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Audiology and speech-language pathology practice in Saudi Arabia

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ABSTRACT

Objectives: Audiology and speech-language pathology (SLP) are relatively new professions in Saudi Arabia. The idea of establishing new audiology and SLP programs in some education facilities has become popular across Saudi Arabia; yet, only four undergraduate and graduate programs are currently available. This study aimed to explore the fields of audiology and SLP in Saudi Arabia, obtain demography of audiologists and Speech-language pathologists (SLPs), understand their current practices, and identify their perspective on what both professions need to improve.

Methods: A cross-sectional mixed methods study design was used to address the aim of this study. Two online surveys were prepared and distributed to reach a large number of audiologists and SLPs. Both surveys consisted of close- and open-ended questions and primarily focused on three categories demography, audiology or SLP practices, and audiologists' or SLPs' perspective on their professions in Saudi Arabia.

Results: A total of 23 audiologists and 37 SLPs completed the surveys (age range = 21-50 years). The majority of respondents were from Riyadh with different academic qualifications and working experiences. Various practices were noticed among audiologists and SLPs who mainly worked in hospitals. Several suggestions regarding the development of audiology and SLP education and practice in Saudi Arabia are discussed.

Conclusion: This study provides useful information about audiology and SLP education and practices in Saudi Arabia. Collaborative work between stakeholders to achieve high-quality educational and practical standards is critical. National database, clinical guidelines and policies should be developed, employed, and supervised. Further research is needed to improve education and practice of both professions in Saudi Arabia.

Keywords: Audiology, education, practice, Saudi Arabia, speech-language pathology

Introduction

Audiologists and speech-language pathologists (SLPs) are health-care professionals practice at several healthcare and educational settings including hospitals, clinics, rehabilitation centers, universities, and schools. According to the American Speech-Language-Hearing Association (ASHA),[1,2] audiologists "provide patient-centered care in the prevention, identification, diagnosis, and evidence-based treatment of hearing, balance, and other auditory disorders for people of all ages," and SLPs "work to prevent, assess, diagnose, and treat speech, language, social communication, cognitive-communication, and swallowing disorders in children and adults."

The history of audiology goes back to the 1940s when the first printed audiology word appeared in the Journal of Speech Disorders and the Volta Review.[3] The first academic program in audiology was begun at Northwestern University in 1947.[4] On the other hand, the history of SLP is older and related to the 1900s when people working in communication disorders were known as "public readers and speakers of elocution."[5] The first academic program in SLP, called "speech and mental hygiene," was established at the University of Wisconsin in 1915.[5] Today, there are over 270 undergraduate programs in communication sciences and disorders, 271 master of speech-language pathology programs, 76 Doctor of Audiology (Au.D.) programs, five Doctor of Speech-Language Pathology (SLP.D.) programs, and 75 Doctor of Philosophy (Ph.D.) programs in the United States (U.S.).[6] In contrast, audiology and SLP professions are relatively new in Saudi Arabia. The first audiology and SLP program was established at King Saud University about 30 years ago whereas the Saudi Society of Speech-Language Pathology and Audiology (SSSPA) was officially established in 2003.[7] At present, Saudi universities offer three undergraduate programs and only one graduate program in audiology and/or speech-language pathology, of which two are governmental

and one is private.[7] King Saud University offers a combined undergraduate program (i.e., a dual degree program) in speech and hearing rehabilitation for male and female students, Princess Nourah Bint Abdulrahman University provides two separate undergraduate programs in audiology and speech-language pathology for female students, and Dar Al-Hekmah University offers undergraduate and graduate programs in speech-language pathology for female students.[7] The lack of graduate programs is a major concern, with only one university offering these.

The requirement of supervised clinical practice before graduation varies between both professions and among countries. In Saudi Arabia, audiology or SLP students must complete a 12-month supervised internship in audiology and/or SLP clinics. In the U.S., Au.D. students must obtain at least 1820 supervised clinical hours, and master of SLP students must have a minimum of 325 supervised clinical hours.[8,9] Furthermore, to practice audiology or SLP, a person must have a minimum academic qualification in addition to other requirements. Unlike countries, such as the U.S. and Australia require a person to hold a graduate degree (e.g., an Au.D., a master's of audiology, or a master's of speech-language pathology), an undergraduate degree in audiology or speech-language pathology is mandatory to practice audiology or speech-language pathology in Saudi Arabia.

Audiology and SLP professions are considered of the growing professions in the world. For example, the job growth for audiology in the U.S. is expected to be 29% from 2014 to 2024, which will result in about 4,800 new jobs.[10] The growth in SLP in the U.S. is expected to be 21% from 2014 to 2024.[10] The American national statistics in 2013 revealed that the number of audiologists for every 100,000 residents was four, and the number of SLPs for every 100,000 residents was 45.[11,12] The population of Saudi Arabia exceeds 31 million people.[13] Consequently, the growth of audiology and SLP jobs in Saudi Arabia is expected to be less than developed countries, but the number of audiologists or SLPs for every 100,000 residents is unknown. There is also limited information about audiologists and SLPs employed in Saudi Arabia and their current practices.

