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Screening for Hearing Loss: Physician Attitudes and Practice

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ABSTRACT

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Age related hearing loss (ARHL) is considered a public health hazard in large part due to the negative health outcomes with which it is associated, such as, cognitive decline, increased risk of falling, social isolation and depression. Despite the health-related costs of ARHL, physician's rarely screen older adults for ARHL. Some of the reasons previously cited include a lack of time and resources in medical offices, a lack of reimbursement for such measures, or lack of knowledge of risk factors associated with hearing loss. The latter is problematic as improved communication among physicians and their patients is an important correlate of positive health outcomes especially in persons with multimorbidity. While available research has revealed the importance of communication for patient centered care and optimal health outcomes, little emphasis is placed on hearing status and how it may affect compliance with physician recommendations and understanding of one's medical health conditions. This is problematic as older adults and physicians alike are unaware that hearing loss can cascade into socially and economically costly health outcomes.

In an effort to determine physician attitudes towards and practice of screening for hearing loss, physicians representing many specialties were surveyed. Their responses shed light into their perceived barriers to performing routine hearing screening and physician knowledge of factors which are associated with an increased risk of hearing loss. The results of this survey will

inform the development of a practical hearing screening protocol to be used by physicians in order to more efficiently identify older adults at risk for hearing related communication deficits.

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INTRODUCTION

Primary care physicians (PCPs) are the gatekeepers responsible for referring their patients to the appropriate medical specialists. In a survey by Paul, Popp, & Hackett (2002), 63% of respondents stated that their primary care physician is the most important source for health information. They went on to claim that primary care physicians are the most influential health providers when it comes to referrals and getting their patients to take health action. After the initial contact and rapport is built with a patient's primary care physician, they begin building secondary, physician-patient relationships with their cardiologists, ophthalmologists, neurologists and so on. All the obtained information, medications and care plans are ideally funneled back through the primary care physician. This cycle places primary care physicians in a unique position to turn the tides for the way hearing health care is perceived and delivered.

Hearing loss is the third most common condition among the U.S. population and contributes to a decline in a patient's physical and mental state if left untreated (Wilson, et al., 2017). If hearing loss is the third most common condition among the U.S population, it is appropriate to assume that a primary care physician is encountering many patients with both diagnosed and undiagnosed communication difficulties. As communication difficulties can impede the transfer of important health related information from the primary care physician to their patient, primary care physicians should be aware of their patients' hearing health. Cohen, Weinstein, Blustein & Chodosh (2017), stress that good physician-patient communication is essential to high quality health care as it plays a role in history taking, knowledge transfer, understanding discharge instructions and finally to patient self-management. Good communication has been linked to better health outcomes, better quality and safer patient care.

Understanding when physician-patient communication may be impaired is critical to a patient centered health care approach.

Hearing impaired older adults often see their primary care physician before anyone else on their healthcare team regarding hearing and balance issues (Johnson et al., 2008). Kochkin (2004) theorized that if hearing impaired patients received a positive recommendation from their primary care physicians then they would be five times more likely to seek treatment than if the physician gives a negative or dismissive recommendation (Kochkin, 2004). Fischer, et al, (2011) also noted that the recommendation from a primary care physician was integral to a decision to pursue hearing assistance. In an instance of a patient reporting hearing difficulties, one of the specialist's primary care physicians might refer to is an Otolaryngologist or ENT physician. The Otolaryngologist is responsible for medical aspects of conditions affecting the ear, nose and throat. The Otolaryngologist often refers to an audiologist, a professional uniquely qualified to address a person's hearing related quality of life. The common referral trend in addressing hearing and balance issues is as follows: the entry point with the PCP, the initial referral to an ENT and finally a referral to the audiologist for the fitting of hearing assistive technology (Johnson et al., 2008). However, this should not be the only referral pattern as it may limit access to timely diagnosis and treatment of hearing loss for many reasons. One reason being long wait times for seeing in demand specialists, unexpected health set-backs which may arise and take precedence over hearing health, and finally developing trust in a new specialist also takes time and the patient may not feel comfortable to again express their difficulties to a new physician. However, with the PCP trust has already been established, and referral directly to an audiologist can reduce the time between identification of hearing difficulty and remediation with a hearing

aid. Overall, a positive physician relationship has been shown to lead to early diagnosis of chronic diseases (Marlow et al., 2017).

Referral to Otolaryngology has its limitations as the clinical encounters tend to be brief with little focus on, the concomitants of ARHL including cognitive decline, falls, and social disengagement, all reasons for referral for a hearing assessment (Mccullagh & Frank, 2013). Anecdotal reports reveal that Otolaryngologists are often burdened with an extremely dense patient population and case load, leaving little time to prioritize their patients hearing related quality of life beyond ensuring the anatomical and physical health of the structures of the ear, nose and throat. Hearing loss affects much more than just the anatomical structures, it affects a person's ability to function independently and to communicate with the world around them, and an audiologist is trained to address just that.

ARHL is an invisible, chronic public health condition. There is no one presentation of hearing loss and therefore no one way of determining candidacy for management of this chronic condition and its sequelae (Yeuh et al., 2010). Hence, screening symptomatic and asymptomatic individuals over the age of 50 for hearing difficulties is an important public health initiative and has been deemed as such by the U.S. Preventative Services Task Force (USPSTF) as they revisited this issue in 2018. Screening for hearing loss becomes even more critical when additional risk factors are present. However, routine screening of asymptomatic individuals is currently not recommended by the USPSTF (2012) in individuals over 50 years of age or older. However, this may change based on a report recently issued by the USPSTF (2018) and a final research plan which was announced in February 2019 to revisit the merits and potential consequences of asymptomatic hearing loss screening for older adults. A failure to screen

asymptomatic individuals is problematic for many reasons. According to Chou, et al. (2011), older adults may not realize that they have hearing loss because it is relatively mild or slowly progressive; they may perceive hearing loss but not seek evaluation for it or realize that they should; finally, they may have difficulty recognizing or reporting hearing loss at all due to comorbid conditions, such as cognitive impairment.

Danhauer, et al. (2008) found that primary care physicians were unlikely to screen for hearing and balance issues unless their patient expressed concern. This is clearly an inadequate approach being that far too many patients will feel embarrassed or in denial of the fact that they are having difficulty hearing, and so we cannot rely on the patient to voluntarily report such difficulties to the physician. Unfortunately, too many patients or their families are left to seek out an audiologist when the communication difficulties have become too severe, and time and time again the hearing loss is identified in its latest stages and there may be little benefit to be received by the hearing aids at that point. Peele, Troiani, Grossman and Wingfield (2011), illustrated how hearing loss left untreated in older adults negatively affects the neural systems needed to support speech comprehension. When the hearing loss is evident even in ideal listening conditions or when the patient finally complains of a hearing problem, it may be too late to reap all of the benefits of amplification. Furthermore, symptoms like social isolation, depression and cognitive decline may have already set in. This is why it is critical for hearing screening to be performed earlier and on a more consistent basis. Johnson, et al. (2008) reported that primary care physicians are crucial pivotal points of breaking down barriers to entry for ensuring that their hearing-impaired patients receive much needed audiology services. They went on to stress the importance for PCPs to determine the need for further evaluation and to make necessary referrals to hearing specialists. Alternatively, easily remediable hearing problems are

overlooked, trivialized in importance to patients when their PCPs fail to acknowledge subtle or even obvious communication difficulties, ultimately resulting in the delay of treatment, which might prolong frustration and reduce hearing related quality of life. Jupiter (2011) found that nursing home residents with greater than a mild hearing loss had significantly poorer cognitive function than residents with just a mild hearing loss. This reinforces the importance of screening and identifying patients with hearing loss as they may not be capable of seeking out such services for themselves.

Currently, physicians are not actively participating in their patient's hearing health, and the resulting cycle is that hearing loss remains to be under-detected and under-treated (Dalton et al., 2003). This may explain why only 25% of hearing impaired individuals with an aidable hearing loss are fit with hearing aids (Yeuh, et al., 2003; Chou et al., 2011). How can this cycle be addressed ? The simple answer is to encourage the regular screening for hearing loss in older adults. Once we come to that conclusion, the next question becomes who is responsible for hearing screening? One might say the audiologist; however, research has shown that it is the primary care physician who develops the strongest patient physician relationship and it is he or she that is privy to all the medical history that might indicate a patient is at an increased risk for experiencing hearing loss. Patients are more likely to address their hearing difficulties, or the possibility of future difficulties, if it were recommended to do so by a medical doctor they trust.

Danhauer, et al. (2008) concluded that hearing related quality of life of elderly patients and their families is greatly impacted by primary care physicians' decisions about whether to screen for hearing/balance problems and the seriousness and enthusiasm with which they make appropriate referrals for diagnosis and treatment. Kochkin (2004) reported that only 14% of

physicians routinely screen for hearing loss. Yet, according to the National Academies of Sciences, Engineering, and Medicine (2016), the risk of hearing loss in older adults is approximately 10 to 20 times greater than the risk of heart disease and about 100 times greater than the risk of cancer . Screening for these conditions is increasingly becoming routine as the associated medical costs of prevention measures are far less then leaving these conditions untreated (Jung et al., 2014) Although some busy physicians may not have time to screen their elderly patients for hearing loss, recent comparison estimates of relative health impact and cost accountability for preventative services deemed effective by the USPSTF and the Advisory Committee on Immunization Practices revealed that hearing screening ranked 11th out of the 15 most common health screenings for adults (Johnson, et al., 2008). Johnson, et al. (2008) went on to report that hearing screening was ranked higher than those for cholesterol and diabetes. The USPSTF (2012) recommended (with a grade of "B") the screening of older adults by periodically questioning them about their hearing, counseling them on the availability of hearing aids, and making referrals when necessary. A grade of "B" indicates that the hearing screening of elderly patients can be made with confidence in the likelihood that the treatment options available are effective for remediation of this chronic condition.

Now the final hurdle, is to convince primary care physicians that hearing loss is a problem worth addressing, to convince specialists that they too have a role in hearing screening and ideally to include the audiologist in this conversation. According to Harris, et al. (2011) one in three older adults presents with hearing impairment. This is an important statistic for physicians to be aware of, as one in three of their adult patients will be affected by some form of hearing loss. Not addressing the likelihood that many of their patients are at risk for not hearing

or understanding important medical information, due to the presence of an untreated hearing loss, is a huge disservice to the adult and elderly populations they serve.

