Article • Use of Smartphones and Vision Accessibility Features by Adults 60 Years and Older

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ABSTRACT

Background: Information, including health-related material, is increasingly being shared electronically. Older adults with relatively normal visual acuity can have functional vision loss (e.g., visual field, contrast) that can impact their ability to view this material. Smartphones have built-in vision accessibility settings that allow text to be enhanced. However, many may not be aware of these features. Older adults presenting for eye examinations were surveyed about their use of smartphones and vision accessibility features.

Methods: A convenience sample attending a geriatric-based eye clinic was surveyed. Respondents had visual acuity better than or equal to 20/40, were ≥60 years old, and verified their own smartphone use/ownership.

Results: Of the 59 people surveyed, all used their smartphone as a telephone. The majority used it for texting (91.5%), internet access (72.9%), e-mail (69.5%), additional light (62.7%), other apps (52.5%), and social media (50.8%). Fewer respondents (27.2%) reported using apps for health/diet/wellness. When the use of multiple methods to access content was considered, only 35.6% used it to text, e-mail, and access the internet/apps related to health diet or wellness. Many may not be seeking out additional training on smartphone use since the majority (82%) reported already using their smartphone for everything that they desired. Accessibility feature use was reported by 33.9%. The majority (70.0%) solely increased font size. Accessibility settings were changed by patients themselves or by a friend/family member (90%). About one-quarter (23.7%) did not use/know about these features. There was a statistical correlation between younger age and social media use.

Conclusion: The large majority of respondents used their smartphone to access electronic communication/information; however, variability existed. These findings support the development/recommendation of electronic health materials. However, consideration should be given to methods for accessing content. The majority of respondents were not using vision accessibility features, and many did not know about them. None had an eye care provider/staff modify these features. Examination findings can be used to tailor suggestions about optimal smartphone settings.

Keywords: accessibility, functional vision, geriatric patients, health education, smartphone

Introduction

The percentage of adults 65 and older who own a smartphone has steadily increased in recent years.[1] In 2019, it was estimated that 53% of Americans 65 and older owned a smartphone, an increase from 18% in 2013.[2] A benefit of owning a smartphone may be the opportunity to communicate through a variety of means with individuals, groups, and organizations. Depression and social isolation are concerns in older adults.[3-5] In fact, social isolation has been assessed as a predictor of mortality.[6] Use of the internet has been shown to decrease loneliness and to increase

social contact among seniors.[7,8] The ability to view text effectively on a smartphone could lead to enhanced use, leading to more engagement with community and family and thus improved health.

An understanding of the trends in vision and ocular disease that occur as people age is important. The incidence and prevalence of many systemic and ocular conditions have been predicted to rise among older adults.9,10 In those without ocular disease, high-contrast visual acuity typically remains relatively well preserved into peoples' seventies.[11-13] Other aspects of functional vision, such as contrast sensitivity, glare perception, glare recovery, and color vision, can be affected as one ages in individuals both with and without significant ocular disease.[11-14] The prevalence of vision impairment and ocular disease increases with age, which can exacerbate functional vision deficits with and without reduction in high-contrast visual acuity.[15,16]

Desktop and portable electronic magnification devices were developed for, and are primarily used by, visually impaired individuals to view printed materials. In addition to magnification, common accessibility features on these devices include contrast enhancement, reverse polarity, color enhancement, and text-to-speech. In addition, programs were created to enhance electronic print. In recent years, consumer electronic devices not primarily developed for the visually impaired (e.g., smartphones, e-readers, and tablets) also have vision accessibility features, which allow visually impaired individuals to access a variety of content.[17,18] While these features vary between brands and models, a device's settings can easily be modified by consumers even by a trial-and-error method. Consumers may be familiar with increasing font size but less familiar with other features such as bold text, reverse contrast, etc. In addition to magnification, contrast- and color-enhancement features have been shown to be beneficial to those with vision impairment and may also aid those without visual impairment.[19] Those with formally diagnosed visual impairment may be recognized as a group that benefits from vision accessibility settings and may receive additional education about these settings. Many with reduced functional vision who are not classified as visually impaired by visual acuity may not be identified as needing vision accessibility feature information. Therefore, many people may be underutilizing these features.