The use of surveys (or questionnaires) is a method to explore audiology and SLP professions (or any other fields). Using surveys to understand the changes and development in practice and service delivery have a long history in literature.[14,15] For example, the U.S. MarkeTrak is a consumer-directed survey that proved useful in understanding changes in practice and its influence on patient outcomes.[16,17] The impact of these surveys on professions is numerous because these surveys lead to better understanding of the practice, services, and patient's outcomes. ASHA prepared guidelines for audiologic screening and manual pure-tone threshold audiometry; consequently, better education and practice strategies can be established to ensure high quality. However, such audiology and SLP practice guidelines are unavailable in Saudi Arabia. To create national guidelines and policies that improve education and practice, it is essential to understand current practices and gain information and opinions of practitioners in both fields. Therefore, this study aimed to (a) obtain demography of audiologists and SLPs working in Saudi Arabia, (b) understand existing practices in both professions, and (c) acquire audiologists' and SLPs' perception of their professions in Saudi Arabia and their suggestions to improve both professions. To the best of my knowledge, this is the first study of its kind to explore audiology and SLP professions in Saudi Arabia.

Methods

This cross-sectional mixed methods study was approved by the University of Arkansas for Medical Sciences Institutional Review Board (#205146). Audiologists and SLPs in Saudi Arabia were the target population.

Inclusion criteria

Audiologists and SLPs who were practicing in Saudi Arabia at the time of completing the surveys were included. Only complete surveys were considered.

Materials

Two online surveys were developed to achieve the aims of this study. Appendices A and B show both surveys which contain three main categories (a) demography, (b) audiology or speech-language pathology practice, and (c) audiologists' or SLPs' perspective on their professions. Close- and open-ended questions were used in both surveys.

Audiology survey

This survey consisted of 22 questions as follow: 13 demography, six audiology services, and three audiologists' perspective questions. Of the 22 questions, 20 questions were mandatory, and two questions about audiologists' perspective were optional. The demography category included 12 questions regarding respondents' gender, age, qualification, years of experience, employment status (i.e., full or part time), and any future plans to pursue graduate studies. Other demography questions focused on daily number and nature of patient population (i.e., adults and/or children patients) being served, number of audiologists in workplace, and whether this number of audiologists was enough to cover caseloads. The audiology service category concentrated on basic and advanced audiologic assessments and re/habilitation services and the use of an in-house (or local) practice protocol. The last category in the audiology survey was audiologists' perspective. This category involved questions about whether there is need of a nationwide clinical protocol, audiologists' level of satisfaction with the services (e.g., professional education opportunities and training) provided by SSSPA, and how to improve the field of audiology in Saudi Arabia.

SLP survey

This survey consisted of 19 questions as follow 14 demography, two speech pathology services, and three SLPs' perspective on their profession questions. Of the 19 questions, 17 mandatory

and two optional questions were used. The optional questions fell into the category of the SLPs' perspective. Questions in both categories of demography and SLPs' perspective were similar to those used in the audiology survey and focused on the field of SLP. The extra question in the demography category explored if SLPs provided services to in- and/or out-patients. The SLP assessments and re/habilitation services category investigated many areas that were mentioned by ASHA such as fluency, swallowing, and voice disorders. This category also included questions about the use of group therapy.

Procedures

To reach a large number of audiologists and SLPs all over Saudi Arabia in a time-efficient and cost-effective method, both surveys were created using SurveyMonkey.[18] Links to both surveys were distributed among SSSPA members by email and posted on social networks (Twitter; Facebook), followed by an electronic reminder a few weeks later. Survey links were accessible for 5 months. Participation was voluntary, and answers were anonymous. Uncompleted surveys and data from audiologists and SLPs practicing in other countries were excluded before analysis. Summary statistics were calculated. Although the amount of qualitative data (i.e., responses to the last open-ended question in each survey) was not huge, these responses were imported into NVivo qualitative data analysis software to identify the frequency of thematic concepts.[19]

Results

This section presented results of each survey separately. The results of each survey were included under the three categories listed in the method section. 13 responses from both surveys (nine audiology responses and four SLP responses) were excluded based on the inclusion criteria.

Audiology survey

Demography

A total of 23 audiologists were included in the analysis based on the inclusion criteria. All the respondents were Saudi citizens, most of who worked in Riyadh. Of the total respondents, 17 audiologists (73.91%) were females, and 14 (60.87%) were younger than 30 years old with different years of experience. 17 audiologist respondents were working in hospitals, and 14 respondents had ≤5 working experience. The audiologist participants who were working at universities had limited clinical practice. Table 1 summarizes the respondents' city, age group, work experience, and workplace. The majority of respondents held a bachelor's degree, and 16 respondents (69.57%) were planning to complete their graduate studies (Figure 1). The majority of respondents were full-time workers, who reported different numbers of adults and pediatric patients they served on a daily basis. The number of patients seen per day by each respondent varied from less than 3 to more than 10 patients. Furthermore, the number of audiologists working in any particular workplace varied from fewer than three audiologists to greater than 7 audiologists. 15 respondents mentioned that the number of audiologists employed at their facility was not enough to cover the caseloads and 15 respondents stated no use of in-house (or local) practice protocol.

Audiology practice

Summary of audiology services and the percentage of audiologists providing these services are shown in Figure 2. Of the total participants, 10 audiologist participants performed otoscopy routinely on all patients whereas four of them reported performing otoscopy most of the time. Only five respondents performed tympanometry and reflex measures on all their patients while nine of them performed only tympanometry on all their patients. One audiologist performed otoacoustic emissions (OAEs) measures on all their patients whereas half of the audiologist respondents reported performing OAEs depending on the patient. Of the 23 audiologists, 12 audiologists used headphones for pure tone audiometry (PTA), and eight of them used both headphones and insert earphones, leaving three audiologists used insert earphones only. The respondents reported using one and/or more speech audiometry test(s). More than 65% of them performed speech recognition threshold (SRT), 48% performed speech detection threshold (SDT), and 40% used word recognition scores (WRS). No audiologist participants mentioned the use of any speech-in-noise tests, such as QuickSIN.