More in depth knowledge about screening practices and knowledge of obstacles and barriers to screening for hearing more routinely may shed light on this issue and can inform future screening and referral practices. The goal of this study is to gather data which will be analyzed and used to inform the design of a practical screening protocol so that screening for hearing loss may become a seamless and efficient part of a primary care physician's annual wellness visit. According to Johnson, et al. (2008), surveys are needed to assess physicians' awareness of hearing loss, current practices and attitudes toward the importance of hearing screening within the overall context of geriatric healthcare. Although the survey they created was both enlightening and impactful, results revealed it to be too time consuming and yielded a relatively low response rate. Our survey was constructed to obtain this much needed insight into the attitudes of practices of physicians in a variety of medical practices, so that a protocol may be developed to overcome any perceived barriers to performing routine hearing screenings.

Primary Care Physicians Screening for Hearing Loss

Unfortunately, since many patients do not discuss their hearing loss or do not accept it, this makes active screening, even without patient complaint, essential (Cohen et. al, 2005). Given the regularly documented low correlation between perceived and measured hearing ability, assessment of hearing ability by patient report alone may result in failure to detect hearing loss and failure to detect when patient-physician communication has been impeded (MucCullagh and Frank, 2012). MucCullagh and Frank (2012) went on to conclude that further research is needed to determine the nature and extent of barriers to hearing screening and assessment in primary

care, and that criteria for screening adults in a primary care setting should be established. Jung, Macatuno and Orozco (2014) found that hearing screening promotes early detection, adequate treatment, and improved quality of life; therefore, changes in the way physicians perceive and approach hearing screening are imperative and are in the best interest of maintaining a patient centered care approach to health promotion.

Barriers to Hearing Screening in Primary Care

According to Johnson et al. (2008) and the replication study conducted by Jeffery Danhauer and colleagues (2008), PCPs were largely unaware of patient self-report screening methods and probably would not use them in the future. Danhauer et al. (2008), further concluded that although PCPs were found to value hearing screenings, time and reimbursement constraints often kept them from conducting them in any capacity. In 2012, the USPSTF published a formal recommendation on screening for age-related sensorineural hearing loss in adults 50 or older without diagnosed hearing loss in the primary care setting. The evidence reviewed led to a position statement that current evidence is still insufficient to assess the balance of benefits and harms for screening for hearing loss in asymptomatic adults. The report goes on to state that the recommendation does not apply to persons seeking evaluation for perceived hearing problems or for cognitive or affective symptoms that may be related to hearing loss (USPSTF, 2012). In those previously mentioned cases, the potential for objective hearing impairment should be assessed. In February 2019, the USPSTF published a research plan which will revisit these statements regarding screening for hearing loss in older adults and hopefully will find merit in conducting such screening in light of recent studies which link untreated hearing loss to cognitive decline, social isolation and increased risk of falls.

Approaches to Screening in Primary Care

According to Weinstein (2011), the primary care physician (PCP) should be the responsible party conducting hearing screening with the audiologist educating the professional regarding protocols and strategies. Since the PCP is the gatekeeper for entry into the healthcare system and that 80% of older adults make at least one annual physician visit and older adults with multiple chronic conditions make multiple visits, the PCP should be the leader for performance of hearing screenings in the medical field. There is a need for implementation of clinical preventive services to direct primary care providers in methods of selection of screening tools (McCullagh and Frank, 2012). However, Johnson et. al (2009), claim that since there is no evidence favoring a particular screening measure, physicians have considerable leeway in assessing functional communication abilities and safety including a risk for falls. Johnson goes on to mention that although family physicians are well qualified to address hearing and risk of falls, screening elderly patients for these problems often seems like a lower priority than evaluating for more serious or potentially life- threatening conditions. Commonly reported barriers to screening of hearing function include: time constraints, reimbursement issues and provider unfamiliarity with screening techniques (Johnson et. al, 2009; Strawbridge and Wallhagen, 2017). These barriers represent missed opportunities to prevent the loss of quality of life due to impaired hearing acuity. Further research is needed into the extent and nature of barriers to hearing screening in primary care and criteria for screening of adults should be established (McCullagh and Frank, 2012). Additionally, the importance of hearing for general well-being warrants an effort to enhance awareness among the general population of the indications of hearing loss and options for assistance (Bainbridge & Wallhagen, 2014).

Risk Factors Associated with Hearing Loss

Commonly accepted risk factors associated with an increased likelihood of having or developing hearing loss include: noise exposure, balance disorders, cigarette smoking, diabetes, head injury, chronic kidney disease, cardiovascular disease and history of use of ototoxic medications or treatment such as radiation or chemotherapy. Despite high hearing loss prevalence and associated health burden, there continues to be limited knowledge about the relationship between hearing loss and the presence of many common chronic medical conditions (Mckee, Stransky & Reichard, 2018). Mckee (2018) also mentioned occupational or war related noise exposure, smoking tobacco, diabetes, hypertension and obesity as factors that appear to be associated with an increased risk of hearing loss. Mckee (2018) analyzed data from the National Health Interview Survey to ascertain the prevalence of medical conditions among individuals with hearing loss. After adjusting for smoking status and disability, hearing loss was found to be significantly and independently associated with arthritis, cancer, cardiovascular disease, diabetes, emphysema, high blood pressure and stroke. Suggesting that the degenerative and age related decline in hearing organs may be enhanced by the presence of these other chronic medical conditions such as diabetes mellitus (DM), cardiovascular disease and renal disease.

Kakarlapudi, Sawyer and Staecker (2003) found that sensorineural hearing loss (SNHL) was more common in patients with diabetes than in the control nondiabetic patients, and severity of hearing loss seemed to correlate with progression of the disease. They also found that poorly controlled diabetes correlated with a worsening of hearing acuity in patients who had preexisting sensorineural hearing loss. The link between diabetes and SNHL makes intuitive sense given the documented neuropathic and microvascular complications of diabetes affecting the complex blood supply of the inner ear and most studies evaluating the relationship between diabetes and

hearing show a presence of mild to moderate high frequency hearing loss (Kakarlapudi et al., 2003). Meneses, Bazoni, Doi and Lozza (2018) recently supported this probable association and found that diabetes mellitis (DM) was significantly associated with high frequency hearing loss in the elderly and with multiple logistic regression, the risk factors are independent of hearing loss only for age and occupational noise. After statistical analysis, DM and a history of exposure to occupational noise were associated with hearing loss in the high frequencies; however, only age and occupational noise were found to be independent risk factors for hearing loss (Meneses et al., 2018). Several studies analyze the changes in hearing which occur with increasing age, metabolic and circulatory disorders, infections and trauma and research points out that every cell in the body relies on an adequate supply of oxygen and nutrients to maintain its functions, this is all dependent on the structural and functional integrity of the heart and blood vessels. As such, hypertension can also cause such changes to the heart and blood vessel integrity, and high pressure in the vascular system can result in bleeding into the inner ear, which can lead to sudden or progressive hearing loss (Meneses et al., 2018).

Part of the difficulty in identifying the effects of diabetes on hearing is the presence of comorbidities such as hypertension and atherosclerosis which can also affect hearing (Kakarlapudi et al., 2003). Friedland, Cederberg and Tarima (2009), found a significant association between low frequency hearing loss and cardiovascular diseases (CVD). They suggest that audiogram patterns correlate strongly with cerebrovascular and peripheral arterial disease and may represent a screening test for those at risk, as patients with low frequency hearing loss should be regarded as at risk for cardiovascular events. One is to assume that this association between hearing and cardiovascular health is a two-way street. Even after controlling for hypertension, diabetes, smoking and hyperlipidemia low frequency hearing loss was

significantly associated with intracranial vascular pathology such as stroke and transient ischemic attacks, coronary artery disease, myocardial infarction, and peripheral vascular disease (Friedland et al. 2009). Tan, Lan, Knuiman, Divitini and colleagues (2017) replicated these findings and revealed a significant association between cardiovascular disease and hearing loss. Obesity and smoking were also found to be significantly associated with both low and high frequency hearing loss and high blood pressure was associated with low frequency hearing loss. There was a graded association between hearing loss and Framingham Risk Score for cardiovascular risk ($p< 0.001$). Ultimately, CVD, obesity, current smoking, peripheral arterial diseases were associated with all measures of HL (Tan et al., 2017).

Harris, Gopinath and Mitchell (2011) also demonstrated that SNHL is a significant handicapping condition contributing to a health burden for sufferers and their communication partners, thus they stress the importance of identifying risk factors associated with hearing loss to ameliorate this burden more rapidly. They observed in their large, population-based study that over half of patients with moderate CKD had some level of hearing loss and that one in four patients had moderate hearing loss. This association between moderate CKD and hearing loss was independent of other known confounding variables such as age, hypertension, diabetes and smoking. Previous studies are in agreement that hearing loss is independently associated with age, stroke, ischemic heart disease, diabetes and smoking. Moreover, a high prevalence of high frequency hearing loss has been observed among patients with chronic kidney disease (CKD) or end stage kidney disease who are on dialysis (Harris et al., 2011). Both epidemiological data and animal models support a causal link between reduced renal function and hearing loss and regardless of the direction of the association, the presence of kidney disease in frequently associated with auditory dysfunction.

Harris et al (2011) concluded that physicians should periodically ask anyone with kidney disease about their hearing function due to the links between the two conditions. Moreover, if hearing loss is detected in patients with kidney disease, then clinicians should recommend the avoidance of treatment with ototoxic medications in order to preserve residual hearing. Finally, they note the importance of implementing referral strategies to hearing health professionals for further evaluation and audiological rehabilitation. Jamaldeen, Basheer, Sarma and Kandasamy (2015) found similar evidence revealing that a mild degree of SNHL was common in CKD patients. They also posit that CKD patients are likely to be older and have significantly greater exposure to ototoxic drugs known to damage residual hearing. Otoxicity is yet another risk factor associated with an increased likelihood of experiencing sensorineural hearing loss. Mujica, Waissbuth, and Daniel (2012) found that patients receiving radiotherapy (RT) for head and neck tumors were at increased risk of developing conductive and sensorineural hearing loss (SNHL) and that radiation induced SNHL is progressive, permanent and dose dependent. However, they mention that use of analytical tools to assess hearing loss is up to the discretion of the treating physician and varies depending on the treatment center. This illustrates the need for a universal screening protocol to identify patients at risk for sensorineural hearing loss, especially in the cases of patients undergoing chemotherapy and radiation.

