

City University of New York (CUNY)

CUNY Academic Works

All Dissertations, Theses, and Capstone
Projects

Dissertations, Theses, and Capstone Projects

6-2020

Primary Care Physician Perceptions of Hearing Loss and Amplification: A Survey

Sophie Racine

The Graduate Center, City University of New York

[How does access to this work benefit you? Let us know!](#)

More information about this work at: https://academicworks.cuny.edu/gc_etds/3723

Discover additional works at: <https://academicworks.cuny.edu>

This work is made publicly available by the City University of New York (CUNY).

Contact: AcademicWorks@cuny.edu

PRIMARY CARE PHYSICIAN PERCEPTIONS OF HEARING LOSS AND
AMPLIFICATION: A SURVEY

By

SOPHIE RACINE

A capstone research project submitted to the Graduate Faculty in Audiology in partial fulfillment of the requirements for the degree of Doctor of Audiology, The City University of New York

2020

©2020

SOPHIE RACINE

All Rights Reserved

PRIMARY CARE PHYSICIAN PERCEPTIONS OF HEARING LOSS AND
AMPLIFICATION: A SURVEY

By

SOPHIE RACINE

This manuscript has been read and accepted for the Graduate Faculty in Audiology in satisfaction of the dissertation requirement for the degree of Doctor of Audiology (Au.D).

Date

Dr. Barbara Weinstein, Ph.D.
Faculty Mentor/Advisor

Date

Dr. Brett A. Martin, Ph.D., CCC-A
Executive Officer

THE CITY UNIVERSITY OF NEW YORK

ABSTRACT

Primary Care Physician Perceptions of Hearing Loss and Amplification: A Survey

By

Sophie Racine

Advisor: Barbara Weinstein, Ph.D.

The goal of this survey is to determine primary care physicians' (PCP) views regarding hearing loss and hearing amplification. A questionnaire was created, using TypeForm©. Factors interrogated in the survey included structural aspects of the health care delivery system, presence of stigma among providers regarding hearing amplification, PCPs' knowledge of hearing loss, the utility of amplification, official recommendations on screening and amplification, costs of hearing aids and risks of untreated hearing loss, and practitioners' viewpoints and practice behaviors surrounding hearing loss and amplification. The survey instrument is comprised of four domains: 1) demographics, 2) knowledge of hearing loss and amplification, 3) preferences of hearing loss and amplification and 4) practice behaviors relating to hearing loss and amplification. Questions were created and collected from previous research studies of PCPs' knowledge of hearing loss. The aim of this project is to contribute to our understanding of the relationship between PCP's demographics, knowledge, preferences and practice behaviors in terms of hearing health care. Ultimately, the objective of this research is to help improve the hearing health of individuals who report hearing difficulties to PCPs in the first place, by encouraging better communication between PCPs and hearing health professionals for patients.

ACKNOWLEDGEMENTS

First and foremost, I would like to express my deepest gratitude to my mentor, Dr. Weinstein, without whom this project would not have been possible. Thank you for your ongoing support and insight. Your guidance these last four years has encouraged me to think critically, challenge myself, and ultimately produce a project that I am incredibly proud of. Your passion and vision have deeply inspired me, both as a clinician and researcher.

I would also like to thank my clinical supervisors for sharing their wealth of knowledge and experiences with me. Your support and feedback have helped shape me into the clinician I am today. I am grateful and honored to have learned from each of you.

To my family and friends, thank you for your unwavering love and support throughout this journey.

Finally, to the audiologists throughout my life for whom I have been the patient: thank you for your wisdom, grace, patience, and support. You have each inspired me to pursue and achieve my dream. I am eternally grateful.

TABLE OF CONTENTS

ABSTRACT.....	iv
ACKNOWLEDGEMENTS.....	v
LIST OF TABLES.....	vii
LIST OF FIGURES.....	viii
INTRODUCTION.....	1
METHODS.....	13
RESULTS.....	18
DISCUSSION.....	31
CONCLUSIONS.....	39
APPENDIX A.....	39
REFERENCES.....	44

LIST OF TABLES

Table 1. <i>Questionnaire Categories</i>	15
Table 2. <i>Sample Demographics</i>	19
Table 3. <i>Knowledge of Hearing Health and Hearing Amplification</i>	20
Table 4. <i>Preferences of Physicians on Hearing Health and Hearing Amplification</i>	22
Table 5. <i>Practice Behavior of Physicians in Relation to Hearing Health and Hearing Amplification</i>	24
Table 6. <i>Bivariate Analysis of Demographics, Knowledge, Preferences and Practice Behaviors</i>	28
Table 7. <i>Bivariate Analysis of Mean Scores of Knowledge and Preferences</i>	29
Table 8. <i>Multivariate Regression Model of Practice Behaviors and Geriatrics Specialty</i>	30

LIST OF FIGURES

Figure 1. *Demographics, Knowledge, Preference, & Practice Behaviors*.....16

Figure 2. *Percentage of Physicians’ Knowledge on Hearing Loss Risk Factors*.....21

Figure 3. *Pie Chart of Physicians’ Practice Behaviors: Medical Training of Hearing Loss Risk Factors*.....25

Figure 4. *Referral for Hearing Test in the Past 6 Months*.....25

Figure 5. *Frequency of Discussing Hearing Difficulties with Patients*.....25

Figure 6. *AUD to MD Toolkit-Educate, Identify and Bridge*.....38

INTRODUCTION

There are approximately 48 million people over the age of 18 who have difficulty hearing and approximately 38 million adults in the United States who could benefit from using hearing aids (National Institute on Deafness and Other Communication Disorders, 2016, Powers & Rogin, 2019). Estimates of percentage of adults using amplification range from 16 to 24.6% (NIDCD, 2016). While 3.77 million hearing aid units were dispensed in the United States in 2017, up from a total of 3.6 million in 2016, this 3.4% gain was modest in comparison to previous two years. In 2015 and 2016, sales increased by 7.2% and 8.7% respectively, which was more in line with the industry's historical norm of a 2-4% annual growth rate. According to the MarkeTrak X (2019) report there are some additional trends regarding hearing aid sales. The rate of first-time buyers of hearing aids rose to 56% in 2018 from 37% in 2008; and satisfaction with hearing aids increased from 74% in 2008 to 83% in 2019 (Powers & Rogin, 2019). Despite the increase in hearing aid purchases and satisfaction rate, patients, on average, are knowingly living with hearing loss for between 8 to 12 years before purchasing hearing aids (Simpson, et al., 2019; Powers & Rogin, 2019).

Why is there a long delay between first learning that one has hearing difficulties and the decision to purchase hearing aids? There are a number of explanations with one possibly having to do with the care seeking behavior of most individuals and/or readiness/activation levels (Simpson et al., 2019). Another possibility is the provider with whom the individual consults to help with a decision regarding their hearing health. Many patients do not seek out audiologists as the first professional to consult about their hearing difficulties but rather they first approach their primary care physician (PCP).

According to the United States Department of Labor there are approximately 126 thousand PCPs in the country (U.S. Bureau of Labor Statistics, 2017). Unfortunately, referral rates to otolaryngologists and audiologists from PCPs are low at less than 35% for both professionals (Mahlboubi et al., 2017). Moreover, reports have shown that PCPs perform different types of hearing screening to determine if a patient can hear. Most of these evaluations are subjective and do not help determine the type (sensorineural or conductive hearing loss), the configuration (mild to profound), and/or the etiology of the hearing loss. While these hearing screenings may identify the presence or absence of a hearing disorder, they do not determine the risk of untreated hearing loss. In the absence of such a risk assessment, the urgency of arranging referral to an audiologist may not occur to a PCP. To better understand how PCPs evaluate and interpret the importance of assessing those with hearing difficulties, it is useful to look at the attributes (e.g., demographics, practice behavior) of PCPs, which may explain how they manage persons complaining of hearing difficulties.

The following literature review will summarize some of the research conducted to determine PCPs' opinion about hearing loss and amplification as a disorder and solution for patients, respectively. This review will highlight what is known about different aspects that might affect PCPs' outlooks on amplification. Specifically, it will focus on the structure of healthcare delivery, the knowledge that PCPs have of hearing loss, amplification (including over-the-counter (OTC) hearing aids), recommendations, costs of untreated hearing loss and lastly, the role played by stigma of amplification in relation to PCPs' opinions of hearing amplification.

There are several approaches to address the question of PCPs' attitude towards amplification and over-the-counter amplification as options for patients with hearing loss. In order to understand how PCPs might view amplification, it is important to recognize how the state of the healthcare system might influence one's opinion of amplification. For the evaluation of any health condition, including hearing loss, the time the PCP has to spend with a patient is of critical importance. Without sufficient time, a PCP is simply unable to conduct a meaningful evaluation of all the potential conditions and concerns exhibited by a patient during a routine healthcare visit. The 2017 Medscape Physician Compensation Report stated that 29% of PCPs in United States spend approximately 13-16 minutes with each patient and since then that time has improved to approximately 17-24 minutes. Time spent with a PCP is an important factor in determining patient satisfaction. Flocke et al., (1997) reported that patients who spend less time with their PCPs are less satisfied with the care from the visit. The research was a cross-sectional observational study that surveyed 2,881 patients visiting 138 PCP practices in Ohio. Using Components of Primary Care Instrument (CPCI) as a measure for patient satisfaction, the study sought to compare patient reported satisfaction across different physician interaction styles (person focused, biopsychosocial, biomedical, and high physician control). The results showed that patients were more satisfied with a person-focused approach that included longer visits than with high physician control and shorter visits. Importantly, PCPs who were more person-focused tended to have longer appointments because they were more engaged with patients (Flocke et al., 1997). However, there are limitations to this research. The study did not control for the self-selection of PCPs by the patient leading to a risk of bias of chosen PCPs. The study also

did not control for the demographic of participants who completed the survey. The majority of the subjects were an older demographic who were more likely to complete the survey than a younger population. Lastly, the study was conducted in Ohio. Therefore, the results cannot be generalized to other practices, environments, towns or cities. Despite the limitations, these results are consistent with other studies that a person-centered PCP approach is more successful in practice. While we did not employ the CPCI, the current survey included elements designed to understand PCPs practice behaviors regarding hearing health.

