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How Can Public Health Approaches and Perspectives Advance Hearing Health Care?

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Abstract

This commentary explores the role of public health programs and themes on hearing health care. Ongoing engagement within the hearing professional community is needed to determine how to change the landscape and identify important features in the evolution of population hearing health care. Why and how to leverage existing public health programs and develop new programs to improve hearing health in older individuals is an important topic. Hearing professionals are encouraged to reflect on these themes and recommendations and join the discussion about the future of hearing science on a population level.

Although the prevalence of age-related hearing loss in the US has decreased over the past half century (Hoffman et al., 2010; 2012), the number of individuals with hearing loss is increasing as the 65 and older demographic continues to flourish. The burden of hearing loss among this demographic and the amplification of cognitive and physical dysfunction, social isolation, and depression that often accompanies hearing loss makes prevention and treatment of hearing loss a national health priority. Healthy People 2020, a program that sets national goals for the purposes of health promotion and disease prevention, has identified several goals to address the rising burden of hearing loss. These goals include to: a) increase the proportion of persons who have had a hearing examination; and b) increase the proportion of persons with hearing loss who have ever used a hearing aid or assistive listening device (Healthy People, 2020). In order to meet these goals, it is recommended that the medical model for diagnosis and treatment of hearing loss in an *individual* should be supplemented with a public health model approach, which places the focus on *populations*,

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groups and communities. Such an approach could better serve the needs of many because the goal in public health is to provide the maximum benefit for the largest number of people (Davis et al., 2016).

Hearing health care professionals bear a social responsibility to take action so that hearing loss can be prevented and/or rehabilitated. With this in mind, clinicians and scientists have begun to discuss ways in which the public health model can be integrated into hearing health care. Discussions, conferences, workshops, and workgroups have been dedicated to the topic including: Institute of Medicine's "Workshop on Hearing Loss and Healthy Aging" (Institute of Medicine & National Research Council, 2014), "Aging America & Hearing Loss: Imperative of Improved Hearing Technologies" by the President's Council of Advisors on Science and Technology (2015), VA RR&D National Center for Rehabilitative Auditory Research biennial conference "Hearing Loss as a Public Health Concern" (2015), and the establishment of a special interest group called Population Hearing Health Care Group. The purpose of this paper is to highlight some major themes, concerns and future directions as it regards hearing health at the population level.

Older US adults are disproportionately afflicted with hearing loss, with as many as one-third of adults over age 65 having hearing loss (Hoffman et al., 2012). According to the Administration on Aging (2011), the number of adults in the US over age 65 will double between 2000 and 2030, reaching 72 million. Consequently, we estimate 24 million people over the age of 65 will have hearing loss, with the poorest individuals having the highest risk due to the fact that hearing loss is unequally distributed across income levels (Lin et al., 2011; World Health Organization, 2012). Compounding the public health issue is the low uptake of interventions to rehabilitate hearing loss (NIDCD Working Group, 2009), and a lack of adequate insurance to cover hearing loss rehabilitation.

The consequences of living with hearing loss include direct impacts on speech understanding and communication, enjoyment of music, access to environmental sounds, and social isolation (Feeny et al, 2012; Lin et al, 2013; Strawbridge et al., 2000; Pichora-Fuller 2015). The aging population is also at risk for downstream effects of hearing loss that impact quality of life by potentially accelerating cognitive decline (Deal et al., 2015; Tomioka et al. 2015), changing family and community engagement (Schneider et al. 2010), increasing the risk of depression (Li et al., 2014) and increasing risk for falls and other physical disabilities (Lin and Ferruci, 2012). Additionally, unaided hearing loss has been shown to be independently associated with increased mortality, especially among older men (Fisher et al., 2014).

There is increasing interest in the health outcomes of older people with hearing loss. As such, there are emerging efforts to understand what information can be gained from a population perspective, and how this information can be used to provide solutions. A population-based approach emphasizes the importance of the social and physical environments that shape patterns of disease and injury, as well as responses to them over the entire life cycle. It provides a broader conceptualization of the important determinants of health that are not easily identifiable or rectifiable within the medical model (Kindig & Stoddart, 2003).

