Published in final edited form as:

Optom Vis Sci. 2018 May ; 95(5): 428–434. doi:10.1097/OPX.0000000000001215.

People with Hemianopia Report Difficulty with TV, Computer, Cinema Use, and Photography

Francisco M. Costela, PhD, Sarah S. Sheldon, BS, Bethany Walker, and Russell L. Woods, PhD

Schepens Eye Research Institute, Massachusetts Eye and Ear, Boston, Massachusetts (FMC, SSS, BW, RLW), and Department of Ophthalmology, Harvard Medical School, Boston, Massachusetts (FMC, RLW)

Abstract

Significance—Our survey found that participants with hemianopia report more difficulties watching video in various formats, including television, on computers and in a movie theater, than participants with normal vision. These reported difficulties were not as marked as those reported by people with central vision loss.

Purpose—To survey the viewing experience (e.g. frequency, difficulty) of viewing video on television (TV), computers and portable visual display devices and at the cinema of people with hemianopia and normal-vision (NV). This information may guide vision rehabilitation.

Methods—We administered a cross-sectional survey to investigate the viewing habits of people with hemianopia (N=91) or NV (N=192). The survey, consisting of 22 items, was administered either in person or in a telephone interview. Descriptive statistics are reported.

Results—There were five major differences between the hemianopia and NV groups. Many participants with hemianopia reported: (1) at least ‘some’ difficulty watching TV (39/82); (2) at least ‘some’ difficulty watching video on a computer (16/62); (3) never attending the cinema (30/87); (4) at least some difficulty watching movies in the cinema (20/56), among those who did attend the cinema; and (5) never taking photographs (24/80). Some people with hemianopia reported methods that they used to help them watch video, including video playback and head turn.

Conclusions—Though people with hemianopia report more difficulty with viewing video on television and at the cinema, we are not aware of any rehabilitation methods specifically designed to assist people with hemianopia to watch video. The results of this survey may guide future vision rehabilitation.

Keywords

homonymous hemianopia; stroke; multimedia; survey; activity of daily living

Hemianopia is a cortical blindness, most commonly from stroke, that usually eliminates vision on one side in both eyes (homonymous), and thus reducing visuo-spatial perception.

This vision impairment diminishes the quality of life and negatively impacts activities of daily living, such as noticing other persons,¹ reading,^{2,3} walking^{4,5} and driving.^{3,4,6-9} Another activity that may be severely affected is watching television and other forms of video (e.g. computer, portable devices, cinema.). A previous survey of 46 people with hemianopia and quadrupia, which included one question about television, found that 30 percent reported some difficulty with watching television.¹⁰ Such difficulties could arise from information missed due to the scotoma, eye movement control including compensatory scanning, and reading problems when text is presented. This may lead to difficulty following the story, and a consequent reduction in value from the viewing experience.

The prevalence of homonymous visual field defects has been reported as 0.8% in the general population over 49 years of age.¹¹ As there were about 100 million people aged 50 years and older in the USA in 2010,¹² this suggests that there were about 800,000 people in the USA with a homonymous visual field defect. The proportion of visual field deficits can be as high as 49% in an acute stroke care setting,¹³ though many visual field deficits resolve in one to six months.¹⁴ Of stroke survivors, 8%¹¹ to 16%¹⁵ have long-term hemianopia, most of which are partial or complete homonymous hemianopia. As there were 6.2 million stroke survivors in the USA in 2010,¹⁶ this suggests that between half and one million stroke survivors in the USA have a permanent hemianopic visual field deficit, which is consistent with the other prevalence estimate above.

Risk of hemianopia increases with age, as does the time watching television. People 65 years and older in the U.S.A. watch over 49 hours of television a week on average.¹⁷ Therefore, it is important to understand the scale of this problem, to investigate its causes, and to develop treatments or aids. Many rehabilitation strategies have been adopted for people with hemianopia, including vision restitution (or restoration), compensation (e.g. scanning training), and substitution (e.g. prisms),¹⁸⁻²⁶ with evidence of benefit from some^{21, 24, 27} but not all^{20, 26} recent randomized trials. There is dearth of literature about rehabilitation aimed at people with hemianopia watching television, even though this is a reported difficulty.¹⁰

In the USA, hemianopia is not generally considered a vision impairment and people with hemianopia do not usually obtain any government assistance at a Federal or state level. Even so, people with hemianopia are not able to hold a driver's license in many states. The situation differs in other jurisdictions, with hemianopia being considered a vision impairment in some, and thus entitled to forms of assistance. In certain jurisdictions driving is allowed, usually after a driving evaluation. People with hemianopia are often not referred to vision rehabilitation services by primary care, neurology or neuro-ophthalmology. Given that there are about half as many people with hemianopia (about 0.8 million),¹¹ as people with central vision loss with visual acuity 20/70 or worse (about 1.5 million),²⁸ we might expect people with hemianopia to be about 1/3 of the patients in vision rehabilitation clinics. However, in our experience the actual proportion is considerably lower.