Bertakis et al., (1991) also reviewed the relationship between physicians practice styles and patient satisfaction. This study specifically described two different styles that physicians use to conduct during medical visits: affiliation and/or control. The first method created a positive relationship between physicians and patients by producing a non-judgmental zone overlaid with empathy. The second technique included behaviors that maintain physician's status and authority in the field. Patient satisfaction was measured through an adapted 43-item questionnaire. The results indicated that physicians who initiate more verbal interactions during the appointment have higher satisfaction rate than those who dominate the sessions. When the results of visits included psychosocial topics, patients were more satisfied with results than when the conversations were limited to biomedical discussion. The more questions physicians asked about psychosocial health, the more responsive and satisfied patients were during the visit. The study suggests that physicians and medical students should acquire communication skills in order to achieve higher patient satisfaction reports (Bertakis et al, 1991). Just as with any other study, there were several limitations to the research. Illustratively, the selection

used for the study targeted mostly adult patients with chronic illnesses, which is not the usual population found at primary care practices, and thus, limiting the generalization of the results. In addition, Bertakis et al., 1991 did not control for other variables that might affect patients' satisfaction such as day-to-day activities or events affecting their quality of life. That being said, the findings did suggest that PCPs who asked more frequent psychosocial questions were more likely to have higher satisfaction rates from patients. Bertakis et al., (1991) also concluded that PCPs and medical students should learn communication strategies because patients with communication disorders such as hearing loss were at risk of missing information. The findings of these two studies suggest that a PCP's awareness of the importance of communication with his or her patient is a critical factor in determining patient satisfaction, giving added relevance to the motivation for the current survey.

Regardless of how PCPs conduct their sessions, patients still turn to them as the first resource for any health-related problem. Popp and Hackett (2002) reported that 63% of people turn to PCPs as their first source of information regarding hearing health (Popp & Hackett, 2002). Similarly, Kochkin (2009) reported that patients were more likely to listen to their PCPs regarding *any* recommendation. This raises the question about the role of PCPs as advocates for patients with hearing loss. An important and more targeted question is how PCPs' views might affect how they interact with patients with hearing loss and/or patients who need hearing amplification, and how these patients, in turn, perceive the visit. This is particularly salient for a healthcare structure in which PCPs spend less time with patients.

Mahlboubi et al., (2017) conducted a study to determine treatment patterns among patients with hearing loss. Specifically, they reviewed responses from adults who participated in the 2014 National Health Interview Survey, a large database with questions about hearing status and physician referrals. Of the 239.6 million adults who participated, 40.3 million reported hearing difficulties (range from “excellent/good to “deaf”) and 48.8 million visited PCPs for hearing problems. Of these, only 32.6% and 27.3% were referred to otolaryngologists and audiologists, respectively. Hearing that was reported functional was determined through the individual’s ability to hear “whispers”, “normal voice”, “only hearing shouting”, and “not appreciating shouting”. Reportedly, 95.5% of the patients could hear whispers or normal voices, 3.4% could hear only through shouting, and 1.1% did not appreciate the shouting. Of the individuals who indicated trouble with hearing, 32.2% had never seen a clinician for hearing difficulties and 28% never had a hearing test performed. This study, however, did have limitations such that the responses were based on subject’s entry and recall bias. The data were subjective and not objective. The presence of hearing loss was determined subjectively (no audiometric data, type of hearing loss, configuration of hearing loss) as well. The investigation offered insight to self-reported hearing loss and the care delivered for such complaints, thus helping researchers understand how to change the health care industry to provide better care for hearing difficulties. This current research will provide information on PCPs’ perspective regarding hearing health care rather than the patients’ standpoint. It is important to gain understanding from both patients and PCPs to help identify the areas that can be improved in providing better care for patients with hearing loss.

Beyond the structure of the visit, the knowledge of how and when to conduct hearing screenings in a primary care setting is also very important. The U.S. Preventive Services Task Force (USPSTF, 2012) updated recommendation statements regarding mandated hearing screening for adults aged 50 or older. Chou et al., (2011) reviewed the literature to help provide better recommendations for PCPs regarding hearing screenings. The review determined that there is no harm or benefit to PCPs screening for hearing using the different subjective screening assessments such as the whisper or finger-rubbing test. However, the literature review did note that the screenings used in the PCPs' offices should be standardized (Chou et al., 2011). There is little evidence either of the effectiveness of the screening tools or what is the most appropriate age to initiate hearing screenings. Therefore, the report concluded that there needs to be more research on the effective methods for improving follow-up rates and acceptance of recommended treatments after screenings (Chou et al., 2011). This survey will dive further into how PCPs' choose the appropriate recommendations for patients who complain of hearing loss. Reviewing the PCPs' views on referrals for patients at risk of hearing loss may help bridge the gap between hearing health professionals and PCPs as well as improve hearing health care.

Results of the current survey may show that the healthcare delivery structure has no bearing on how PCPs view hearing amplification for their patients. Instead, we may find that the lack of hearing amplification referrals is due to PCPs' knowledge of appropriate recommendations to give to patients with hearing impairment. Kochkin (2009) reported on MarkeTrak VIII that PCPs are more likely to positively recommend amplification to 4% but negatively recommend amplification to 18% of people with mild

hearing loss. For those with moderate to severe hearing loss PCPs are likely to positively recommend amplification to only 16% but negatively recommend amplification to 16% as well (Kochkin, 2009). These results indicate that PCPs are not often recommending amplification to patients with mild and moderate-severe hearing loss. However, the results only cover the patients who took the survey *and* who understand they have hearing loss or who are aware of their hearing loss, not the patients who were unaware of their hearing loss and/or who have not accepted the hearing loss as a health problem. Therefore, adoptees of hearing amplifications were not included as respondents. Abrams et al., (2015) reported on MarkeTrak IX that approximately one-third of the respondents to the survey indicated that the PCPs discussed or screened their hearing as part of the appointment. In fact, 55% of non-hearing aid owners reported that the PCPs validated their concern of hearing difficulties. However, 30% reported that their PCPs noted that their hearing loss did not warrant hearing aids (Abrams et al., 2015).

If PCPs were more likely to recommend hearing amplification, the number of years waiting before purchasing hearing amplification might decrease. Johnson, Carole, Danhauer, et al., (2009) reported in a survey, conducted on 95 PCPs across the country, that 59% of the respondents were unsure of whether most non-medical hearing losses could be treated effectively with hearing aids. Only 13% of the PCPs' population across the country responded. The result is revealing in that it questions PCPs' knowledge and ability to provide appropriate recommendations for different types of hearing losses. However, it is not as robust as it might have been, had the survey respondents been larger. Therefore, the question remains whether PCPs are less likely to recommend

amplification due to their lack of knowledge on amplification or due to picking the appropriate recommendations for the different type of hearing losses.

PCPs may be aware of hearing loss and recommendations but might not be aware of the different hearing loss range and the day-to-day life implication that hearing loss has on patients. In the same survey as above, Popp and Hackett (2002) surveyed physicians' knowledge on hearing loss identification and counseling. The survey only reported 27 participants of the 131 physicians resulting in a 20% response rate. Nearly 33% of the physicians participating in the study reported their knowledge of medical options for hearing loss to be fair or poor (Popp & Hackett, 2002). While the survey limitations include small sample size, the result still indicates some lack of awareness regarding how hearing loss might affect a patient's daily activity. PCPs who are not familiar with the struggles might not readily recommend amplification because it is not their first priority. In the same study, 80% of PCPs indicated that they would continue education seminars on hearing loss and hearing instruments, if available. Counseling is a large factor for how comfortable patients feel with results and recommendations. Furthermore, if PCPs are uncomfortable or are not knowledgeable in counseling patients with hearing loss, they might be less likely to recommend hearing amplifications. These results indicate a gap between hearing health knowledge and solutions, with the caveat that the responses are limited in number and therefore cannot be generalized to all PCPs' perspectives.