The potential of electronic-based health promotional materials and programs has been recognized.[20] These materials may positively impact modifiable risk factors and health literacy. Email, texting, the internet, and apps related to health, diet, and wellness might all be used to communicate health-related information. When content is developed and distributed, it would be helpful to understand what methods older adults are comfortable using to access information.

The benefits of owning a smartphone can be optimally realized if the user is comfortable accessing content and the text is optimally presented. A better understanding of older adults' smartphone use could benefit providers examining patients as well as inform population-based research and program development. To understand smartphone behaviors and vision accessibility feature utilization in this population better, patients 60 years and older with visual acuity of 20/40 or better were surveyed.

Methods

A questionnaire was developed that queried respondents for demographic information as well as smartphone brand and eight different smartphone uses (e.g., telephone, text/message, email, internet, etc.). The questionnaire also asked about modifications of visual accessibility settings on the respondent's smartphone. If settings were modified, respondents were asked what settings were modified and by whom. If settings were not changed, respondents were asked whether they were aware that settings could be changed. See the Appendix for survey content. Approval for this project was obtained from the Institutional Review Board of the Illinois College of Optometry and followed the tenets of the Declaration of Helsinki.

After informed consent was obtained and smartphone use was verified, a convenience sample of patients attending a geriatric-based eye care clinic at the Illinois Eye Institute (Chicago, IL, USA) completed the verbally administered survey anonymously. The survey took place when the patients presented for eye examinations . Patients answered all questions independently. All patients were fluent in English. Visual acuity information and ocular disease diagnosis were obtained from the medical record on the day of examination by either author. If refraction was performed, visual acuity from refractive assessment was recorded. If refraction was not performed during examination, entering distance visual acuity was recorded. Inclusion criteria were: age at least 60 years,

Table 1. Patient Demographic and Visual Acuity Information Listed by Percent (number of individuals)

Age	15.3% (9) 60-64 yrs. 33.9% (20) 65-69 yrs. 13.6% (8) 70-74 yrs. 25.4% (15) 75-79 yrs. 11.9% (7) 80 yrs. or older
Gender	64.4% (38) Female 35.6% (21) Male
Race	91.5% (54) African American 3.4% (2) White 3.4% (2) Hispanic 1.7% (1) Other
Visual Acuity In the Better-Seeing Eye	67.8% (40) 20/20 22.0% (13) 20/25 6.8% (4) 20/30 3.4% (2) 20/40

owning/using a smartphone, and visual acuity in the better-seeing eye of 20/40 or better.

Descriptive statistics, frequencies, and proportions were generated on demographic data from the medical record review, and survey responses. In order to analyze data trends, patient ages were grouped into two categories: 60-69 years and 70 and older. Cross-tabulations were generated to examine associations between age and use of smartphone, as well as presence of ocular disease. A p value of less than 0.05 was used to determine statistical significance. All data were analyzed with SPSS Statistics 25.0.

Results

Of the fifty-nine respondents, the majority were African American (92%) and female (64%). Respondents were about equally divided between those 60-69 years (49.2%) and 70 or older (50.8%). See Table 1 for more specific demographic and visual acuity data. Despite visual acuity being 20/40 or better, 74.6% were diagnosed with at least one of the following ocular diseases: glaucoma (15.2%), diabetic retinopathy (8.5%), cataract (40.7%), macular degeneration (1.7%), or dry eye (18.6%).