Auditory brainstem response (ABR) and auditory steady-state response (ASSR) were used by 11 (47.82%) audiologist respondents. The remaining audiologists did not perform any electrophysiology tests. The majority of audiologist respondents (88%) did not perform any vestibular assessments and/or rehabilitation. The remaining respondents reported performing vestibular evoked myogenic potential, videonystagmography, and/or caloric testing. Of the total respondents, six audiologists performed auditory processing disorder (APD) assessments, but no information was provided about the type of tests or management and whether these tests were in Arabic or English. Tinnitus assessment, counseling, and/or management were

Table 1: Audiologist respondents' city, age group, work experience, and workplace

City	*n* (%)	Work experience (years)	*n* (%)
Riyadh	15 (65.22)	<5	14 (60.87)
Jeddah	3 (13.04)	6-10	4 (17.39)
Dammam	2 (8.70)	11-15	4 (17.39)
Al-Ahsa	1 (4.34)	>20	1 (4.34)
Abha	1 (4.34)		
Al-Qassim	1 (4.34)		
Age group (years)	***n* (%)**	**Work place**	***n* (%)**
21-30	14 (60.87)	Hospitals	17 (73.91)
31-40	8 (34.78)	Universities	4 (17.39)
41-50	1 (4.34)	Rehabilitation centers	2 (8.70)

N=Number of audiologists; %=Percentage of audiologists

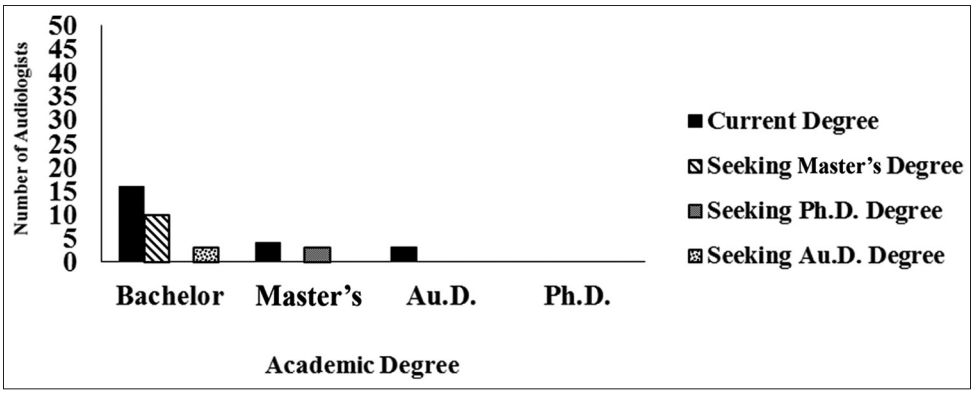

Figure 1: Number of audiologist respondents and their current academic degrees and future academic plan. Au.D.= Doctor of Audiology; Ph.D.= Doctor of Philosophy

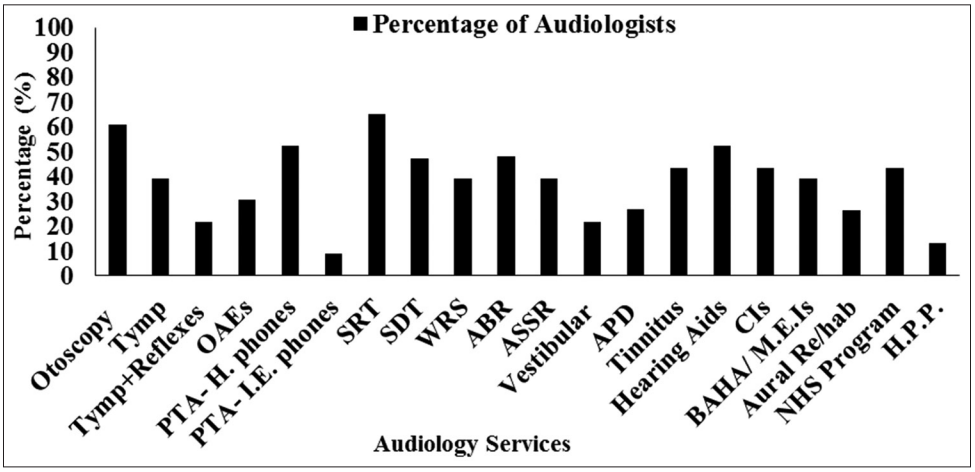

Figure 2: Summary of audiology services and the percentage of audiologists. OAEs: Otoacoustic emissions, PTA: Pure tone audiometry, H. phones: Headphones, I.E. phones: Insert earphones, SRT: Speech recognition threshold, SDT: Speech detection threshold, WRS: Word recognition threshold, ABR: Auditory brainstem response, ASSR: Auditory steady-state response, CIs: Cochlear implants; Re/hab: Re/habilitation, APD: Auditory processing disorder, M.E.Is: Middle ear implants, NHS: Newborn hearing screening, and H.P.P.: Hearing protection program

performed by 10 respondents with no information about the types of tinnitus management.

