Sensory Impairments Among Rural Populations in America

15

Bradley W. McDaniels, Byung Jin Kim, and Debra A. Harley

Overview

Sensory impairment usually refers to blindness or a degree of vision loss and deafness or a degree of hearing loss. Vision impairment may be characterized by symptoms of central vision loss, peripheral vision loss, contrast impairment, glare, reduced depth perception, and blur (Burton, Lee, & Potter, 2016; Corn & Erin, 2010). Hearing loss occurs when there is diminished sensitivity to sounds normally heard, and deafness is a degree of impairment in which a person is unable to understand speech even with amplification (Falvo & Holland, 2018). Although the focus of this chapter is vision and hearing impairment, sensory integration dysfunction (SID) (formerly called sensory processing disorder [SPD]) is mentioned because it is a condition that interrupts sensory signals and interferes with communication. Sensory integration disorder refers to the way the nervous system receives messages from the senses. More specifically, the inability of sensory signals to organize into appropriate responses results in certain parts of the brain being unable to receive the information needed to interpret sensory information correctly. Subsequently, the person exhibits motor clumsiness, behavioral problems, anxiety, depression, and learning difficulties. SID can affect people in a singular sense or multiple senses. Individuals with SID have chronic difficulties processing sensory information, which manifest as highly disruptive to everyday life, safety, difficulty in performing work activities, and difficulty in forming close relationships and regulating emotions (Achieve Australia, 2016; Sensory Processing Disorder Resource Center, n.d.).

In rural areas, people with sensory impairment experience a sense of social isolation, loneliness, and even depression. The sequelae of sensory impairments is similar to what may be seen in more urban settings but is frequently more pronounced among individuals living in rural communities who may lack the resources and means to obtain appropriate interventions and essential supports found in larger cities. Moreover, rural communities typically have a larger number of older individuals who, as research supports, are much more likely to have disabling sensory impairments.

Sensory impairments are increasingly prominent among older adults (Crews & Campbell, 2004; Vreeken et al., 2013; Zambelli-Weiner, Crews, & Friedman, 2012), persons with certain type of diseases (e.g., diabetes), individuals with multiple disabilities including intellectual disability (Fellinger, Holzinger, Dirmhirn, van Dijk, & Goldberg, 2009), individuals living in poverty (Dillon, Gu, Hoffman, & Ko, 2010), people with micronutrient deficiencies (e.g., vitamin A defi-

B.W. McDaniels (✉) • B.J. Kim • D.A. Harley
Department of Early Childhood, Special Education, and Rehabilitation Counseling, University of Kentucky, Lexington, KY, USA
e-mail: bradley.mcdaniels@uky.edu

D.A. Harley et al. (eds.), *Disability and Vocational Rehabilitation in Rural Settings*,
DOI 10.1007/978-3-319-64786-9_15

ciency), and among certain populations such as veterans (Smith, Bennett, & Wilson, 2008), non-Hispanic Whites, and older women (Prevent Blindness America, 2012). Dual sensory loss (DSL) or dual sensory impairment (DSI) has a negative impact on functional ability, health, and well-being and creates a financial burden (Cacchione, 2014; Vreeken et al., 2013). Research suggests vision impairment is associated with increased mortality rates in older adults (Freeman, Egleston, West, Bandeen-Roche, & Rubin, 2005; Karpa et al., 2010), and hearing impairment is linked to the cause of mortality through three mediating variables: disability in walking, cognitive impairment, and self-rated health (Karpa et al., 2010).

In RFT areas, several factors converge to adversely place residents at risk for visual impairment including low educational attainment, high unemployment, limited access to a health-care facility, and lack of comprehensive health insurance coverage (Iezzoni, Killeen, & O'Day, 2006; Nayar, Yu, & Apenteng, 2013). Concomitant risk factors of visual impairments include falls, depression, reduced cognitive function, and various functional limitations (Swenor et al., 2015). In RFT areas, occupational noises, especially in farming and agricultural jobs, can lead to hearing loss. In general, it is difficult to determine the extent of and risk factors for dual sensory impairment in rural areas; however, the general consensus is persons with dual sensory impairment have more difficulty in performing activities of daily living, more depressive symptoms, lower quality of life, and increased risk of mortality in comparison with a single sensory impairment (Ramamurthy, Kasthuri, & Sonavane, 2014).

Learning Objectives

Upon completion of this chapter, the reader should be able to:

1. Understand the challenges of people with sensory impairments living in rural areas
2. Understand the benefits of service coordination for persons with sensory impairment living in rural areas
3. Identify strategies to improve service delivery for sensory impairment in rural areas

Sensory Impairments

Sensory impairments can present at any age and are identified as one of the most frequently diagnosed disabilities for individuals later in life (Brennan, Horowitz, & Su, 2005). Typically, sensory impairments relate to sight and/or hearing loss but, more accurately, are made up of multiple components of the central nervous system and include vision, hearing, touch, taste, smell, movement, and body position (Dunn, Saiter, & Rinner, 2002). Individuals receive information from the environment either through the eyes or ears, which are considered primary pathways for acquisition of information essential to appropriate growth and learning (Dutton & Bax, 2010). Individuals with disabilities, including sensory impairments, are associated with poorer health outcomes, lower educational achievements, and higher rates of poverty related to lower rates of economic participation (World Health Organization [WHO], 2011).

Deafness and Hearing Loss Hearing loss is considered a key public health issue due to its impact on cognitive, social, and physical functioning of those affected (Lin et al., 2013). According to recent estimates, hearing loss is the most common, chronic, disabling condition in the United States (Jantz & Thompson, 2017). Hearing loss affects approximately 48 million (20%) people in the United States and can occur at birth (congenital) or develop at any age (acquired; Center for Hearing and Communication, n.d.). Frequently, hearing loss is the result of both genetic and environmental factors (Williams, 2000). Unfortunately, because prevalence estimates are

typically based on self-reported data, when utilizing audiometric testing, the actual numbers may be even higher (Lin, Niparko, & Ferrucci, 2011). Age is the strongest predictor of hearing loss with nearly 66% of individuals aged 70 and older having bilateral hearing loss and roughly 75% having hearing loss in one ear (Goman & Lin, 2016). Hearing loss can, indeed, be life altering and result in a number of sequela (e.g., depression, isolation, withdrawal). Presbycusis, age-related hearing loss, is the most common type of hearing loss and generally affects speech comprehension in both quiet and loud atmospheres (Gates, Beiser, Rees, D'Agnostino, & Wolf, 2002). As a result of even mild hearing loss, individuals may experience impaired verbal language abilities affecting both communication and social connectedness (Agrawal, Platz, & Niparko, 2008).