Chou et al., (2014) reviewed the evidence collected by the UPSTF in 1996 which further stated that factors contributing to hearing loss in older adults include: aging, genetic factors, exposure to loud noises, exposure to ototoxic agents, history of inner ear infections, and the presence of systemic diseases such as diabetes mellitus and kidney or cardiovascular diseases. Moyer (2012) state; however, that age is the most important risk factor for hearing loss. Yueh et al, (2003), posited that prevalence of hearing loss increases with age ranging from 40% to 66%

in patients older than 75 years and more than 80% in patients older than 85 years. Yet, it is also commonly accepted that with increasing age comes the likelihood of co-morbid chronic conditions, all of which are intricately interlaced with one another. Balance disorders become increasing prevalent in older adults, increasing likelihood of falling and thus, increasing the likelihood of a head injury, all of which are associated with cooccurring or incident hearing loss. Munjal, Panda and Pathak (2010) explained that the risk of hearing impairment as a sequela of head injury is evident and has been demonstrated in several studies and that motor vehicle accidents were the most frequent cause of conductive hearing loss, followed by fall from height, such as falls that may occur in patients with vestibular issues. This makes both head injury and suspected vestibular pathology important risk factors to consider when assessing the need to screen for hearing loss. Bergemalm (2003) also evaluated the progression of conductive hearing loss in closed head injuries. He found that especially in cases of temporal bone fractures, audiometric evaluation and follow up is extremely important. He also mentions the potential risk of synergistic interactions between trauma and the effects of noise exposure, and ototoxic agents such as solvents and medications. Finally, It is important to recognize that certain hearing disorders, such as traumatic injury with vestibular symptoms and/or deafness, and erosive lesions, such as cholesteatoma, require urgent consultation and therefore screening for hearing loss can lead to earlier intervention for such disorders (Yueh, 2003).

The ototoxic effects of antibiotics and antineoplastic agents are well documented. The aminoglycosides and platinum compounds are particularly ototoxic. When known ototoxic agents need to be administered, ultra-high-frequency audiometry is available for early detection of ototoxicity in adult populations. Because high-frequency hearing loss usually precedes loss in the normal range, early detection of such loss may lead to modifications in treatment that prevent

clinically important hearing loss (Yueh, 2003). This research serves to further stress the importance of hearing screening when such risk factors as noise induced hearing loss or history of ototoxicity are present. Both ototoxic medications and cigarette smoking have been found to have synergistic effects with occupational noise-induced hearing loss. Mohammadi, Mazhari, Mehrparvar and Attarchi (2009) concluded from their cross-sectional study that smoking may accelerate noise induced hearing loss. Nomura, Nakao and Morimoto (2004) assessed hearing loss even in the absence of noise exposure and also found evidence suggestive of a positive association between smoking and hearing loss, that was multiplicative with increasing age.

Consequences of Untreated Hearing Loss

ARHL is a common chronic condition affecting older adults and it has become increasingly important to understand its impact on quality of life and the consequences of leaving hearing loss untreated. Hearing loss has recently been recognized as a public health concern as several studies have found independent associations between ARHL and more severe conditions including: falls, hospitalization, social isolation, frailty and even mortality (Golub, Luchsinger, Manly, Stern and colleagues, 2017). Even in light of this recent research, there may be a tendency to dismiss hearing loss as being either unimportant or an inevitable part of aging (Dalton, Cruickshanks, Klein, Klein and colleagues, 2003). In an effort to combat this notion to ignore hearing loss as a normal part of the aging process, Dalton and colleagues (2003) sought to quantify the impact of hearing loss on quality of life in older adults. In a 5-year study of the epidemiology of hearing loss, severity of hearing loss was found to be significantly associated with having a hearing handicap, self-reported communication difficulties, and impaired activities of daily living (Dalton et al, 2003). The major implications of their findings is that severity of

hearing loss was associated with reduced quality of life and decreased function in both mental and physical health measures. In spite of the importance of hearing in everyday life, hearing loss remains to be an unrecognized and undertreated health disorder.

One of the more troublesome potential associations that has come to light is the association between observed hearing loss (OHL) and incident dementia. In one study, subjects with even a mild HL had 1.9 times the risk of incident dementia, rising to 4.9 times for those with severe HL after adjusting for confounders (Golub et al, 2017). In an attempt to replicate these findings, Golub and his colleagues (2017) found that OHL was associated with 1.69 times greater risk of incident dementia in a multi-ethic cohort. They went on to explain the potential mechanisms through which hearing loss may contribute to incident dementia including: increased cognitive load, change in brain structure and function, and low social engagement. Two converging lines of evidence suggest that hearing impairment and alterations in peripheral auditory function could directly or indirectly lead to central effects on brain structure and function (Lin, Ferucci, An, Goh and colleagues, 2013). Neuroimaging studies have demonstrated that peripheral hearing impairment (PHI) is associated with reduced cortical volume in the primary auditory cortex (PAC), variation in the integrity of central auditory white matter tracks suggesting that PHI may carry cascading consequences for other brain regions (Lin, Ferruci et al, 2017). In an attempt to replicate previous findings, Lin, Ferruci and colleagues (2017) found that HL in older adults was independently associated with accelerated rates of whole brain atrophy and decline in regional brain volumes concentrated in the right temporal lobe, which is critical for spoken language processing.

Visual and hearing impairment prevalence increase proportionately with age, and people with concurrent visual and hearing impairment have been shown to present poorer functional status than those with a single sensory loss (Bernabei, Morini, Moretti, Marchiori and colleagues, 2010). Bernabei et al, (2017) sought to evaluate the association between vision and hearing impairment and depressive-anxiety syndrome. They found that sensory impairment in older adults can increase the probability of experiencing depressive and anxiety syndrome and recommend further research to ascertain as to whether correction of these deficits could improve quality of life in this population. Furthermore, the findings are in agreement with the concept of the protective role of cognitive reserve against brain decline, which is determined by mental, physical and social activity, educational level and occupation. These components of daily living influence the number and quality of cerebral connections and can defer the beginning of cognitive and functional decline (Bernabei et al., 2010). Dual sensory impairment (DSI) not only contributes to depression and anxiety, but has also been linked to increased incidence of falls in older adults. Gopinath, McMahon, Burlutsky and Mitchell (2016), assessed the association between DSI and incidence of falls and found that DSI in older adults could significantly increase their risk of falling. Visual and hearing impairments are thought to impair balance control, increase cognitive load, and reduce ability to multi-task resulting in an inaccurate assessment of environmental obstacles and surroundings (Gopinath et al, 2016). Because of these age related sensory and cognitive changes, older people must allocate more attention to maintaining their balance during everyday activities. Lin and Ferruci (2012) also found that in an unadjusted model, hearing loss was significantly associated with the odds of self-reporting a history of falls and for every 10 dB increase in hearing loss there was a 1.4-fold increase in odds of a self reported fall over the preceding 12 months.

Finally, numerous studies suggest sensory impairment, especially dual sensory impairment, are predictors of decreased survival, and poorer health outcomes including functional disability, depression and cognitive decline (Fisher, Ming Li, Chiu, Themann and colleagues, 2014). In an attempt to ascertain the mortality risk of hearing impairment and DSI, Fisher and colleagues (2014) examined the relationship with mortality rates from all causes and from CVD among older people. They found that after adjusting for age, significantly increased mortality rates from all causes and CVD was observed for participants with hearing impairment (HI) and DSI, especially among men. Even after further adjustment for established mortality risk factors, HI remained at a higher risk for CVD mortality and DSI remained at higher risk for all cause mortality. Vision impairment alone was not associated with mortality from all causes or CVD in men or women. Interestingly, men and women who used hearing aids, even in older age and with more severe hearing loss, were found to have significantly lower mortality risk compared with hearing impaired men and women who did not use hearing aids (Fisher et al, 2014).

Summary

With this research in mind, health professionals delivering care to older people need to realize multiple sensory impairments are common and may predict other adverse health conditions increasing risk of death; therefore, the regular assessment of sensory impairment and rehabilitation services targeted for decrements in hearing and other sensory impairments can promote enhanced quality of life, overall health and longevity (Fisher et al, 2014). The consequences of untreated hearing loss are numerous and almost entirely avoidable when addressed early. Knowledge of key risk factors associated with hearing loss can aid in the earlier

diagnosis of hearing loss in older adults. Primary care physicians are in a unique position to screen for hearing loss in high-risk populations. The burden of disease associated with hearing loss can be handicapping to the social and emotional well-being of their patients, and the existence of many co-morbid conditions can increase this burden exponentially. Hearing loss has been identified as a modifiable risk factor for all cause dementia and has been linked extensively to cognitive decline (Livingston &Frankish, 2015; Orgeta et al., 2018). Screening for hearing loss with these high-risk criteria in mind can potentially prevent hearing loss from cascading into dementia and minimize the likelihood of patients experiencing later effects of hearing loss such as depression, social isolation and an overall reduced quality of life.

METHODS

Participants

The study was approved by the Institutional Review Board of the Graduate Center, CUNY in October of 2018. Physicians currently in medical practice, in good health and over the age of 18 were recruited to participate. Individual physicians were independently contacted, via email recruitment, and invited to participate in the survey. The participants were invited to complete the survey at their discretion and were informed that all answers would remain anonymous. They were informed that the survey answers would aid in the development of a practical hearing screening protocol for physicians. The need to spread awareness about hearing health and the importance of optimizing communication ability between physicians and their patients was stressed. Internet based informed consent forms were sent along with the survey to encourage participation and prove the legitimacy of the survey. The collection period was open for 3 months after the initial IRB approval date, at the conclusion of the data collection period, responses from 47 physicians were obtained.

Post analysis of survey respondents lead to the development of three respondent categories: Primary care, High risk specialist and Low risk specialist. It was decided after collection of responses had ended, that any responses obtained from pediatricians and ENTs would be excluded as neither fit directly into one of those three categories. Inclusion of ENTs into the analysis would have misrepresented referral choices and inclusion of pediatricians was not appropriate for the development of a hearing screening tool for adults. After removing 3 physician responses which fell under these medical backgrounds, 44 survey responses remained.

Materials

A survey was created with responses gathered and analyzed using Survey Monkey, to assess physician attitudes towards hearing loss and their practice regarding hearing screening. The questions comprising the survey pertained to demographics, hearing screening measures, referral practices, attitudes towards the presentation of hearing loss and knowledge regarding risk factors associated with hearing loss. Questions were derived from previous research studies; however, the composition of the survey was completely unique in order to meet the needs for a unique protocol development that has not previously been attempted (Johnson et al., 2009; Yueh et al., 2010; Pop & Hackett, 2002). The survey consisted of 8 question items and concluded with a 9th question which "allowed the physician to be sent a copy of the protocol after it had been constructed". The 9th question was used as an indirect tool to calculate the percentage of respondents willing to learn more about hearing health or how to better incorporate hearing screening into their practice.