More than half of the respondents dispensed and fitted more than one type of hearing aids. Behind the ear (BTE), hearing aids were the popular fitted type. Other types of hearing aids including custom hearing aids, receiver in the canal (RIC), and (bilateral) contralateral routing hearing aids (BiCROS/CROS) were also reported by the respondents. National Acoustic Laboratories-Non Linear2 ([NAL]-NL2) and desired sensation level (DSL) were the most used hearing aids prescription formulae. Verification of hearing aids fitting based on the patient's feedback was used by about 60% of the respondents, and the rest of them verified hearing aids fitting based on the real ear and functional measurements. Fitting and programming cochlear implants were performed by 10 (43.47%) audiologists, and 8 (34.78%) of the total participants worked with bone-anchored hearing aids patients. Only one respondent (4.34%) worked with patients fitted with middle ear hearing aids (e.g., vibrant sound bridge) and no responses were obtained regarding auditory brainstem implants. The majority of audiologists did not provide any aural re/habilitation services. The presence of newborn hearing screening (NHS) programs was reported by 44% of the audiologists and 13% of them reported that their facility had hearing protection programs.

Audiologists' perspective

All the audiologist participants reported the need for a nationwide practice (or clinical) protocol. More than half of audiologist respondents rated their level of satisfaction with the services provided by SSSPA as neutral, and only 17.40% of the audiologist respondents were either satisfied or very satisfied with SSSPA services. Frequency of responses to the last open-ended question was identified. The most frequently presented responses that audiologist participants described about what audiology profession in Saudi Arabia needed were (a) standard protocols and policies, (b) universal NHS and school screening programs, (c) database and national statistics of hearing loss, (d) better understanding of the field among other health-care professionals and in the community, (e) more interprofessional education (IPE) and collaboration

with other health-care professions, (f) national hearing aids programs, and (g) more workshops and conferences. One of the respondents said, "The profession of audiology in Saudi Arabia needs everything to improve!"

SLP survey

Demography

A total of 37 SLPs were included in the analysis based on the inclusion criteria. The majority of respondents were Saudi citizens, and two respondents were Jordanian and Egyptian. Of the total respondents, 30 SLPs (81.08%) were females from Riyadh, and half of the respondents were younger than 30 years old with different years of experience (Table 2). The number of SLP respondents who held a bachelor's degree was 26 (70.27%), and 24 respondents (64.86%) were planning to complete their graduate studies (Figure 3). More than half of SLPs were full-time employee working in hospitals with both in- and out-adult and pediatric patients. The number of patients seen per day by each respondent varied. Of the 37 respondents, 12 and 14 respondents had 7-10 patients and 4-6 patients scheduled every day, respectively. The number of SLPs employed at the same work place was also different: 11 of the respondents mentioned <3 SLPs, 12 of respondents reported 4-6 SLPs, and five respondents mentioned that they were the only SLPs in their workplaces. 30 respondents (81.08%) considered the number of SLPs in their work facility was not enough to cover the workload and about 65% of the total respondents mentioned the lack of in-house practice protocol.

SLP practice

The survey was designed to allow participants to choose one or more SLP services. The percentage sums to more than 100% because SLPs provided diagnosis and therapy in more than one SLP area. The majority of SLPs treated patients with articulation, phonological, and language disorders. Of the total respondents, 46% SLPs provided services for those who had fluency disorders and autism represented whereas 32.43% of SLP respondents worked with patients who had voice and resonance disorders. Figure 4 shows the SLP areas

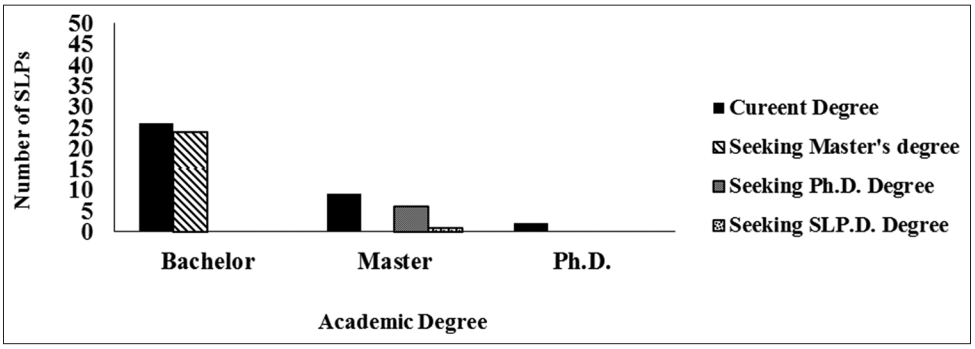

Figure 3: Number of speech-language pathology respondents and their current academic degrees and future academic plan. SLP.D.: Doctor of speech-language pathology, Ph.D.: Doctor of philosophy