Despite the above-mentioned knowledge gap, it should be acknowledged that PCPs have a unique rapport with their patients, especially patients who visit them first regarding any hearing difficulties (Kochkin, 1998). When PCPs are familiar with their

patients, they might argue that hearing amplification is not always the best solution for the patients. Some of the reasons might include that patients are not likely to adapt to new technology or that patients are not likely to accept hearing amplification because of the negative stigma of hearing aids. Therefore, PCPs holding such views would be less likely to recommend hearing amplification. Poost-Foroosh, et al., (2009) conducted a study on how client-clinician interaction influences hearing aid adoption. The research reviewed client group (patients) between 45-85 years of age with acquired hearing loss and who have received the recommendation of hearing aids within 3 months prior to the study. The research was designed to review statements of the patients during sessions. A point scale rated the statements which included comments on comfort, understanding, acknowledgement of patients, percent centered care and actions, discomfort and more. The results indicated that patients were more likely to pursue hearing aids if they were more comfortable rather than pressured into purchasing the devices (Poost-Foroosh, Jennings, Shaw, Meston, & Cheesman, 2011). However, the study has limitations such as the small sample size of participants, making it difficult to generalize results and leaving the study underpowered. In spite of the small sample size, the results underscore the negative stigma of hearing amplification, which in turn discourages patients to pursue them (David & Werner, 2016). There has been little reported on how PCPs view the stigma of hearing amplification and whether the stigma influences their practice behaviors.

Even though patients usually go to PCPs for first-hand information about hearing loss, PCPs may not be aware of the cost and risks posed by untreated hearing loss. Little research has been conducted on PCP's knowledge of cost risks and hearing loss. There

have been reports that show that there is a high cost effect of untreated hearing loss on patients. World Health Organization (WHO, 2020) conducted a study to calculate the economic costs of untreated hearing loss. The cost for the health care sector is estimated to be \$67-107 billion while the costs for the education sector to support children from ages 5-14 with untreated hearing loss is \$3.9 billion. The loss of productivity due to unemployment among those with hearing loss is estimated to be \$105 billion annually. Overall, the annual costs of untreated hearing loss ranges between \$750-790 billion globally (WHO, 2017). Billions of dollars are wasted on industries due to untreated hearing loss that can be addressed with hearing amplifications. Abrams et al., (2005) compared the cost-effectiveness of hearing aids with that of hearing aids and audiological rehabilitation post hearing-aid fitting. For adults with mild hearing loss (sensorineural) the results indicated higher cost effectiveness of hearing aids and rehabilitation. In short, patients who have both hearing amplification and rehabilitation were more likely to save money than those with just hearing amplification. Similarly, Ciorba et al., (2012) conducted a study showing that the fitting of hearing aids is cost effective for patients with mild hearing loss, suggesting that even hearing losses that are mild still benefit from hearing amplification (Ciorba et al., 2012). However, this study is limited to only people with mild hearing loss. Some hearing losses such as profound may not have the same benefits as a mild hearing loss. Therefore, the study cannot be generalized to other hearing loss ranges. At the same time, it is important to note that mild hearing loss has been infrequently studied so that people may be less aware of its implications on daily life. A majority of research indicates that untreated hearing loss places a large financial burden on individuals. Past studies do not address the question as to whether PCPs are

aware of the enormous effects of hearing amplifications on individuals' spending in the long term. PCPs may not be familiar with untreated hearing loss leading to other accidents and injuries causing medical bills to increase dramatically in a short period of time. It is important as audiologists and hearing health care professionals to educate PCPs on possible questions and recommendations for patients who have experienced years of untreated hearing loss. Various toolkits have been utilized as a guide for audiologists to engage physicians in conversations around risks of undiagnosed hearing loss. Medicare Annual Wellness Visit (AWV) was introduced in 2011 to shift the focus of acute medical issues (i.e. hearing loss) to early identification and intervention (Weinstein, 2019). Interventional Audiology Toolkit was created in 2016 as a guide for audiologists to engage with local PCPs (Tayler & Tysoe, 2016). Cost risks of untreated hearing loss could affect how PCPs view amplifications in the future. Thus, hearing health care professionals could be the guiding force in educating physicians on the risks of untreated hearing loss.

Current and past research has addressed different aspects of the health care system and PCPs' relationship with patients. Different studies appear to agree that PCPs are less likely to recommend hearing amplification. The reason for PCPs not recommending hearing amplification has been linked to time and other pressing concerns during initial office visits. The need for this research is to gain better understanding of PCPs' opinions of amplification as the literature remains limited in this area. The goal of the current research is to address the different possible avenues that influence PCPs' view of hearing loss and hearing amplification. This may lead to a more complete understanding of the underlying reasons for why PCPs do not recommend amplification. Past research has not

reviewed PCPs' attitude towards amplification through different lenses. This survey, specifically, will review the PCPs' knowledge of hearing loss and hearing amplification, preferences of hearing amplification, and practice behaviors within the scope of hearing health care. By interpreting through different lenses, it will help us understand how to better improve communication between PCPs' and hearing health professionals. The ultimate aim of this study is to further understand and explore ways to improve hearing health for those millions with hearing loss. The study will address four main questions:

1. Demographics:
 - a. How do the selected characteristics of physicians influence their understanding of hearing loss and hearing amplification?
 - b. How do selected characteristics of physicians impact their preferences/attitudes about hearing aids/amplification?
2. Knowledge and Preferences:
 - a. How does knowledge about hearing loss and amplification impact physician preferences in terms of hearing health care and hearing aids/amplification?
3. Practice Behaviors
 - a. What are the impacts of demographics, knowledge, and/or preferences of hearing health care options on physician practice behaviors?

METHODS

Participants

Participants (male and females) were primary care physicians affiliated with Montefiore Health System in the Bronx, NY. They were eligible for the study inclusion if they were English speaking and post-residency practicing in NY. The list of physicians

was provided by The Montefiore Care Management Organization (CMO), a wholly owned subsidiary of Montefiore Health System that maintains a roster of credentialed physicians associated with the medical center. 620 physicians were contacted individually via email to participate in the survey. Individuals were excluded from the study if they were specialty medical doctors (non-primary care) or practicing outside NY State. The subjects were invited to participate at their discretion and were informed that all answers would remain anonymous. They were informed that the survey answers were designed to elicit PCPs' views on hearing health care and amplification options to further improve the communication between physicians and audiologists. Internet based informed consent forms were included as part of the survey to facilitate participation and confirm the legitimacy of the survey.

Materials

A questionnaire was created with responses gathered and analyzed using Typeform[©] survey platform, to assess PCPs' knowledge of hearing amplification (options, prices and resources), to characterize PCPs' personal opinions on hearing amplification, and to gauge PCPs' thoughts and practice behaviors on hearing health care. The questions comprising the survey pertained to demographics, hearing amplification options, appropriate intervention, possible outcomes of hearing loss risk factors and treatment of hearing loss. The survey consisted of 21 items, shown in Table 1. Questions were derived from collection of previous research studies attempting to measure PCPs' knowledge on age-related hearing loss (Popp & Hackett, 2002; Danhauer, et al., 2008; Johnson, et al., 2008).

Table 1. Questionnaire Categories

Type	Demographics	Binary (Yes/No)	Multiple Answer Multiple Choice	Single Answer Multiple Choice	Likert Scale	Total
Demographic	4	1	-	-	-	5
Knowledge	-	1	-	1	3	5
Preferences/Attitudes	-	-	-	1	3	4
Practice Behavior	-	-	1	5	1	7
Total	4	2	1	7	7	21

Five questions asked for basic demographic elements (including whether or not the respondent wore hearing aids him or herself), five explored hearing-related practice behaviors employed by the respondents, five queried the respondents' knowledge regarding hearing-related subjects and four questions explored the attitudes of the respondents toward hearing-related issues. One question asked whether or not the respondent received formal training in hearing-related issues as a trainee. The questionnaire format was divided into several categories: Demographics questions (4 questions), binary response questions (2 questions), a multiple answer multiple choice question (1 question), single answer multiple choice questions (7 questions), and Likert questions (7 questions). Percentages of responses were analyzed based on the number of persons responding to the survey out of the total number of persons surveyed.

Procedures

The study was approved by the Institutional Review Board of the Graduate Center, CUNY. Following approval, the survey was emailed to the list of primary care physicians provided by Montefiore CMO. Participants were sent a reminder email every three to four weeks from October 2019 to February 2020 to maximize response rates. Participants were given the option to provide feedback in the survey, which also remained anonymous. Respondents did not receive any feedback or score regarding their

answers and all answers remained confidential. 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.

Statistical Analyses

Data from the survey were entered into STATA for statistical analysis. To begin with, percentages of each response were tabulated to display the distribution of answers received from all respondents grouped into the four main categories: demographics, practice behaviors, knowledge of hearing-related items, and hearing-related attitudes/preferences of the respondents. The data were collected to understand the different relationship, as shown in Figure 1, across the responses between demographics and knowledge, demographics and attitudes/preferences, and whether knowledge impacts preferences which then impacts practice behaviors.

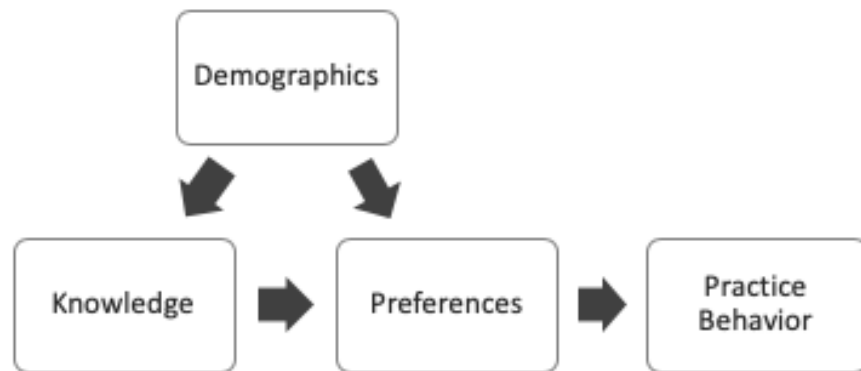


Figure 1. Demographics, Knowledge, Preference, & Practice Behaviors

Next, for each of the non-demographic domains, aggregate scores were calculated by combining the results from the five questions within the domain to define a singular score. For example, within the knowledge domain there were two questions, one multiple choice and one binary that had correct and incorrect responses. For the three Likert questions the “Agree” and “Somewhat agree” categories were combined and

considered correct while the “Neutral”, “Somewhat disagree” and “Disagree” responses were combined and considered incorrect responses. The total percent of correct responses out of the five knowledge questions was then tabulated for each respondent to arrive at an overall knowledge score.