Public health is “the science and art of preventing disease, prolonging life and promoting health through organized efforts and informed choices of society, organizations, public and private, communities and individuals” (Winslow, 1920). It refers to all organized measures taken to prevent disease, promote health, and prolong life among the population as a whole (World Health Organization, 2015). The public health model focuses on populations, groups and communities rather than on individuals; it has the goal of promoting and maximizing health. There are three core functions in public health, each of which can be applied to audiology: Assessment, Policy, and Assurance.

Assessment entails monitoring health status to identify and solve community health problems as well as diagnosing and investigating health problems and hazards in the community (IOM 1988). As applied to audiology, this could involve surveillance and assessment of hearing health at a population level such as reporting incident hearing loss among newborns, recently discharged Veterans or investigating environmental factors such as noise levels.

Policy includes developing guidelines that protect and serve the population, setting goals for health services, and developing performance standards (IOM 1988). Policy is also the process of informing, educating, and empowering people about health issues. This can include mobilizing community partnerships to identify and solve health problems and developing policies that support healthy lifestyles by individuals and communities. As applied to audiology, the policy core function includes informing the public about hearing health issues. Examples of policy in action include the public education campaigns “It’s a Noisy Planet. Protect Their Hearing” and “Dangerous Decibels”. Both of these campaigns aim to prevent noise-induced hearing loss (NIHL) in children. They were designed to educate parents and children about the causes and prevention of NIHL so that safe listening becomes a habit for life. Policy also includes mobilizing community partnerships and community health workers to promote hearing conservation and health care among hard-to-reach populations. Hearing conservation through outreach, community education, and advocacy, attempt to engage hard-to-reach populations. Some examples include: farmers (Ehlers and Graydon 2011), culturally unique populations such as Native Americans (Sobel et al 2011), and populations suffering from health disparities such as the Hispanic/Latino community (Marrone et al 2014).

The third core function, *assurance*, is the process of enforcing laws and regulations that arise out of the policy domain to protect health. It is linking people to needed health services and assuring the provision of services when otherwise unavailable, assuring a competent workforce, evaluating effectiveness, accessibility, and quality of individual and population-based health services and conducting research for new insights and innovative solutions to health problems (IOM 1988). For audiology this includes activities to make sure that the population’s hearing health needs are being met, for example, through enforcement of noise codes or legislation that mandates access to technology for persons with hearing and other communication disabilities (Americans with Disabilities Act, the Individuals with Disabilities Education Act, and Section 504 of the Rehabilitation Act). These federal statutes have been instrumental in the widespread provision of FM systems in classrooms. Assurance also includes evaluating the effectiveness of hearing health care interventions such as aural

rehabilitation and programs such as newborn hearing screening. Assuring health needs are met likewise encompasses monitoring the accessibility of audiology services, which could include ensuring there are sufficient numbers of audiologists available to the community, or decreasing transportation barriers. For the latter, this may mean hearing health care delivery should move out of the sound booth and into the home.

The domains of public health provide mechanisms for investigating and understanding the causes and consequences of hearing loss, and for preventing hearing loss from occurring through primary prevention programs, policy interventions and advocacy. While the programs highlighted above have been critical to advancing the hearing health care needs of individuals and communities, incident hearing loss still occurs. Because hearing loss in some instances is an unavoidable consequence that cannot be fully anticipated or prevented, public health principles should be extended to those living with hearing disability to prevent the secondary conditions such as social isolation, depression, cognitive decline, etc., that arise from hearing loss. To further illustrate the application of public health domains to audiology, Table 1 highlights successful public health programs that tackle issues surrounding hearing loss and offers future applications and directions (in italics) for public health implementation.