Here, we report the first systematic survey of people with hemianopia (N=91) that is focused on watching video in various formats, including their viewing habits, the difficulties that they experience, and compensatory strategies that they employ. Items from a previous survey of people with central vision loss were employed.²⁹ As people with hemianopia had reported

difficulties taking photographs to us, our survey also included questions related to their habits taking photographs. We include 192 people with normal vision as a control group.

Methods

Survey

The viewing-habits survey was similar to a previous survey that investigated the viewing habits of people with impaired central vision.²⁹ It was administered either in person (n=22) or as a telephone interview (n=69). Verbal consent from each participant was obtained for the telephone-administered survey after the study was explained and the consent form was read out. Written consent was obtained from participants who took the survey in person. In addition to demographic and clinical questions, there were five questions related to television viewing habits, two about portable devices, seven about computer use, two about the cinema and six questions about photography. The items of the survey can be found in the Appendix, available at [LWW insert link]. Data collection was administered by an examiner who recorded verbal responses using a custom computer interface. The viewing-habits survey took about 10 to 15 minutes to complete.

Participants

Of the 283 participants, 192 had normal vision and 91 had some form of hemianopia. These participants were primarily from Massachusetts (111/192 normal vision and 68/91 hemianopia). People with hemianopia came from three sources: (1) people who had participated or expressed a willingness to participate in studies at the Schepens Eye Research Institute (n=79); or (2) had been patients at the Massachusetts Eye and Ear Infirmary, Boston MA (n=10); or (3) volunteered in response to advertisements placed on the ResearchMatch.org website (n=2). For the survey, hemianopia was documented as lack of vision by quadrants. So, a participant with hemianopia would have two quadrants with missing vision, except for the two participants with bitemporal hemianopia (Table 1). Some of the participants did not have complete hemianopia, having some vision beyond the midline, but the majority of the visual field was missing in both quadrants. For the participants seen at the institute, visual fields were measured with a Goldmann perimeter. For participants interviewed by telephone only, some were able to provide visual field measurements, while the rest answered questions about their ability to see in the four quadrants. Participants from Massachusetts Eye and Ear Infirmary were identified using a billing code (ICD-9) for homonymous hemianopia. Potential participants with hemianopia who reported physical disability that might affect their ability to view video were not included. See Table 1 for descriptive demographic and clinical information of all the participants. In our survey sample, the reported cause of hemianopia was similar to previous studies,^{11, 14, 30} with 61% stroke, 11% traumatic brain injury, 13% a tumor and 11% a consequence of brain surgery.

Participants with normal vision had visual acuity with both eyes of 20/30 or better and self-reported normal vision (using a questionnaire). Some participants with normal vision had visual acuity in one eye that would not be considered normal vision on its own (e.g. 20/200 in the right eye). However, those participants had good visual acuity when viewing with both

eyes and full visual fields (e.g. 20/20 for that example participant), so had functionally normal vision (as daily activities are usually conducted with both eyes open). Analyses without these participants with one eye worse than 20/30 did not alter the interpretation of the outcomes reported below. As shown in Figure 1, the number of younger (20 to 35 years) and older (75 to 85 years) participants was greater in the normal vision sample (Kolmogorov-Smirnov two-sample, $p=0.02$). Age was included as a covariate in analyses. There were no differences in education ($p=0.23$) or gender ($p=0.14$) between the two groups. The participants with hemianopia were more likely to be white than the normal vision participant group ($p=0.003$).

This study was approved by the Institutional Review Board of the Schepens Eye Research Institute.

Statistical Analyses

Data from the FileMaker Pro survey database were exported into the Stata statistical package (version 14, Stata, College Station, TX) for data analysis. Comparisons between the hemianopia and control groups for the survey questions used logistic regression and ordered logistic regression as these allowed inclusion of the covariates age, education level, and gender. Since we performed many statistical analyses, $p = 0.01$ was considered statistically significant. As our sample size was not large ($N=283$), effects that approached significance ($0.01 < p \leq 0.10$) are also noted.

Results

The main aspects of the viewing-habits survey responses are summarized in Table 2. As illustrated in Figure 2, responses of participants with hemianopia were significantly different from participants with normal vision for many items.