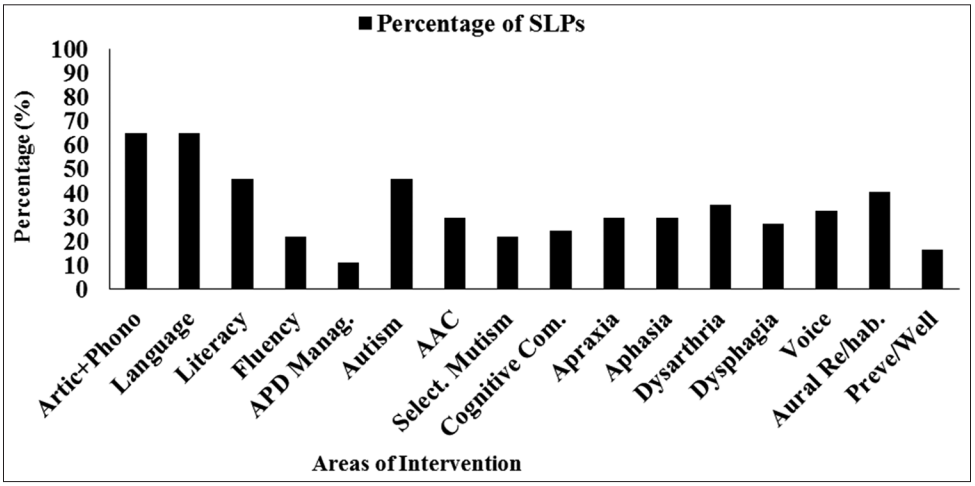

Figure 4: Speech-language pathology (SLP) areas of intervention and the percentage of SLPs. Artic: Articulation, Phono: Phonology, Language: Semantics, morphology, syntax, and pragmatics disorders, Literacy: Reading and writing difficulties, Fluency: Stuttering, APD manage: Auditory processing disorder management, Autism: Pervasive developmental disorder (PDD) and Asperger's, AAC: Augmentative and alternative communication (nonverbal), select: Selective, Com: Communication, Dysphagia: Swallowing and feeding difficulties, Voice: Voice and resonance disorders, Re/hab: Re/habilitation, Preve: Prevention, Well: Wellness

Table 2: SLP respondents' city, age group, work experience, and workplace

City	*n* (%)	Work experience (years)	*n* (%)
Riyadh	28 (75.68)	< 5	20 (54.05)
Jeddah	3 (8.11)	6-10	11 (29.73)
Dammam	4 (10.81)	11-15	5 (13.51)
Al Madinah Al Munwarah	2 (5.41)	>20	1 (2.70)
Age group (years)	***n* (%)**	**Work place**	***n* (%)**
21-30	19 (51.35)	Hospitals	20 (54.05)
31-40	16 (43.24)	Universities	6 (16.22)
41-50	2 (5.41)	Rehabilitation centers	5 (13.51)
		Schools	4 (10.81)
		Private practice	2 (5.41)

N=Number of SLPs; %=Percentage of SLPs. SLP: Speech-language pathology

of intervention and the percentage of SLPs. Finally, more than 54% of the respondents declined the use of group therapy.

SLPs' perspective

Thirty-four SLP participants (91.89%) reported that SLP needed a nationwide practice protocol. Approximately half of the respondents (56.76%) rated their level of satisfaction with the services provided by SSSPA as neutral, and only 13.51% of the total respondents were either satisfied or very satisfied with SSSPA services. Frequency of responses to the last open-ended question was identified in this survey too. The most frequently presented responses that SLP participants stated about what SLP profession in Saudi Arabia needed were (a) more standardized tests in language and articulation for Saudis, (b) more undergraduate and graduate programs, (c) national programs and guidelines, (d) better recognition of the profession by national authorities, (e) standard protocols and policies, (f) up-to-date academic and clinical training, (g) more services in more cities in the kingdom, (h) more specialized courses and workshops, and (i) "everything." One of the respondents said, "The profession of SLP in Saudi Arabia needs research to improve."

Discussion

Audiology and SLP professions were established in Saudi Arabia about 30 years ago. There is no data available about professionals' demography or practices in either field in Saudi Arabia. The online surveys aimed at exploring information about audiologists and SLPs, understanding their current practices and obtaining their perception of what both professions need to improve. Both surveys were distributed to a random sample of audiologists and SLPs who were employed in Saudi Arabia. Results from this study provided fundamental data regarding both professions in Saudi Arabia. The current study sample consisted of 23 practicing audiologists and 37 practicing SLPs. The Saudi Commission for Health Specialties (SCHS), which conducts licensure examinations for native and foreign diplomats and foreign nationals before they may practice in Saudi Arabia ensuring quality of care, does not announce the number of licensed audiologists and SLPs practicing in Saudi Arabia. Furthermore, not all audiologists and SLPs are SSSPA members, and the number of audiologists and SLPs who actually received the survey links from SSSPA was unidentified. Therefore, the actual survey response rate could not be calculated. However, the number of participants in this study (i.e., 60 audiologists and SLPs) is estimated around 9% of the total number of audiologists and SLPs currently employed in Saudi Arabia.

Audiology survey

Demography

The present data suggests that majority of audiologist work in hospitals, accounting for about 74% of the respondents. This result is consistent with the number of audiologists (73.5%) who are employed in health-care settings in the U.S.[1] Audiologists also work at education facilities. ASHA estimated that 8.4% of certified audiologists work in schools and 7.2% of certified audiologists work at universities or colleges.[1] This study revealed that no audiologist participants were employed in schools, but 17.39% of audiologists were employed in universities. The majority of respondents worked full-time with 1 to 10 patients scheduled per day for every audiologist. This survey showed that around 65% of the participants need more audiologists employed in their workplaces to help them with the workload. However, main government hospitals, rehabilitation centers and schools in Saudi Arabia hire a few graduated audiologists. There are several reasons, but the lack of understanding of professional services provided by audiologists and the complexity of recruitment policies and procedures are the big elephants in the room.

Most of the audiologists in the current study were females. The shortage of male audiologists found in this study was also mentioned in literature. In a survey study, Sullivan reported a ratio of approximately 3:1 female audiologists to male.[20] ASHA conducted a survey of audiologists in school settings, and the results revealed that only 10% of 282 respondents (i.e., 28 audiologists) were males.[21] Another ASHA survey of audiologists in health-care settings revealed only 16% of 1811 respondents (i.e., 290 audiologists) respondents were males.[22] Student statistics from King Saud University in 2010 showed that only 30% of students admitted into speech and hearing rehabilitation program were males.[23] Two universities that offer academic audiology and SLP programs are based in Riyadh, so the majority of audiologist participants in this study were from Riyadh. This may be an explanation of the dearth of audiological services in other cities in Saudi Arabia. More than half of audiologists in the survey population tended to be between ages 20 and 31. This indicated the lower level of experience among the audiologist participants. The median age of audiologists working in the U.S. was 47 years.[22] The present study showed that about 70% of the respondents were seeking a graduate degree. This result supports the highly demands

of establishing graduate audiology programs in Saudi Arabia where there is only one SLP graduate program.

