 1 notes the percentages of the accessibility feature on all mobile phones included in the sample.

Table 1. All Accessibility Features 2022

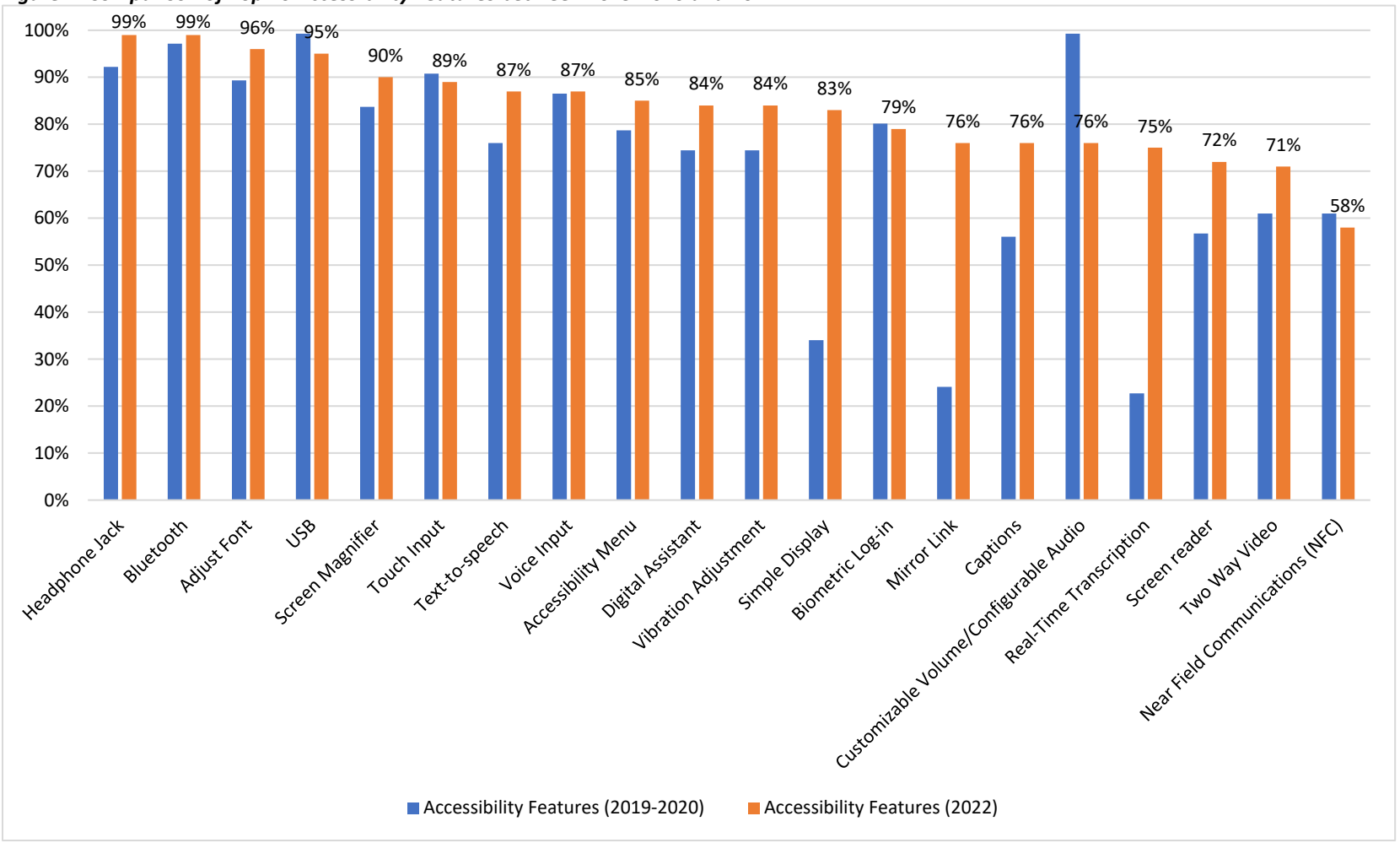
Accessibility Features (Top 21)	Percent	Accessibility Features (Middle-Range)	Percent	Accessibility Features (Bottom 15)	Percent
Headphone Jack	99%	Intelligent Personal (Digital) Assistant	84%	Flashlight notification	59%
Bluetooth	99%	Adjustable Vibration	84%	Near Field Communications	58%
Speaker-phone capable	98%	Emergency Services & Location	83%	Voice Notes	57%
GPS Capability	97%	Simple display	83%	Automatic Redial	56%
Adjust Font	96%	Supports Gesture Based Navigation	83%	Automatic Answer or Any Key Answer	51%
Alternative Biometrics	96%	Contrast Adjustment	82%	Switch Control	48%
USB	95%	Stylus or Prosthetic Device support	82%	Haptic Feedback	42%
Speed Dial	95%	Biometric Log-in	79%	Visual Indicators on Display	41%
No Screen Timeout	93%	Closed-captioning Support	76%	Easy Battery Placement	39%
WEA-capable	92%	Configurable Audio	76%	Anti-slip Features	37%
screen magnifier	90%	Mirror Link	76%	Eye tracking	33%
Touch input	89%	Real-time text	75%	Audible Cues	31%
Battery Saver or Adaptive Battery Settings	87%	External Keyboard Support	75%	Braille Display Support	25%
Speech-to-text/Dictation	87%	Assistive Touch	73%	Physical keyboard/number pad	15%
Supports Accessibility APIs	87%	Hand Movement	73%		
Text-to-speech	87%	Screen reader	72%		
Dedicated and clearly distinguishable key to lock the screen	86%	Two-way video	71%		
Dedicated and clearly distinguishable volume keys	86%	External Switch / Pointer Support	70%		
Predictive Text Input	86%	FM radio	61%		
Accessibility Menu	85%				
Visual Indicators on Display	85%				

The growth of accessibility features between 2019-2020 and 2022 also aligns with the increased presence of smartphones and the advanced technology that these devices are capable of. As the last two years of the COVID-19 pandemic has propelled the need for contactless interactions and increased phone usage[6] to improve social connectedness, these accessibility features have become more prominent in mobile devices which is a secondary effect of accessibility needs for people with disabilities, as many features were not explicitly developed with accessible design in mind, but rather their functionality for the broader public. Thus, many of these features (e.g., digital assistants, two-way video, biometrics login) have been adapted by the disability community to increase the accessibility of these devices.

[6] Ratan, Z. A., Zaman, S. B., Islam, S. M. S., & Hosseinzadeh, H. (2021). Smartphone overuse: A hidden crisis in COVID-19. *Health Policy and Technology*, *10*(1), 21.

Serra, G., Lo Scalzo, L., Giuffrè, M., Ferrara, P., & Corsello, G. (2021). Smartphone use and addiction during the coronavirus disease 2019 (COVID-19) pandemic: cohort study on 184 Italian children and adolescents. *Italian Journal of Pediatrics*, *47*(1), 1-10.

Figure 4: Comparison of Top 20 Accessibility Features between 2019-2020 and 2022



Within Figure 5, there is a noticeable decline in the presence of configurable audio, formerly customizable volume, from 2019-2020 to 2022 likely due to the higher standard set forth in this year's analysis. Table 2 shows the other steepest percentage point differentials since the 2019-2020 report. As mobile phones saw an increase in real-time-text (52 points), there was also a noticeable rise in captioning (20 points) in mobile devices between the 2019-2020 and 2022 data collection periods. Although WEA is not an accessibility feature per se, there was a notable increase in its presence in mobile phones between 2019-2020 (74%) and 2022 (92%). The 18-percentage point differential illustrates that manufacturers are improving access to emergency communication for individuals who are acquiring these devices.

Figure 5: Comparison of Bottom 3 Accessibility Features between 2019-2020 and 2022

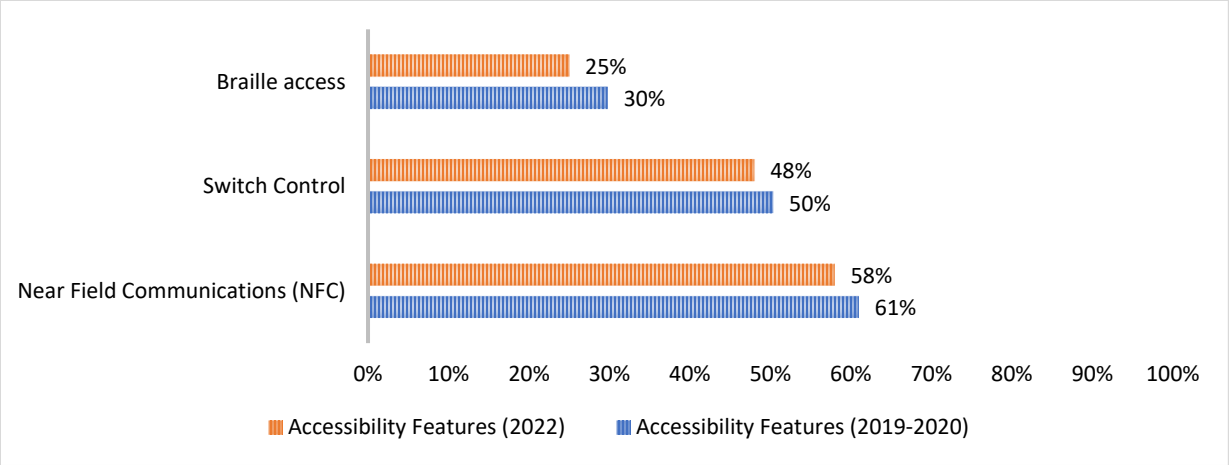


Table 2: Comparison of Accessibility Features - Top 10 Steepest Percentage Point Differentials

Feature	2019-2020	2022	Difference
Real-Time Text	23%	75%	+ 52 points
Mirror Link	24%	76%	+ 52 points
Simple Display	34%	83%	+ 49 points
FM Radio	23%	61%	+ 38 points
Customizable Volume/Configurable Audio	99%	76%	*- 23 points*
Captions	56%	76%	+ 20 points
Screen reader	57%	72%	+ 15 points
Text-to-speech	76%	87%	+ 11 points
Two Way Video	61%	71%	+ 10 points
Digital Assistant/Personal Intelligent Assistant	74%	84%	+ 10 points
Vibration Adjustment	74%	84%	+ 10 points

Assistive Technology (AT) Connections

Having multiple ways to connect a device to external AT is critical for some people with disabilities' use of a smartphone. AT connections are particularly pertinent to those who are blind who use refreshable Braille displays, those with quadriplegia who use switch access, or individuals who utilize neck-loops to amplify sounds. Connectivity options such as Mirror Link, NFC, and infrared allow users to connect to their vehicles, perform cashless transactions, and utilize a smartphone as a universal remote. Furthermore, Bluetooth technology is increasingly used to connect smartphones to smart prosthetic devices and hearing aids. As shown in Figure 6, of all mobile phones in the sample, 99% had Bluetooth, 99% had Headphone Jack, 96% had USB outlets, 84% Digital Assistant[7], 76% had Mirror Link.