Hearing loss is typically characterized by type and onset. Hearing loss may also be identified as unilateral or bilateral depending on whether the impairment is in one or both ears. Because an individual can have unilateral or bilateral hearing loss, the degree of hearing loss can be classified as either symmetrical (i.e., the same in both ears) or asymmetrical (i.e., different in each ear) hearing loss. Hearing loss is typically described based on the specific type (see Table 15.1) and time of onset (e.g., prelingual or postlingual). Following the identification of the specific type of hearing loss, audiometric testing ensues to evaluate the severity of hearing loss. The WHO standards are typically used to classify individuals' hearing loss (measured in decibels) on a continuum consisting of mild (26–40 dB), moderate (41–55 dB), severe (71–90 dB), and profound (>90 dB) (Table 15.2).

Table 15.1 Type of hearing loss

Type	Description
Conductive	Reduced hearing ability even though the cochlea is normally functioning results from external ear abnormalities
Sensorineural	Decreased ability to hear resulting from damage or malfunction to inner ear structures
Mixed	A combination of both conductive and sensorineural
Central auditory dysfunction	Hearing deficits resulting from damage or dysfunction in the brain

Note: Adapted from Smith, Shearer, Hildebrand, and Van Camp (2014)

Table 15.2 Severity of hearing loss

Severity	Measurement (Db)	Undetectable sounds
Normal	−10–15 dB	
Mild	26–40 dB	Faucet dripping, leaves rustling, birds chirping, whisper
Moderate	41–55 dB	Light traffic, conversational speech, refrigerator, air conditioner
Severe	71–90 dB	Dish washer, vacuum cleaner, garbage disposal
Profound	>90 dB	Lawn mower, food processor, arc welder

Note: Adapted from Jantz and Thompson (2017)

Blindness and Vision Loss Loss of vision can present individuals with numerous significant changes to his/her life. Moreover, vision loss is associated with a number of negative effects including increased loneliness, clinically significant depressive symptoms, loss of functional independence, and possible suicidal ideation (Carrière et al., 2013; Gopinath et al., 2013) Blindness is defined in several ways. One definition is the inability to see at all, at best, to discern light from darkness. The National Federation of the Blind uses a broader definition, which suggests blindness refers to sight that is bad enough, even with corrective lenses, that a person must use alternative methods to engage in any activity that persons with normal vision would do using their eyes. Yet, the US Bureau of Census question

about "significant vision loss" includes both total or near-total blindness and "trouble seeing, even when wearing glasses or contact lenses." The statutory definition of "legally blind" is that central visual acuity must be 20/200 or less in the better eye with the best possible correction or that the visual field must be 20 degrees or less (National Federation of the Blind, 2016).

The 2014 National Health Interview Survey (NHIS) Preliminary Report (Centers for Disease Control and Prevention) estimated 22.5 million (10%) American adults reported they either have trouble seeing, even with correction, or are blind or unable to see at all. In fact, according to the National Federation of the Blind (2016), assessing national and regional visual impairment for 2013, the prevalence of blindness for the United States was 2.3%, while in rural states like Kentucky, the incidence was nearly 50% higher at 3.4%. Of particular concern, as reported by the American Federation for the Blind (AFB, 2017), the age group most affected by blindness was adults between 35 and 64: those in the most fruitful years of employment. The American Community Survey in 2014 results indicates the prevalence of visual disability for all ages is 7,358,400 (2.3%), of which 6,906,500 (8.6%) are age 16–75 years and older, 3,810,600 (9.0%) are women, 3,095, 900 (8.0%) are men, 3,831,700 (1.9%) are age 18–64, and 3,000,400 (6.7%) are age 65 and older. The breakdown by race or ethnicity reported to have a visual disability is (a) White 5,348,700 (2.3%), (b) Black/African American 1,143,500 (2.9%), (c) Hispanic 1,179,800 (2.2%), (d) Asian 230,400 (1.4%), (e) American Indian or Alaska Native 95,300 (3.8%), and (f) some other race 540,400 (2.2%). The median annual earning for persons aged 21–64 years with a visual disability in the United States in 2013 was $35,800, the median annual household income was $37,500, and the number living below the poverty line was 1,124,200 (30.5%). Persons aged 21–64 years with a visual disability that received SSI benefits in 2014 were 662,000 (17.9%). For working age adults reporting significant vision loss, only 40.4% were employed in 2014 (Erickson, Lee, & von Schrader, 2016). Statistics on mobility issues of persons with visual impairment are more difficult to ascertain; however, Guiding Eyes for the Blind (2015) estimates there are approximately 10,000 guide dog teams currently working in the United States, and only about 2% of all people who are blind and visually impaired work with guide dogs.

More than one-third of adults who are blind live in the South and the rest are evenly distributed in the Northeast, Midwest, and West (Zuckerman, 2004). Zuckerman suggests regional differences influence how these blind adults live. For example:

> Blind men outnumber blind women in the South, while the pattern is reversed in the other three regions. Blind adults are older in the Northwest, more likely to be married in the South, less educated in the South, and more educated in the West. Blind adults in the Northeast (89%) and West (86%) are more likely to live in an urban area than in the South (70%) and Midwest (71%; p. 5).

Vision loss can be attributed to a number of causes, but the most common and preventable predictor is diabetes (19.7%; AFB, 2017). The rate of complications (e.g., retinopathy) associated with diabetes is reportedly higher in rural communities for reasons to be discussed later in this chapter (Hale, Bennett, & Probst, 2010).