Television

The median amount of television watched per day was 2 to 3 hours and was not different between the two groups (ordered logistic regression, $z=1.00$, $p=0.32$). As reported previously,²⁹ the number of hours of television watching increased with age ($z=2.83$, $p=0.005$), and that did not vary significantly between the groups ($z=0.60$, $p=0.59$). Frequency of viewing reduced with increasing level of education (ordered logistic regression, $z=3.64$, $p<0.001$) and tended to be more for male participants ($z=1.76$, $p=0.08$). Four participants with hemianopia and three with normal vision reported watching no television (zero hours/day). When watching television, 58% of people reported that their viewing occurred when there was usually no other viewer ('sometimes' or less). Participants with hemianopia were slightly less likely to watch television with others (ordered logistic regression, $z=1.90$, $p=0.03$), regardless of age ($z=1.31$, $p=0.19$). Conversely, participants with normal vision decreased the likelihood of watching in the presence of another viewer with increasing age ($z=-2.46$, $p=0.01$). As shown in Figure 2A, participants with hemianopia (58%) were more likely than participants with normal vision (18%) to report at least 'some' difficulty watching television (ordered logistic regression, $z=4.57$, $p<0.0001$). There was no change with age in reported difficulty watching television ($z=0.91$, $p=0.36$). Comments

about the experienced difficulties included not seeing things of interest on the blind side, difficulty with specific viewing situations (e.g. following ball path to right handed batter in baseball; tennis; fast action) and with text, particularly scrolling text. Participants with hemianopia (30%) were more likely than participants with normal vision (6%) to report the use of a special strategy, assistive device, or visual aid while watching television or movies (logistic regression, $z=3.12$, $p=0.003$). The 24 participants with hemianopia who reported an assistive strategy for watching television reported (numbers add to >24, as some participants reported more than one strategy): only watching with a spouse who could assist with understanding ($n=2$), using a video storage device such as a DVR or TiVo (allows going back to review segments, $n=4$), compensatory scanning ($n=3$), glasses specifically for television ($n=3$), closing one eye ($n=2$), tilting the head ($n=2$), turning the head or looking to the side ($n=3$), sitting to one side ($n=4$), and using closed captions ($n=2$). Six reported using peripheral prism glasses and one reported that they did not help for viewing television. This survey was not able to assess whether these approaches provided real benefit, and it was not obvious to us how some of the reported strategies might help. We presume that a viewer would only continue with the use of a strategy if it was perceived to provide a benefit to them.

Portable Devices

Most (73%) participants reported never using a portable device (e.g. iPhone, personal DVD player) to watch videos, with no difference between the groups (logistic regression, $z=0.74$, $p=0.46$). Older participants ($z=4.08$, $p<0.001$) and females ($z=1.94$, $p=0.05$) were less likely to have watched video on a handheld device. Of the 51 participants who reported watching video on handheld devices, there was a tendency for participants with hemianopia (22/29 reported 'never'), as compared to participants with normal vision (10/22), to be less likely to report that they had difficulty seeing details (ordered logistic regression, $z=1.94$, $p=0.05$). It is possible that this outcome was a result of selection bias, with only those with hemianopia who were able to use a portable device to view video providing a response about difficulty.

Computer

Most (86%) participants reported having a computer at home, with no significant difference in availability between the two groups (ordered logistic regression, $z=1.06$, $p=0.29$). Older participants with normal vision were less likely to have a computer at home than younger participants ($z=2.45$, $p=0.01$) but there was no effect of age among the participants with hemianopia ($z=0.13$, $p=0.90$). Of the participants reported to have a computer at home, only 39% of the normal vision participants and 30% of the participants with hemianopia watched movies (e.g. DVD) on the computer. Frequency of viewing movies on a computer decreased with increasing age (ordered logistic regression, $z=4.11$, $p<0.001$), with no difference between the two groups ($z=0.61$, $p=0.54$). Most participants with internet access (127/191) reported watching internet video content (e.g. YouTube, Hulu, television shows from network websites), with no difference between the groups ($z=0.16$, $p=0.88$) and frequency declined with increasing age ($z=6.74$, $p<0.001$). Among those people watching video material on computer, it was uncommon for there to be another viewer present, with only 23/157 reporting another viewer often or always present, with participants with hemianopia tended to be less likely to have another viewer present (ordered logistic regression, $z=2.30$,

$p=0.02$). Among participants with normal vision, the likelihood of having another viewer present decreased with age ($z=4.07$, $p<0.001$), whereas there was no variation with age among the participants with hemianopia ($z=0.12$, $p=0.91$). Participants with hemianopia (26% at least 'sometimes') were more likely (ordered logistic regression, $z=2.56$, $p=0.01$) to report having difficulty with details on a computer screen than normal vision participants (7%), with no effect of age ($z=0.37$, $p=0.72$). Over a quarter (14/62) of the participants with hemianopia who used a computer reported at least 'sometimes' to use assistive technologies, which was more than the 2% of the normal vision participants who reported using assistive technologies ($z=2.32$, $p=0.02$). Older participants tended to be less likely to use assistive technologies with the computer ($z=1.93$, $p=0.05$). The reported assistive approaches were reducing viewing distance ($n=3$), increasing mouse icon visibility ($n=3$), large font size ($n=2$), zoom software ($n=2$) and reading software ($n=1$). We are not aware of assistive technologies designed specifically to assist people with hemianopia in the use of computers.