Figure 6: Assistive Technology Connection (2022)

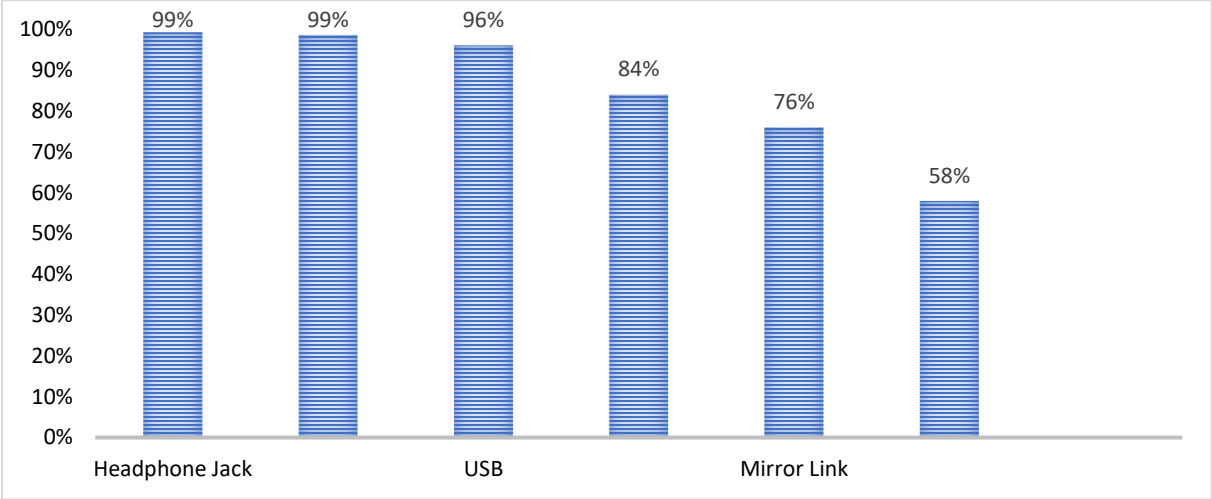
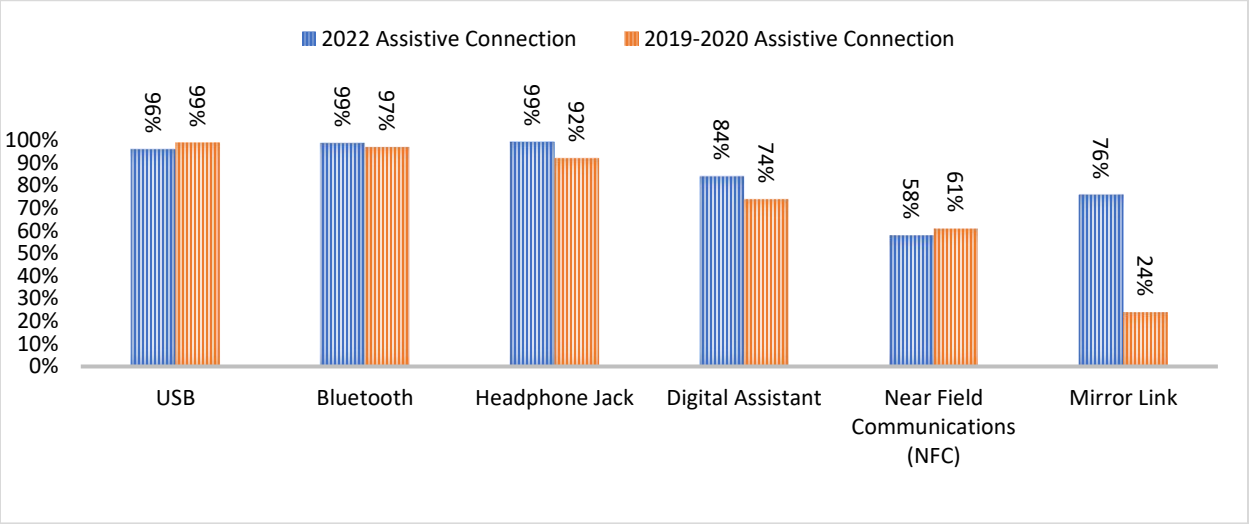


Figure 7 illustrates differences in the presence of assistive technology connection features between 2019-2020 and 2022. Most noteworthy was the substantial increase of the mirror link feature from 2019-2020 (24%) to 2022 (76%) and the slight decline in Near Field Communications (from 61% to 58%).

[7] Digital assistant is included as an AT connection because of its ability to control external devices

Figure 7: Comparison of Assistive Technology Connection (2019-2020) and 2022



Accessibility Features for Vision Disabilities

In assessing the accessibility features for vision disabilities, the study focused on the percentage of phones that had individual features that improve access for people with vision disabilities. As shown in Figure 8, 96% adjust font, 93% no screen timeout, 90% screen magnifier, 87% speech-to-text/voice input, 87% text-to-speech, 86% dedicated and clearly distinguishable key to lock the screen, 86% dedicated and clearly distinguishable volume keys, 85% accessibility menu, 84% digital assistant, 82% contrast adjustment, 79% biometric login, 75% external keyboard support, 72% screen reader, 61% FM radio, 57% voice notes, 42% haptic feedback, 25% braille display support, 15% physical keyboard/QWERTY. In 2022, we added several additional features that further support people with vision disabilities, specifically haptic feedback, and dedicated buttons for locking the screen as well as adjusting the volume.

Figure 8: Vision Accessibility Features (2022)

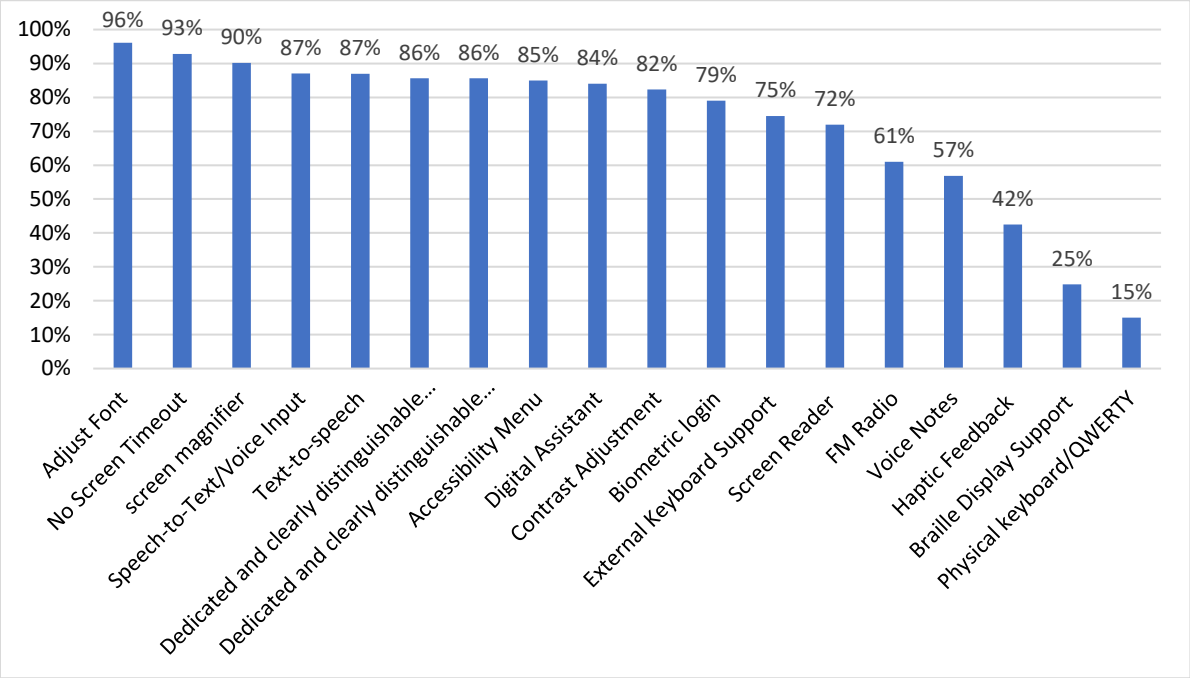


Figure 9 shows growth in the presence of every accessibility feature for vision related disabilities except Braille display support, which has seen a decrease of 5% from 2019-2020 (30%) and 2022 (25%), and Biometric Login saw a 1% decrease (80% in 2019-2020 to 79% to 2022). Table 3 further illuminates differences between these two years. These data suggest a general trend towards improved accessibility for people with vision disabilities.

Figure 9: Comparison of Accessibility Features for Vision Disabilities (2019-2020) and 2022

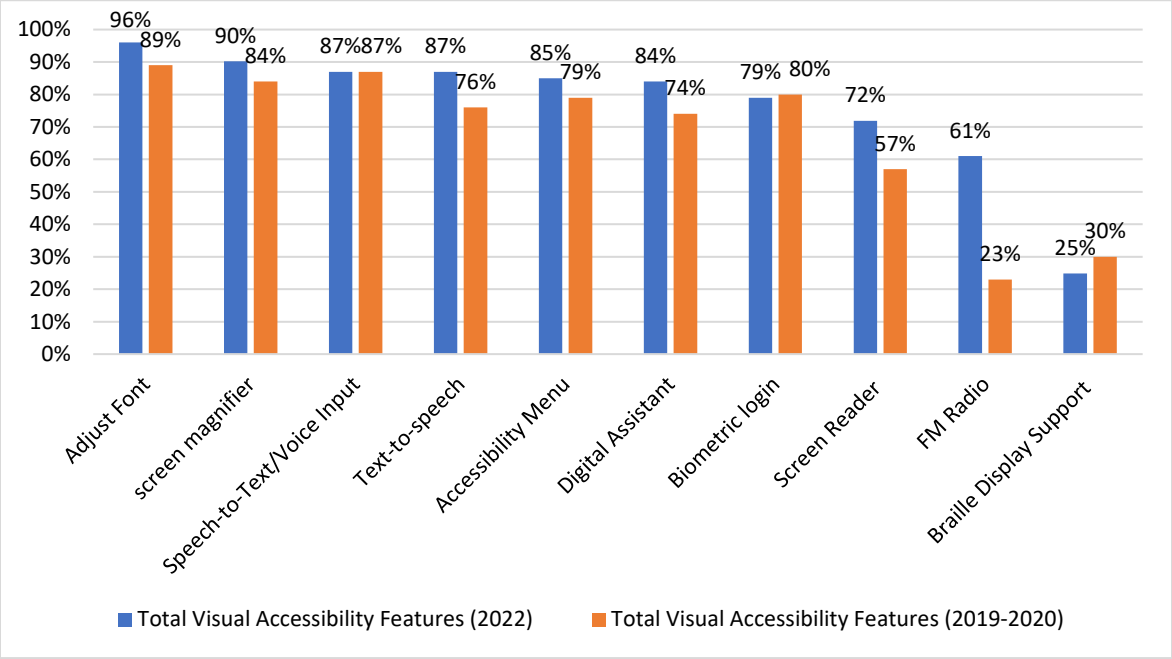


Table 3. Changes in Accessibility Features Supporting Vision and Visual Disabilities