Public health programs can impact the health and well-being of a substantive number of individuals. One such example in audiology is newborn hearing screening. In 1965, the Babbidge Report noted that persons with profound hearing impairment (deaf) were woefully under-educated, over represented in manual labor jobs and lacked full participation in our society. The Babbidge Report put forward "...but the vital importance to the education of deaf children of early detection of the defect requires that we improve chances of establishing the facts in questionable cases as early as possible. The hospital where the child is born provides the best organized opportunity for such discovery" (Babbidge 1965 pg. 4). Over the next 50 years, high-risk registries for newborn hearing loss were established, public awareness campaigns launched, organizations dedicated to infant hearing screening and diagnosis emerged, and legislation was passed establishing an Early Hearing Detection and Intervention (EHDI) Program at the federal level. State EHDI programs began to materialize as widespread adoption of the program began to take place, and audiology staff and students, nurses, and volunteers became trained screeners. Currently 43 states plus DC and Puerto Rico mandate newborn hearing screening programs. As a result of the years of assessment, policy, and assurance, the number of infants screened for hearing loss at birth rose quickly. Data show that in 2012, 96.6% of newborns were screened for hearing loss within 1-month of birth, and of those diagnosed with hearing loss, 61.7% were enrolled in an early intervention (Williams et al., 2015). Long-term outcomes have demonstrated that children who were identified early and received intervention had significantly better language outcomes compared to children who were identified later (Nelson et al. 2008). To continue the public health cycle, these findings need to be explored by examining the relative impacts of newborn hearing screening and intervention on functional outcomes: school performance, social interaction, and quality of life (Nelson et al. 2008), as well identifying why some children are not receiving early interventions.

To date, public health efforts have primarily focused on the hearing health of children, while hearing loss prevention and rehabilitation among the aging population has largely remained a neglected public health issue. Adults are still lacking: 1) routine hearing screenings during annual primary care visits; 2) improved room acoustics in public spaces, nursing homes, and restaurants; 3) policy that assures persons with hearing impairment have access to the built environment; and 4) enhanced financial access to hearing aids through insurance coverage (Davis & Smith, 2013; Wallhagen 2014). There is a need to promote public health education regarding hearing loss, with an emphasis on its risk factors, conservation and prevention, and rehabilitation strategies. Additional future directions (in italics) are proposed in Table 1. Together, these approaches have the potential to ensure change in hearing health care among the aging population on a societal level which will help to alleviate the burden and repercussions of hearing loss in the population as a whole.

The traditional public health approach provides a framework within which hearing health care practitioners and scientists can begin to tackle the rising problem of hearing loss; however, it does not describe the larger ecological context within which hearing loss occurs. There are many models and approaches to guide public health planning. In general, these recommend taking a broad view of health and comprehensive interventions. One such model is the International Classification of Functioning, Disability, and Health (World Health Organization, 2001), which portrays health and disability as a combination of medical conditions and social factors and thus points out that multifactorial interventions should be used to address a problem. The Institute of Medicine (2003) also endorsed a broad approach to public health interventions by recommending the adoption of an ecological model for understanding the complex relationships that exist between public health problems and interventions. The model, known as the Social-Ecological Model (SEM; Figure 1), illustrates the interplay between biologic characteristics of the individual, and their interaction with factors at the individual, relationship, community and societal levels. In other words, it emphasizes that factors that impact the health and well-being of an individual, must be viewed within a larger context of family, community, and society (Fielding et al. 2010). Figure 1 shows that there are multiple determinants of population health beyond biological factors and innate traits (innermost circle), and that these determinants are linked and related. Further, it shows how the social and physical environments shape patterns of disease and injury over the entire life cycle, and provides insight as to why health disparities across socioeconomic, racial, ethnic and minority groups exist. Within each concentric circle in unbolded font are examples of factors that can influence hearing or hearing rehabilitation in the population.