Cinema

About 3/4 participants reported watching movies in a cinema, with most going to movie theatres a 'few times a year'. Frequency of attendance decreased with age (ordered logistic regression, $z=3.48$, $p<0.001$) and participants with hemianopia reported lower frequency ($z=2.80$, $p=0.05$). In particular, participants with hemianopia (34%) were much more likely (logistic regression, $z=3.56$, $p<0.001$) to report never attending the cinema than normal vision (19%)(Figure 2C). As shown in Figure 2B, participants with hemianopia (31/72) were more likely to report at least 'some' difficulty watching movies in a cinema (ordered logistic regression, $z=4.73$, $p<0.001$) than participants with normal vision (7/92). Turning the head ($n=2$), sitting to one side ($n=3$), compensatory scanning ($n=2$) and peripheral prism glasses ($n=1$) were reported as strategies to improve the viewing experience. Reasons for never or very infrequently attending the cinema or difficulties when attending included reports of missing information ($n=4$) or missing objects on the blind side ($n=2$) making it difficult to follow the story, the very large cinema screen ($n=4$), fast action ($n=4$) or reading text on the screen ($n=2$) and uncertainty about being able to obtain a preferred seating location (to the back so that the screen subtends a smaller visual angle or on the blind side of the cinema, so that the screen is on the seeing side).

Photography

Many participants with hemianopia (24/80) reported never taking photographs, which was more likely than among participants with normal vision (logistic regression, $z=4.93$, $p<0.001$) (see Figure 2D). Overall, participants who had hemianopia (ordered logistic regression, $z=2.02$, $p=0.04$), were older ($z=4.10$, $p<0.001$), had less education ($z=2.40$, $p=0.02$) and were male ($z=1.80$, $p=0.07$) took photographs less frequently. Of those that did take photographs, there was no difference between the groups ($z=1.33$, $p=0.18$) nor an effect of age ($z=0.20$, $p=0.84$) in the difficulty taking photographs (note that this subset was biased, as those that had most difficulty did not take photographs). Participants with hemianopia who expressed difficulties described problems locating the picture target using the device (14%), understanding the technology (20%), placing the picture target at the desired location in the picture (9%), fitting multiple targets in the picture (7%), and issues related to lighting or focusing (18%). Some participants with hemianopia reported not taking photographs

because of cognitive problems (e.g. cannot find camera, difficulty operating the camera), physical problems (e.g. tremor) and because others take the photographs instead (or take better photographs). Sharing of photographs was less frequently among older participants (OLR, $z=3.24$, $p=0.001$) and participants with less education ($z=2.55$, $p=0.01$), and did not vary between the two groups ($z=0.00$, $p=1.0$).

Discussion

Most (56%) of the participants with hemianopia reported at least ‘some’ difficulty watching television, which was much higher than among participants with normal vision. Similarly, a previous, smaller survey¹⁰ reported that 30% of participants with hemianopia reported difficulty with “following the action in programs” on television. In our survey, similar difficulties were also reported with related activities, watching video on a computer and movies at the cinema (Table 2; Figure 2). Participants with hemianopia were much less likely to watch movies in a cinema and much less likely to ever take photographs. The lower rates of cinema attendance and photography were presumably because they found these tasks more difficult than people with normal vision, and thus suggest that their vision impairment may make them refrain from engaging in these activities. While the difficulties leading to this reduced activity may not be all visual, and could be from other factors such as cognitive or physical impairment, this population has reduced engagement in these activities. Conversely, despite reporting more difficulty watching television, participants with hemianopia reported watching slightly more television. Perhaps this reflects a reduction in other activities due to the vision impairment, and that additional available time is used to watch television, as it is an easy option.

If we accept the estimate of 500,000 to 1,000,000 people with hemianopia in the USA,^{11,12,14,15} and that our survey was representative of that population, this suggests that between 280,000 and 560,000 people with hemianopia in the USA feel that they have difficulty watching television. Although self-reported difficulties with activities of daily living, such as watching television, have been previously reported for hemianopia,¹⁰ there have been no assessment methods to measure this difficulty. In a separate study that is currently under review, Costela and colleagues provide data which shows that watching video is measurably more difficult for people with hemianopia, using a recently developed method we call sensory information acquisition.^{31,32} In this approach, information acquisition is a measure of the ability to follow the story. Even when watching video for enjoyment, if you cannot follow the story, the value of the activity is usually diminished.