Accessibility Features Supporting Vision	Percent Point Increases Since 2019-2020
Simple display	49 points
Intelligent Personal Assistant	21 points
Contrast Adjustment	18 points
Screen reader	15 points
Built-in TTS	11 points
Adjust Font	7 points
Accessibility Menu	6 points
Accessibility Features Supporting Vision	**Percent Point Decreases/No Change Since 2019-2020**
Speech-to-text/Dictation	0 points
Biometric Log-In	-1 points

Accessibility Features for Hearing Disabilities

Figure 10 illustrates the accessibility features and phone characteristics that are salient for people with hearing disabilities. Touch input was included as an input alternative to voice input, and Bluetooth was included because of the availability of Bluetooth connected hearing aids. Hearing Aid Compatibility is discussed separately, and results are shown in Figure 11. Ninety-nine percent (99%) of phones had Bluetooth, 98% speakerphone capable, 94% HAC rating, 93% adjustable vibration, 93% no screen timeout, 89% had touch input, 85% had accessibility menu,

85% had visual indicators on display, 76% configurable audio, 76% closed captioning, 75% real-time text, 71% two-way video, 59% flashlight notification, 42% haptic feedback, and 41% visual indicators on display. This year's review, 2022, included a flashlight notification feature which refers to the device's capability to notify the user of messages or notifications through light flashing (GARI, 2022).

Figure 10. Accessibility Features for Hearing Disabilities

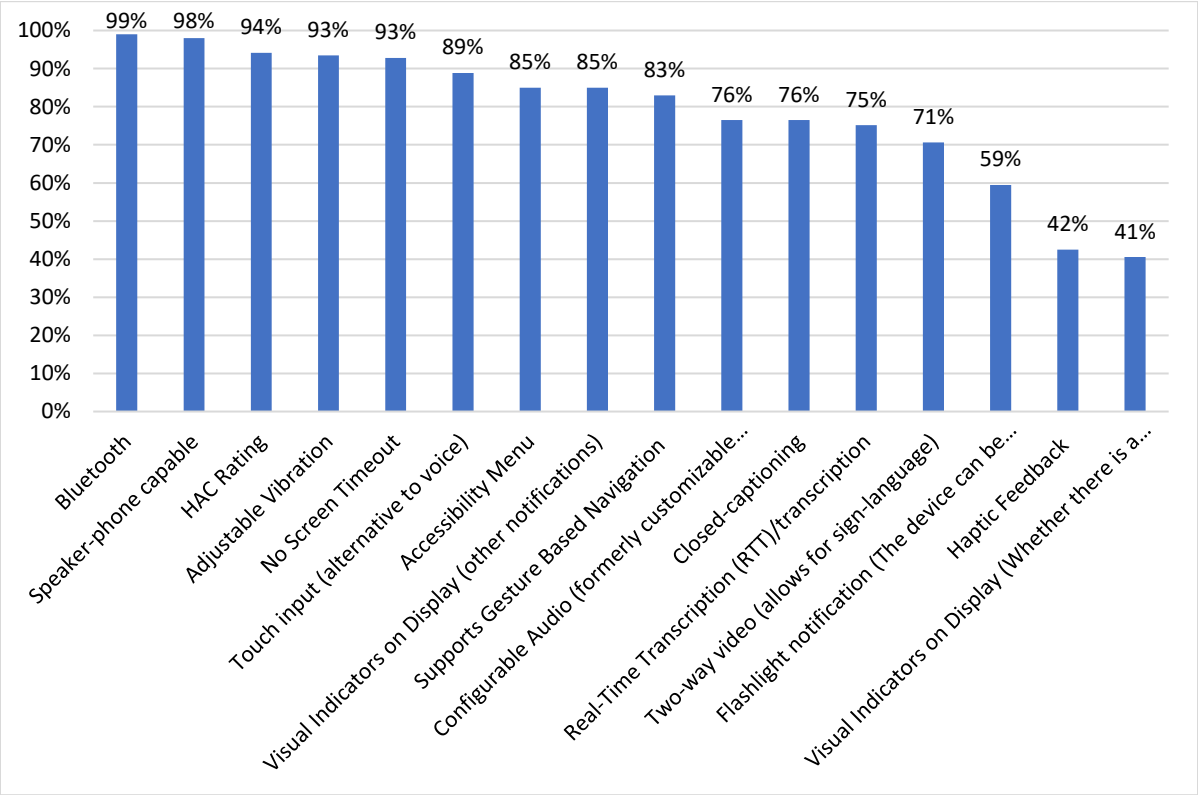


Figure 11 shows a comparison of accessibility features for hearing disabilities from 2019-2020 to 2022. These data suggest a upward tick of increased accessibility for people with hearing disabilities in the sampled mobile phones. As noted in the 2019-2020 report, phone manufacturers introduced real-time text (RTT). As it was a relatively new accessibility feature in 2019, we experienced a low presence of this feature (23%). However, there was a sharp uptick in the presence of this feature in 2022. There was a decrease in the availability of two-way video capability from 91% in 2019-2020 to 2022. This feature is essential for people who are Deaf and whose primary language is American Sign Language (ASL).

Figure 11. Comparison of Accessibility Features for Hearing Disabilities

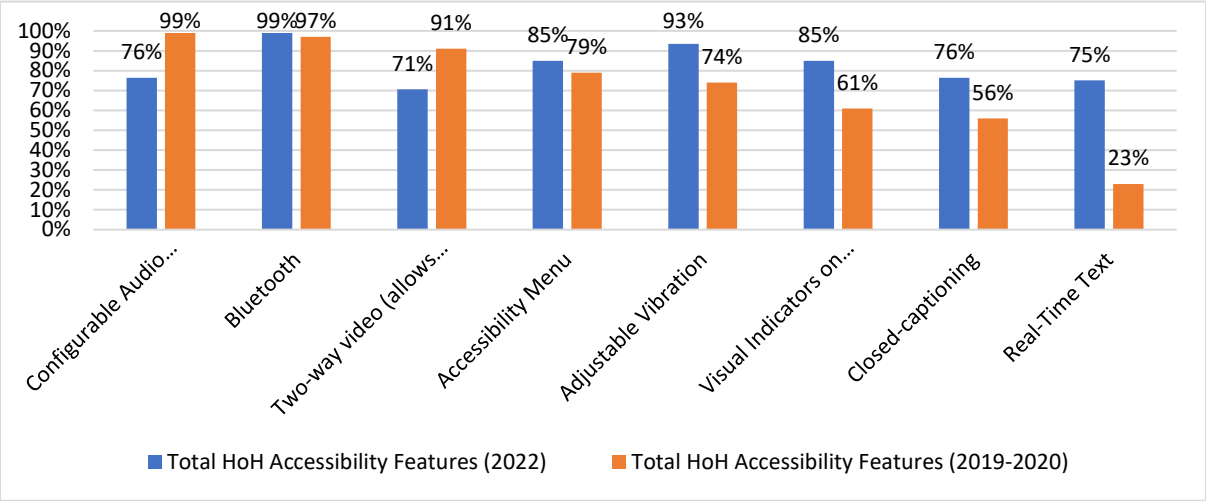


Table 4 shows other percent point differentials between 2019-2020 and 2022.

Table 4. Differential of Accessibility Features for Hearing Disabilities between 2019-2020 and 2022

Accessibility Features Supporting People who have Hearing/Hard of Hearing Disabilities	**Percent Increase Since 2019-2020**
Real-Time Text (RTT)	52 points
Visual Indicators on Display (other notifications)	24 points
Closed captioning	20 points
Adjustable Vibration	1 point
Accessibility Menu	6 points
Bluetooth	2 points
Accessibility Features Supporting People who have Hearing/Hard of Hearing Disabilities	**Percent Decreases/No Change Since 2019-2020**
Two-way video (allows for sign-language)	-20 points
Configurable Audio (formerly customizable volume)	-23 points

Another phone feature useful for people who use hearing aids and cochlear implants is the HAC rating. Without a HAC-compliant device, a user with a hearing aid or cochlear implant would experience interference. Out of the 153 mobile phones, all of the phones with ratings had at least a HAC rating of M3 or T3, on a scale of 1 to 4, with four being considered excellent. As

shown in Figure 12, M3/T4 accounts for 46%, M3/T4 (27%), M4/T3 (12%), M4/T4 (8%), N/A (7%). HAC ratings were found for 93% of the sample, which is a decrease of 6% from the 2019 sample. Figure 13 displays a comparison of HAC ratings from 2019-2020 to 2022.