The five preference questions were combined along a spectrum of hearing-aid acceptance where responses indicating greater acceptance of the use or recommendation of hearing aids received higher scores along the Likert scale compared with responses indicating less acceptance. The five questions in this domain were then combined into a single score with higher scores indicating an attitude of greater degree of hearing aid acceptance.

Bivariate analyses were conducted to assess the degree to which greater knowledge or greater degree of hearing aid acceptance was associated with certain demographic characteristics or with specific hearing-related behavior practices among the respondents. For dichotomous comparisons, chi square tests were employed to test for statistical significance. Since the knowledge and attitude scores were continuous variables, student t tests were used to test whether or not statistically significant differences existed with respect to these two domains between different demographic categories or with practice behaviors.

Finally, ordinary least squares multivariate regression models were fitted to estimate the association of the individual knowledge and attitude responses with different hearing-related physician practices controlling for demographic variables as covariates. We estimated three models: Model 1 included just demographic variables of sex, length of time in practice and type of physician; Model 2 added the mean knowledge score to

Model 1 and; Model 3 also added the mean preference score for a complete specification. We also tested logit specifications to determine whether or not the statistical significance of various coefficients were sensitive to model specification but found no differences. We report the OLS coefficients for ease of interpretation. In all calculations we used a significance factor of 0.05.

RESULTS

96 of the 620 individual PCPs contacted via email responded, representing a 15% response rate. The survey was designed to examine only primary care physicians; therefore, all responses were included in the analysis. The results are broken into several categories: demographics, knowledge, preferences, practice behaviors and relationships between the different categories.

Demographics

The physicians who responded to the survey are part of or affiliated with Montefiore Health System in the Bronx. Over half (67%), shown in Table 2, of the respondents were female and half (50%) were pediatricians. A little less than half (41%) have been in the work force for longer than 20 years. A majority of the respondents work in a Hospital or Medical University setting. It was identified that only three respondents wear hearing aids, one physician wears it all the time, while the other two respondents wear hearing aids sometimes.

Table 2. Sample Demographics

Item	Frequency (N=96)	Percent
Sex		
Female	64	67%
Male	32	33%
Specialty		
Family Medicine	18	19%
Internal Medicine	22	23%
Pediatrics	48	50%
Geriatrics	4	4%
Other	4	4%
Practice Setting		
Hospital	56	58%
Medical University	38	40%
Community Practice	37	39%
Private Practice	1	1%
Concierge Practice	0	0%
Other	11	11%
Years in Practice		
<5 years	17	18%
5 to 9 years	23	24%
10 to 14 years	9	9%
15-19 years	8	8%
>20 years	39	41%
Hearing Aid Usage		
Always	1	1%
Sometimes	2	2%
Never	92	96%

Knowledge

Knowledge questions, shown in Table 3, were broken into five different questions: cost of hearing aids, if hearing aids can be purchased online, if hearing loss is a risk factor for dementia, if hearing loss increases risk for falls, and if hearing loss increases risk of social isolation. Approximately half (47%) respondents answered that hearing aids cost \$2,000 each. A majority of respondents (59%) believed that hearing aids can be purchased online. 71% of the PCPs agreed (and somewhat agreed) that hearing loss is a modifiable risk for dementia, however 24% felt neutral about the statement. Respondents overwhelming agreed (and somewhat agreed) that hearing loss

increases risk for falls (86%) and social isolation (97%). Figure 2 shows that physicians appear more knowledgeable regarding risk factors of hearing loss in terms of social isolation than of dementia.

Table 3. Knowledge of Hearing Health and Hearing Amplification

Item	Frequency (N =96)	Percent
Cost of hearing aids		
\$500 each	25	26%
\$2,000 each	45	47%
\$4,000 each	22	23%
\$6,000 each	4	4%
Hearing aids can be purchased online		
Yes	59	61%
No	37	39%
Hearing loss is a modifiable risk for dementia		
Agree	40	42%
Somewhat agree	28	29%
Neutral	23	24%
Somewhat disagree	3	3%
Disagree	2	2%
Hearing loss increases risk for falls		
Agree	61	64%
Somewhat agree	21	22%
Neutral	13	14%
Somewhat disagree	1	1%
Disagree	0	0%
Hearing loss increases risk for social isolation		
Agree	89	93%
Somewhat agree	4	4%
Neutral	1	1%
Somewhat disagree	2	2%
Disagree	0	0%
Total Knowledge Score	Mean = 3.15	Std. Dev = 0.89

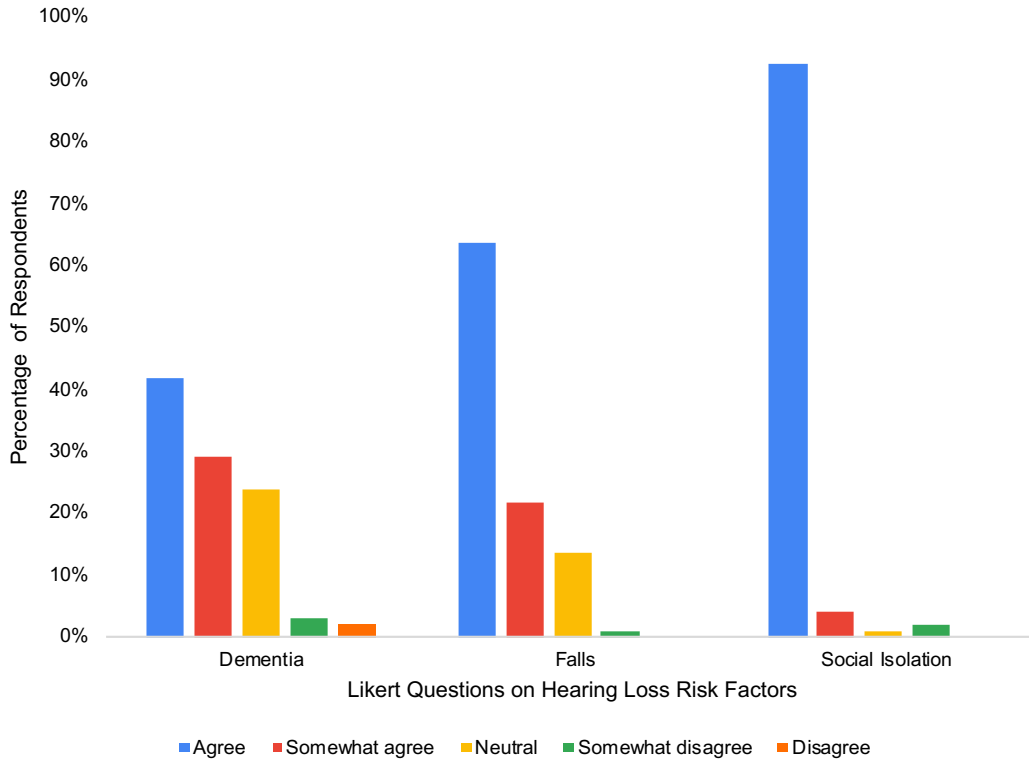


Figure 2. Percentage of Physicians' Knowledge on Hearing Loss Risk Factors

Preferences/Attitude

Questions addressing preferences of physicians in relation to hearing loss and hearing aids, shown in Table 4, were divided into four section: (1) are physicians aware of patients' beliefs that hearing aids are worthwhile investments, (2) do physicians believe that patients with age related hearing loss will benefit from hearing aids, (3) would physicians purchase hearing aids if they were struggling to hear, and lastly, (4) if a specialist recommended to a respondent that he or she wear hearing aids, would they wear the devices. More than half (84%) of the respondents believed that their patients were more agreeable to hearing devices as a worthwhile investment. 79% of the physicians agreed (and somewhat agreed) that patients with age related hearing loss would benefit from hearing aids. Physicians mostly agreed (and somewhat agreed) (76%) that if they perceived hearing difficulties, they would purchase hearing aids, while 89%

of physicians agreed (and somewhat agreed) that if a specialist recommended hearing aids to them, they would wear the devices.

Table 4. Preferences of Physicians on Hearing Health and Hearing Amplification

Item	Frequency (N =96)	Percent
Do your patients believe hearing aids are a worthwhile investment		
Yes	81	84%
No	15	16%
Most persons with age related hearing loss benefit from hearing aids		
Agree	52	54%
Somewhat agree	24	25%
Neutral	10	10%
Somewhat disagree	9	9%
Disagree	1	1%
If I had difficulty hearing, I would purchase hearing		
Agree	52	54%
Somewhat agree	21	22%
Neutral	17	18%
Somewhat disagree	4	4%
Disagree	2	2%
If a hearing specialist recommended hearing aids, I would wear them		
Agree	57	59%
Somewhat agree	29	30%
Neutral	9	9%
Somewhat disagree	1	1%
Disagree	0	0%
Total Preference Score	Mean = 3.3	Std. Dev = 0.82

Practice Behaviors

The last seven set of questions addressed physician responses to practice behaviors surrounding hearing loss and hearing aids. As shown in Table 5, physicians were asked:

1. How frequently in the past 6 months did they refer a patient for a hearing test when complaining of hearing difficulties?
2. How often in the past 6 months did they refer a patient complaining of hearing difficulties to a specialist for hearing aids?