Dual Sensory Impairment People who are deaf-blind have a combination of vision and hearing loss. It does not mean a person is fully deaf and fully blind. There are two definitions of deaf-blindness. One is used primarily in education and the other in rehabilitation. In education, deaf-blindness is officially defined as "concomitant {simultaneous} hearing and vision impairments, the combination of which causes such severe communication and other developmental and educational needs that they cannot be accommodated in special education programs solely for children with deafness or children with blindness" (34 CFR 300.8 (c) (2), 2006). In rehabilitation, the federal definition of deaf-blind is:

> (A)(i) An individual who has a central visual acuity of 20/200 or less in the better eye with corrective

> lenses, or a field defect such that the peripheral diameter of the visual field subtends an angular distance no greater than 20 degrees, or progressive visual loss having a prognosis leading to one or both of these conditions; (ii) who has chronic hearing impairment so severe that most speech cannot be understood with optimum amplification, or a progressive hearing loss having a prognosis leading to this condition; and (iii) for whom the combination of impairments described in clauses (i) and (ii) cause extreme difficulty in attaining independence in daily life activities, achieving psychosocial adjustment, or obtaining a vocation; (B) who despite the inability to be measured accurately for hearing and vision loss due to cognitive or behavioral constraints, or both, can be determined through functional and performance assessment to have severe hearing and visual disabilities that cause extreme difficulty in attaining independence in daily life activities, achieving psychosocial adjustment, or obtaining vocational objectives (Helen Keller Act, 2011, para A[i]).

In other words, when an individual presents having visual or hearing impairments that effect their daily functioning they are deemed eligible for services. Although individuals rarely present as totally blind and completely deaf, the presence of limitations to both sight and hearing result in compounding difficulties. Dual sensory impairment, like either visual or hearing impairment individually but largely absent in the literature, is associated with functional decline (Brennan, Su, & Horowitz, 2006), loss of social participation (Crews & Campbell, 2004), depression (Hallberg, Hallberg, & Kramer, 2008; McDonnall, 2009), decreased perceived quality of life (Wahl, Heyl, & Langer, 2008), and cognitive decline (Lin et al., 2013).

Barriers in Rural Communities

Considering the challenges associated with hearing and visual impairments for those living in metropolitan communities, the barriers for those living in RFT areas are likely to be demonstrably more evident. As discussed in Chap. 3 of this book, transportation is an unresolved issue in the majority of RFT communities, and the challenges may be even greater for individuals with hearing or vision loss. RFT communities frequently lack the accommodations that allow individuals with disabilities to be able to fully participate in life. In the following sections, specific barriers affecting individuals with visual and hearing impairments will be discussed.

Availability of Care Serving small populations of widely dispersed individuals results in a financial disincentive for specialists, which leads to a greater reliance on generalists and subprofessional staff (Nayar et al., 2013). Compared to the nondisabled population, individuals with disabilities consistently face socioeconomic disadvantages, and in RFT communities, the challenges are likely compounded. Research clearly describes the barriers of the limited availability of primary care and specialist physicians, the absence of appropriate diagnostic services, and the inadequate health insurance coverage, which is severely affected by poverty and high unemployment (Acrury et al., 2005; Goins, Williams, Carter, Spencer, & Solovieva, 2005; Larson & Hill, 2005; Pathman, Ricketts III, & Konrad, 2006). Even for individuals who have health-care insurance, having access to specialists is severely limited. The most likely scenario is for specialists from neighboring metropolitan areas to come into RFT communities to offer services on a limited basis. Additionally, research suggests that primary care clinicians in RFT communities have insufficient knowledge regarding disabilities; there exists a lack of access to appropriate specialists, inadequate continuity of care, and inaccessible information (Iezzoni, 2003; Iezzoni & O'Day, 2006). Because RFT communities face geographical, personnel, funding challenges, and lack a formal health-care infrastructure, many RFT areas are designated as health professional shortage areas (HPSAs) and/or medically underserved areas (MUAs; Pennel, Carpender, & Quiram, 2008). Several explanations have been posited as to the reasons for the health-care disparity: (a) undesirable location, (b) fewer educational opportunities, and (c) financial constraints,

which all hinder recruitment and retention of physicians.

As a result of diabetes being more prevalent in RFT communities, specialist services are critical for the prevention and early detection of diabetic retinopathy. In fact, fewer individuals with diabetes living in RFT areas report having received an eye exam in the past year, which correlates with the increased incidence of diabetes among rural residents (Hale et al., 2010). Clearly, routine health care is essential to detect early vision and hearing loss; however, in RFT communities, the limited availability of both primary care and specialty physicians along with poverty and transportation barriers result in significant barriers for residents.

Topographical Inaccessibility Rural residents with disabilities experience many of the same challenges to obtaining health care as nondisabled residents, but often the barriers are compounded due to a sensory impairment of other disability. Due to the fact that many RFT communities lack health-care providers, particularly specialists, residents are required to travel long distances to reach appropriate care. Moreover, due to geographic distance, environmental barriers, inaccessible or nonexistent public transportation, and topography challenges, many RFT residents may not be able to access the necessary health care. Personal vehicles are the main form of transportation for rural residents, but as a result of an individual's sensory impairments, he/she will be precluded from driving and will be responsible for finding alternative transportation. For individuals who are deaf or hard of hearing, getting to the health-care provider may not be the greatest challenge; due to the overall costs, having an interpreter available to assist with communication is not likely.

To assist individuals who have low vision or blindness maintain independence, orientation and mobility training is frequently undertaken to assist individuals with sensory impairments in being able to ambulate and negotiate the environment (Zijlstra, Ballemans, & Kempen, 2012). Generally, orientation and mobility training consists of teaching individuals with vision impairment the use of the identification cane (i.e., symbol cane), which is used to indicate one's low vision and help to navigate one's path (Ballemans, Kempen, & Zijlstra, 2011). Echolocation, a learned skill to allow individuals who are visually impaired to navigate through sound, is frequently used and can become one of the main sources of gathering information from one's surroundings. Moreover, many rural communities do not have crosswalk audible crosswalk signals to alert visually impaired individuals when it is safe to cross the street. For individuals with dual sensory impairment, for example, as a result of the inability to localize sound, individuals using a cane may need to hold up a card signifying a need for assistance when crossing the street.

