Compensating technologies for older people with visual restrictions

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N. Neustadt-Noy, Compensating technologies for older people with visual restrictions. Gerontechnology 2006; 5(4):195-207. Currently hundreds of devices are available to assist people who are visually impaired. This article discusses some of the technologies available in the areas of communication, daily living and mobility that attempt to meet the needs of elderly persons with visual restrictions. The potential to reduce barriers and increase access to self-managed activities is discussed, with emphasis on the gap between the availability of the technologies and the ability of the aging population to make use of them.

Keywords: low vision, blind, assistive technology, mobility, communication

The number of individuals experiencing age-related eye diseases is steadily increasing. Age-related macular degeneration (AMD) is the leading cause of severe, irreversible vision loss in the Western world[1]. In addition to AMD, diabetes, glaucoma, retinitis pigmentosa, and cataract are creating visual restrictions in an increasing number of aged persons. While reliable statistics are difficult to obtain, estimates suggest that in the UK, for example, more than 75% of the 100,000 residents registered as blind are over age 65[2].

In 1991, the U.S. National Health Interview Survey defines visual impairment as the inability to read newsprint. According to this measure, preliminary data indicates that approximately 13% of non-institutionalized Americans age 65 and older have some form of visual impairment[3]. According to the latest United States census there are approximately five million people in the U.S. over age 65 with substantial vision loss. This number is expected to double during the first decade of this century[4]. In the 75+ age group in western industrialized countries, 25% have been reported to have vision impairment[5].

Varying definitions of visual impairment affect the magnitude of incidence and prevalence. ‘Legal blindness’ is a level of visual impairment that has been defined by law to determine eligibility for benefits. The World Health Organization (WHO) definitions of visual impairment (1977) were created to meet the US population culturally[6]. The WHO applies another global distinction between 'low vision' and 'blindness': Low vision: 0.3 > visual acuity > 0.05; Blindness: visual acuity equal to or less than 0.05, or seeing only 10% or less of the visual field. The European Blind Union (EBU) suggested using the six class categorization of the WHO to describe the various levels of visual impairments. It has been agreed by the above mentioned organizations that under all definitions, the largest group of visually impaired persons are the aged[7].

For the reader who is not familiar with the blindness and low vision definitions, it should be noted that for years a large variety of definitions were used around the world. Ten years ago, an international group of multi-disciplinary experts redefined and unified the many blindness categories in a scale that makes sense to many in the medical field, but does not help understand the functional ability of the assessed individual.

The effect of the onset of visual impairment over the age of 65 differs for each individual, and is related to personal history and life experiences. As for technical aids compensating for visual restrictions, there have been major advancements in industrial countries in recent years in applying accessibility laws[8,9]. These laws have mandated inclusive designs and the use of advanced technologies that significantly affect the daily life of the elderly, as well as assisting people with various handicaps in the general population.

Visual impairment may severely impede independence at all ages in the most important life domains: communication, mobility, daily living and leisure time activities[10]. More than 50% of those defined as legally blind are handicapped by at least one additional disability associated with age related deteriorating health conditions[11]. The main life activity affected by the loss of vision, as reported by the elderly, is reading, followed by general communication, orientation and mobility, and daily living challenges[12]. Quite a few older people experience both a visual and an auditory loss.

In some countries in Europe there is a growing awareness of this group as a result of surveys to establish the size and characteristics of their problems. Three of such surveys were carried out in The Netherlands, Denmark, and the UK. The surveys used the same functional definition of deafblindness. The reports differ in the way they present their findings and distinguish between age groups. There are several differences in the methods used in the surveys and it is interesting to notice that despite these differences, the results they produced were in many ways very similar. However, none of the studies and surveys claim to have found exact and accurate numbers. There is still a lot of estimation and 'guesstimation' involved in the census. According to these studies, in 1991 the Royal National Institute for the Deaf in the UK estimated that there were 50,000 people with some degree of both visual and hearing impairment (approximately 431/100,000 of total population above). They also discovered that possibly as many as 45% of people over age 75 with visual impairments also have difficulties with hearing. A Danish survey revealed similar findings, indicating a prevalence of combined visual and hearing impairment in the elderly population of 346/100,000. In The Netherlands, the results of a survey in 1991 were an estimated 3,000-4,000 deafblind people in a population of 15 million (a prevalence of 20/100,000-27/100,000)[13].