3. Which specialist did the respondent refer patients for hearing difficulties/hearing aids?
4. How often did respondent discuss hearing loss with patients?
5. How often did respondents discuss hearing aids with patients?
6. How often did respondents raise their voice for patients?
7. Did they feel that their medical training prepared them to discuss risk factors surrounding hearing loss with their patients?

More than half the respondents referred anywhere between 0-4 patients in the past 6 months for a hearing test, shown in Figure 4. Similarly, more than half the physicians referred 0-4 patients for hearing aids due to hearing difficulties. 81% of the respondents would refer patients to an Audiologist and/or 72% to Ear, Nose, Throat (ENT) specialist if patient complained of hearing loss. More than half the physicians occasionally discuss hearing difficulties (63%), shown in Figure 5, hearing aids (59%) in Table 5, or raised their voice (67%) with their patients. Lastly, 28% of the physicians, shown in Figure 3, felt neutral that their medical training prepared them to discuss risk factors surrounding hearing loss.

Table 5. Preferences of Physicians on Hearing Health and Hearing Amplification

Item	Frequency (N =96)	Percent
How often in the past 6 months have you referred patient complaining of hearing difficulty for a hearing test		
0	28	29%
1 to 4	45	47%
5 to 10	17	18%
> 10	6	6%
How often in the past 6 months have you referred patient complaining of hearing to specialist to obtain hearing aids		
0	66	69%
1 to 4	20	21%
5 to 10	8	8%
> 10	2	2%
To which specialist do you refer patients who need hearing aids*		
Audiologist	78	81%
Ear Nose and Throat Doctor	69	72%
Hearing Aid Dispenser	1	1%
Cotsco	1	1%
Online	0	0%
Patient decides	8	8%
No one	3	3%
Do you ever discuss hearing problems with patients		
Always	12	13%
Usually	17	18%
Occasionally	60	63%
Never	6	6%
Do you ever discuss hearing aids with patients		
Always	3	3%
Usually	4	4%
Occasionally	57	59%
Never	32	33%
How often do you find raising your voice for patients to understand you		
Always	0	0%
Usually	6	6%
Occasionally	64	67%
Never	26	27%
My medical training prepared me to discuss risks of untreated hearing loss with patients		
Agree	17	18%
Somewhat agree	11	11%
Neutral	27	28%
Somewhat disagree	24	25%
Disagree	15	16%

*specialty referral question allowed multiple answers

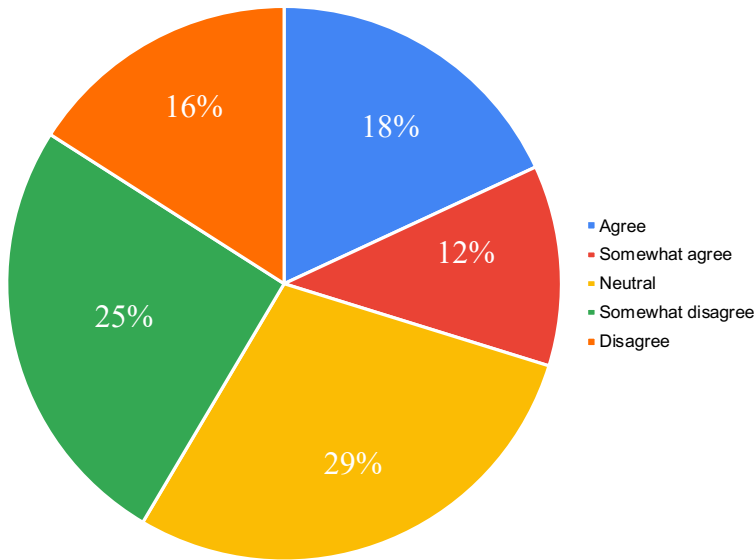


Figure 3. Pie Chart of Physicians' Practice Behaviors: Medical Training of Hearing Loss Risk Factors

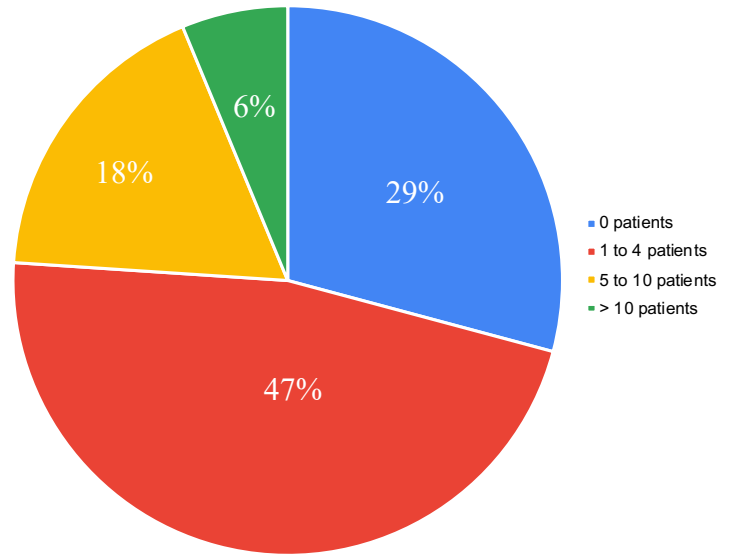


Figure 4. Referral for Hearing Test in the Past 6 Months

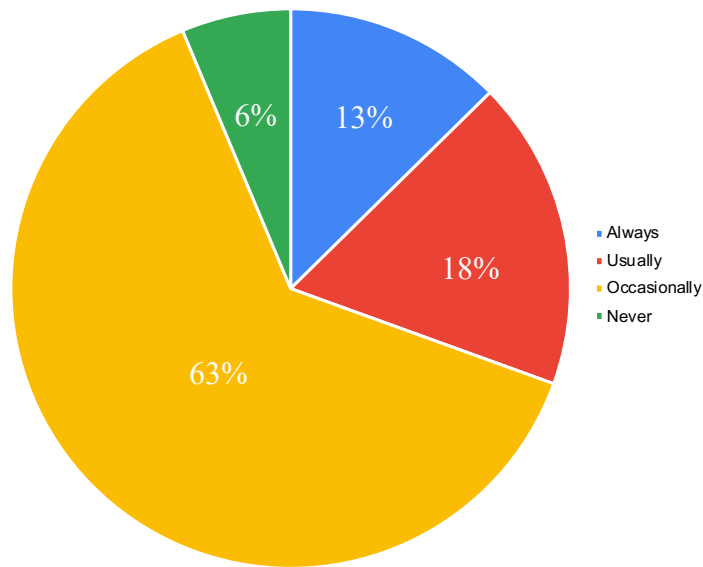


Figure 5. Frequency of Discussing Hearing Difficulties with Patients

Bivariate Analysis

Table 6 depicts bivariate analysis between the different variables used for each question and demographics (gender, tenure, and medical specialty). The table is divided into three sections: one depicting the relationship between the demographic variables and the elements within the knowledge score; a second showing the relationship between

demographic variables and the elements of the preferences/attitudes score; and a third showing the relationship between the demographic variables and the behaviors of physicians in practice. For questions with a yes/no response the cells indicate the percentage of respondents agreeing to the statement for each demographic category. For the overall score elements, the table summarizes the mean scores for each demographic category. The p-values are significant if less than 0.05. For overall knowledge score and overall preference score, since they are continuous variables, the differences between mean scores were evaluated using t-tests. There are several significant findings through this analysis. For example, gender of physician and if physicians believed that hearing loss was a modifiable risk factor for dementia revealed a significant p-value of 0.01 with male respondents being more likely to endorse this belief than female respondents. The different specialties demonstrated differences in practice behaviors with regard to likelihood of raising their voices with patients, likelihood of referring patients for hearing aids, and the degree to which they felt their medical training prepared them to discuss hearing loss risk factors.

Table 7 provides information on whether there were significant findings in the relationship between overall knowledge mean score and different preferences, and overall knowledge mean score with different practice behaviors. The table also shows the relationship between overall preference mean scores and different practice behaviors. With respect to knowledge mean scores, the table indicates that respondents who themselves believed that hearing aids were beneficial and those who believed that their patients felt that hearing aids were beneficial had higher mean knowledge scores than those who felt otherwise. Pearson's correlation analysis for the relationship between

overall mean knowledge score and overall mean preference score indicated a correlation of 0.21 ($p= 0.04$). There were no significant findings among overall mean knowledge score and practice behaviors. Similarly, there were no significant findings between overall preference mean score and practice behaviors.