Although orientation and mobility afford a certain degree of freedom for individuals with vision impairments, rural communities frequently lack of sidewalks, curb cuts, paved roads, and cross walks negatively impact mobility. Often, the limitation on mobility ushers in a certain degree of isolation for these rural residents. Refer to Chap. 3 for a more detailed description of the topographical, geographical, and infrastructure barriers in RFT areas.

Technology Almost everyone uses some form of assistive technology (e.g., calculator, cell phone, computer). To garner an understanding of exactly what is meant by assistive technology (AT), having a working definition would be prudent. Blake and Bodine (2002) informally define AT as any tool, device, or machine used to complete a task. A more formal definition is proffered in the Assistive Technology Act of 1998:

> Any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities (Sec. 3(a)(3)).

Therefore, any device or technology that can assist an individual who is visually or hearing impaired falls into the aforementioned definition. Clearly, the availability of various assistive technology devices is critical to afford individuals with sensory impairments the opportunity to fully participate in daily activities. As technology continues to advance, new and improved devices are

entering the market, which increases functioning and provides more options for those who require assistance. One of the many challenges surrounding the availability of services to individuals who live in rural communities is accessibility and affordability. Although there are some AT devices that are less expensive, there is usually a positive association between quality and price. For individuals who experience dual sensory impairment, typically either hearing or vision is better than the other, and the decision regarding appropriate AT devices will follow accordingly. A list of devices available for individuals who are hard of hearing or deaf and those with vision impairments is contained in Tables 15.3 and 15.4, respectively. For a more detailed description of assistive technology refer to Chap. 4.

Legislation Individuals with vision and/or hearing impairments are fully covered by the Americans with Disabilities Act of 1990 (ADA). Several parts of the ADA were enacted to specifically address individuals with "communication disabilities." Title II of the ADA dealing state and local government entities and Title III, which addresses business and nonprofit organizations that serve the public be equipped to communicate effectively with individuals who have communication difficulties (e.g., vision or hearing loss). These accommodations include what are termed "auxiliary aids and services" (e.g., qualified reader, audio recording of printed information, interpreters, captioning). Through the amendment of the Communications Act of 1934, specific language pertaining to telecommunications was added under Title IV (sec 255) of the ADA, which mandated the availability of relay services nationwide. As a result of Title IV, law mandated that relay services be functionally equivalent between those who are deaf or hard of hearing and those who are not. There exist four specific requirements for relay services (a) relay services must be available 24 hours per day, (b) no restrictions on length or content of calls, (c) maintenance of confidentiality of relay operators, and (d) same rates for relay services as typical service calls (Strauss, 1991). For a detailed discussion of the ADA, see Chap. 31.

More recently, additional legislation has been passed to update the nation's telecommunications protections for individuals with disabilities. The Twenty-First Century Communications and Video Accessibility Act of 2010 (CVAA). The CVAA was passed to ensure additional safeguards for individuals with disabilities to continue to be able to access technology in the internet-based and digital communication age (e.g., broadband, mobile communication). There are a number of provisions contained in the CVAA, and several of the more pertinent specifications will be discussed. The CVAA is composed of two main titles: Title I addresses communication access and Title II deals with internet and television programming. Under Title I, the law requires that:

(a) All newly manufactured telephones are compatible with hearing aids.
(b) Relay services are available to all individuals with speech or hearing impairments and extends to those entities providing IP-enabled communication.
(c) Internet-based communication technologies (equipment, services, and networks) must be accessible to individuals with disabilities, unless an undue hardship would result.
(d) Individuals with disabilities are specifically eligible to receive universal service support through both granting the FCC the authority to designate broadband services needed for communication under existing universal service programs and the authority to designate those entities who make specialized equipment eligible for universal service support.
(e) For establishment of an emergency access and real-time text support network that ensures that those who rely on text as a primary means of communication have equal access to emergency services.

Title II, which addresses video programming, has several provisions including (a) video programming guides and menus designed to make video guides, menus, and controls accessible to those who are visually impaired; (b) closed-captioning decoding and video description capa-

Table 15.3 AT options for hard of hearing/deafness

Device	Description
Practical devices	
Baby crying signaler, carbon monoxide detector, doorbell signaler, smoke alarm signaler	All of these devices offer a load tone, flashing lights, and/or vibrations to signal the individual
Telecommunication	
Amplified ringers and telephones	Provides increased volume
TTY/TTD	Utilizes a keyboard and visual display to allow users to communicate
Video phone	Uses a video connections to allow users to communicate through sign language
CapTel	For people who are unable to hear over the telephone but prefer to use their voice to communicate. CapTel calls also must be made through a relay service. This connection allows the person with the hearing loss to speak to the other party and read their incoming message on the telephone's display screen. Today, many people are using CapTel
Assistive listening devices (ADLs)	
Hearing aids	Continue to be one of the most widely used ADLs. There are a wide variety of styles and tremendous variability in quality
FM system	The speaker wears a compact transmitter and microphone, while the listener wears a portable receiver
Infrared system	This wireless system transmits sound via invisible light beams with the volume controlled by the user

Note: Adapted from Minnesota Department of Human Services Online (2013)

Table 15.4 AT options for visual impairment

Device	Description
Video magnifiers	Also referred to as close-circuit TV (CCTV). Uses a stand-mounted or handheld video camera to project a magnified image onto a monitor or TV (cost $400–$4000)
Braille displays	Technology provides access to information on a computer screed in braille (cost $3500–$15,000)
Braille printers	Provides a braille hardcopy of information from computers (cost $1800–$5000)
Optical character recognition system	Allows users to scan printed text, which is then spoken back in synthetic speech (cost $1300–$5500)
Speech systems	Converts information from a computer into synthesized speech (cost up to $1100)
Screen magnifiers and phone apps	Many of the new phone apps allow for greater functionality with magnification, currency recognition, and more

Note: Adapted from American Federation for the Blind (2017)

bility, which requires that all devices that receive programming over the internet have closed-captioning and that all devices be able to transmit and deliver video descriptions; and (c) improved user interfaces require that all devices that receive or display video programming are accessible by individuals with disabilities (e.g., controlling volume, selecting programming) as well as a conspicuous means of accessing closed-captioning.