Table 2. Respondents Who Reported Each Smartphone Use Combination

Smartphone Uses	Percentage (number)
Text + Internet	71.2% (42)
Text + Email	69.5% (41)
Text + Email + Internet	64.4% (38)
Email + Internet	64.4% (38)
Text + App Health Diet Wellness	39.0% (23)
Email + App Health Diet Wellness	37.3% (22)
Internet + App Health Diet Wellness	37.3% (22)
Text + Internet + App Health Diet Wellness	37.3% (22)
Text + Email + App Health Diet Wellness	37.3% (22)
Text + Email + Internet + App Health Diet Wellness	35.6% (21)
Email + Internet + App Health Diet Wellness	35.6% (21)

The smartphone brand owned by most was an Apple iPhone (42.4%), followed by Samsung Galaxy (27.1%), LG (13.6%), Motorolo Moto (5.1%), and another brand (11.9%). All of the respondents reported using their smartphones as a telephone. The fewest (39.0%) reported using apps related to health, diet, or wellness. Figure 1 shows the percentage of respondents for each smartphone use. Anecdotally, many reported using apps for games. Assessing the use of email, texting, internet, and apps related to health, diet, and wellness in combination, about one-third (35.6%) reported using their smartphone for all four of these purposes. The largest percentage reported using their smartphone to text and to access the internet. Table 2 displays different combinations of those usages. In general,