The majority of the elderly defined as legally blind have moderate residual vision, which allows them to maintain their life style independently when using assistive devices. Maximizing independent functioning utilizing remaining vision can be achieved through rehabilitation training programs. For the majority who lose vision it is too complex and frustrating to identify and master the great number of aids that may enable independence. More so with the aging visually impaired individual who wishes to master independency when vision is significantly reduced. Many agencies providing rehabilitation services for people with visual restrictions offer specialized services for aging consumers. They focus on the use of optical and non-optical devices of various technological levels. Specialized training may be for a short period for some technologies or may require long-term supervision.

Environmental adaptations and technological advances may partially improve the ability of the visually impaired to cope with many daily challenges. Many of the great variety of specially designed devices for visually impaired people have the potential of making a great difference in endowing independence in the daily life of older individuals. In fact, for aging individuals who are visually impaired and who are fit, physically, mentally, socially, and economically, the current available technological options may reduce the effect of disability. This may not be the case for the many others who may have additional disabilities and/or financial difficulties. Rehabilitation training services are often unavailable to them.

Some of the technologies designed for people who are visually impaired are relatively easy to handle and those people who are 60+ can gain unassisted comfort by using them. In contrast, many of the advanced technologies are not friendly to the novice user and require intensive training. As technology becomes more complex, people who are aging and visually or multiply disabled may not be suitable candidates for the use of new products. In addition it is important to note that many of the developments intended to respond to the needs of visually impaired people were not intended to specifically meet the needs of the elderly visually impaired. Many very interesting developments have not passed through the door of the lab to the commercial market.

To the best of my knowledge, there are no evaluation studies available to date to assess the suitability of technologies for aging people with regard to appropriateness for those who are both visually impaired and hard of hearing, both visually and cognitively impaired, both visually and physically impaired, etc.

The mentioning of specific devices by their commercial names in this article is done for illustration only and does not suggest any commercial interest or recommendation.

Communication

Low Vision

Magnification

Early signs of visual difficulties are often manifested in everyday reading and writing. It is then that the individual experiences frustration for the first time, due to the inability to perform ordinary, habitual activity. Loss of self-confidence and social disengagement may result.

A wide range of solutions, from non-tech to high–tech, can enhance communication skills, some of which are easily available. Nearly all equipment that compensates for visual impairments requires training in order to achieve successful use. Rosenbloom suggests that provision of all low-vision devices requires training of the patient in the correct usage of the aid[14]. Langmann et al found that the failure rate of patients using low-vision systems decreased from 22% to 3% with improved training. Even a simple magnifier can be difficult to use if it is held at the wrong working distance[15].

Also, it should be noted that simple activities such as writing and reading may require separate devices, as, for example, both a writing guide and a Visual Tracking Magnifier (Visolett) or other hand-held magnifiers for reading print and telescope for reading distant signs, as well as a medium term magnifier to view TV captions. In fact, one could end up with a number of devices which perform a range of communication tasks.

Beyond the extra costs involved in purchasing these devices, each may require separate training.

Among the low-tech devices available are numerous magnification alternatives, from improved specialized low-vision lenses to high-power magnifiers (with or without a built-in light source), hand-held, base mounted and head-mounted magnifiers, telescopes for distance viewing and dual capacity auto-focus devices. Some of these are easier to use than others and the range of prices is very wide.

For close distance activities an assortment of electronic magnifiers is available: stand-alone closed-circuit televisions (CCTV), carry-on mini CCTV, built-in glass CCTV; mouse CCTV, computer graphic converters, and optical character recognition technology (OCR), to mention just a few. The type of CCTV chosen should include an evaluation with real world items such as newspapers, telephone books, utility bills, etc. Filling an insulin syringe or performing glucometry should be demonstrated for the insulin dependent diabetic. Preferences for image size, type of contrast, color, and the ability to operate the system should be determined. Motion problems of images on the screen may be reduced with larger monitors that allow the display of more text[15]. In addition, improved illumination systems such as light emitting diodes (LEDs) and others may be built-in or separate elements with vision enhancing capabilities.

Illumination

Numerous environmental solutions are also available. It is advisable to make proper use of natural and artificial light sources to suit the personal needs of the individual to adjust and control the lighting level over the reading material, and to create optimal contrast between the material and the background surface. In addition, facilitation of ergonomic comfort when reading, through the use of a reading stand, a clear font, and non-reflective print material are important. All these general considerations are preliminary to any low- or high-tech efforts to increase reading aptitude.