Although these provisions are aimed at the improvement of accessibility of telecommunications for individuals who have sensory impairments, if individuals live in rural areas where Internet and broadband access is scarcely available, little effect may be realized. One of the barriers apparent in rural communities is the transmission of information to residents. Many may not be aware of what is available to them nor have the necessary supports to ensure that the law is effectively providing meaningful improvements. How individuals become informed and access available services is one of the most salient issues needing attention.

Rural Outreach

One of the challenges is how to effectively and efficiently ensure that those living in rural communities have both knowledge about and accessibility to necessary services and AT to allow them to fully participate in the community. As has been demonstrated throughout this chapter, there are numerous barriers preventing the acqui-

sition of available services. Addressing the obstacles faced by individuals living in rural communities will, indeed, require the concerted efforts by local, state, and federal legislators. Overcoming the economic factors, provider availability, educational shortcomings, and geographical isolation are critical factors affecting the delivery of care.

The *Institute of Medicine (IOM) Rural Health Report* (2006; Mueller et al., 2006) asserts rurality or remoteness of location should not be a barrier to access of quality health care. The IOM report includes program recommendations in the areas of developing the rural health workforce, building rural quality improvement infrastructure, financing rural health care, and furthering information technology implementation and utilization. An important consideration to capitalize on recommendations to improve rural health care is an appropriate degree of coordination and recognition of what is working currently and what requires new initiatives (Mueller et al., 2006).

Consider the case of Sydney, a 16-year-old student with a hearing impairment. She presents with several challenges that cut across her functioning in several settings. Review the case of Sydney and examine how living in a rural area may have added to or intensified barriers for her in school, social, and family functioning.

Strategies for Service Delivery One of the solutions considered for bridging the gap between urban and rural health care is telehealth. Many specialties have effectively adopted telehealth as a feasible alternative to face-to-face office visits. One of the major barriers to telehealth in many rural communities is the availability of broadband Internet access. The congressional report of *Broadband Internet Access and the Digital Divide: Federal Assistance Programs* indicates there are nearly 19 million Americans who do not have access to fixed broadband and 14.5 million live in rural areas (Kruger & Gilroy, 2016). For those areas where broadband access is available, telemedicine screening for diabetic retinopathy has been demonstrated to be both effective and cost-effective, eliminating many of the barriers to care (Yogesan, Constable, & Chan, 2002). Technology should serve as a means to increase

Discussion Box 15.1

Sydney is a 16-year-old high school student living in a rural community in eastern Kentucky. She was born with congenital hearing loss and has severe hearing loss (71–90 dB). Although as a teenager Sydney has a diagnosis to explain her hearing loss, for the majority of her schooling, neither her family nor the school knew about her challenges. In grade school, Sydney performed poorly on her assignments, and both her parents and teachers intimated that she was not applying herself. After a couple of years, it was suggested that Sydney may have a learning disability and was placed in special education classes, which failed to improve her work. She was described as shy and uninvolved with her classmates and was referred for counseling. In counseling, Sydney told the therapist that she was embarrassed that she could not hear teachers or classmates and chose to avoid situations where conversations were necessary. Through her work with a therapist, Sydney's hearing impairment was discussed and hearing aids were recommended. Through Medicaid, Sydney was able to receive hearing aids, but they were of poor quality and only amplified sounds – all sounds. Therefore, even when Sydney was wearing the hearing aids at school all of the background noise continued to interfere with hearing the teachers. Although the city was only about 90 min away, Sydney's family only had one car, which was not very reliable. Through the help of a local church, Sydney was able to secure transportation to the city for a thorough evaluation. The audiologist determined that Sydney needed higher-quality hearing aids, but they would cost nearly $1000.

1. What type of skills do you think would have helped teachers to recognize Sydney's hearing loss?

2. How could have coordinated efforts across the school system, health-care providers, and her family helped to identify Sydney's hearing loss? What recommendations would you make to the various service entities in the rural area working with Sydney?
3. What issues could have contributed to Sydney's hearing loss when she was a young child? How could this change if primary care providers in rural areas always conduct hearing tests?
4. What difference would it make to have the appropriate hearing aids at an early age made in Sydney's life?

access to and to improve health-care quality and in itself is not the measure of success. The end results are "patient safety, health care quality, and improved quality of life for rural people and places" (Mueller et al., 2006, p. 14). An addition to the use of technology for actual patient care is the importance of adapting information systems to the scale of rural health-care providers. The IOM suggests avoiding super imposing an urban system in rural settings, rather, to design appropriate information systems to interface with urban information systems to promote ease of communication and patients transitioning between care delivery sites.

There are several practices that may provide greater availability of specialty care in rural areas. One is increasing financial incentives for health-care providers serving in underserved areas. Many rural communities have had success in attracting new providers by partnering with medical schools and offering forgiveness of student loans for providers who practice in rural communities. In addition to using financial incentives to recruit new providers, The IOM report emphasizes the need to sustain a high-quality health-care delivery system in rural areas. Thus, two critical elements to this end are (a) financing must be sufficient to sustain the system, and (b) payment systems (e.g., bonus payments, cost-based payments) must support innovations that improve quality in health-care delivery (Mueller et al., 2006).

Another practice is increasing transportation options in rural areas can affect patients being able to access providers in neighboring communities. This can potentially be accomplished through a voucher system or community organizations assisting with ridesharing. Transportation options become increasingly important in rural areas not only because of geographic distance but also extreme weather conditions and environmental and climate barriers (see Chap. 33).

Education of community health-care workers in the identification of visual and hearing changes is yet another practice that may help to get patients to a specialist before irreversible damage occurs. Community health-care workers can play a critical role in both screening and appropriate management of sensory impairment. This idea is best represented through the coordination of accessibility across the continuum of care. Because of the limited access to specialists in rural areas, those working in the primary care setting need to be equipped to effectively address a variety of issues and make appropriate referrals. Moreover, all of the providers involved in an individual's care need to communicate about the treatment plan and assessments of needs. Often, in rural areas and because of geographic variation, lack of access to a specialist such as an audiologist or ophthalmologist may necessitate the functions and services of the care provider be integrated in the context in which the user of health-care services lives (Green, 2004) rather than by the credentials of the person providing the services.