The survey covered several topics: physician's area of medical practice, whether or not hearing screenings were routinely or occasionally performed, if the physician responded they

choose not to screen for hearing at all what was the main barrier contributing to this decision, to whom are they referring patients who complain of difficulty hearing, which behaviors physicians associate with hearing loss and finally which medical conditions they felt placed a patient at an increased risk for experiencing some type of hearing loss. Respondents were instructed to skip questions which they felt did not pertain to them and were allowed to fill in responses in an "other category" if their chosen response was not listed. Percentage of responses was analyzed based on the number of persons responding to the survey out of the total number of persons surveyed. The sequence of question and answer course may have required the physician to skip certain questions; therefore, the surveys were analyzed based on whether or not they routinely, occasionally or never screen for hearing loss. The items on the survey are included in Appendix A. Respondents were instructed to answer yes or no variety questions or participants were asked to choose one and sometimes multiple of the provided answers or asked to write a response. Responses to each item were analyzed separately.

Procedures

The study was approved by the Institutional Review Board of the Graduate Center, CUNY in October of 2018. Immediately following approval, the survey was emailed to 100 medical doctors across the United States and the collection period was open for 3 months beyond the approval date. Potential respondent emails were obtained via public record from WebMD, Google, or via phone call to physician offices, whose numbers were also of public record, and requested a contact email for the purposes of distributing a student research survey. The survey was sent out to 50 medical doctors; and would continue to be sent out to 50 additional doctors until the minimum number of 25 responses was reached. In addition to the initial invitation to participate in the survey, participants were resent the invitation two weeks later to help ensure

participation. The proportion of people responding out of total invitations sent out was 47 out of 100, making the response rate 47 percent. Respondents did not receive any feedback regarding their answers and all answers remained confidential. The only contact with participants after completing the survey was an automatically generated "Thank You" email. There was no financial incentive offered to participants. Responses were anonymous as respondents did not have to provide their names or any identifiers; therefore, all participants remained anonymous.

RESULTS

The survey was sent to 100 physicians from across the United States, 47 physicians responded to the survey. Of the 47 respondents, 3 were excluded from analysis as the responses were from Ear Nose and Throat Physicians and Pediatricians. Including these responses would have inaccurately skewed the data for referral choices, as well as, likelihood to routinely screen for hearing loss. The remaining 44 responses consisted of physicians from the following medical practices: Primary Care, Geriatric Medicine, Neurology, Cardiology, Oncology, Internal Medicine, Ophthalmology, Psychiatry, Pain Management, Urgent Care, General Surgery, Gastroenterology, Immunology, Anesthesiology, Obstetrics and Gynecology (OBGYN) and Dermatology. Figure 1 displays the demographic breakdown, according to the responses to Question 1, "What is your Area of Medical Practice".

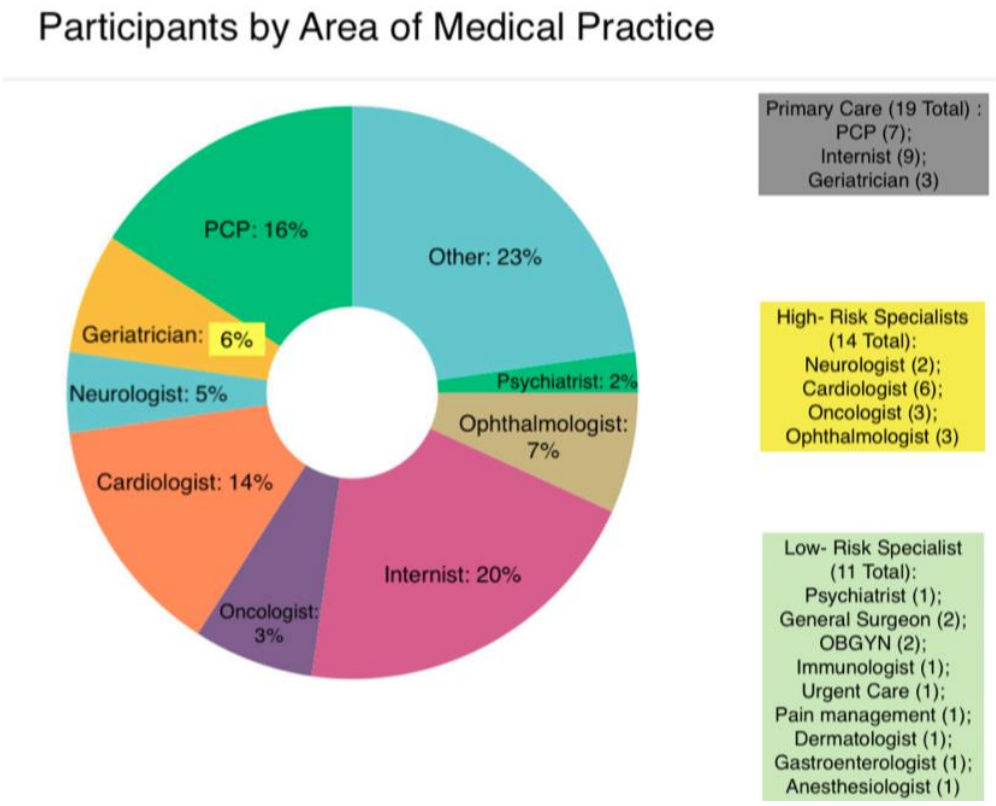
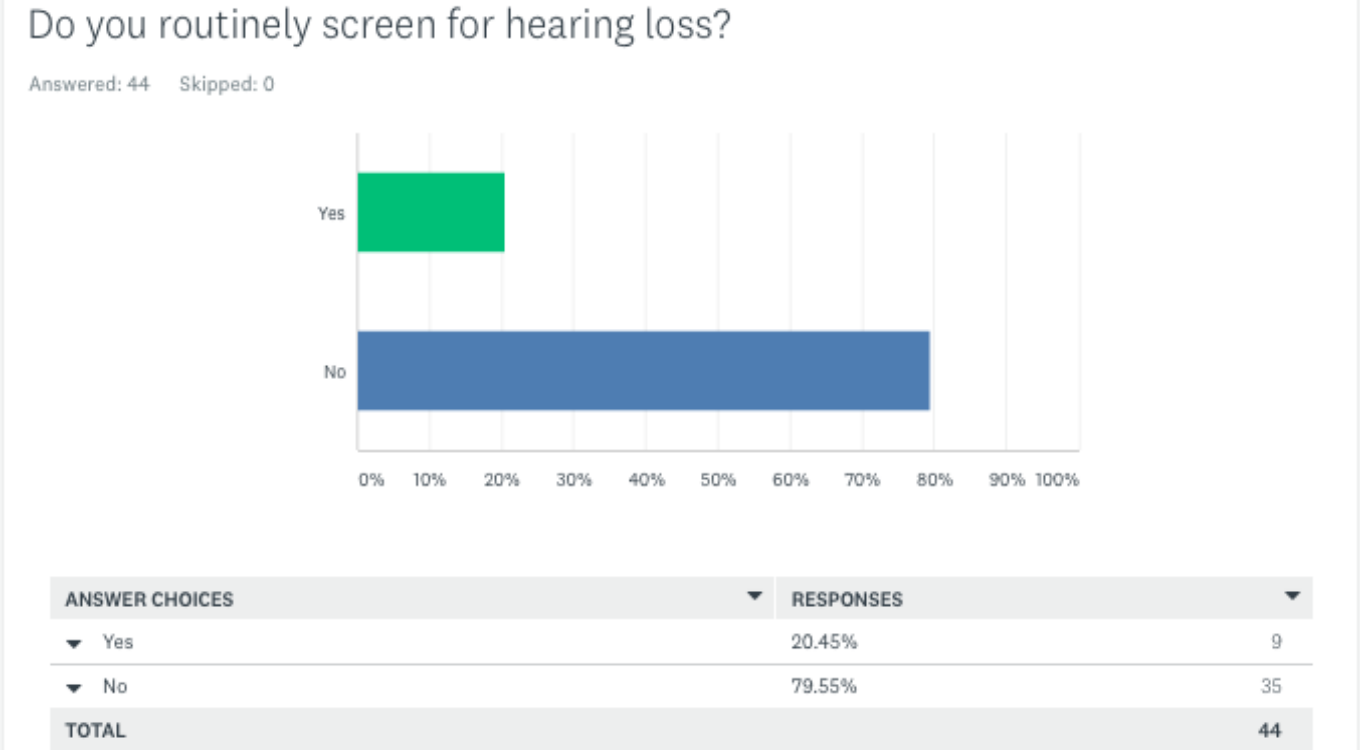


Figure 1. DEMOGRAPHICS

Responses by Question

Question 2 asked whether or not the participants routinely screened for hearing loss, as shown in Figure 2, only 20% of respondents answered that they routinely screened for hearing loss in their practice. Five of the respondents were PCPs, 3 were internists and one was a neurologist. The remaining 80% of respondents did not routinely screen for hearing.



ANSWER CHOICES	RESPONSES	
Yes	20.45%	9
No	79.55%	35
TOTAL		44

Figure 2. ROUTINE HEARING SCREENING

Question 3 asked whether or not the respondent occasionally screened for hearing loss, as shown in Figure 3. Approximately 26% of respondents answered that, although they did not routinely screen for hearing, they would screen for hearing loss occasionally in their practice. In total, 46% of respondents answered that they did perform hearing screenings in some capacity and 54% of respondents never screened for hearing loss in their practice. This is slightly lower than previous research by Johnson et. al (2008) which revealed that 60% of physicians were performing hearing screenings. This difference could be due to the larger sample size achieved by the Johnson study where-in they analyzed 85 respondents and this sample size was approximately half of that with 44 respondents.