Speech technology

Stand-alone scanner readers, as well as OCR technology which converts print to voice and reads print information, are becoming easier and friendly to handle[16] and also more popular and affordable[17]. For book reading there are simple machines such as the Very Easy Reading Application (VERA), or the Scanning and Reading Appliance (SARA). These are simple looking boxes with a few tactile enhanced operation buttons and knobs. The individual using them has to insert the book page as on a scanner. The device then reads the information aloud[18]. However, for almost half of the visually impaired who are also hearing impaired the voice technology may not be of any help without a volume control.

General observations

Of great concern is the instability of visual impairment, which may require modifying or replacing devices often. This could involve adaptations and re-training, a process which is difficult to accomplish at later stages in life. Continuous advice by specialists is required in order to make the proper choice of device to meet individual interests, needs, and capabilities. Training is an essential aspect when considering assistive technologies. The frustration of losing the capabilities of a recently mastered visual tool and going through the learning process once again is an aggravation. Not many of the elderly with visual impairments have the energy to overcome this, nor the financial resources required. However, with gained experience, training becomes an easier process - shorter and less anxiety producing. If during training a family member is present and becomes familiar with the specific equipment, he or she can become an assistant should a 'senior moment' take effect and operating the equipment become a predicament.

It is believed that visually impaired persons among the baby-boomer generation will be more adaptable to technological advances, as many of them have had long term experience with high-tech devices[19]. Their choice of technology will perhaps be simpler than that of previous generations of the aging visually impaired, as the majority have been regular customers of advanced technology for many years. However, we should bear in mind the growing complexity of technologies and the heavy dependence on visual monitor interface, which is not accessible or helpful for the visually impaired without adjustments.

Blind

Devices which are designed for the totally blind may suit only a small fraction of the older visually impaired since the majority does not read Braille and is not able to learn this language at later stages in life. In addition, finger tips are not as receptive as required to sense the little dots or their vibrating output on a computer Braille display.

For day-to-day communication the elderly who are totally blind and have had experience in tactile graphics such as Braille may make use of a slate and stylus as a simple tool or a more sophisticated Braille note taker, which may also speak the notes. For a fraction of the totally blind elderly a number of easy to operate devices[18] are available, from hand-writing (slate and stylus) to electronic computer display output, Braille, voice output hand-held electronics (Palms), voice activated and voice output cell phones. Some of the more advanced communication options include talking ATMs, ticketing kiosks and talking buses. Among them is the Victor Reader, supported by Daisy Digital Technology which provides recorded literature and information for end users in common format with extremely rapid reproduction[20].

Speech technology has led to significant improvements in the quality of talking machines, which can enhance interpersonal communication, access to information, and control of the environment. Advanced cell-phone technology provides the opportunity for orientation and distant supervision. Information can be provided to people who are having difficulty remembering what is needed to complete a task, be it taking medicine or reaching a destination. This supervision may be provided from a distance by a medical service, family member, social agency or other arrangement suitable to the individual situation. The use of built-in cameras and user-friendly function keys can bring the visually impaired individual and his family virtual socializing through the use of multiple lines, as well as crisis intervention via cell phone instruction. Health care providers may view the person via his own cell-phone camera to aid in diagnosis of a health condition.

The most important change for many blind individuals in general and the elderly in particular has been the advent of the personal computer. Using text-based operating systems, a visually impaired or blind person can access computer information by using the proper software for enhancing the font size, color contrast, or using talking and dictating software[21].

Braille output devices are options as computer components or stand-alone Braille transcribers, and are mostly used by experienced Braille readers. They are simple to operate and can read any print using a small mouse to convert the scanned print to Braille. The majority of aging individuals who are losing sight, and can no longer read and write regular print, also have sensorial difficulty in gaining Braille reading skills. They may use Braille as a marking method in daily living, but rely on tapes for listening and reading.

Orientation and Mobility

Indoor

Before applying any type of advanced mobility technology, indoor environmental adaptations such as controlled natural and artificial light, reduced glare sources, increased color contrast, rearrangement of furniture to ease safe indoor movement, and alterations to reduce possible home accident risks are required. After applying these means, the use of indoor mobility devices such as the Alternative Mobility Device or Mini-Guide may be effective[22].