Smith, Shepherd, Jepson, and Mackay (2016) found a support center for people with sensory impairment living in rural areas provided one way of ameliorating health inequalities in this population. Following the sensory center assessment and support, some patients identified ways in which interventions had reduced their sense of

isolation, increased sense of self-esteem and safety, and supported greater functional independence in their own homes. Clearly, such support was about more than medical intervention.

Summary

Visual, hearing, and dual sensory impairment present numerous challenges for individuals in all areas of society, but in RFT communities, the barriers are significantly more pronounced. Both visual and hearing impairments are linked to reduced functioning and negatively impact one's participation in desired and necessary activities as well as quality of life. Due to the lack of eye care specialists practicing in RFT areas, the unavailable and/or inaccessible transportation options to allow individuals to commute to receive appropriate care, the persistently low socioeconomic status resulting in part from high unemployment rates, and lack of comprehensive health insurance coverage, individuals in RFT communities have difficulty accessing and receiving the services needed to afford them the opportunity to be as fully functioning as possible. Clearly, more research needs to be undertaken to effectively ensure that all individuals with sensory impairments living in RFT areas know what services are available and necessary and have the ability to access them. As advancements in technology continue, additional service options will likely become available and ultimately improve the lives of individuals with sensory impairments in RFT communities.

Resources

American Association of Deaf-Blind: http://wwwaadb.org
American Foundation for the Blind: http://www.afb.org
Center for Hearing and Communication: http://chchearing.org
Gallaudet University
National Association of the Deaf: http://ww.nad.org
National Federation of the Blind: https://nfb.org

Learning Exercises

Self-Check Questions

1. Why is it important for various service delivery entities in rural areas to coordinate services when working with persons with sensory impairment?
2. What is the difference between a hearing loss and deafness?
3. What are some of the social experiences of people with hearing loss in rural areas?

Experiential Exercises

1. Interview an individual with a sensory impairment living in a rural area to identify the challenges they have had to overcome.
2. Work with a rehabilitation counselor to develop a resource manual for persons with sensory impairment living in rural areas.
3. Develop an advocacy plan for a person with a dual sensory impairment living in a rural area.

Multiple Choice Questions

1. Which of the following is not one of the side effects of sensory integration dysfunction?
   (a) Depression
   (b) Cognitive decline
   (c) Motor clumsiness
   (d) Behavioral problems
2. Research suggests that visual impairment is frequently associated with _____ in older adults.
   (a) Heart disease
   (b) Obesity
   (c) Mortality
   (d) Being single
3. Which of the following is not associated with individuals with sensory impairments?
   (a) Lower educational attainment
   (b) Higher poverty
   (c) Poorer health outcomes
   (d) High rates of employment

4. Hearing loss affects roughly how many individuals in the United States?
   (a) 48 million
   (b) 36 million
   (c) 64 million
   (d) 22 million
5. What is considered to be the strongest predictor of hearing loss?
   (a) Income
   (b) Age
   (c) Employment
   (d) Additional disabilities
6. The statutory definition of blindness is a central visual acuity of _____
   (a) 20/400
   (b) 10/200
   (c) 20/10
   (d) 20/200
7. According to research, the majority of individuals with blindness reside in which region of the United States?
   (a) Midwest
   (b) West
   (c) South
   (d) Northeast
8. What is considered to be the number one cause of vision loss?
   (a) Diabetes
   (b) Genetic factors
   (c) Injury
   (d) Age
9. What section of the Americans with Disabilities Act addresses telecommunication?
   (a) Title I
   (b) Title II
   (c) Title III
   (d) Title IV
10. The decreased ability to hear resulting from damage or dysfunction to inner ear structures is known as ____ hearing loss.
   (a) Conductive
   (b) Sensorineural
   (c) Mixed
   (d) Central Auditory Dysfunction

Key

1. B
2. C
3. D
4. A
5. B
6. D
7. C
8. A
9. D
10. B

References

Achieve Australia. (2016). What is sensory impairment? Retrieved from http://achieveaustralia.org.au/people-we-support/what-is-sensory-impairment/

Acrury, T. A., Gesler, W. M., Preisser, J. S., Sherman, J., Spencer, J., & Perin, J. (2005). The effects of geography and spatial behavior on health care utilization among residents of a rural region. *Health Services Research, 40*(1), 135–156.

Agrawal, Y., Platz, E. A., & Niparko, J. K. (2008). Prevalence of hearing loss and differences by demographic characteristics among US adults: Data from the National Health and Nutrition Examination Survey, 1999–2004. *Archives of Internal Medicine, 168*(14), 1522–1530.

American Federation for the Blind. (2017). Retrieved from http://www.afb.org/info/living-with-vision-loss/using-technology/assistive-technology/123

Americans with Disabilities Act of 1990, 42 U.S.C. §12101 *et seq.*

Assistive Technology Act of 1998. P.L. 105–394. Retrieved from https://www.section508.gov/assistive-technology-act-1998

Ballemans, J., Kempen, G. I. J. M., & Zijlstra, G. A. (2011). Orientation and mobility training for partially-sighted older adults using an identification cane: A systematic review. *Clinical Rehabilitation, 25*, 880–891.

Blake, D. J., & Bodine, C. (2002). An overview of assistive technology for persons with multiple sclerosis. *Journal of Rehabilitation Research and Development, 39*(2), 299–312.

Brennan, M., Horowitz, A., & Su, Y.-P. (2005). Dual sensory loss and its impact on everyday competence. *The Gerontologist, 45*, 337–346.