Table 6. Bivariate Analysis of Demographics, Knowledge, Preferences and Practice Behaviors

	Sex			Tenure			MD Specialty					
	Male	Female	p-value	<10 years	>=10 years	p-value	Family Medicine	Internal Medicine	Geriatrics	Pediatrics	Other	p-value
Knowledge												
HA purchased online (% yes)	66%	59%	0.53	15%	85%	0.41	23%	20%	3%	50%	3%	0.45
HL risk factor for dementia (% yes)	88%	63%	0.01*	19%	81%	0.59	20%	23%	4%	45%	7%	0.48
HL risk factor for falls (% yes)	84%	86%	0.84	16%	84%	0.24	19%	24%	4%	48%	5%	0.85
HL risk factor for isolation (% yes)	100%	95%	0.21	17%	83%	0.46	18%	23%	4%	49%	5%	0.82
Overall knowledge score (mean score)	3.38	3.03	0.08	3.00	3.19	0.44	3.39	3.18	3.00	3.06	3.20	0.46
Preference/Attitudes												
Preferences of HA (% yes)	34%	66%	0.74	18%	82%	0.89	15%	25%	4%	49%	5%	0.43
HA referral by specialist (% yes)	33%	67%	0.64	18%	82%	0.51	20%	23%	5%	47%	6%	0.65
Perceived benefit of HA by patients (% yes)	34%	66%	0.72	16%	84%	0.39	18%	22%	4%	50%	5%	1.00
Overall preference score (mean score)	3.38	3.25	0.48	3.35	3.27	0.74	3.11	3.27	3.25	3.35	3.50	0.35
Practice Behavior												
Raising Voice (% yes)	81%	69%	0.19	21%	79%	0.12	23%	30%	6%	36%	6%	<0.01*
Referral for hearing test (% yes)	28%	72%	0.08	14%	86%	0.22	19%	19%	6%	52%	4%	0.43
Referral for HA (% yes)	40%	30%	0.35	23%	77%	0.37	26%	26%	13%	26%	10%	0.02*
Discussing HL (% yes)	31%	69%	0.08	23%	77%	0.37	20%	21%	4%	49%	4%	0.65
Referral to specialist for HL (% yes)	34%	66%	0.21	17%	83%	0.46	20%	22%	4%	50%	4%	0.22
Medical training on HL/HA (% yes)	21%	74%	0.16	11%	89%	0.30	18%	14%	14%	46%	7%	0.03*

*p-value < 0.05

HL: hearing loss

HA: hearing aids

Table 7. Bivariate Analysis of Mean Scores of Knowledge and Preferences

	Knowledge Mean Score			Preference Mean Score		
	Agree	Other	p-value	Agree	Other	p-value
Preference/Attitudes						
Preferences of HA	3.24	2.87	0.03*	-	-	-
HA referral by specialist	3.12	4.00	0.26	-	-	-
Perceived benefit of HA by patients	3.19	2.80	<0.01*	-	-	-
Overall preference score (correlation)		0.21	0.04*	-	-	-
Practice Behavior						
Raising voice	3.17	3.08	0.13	3.32	3.19	0.47
Referral for hearing test	3.11	3.25	0.82	3.30	3.25	0.81
Referral for HA	3.22	3.12	0.80	3.33	3.27	0.93
Discussing HL	3.15	3.00	0.73	3.33	3.16	0.48
Referral to specialist for HL	3.12	4.00	0.26	3.29	3.33	0.66
Medical training on HL/HA	3.03	3.19	0.87	3.35	3.24	0.88

*p-value < 0.05

HL: hearing loss

HA: hearing aids

Multivariate Regression Analysis

Ordinary least squares multivariate regression models in Table 8 show the estimated association of the individual knowledge and attitude responses with different hearing-related physician practices controlling for demographic variables as covariates. Model 1 shows the demographic variables of sex, tenure and type of physician (geriatrics); Model 2 includes the mean knowledge score to Model 1 and; Model 3 includes mean preference score for a complete specification. As shown in all three model specifications geriatric practitioners were 78% more likely than other specialties to refer patients for hearing aids. In model 2 and 3, males are 11% less likely to discuss hearing loss with patients than were female physicians. While, female physicians are less likely to refer patients to a specialist for hearing difficulties in models 2 and 3. Those with higher knowledge scores were less likely to refer patients to specialists for hearing loss. For every increase point in the overall knowledge score, respondents were 4% less likely to make these referrals. Lastly, geriatrics felt more well trained to address risk factors of hearing loss than other specialties.

Table 8. Multivariate Regression Model of Practice Behaviors and Geriatrics Specialty

		Model 1		Model 2		Model 3	
		Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Raising Voice							
	Gender	0.11	0.30	0.10	0.36	0.10	0.36
	Tenure	0.16	0.19	0.17	0.18	0.17	0.19
	Geriatrics	0.35	0.13	0.35	0.13	0.35	0.13
	Knowledge Score			0.02	0.67	0.02	0.76
	Preferece Score					0.03	0.59
Referral for Hearing Test							
	Gender	-0.14	0.19	-0.13	0.25	-0.13	0.24
	Tenure	-0.08	0.52	-0.09	0.48	-0.09	0.47
	Geriatrics	0.24	0.31	0.24	0.31	0.24	0.31
	Knowledge Score			-0.03	0.61	-0.03	0.54
	Preferece Score					0.03	0.37
Referral for Hearing Aids							
	Gender	0.11	0.37	0.10	0.32	0.10	0.33
	Tenure	0.12	0.35	0.12	0.33	0.12	0.34
	Geriatrics	0.78	<0.01*	0.78	<0.01*	0.78	<0.01*
	Knowledge Score			0.02	0.69	0.02	0.72
	Preferece Score					0.01	0.85
Discussing Hearing Loss							
	Gender	-0.10	0.07	-0.11	0.05*	-0.11	0.05*
	Tenure	0.05	0.51	0.05	0.44	0.05	0.45
	Geriatrics	0.04	0.76	0.04	0.75	0.04	0.75
	Knowledge Score			0.02	0.37	0.02	0.45
	Preferece Score					0.01	0.74
Referral to Specialists for Hearing Loss							
	Gender	0.06	0.12	0.08	0.04*	0.02	0.04*
	Tenure	-0.06	0.26	-0.07	0.15	-0.07	0.15
	Geriatrics	0.04	0.62	0.04	0.64	0.04	0.64
	Knowledge Score			-0.04	0.03*	-0.04	0.03*
	Preferece Score					0.01	0.77
Well Trained for to Discuss Hearing Loss							
	Gender	-0.08	0.41	-0.07	0.49	-0.07	0.49
	Tenure	-0.07	0.60	-0.08	0.56	-0.08	0.54
	Geriatrics	0.69	<0.01*	0.69	<0.01*	0.69	<0.01*
	Knowledge Score			-0.03	0.58	-0.04	0.48
	Preferece Score					0.05	0.40

*p-value < 0.05

Summary of Results

In summary, the results show that physicians' knowledge of hearing loss as a risk factor for selected conditions and need for hearing aids is high. Demographics impacts a physician's understanding of hearing loss and different practice behaviors. Secondly, the data shows that there is a relationship between a physicians' knowledge of hearing loss and their preferences of hearing aids. The regression model provides insight to how geriatricians are more likely to refer patients for hearing aids and specialists and feel well equipped to discuss hearing loss risk factors with their patients. The data provide insight about the relationship between demographics, knowledge, preferences and practice behaviors of PCPs in terms of hearing loss and hearing amplification.

DISCUSSION

The purpose of this survey is to gain comprehension into physician knowledge and preferences about hearing loss and hearing amplification to better improve the rapport between PCPs and hearing health specialists. The study examines the association between PCPs' demographics, knowledge of hearing health, preferences of amplification options and the practice behaviors addressing hearing health. This provides information on whether PCPs' demographics influences their knowledge and preferences thus influencing their practice behaviors.

Demographics

The physicians who responded to the survey were mostly pediatricians and female. The response rate was not optimal (15%) but the responses were informative. Many of the respondents have been in the workforce for 20 or more years. Gender and tenure, however, did not appear to influence PCPs' overall knowledge score regarding

hearing loss and hearing amplification or preferences of hearing amplification, with the exception of the question on hearing loss risk factors and dementia. The Likert question ask PCPs whether hearing loss was a modifiable risk factor of dementia. In this question, 63% of the female physicians agreed with the statement and 88% of the male physicians agreed with the statement. While there were more female physicians and pediatricians who responded to the survey, it is interesting to note that many pediatricians who are less likely to cover dementia in their care, agreed with the statement that hearing loss is a modifiable risk factor for dementia. That said, the results do not show gender affecting any other aspect of PCPs' responses or practice behaviors.

The outcomes revealed that medical specialty influences certain practice behaviors, specifically referral rate for hearing test and hearing aids. For hearing test, 75% of geriatric doctors referred 5-10 patients in the past six months. However, 44% of family medicine physicians, 54% of pediatricians and 50% of internal medical physicians referred 0-4 patients for hearing tests in the past six months. When conducting the bivariate analysis, significant findings indicated that medical specialty does in fact influence the rate at which PCPs refer patients for hearing tests, specifically that geriatric PCPs refer more patients for hearing tests than other specialties. As seen, 36% of pediatricians and 30% of internists raise their voices to their patients. 26% of internists and pediatricians refer patients for hearing aids while 13% of geriatricians refer patients for hearing aids. Similarly, 14% of geriatricians believe they are well trained to discuss risk factors of hearing loss. Interestingly 46% of pediatricians felt that their training prepared them to deal with hearing loss in their practices.