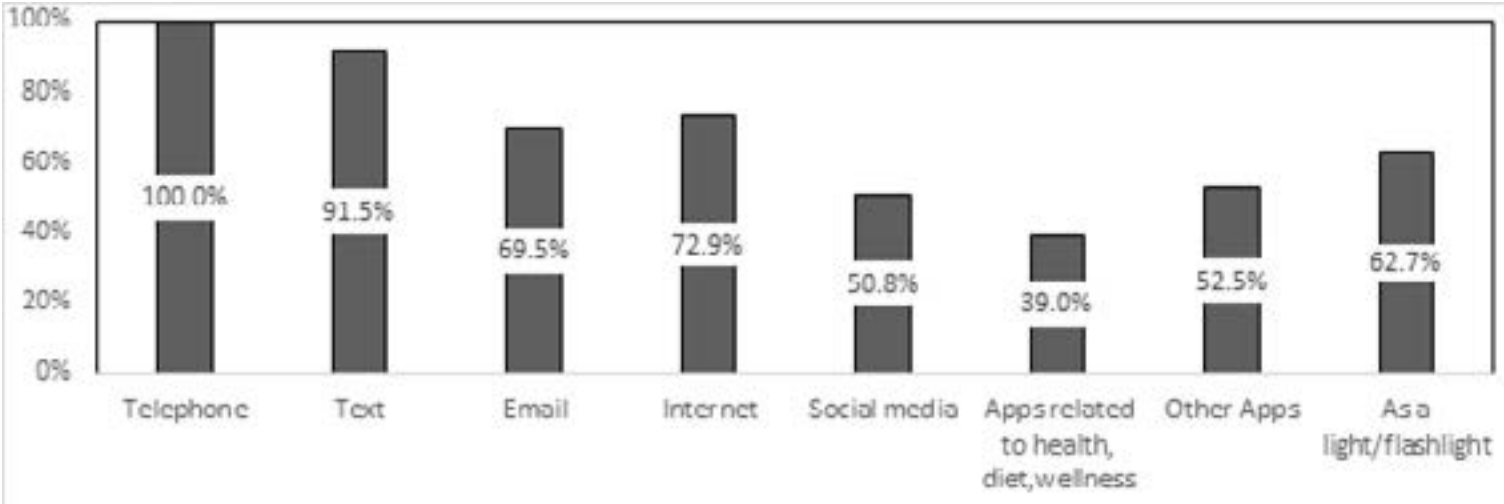

***Figure 1.** Percentage of respondents for each smartphone use*

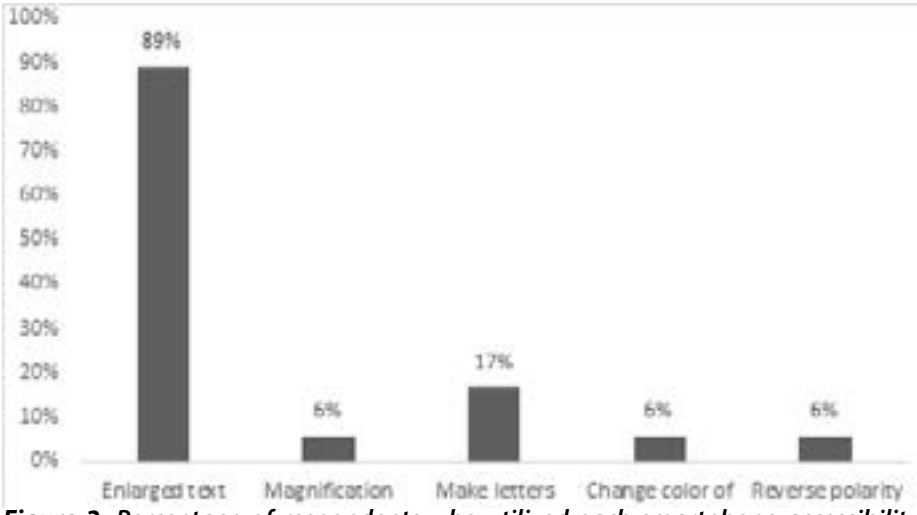

***Figure 2.** Percentage of respondents who utilized each smartphone accessibility feature*

Table 3. Percent (number of individuals) in Each Age Group who Responded Positively to Each Smartphone Use or Whose Record Indicated Presence of Ocular Disease

	% (number) Age 60-79 years	% (number) Age 80 years or older	P
Social media	65.5% (19)	36.7% (11)	.027
E-mail	79.3% (23)	60.0% (18)	.107
Ocular disease	79.3% (23)	63.3% (10)	.176
Internet	79.3% (23)	66.7% (20)	.275
Health diet wellness apps	44.8% (13)	33.3% (10)	.365
Messaging/texting	93.1% (27)	90.0% (27)	.669
Vision accessibility features	65.5% (19)	66.7% (20)	.926

there was a large decrease in reported use when apps related to health, diet, and wellness were included. Only two (3.4%) reported using their smartphone only as a telephone. The majority (82%) reported using the phone for everything they wanted, indicating that they might not be seeking out additional training on smartphone use.

Vision accessibility features were used by about one-third (33.9%; n=20). Of those, the majority (70%) solely increased the font size, 25% increased the font size and modified an additional feature (used magnification box, made font bolder, modified color of text, or used text-to-speech feature), and 5% made font bolder and used reverse polarity. Figure 2 illustrates the percentages of who used each accessibility feature. Respondents reported that settings were modified by themselves (45%), friend/family (45%), or a phone store employee (10%). None reported that settings were changed by an eye care provider or staff at the eye care provider's office. Of those who did not modify vision accessibility features, 42.3% knew that these features existed. Almost one quarter (23.7%) of respondents did not know that text settings could be modified using their smartphone.

There was a statistically significant correlation between younger age and social media use. There was no statistically significant correlation between age or use of vision accessibility features and utilization of smartphone for e-mail, messaging/texting, internet, and/or apps related to health, diet, or wellness. There was also no statistically significant correlation between age or presence of ocular disease and use of vision accessibility features ($p>0.05$, Table 3).

Discussion

Smartphone use assessed in this questionnaire illustrated the broad handling of smartphones by most participants. All patients used their smartphone as a telephone, while the next highest percentage use was text messaging. This seems logical, since texting involves the use of phone numbers, with which respondents were likely familiar. The percentage of respondents using their smartphone for text messaging or e-mail was higher than previously reported, which might be due to differences in recruitment methods.[21] While a majority of respondents employed their smartphones for many functions, there was a range of uses. For example, based on the results, it cannot be assumed that individuals text or use email because they possess a smartphone. However, many have experience sending/receiving/accessing communication through a variety of methods. The majority reported that they were satisfied with the tasks that they could perform with their smartphone.

The broad use of smartphones does support the importance of eye care providers' awareness of this use during the visual assessment, as well as targeted communication and recommendations for educational

materials. While the majority of respondents used several functions for accessing communication, fewer were using apps related to health, diet, and wellness. Additional assistance might be needed if such an app were to be recommended. These findings also support the continued development of electronic health-based programming.