Half of the participants with hemianopia expressed strong interest in assistive technology. One of the concerns with an intervention that modifies the displayed image is that it may be unacceptable to other viewers watching the same display. Most participants with hemianopia watched television with others infrequently (44/78, sometimes or less). Viewing without another person present provides the opportunity to use a rehabilitation aid that might be unacceptable to a viewer with normal vision. Participants with hemianopia reported that watching television or video on a computer while alone was common, and, in a previous, related study, the median number of televisions per home was found to be two.²⁹ People with hemianopia reported a variety of assistive methods (e.g. DVR), but we are aware of no

previous reports of rehabilitation methods developed specifically to assist people with hemianopia watch television or video. In a separate unpublished study, Costela and colleagues investigated an innovative rehabilitation method that holds promise for improving the ability to follow the story (improved information acquisition). The approach involves providing a visual content guide to the location that contains most information. It is sufficient to look at this highlighted region to follow the story. The rationale being that the viewer no longer has to look into the blind side to check whether there are objects of interest (compensatory scanning) and that looking away from the object of interest to make a compensatory scan disrupts the ability to follow the story. If the highlighted region was not visible, then the viewer would know that the object of interest was on the blind side and make a gaze shift to locate the highlighted object of interest. However, viewers with hemianopia tend to follow the dynamic content guide effectively, and do not usually lose it into the blind side.

Central vision loss (reduced visual acuity) is the most common form of low vision. Here we briefly report some differences and similarities in the responses of 116 participants with central vision loss (visual acuity of 20/60 or worse), most of whom participated in a previous study,²⁹ to our participants with hemianopia. Participants with central vision loss reported similar frequency of television viewing ($z=0.15$, $p=0.88$), more difficulty watching television ($z=8.35$, $p<0.001$), less use of assistive strategies ($z=1.99$, $p=0.05$), but more interest in enhancement technologies for television and movies ($z=6.73$, $p<0.001$). Participants with central vision loss tended to be less likely to have a computer at home when corrected for age ($z=1.87$, $p=0.06$), were as likely to watch movies on a computer ($z=0.96$, $p=0.34$) or use the internet ($z=0.93$, $p=0.35$), reported more difficulty viewing movies and video on a computer ($z=4.92$, $p<0.001$), were more likely to report using an assistive technology when using the computer ($z=3.65$, $p<0.001$), and were more likely to be interested in enhancement technologies for use when watching movies and videos using the computer ($z=6.93$, $p<0.001$). Overall, participants with central vision loss had a similar frequency of cinema attendance ($z=1.41$, $p=0.16$), though tended to be less likely to never attend ($z=1.65$, $p=0.10$).

In summary, our survey found that participants with hemianopia report difficulties watching video in various formats, including television, on computers and in a movie theater. While these reported difficulties were not as marked as those reported by people with central visual loss, the reported difficulties were greater than those reported by participants with normal vision. These difficulties seem to lead to reduced attendance at movie theaters and reduced taking of photographs. These changes in behavior and difficulties with activities of daily living are related to a reduced quality of life experienced by people with hemianopia that may not be well captured by various instruments^{3,4,6,8,10} and warrants further investigation.

Acknowledgments

Funding: This study was supported by NIH grant R01EY019100 and Core grant P30EY003790.

Appendix

The list of questions asked in our survey can be found in the Appendix, available at [LWW insert link]. There were five questions related to TV viewing habits, two about portable devices, seven about computer use, two about the cinema and six questions about photography.

List of Questions Asked in the Survey

1. How many hours a day do you spend watching TV or movies?
(a) 0 (b) <1 (c) 1-2 (d) 2-3 (e) 3-4 (f) 4-5 (g) >5
2. How frequently do you watch TV or movies with other people?
(a) Never (b) Rarely (c) Sometimes (d) Often (e) Always
3. Do you find it difficult to see details, or feel that you miss important information when watching TV or movies on the television?
(a) Never (b) Rarely (c) Sometimes (d) Often (e) Always
4. Do you use any special strategy, or assistive device, or visual aid when watching TV or movies on your television (e.g., TiVo, DVR, scanning, telescope¹, Fresnel prism², glasses specifically for TV, prism glasses³)?
(a) No (b) Yes
If yes, what device or strategy do you use? _____
5. Would you be interested in technology to enhance the TV image to help you see it?
(a) No (b) Maybe (c) Yes (d) Don't know
6. Do you ever watch TV, movies, or videos on a portable device (e.g. iPhone, personal DVD player)?
(a) No (b) Yes
7. **If YES to Question 6:** Do you find it difficult to see details or feel that you miss important information when watching TV or movies on a handheld device?
(a) Never (b) Rarely (c) Sometimes (d) Often (e) Always
8. Do you have a computer in your home?
(a) No (b) Yes
9. Do you ever watch DVDs (e.g. movies) on a computer?
(a) Never (b) Once a year (c) Once a month (d) Every two weeks (e) Once a week (f) A few times per week (g) Once a day (h) More than Once a day
10. Do you ever watch videos on the internet? (e.g. YouTube, Hulu, TV shows from network websites)?