The multivariate regression analysis showed that geriatricians are 78% more likely to refer patients for hearing aids than other medical specialties. Pediatricians are 28% less likely to refer patients for hearing aids. Early Detection and Hearing Intervention (EDHI) program implementation of a national newborn hearing screening protocol is designed to identify hearing loss earlier in a baby's life. However, the program does not mean that pediatricians are exempt from reviewing hearing as part of a child's development. Similarly, people wait on average 8-12 years from the time they know they have hearing loss until they receive hearing aids (Powers & Rogin, 2019; Simpson et al., 2018). PCPs' low referral rate for hearing amplification could potentially impact patients' wait time for receiving hearing amplification (Powers & Rogin, 2019). This survey also revealed that 79% of the respondents believe that patients believe amplification to be a worthwhile investment. This contrasts with the low referral rate of amplification and previous research indicating PCPs' low referral rate for hearing amplification. Male PCPs are 11% less likely to discuss hearing loss with their patients than female physicians. However, 8% of female PCPs are likely to refer patients to specialist for hearing difficulties. Lastly, the model emphasizes the bivariate analysis that geriatricians are 69% more likely to say they are well trained to discuss hearing loss risk factors than other medical specialties.

Knowledge and Preferences

It appears that demographics of the physicians who responded to the survey influences both knowledge and practice behaviors in terms of hearing loss and hearing amplification. The results indicated some relationship between PCPs' knowledge of hearing loss and hearing amplification and their preferences of hearing loss and hearing

amplification. Specifically, the study revealed significant findings that there is a relationship between individual preference question and the overall knowledge mean score. Respondents agreed that hearing aids are beneficial for patients with hearing loss as well as that their patients believe that hearing aids are a worthwhile investment. In addition, most respondents agreed that they would wear hearing aids when advised to by a specialist. Correlation analysis showed a mild correlation between the overall preference mean score and the overall knowledge mean score. This was found to be statistically significant suggesting that there is some relationship between PCPs' overall knowledge and overall preferences. Thus, if overall knowledge of hearing loss and hearing amplification improves, the overall acceptance and preferences of hearing amplification would be expected to improve as well. Conversely, we were unable to demonstrate relationships either between overall knowledge mean score and the practice behaviors nor between overall preferences mean scores and practice behaviors. This suggests that PCPs' knowledge and preferences of hearing loss and hearing amplification does not meaningfully influence practice behaviors.

Practice Behaviors and Multivariate Analysis

The regression models offered more detailed insight to the relationships between demographics, knowledge and preferences for each practice behavior. As discussed, there were significant findings in the model suggesting that demographics influences how PCPs' practice within the domain for hearing loss and hearing amplification. The models also show that there were significant findings regarding PCPs' knowledge of referring patients to specialist for hearing loss. Specifically, the higher the knowledge score of a PCP the less likely they will refer a patient to a specialist. In this model, for every one-

point increase in knowledge score there is a 4% decrease in referral to specialist for hearing loss. This finding is somewhat counterintuitive and may suggest that practitioners with better knowledge scores consider themselves better prepared to handle issues of hearing without having to refer to specialists for help.

Limitations

In the face of these findings, it is important to recognize that there are limitations to the survey findings. The sample size is small with a 15% response rate limiting generalizability. Had more physicians responded perhaps there would be greater power and therefore more statistically significant findings and stronger relationships between demographics, knowledge, preferences and practice behaviors. Among the respondents, the majority of the physicians were pediatricians. A more diverse selection may change the course of the data to show other relationships between the variables. Lastly, the survey lacked questions regarding hearing loss in the pediatric population such as “What is the youngest age a patient can be amplified?”. Pediatricians were the least likely to refer for hearing tests. It would be interesting to examine how knowledgeable PCPs are regarding amplification among the pediatric population.

Audiology Intervention Toolkit

There is a need for intervention between audiologists and physicians in order to better support the patient population with hearing loss. Research has shown that physicians spend 17-24 minutes with each patient to cover overall well-being (Medscape Physician Compensation Report, 2017). Therefore, how can audiologists help support physicians support their patients with hearing loss? How can we better build the relationship and rapport with local physicians to ensure those patients are getting the

proper hearing health care and intervention to help mitigate modifiable risks of other comorbidities, isolation, and/or accidents. The physicians who participated in this study have shown the need for hearing education and support. AUD to MD Toolkit-Educate, Identify and Bridge (EIB) is designed using Interventional Audiology Toolkit as a guide (Taylor & Tysoe, 2013). Interventional Audiology Toolkit specifically tackles changing the framework of audiology intervention towards patient care away from dispensing of hearing aids or medical devices to evaluating hearing loss and other chronic diseases. By changing the orientation, audiologists become active participants in patient care through including physicians' verbal instructions during routine appointment.

AUD to MD Toolkit-EIB, shown in Figure 8, is designed to better communicate and support physicians and their hearing loss patients. As shown through the data, physicians still need some education on hearing loss risk factors. Thus, educating physicians with the least amount of involvement (e.g. utilizing social media platforms and websites for evidenced based materials for them to read on their own time) to the most involvement (e.g. lectures and seminars). Audiologists can reach out to local physicians through educational newsletters connected with social media platforms. This allows physicians to have access to materials.

Identifying hearing loss in practice through different short screening tools can help physicians minimize the time and increase the referral to hearing health care specialists. Multifactorial risk assessment (Weinstein, 2011) identifies co-morbidity risk assessments that can be completed by patients before appointments. Any patient that scores 2 or higher are at risk of hearing loss. SOFI (Weinstein, 2013) is another tool that physicians can use for intake information that can identify patients likely to be suffering

from hearing loss. Mini-Cog is an assessment that requires more time but can be used for physicians who believe patients are suffering from cognitive impairments (Borson et al., 2006). Through the different assessment audiologists can provide physicians with referral to specialists who accept different insurance information and with first glance treatment options in the local area.

In summary, we believe the present study confirms that audiologists have a significant opportunity to bridge the communication gap between hearing health specialists and physicians. Insights derived from this analysis will help support patients with hearing loss by indicating a path forward to develop detailed reports with treatment options, aural habilitation and rehabilitation programs at different local clinics, and active participation in improving the welfare of patients through ongoing communication with the patient and his/her physician.

AUD TO MD TOOLKIT- EDUCATE IDENTIFY AND BRIDGE

EDUCATE

Audiologist can implement educational tools for physicians to review on hearing loss and various chronic diseases through:

- Social media platforms and websites for local physicians
- Newsletters for local physicians
- Lectures, seminars and networking events for audiologists and physicians on hearing loss, healthy hearing practices, and intervention
- Clinical processes and patient materials for the physicians' office
- Evidence based educational material on hearing loss provided for physicians



IDENTIFY

Audiologist can provide physicians with identification and screening tools to be used in their practice:

- Multifactorial risk assessment form (Weinstein, 2011)
- SOFI questionnaire (Weinstein, 2013)
- Mini-Cog Tool (Borson et al., 2006)
- Referral network for physicians on specific chronic diseases and hearing loss
- Provide physicians with treatment options for hearing loss and chronic diseases



BRIDGE

Audiologists can bridge the communication gap and help support physicians and their patients with hearing loss through:

- Providing detailed reports back to referring physicians with comprehensive treatment options
- Providing physicians and their practices with information of habilitation services and aural rehabilitation programs locally
- Participation in wellness of patient through ongoing communication with the patients' physicians



Figure 6. AUD to MD Toolkit-Educate, Identify and Bridge

CONCLUSION

This study examined different aspects of PCPs' understanding of hearing loss and hearing amplification. It is shown that there are several relationships that warrant further examination, such as demographics influences of knowledge and practice behaviors and knowledge effect on overall preferences of PCPs in terms of hearing loss and hearing amplification. This provides better insight for audiologists in creating a bridge with PCPs for patients with hearing loss. Perhaps it behooves audiologists to create a dialogue with internal medicine and family medicine physicians as well as with pediatricians when reviewing referrals for hearing tests. Or audiologists may need to educate PCPs on how hearing loss is a modifiable risk factor for dementia. Overall, this research offers vocabulary and guidance for audiologists and physicians alike when addressing hearing loss and hearing amplification to further improve hearing healthcare for all patients.

APPENDIX A

This survey was conducted through TypeForm ©. Link to the survey itself:
<https://sophieracine105946.typeform.com/to/JBCekg>

Welcome Page

My name is Sophie Racine. I am a 4th year audiology graduate student at CUNY Graduate Center in NYC conducting research on hearing impairment. The purpose of this research is to gain insight into physicians' views on hearing-related health care and amplification options for patients. Information derived from this survey will help improve communication between physicians and audiologists to best serve patients in our community.

The survey will only take 5 minutes of your time, and is completely anonymous. If you have any questions or feedback do not hesitate to contact me at sracine@gradcenter.cuny.edu.

Thank you for your participation! I look forward to hearing from you!

Consent Form

Informed Consent to Participate in Survey

Participation:

Your participation in this survey is voluntary. You may refuse to take part in the research or exit the survey at any time without penalty.

Benefits:

You will receive no direct benefits from participating in this research study. However, your responses may help us gain insight into physicians' views on hearing related health care and amplification options for patients.

Risks:

There are no foreseeable risks involved in participating in this study other than those encountered in day-to-day life.

Some of the survey questions ask about hearing loss and may be distressing to you as you think about your experiences.

The possible risks or discomforts of the study are minimal. You may feel a little uncomfortable or embarrassed answering personal survey questions.