Brennan, M., Su, Y.-P., & Horowitz, A. (2006). Longitudinal associations between dual sensory impairment and everyday competence among older

adults. *Journal of Rehabilitation Research and Development, 43*(6), 777–792.
Burton, J. R., Lee, A. G., & Potter, J. F. (2016). *Geriatrics for specialists*. Cham, Switzerland: Springer International Publishing.
Cacchione, P. Z. (2014). Sensory impairment: A new research imperative. *Journal of Gerontological Nursing, 40*(4), 3–5.
Carrière, I., Delcourt, C., Daien, V., Pérès, K., Féart, C., Berr, C., et al. (2013). A prospective study of the bidirectional association between vision loss and depression in the elderly. *Journal of Affective Disorders, 151*, 164–170.
Center for Disease Control and Prevention. (2014). National health interview survey preliminary report. Retrieved from http://www.cdc.gov
Center for Hearing and Communication. (n.d.). Statistics and facts about hearing loss. Retrieved from http://chchearing.org/facts-about-hearing-loss/
Corn, A., & Erin, J. (Eds.). (2010). *Foundations of low vision: Clinical and functional perspectives* (2nd ed.). New York, NY: AFB Press.
Crews, J. E., & Campbell, V. A. (2004). Vision impairment and hearing loss among community-dwelling older Americans: Implications for health and functioning. *American Journal of Public Health, 94*(5), 823–829.
Dillon, C. F., Gu, Q., Hoffman, H. I., & Ko, C. W. (2010). Vision, hearing, balance, and sensory impairment in Americans aged 70 years and over: United States, 1999–2006. *NCHS Data Brief, 31*(1), 1–8. Retrieved from http://europepmc.org/abstract/MED/20377973.
Dunn, W., Saiter, J., & Rinner, L. (2002). Asperger syndrome and sensory processing: A conceptual model and guidance for intervention planning. *Focus on Autism and Other Developmental Disabilities, 17*(3), 172–185.
Dutton, G. N., & Bax, M. (2010). Introduction. In G. N. Dutton & M. Bax (Eds.), *Visual impairment in children due to damage to the brain* (pp. 1–4). London, UK: MacKeith Press.
Erickson, W., Lee, C., & von Schrader, S. (2016). *Disability statistics from the 2014 American community survey (ACS)*. Ithaca, NY: Cornell University Employment and Disability Institute. Retrieved from http://www.disabilitystatistics.org.
Falvo, D., & Holland, B. E. (2018). *Medical and psychosocial aspects of chronic illness and disability* (6th ed.). Burlington, MA: Jones & Bartlett Learning.
Fellinger, J., Holzinger, D., Dirmhirn, A., van Dijk, J., & Goldberg, D. (2009). Failure to detect deaf-blindness in a population of people with intellectual disability. *Journal of Intellectual Disability Research, 53*(10), 874–881.
Freeman, E. E., Egleston, B., West, S. K., Bandeen-Roche, K., & Rubin, G. (2005). Visual acuity change and mortality in older adults. *Investigative Ophthalmology and Visual Science, 46*, 4040–4045.
Gates, G. A., Beiser, A., Rees, T. S., D'Agnostino, R. B., & Wolf, P. A. (2002). Central auditory dysfunction may precede the onset of clinical dementia in people with probable Alzheimer's disease. *Journal of the American Geriatrics Society, 50*, 482–488.
Goins, R. T., Williams, K. A., Carter, M. W., Spencer, S. M., & Solovieva, T. (2005). Perceived barriers to health care access among rural older adults: A qualitative study. *Journal of Rural Health, 21*(3), 206–213.
Goman, A. M., & Lin, F. R. (2016). Prevalence of hearing loss by severity in the United States. *American Journal of Public Health Research, 106*(10), 1820–1822. doi:10.2105/AJPH.2016.303299.
Gopinath, B., Schneider, J., McMahon, C. M., Burlutsky, G., Leeder, S. R., & Mitchell, P. (2013). Dual sensory impairment in older adults increases the risk of mortality: A population-based study. *PloS One, 8*(3), e55054. doi:10.1371/journal.pone.0055054.
Green, L. A. (2004). Is primary care worthy of physicians? An ecological perspective. In J. Showstack, A. A. Rothman, & S. B. Hassmiller (Eds.), *The future of primary care* (pp. 143–160). San Francisco, CA: Jossey-Bass.
Guiding Eyes for the Blind. (2015). General information. Retrieved from https://ww.guidingeyes.org/about-us/general-information/
Hale, N. L., Bennett, K. J., & Probst, J. C. (2010). Diabetes care and outcomes: Disparities across rural America. *Journal of Community Health, 35*, 365–374. doi:10.1007/s10900-010-9259-0.
Hallberg, L. R., Hallberg, U., & Kramer, S. E. (2008). Self-reported hearing difficulties, communication strategies and psychological general well-being (quality of life) in patients with acquired hearing impairment. *Disability and Rehabilitation, 30*(3), 203–212.
Helen Keller Act. 29 U.S.C. § 1905 (2011).
Iezzoni, L., Killeen, M., & O'Day, B. (2006). Rural residents with disabilities confront substantial barriers to obtaining care. *Health Research Services, 41*(4), 1258–1275. doi:10.1111/j.1475-6773.2006.00534.x.
Iezzoni, L. I. (2003). *When walking fails: Mobility problems of adults with chronic conditions*. Berkeley, CA: University of California Press.
Iezzoni, L. I., & O'Day, B. L. (2006). *More than ramps: A guide to improving health care quality and access for people with disabilities*. New York, NY: Oxford University Press.
Institute of Medicine. (2006). *The future of public health*. Washington, DC: National Academies Press.
Jantz, P., & Thompson, V. (2017). Deafness and hearing loss. In J. D. Andrew & M. J. Andrew (Eds.), *The disability handbook*. Linn Creek, MO: Aspen.
Karpa, M. J., Gopinath, B., Beath, K., Rochthina, E., Cumming, R. G., Wang, J. J., & Mitchell, P. (2010). Associations between hearing impairment and mortality risk in older persons: The Blue Mountains hearing study. *Annals of Epidemiology, 20*, 452–459. doi:10.1016/j.annepidem.2010.03.011.
Kruger, L. G., & Gilroy, A. A. (2016). *Broadband internet access and the digital divide: Federal assistance programs*. Washington, DC: Congressional Research