- (a) Never (b) Once a year (c) Once a month (d) Every two weeks (e) Once a week (f) A few times per week (g) Once a day (h) More than once a day
- 11.** When watching a video on a computer, do you watch with other people?
(a) Never (b) Rarely (c) Sometimes (d) Often. (e) Always
- 12.** Do you find it difficult to see details or feel that you miss important information when watching DVDs or videos on a computer?
(a) Never (b) Rarely (c) Sometimes (d) Often (e) Always
- 13.** Do you use any assistive technologies on your computer such as ZoomText, or any other enhancement or magnification software?
(a) Never (b) Rarely (c) Sometimes (d) Often (e) Always
- 14.** Would you be interested in technology to enhance your computer monitor's display to help you see programs/text/videos on it?
(a) No (b) Maybe (c) Yes (d) Don't know
- 15.** How often do you go to the movie theater?
(a) Never (b) Once a year (c) A few times a year (d) Once a month (e) Every two weeks (f) A Once a week (g) A few times per week
- 16.** Do you find it difficult to see details or feel that you miss important information when watching movies at the theatre?
(a) Never (b) Rarely (c) Sometimes (d) Often (e) Always
- 17.** How often do you take pictures?
(a) Never (b) Once a year (c) A few times a year (d) Once a month (e) Every two weeks (f) Once a week (g) A few times per week (h) Once a day (i) More than once a day
- 18.** What device(s) do you use to take pictures?
(a) Dedicated camera (b) Smart phone/iPhone (c) Tablet (d) Other, specify _____
- 19.** How do you share your pictures? (tick as many responses as needed)
(a) I don't (b) printed pictures (c) text message (sms) (d) e-mail (e) DropBox (f) Facebook (g) Instagram (h) Snapchat (i) Flickr (j) Google Drive (k) Picasa (l) SmugMug (m) Shutterfly (n) Snapfish (o) Other, specify _____
- 20.** How often do you share your pictures?
(a) Never (b) Once a year (c) A Few times a year (d) Once a month (e) Every Two weeks (f) Once a week (g) A Few times per week (h) Once a day (i) More than Once a day
- 21.** Do you find it difficult to take a good picture?

(a) Never (b) Rarely (c) Sometimes (d) Often (e) Always

22. When taking a picture, do you have difficulty with...

(a) None (b) Locating the picture target using the device (c) Placing the picture target at the desired location in the picture (d) Fitting multiple targets in the picture (e) Other, specify _____

¹Telescope = monocular or binocular telescope, spectacle-mounted or hand-held

²Fresnel = a magnifying sheet placed over the TV screen (is marketed for watching TV)

³Prism glasses = optical glasses that include prism segments

References

1. Meienberg O, Zangemeister WH, Rosenberg M, et al. Saccadic Eye Movement Strategies in Patients with Homonymous Hemianopia. *Ann Neurol*. 1981; 9:537–44. [PubMed: 7259115]
2. Kerkhoff G, Munssinger U, Haaf E, et al. Rehabilitation of Homonymous Scotomata in Patients with Postgeniculate Damage of the Visual System: Saccadic Compensation Training. *Restor Neurol Neurosci*. 1992; 4:245–54. [PubMed: 21551879]
3. Gall C, Lucklum J, Sabel BA, Franke GH. Vision- and Health-Related Quality of Life in Patients with Visual Field Loss after Postchiasmatic Lesions. *Invest Ophthalmol Vis Sci*. 2009; 50:2765–76. [PubMed: 19117930]
4. Gall C, Franke GH, Sabel BA. Vision-Related Quality of Life in First Stroke Patients with Homonymous Visual Field Defects. *Health Qual Life Outcomes*. 2010; 8:33. [PubMed: 20346125]
5. Yates JS, Lai SM, Duncan PW, Studenski S. Falls in Community-Dwelling Stroke Survivors: An Accumulated Impairments Model. *J Rehabil Res Dev*. 2002; 39:385–94. [PubMed: 12173758]
6. Papageorgiou E, Hardiess G, Schaeffel F, et al. Assessment of Vision-Related Quality of Life in Patients with Homonymous Visual Field Defects. *Graefes Arch Clin Exp Ophthalmol*. 2007; 245:1749–58. [PubMed: 17653566]
7. Bowers AR, Mandel AJ, Goldstein RB, Peli E. Driving with Hemianopia, I: Detection Performance in a Driving Simulator. *Invest Ophthalmol Visual Sci*. 2009; 50:5137–47. [PubMed: 19608541]
8. Chen CS, Lee AW, Clarke G, et al. Vision-Related Quality of Life in Patients with Complete Homonymous Hemianopia Post Stroke. *Top Stroke Rehabil*. 2009; 16:445–53. [PubMed: 20139047]
9. Wood JM, McGwin G Jr, Elgin J, et al. On-Road Driving Performance by Persons with Hemianopia and Quadrantanopia. *Invest Ophthalmol Vis Sci*. 2009; 50:577–85. [PubMed: 18936138]
10. Warren M. Pilot Study on Activities of Daily Living Limitations in Adults with Hemianopsia. *Am J Occup Ther*. 2009; 63:626–33. [PubMed: 19785262]
11. Gilhotra JS, Mitchell P, Healey PR, et al. Homonymous Visual Field Defects and Stroke in an Older Population. *Stroke*. 2002; 33:2417–20. [PubMed: 12364731]
12. U.S. Department of Commerce Economics and Statistics Administration, U.S. Census Bureau. [Accessed March 9, 2018] Age and Sex Composition: 2010. Available at: <http://www.census.gov/prod/cen2010/briefs/c2010br-03.pdf>
13. Rowe F, Brand D, Jackson CA, et al. Visual Impairment Following Stroke: Do Stroke Patients Require Vision Assessment? *Age Ageing*. 2009; 38:188–93. [PubMed: 19029069]
14. Zhang X, Kedar S, Lynn MJ, et al. Homonymous Hemianopias: Clinical-Anatomic Correlations in 904 Cases. *Neurology*. 2006; 66:906–10. [PubMed: 16567710]
15. Townend BS, Sturm JW, Petsoglou C, et al. Perimetric Homonymous Visual Field Loss Post-Stroke. *J Clin Neurosci*. 2007; 14:754–6. [PubMed: 17270447]
16. Schiller JS, Lucas JW, Ward BW, Peregoy JA. Summary Health Statistics for U.S. Adults: National Health Interview Survey, 2010. *Vital Health Stat*. 102012:1–207.