Outdoor

The outdoor environment in which we live is becoming increasingly complex for the visually impaired to handle independently. Avoiding unexpected obstacles and hazards on the sidewalk, maintaining the line of direction, safely crossing the road, taking a cross-city bus journey, etc., require a range of skills utilizing 3D environment structure information - continuously recognizing points of reference and relationships in the environment. Distinguishing when a destination has been reached, identifying a bus line at a multiple bus stop and finding a vacant seat, may all seem like trivial tasks, but for someone who has become sight-limited these are skills which have to be re-learned in this new context. Due to the complexity and fear of physical harm, even in most familiar environments, the majority of visually impaired elders use human sighted guides for moving around in indoor and outdoor environments. Visual disability may in fact paralyze the orientation and independent mobility of elderly individuals, especially if there is also hearing deterioration.

For those who have physical walking balance problems or are mentally and cognitively challenged in addition to visually impaired, a simple non-technological tool such as an Alternative Mobility Device, which is a home made device made of simple tubes and tailored for the individual's need, replaces a standard cane. It is ideal for support, environmental information, and providing protection. The Mini-guide is a tiny, hand-held electronic travel device that can enhance the self-confidence of an older person in the realm of indoor mobility and increase ease of outdoor mobility when used in addition to the primary mobility aid - be it a long cane or a guide dog. The Mini-guide uses ultrasound to detect objects, and gives auditory feedback by vibrating or chirping more rapidly as one approaches an object. It is ideal for use by visually impaired, deaf-blind persons[23]. It can help a blind person avoid obstacles and overhangs, locate landmarks and items such as mailboxes or trash cans, and find open paths through crowds at ranges from 0.5 to 8 m.[24]

Stairs present common hazards in indoor and outdoor environments. Visually impaired older adults are at high risk of falling[25]. A new, hand-held apparatus that detects stairs and curbs by incorporating laser and camera technologies[26,27] could minimize stair risks, especially if used in conjunction with a laser cane or Ultra-Cane, which increases the amount of information available to the user about obstacles in the path and at head height. This means the user can make decisions quicker; thus it gives more confidence and allows walking faster than with a traditional white cane.

For outdoor mobility, a number of devices are available to improve navigation and complement the use of a long cane or guide dog. The Talking Sign is based on pre-installed information in transmitters located at strategic points and relaying information to hand-held receivers. A Global Positioning System (GPS) can relay walking directions either through voice output or Braille display. It suits various hardware systems such as the portable Braille-Note taker, Braille computers, and mobile phones. It has great value for the aged visually impaired user as it contains a wide variety of maps covering most Western countries. Maps can be bought online and downloaded, or delivered on cards[28,29]. Despite the opportunities available, it still needs to be seen if aging individuals who are part of the cell-phone generation will be able to efficiently activate the GPS.

For those who may require enhancing remaining vision, full-field telescopes or spectacle mounted devices (Vision Enhancement System) enable automating the focusing mechanism so that the user does not have to twist a dial in order to refocus the telescope for viewing objects at different distances. However, when using a telescope one must be stationary and not in motion. If the device is not auto-focus and mounted in a frame, individuals with poor manual dexterity or hand tremor may face difficulties in focusing, especially if the apparatus is small in size.

The mini portable CCTV can magnify street signs, bus numbers etc. It is easy to carry as it weighs about 100 gram to one kilo depending on the model, and is simple to operate[30]. Many visually impaired elderly are restricting themselves from night travel as this is the time they can least utilize their remaining vision. To assist them in moving unhindered in the dark, night-vision spectacles have been developed[31]. The lab evaluations have given satisfying results. As is the case with many valuable prototypes, it remains to be seen if the elderly visually impaired, who are the target population for whom it was designed, will benefit by using it.

In urban life, street crossing and bus rides are complicated tasks for everyone. Signage and tactile information are available to assist in specific dangerous situations. Among the advanced developments are remote control units that identify crosswalk locations and convert light to sound, thus indicating 'walk-don't walk' cycles. Sound devices that are activated by street lights can assist the blind in crossing, but must create minimum noise pollution. Mobile phones equipped with a Bluetooth interface can inform a pedestrian-controlled crossing that they wish to cross the road and require more than the standard time for so doing. An audible message on the handset could tell when it was safe to cross.