Audiology practice

The present study revealed inconsistencies use of essential basic procedures such as otoscopy. Less than half of the audiologists performed otoscopy examination on all patients. Using otoscopy examination has become more accessible due to technology advances. For example, CellScope, an iPhone-enabled otoscope, can be used to examine the ear.[24] Otoscopy helps in identifying abnormalities in the external and middle ear, such as middle ear effusion.[25] Likewise, less than one-quarter of audiologists performed both tympanometry and acoustic reflexes on all patients whereas about 40% of audiologists performed only tympanometry on all their patients. Since more than half of audiologist participants have worked with adults and children and dispensed hearing aids, the use of otoscopy and tympanometry examinations is crucial, and the absence of these examinations may lead to higher number of false negatives in detecting middle ear problems, especially in children.[26]

This survey also indicated that a few respondents performed OAEs measures on all their patients. Although less than half of the respondents mentioned that their facility had NHS programs, it is expected that none of those audiologists performed NHS, which heavily depends on OAEs examinations. Assuming the middle ear is normal; OAEs testing is beneficial to be conducted among all patients. OAEs tests provide early evidence of cochlear outer hair cell dysfunction, such as vascular or hypoxic and helps monitor ototoxicity and diagnose auditory neuropathy (i.e. auditory neuropathy spectrum disorder [ANSD]).[27] The absence of in-house practice protocols may have led to these variations (or deficiencies) in testing procedures.

The results of the survey showed that about 35% of the audiologists used both headphones and inserted earphones in PTA testing. The use of insert earphones alone was very limited. Audiologist participants may prefer the cost-effectiveness when using headphones over other advantages that the insert earphones may offer, such as infection control and higher interaural attenuation. The other fundamental tool in hearing battery tests is speech audiometry. It serves to cross-check the results of PTA, examine word recognition abilities, and determine the proper gain and output of amplifying devices. The inconsistency between PTA and speech audiometry may suggest neural problems such as ANSD.[28] The respondents reported using one or more speech audiometry assessments, such as SRT, SDT, and WRS. It is believed that most of these tests were used in Arabic; however, no further details about these tests were asked in the survey (e.g., speech tests' validity and reliability).

Audiologist participants in the present study worked with adults and children, but less than half of them administered electrophysiological tests, such as ABR and ASSR. Electrophysiological measures used to test children or adults who have a difficult time with conventional behavioral methods of hearing assessment. For instance, ABR has a wide range of clinical applications, such as screening for retrocochlear pathology, universal NHS, and frequency-specific estimation of auditory sensitivity.[29] The scarcity of audiology services was not limited to electrophysiological tests but also extended to vestibular tests and rehabilitation, APD and tinnitus testing and management, hearing conservation and protection, and aural re/habilitation services. Four reasons could lead to the lack of these audiologic services (a) around 70% of audiologist participants had a bachelor's degree with clinical experiences <5 years, (b) the dearth of standardized tests in Arabic (e.g., APD tests) and specialized training courses on these areas, (c) several health-care settings are not equipped with electrophysiological and vestibular equipment, and (d) some of these settings did not have programs designed for hearing protection, aural re/habilitation, or other specialized audiologic services.

Finally, more than half of the respondents dispensed and fitted some types of hearing aids. Combinations of BTE, RIC, CROS, and BiCROS hearing aids were being prescribed. The most prescribed hearing aids were BTE hearing aids because most of the audiologists worked in the government hospitals where free BTE hearing aids are provided for eligible patients. The survey's data showed that NAL-NL2 and DSL were the most used prescription formulae for adults and children, respectively. This result is consistent with the trends observed in literature.[30,31] It is surprising that only 46% of the audiologists use real ear measurements for verification while the remaining audiologists verified the hearing aid fitting based on the patient's feedback. Research shows that the use of verification measures with validated prescriptive targets during hearing aids fitting has been associated with improved patient outcomes.[32]

SLP survey

Demography

The current data suggests that more than half of SLPs worked in hospitals, accounting for about 54% of the respondents. Few respondents were working in schools and private practice. This result is inconsistent with the number of SLPs in the U.S. who are employed in health-care settings and schools. ASHA estimated that 39% of SLPs are employed in health-care settings, including 13% in hospitals.[2] Furthermore, the majority of SLPs in the U.S. are employed in educational settings, including 3% in universities or colleges and 53% in schools, and 19% of SLPs are employed in private practice.[2] The present study revealed that about 78% of SLPs were employed full-time and worked with different number of in- and out-patient adults and children. According to ASHA, 67% of SLPs' time in health-care settings in a typical week spent in providing direct treatment to individuals.[33] Moreover, SLPs practicing in the

U.S. spent 60% of their clinical services time with adults and about 40% of this time with infants and toddlers, preschoolers, and school-age children.[33]

Of the total SLP respondents, about 70% of them reported that they served 4 to10 patients every day. Thus, 81% of SLPs reported that the number of SLPs employed in their workplaces was not enough to help with the caseloads. Similar to audiology, major government hospitals, rehabilitation centers, and schools in Saudi Arabia employ a limited number of graduated SLPs. Recruitment policies and the lack of understanding SLP job responsibilities (e.g., misunderstanding between SLP services and special education services) are the main reasons. Most of the SLP respondents in this study were females, and the shortage of male SLPs was also reported in other surveys. This shortage of males in the profession obviously extends overseas.[34] It appears the shortage of male SLPs is more than what is reported in audiology. For example, ASHA conducted a survey of SLPs in school settings that revealed only 3% of 2,544 respondents (i.e., 76 SLPs) were males.[21] It is thought, "there are still some health-care professions viewed by men as being something that women do."[35]