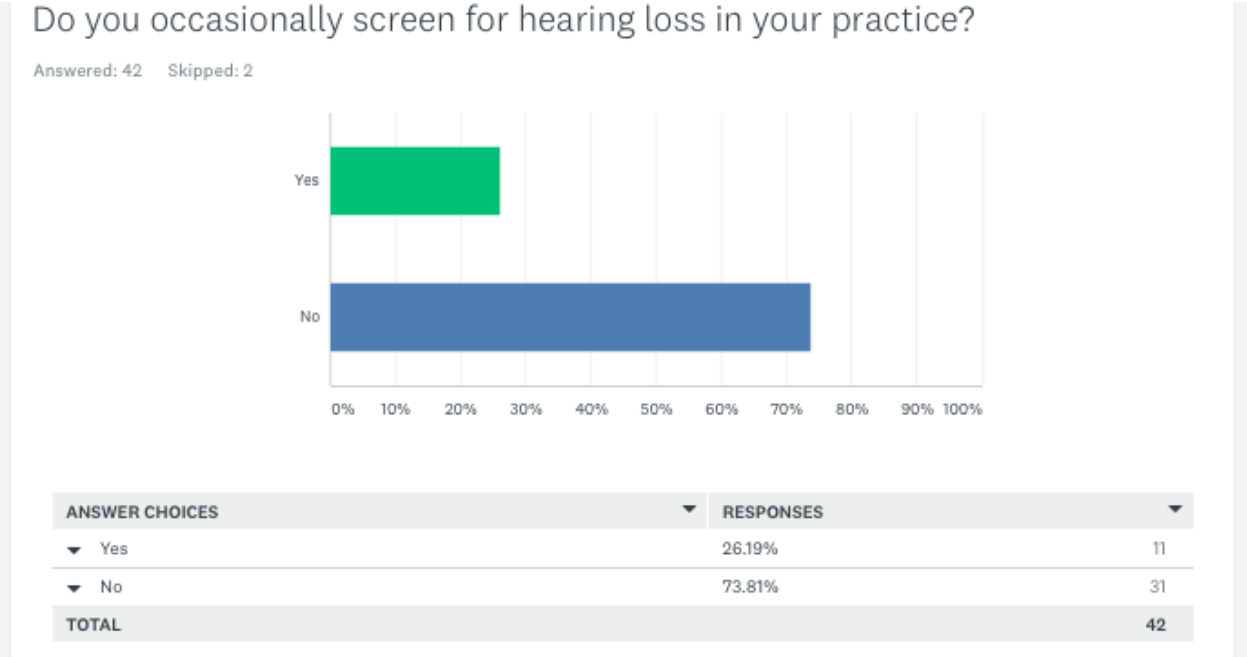
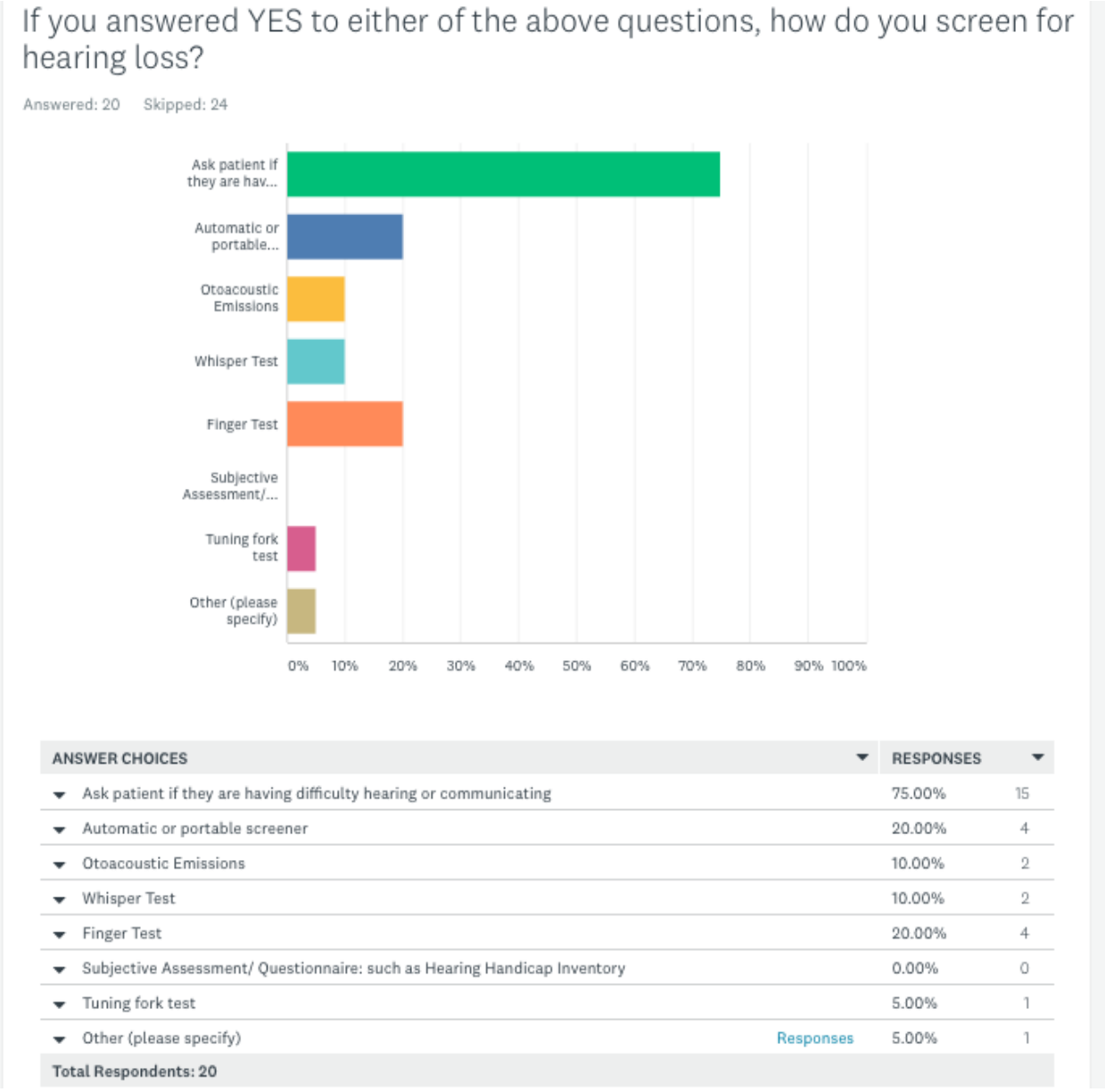


Figure 3. OCCASIONAL HEARING LOSS SCREENING

Question 4 served to ascertain the methods which physicians used to screen for hearing loss. The possible answer choices included: asking if the patient was having difficulty hearing or communicating, automatic or portable screener, otoacoustic emissions, whisper test, finger rub test, subjective assessment or the tuning fork test. Figure 4 summarizes responses to this question. The most widely utilized method of hearing screening was simply asking if the patient was having trouble hearing, comprising 75% of the chosen methods. The least utilized method was the tuning fork test, with just 5% use among those physicians screening for hearing. Most respondents used a combination of two or more methods. Especially for those that routinely screened for hearing, 6 out of 9 respondents used two or more methods. However, of those participants that reported they occasionally screened for hearing loss, 82% used only the asking method. 20% of physicians reported they would use an automatic screener, 20% used the finger rub test, 10% used otoacoustic emissions, and 10% used the whisper test. Unfortunately, none of

the physicians performing hearing screening utilized any form of subjective assessment such as the Hearing Handicap Inventory. This supports the findings of Johnson et. al (2008), stating that PCPs were not routinely conducting hearing/balance screenings and were not aware of the patient self-report screening questionnaires available to them.



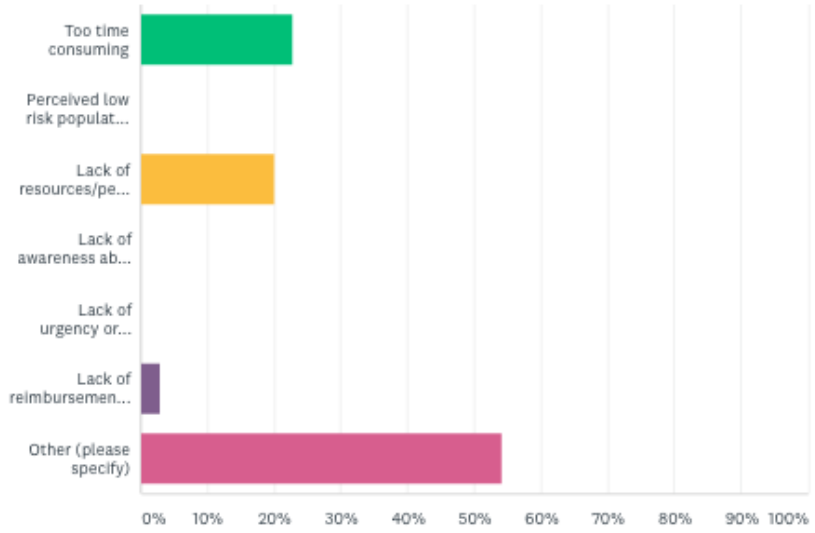
ANSWER CHOICES		RESPONSES	
Ask patient if they are having difficulty hearing or communicating		75.00%	15
Automatic or portable screener		20.00%	4
Otoacoustic Emissions		10.00%	2
Whisper Test		10.00%	2
Finger Test		20.00%	4
Subjective Assessment/ Questionnaire: such as Hearing Handicap Inventory		0.00%	0
Tuning fork test		5.00%	1
Other (please specify)	Responses	5.00%	1
Total Respondents: 20			

Figure 4: CHOSEN METHODS OF HEARING SCREENING

Question 5 asked why physicians are choosing to not routinely screen for hearing loss. These responses illustrated in Figure 5 helped to illuminate potential barriers for screening for hearing loss presently and in the future.. 80% of the total respondents are not performing routine hearing screening. Of this 80%, 23% felt screening was too time consuming, 20% reported a lack of resources to screen, 3 % reported lack of reimbursement as the primary reason for not screening and 54% plainly felt it was not their responsibility to do so or it was outside their area of specialty.

If you answered NO for questions one or two, what is the primary reason that you do not routinely screen for hearing loss?

Answered: 35 Skipped: 9



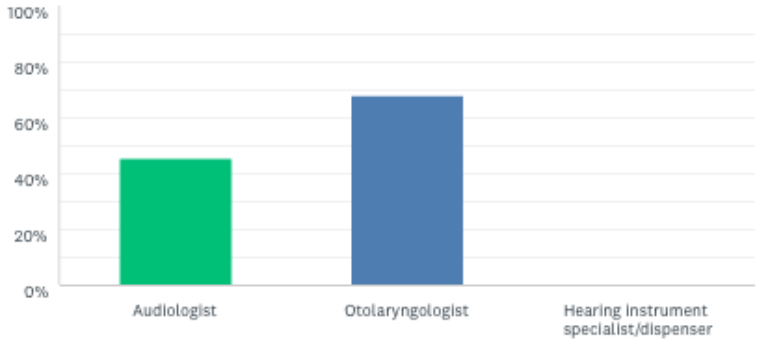
ANSWER CHOICES		RESPONSES	
Too time consuming		22.86%	8
Perceived low risk population of patients in your practice		0.00%	0
Lack of resources/personnel/ equipment		20.00%	7
Lack of awareness about hearing screening or associated risks of untreated hearing loss		0.00%	0
Lack of urgency or importance to screen for hearing		0.00%	0
Lack of reimbursement for services		2.86%	1
Other (please specify)	Responses	54.29%	19
TOTAL			35

Figure 5. PRIMARY REASON PHYSICIANS DO NOT ROUTINELY SCREEN FOR HEARING LOSS

Question 6 asked to which professionals a physician would refer to if a patient was complaining of difficulty hearing and/or understanding others. According to Figure 6b, 32% of respondents would refer to an audiologist only and 54% would refer to an otolaryngologist only, and approximately 14% reported they would refer to a combination of both. As shown in Figure 6a, 100% of respondents reported they would not refer to a hearing aid dispenser.