It is anticipated that third generation mobile telecommunication systems, such as UMTS (Universal Mobile Telecommunications System), represent an evolution in terms of data capacity and information provision, including the position of the user and other services. However, further research is needed to determine how to present the information in the most appropriate form for visually impaired and blind aging individuals[32]. An alternative mode would be for buses to be equipped with a Bluetooth transmitter giving the destination of the bus. The blind pedestrian could signal back (via the mobile phone handset) that they would like to board the bus. Such systems need to be evaluated to determine the optimum interface for the use of visually impaired aging individuals.

The so-called 'Talking Signs' technology offers orientation information both indoors and outdoors, as in building entrances, elevators, halls, etc. It may provide outdoor information on buses arriving at multiple-bus stations as well as other orientation information. It is effective in selected strategic locations where the transmitter's technology is installed and the user is provided with a receiver to interpret the information[33]. The voice output is intelligible and can be adjusted to the level needed by the user. For people with both vision and hearing restrictions, however, automatic speech may be a disadvantage because of their hearing loss.

Activities of Daily Living

The expected increase in the number of people over 60 with visual impairment has implications for the appropriate use of assistive technologies, particularly since life expectancy is longer and since over half of visually impaired persons live alone[34], having to cope with cooking, housework, taking medication, personal care and social activities. Visually impaired people have a tendency to disengage socially a decade before the general population, due to difficulties in performing daily living chores[35].

About 10% of the total population experiences general color deficiencies[36]. Additionally there are numerous other sight reducing conditions that interfere with color distinction. This has a negative effect in distinguishing the colors and cleanliness of garments and adds to the dependency on sighted people. Color reading devices are available to help distinguish between 1,700 different colors. The device scans an item and the color is immediately announced in a clear, natural voice with volume control option. This device can help an adult to regain independence in making personal and intimate choices in simple daily living activities. A newer concept is the innovative Java computer code that can translate images into sound, via a rudimentary software program capable of converting pixels of various colors into piano notes of various tones. The consequence of this image-to-sound technology is that it enables blind people to read geography and weather maps[37,38]. The vOICe auditory 'Magic Lens' technology and other technologies such as Mobil Speak Plus are cellular phone based and can tell the user the color of a solid compound or a solution[39].

Assistive technology has also improved personal health care control by using voice output for a variety of activities, as in the 'Talking Pill Bottle' technology, which provides voice information. An example is the audio prescription label, on which the user can record information, or, with text-to-speech technology, the pharmacist can type the label information that will be read to the customer when touched. It was developed to prevent accidental overdoses or misuse by customers who are visually impaired or have trouble in reading[40]. Other personal medical devices such as the talking glucose meter are available to assist visually impaired people[41]. It remains to be seen how the senior visually impaired who are also hard of hearing and may experience short memory lapses or memory loss can rely on these voice developments for personal independent use. The medical industry must engage in in-depth studies to categorize the groups of consumers for whom these newly developed devices can provide proper solutions and assure efficient independent use.

The Bank-Note Teller is a talking device that assists in identifying the value of paper money, thus allowing self-regulation of one's bank notes. This mechanism, however, is about to become obsolete as Smart Cards are taking over and will provide blind people with easy control over their financial resources and the ability to make payments and purchases without intervention or assistance. The Smart Card may also be used for telecommunication, transportation, banking, and at ATMs. Also, Smart Cards, which are coming into everyday use on a small scale in some countries[42], may carry information that tells an ATM to allow the user more time. Many visually impaired elderly people with cognitive difficulty do not like to be rushed or to think that they are likely to be 'timed out' by a machine. It also allows issue of a pre-set amount of money, larger characters on the screen, and audio output of non-confidential information.

The Talking Scanner is a device that assists in reading product packaging, thus permitting blind people to conduct their supermarket shopping independently, providing they have good orientation and mobility skills.

Discussion

Visual impairment disables routine activities of the elderly whose life customs and practice may also be hindered by additional age related difficulties. Inclusive, no-barrier designs, in addition to a large array of technologies applied at home for personal use and in public environments, may make a great difference. These range from simple modification of color contrast, light adjustment at the personal level, audible output to compensate for failing vision, to the most complex technologies to respond to individualized activities.