Acknowledging that social and physical determinants shape the burden of hearing loss in terms of population distribution, severity and rehabilitation is critically important since it guides population-based interventions, as in the following example. Data show hearing loss is associated with low educational attainment and, even after controlling for education and other relevant demographic factors, hearing loss is independently associated with economic hardship, including low income and unemployment/underemployment (Emmett & Francis. 2015). Consistent with the SEM, if focus is placed on quality education, individuals in the population are expected to have better employment opportunities, higher income, fewer transportation barriers, and greater financial access to hearing health care. Further,

increasing education leads to higher health literacy, which should translate to better hearing health outcomes. Individuals with greater health literacy are more likely to subscribe to health promotion measures, seek care earlier when warning signs present, and better understand and follow the clinician's advice. Therefore, we would expect that improving education should have the downstream effect of improved hearing conservation and rehabilitation on an individual level. By applying interventions through an upstream approach (meaning the underlying societal conditions of the problem), there are also positive synergistic impacts on other health conditions and overall well-being. In the example above, improved health literacy has shown clinical improvements in self-management or lifestyle interventions across conditions such as diabetes, coronary heart disease, heart failure and rheumatoid arthritis (Adams, 2010). The SEM illustrates where and how to apply the public health approach and helps elucidate the mechanisms by which interventions might be working.

The medical model for individual care is necessary but not sufficient to reduce the widespread exposures leading to, and the resulting impact of, hearing loss. The public health approach aims to solve the problem underlying poor hearing and health at multiple levels (individual, interpersonal, organizational, community and public policy) as opposed to solving the problem by focusing only at the individual level. Hearing health care professionals will need to modify and expand their understanding of hearing health in the context of social and physical determinants and take a more active role in interventions and policies within a public health model. Accomplishing these tasks will require strong engagement from the discipline of audiology including audiologists and other hearing professionals, professional societies, government and scientists.

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Figure 1.

Adapted from the social ecological model (SEM) to represent determinants of hearing health. A multi-level approach to demonstrate that hearing loss prevention and rehabilitation go beyond the individual. The five levels are depicted by the concentric circles and titled in bold. Within each concentric circle in unbolded font are examples of factors that can influence hearing or hearing rehabilitation in the population. Some examples may crossover multiple levels of this model. For instance, hearing protection can be an individual behavioral choice but also be a part of one's working conditions if they participate in an occupational hearing conservation program. The arrow on the left indicates the relative impact any public health intervention would have applied to each level. For instance, interventions that target one person have a small impact, but interventions targeting broad economic policies would impact a larger population.

Table 1

Three Core Functions of Public Health and the Hearing Professional Community's response. The left column identifies public health core functions and offers a brief description. The right column highlights current actions (normal font) that fall under the public health framework and future directions and/or areas of investigation (*italic font*). Actions listed are not all-inclusive but were recurring themes at past conferences and workshops.

	Core Function	Actions of Hearing Professionals
Assessment	Surveillance and risk assessment	<ul style="list-style-type: none"> • Epidemiology studies (e.g. Epidemiology of Hearing Loss Study) • Newborn hearing screenings and monitoring program outcomes • <i>Hearing screenings for adults</i> • <i>Identify at risk and/or health disparate populations</i> • <i>Identify barriers to audiology health care</i> • <i>Outcomes research database for the purpose of defining the success or failure of aural rehabilitation interventions</i>
Policy	Inform, educate, empower clinicians & public about hearing loss. Mobilizing community partnerships and developing policies.	<ul style="list-style-type: none"> • Development of noise codes • Occupational noise monitoring programs • Public health campaigns for hearing conservation e.g. Dangerous Decibels via educational/school partnerships • <i>Community health workers (e.g. promotoras)</i> • <i>Open wireless standards for hearing aids</i> • <i>Reimbursement for rehabilitation services outside of fitting hearing aids</i> • <i>Hearing aid tax credits</i> • <i>Organizing for policy action</i>
Assurance	Making sure hearing health needs are met. Evaluate effectiveness of hearing health care, interventions, programs, services. Services provided directly to the public	<ul style="list-style-type: none"> • Individualized education program in schools for children with hearing loss • Improved classroom acoustics • Provide free or reduced cost audiology services to the medically indigent (e.g. partnering with Remote Area Medical) • <i>Work to establish and train audiology assistants</i> • <i>More rigorous training accreditation</i> • <i>Audiology health care delivery methods outside the sound booth (e.g. home visits)</i> • <i>Ensure better access to hearing-related benefits and devices</i> • <i>Consideration of alternative sound amplification devices</i> • <i>Improved built environment room acoustics</i>