17. The Nielsen Company. [Accessed: August 24, 2010] Three Screen Report Q2 2009. Television, Internet and Mobile Usage in the U.S. Available at: <http://www.nielsen.com/us/en/insights/reports/2009/3screen-q2-2009.html>
18. Nelles G, Esser J, Eckstein A, et al. Compensatory Visual Field Training for Patients with Hemianopia after Stroke. *Neurosci Lett*. 2001; 306:189–92. [PubMed: 11406327]
19. Pambakian A, Currie J, Kennard C. Rehabilitation Strategies for Patients with Homonymous Visual Field Defects. *J Neuro-Ophthalmol*. 2005; 25:136–42.
20. Roth T, Sokolov AN, Messias A, et al. Comparing Explorative Saccade and Flicker Training in Hemianopia: A Randomized Controlled Study. *Neurology*. 2009; 72:324–31. [PubMed: 19171828]
21. Jobke S, Kasten E, Sabel BA. Vision Restoration through Extrastriate Stimulation in Patients with Visual Field Defects: A Double-Blind and Randomized Experimental Study. *Neurorehabil Neural Repair*. 2009; 23:246–55. [PubMed: 19240199]
22. Pollock A, Hazelton C, Henderson CA, et al. Interventions for Visual Field Defects in Patients with Stroke. *Cochrane Database Syst Rev*. 2011:CD008388.
23. Hayes A, Chen CS, Clarke G, Thompson A. Functional Improvements Following the Use of the Nvt Vision Rehabilitation Program for Patients with Hemianopia Following Stroke. *NeuroRehabilitation*. 2012; 31:19–30. [PubMed: 22523012]
24. de Haan GA, Melis-Dankers BJ, Brouwer WH, et al. The Effects of Compensatory Scanning Training on Mobility in Patients with Homonymous Visual Field Defects: A Randomized Controlled Trial. *PLoS One*. 2015; 10:e0134459. [PubMed: 26275160]
25. Matteo BMVB, Cerri CG, Perin C. Visual Field Restorative Rehabilitation after Brain Injury. *J Vision*. 2016; 16:1–11.
26. Reinhard J, Schreiber A, Schiefer U, et al. Does Visual Restitution Training Change Absolute Homonymous Visual Field Defects? A Fundus Controlled Study. *Br J Ophthalmol*. 2005; 89:30–5. [PubMed: 15615742]
27. Bowers AR, Keeney K, Peli E. Randomized Crossover Clinical Trial of Real and Sham Peripheral Prism Glasses for Hemianopia. *JAMA Ophthalmol*. 2014; 132:214–22. [PubMed: 24201760]
28. Massof RW. A Model of the Prevalence and Incidence of Low Vision and Blindness among Adults in the U.S. *Optom Vis Sci*. 2002; 79:31–8. [PubMed: 11828896]
29. Woods RL, Satgunam P. Television, Computer and Portable Display Device Use by People with Central Vision Impairment. *Ophthalmic Physiol Opt*. 2011; 31:258–74. [PubMed: 21410501]
30. Pambakian AL, Kennard C. Can Visual Function Be Restored in Patients with Homonymous Hemianopia? *Br J Ophthalmol*. 1997; 81:324–8. [PubMed: 9215064]
31. Saunders DR, Bex PJ, Woods RL. Crowdsourcing a Normative Natural Language Dataset: A Comparison of Amazon Mechanical Turk and in-Lab Data Collection. *J Med Internet Res*. 2013; 15:e100. [PubMed: 23689038]
32. Saunders DR, Bex PJ, Rose DJ, Woods RL. Measuring Information Acquisition from Sensory Input Using Automated Scoring of Natural-Language Descriptions. *PLoS One*. 2014; 9:e93251. [PubMed: 24695546]