The significant increase in the older visually impaired population inspires integrative efforts and resourcefulness of engineers of various disciplines to produce improved devices specifically designed for this group. With the currently available numerous technological options, visual impairment might become a less handicapping condition, provided the elderly are well-off mentally and economically and are stimulated to maintain their independent style of life. The situation may be different for those with financial difficulties who cannot acquire expensive technologies, or those with mental deficiency who are unable to handle complex technologies. For these groups newer technologies may create further frustration as their inability to use assistive technologies becomes an additional component to their disability.

Blindness fascinates researchers within numerous disciplines that are supported by generous research grants. This promotes the development of many innovative devices specially designed for the elderly population. However, due to research laboratories' financial constraints and lack of start-up financial support for their product beyond the prototype, many of these developments are arrested in the development stage. Two examples are the Mobic System, which was designed to support the visually impaired elderly and provide information on-site and the Robotic Shopping Cart, which was designed to assist blind persons in navigating the aisles of a grocery store. Both were developed by research teams at university laboratories. RoboCart uses sensors placed in a specific environment, such as a grocery store, to navigate. It gives audio prompts to the user, who uses a keypad similar to a telephone to tell the robot where to go[43]. It remains to be seen if the market of elderly visually impaired will adopt these two innovative devices.

It has been suggested that voice-activated television displays will become a primary interactive center in home communication for the elderly who do not use computers[44] for personal services such as library reading books, descriptive narration of visual performances, and general information. Volume control and earphones to outfit the hard of hearing should thus be an integral component of these systems.

Mobile phones may soon include speech-to-text and text-to-speech choices, traffic light remote control activator, color analyzer, interactive calendar, health monitoring and medication taking reminders, door keys and ATM banking, all by voice option. In addition, they may become a means of data collection and a satellite global positioning navigation system activated by touch and voice. Laser, infrared, sonar, light emitting diodes, and intelligence technologies complemented by installation of a network of lighthouse beams which acoustically classify objects in certain environments, will provide hazard warning and visual substitution. Some of these technologies may be integrated into the mobile phone, thus creating a personal point of reference that will significantly improve mobility and daily life performance for the visually impaired elderly. The complexity of these newer developments may be unsuitable to support people with restricted vision. More evaluation research is needed, however, to determine their effect and added value to independent living.

The assistive technological devices available today may be an asset to the highly capable aging population whose residual vision can be better utilized to maintain or regain independent functioning. These devices should be user-friendly, inexpensive, and easily modifiable to individual needs, including the needs of those who are cognitively and multiple-physically challenged. Assistance in selecting the proper personal devices for the individual's needs should be an integral element in the therapeutic approach, and should include personal tutoring in the use of the devices.

Embracing all these characteristics may significantly improve the usability of the various devices and prevent them from being neglected and/or hidden away. In addition, taking this approach will maintain the quality of life and allow the visually impaired elderly to stay within the community and possibly reduce the need to move into supervised sheltered environments. Given that vision loss is a medical condition which requires a number of assistive technological devices to perform independent daily routines, the supporting technological services should be viewed as a remedy accommodated by health care systems in the medical and social rehabilitation processes.

For the totally blind individual, implanting chips on the retina, bypassing the optic nerve, or implanting bionic eyes which provide visual information directly to the brain, may still sound like science fiction, although several groups of scientists have already developed silicon microchips that can create artificial vision[45]. It may take less than a generation to adapt research prototypes to reality[46].

Until vision can be medically or artificially restored, the technologies available to assist the elderly with visual impairments or restrictions should also suit low cost budgets, which are the norm for seniors relying on limited social security income, which is typically used to cover extra health care costs[47]. Technology should be practical, affordable, intuitive to operate and simple to maintain. It should be provided to the individual on a long-term loan system under medical care and insurance plans[48]. In some of the wealthy countries this approach is already practiced. Nevertheless, to this date, despite the potential to support personal independent living, advanced technology is out of reach of the majority of the aging visually impaired population in both wealthy and poor countries. In various regions of the world services and technology for older people with restricted vision may differ to respond their style of life and practical needs.

Despite the wish of international organizations and policy planners to apply equal distribution of technology supporting the aging with restricted vision, the industrializing or poor countries are unfortunately a generation behind in attaining use of advanced assistive technologies developed to improve daily living, orientation and mobility or communication. Social changes, infrastructure amenities, inclusive environment and the impact of improved technology could and should have vast positive affects on the independent living of the aging visually impaired. It is expected that with greater intervention of governments the gap in the use of technology between wealthy and poor countries will be reduced.

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