Figure 12. HAC Rating

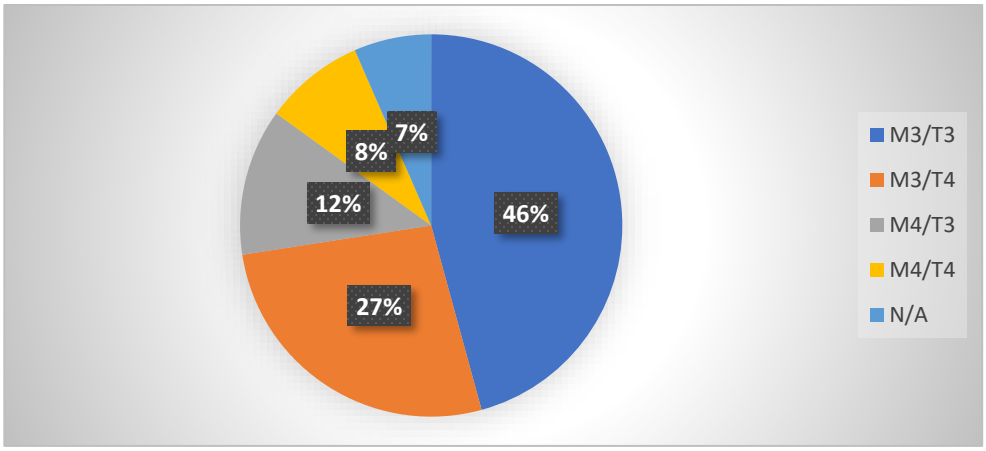
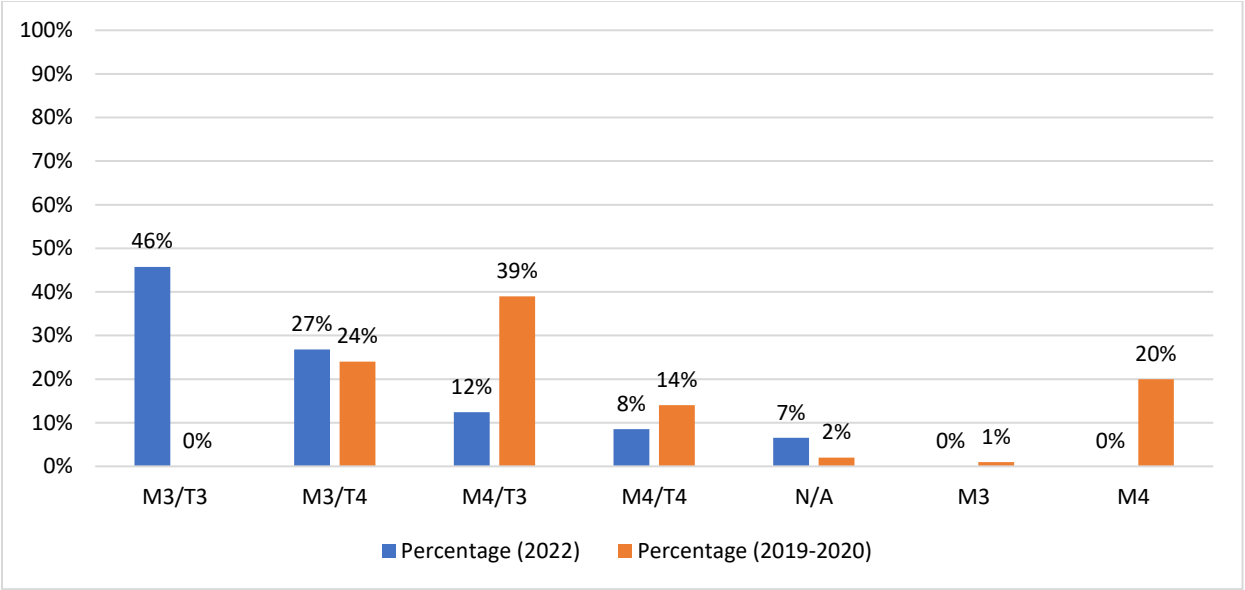


Figure 13. Comparison of HAC Rating from 2019-2020 to 2022



Accessibility Features for Cognitive Disabilities

Figure 14 displays accessibility features and phone characteristics aimed to improve the accessibility of the device for people with cognitive disabilities. Of the sampled mobile phones, 96% adjust font, 95% speed dial, 93% no screen timeout, 87% speech-to-text/dictation, 86% dedicated and clearly distinguishable key to lock the screen, 86% predictive text input, 85% accessibility menu, 84% intelligent personal assistant, 83% simple display, 82% contrast

adjustment, 79% biometric log-in, 72% screen reader, 57% voice notes, 56% automatic redial, 51% automatic answer or any key answer. Features for customizing the display, the appearance of on-screen text, and alternative log-ins (e.g., biometrics) can be assistive to people with cognitive disabilities, as they allow for:

- Ease of call taking/making (auto answer/ any key answer, speed dial, and auto redial),
- Ease of navigation (distinguishable home button),
- Shorter word counts per line (adjust font),
- Auditory information processing (TTS and screen reader),
- Removal of distracting stimuli (simple display),
- Readability (contrast adjustment),
- Limiting dependence on typing (voice input, digital assistants, predictive text), and
- Limiting dependency on memory (biometric log-in).

Figure 14. Accessibility Features for Cognitive Disabilities (2022)

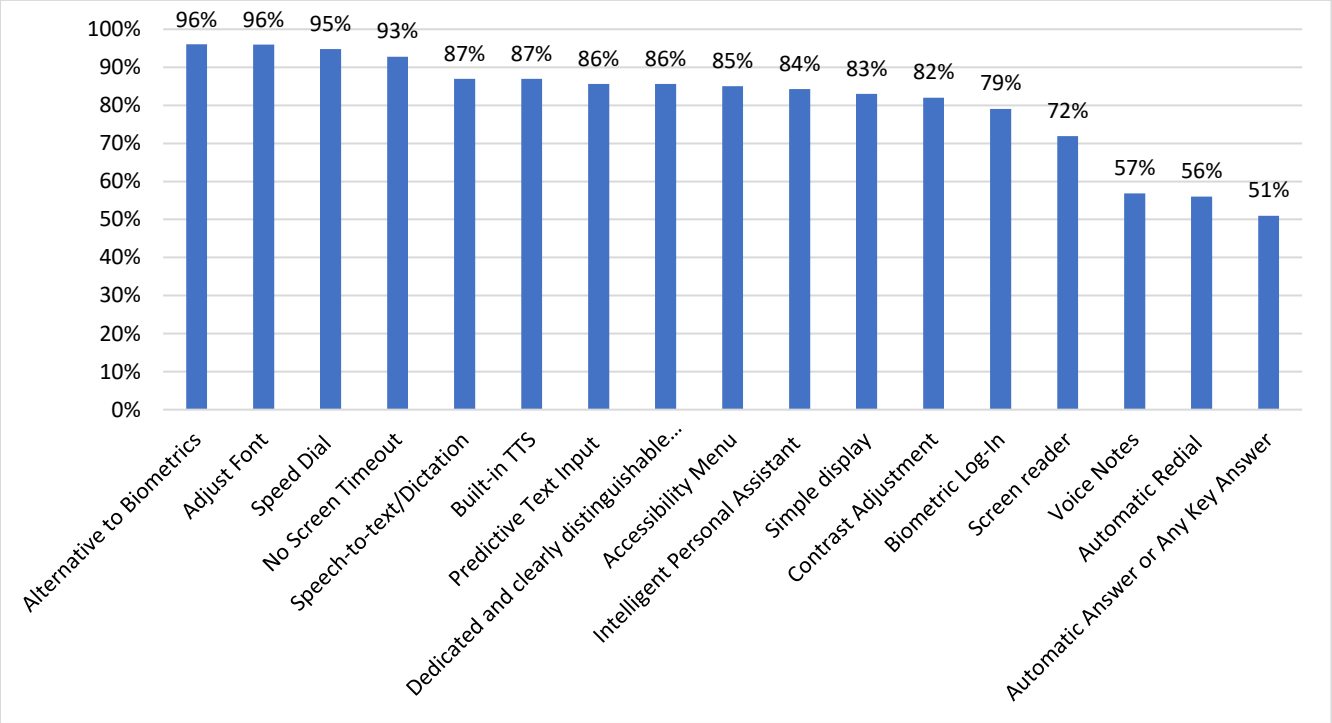
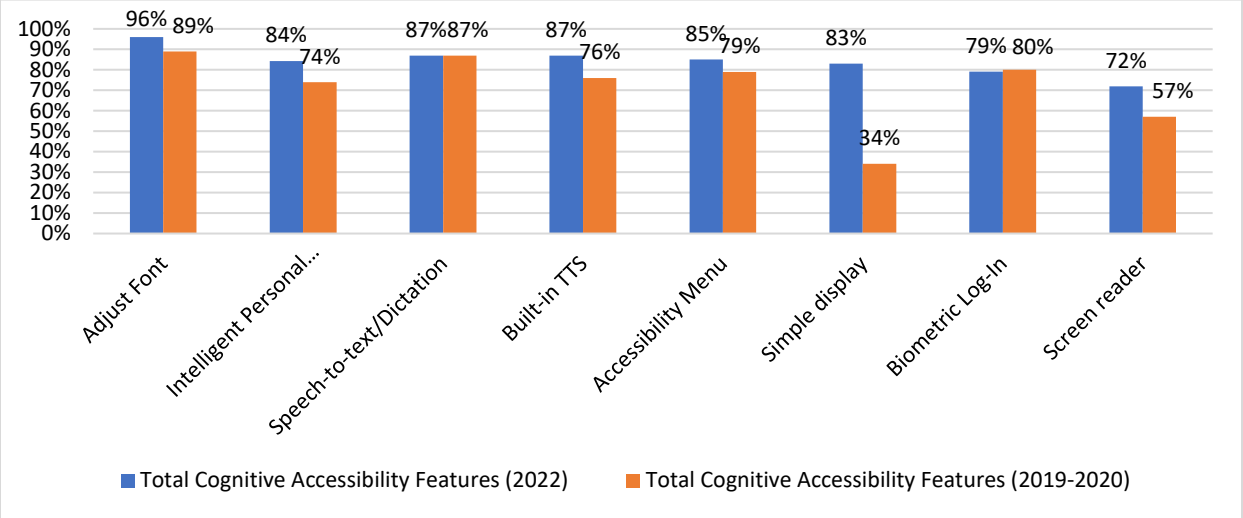


Figure 15. Comparison of accessibility Features for Cognitive Disabilities between 2019-2020 and 2022



These data illuminate an increase in the percentage of phones with features available for people with cognitive disabilities. Specifically, for people who use the voice input features and the alternative log-in as there was a significant *increase* in the presence of digital assistants or intelligent personal assistants (from 74% to 95%), talk-to-text functionality (from 76% to 87%) simple display (34% to 83%), and screen reader (57% to 72%). Table 5 highlights differences between the presence of these features between 2019-2020 and 2022.

Table 5. Differentials of Accessibility Features for Cognitive Disabilities between 2019-2020 and 2022

Accessibility Features Supporting People with Cognitive Disabilities	**Percent Increase Since 2019-2020**
Simple display	49
Intelligent Personal Assistant	21
Contrast Adjustment	18
Screen reader	15
Built-in TTS	11
Adjust Font	7
Accessibility Menu	6
Accessibility Features Supporting People with Cognitive Disabilities	**Percent Decreases/No Change Since 2019-2020**
Speech-to-text/Dictation	0
Biometric Log-In	-1

Accessibility Features for Mobility Disabilities

Figure 16 illustrates accessibility features and phone characteristics that may improve the accessibility of the device for people with mobility and dexterity disabilities. In this 2022 Review, 21 features were intended to aid people living with mobility/dexterity disability in unlocking, navigating the device, and interacting with external systems. Within the sample, 95% of phones had Speed Dial, 93% No Screen Timeout, 87% Voice Input/Speech-to-Text, 86% Predictive Text Input, 85% Accessibility Menu, 84% Intelligent Personal Assistant, 83% Supports Gesture Based Navigation, 83% Simple display, 82% Stylus or Prosthetic Device support, 79% Biometric Log-In, 75% of phones had External Keyboard Support 73% Hand Movement, 73% Assistive Touch, 58% Near Field Communications (NFC), 57% Voice Notes, 56% Automatic Answer or Any Key Answer, 54% Easy Battery Placement, 51% Automatic Redial, 48% Switch Control, 45% Anti-slip Features, 33% Eye tracking.