To which of the following professionals would you refer a patient complaining of difficulty hearing and understanding others?

Answered: 44 Skipped: 0



ANSWER CHOICES	RESPONSES	
Audiologist	45.45%	20
Otolaryngologist	68.18%	30
Hearing instrument specialist/dispenser	0.00%	0
Total Respondents: 44		

FIGURE 6A. REFERRAL SOURCES

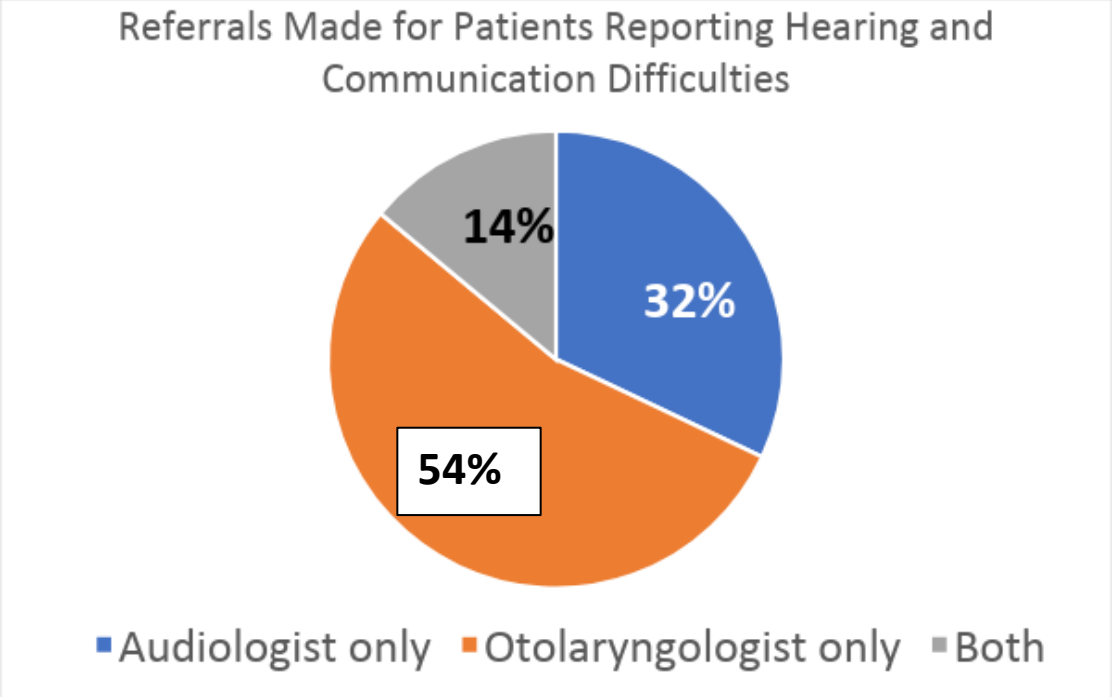


FIGURE 6B. REFERRAL PATTERN

Question 7 asked which behaviors the physicians associated with hearing loss, physicians were allowed to select more than one answer. Incorrect or off topic responses to questions, requests for repetitions of instructions, straining to understand what is said, requests to speak louder and use of a hearing aid are all behaviors associated with hearing loss. As illustrated in Figure 7, 86% of respondents were in agreement that `a request to speak louder is a behavior associated with hearing loss. 35% of respondents neglected to associate use of a hearing aid with hearing loss. This is an important finding which suggests patients with a hearing aid are perceived by physicians not to be at risk for mishearing or misunderstanding important medical information. It is important for all physicians to review and repeat important medical information and to ensure the patient has understood the information provided. Many physicians also neglected to identify incorrect or off topic responses and straining to understand information provided as behaviors

associated with hearing loss. This suggests that physicians have a very rigid understanding of the presentation of hearing loss and therefore, many patients clearly exhibiting behaviors associated with hearing loss may not be identified or referred without a formal screening measure. Another interesting finding is that one oncologist mentioned family concern for dementia as a behavior associated with hearing loss. This physician also correctly identified all of the behaviors associated with hearing loss, yet the respondent answered that he/she only occasionally screened for hearing loss. This suggests that despite an Oncologist's extensive knowledge of the importance of screening for hearing and the behaviors associated with a hearing loss, these specialists may not be screening routinely due to perceived barriers to their practice. This indicates the need for an efficient and effective hearing screening tool for high-risk specialists. Screening for hearing; however, should not replace full audiological evaluations and monitoring, but serve as a supplement or complement.

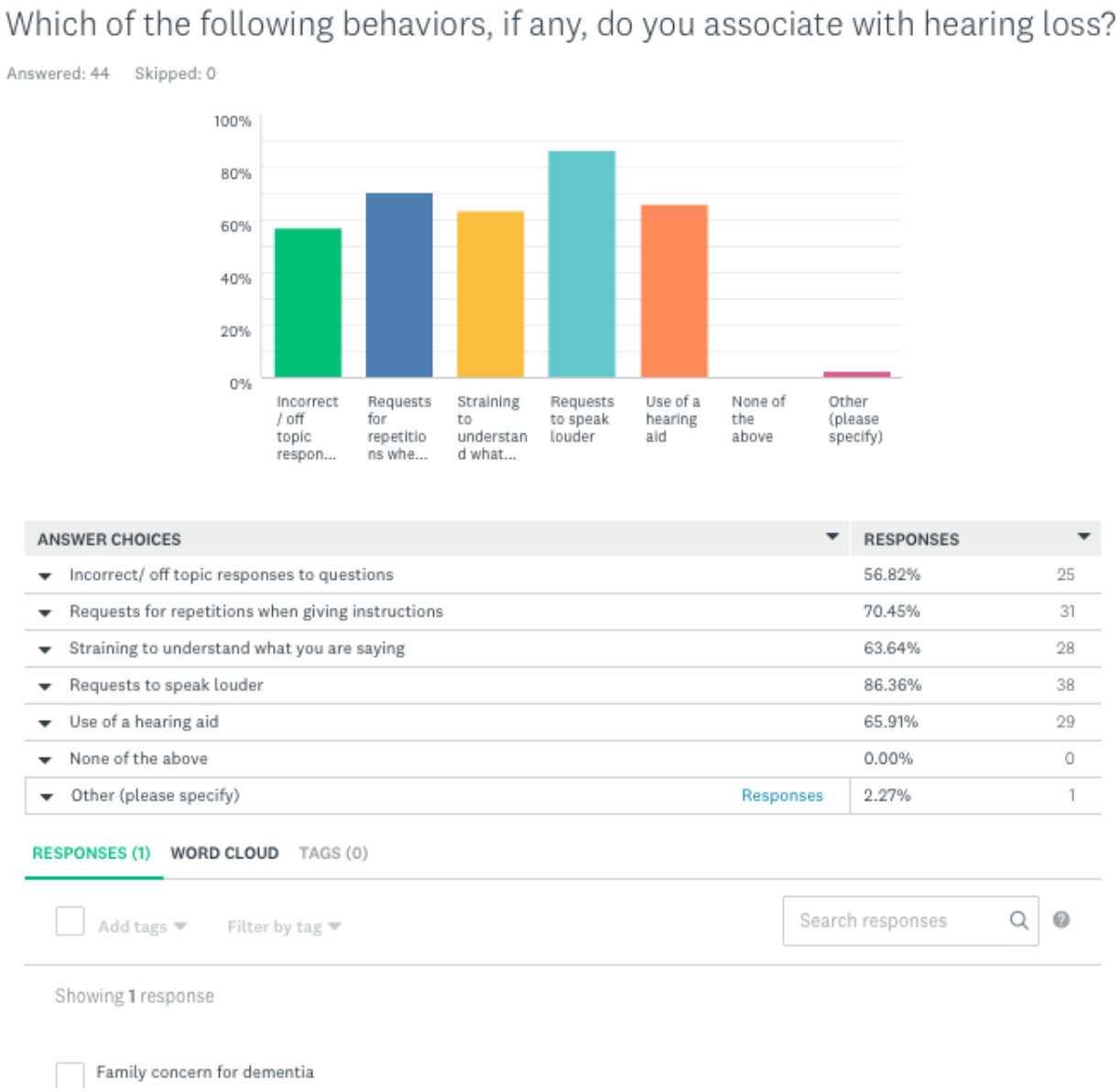


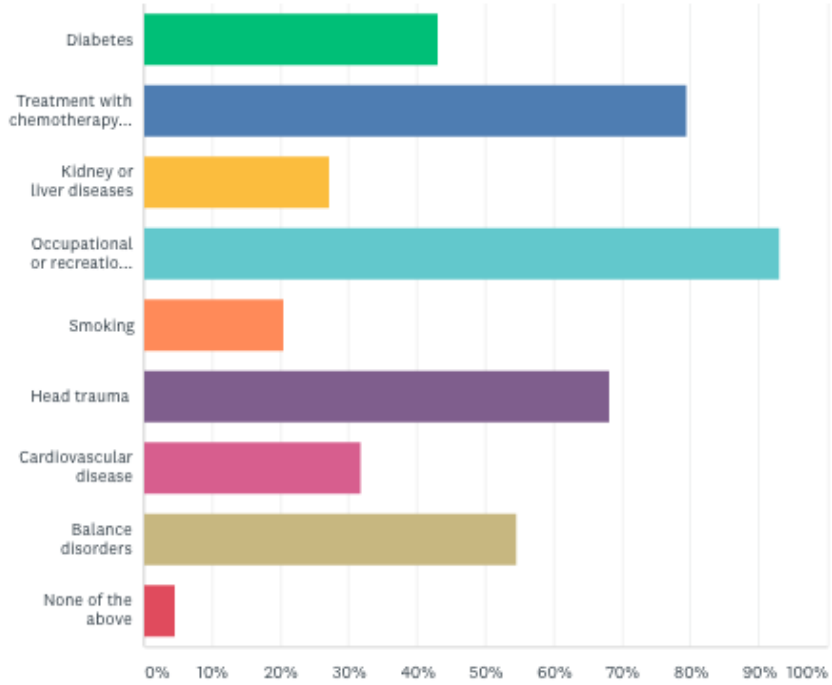
FIGURE 7. BEHAVIORS ASSOCIATED WITH HEARING LOSS

Question 8, "Which of the following, if any, do you feel places a patient at an increased risk of having a hearing loss?" revealed major inconsistencies in physician knowledge of risk factors associated with hearing loss. As illustrated in Figure 8, only 43% of physicians identified diabetes as being associated with an increased risk of hearing loss. The most widely recognized association with hearing loss was history of occupational or recreational noise exposure with

93% of respondents correctly identifying it as a risk factor. 80% of respondents also correctly identified treatment with chemotherapy, radiation or ototoxic medications as associated with an increased risk of hearing loss. Physicians neglected to identify smoking as a risk factor associated with hearing loss, with only 20% of respondents correctly identifying it as such. Approximately 30% of physicians correctly identified cardiovascular disease and kidney disease as risk factors. Finally, only 4% of respondents felt that none of the listed risk factors were associated with hearing loss.