Confidentiality:

Your survey answers will be sent to a link at TypeForm.com where data will be stored in a password protected electronic format. Typeform does not collect identifying information such as your name, email address, or IP address. Therefore, your responses will remain anonymous. No one will be able to identify you or your answers, and no one will know whether or not you participated in the study.

Contact:

If you have questions at any time about the study or the procedures, you may contact me at sracine@gradcenter.cuny.edu.

If you feel you have not been treated according to the descriptions in this form, or that your rights as a participant in research have not been honored during the course of this project, or you have any questions, concerns, or complaints that you wish to address to someone other than the investigator, you may contact the The Graduate Center Institutional Review Board at 365 Fifth Avenue New York, NY 10016.

ELECTRONIC CONSENT: Please select your choice below. You may print a copy of this consent form for your records. Clicking on the "Agree" button indicates that

- You have read the above information
- You voluntarily agree to participate
- You are 18 years of age or older

Do you consent to this survey?

Agree

Disagree

(IF THE PERSON PICKS DISAGREE THE PAGE AUTOMATICALLY GOES TO THE END OF THE SURVEY THANKING THEM FOR THEIR TIME)

1. What is your gender?
 - a. Male
 - b. Female
 - c. Other

2. Which of the following best describes your medical specialty?
 - a. Internal Medicine
 - b. Family Medicine
 - c. Pediatrics
 - d. Geriatrics
 - e. Other

3. In what setting (s) do you work; Please check all that apply
 - a. Hospital
 - b. Private Practice – sole practitioner
 - c. Community Practice
 - d. Medical School/University
 - e. Concierge Practice
 - f. Other

4. How many years have you been practicing medicine (post internship)?
 - a. <5
 - b. 5-9
 - c. 10-14
 - d. 15-19
 - e. 20 or more

5. How often in the past 6 months have you referred a patient complaining of hearing loss/difficulty for a hearing test?
 - a. 0
 - b. <5
 - c. 5-10
 - d. >10

6. How often in the past 6 months have you referred a patient complaining of hearing loss to a specialist to obtain hearing aids?
 - a. 0
 - b. <5
 - c. 5-10
 - d. >10

7. When a patient needs hearing aids, to what specialist do you refer?
 - a. Audiologist

- b. Costco
 - c. Patient decides
 - d. Ear Nose and Throat Doctor
 - e. Hearing Aid dispenser
 - f. Online
 - g. No one
8. Do you wear hearing aids?
- a. Yes
 - b. No
 - c. Sometimes
9. Do you ever discuss hearing problems with patients?
- a. Never
 - b. Occasionally
 - c. Routinely
 - d. Always
10. Do you ever discuss hearing aids with patients?
- a. Never
 - b. Occasionally
 - c. Routinely
 - d. Always
11. Please estimate the cost to the consumer of a set of hearing aids:
- a. \$500 each
 - b. \$200 each
 - c. \$4000 each
 - d. \$6000 each
12. To your knowledge can people with hearing loss purchase hearing aids online without seeing a hearing specialist
- a. Yes
 - b. No

FOR THE FOLLOWING PLEASE STATE WHETHER YOU AGREE OR DISAGREE WITH THE STATEMENTS BELOW

13. Based on feedback you receive from your patients, would you agree that hearing aids a *worthwhile* investment for people who have difficulty communicating with family, friends, healthcare professionals, etc.?
- a. Agree
 - b. Disagree
14. Most persons with age related hearing loss can benefit from hearing aids
- a. Agree

- b. Somewhat agree
 - c. Neutral
 - d. Somewhat disagree
 - e. Disagree
15. How often do you find you have to raise your voice for your patients to understand you?
- a. Never
 - b. Occasionally
 - c. Usually
 - d. Always
16. If I had difficulty hearing/communicating with family, friends or patients, I would purchase hearing aids
- a. Agree
 - b. Somewhat agree
 - c. Neutral
 - d. Somewhat disagree
 - e. Disagree
17. If a hearing specialist recommended hearing aids, I would wear hearing aids.
- a. Agree
 - b. Somewhat agree
 - c. Neutral
 - d. Somewhat disagree
 - e. Disagree
18. Hearing loss is a modifiable risk factor for dementia.
- a. Agree
 - b. Somewhat agree
 - c. Neutral
 - d. Somewhat disagree
 - e. Disagree
19. Hearing loss increases risk for falls.
- a. Agree
 - b. Somewhat agree
 - c. Neutral
 - d. Somewhat disagree
 - e. Disagree
20. Hearing loss increases risk for social isolation and loneliness.
- a. Agree
 - b. Somewhat agree
 - c. Neutral
 - d. Somewhat disagree

- e. Disagree
21. My medical training prepared me to discuss the risks of untreated hearing loss with my patients.
- a. Agree
 - b. Somewhat agree
 - c. Neutral
 - d. Somewhat disagree
 - e. Disagree

REFERENCES

- Abrams, H. B., Chisolm, T. H., & McArdle, R. (2005). Health-Related Quality of Life and Hearing Aids: A Tutorial. *Trends in Amplification*. 9(3), 99–109.
- Abrams H.B., Kihm, J. (2015). An introduction to MarkeTrak IX: A new baseline for the hearing aid market. *Hearing Review*. 22(6):16-21.
- Bertakis, K. D., Roter, D., & Putnam, S. M. (1991). The relationship of physician medical interview style to patient satisfaction. *The Journal of Family Practice*. 32(2), 175–181.
- Borson, S., Scanlan, J. M., Watanabe, J., Tu, S.-P., & Lessig, M. (2006). Improving identification of cognitive impairment in primary care. *International Journal of Geriatric Psychiatry*. 21(4), 349–355.
- Chou, R., Dana, T., Bougatsos, C., Fleming, C., & Beil, T. (2011). Screening Adults Aged 50 Years or Older for Hearing Loss: A Review of the Evidence for the U.S. Preventive Services Task Force. *Annals of Internal Medicine*. 154(5), 347.
- Ciorba, A., Bianchini, C., Pelucchi, S., & Pastore, A. (2012). The impact of hearing loss on the quality of life of elderly adults. *Clinical Interventions in Aging*. 7, 159–163.

Estimates based on manufacturers' voluntary reports of registered devices to the U.S.

Food and Drug Administration. (December 2012). NIDCD.

<https://www.nidcd.nih.gov/health/statistics/quick-statistics-hearing>

Family and primary Practitioners. (2018). U.S. Bureau of Labor Statistics, U.S. Bureau of Labor Statistics.

Flocke, S. A. (1997). Measuring attributes of primary care: development of a new instrument. *The Journal of Family Practice.* 45(1), 64–74.

Global costs of unaddressed hearing loss and cost-effectiveness of interventions: a WHO report. (2017). Geneva: World Health Organization. License: CC BY-NC-SA 3.0 IGO.

Haynes, W. O., & Johnson, C. E. (2009). *Understanding Research and Evidence-based Practice in Communication Disorders: A Primer for Students and Practitioners.* Pearson.

Kochkin, S. (1998). MarkeTrak IV: Correlates of hearing aid purchase intent. *The Hearing Journal.* 51(1):30-41.

Kochkin, S. (2007). MareTrak VII: Obstacles to adult non-user adoption of hearing aids. *The Hearing Journal.* 60(4):24-51.

Kochkin, S. (2009). MarkeTrak VIII 25-year trends in the hearing health market. *Hearing Review.* 16(11):12-31.

Mahboubi, H., Lin, H. W., & Bhattacharyya, N. (2017). Prevalence, Characteristics, and Treatment Patterns of Hearing Difficulty in the United States. *JAMA Otolaryngology–Head & Neck Surgery.* doi:10.1001/jamaoto.2017.2223

- Moeller, M.P., White, K.R. & Shisler, L. (2006). Primary Care Physicians' knowledge, attitudes, and practices related to newborn hearing screening. *Pediatrics*. 118(4)1357-1370
- Poost-Foroosh, L., Jennings, M. B., Shaw, L., Meston, C. N., & Cheesman, M. F. (2011). Factors in client-clinician interaction that influence hearing aid adoption. *Trends in Amplification*. 15(3), 127–139.
- Popp, P., & Hackett, G. (2002). Survey of primary care physicians: Hearing loss identification and counseling. *Audiology Online*.
- Powers, T.A., Rogin CM, MarkeTrak 10: Hearing aids in an era of disruption and DTC/OTC devices. *Hearing Review*. 26(8):12-20.
- Simpson, A. N., Matthews, L. J., Cassarly, C., & Dubno, J. R. (2019). Time From Hearing Aid Candidacy to Hearing Aid Adoption: A Longitudinal Cohort Study. *Ear and Hearing*. 40(3), 468–476.
- Statistics and Epidemiology*. (2016). NIDCD. <https://www.nidcd.nih.gov/health/statistics>
- B Taylor, & Tysoe, B. (2016). Interventional Audiology: Partnering with Physicians to Deliver Integrative and Preventive Hearing Care. *Hearing Review*. 20(12):16-22.
- Weinstein, B. E. (2019). Maximizing Annual Wellness Visits to Promote Hearing Health. *The Hearing Journal*. 72(4).
- Weinstein, B. E. (2011). Screening for Otologic Functional Impairments in the Elderly: Whose Job is it Anyway? *Audiology Research*. 1(1), e12.
- Weinstein, B. E. (2013). Tool kit for screening otologic function of older adults. *American Journal of Audiology*. 22(1), 179–182.