Figure 16. Accessibility Features for Mobility Disabilities (2022)

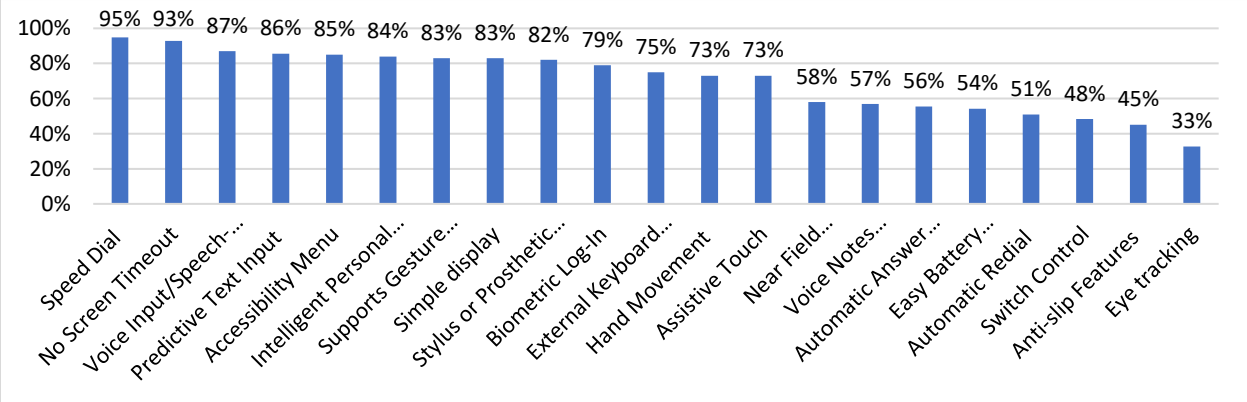


Figure 17 shows the change in the presence of mobility/dexterity-related accessibility features between the 2019-2020 and 2020 data sets.

Figure 17. Comparison of Accessibility Features for Mobility Disabilities from 2019-2020 and 2022

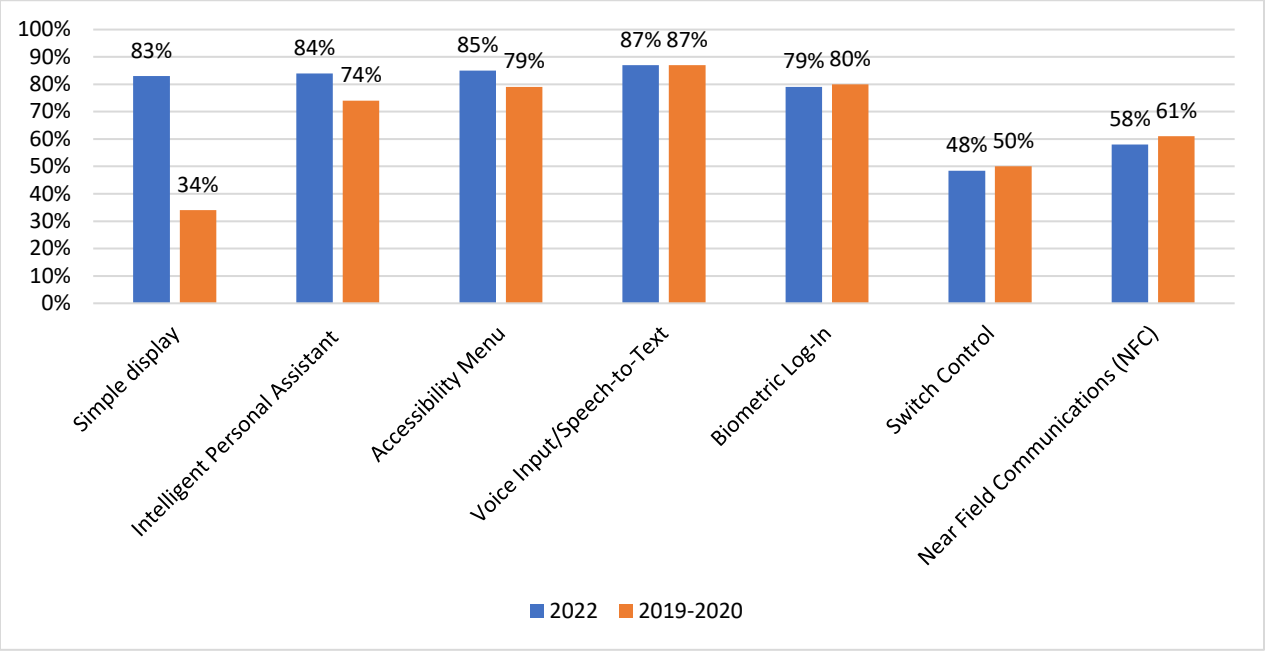


Table 6 shows a breakdown of the presence of features and percentage point changes since 2019-2020.

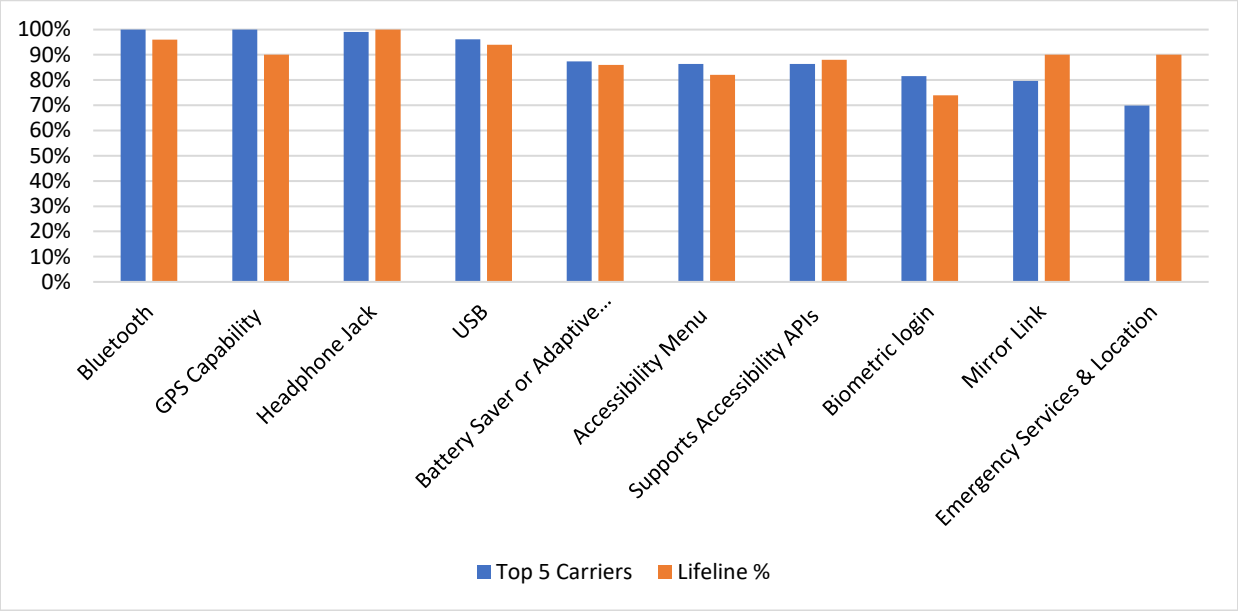
Table 6. Differential Accessibility Features for Mobility Disabilities between 2019-2020 and 2022

Accessibility Features Supporting People with Mobility Disabilities	**Percent Increase Since 2019-2020**
Simple display	+49 points
Intelligent Personal Assistant	+10 points
Accessibility Menu	+6 points
Accessibility Features Supporting People with Mobility Disabilities	**Percent Decreases/No Change Since 2019-2020**
Voice Input/Speech-to-Text	0 points
Biometric Log-In	-1 points
Switch Control	-2 points
Near Field Communications (NFC)	-3 points

Comparative Analyses and Implications

Provider Type: Tier 1 Phones and Lifeline Phones

Figure 18: Comparison of Tier 1 and Lifeline Phone Top 10 Accessibility Features (2022)



Despite Tier 1 phone models slightly outpacing Lifeline-provided models on the presence of accessibility features, there is a more encouraging outcome that shows devices obtained from Lifeline providers have improved accessibility levels compared to 2019-2020 data. The Lifeline program was designed to close the gap in access to technology between low-income populations and higher-income populations. Figure 18 illustrates that the gap is narrowing. Figure 19 shows the increase in accessibility features present in Lifeline phone models in the 2019-2020 sample compared to the 2022 sample. Only features captured during both data collection periods are included.

Figure 19: Comparison of Notable <u>Differences</u> between Lifeline Phone Features in 2019/20 and 2022

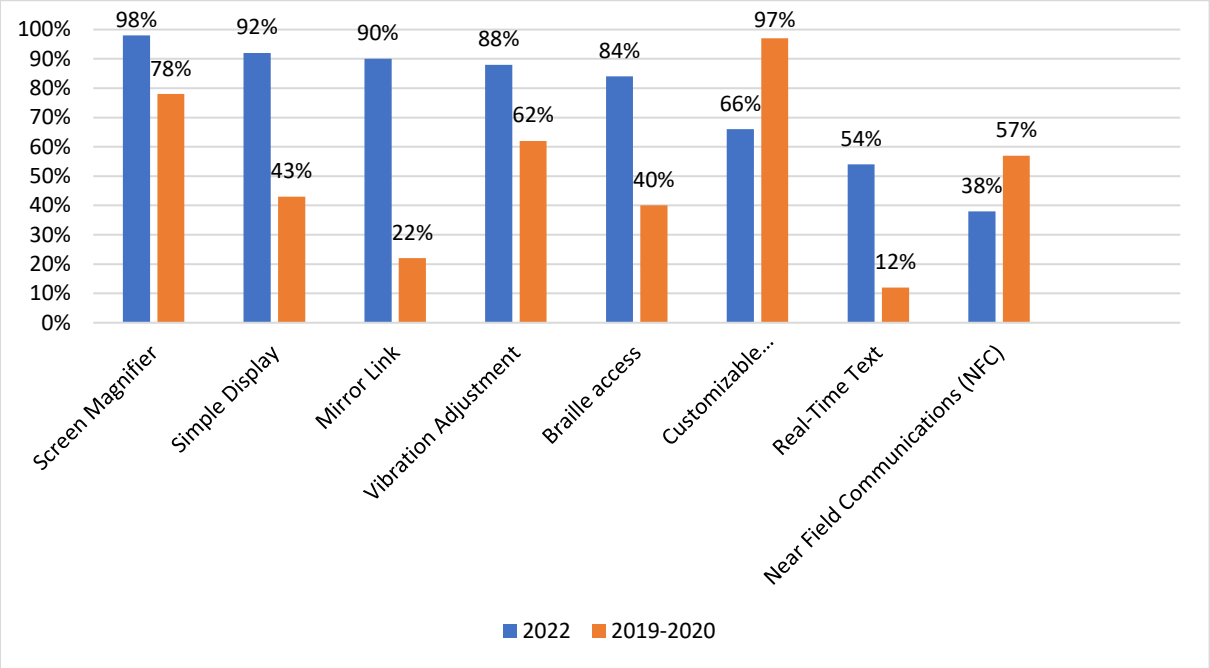


Table 7. Differences in the Presence of Lifeline Phone Features between 2019-2020 and 2022