Which of the following, if any, do you feel places a patient at an increased risk of having a hearing loss?

Answered: 44 Skipped: 0



ANSWER CHOICES	RESPONSES	
Diabetes	43.18%	19
Treatment with chemotherapy, radiation or other ototoxic medications	79.55%	35
Kidney or liver diseases	27.27%	12
Occupational or recreational noise exposure	93.18%	41
Smoking	20.45%	9
Head trauma	68.18%	30
Cardiovascular disease	31.82%	14
Balance disorders	54.55%	24
None of the above	4.55%	2
Total Respondents: 44		

FIGURE 8. RISK FACTORS ASSOCIATED WITH HEARING LOSS

Question 9 asked if participants would be willing to receive a copy of the screening protocol after its completion along with research containing information about consequences of untreated

hearing loss, importance of assuring patient compliance and understanding of medical information and comorbidities associated with hearing loss. This question served as a litmus test for the impact of the survey on participants, as well as, to estimate the likelihood to screen for hearing loss in the future. 34% of participants (15 physicians) responded that they would be interested in receiving the screening protocol and by extension, interested in learning more about hearing loss and the importance of screening for hearing loss in the elderly. Of these 15 physicians, 3 were already routinely screening for hearing loss, 5 were only occasionally screening for hearing loss and 7 were not currently performing any form of hearing screening. This indicates an opportunity for physician education and willingness to screen for hearing loss in the future. Of the 24 physicians surveyed that were not performing any form of hearing screening, 29% were impacted by the contents of the survey and possibly interested in performing hearing screenings in the future.

DISCUSSION

Summary of Results

Overall, 47% of physicians receiving the questionnaire responded. Of the 44 respondents, only 20% answered that they routinely screened for hearing loss in their practice. Approximately 26% of respondents answered that, although they did not routinely screen for hearing, they would screen for hearing loss occasionally in their practice. In total, 46% of respondents answered that they did perform hearing screenings and 54% of respondents never screened for hearing loss in their practice. The most widely utilized method used to screen for hearing loss was simply asking if the patient was having trouble hearing, comprising 75% of the chosen methods. Unfortunately, none of the physicians performing hearing screening utilized

any form of validated patient reported outcome measure (PROM) such as the Hearing Handicap Inventory. Of the 80% of respondents that are not routinely screening for hearing loss, 23% felt screening was too time consuming, 20% reported a lack of resources to screen, 3% reported lack of reimbursement as the primary reason for not screening and 54% plainly felt it was not their responsibility to do so or it was outside their area of specialty.

When asked to whom they would refer in the case of a patient complaining of difficulty hearing and understanding others, 54% of respondents reported they would only refer to an Otolaryngologist, 32% responded they would refer only to an Audiologist and 14% responded they would make a referral to both professionals. Interestingly, 100% of respondents reported they would not refer to a hearing aid dispenser. This information helps to illustrate that audiologists and otolaryngologists are widely accepted as experts in hearing and balance, and when given the choice, physicians will choose to refer to experts in the field for hearing and balance testing over those who do not have a doctoral or medical degree in the field.

When asked about behaviors associated with hearing loss, 86% of respondents were in agreement that requests to speak louder is indicative of a behavior associated with hearing loss. However, many commonly accepted behaviors associated with hearing loss were ignored, indicating the potential for many patients exhibiting signs of hearing loss to be left undiagnosed and untreated without the existence of a formal hearing screening protocol for patients aged 50 and older. The survey also revealed a general lack of physician knowledge of risk factors associated with hearing loss. Only 43% of physicians identified diabetes as being associated with an increased risk of hearing loss. The most widely recognized association with hearing loss was history of occupational or recreational noise exposure with 93% of respondents correctly identifying it as a risk factor. The inconsistencies highlighted among the respondents indicate

potential opportunities for physician education and spreading awareness about the importance of routine hearing screening.

Recommended Screening Protocols

After responses were analyzed, the data was divided into 3 categories based on the likelihood that a physician in a particular specialty would encounter an older adult with hearing loss. These categories were constructed for the purpose of recommending a practical screening tool for physicians which reflected the potential risk level for hearing loss in the populations they serve. Depending on the likelihood of encountering an older adult with age related hearing loss, the recommended screening measures will vary. Since primary care is the most likely setting, the most comprehensive screening protocol is recommended for this group of professionals. In contrast, for the low-risk specialist protocol, which is the least comprehensive, would be recommended for doctors not considered to be gatekeepers. The response trend may be reflective of this categorical division as physicians belonging to a primary care category (43%) may have been the most likely to respond to a survey about screening for hearing loss, and high-risk specialists (34%) were more likely to respond than physicians belonging to a low-risk category (23%).

All doctors, regardless of the populations they serve, are encouraged to look for signs and symptoms of hearing loss and if a hearing loss is suspected to ensure that communication breakdowns are repaired and/or strategies employed to ensure all pertinent medical information or instructions is heard correctly and completely. In best practice, physicians should go beyond this basic responsibility and take extra precaution via use of the appropriate screening protocol to determine when an audiology referral would be appropriate. An increase in patient referrals to

audiology, has the potential to improve the social and emotional well-being and overall quality of life in patients with this hidden disability of unidentified hearing loss.

A screening protocol is necessary for asymptomatic adults in order for physicians to identify patients who are at risk for mishearing and misinterpreting their medical information and instructions. Marlow and Colleagues (2014) speculated that some individuals with hearing impairment may be reluctant to acknowledge their condition and feel inclined to conceal their hearing loss to avoid stigma. They go on to posit that this activity of concealment may lead to lack of disclosure of their other medical conditions and decreased ability to communicate with their primary care provider. This communication breakdown may be one of the contributing factors in the association between untreated hearing loss and a greater incidence of hospitalizations and re-hospitalizations in this population. A failure of any of these simple screening measures is an easily interpretable and tangible representation of the struggle these patients' may be having in their activities of daily living. Receiving affirmation that their difficulties warrant further investigation by a hearing specialist may encourage patients to disclose or admit the difficulties in communication they have been facing.

A Screening Protocol for Primary Care

Primary Care respondents comprised of Primary Care Physicians, Internists and Geriatricians. Primary Care respondents represented 43% of the total responses collected.

Primary Care Physician Hearing Screening Protocol

For patients over the age of 50 without any high-risk criteria, screening measure number 1 is recommended

For patients with any of the following high-risk criteria, screening measures 1-3 are recommended. If the patient does not pass all measures, referral to an audiologist for a complete audiological evaluation is indicted.

High Risk Criteria

- Diabetes
- History of Ototoxicity (chemotherapy, radiation, ototoxic medication)
- History of cigarette smoking
- History of occupational noise exposure
- Cardiovascular disease
- History of head trauma
- History of falls
- Kidney or liver disease
- Dementia diagnosis
- Socially isolated or lonely

1. For Patients 50 years of age or older, please include a "Hearing Handicap Inventory" Screening version (HHIE-S; HHIA-S) in the patient's well visit paperwork. This can be completed in the waiting room or with an intake nurse.

   A score of 10 or greater indicates the need for a referral to an audiologist

2. Visual and Non-Visual Conversation Level Test Administered by the Physician:

   Ask the patient to repeat the following phrase with mouth uncovered, speaking at a normal conversational level: "Leave now and you will arrive on time"

   Ask the patient to repeat the following phrase with mouth covered, speaking at a normal conversational level: "She saw a cat in the neighbor's house"

   If the patient gets any of the key words incorrect in the visual or non-visual mode, this indicates the need for a referral to an Audiologist.

3. Whisper Test Administered by the Physician:

   In a whispered voice with mouth covered, ask the patient to repeat the following phrase: "One step more and the board will collapse"

   If the patient gets any of the key words incorrect in the whispered mode, this indicates the need for a referral to an Audiologist.

A Screening Protocol for High Risk Specialists

High- risk specialists represented 34% of the collected responses and consisted of neurologists, cardiologists, oncologists and Ophthalmologists.

<u>High Risk Specialist Hearing Screening Protocol: (Oncologist, Cardiologist, Neurologist, Ophthalmologist)</u>

1. 1) Ask if the patient ever experiences difficulty hearing or communicating with others. If the patient answers yes, this indicates a need for referral to an Audiologist for a complete audiological evaluation.
2. 2) Include the Hearing Handicap Inventory Screening version in patient intake forms for patient's over the age of 50.
   A score of 10 or greater indicates the need for a referral to an Audiologist.

At the conclusion of the appointment, ask if the patient has heard and understood all of the medical information presented during the visit and provide a written summary of recommendations.

A Screening Protocol for Low Risk Specialists

Low- risk specialists represented the "Other Category" which made up 23% of the total respondents. The Low-risk specialist group was comprised of psychiatrists, general surgeons, OBGYN, immunologists, urgent care physicians, pain management physicians, dermatologists, gastroenterologists and anesthesiologists.

Low Risk Specialist Hearing Screening Protocol:
(Gastroenterologist, OBGYN, Immunologist/Allergist, Dermatology, Psychiatrist, General Surgery)

In the event that a physician notices a patient exhibiting any of the following behaviors please perform the following Mini-Screen:

- Incorrect/off topic responses
- Requests to repeat what the physician has said
- Requests to speak louder
- Excessive use of the words "What" or "Excuse Me" and their variations
- Visible straining to understand instructions

1) Ask if the patient ever experiences difficulty hearing or communicating with others.
If the patient answers yes, suggest that the patient bring this concern to their primary care physicians attention so that the PCP can perform a screening for hearing loss. At the conclusion of the appointment, ask if the patient has heard and understood all of their medical information presented during the visit.