Figure 1.
Age distribution of participants with hemianopia (HH) and normal vision (NV) in the survey (Study 1).

Figure 2.

Some aspects of the video viewing habits survey. Participants with hemianopia (HH) were more likely than participants with normal vision (NV) to report at least 'some' difficulty (**A**) watching television (ordered logistic regression, $z=4.71$, $p<0.0001$) and (**B**) movies in a cinema (ordered logistic regression, $z=4.50$, $p<0.001$). (**C**) Participants with hemianopia were much more likely to never attend the cinema (logistic regression, $z=3.56$, $p<0.001$). (**D**) Many more participants with hemianopia reported never taking photographs (logistic regression, $z=4.93$, $p<0.001$).

Table 1

Self-reported demographic, clinical, and visual characteristics of participants (N=286). TBI = traumatic brain injury.

		NV	Hemianopia
N		192	91
Gender	Male	83	51
	Female	86	39
	Not recorded	23	1
Race	Asian	11	1
	African American	19	1
	White	127	63
	American Indian	2	0
	Not recorded	32	24
Median Age (min-max)		61y (19-87y)	58y (19-86y)
Education level	<High school	1	2
	High school	12	11
	Some college	11	16
	Technical	1	4
	Associate	2	5
	Bachelor's	32	19
	Master's	26	18
	Professional	5	7
	Doctoral	8	5
	Not recorded	93	4
Median Visual Acuity (range)			
Right Eye		20/20 (20/15 to 20/400)	20/20 (20/10 to 20/800)
Left Eye		20/20 (20/15 to 20/80)	20/20 (20/15 to 20/60)
Both Eyes		20/20 (20/15 to 20/30)	20/20 (20/10 to 20/40)
Vision Loss	Right hemi		31
	Left hemi		53
	Bitemporal		2
	Not recorded		5
Cause	Stroke		56
	Ischemic		17
	Hemorrhagic		6
	Unknown		33
	TBI		10
	Tumor		12
	Surgery		10
Congenital			2

	NV	Hemianopia
Not known		4

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table 2

Summary of video viewing habits compared between the hemianopia group (N=91) and normal-vision (NV) group (N=192). Statistical test of difference shows the LR or OLR between groups using age as covariate.

(Survey questionnaire number), survey question	NV Median (range) or proportion	Hemianopia Median (range) or proportion	Statistical test of difference
(1) Hours watching TV per day	2 to 3 (0 to >5)	2 to 3 (0 to >5)	$z=1.44$, $p=0.15$
(2) Frequency watch TV with others (>never)	84.9% 107/126	93.6% 73/78	$z=0.71$, $p=0.47$
(3) Difficulty watching TV? (>never)	24.2% 23/95	55.3% 47/85	$z=4.71$, $p<0.0001$
(4) Special strategy (yes/no)	5.7% 3/52	30.8% 24/78	$z=3.08$, $p=0.002$
(6) Watch TV, movies on portable device (yes/no)	24.7% 40/162	31.4% 27/86	$z=1.05$, $p=0.29$
(8) Computer at home (yes/no)	83.2% 109/131	91.1% 72/79	$z=1.31$, $p=0.19$
(9) Watch DVDs on computer (>never)	39.1% 45/115	30.1% 22/73	$z=1.16$, $p=0.25$
(10) Watch videos on internet (>never)	68.9% 80/116	64.4% 47/73	$z=1.71$, $p=0.088$
(12) Difficulty watching DVDs or video on computer (>never)	11.6% 5/43	30.6% 19/62	$z=2.56$, $p=0.011$
(13) Assistive technology on computer (>never)	2.2% 1/44	27.4% 17/62	$z=2.62$, $p=0.009$
(15) Frequency movie theater (>never)	81.1% 133/164	65.8% 56/85	$z=3.48$, $p=0.001$
(16) Difficulty watching movies at theater (>never)	11.9% 11/92	43.0% 31/72	$z=4.50$, $p<0.001$
(17) Frequency take pictures (>never)	97.3% 73/75	78.2% 61/78	$z=2.61$, $p=0.009$
(21) Difficulty take good pictures (>none)	37.3% 28/75	52.3% 34/65	$z=0.49$, $p=0.62$