Lifeline Phone Features	**Percent Decreases Since 2019-2020**		
	2019-2020	**2022**	**Differentials**
Customizable Volume/Configurable Audio	97%	66%	-31 points
Near Field Communications (NFC)	57%	38%	-19 points
Lifeline Phone Features	**Percent Increase Since 2019-2020**		
	2019-2020	**2022**	**Differentials**
Screen Magnifier	78%	98%	20 points
Vibration Adjustment	62%	88%	26 points
Real-Time Text	12%	54%	42 points
Braille access	40%	84%	44 points
Simple Display	43%	92%	49 points
FM Radio	12%	68%	56 points
Mirror Link	22%	90%	68 points

WEA-Capable Compared to Non-WEA-Capable Mobile Phones

In Figure 21 the data indicates that WEA-capable devices have more accessibility options than non-WEA-capable phone models. The three features with the greatest differentials include Gesture-Based Navigation Support (0% for Non-WEA to 91% for WEA), Simple Display (0% for Non-WEA to 90% for WEA), and Stylus or Prosthetic Device Support (0% for Non-WEA to 89% for WEA). (Table 7). Non- WEA-capable phones outperformed WEA-capable phones in headphone jack (99% WEA; 100% non-WEA), adjust font (97% WEA; 100% non-WEA), alternative to biometrics (96% WEA; 100%; non-WEA), USB (95% WEA; 100% non-WEA), battery saver or adaptive battery settings (86% WEA; 100% non-WEA), easy battery placement (36% WEA; 58% non-WEA), physical keyboard/QWERTY (7% WEA; 100% non-WEA).

Figure 20: Top 22 WEA-Capable Phones' Accessibility Features (2022)

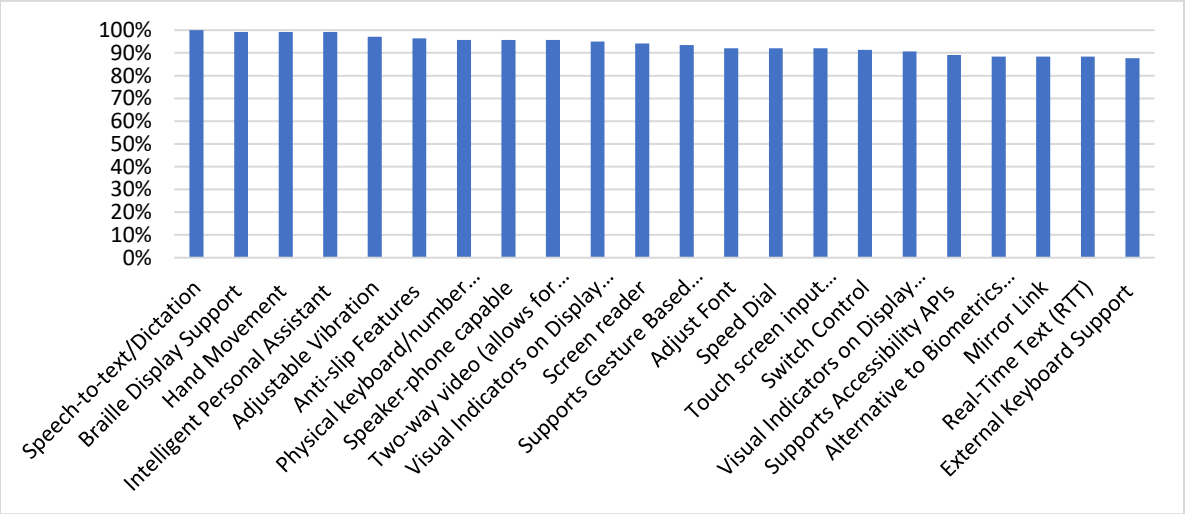


Figure 1: 2022 and 2019-2020 Comparison WEA-Capable Phones' Accessibility Features

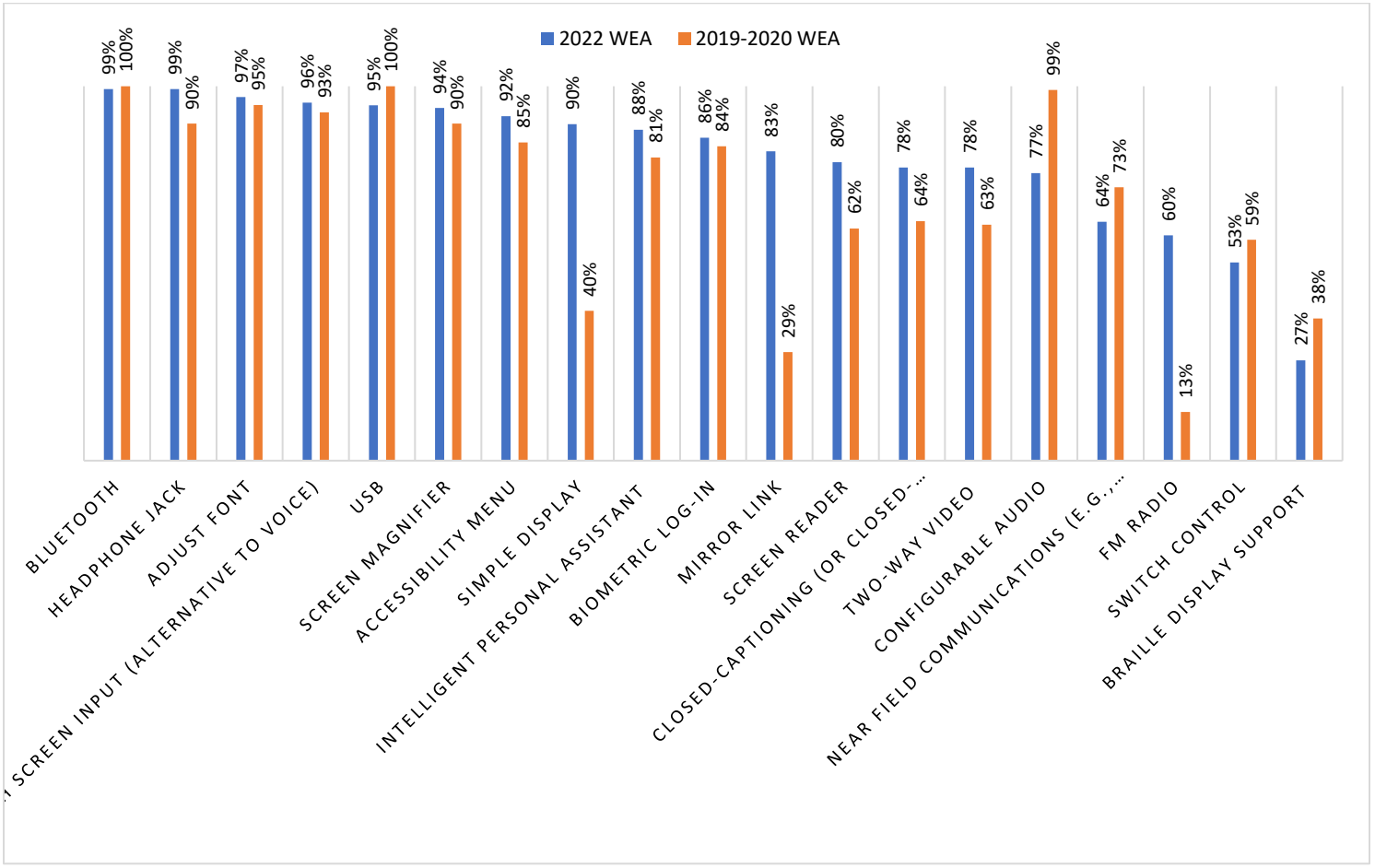


Figure 2: Comparison of WEA-Capable Phones' Accessibility Features to Non-WEA Phones (2022)