Finally, Riyadh included most of SLP respondents. Similar to audiology; there is a shortage of SLP services provided to individuals in other cities of Saudi Arabia. About 95% of SLPs in the survey population tended to be between ages 20 and 40; consequently, most of their experiences ranged between 1 and 10 years. The median number of SLPs years of experience in the U.S. is 15 years, and the mean is 18 years.[35] More than 70% of SLP respondents had a bachelor's degree, so it is not surprising that around 65% of them were seeking a graduate degree. Again, this result supports the need of Saudi graduate programs in SLP.

SLP practice

The survey data revealed that SLPs provided assessments, diagnosis and intervention in several SLP areas from phonology and articulation disorders to neurological disorders, such as apraxia. This survey revealed about 65% of SLPs worked with patients who have articulation, phonology, and language disorders. In contrast, 35% and 24% of SLPs' time in health-care settings in the U.S. is spent on language and articulation phonology, respectively.[33] Only 27% of the SLP respondents worked with dysphagia patients. This result is inconstant with ASHA report in which at least 57% of SLPs' time in health-care settings is allocated to swallowing and feeding difficulties.[33]

In this study, 46% of SLPs provided services to individuals with autism. Research shows that children with autism accounted for 15% of SLPs' caseloads in the U.S. health-care settings and 20% to 25% of SLPs' caseloads in the outpatient clinic.[33] The current study also revealed about 30% of SLPs worked with aphasia and apraxia patients while approximately 35% of SLPs worked with dysarthria patients. In the U.S., 16% and 7% of SLPs' time focuses on diagnosing and treat aphasia and motor speech disorders, respectively.[33] More than half of the SLPs participants in this study did not benefit from the group therapy approach. The use of group therapy can limit SLPs' caseloads and devote more time to planning and implement treatment programs.

Audiologists' and SLPs' perspective

SSSPA was established in 2003, yet SSSPA should play a major role in supporting audiology and SLP education and practices in Saudi Arabia. The current study showed that about 50% of audiologist and SLP participants' satisfaction level were neutral with the services provided by SSSPA, leaving about 30% satisfied and 20% dissatisfied. The respondents to both surveys agreed on the need for national clinical protocols. Many demands provided by audiologists and SLPs to improve both professions in Saudi Arabia were acquired. Guidelines, policies, continuing education, national databases and statistics, and better introduction of both professions to other health-care professionals and community represent some of these demands. Regardless of the age of both professions in Saudi Arabia, it is not unexpected that some respondents indicated that both professions need "everything" to improve.

Audiology and SLP professions are still in their infancy in Saudi Arabia. Cooperation and collaboration among a diverse group of stakeholders, including SSSPA, the scientific committee of audiology and SLP at SCHS, current audiology and SLP academic program directors and faculty members, Ministry of Health, Ministry of Education, and King Salman Center for Disability Research should be started and supported to (a) achieve better education and practice of both professions and (b) encourage research.

Audiology and SLP academic programs

The Saudi government provides a huge financial support for youth education, so audiology and speech-language pathology professions are anticipated to grow. However, there is no data available to estimate the growth in Saudi Arabia. It is obvious that the current undergraduate programs are not enough to cover the high necessity of both audiology and SLP services in Saudi Arabia. Trained audiologists and SLPs will be increasingly needed to fulfill the demands of the community. More undergraduate and graduate programs must be established, but the efforts to establish new programs should concentrate on graduate programs. It is thought that individuals with only a bachelor's degree and limited clinical experiences do not have sufficient academic and clinical training; therefore, a master's degree and/or a doctoral degree in either field are the minimal entry level degrees to work as an audiologist or a SLP in many countries. The efforts aiming to establish academic programs in Saudi Arabia may encounter a number of obstacles, such as complexity of regulations and shortage of faculty with research and academic degrees. Further, there are other challenges, one of which is the national accreditation of the clinical doctorate programs (i.e., Au.D. and SLP.D. programs). The Ministry of Education in Saudi Arabia accredits

Au.D. and SLP.D. degrees as bachelor degrees.[36] Either degree should be equivalent to at least a master's degree for a person who already had an undergraduate degree.

Education in allied health professions including audiology and SLP has gone through several changes during the past few decades, moving from bachelors to masters and now to clinical doctorate, which mainly focuses on clinical training and the application of research and theory. In 2007, the Au.D. has replaced masters-level audiology programs as the entry-level degree,[37] and the same move in SLP programs is expected. Therefore, authorities in Saudi Arabia, such as the Ministry of Education and SCHS are encouraged to determine the advantages and disadvantages of turning current or future undergraduate audiology and SLP (or any other allied health profession) programs to clinical doctorate programs. Such decision and how this decision affects the future practice of audiology and SLP in Saudi Arabia need further investigations and a great deal of collaboration among stakeholders.

Limitations and Future Research

The small sample size is the first limitation, and therefore interpretation of the results should be taken with caution and overgeneralization of the data avoided. This study has limited representation of all audiologists and SLPs in Saudi Arabia for three reasons: (a) Not all practicing audiologists and SLPs are members of SSSPA, so a limited distribution of survey links among those practitioners was anticipated, (b) most of the respondents were from one city, Riyadh, and (c) less familiarity with social networks could hinder obtaining more responses. Finally, not all audiology or SLP services were captured in either survey.