Service. Retrieved from https://fas.org/sgp/crs/misc/RL30719.pdf.
Larson, S. L., & Hill, S. C. (2005). Rural-urban differences in employment-related health insurance. *Journal of Rural Health, 21*(1), 21–30.
Lin, F. R., Niparko, J. K., & Ferrucci, L. (2011). Hearing loss prevalence in the United States. *Archives of Internal Medicine, 171*(20), 1851–1852.
Lin, F. R., Yaffe, K., Xia, J., Xue, Q.-L., Harris, T. B., Purchase-Helzner, E., et al. (2013). Hearing loss and cognitive decline in older adults. *JAMA Internal Medicine, 173*(4), 293–299.
McDonnall, M. C. (2009). Risk factors for depression among older adults with dual sensory loss. *Aging & Mental Health, 13*(4), 569–576.
Minnesota Department of Human Services online. (2013). Retrieved from http://www.dhs.state.mn.us/main/idcplg?IdcService=GET_DYNAMIC_CONVERSION&RevisionSelectionMethod=LatestReleased&dDocName=id_003399
Mueller, K. J., MacKinney, A. C., Slifkin, R. T., Coburn, A. F., McBride, T. D., & Wakefield, M. (2006). *The institute of medicine rural health report: Next steps in legislation and programs*. Columbia, MO: University of Missouri Rural Policy Research Institute. Retrieved from http://www.rupri.org/Forms/P2006-1.pdf.
National Federation of the Blind. (2016, March). Statistical facts about blindness in the United States. Retrieved from https://nfb.org/blindness-statistics
Nayar, P., Yu, F., & Apenteng, B. A. (2013). Frontier America's health system challenges and population health outcomes. *The Journal of Rural Health, 29*, 258–265. doi:10.1111/j.1748-0361.2012.00451.x.
Pathman, D. E., Ricketts III, T. C., & Konrad, T. R. (2006). How adults' access to outpatient physician services relates to the local supply of primary care physicians in the rural southeast. *Health Services Research, 41*(1), 79–102.
Pennel, C. L., Carpender, S. L., & Quiram, B. J. (2008). Rural health roundtables: A strategy for collaborative engagement in and between rural communities. *Rural and Remote Health, 8*(1054). Retrieved from http://www.rrh.org.au
Prevent Blindness America. (2012). Vision problems in the U.S.: Prevalence of adult vision impairment and age-related eye disease in America. Retrieved from http://www.visionproblemsus.org/index.html
Ramamurthy, D., Kasthuri, A., & Sonavane, R. (2014). Dual sensory impairment among community dwelling rural elderly: Concern for rehabilitation. *Journal of Geriatrics*, vol. 2014, Article ID 254518, 7 pages. Doi:10.1155/2014/254518. Retrieved from https://www.hindawi.com/archive/2014/252418/
Sensory Processing Disorder Resource Center. (n.d.). Sensory processing disorder. Retrieved from http://www.swnsory-processing-disorder.com
Smith, A., Shepherd, A., Jepson, R., & Mackay, S. (2016). The impact of a support centre for people with sensory impairment living in rural Scotland. *Primary Health Care Research Development, 17*(02), 138–148.
Smith, R. J. H., Shearer, A. E., Hildebrand, M. S., & Van Camp, G. (2014). Deafness and hereditary hearing loss overview. In R. A. Pagon, M. P. Adam, H. H. Ardinger, S. E. Wallace, A. Amemiya, L. J. H. Bean, et al. (Eds.), *GeneReviews*. Seattle, WA: University of Washington.
Smith, S. L., Bennett, L. W., & Wilson, R. H. (2008). Prevalence and characteristics of dual sensory impairment (hearing and vision) in a veteran population. *Journal of Rehabilitation Research & Development, 45*(4), 597–610.
Strauss, K. P. (1991). Implementing the telecommunication provisions. In J. West (Ed.), *The Americans with disabilities act: From policy to practice* (pp. 238–267). New York, NY: Milbank Memorial Fund.
Swenor, B. K., Simonsick, E. M., Ferrucci, L., Newman, A. B., Rubin, S., & Wilson, V. (2015). Visual impairment and incident mobility limitations: The health, aging and body composition study. *Journal of the American Geriatrics Society, 63*(1), 46–54.
The Twenty-First Century Communications and Video Accessibility Act of 2010, Pub. L. No. 111–260 (2010). Retrieved from https://www.fcc.gov/consumers/guides/21st-century-communications-and-video-accessibility-act-cvaa
Vreeken, H. L., van Rens, Ger. H. M. B., Kramer, S. E., Knol, D. K., Festen, J. M., & van Nispen, R. M. A. (2013). Dual sensory loss: Development of a dual sensory loss protocol and design of a randomized controlled trail. *BMC Geriatrics, 13*(84). doi:10.1186/1471-2318-13-84. Retrieved from http://bmcgeriatr.biomedcentral.com/articles/10.1186/1471-2318-13-44
Wahl, H. W., Heyl, V., & Langer, N. (2008). Quality of life by limited vision in old age: The example of age-related macular degeneration. *Der Ophthalmologe, 105*(8), 735–743.
Williams, P. J. (2000). Genetic causes of hearing loss. *New England Journal of Medicine, 342*(15), 1101–1109.
World Health Organization. (2011). World report on disability. Retrieved from http://www.who.int.disabilities/world_report/2011/report/en/
Yogesan, K., Constable, I. J., & Chan, I. (2002). Telemedicine screening for diabetic retinopathy. *Disease Management and Health Outcomes, 10*(11), 673–678.
Zambelli-Weiner, A., Crews, J. E., & Friedman, D. S. (2012). Disparities in adult vision health in the United States. *American Journal of Ophthalmology, 154*, S23–S30.e1.
Zijlstra, G. A. R., Ballemans, J., & Kempen, G. I. J. M. (2012). Orientation and mobility for adults with low vision: A new standardized approach. *Clinical Rehabilitation, 27*(1), 3–18. doi:10.1177/0269215512445395.
Zuckerman, D. M. (2004). Blind adults in America: Their lives and challenges. Washington, DC: National Center for Policy research for Women & Families. Retrieved from http://center4research.org/wp-content/uploads/2010/05/blind02041.pdf