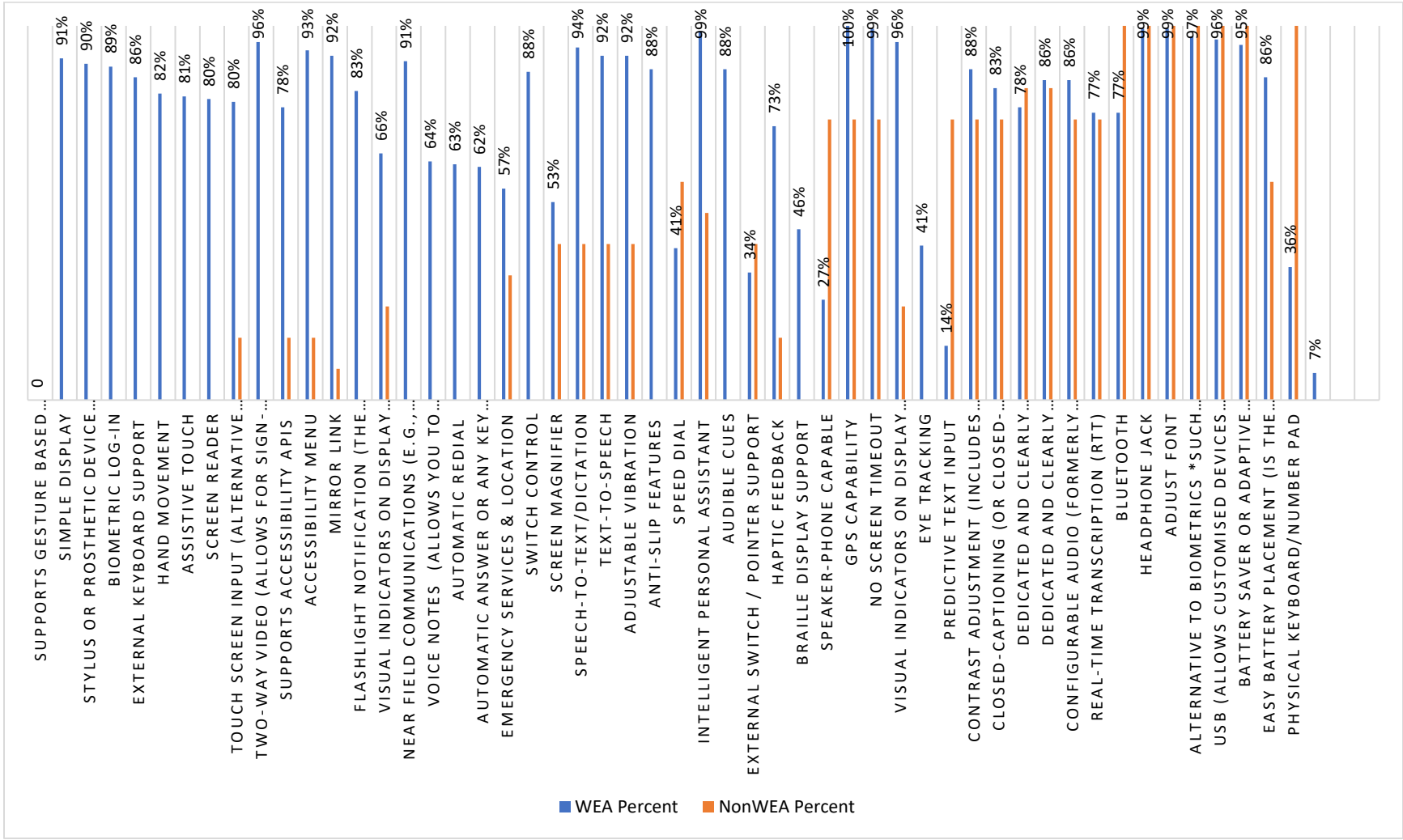
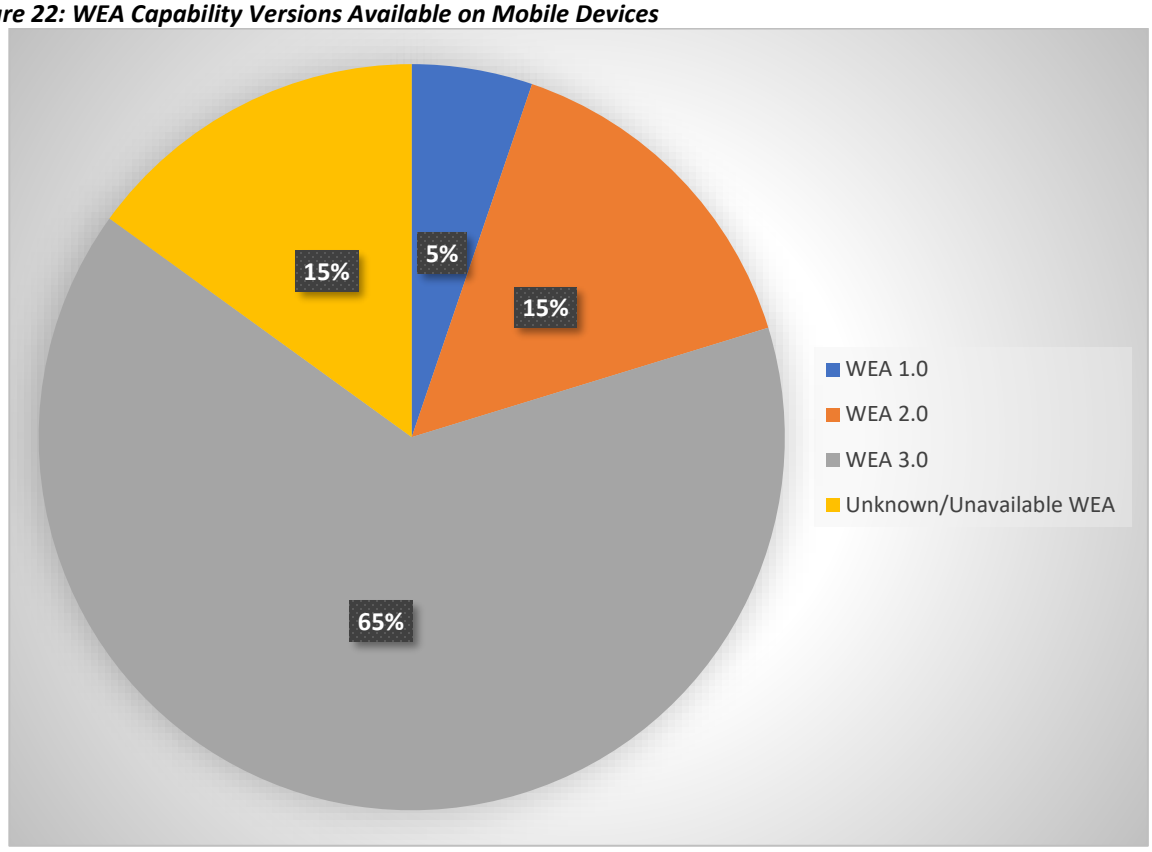


Table 7. Top 20 Steepest Differences in the Presence of Accessibility Features between WEA and Non-WEA Capable Phones

Accessibility Feature	Point Differential	Accessibility Feature	Point Differential
Supports Gesture Based Navigation	91 points	Mirror Link	74 points
Simple display	90 points	Flashlight notification	66 points
Stylus or Prosthetic Device support	89 points	Visual Indicators on Display	66 points
Biometric Log-in	86 points	Near Field Communications (e.g., Google Pay/Apple Pay)	64 points
External Keyboard Support	82 points	Voice Notes	63 points
Hand Movement	81 points	Automatic Redial	62 points
Assistive Touch	80 points	Automatic Answer or Any Key Answer	57 points
Screen reader	80 points	Emergency Services & Location	54 points
Touch screen input	79 points	Switch Control	53 points
Two-way video	78 points	screen magnifier	53 points
Supports Accessibility APIs	77 points	Speech-to-text/Dictation	50 points
Accessibility Menu	75 points	Text-to-speech	50 points

Figure 22: WEA Capability Versions Available on Mobile Devices



Over the last five years, the Federal Emergency Management Agency (FEMA) and Federal Communications Commission (FCC) have released regulatory updates that allow WEA messaging to offer more information (e.g., characters allowed in the text), expanded languages WEA message is delivered in, and geo-targeted messages for more precise reach. WEA 1.0 allows a maximum of 90 characters. In 2019, FCC authorized WEA 2.0, which allows a maximum of 360 characters in both English and Spanish. Now, WEA 3.0 offers enhanced geotargeting.

Phone Type: Smartphones Compared to Non-smartphones

Mobile phone accessibility features were evaluated by phone type: smartphone or non-smartphones. Eighty-nine percent (89 points) of the phones in the 2022 Accessibility Review sample were smartphones, and 11 points were non-smartphones. The results indicate that both phone types contained features that can be assistive to people who are blind, have low vision, cognitive disabilities, and/or physical disabilities. In the smartphone subsample, the most frequently incorporated (top five) features were Bluetooth (100 points), Touch Screen/Input (100

points), GPS (100 points), Speakerphone (100 points), Headphone Jack (99 points). For the non-smartphones subsample, the top five features included USB (100 points), Physical Keypad (100 points), Headphone Jack (100 points), Dedicated and clearly distinguishable key to lock the screen (100 points), and dedicated and clearly distinguishable volume keys (100 points).

Smartphones outperformed non-smartphones in the percentage of accessibility features present, pulling higher percentages for 24 of the 33 features examined (73 points) which is a decrease from the 2019-2020 sample. In the 2019-2020 sample, smartphones outperformed nonsmartphones in 26 of 35 features (74 points). However, the continued outpacing of smartphones to nonsmartphones shows that smartphones not only have a greater variety of accessibility features, but they outperform non-smartphones in many categories of accessibility. Figure 22 demonstrates a noteworthy phenomenon: non-smartphones can have advanced features. 12 points of non-smartphones had mirror link capabilities, and 18 points of non-smartphones had text-to-speech. To better compete with smartphones, it appears that non-smartphone manufacturers are integrating popular smartphone features into their core models. The 2022 trend of non-smartphone capabilities illustrate that manufacturers have begun to offer a lot in the way of integrating a durable tactile form factor with some advanced software (e.g., GPS capabilities and Intelligent Personal Assistant).

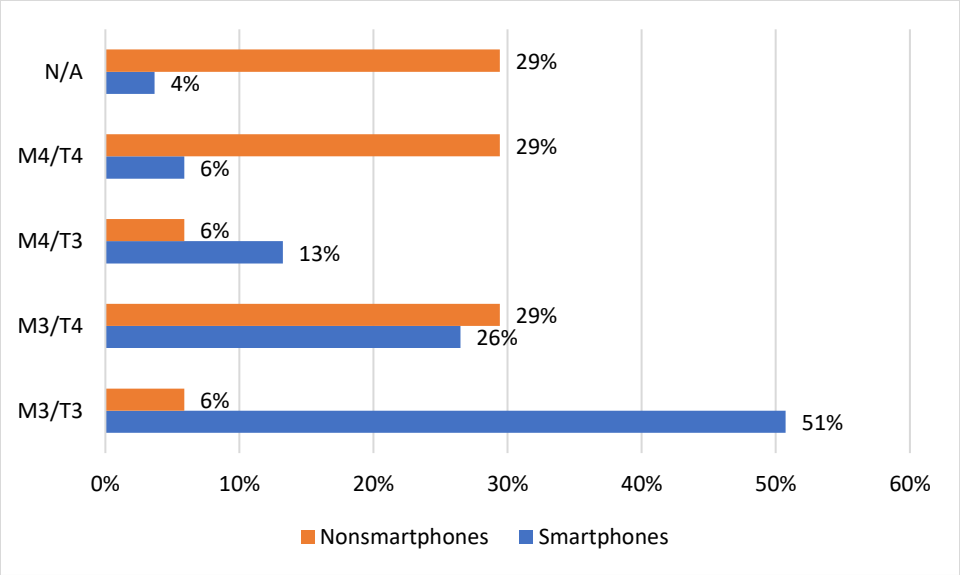
Table 8: Steepest Point Differential between Smartphone and Non-Smartphone Features (2022)

Features	**Percentage Point Differential**
Simple display	80 points
Stylus or Prosthetic Device support	79 points
Speech-to-text/Dictation	78 points
Text-to-speech	78 points
Visual Indicators on Display (other notifications)	76 points
Adjustable Vibration	74 points
Mirror Link	73 points
External Keyboard Support	71 points
screen magnifier	68 points
Emergency Services & Location	60 points
External Switch / Pointer Support	59 points
Intelligent Personal Assistant	55 points
GPS Capability	29 points
Speed Dial	27 points

Visual Indicators on Display	26 points
No Screen Timeout	25 points

Of the features that were present in both phone types, the ones with the steepest differentials are shown in Table 8. These data indicate that consumers with disabilities seeking to purchase smartphones have more device options with a greater variety of accessibility features. Of concern, however, is that some users prefer non-smartphones for their perceived durability,[8] and this preference could inhibit access to WEA messages since only 41 points of non-smartphones were WEA-capable compared to 99 points of smartphones in 2022.

Figure 24: Comparison of Smartphone and Non-Smartphone HAC Ratings



Looking at HAC (Figure 24), the non-smartphones sampled had the greatest percentage of phone models with dual M4/T4 ratings (29 points compared to 6 points) and M3/T4 ratings (29 points compared to 26 points). Whereas the smartphones had greater percentages of phone models with M3/T3 HAC ratings (51 points compared to 6 points) and M4/T3 HAC ratings (13 points compared to 6 points).