There were no statistically significant correlations between the use of smartphone for email or texting and age, as has been previously reported.[21] This finding may be related to the method of recruitment or the number of participants. Subjects in this study were presenting for an eye exam versus being contacted in their home. Trends in the use of smartphone and age should be considered in program development. More research could further the understanding of age and smartphone use.

The large majority of survey respondents were African American. Results of this study may give insight into smartphone use in this community, since at least one study has shown that African Americans may be less likely to use certain technologies than whites.[22] Health disparities have been documented in the African American population.[23-28] An understanding of device availability and the use of technology in underserved populations is important in the development of health promotion programs to address health disparities.

Most respondents did not modify their smartphone's vision accessibility features, and one-quarter did not know that this could be done. Eye care providers may be able to make specific recommendations regarding smartphone settings based on exam findings such as visual acuity, color vision, visual field, contrast sensitivity, and glare testing. Future research could further assess factors associated with accessibility feature use after professional recommendation.

Of the one-third of respondents who modified vision accessibility features, most solely increased font size. Font size change may have been chosen due to familiarity in the general population. It has been shown that few visually impaired patients receive training or recommendations from eye care providers regarding the use of accessibility features, so it seems logical that the trend would remain the same among those with BVA of 20/40 or better.[29] No correlation was found between the use of smartphone for email, messaging/texting, and internet and the use of accessibility features. Due to lack of professional recommendation, it is not known whether those who used accessibility features were the respondents who would have benefited most from them or whether accessibility features were set appropriately.

While results cannot be generalized, they do illustrate an opportunity. As educational materials continue to be developed, it is important to be aware of how older adults are accessing information on a smartphone. Education should be considered if smartphones are not being used to access information in the manner desired. For example, in this study, fewer patients were using apps related to health, diet, and wellness, so additional education may be needed if access information via this type of app is desired. Apps can require an e-mail address to log in, which might be a factor causing reduced utilization as well. In addition, eye care providers should consider whether the near prescription is appropriate for the distance at which the phone is held and advise patients about optimal smartphone settings. As more individuals 60 and older utilize smartphones, guidance will be needed in order to ensure the patients' best visual function.

Conclusion

The majority of participants used their smartphone for a variety of roles, which supports the development of electronic health promotion materials. However, smartphone use varied and cannot be assumed in this population. Many respondents were not using the vision accessibility features, and many did not know that these features existed, despite using their smartphone for many tasks. Of those who did use accessibility features, few used features other than enlarged font size. None of the patients had an eye care provider or staff member modify features. Because of their understanding of functional vision loss, we suggest that eye care providers make recommendations for optimal smartphone settings tailored to patients' vision and visual demands.

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Winters JE, Piser D. Use of smartphones and vision accessibility features by adults 60 years and older. Optom Vis Perf 2022;10(2):145-151.

Appendix: Questionnaire assessing smartphone and vision accessibility feature use

What is your age?	60-64 yrs 65-69 yrs 70-74 yrs 75-79 yrs 80 yrs or older
Gender	Female Male
Race	African American Asian White Hispanic Other
What is the brand of your smartphone?	Apple iPhone Google Pixel Huawei LG Motorola Moto Samsung Galaxy Sony Xperia Other
What do you use your smartphone for? Select All	Telephone Text or Messaging Email Internet Social media like Facebook, Twitter, or Instagram Apps related to health diet or wellness Other Apps As a light/in place of a flashlight
Can you use your smartphone for everything you would like to?	Yes No
Were the settings on your smartphone changed to help to see letters or words easier or have words read to you?	Yes No
If 'YES' how were the setting changed? Select All	Make letters bigger A box that magnifies letters Make letters bolder Change colors of letters Make the letters white and background black Have words read aloud
If 'YES' who changed the settings on your smartphone?	I changed them myself Friend/family member Employee at the store where you bought your phone Someone at the eye doctor's office Other Not sure
If 'NO', did you know the settings on your smartphone could be changed to make letters bigger, bolder or read aloud?	Yes No