Rationale for Protocol Construction

Screening tests used by primary care physicians are varied ranging from: the whispered voice and finger rub test, single question screening, handheld audiometers and self-administered questionnaires such as the HHIE-S. Reliability and validity of these measures have been infrequently studied in primary care; however, Strawbridge and Wallhagen (2017) found that simple tests were just as reliable as a hand-held audiometer and Yueh, et al. (2003) found that a combination of the Audioscope (a hand-held combination otoscope/audiometer) and self-administered Hearing Handicap Inventory for the Elderly-Screening [HHIE-S] was the most valid combination used for the detection of hearing loss. Gates et al., (2003) compared the HHI and a simple question namely asking whether or not a patient has a hearing problem and found the single question to be as effective if not more so than the HHIE-S in identifying persons with unrecognized handicapping hearing loss. Their data suggest that for patients in a low risk population, simply asking if they have a hearing problem may be sufficient and beneficial to both patients and physicians as it is an inexpensive and time efficient measure to identify people who should have a baseline test. Johnson et. al, 2009 also came to similar conclusions that a combination of time saving self- assessment questionnaires and the use of plain questions about hearing status can be just as effective as more objective measures. This research should encourage PCP's to at least ask their patients whether they have a hearing problem and to refer patients who report that they do for formal testing. Finally, the whispered voice test was evaluated via systematic review in 2003. The results of the review indicated the whispered voice test to be simple to administer, accurate, and comparable measure as compared to the use of an Audioscope (McCullaugh and Frank, 2012). Strawbridge & Wallhagen (2017) concluded that simple screening procedures can be used to identify older adults with hearing loss in a primary

care setting to facilitate early referral and treatment. The sensitivity of these measures as stated by Strawbridge and Wallhagen were as follows: direct question (89%), indirect question (85%) and the whisper test (79%). Finally, in order to be most effective, Weinstein (2011) suggests we target individuals with co-comorbid conditions in whom identifying a hearing related conditions to help physicians better manage the patient, improve the patient's ability to understand health instructions, and participate in shared decision making

Treatment of Hearing Loss

Increased use of these screening measures for hearing loss, we hypothesize will lead to the earlier treatment of handicapping hearing loss in older adults. The most widely accepted treatment for handicapping hearing loss is use of a hearing aid (Bainbridge & Wallhagen 2014). In a recent systematic review, hearing aids have been shown to lead to an improvement in quality of life and facilitate ease of communication by reducing the negative psychological, emotional and social effects of hearing loss (Bainbridge & Wallhagen 2014). Hearing aids have also been efficacious in lowering odds of incurring a major depressive disorder (MDD) and depressive symptoms (Mener et al., 2013), lowering risk of cognitive decline via improved audibility and associated increases in self-efficacy (Dawes et al., 2015) and ultimately reducing mortality risk in both men and women (Fisher et al., 2014). Yes, management strategies for age related hearing loss can be costly, yet the indirect costs due to lost productivity among people with communication difficulties are also substantial and likely to grow (Bainbridge & Wallhagen, 2014)

CONCLUSION

The creation of a tiered hearing screening protocol will aid in the identification of older adults at risk for hearing loss and will help to raise awareness to patients and physicians of the connection between hearing loss and overall health outcomes. Physicians have a responsibility to ensure that medical information is understood by their patients, to share with a patient when they are at increased risk of experiencing hearing loss due to their current medical conditions, and finally to suggest a hearing test when cognitive decline is a concern for the patient or the physician. There is a role for every medical professional to play in the raising of hearing health awareness. Hearing impairment may affect disclosure of important signs and symptoms as well as the comprehension of medical conversations surrounding chronic disease management. General practitioners can play a critical role in improving medical communication by responding with sensitivity to the signs of hearing impairment in their patients (Marlow et al., 2017).

Data from this study revealed that only 20% of physicians are routinely screening for hearing loss in their practice, and an additional 26% reported that they would only screen for hearing loss occasionally. Of the 46% of physicians found to be performing hearing screening, the chosen method of screening by 75% of respondents was simply asking the patient if they were having trouble hearing. This is an encouraging finding, because research has revealed that simply noticing a patient is having difficulty hearing or understanding medical information presented to them and making the recommendation or referral for the patient to have their hearing tested can make all the difference (Johnson et al., 2009; Strawbridge & Wallhagen 2017). The screening protocol developed from the gathered attitudes of physicians, will aim to overcome the perceived barriers to performing hearing screening that was reported by the respondents in our survey. It is our mission to help physicians to be able to screen for hearing

loss more efficiently and to identify a greater number of patients at risk for hearing loss. By separating patients into high-risk and low-risk categories, it is the goal of this protocol to identify more patients with hearing loss at an earlier stage; all the while considering the concerns that physicians expressed in our survey for saving time, money and resources in their practice. Unfortunately, according to response analytics our survey revealed that physicians were largely unaware of all of the risk factors associated with an increased risk of hearing loss. Knowledge of these risk factors will be critical for the screening protocol's efficacy and therefore, greater physician education regarding these risks and increased communication between physicians and audiologists will be needed in order for these screening tools to be successful.

Some potential study limitations were that response rate (47%) was relatively low, as it has been when similar studies have attempted to pool the attitudes and practices of physicians screening for hearing loss. Another limitation could be that physicians knew an audiology student had constructed and distributed the survey, as a result, physicians could have felt indirectly obligated to choose audiologists as one of their referral choices. Future studies should try to recruit a greater number of participants from each medical background so that individual inferences can be made based on the physician's specialty and how their specialty might influence and/or increase referrals for audiologic evaluation. Future studies should also attempt to validate the use of the screening tools created. It would also be useful to conduct a follow-up study to see if physician referrals were increased simply by participating in the survey and being exposed to various hearing health care issues and exposure to the possible risk factors associated with hearing loss.

In conclusion, physicians choosing to screen for hearing loss and exercising their positive influence on patient's will ultimately help to improve their patients' quality of life when their

barriers to communication and socialization have been addressed. Countless studies have shown and replicated that severity of hearing loss has been associated with reduced quality of life measures in older adults as measured by a variety of validated instruments (Dalton et al., 2003; Bainbridge & Wallhagen 2014; Dalton et al., 2003). Hearing loss has also been associated with depression and anxiety (Bernabei et al., 2011; Mener et al., 2013), increased incidence of falls (Gopinath et al., 2016; Lin & Ferrucci 2012), cognitive impairment (Lin et al., 2013; Uchida et al., 2018), dementia (Livingston & Frankish 2015; Orgeta et al., 2018), and ultimately an increased risk of mortality (Lopez et al., 2011; Fisher et al., 2014). Physicians should be concerned with their patients hearing status not only for the potential negative implications of untreated hearing loss, but also to ensure the highest standard of care for their patients. Being that hearing impairment can interfere with physician patient communication and thus quality of health care, an effective physician- patient relationship was found to be associated with improved health outcomes, greater compliance with therapy, increased patient satisfaction and greater efficacy of care (Marlow et al., 2017; Weinstein 2014; Cohen et al., 2017).

It is hypothesized that if primary care and specialty physicians were aware of the health detriments and potential risk factors associated with hearing loss, that physicians would choose to take a more active role in screening for hearing loss. It is further assumed, that should their perceived barriers to screening be overcome with a simple, time efficient and cost-effective solution for hearing screening that they would be more inclined to do so routinely. We also hypothesize that through increased use of these screening measures, that audiology referral and ultimately hearing aid adoption would increase. Both physicians and their patients can benefit from reducing potential communication barriers affecting the transfer of medical knowledge and related health information. Screening for hearing loss can help to identify when a potential

communication barrier exists and ultimately lead to the physician's diligence in ensuring important medical information has been heard correctly and understood. Improving the physician- patient relationship can help lead to earlier diagnosis of chronic disease, increase patient compliance, patient satisfaction and ultimately the efficacy of health care as a whole (Marlow et al., 2017).

APPENDIX A. SURVEY QUESTIONS

Screening for Hearing Loss: Physician Attitudes and Practice

1. What is your area of Medical Practice?

- ○ Primary Care Physician
- ○ Ear Nose and Throat Specialist/ Otolaryngologist
- ○ Geriatrician
- ○ Neurologist
- ○ Cardiologist
- ○ Oncologist
- ○ Internist
- ○ Other (please specify)
- ○ Ophthalmologist
- ○ Osteopathic Medicine
- ○ Pediatrician
- ○ Psychiatrist
- ○ Rheumatologist
- ○ Pulmonologist

2. Do you routinely screen for hearing loss?

- ○ Yes
- ○ No

3. Do you occasionally screen for hearing loss in your practice?

- ○ Yes
- ○ No

4. If you answered YES to either of the above questions, how do you screen for hearing loss?

- ☐ Ask patient if they are having difficulty hearing or communicating
- ☐ Automatic or portable screener
- ☐ Otoacoustic Emissions
- ☐ Whisper Test
- ☐ Other (please specify)
- ☐ Finger Test
- ☐ Subjective Assessment/ Questionnaire: such as Hearing Handicap Inventory
- ☐ Tuning fork test

5. If you answered NO for questions one or two, what is the primary reason that you do not routinely screen for hearing loss?

- ◯ Too time consuming
- ◯ Perceived low risk population of patients in your practice
- ◯ Lack of resources/personnel/ equipment
- ◯ Lack of awareness about hearing screening or associated risks of untreated hearing loss
- ◯ Lack of urgency or importance to screen for hearing
- ◯ Lack of reimbursement for services
- ◯ Other (please specify)

6. To which of the following professionals would you refer a patient complaining of difficulty hearing and understanding others?

- ☐ Audiologist
- ☐ Otolaryngologist
- ☐ Hearing instrument specialist/dispenser

7. Which of the following behaviors, if any, do you associate with hearing loss?

- ☐ Incorrect/ off topic responses to questions
- ☐ Requests for repetitions when giving instructions
- ☐ Straining to understand what you are saying
- ☐ Requests to speak louder
- ☐ Use of a hearing aid
- ☐ None of the above
- ☐ Other (please specify)

8. Which of the following, if any, do you feel places a patient at an increased risk of having a hearing loss?

- ☐ Diabetes
- ☐ Treatment with chemotherapy, radiation or other ototoxic medications
- ☐ Kidney or liver diseases
- ☐ Occupational or recreational noise exposure
- ☐ Smoking
- ☐ Head trauma
- ☐ Cardiovascular disease
- ☐ Balance disorders
- ☐ None of the above

9. Thank you for taking time to participate in this survey! I will be using the responses obtained to formulate a hearing screening protocol for physicians.

If you are interested in receiving a copy of this protocol, along with my research on the importance of screening for hearing (comorbidities of hearing loss, consequences of untreated hearing loss, and assuring patient compliance and understanding of medical information for patients with hearing loss) please click yes below!

- ◯ Yes
- ◯ No

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