[8] Mitchell, H., LaForce, S., Moon, N., Baker, P.M.A., Garcia, A., & Jacobs, B. (2018, May 3). Comments submitted in response to the Public Notice in the Matter of The Accessibility of Communications Technologies for the 2018 Biennial Report Required by the Twenty-First Century Communications and Video Accessibility Act [CG Docket No. 10-213, Consumer and Governmental Affairs Bureau]. Federal Communications Commission: Washington, D.C.

Discussion

Previous research illustrates the importance of accessible mobile devices for people with disabilities in executing daily life activities.[9,10,11] Over the last two years, an unprecedented global health crisis led to an increased reliance on mobile devices to engage in social connectedness, education, employment, and to stay up to date with pertinent news. The ability of mobile device users to receive timely and pertinent health information over the last two years was predicated, in part, on whether the device held WEA capabilities. Our market analysis of mobile phones showed that the current sample of devices had an increase of 18% in WEA-capabilities (92%) in 2022, from the 2019-2020 analysis where only 74% of devices were WEA-capable. It is encouraging that manufacturers are integrating these functionalities within more devices. However, as Figure 22 showed, there are still mobile devices (15%) that are available on the market that do not have WEA-capabilities, or the information is not readily available to consumers. Furthermore, there are some mobile device markets operating on WEA 1.0 (5%), and although this isn't a sizable portion, these phones are primarily nonsmartphones that are available through Lifeline. **This discrepancy causes inequities in accessing pertinent emergency communication and limits these individuals' abilities to take appropriate protective actions.** This issue becomes particularly salient as we reflect on the last two years and the communities that were particularly vulnerable to COVID-19 exposure.

In a forthcoming survey study conducted by the CACP in 2021, we inquired about barriers to accessing COVID-19 information, and some respondents (17%) indicated that captions were inadequate or there was no captioning provided for audio or emergency communication on their device. As a result, these individuals did not experience equitable access to salient information. **Thus, as the mobile manufacturers continue to make progress, we urge the FCC and Congress**

[9] DePompei, R., Gillette, Y., Goetz, E., Xenopoulos-Oddsson, A., Bryen, D., & Dowds, M. (2008). Practical applications for use of PDAs and smartphones with children and adolescents who have traumatic brain injury. *NeuroRehabilitation*, *23*(6), 487-499.

[10] Lancioni, G. E., Singh, N. N., O'Reilly, M. F., Sigafoos, J., Alberti, G., Zimbaro, C., & Chiariello, V. (2017). Using smartphones to help people with intellectual and sensory disabilities perform daily activities. *Frontiers in public health*, *5*, 282.

[11] Morris, J. T., PhD, Sweatman, M., PhD, & Jones, M. L., PhD. (2017). Smartphone Use and Activities by People with Disabilities: User Survey 2016. Retrieved from http://scholarworks.csun.edu/bitstream/handle/10211.3/190202/JTPD-2017-p50-66.pdf?sequence=1

to consider ways in which accessibility of mobile devices intersects with access to emergency communications.

Relatedly, the 2022 Review included easy battery replacement as an accessibility feature, as it can be helpful for people with a variety of disabilities who may need to exchange out their battery to avoid replacing their mobile phone because the battery is depleted. Our research has shown that easily replaceable battery is also important to people with disabilities in the wake of an emergency when electric power is disrupted. Thus, the presence of easy battery replacement in mobile phones (39%) has post-disaster battery preservation implications for people with disabilities who rely on their devices for communications (i.e., mobile only households), and persons with disabilities that require the use of battery-hogging features such as screen brightness, two-way video, GPS, maps apps, and more. Kongsiriwattana & Gardner-Stephen noted that the battery life needed during non-disasters is lower than during emergencies.[12] The study found that roughly half of the participants indicated that their mobile phones lasted longer than 24 hours on a single charge during a typical day. As many phones are not completely charged when disasters occur, the scholars calculate that only 46% of users would have sufficient battery power for the phone to be useful.

However, certain phone features are a requisite for effective use regardless of circumstances, whether on a typical day or in the wake of a disaster. With our focus group participants, concomitant with the use of two-way video was the need for increased brightness levels, which places the phone in double-jeopardy of rapid battery drain that is tied to communications access. "Whenever I am using anything video-related, the power goes super-fast," explained one participant. **Persons who are Deaf are seemingly differentially impacted by battery drain issues as their use of video and high brightness levels are required to maintain communications on a normal day and during emergency events.** Finally, emergency managers recommend that emergency preparedness kits include backup batteries for cellphones. As such, again we see that the ease of replacing a battery, is tied to disaster preparedness, and we

[12] Kongsiriwattana, W., & Gardner-Stephen, P. (2016, October). Smart-phone battery-life short-fall in disaster response: Quantifying the gap. In 2016 IEEE Global Humanitarian Technology Conference (GHTC) (pp. 220-225). IEEE.

encourage that the context of mobile phone use be considered when assessing the accessibility of devices on the market.

Accessibility Over the Years

This paper began with an overarching evaluation of accessibility since the last biennial report (2019-2020), and we noted that in the aggregate growth has continued in accessibility features for people with a wide range of disabilities. Upon disaggregating this data, as shown in Figures 7, 9, 11, 15, and 17, the sampled mobile phones in 2022 outperformed the sampled phones in 2019-2020 in most accessibility features. One of the unexpected findings is the drastic increase of mirror link feature in mobile phones (24% in 2019-2020, 76% in 2022). The increase in Mirror Link indicates an increase in connected vehicle technology. **As such, the accessibility of in-vehicle technology extends to the accessibility of smartphones, and vice versa.** With 65% of persons with disabilities being drivers, it's important to tease out any accessibility gaps that may exist between the connected car technology and the smartphones.[13]

Hearing Aid Compatibility (HAC) Accessibility

While the vast majority of phones in the sample had a HAC rating, the highest quality rating, M4/T4, accounts for only 8% of phones. Switching between the microphone and the telecoil, the individuals should not have a degraded experience. Of course, the HAC ratings are likely impacted by advances in the hearing aid industry itself-for example, adaptive directional microphones that address the competing sounds issue, originally the purview of the telecoil. Nevertheless, manufacturers and policymakers should not assume hearing aid users have the latest and greatest hearing aids. **Again, we find ourselves in a place where the capabilities of an external technology, in this case hearing aids, interacts with the quality of a mobile phone accessibility feature, and vice versa.** As a remedy, increasing the percentage of phones with a M4/T4 HAC rating is recommended.

[13] Bureau of Transportation Statistics (2011). Data Analysis. https://www.bts.gov/archive/publications/freedom_to_travel/data_analysis

Braille Display Support

The Public Notice acknowledged several commenters feedback regarding the lower accessibility of mobile phones for people who use braille readers (p. 2). In our study, we found that only 25% of the phones in the sample had Braille Display Support. This finding offers further evidence to the AFB's argument (p. 2) that people who utilize braille readers have lower accessibility for some advanced communication devices (e.g., mobile phones). **Recommendation**: Although, there are alternative accessibility features (e.g., speech to text/voice input) for people with visual disabilities, we do recommend that the FCC further construct regulatory standards for the integration of this feature to improve these users' ability to utilize their devices

Usability

In the Public Notice, the FCC requested response comments to the initial filing and further data exploring the accessibility of telecommunications and advanced communications equipment. Based on our biennial market analysis of mobile phones, we note that manufacturers are severely lacking in compliance on Sections 255, 716, and 718 that require "covered services and equipment are usable by people with disabilities." In the Public Notice, the FCC defines a product or service as "usable" if "companies provide people with disabilities with information on how to use services, such as documentation for the product or service, including instructions, product or service information (including accessible feature information), customer support, and technical support." More than 30% of the phones in our sample either did not have readily accessible phone manuals online for consumers to review features, inadequate phone manuals (less than five pages), or missing feature information. As a result, we, as researchers, utilized and cross-referenced our coding with three to four other sources. The average consumer may not have the endurance or desire to review mobile devices as extensively. The majority of the limited utility of product instructions were non smartphones provided via Lifeline carriers. **Recommendation**: We urge the FCC to develop cohesive and defined standards for manufacturers' product instructions, information, and services, particularly those surrounding accessible feature information.

Conclusion

We concur with the initial findings that the mobile phone field has rapidly adopted, expanded, and enhanced accessibility features to improve the digital inclusion of people with disabilities over the last two years. However, there is a need for standardization around "minimum" compliance for accessibility by Lifeline carriers who are receiving federal subsidies.

As it defeats the purpose of the digital equity program if low-cost devices offered via the program have diminished levels of accessibility compared to the Top 5 carriers. In some cases, namely when the cell phones lack WE-capability and/or high accessibility levels, inequities between those most vulnerable to poverty and disaster and the more affluent consumers are perpetuated. Finally, there also exists a need to standardize around "usable" product information and instructions as manufacturers widely vary on what and how they share this vital information.

Respectfully submitted,

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Dated this 8th day of August 2022

Appendices

Appendix A. List of 2022 Accessibility Features

Headphone Jack
Bluetooth
Speaker-phone capable
GPS Capability
Adjust Font
Alternative to Biometrics *such as a PIN*
USB (Allows customized devices to work with the phone. Device can be connected to the phone by using a USB connection.)
Speed Dial
No Screen Timeout
WEA-capable (Dichotomous Y/N)
screen magnifier
Smartphone
Touch input (alternative to voice)
Battery Saver or Adaptive Battery Settings
Speech-to-text/Dictation
Supports Accessibility APIs
Text-to-speech
Dedicated and clearly distinguishable key to lock the screen
Dedicated and clearly distinguishable volume keys
Predictive Text Input
Accessibility Menu
Visual Indicators on Display (other notifications)
Intelligent Personal Assistant
Adjustable Vibration
Emergency Services & Location
Simple display
Supports Gesture Based Navigation
Contrast Adjustment (includes color inversion, dark theme, gray scale)
Stylus or Prosthetic Device support
Biometric Log-in
Closed-captioning Support
Configurable Audio (formerly customizable volume - Allows users to configure or customize specific audio parameters by allowing to adjust frequencies and sound from their headphones.)

Mirror Link
Real-time text
External Keyboard Support
Hand Movement
Assistive Touch
Screen reader
Two-way video (allows for sign-language)
External Switch / Pointer Support
FM radio
Flashlight notification
Near Field Communications
Voice Notes (Allows you to record, save and play back a short voice reminder)
Automatic Redial
Automatic Answer or Any Key Answer
Switch Control
Haptic Feedback
Visual Indicators on Display (Whether there is a visual indicator on the display to indicate whether any enhancements are connected (Loopset, Headset or TTY/Textphone))
Easy Battery Placement
Anti-slip Features
Audible Cues
Braille Display Support
Physical keyboard/number pad
Eye tracking