The design of future survey may include different survey categories and more areas of specialty in both practices. Future research needs to focus in depth on either profession and identify the gaps in both clinical practice and training programs in Saudi Arabia. There is need to establish national statistics of communication sciences and disorders and whether the growth in both professions is parallel with the growth of Saudi population.

Conclusion

The present study has shed light on audiology and SLP in Saudi Arabia. Data is preliminary and provides an understanding of audiologists and SLPs and their current practices in Saudi Arabia. This study also identifies the need for national guidelines and policies that regulate these practices. SSSPA and the scientific committee of audiology and SLP at SCHS should engage effectively and sufficiently prepare, conduct, evaluate, and continuously improve education and clinical programs, roles and responsibilities, research, and even a future national plan for both professions in Saudi Arabia. To support research, SSSPA and the other related stakeholders should are encouraged to establish a national peer-reviewed journal specialized in the field of audiology and SLP in Saudi Arabia and other neighbor countries. This journal will support and accelerate faculty, clinicians, and students' motivation to design and publish research in both fields.

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References

1. American Speech-Language-Hearing Association. Learn About the CSD Professions: Audiology; 2016. Available from: http://www.asha.org/Students/Audiology/. [Last accessed on 2017 Jul 20].
2. American Speech-Language-Hearing Association. Learn About the CSD Professions: Speech-Language Pathology; 2016. Available from: http://www.asha.org/Students/Speech-Language-Pathology/. [Last accessed on 2017 Jul 20].
3. Mueller GH, Ricketts TA, Bentler RA. Modern Hearing aids: Pre-Fitting Testing and Selection Considerations. San Diego: Plural Publishing; 2008.
4. Olsen W, Rose D, Hedgecok L. A brief history of audiology at Mayo clinic. J Am Acad Audiol 2013;14:173-80.
5. American Speech-Language-Hearing Association. The Profession: A History of the American Speech-Language-Hearing Association; 2007. Available from: http://slhs.phhp.ufl.edu/files/2011/08/History-of-the-Profession.pdf. [Last accessed on 2017 Jul 20].
6. American Speech-Language-Hearing Association Programs. Available from: http://www.caa.asha.org/programs/. [Last accessed on 2017 Jul 20].
7. Saudi Society of Speech-Language Pathology and Audiology (SSSPA). History and Academic Programs; 2014. Available from: http://www.ssspa.org.sa. [Last accessed on 2017 Jul 25].
8. American Speech-Language-Hearing Association; 2012 Standards and Implementation Procedures for the Certificate of Clinical Competence in Audiology. http://www. asha.org/Certification/2012-Audiology-Certification-Standards/. [Last accessed on 2017 Jul 25].
9. American Speech-Language-Hearing Association; 2014 Standards and Implementation Procedures for the Certificate of Clinical Competence in Speech-Language Pathology. http://www.asha.org/Certification/2014-Speech-Language-Pathology-Certification-Standards/. [Last accessed on 2017 Aug 02].
10. American Speech-Language-Hearing. Market Trends; 2016. Available from: http://www.asha.org/Careers/Market-Trends/. [Last accessed on 2017 Aug 02].
11. American Speech-Language-Hearing Association. Supply and Demand Resource list for Audiologists; 2016. Available from: http://www.asha.org/uploadedFiles/Supply-Demand-Audiology.pdf.
12. American Speech-Language-Hearing Association. Supply and Demand Resource List for Speech-Language Pathologists; 2016. Available from: http://www.asha.org/uploadedFiles/Supply-Demand-SLP.pdf. [Last accessed on 2017 Aug 10].
13. General Authority for Statistics. Population Statistics; 2016. Available from: http://www.stats.gov.sa/en. [Last accessed on 2017 Aug 10].
14. De Bonis DA, Donohue CL. Survey of Audiology: Fundamentals for Audiologists and Health Professionals. 2nd ed. Boston: Pearson/Allyn

and Bacon; 2007.

15. American Speech-Language-Hearing Association; 2015. Work life Survey. CCC-A Survey Summary Report: Number and Type of Responses; 2016. Available from: http://www.asha.org/uploadedFiles/2015-Work-Life-Survey-Aud-Summary-Report.pdf. [Last accessed on 2017 Aug 10].
16. Kochkin S. Marke Trak VIII patients report improved quality of life with hearing aid usage. Hear J 2011;64:25-6.
17. Kochkin S. 20 Q: 25 Years of Mark Trak: MarkeTrak-the Highlights, Audiol Online; 2012. Available from http://www.betterhearing.org/sites/default/files/hearingpedia-resources/MarkeTrak-AO1.pdf.
18. Inc. Palo Alto, California, USA. Survey Monkey; 2016. Available from: https://www.surveymonkey.com/mp/take-a-tour/?ut_source=header. [Last accessed on 2017 Aug 17].
19. QSR International Pty Ltd. N Vivo: Qualitative Data Analysis Software. Version 11; 2015. Available from: http://www.qsrinternational.com/nvivo-product. [Last accessed on 2017 Jul 05].
20. Sullivan E. Personal Communication Regarding Profiles of 7, 900 Members of the American Academy of Audiology; 2002. Available from: http://www.audiology.org/publications/about-journal-american-academy-audiology. [Last accessed on 2017 Aug 10].
21. American Speech-Language-Hearing Association; 2010 Schools Survey: Survey Methodology, Respondent Demographics, and Glossary; 2010. Available from: http://www.asha.org/uploadedFiles/Schools10Methodology.pdf. [Last accessed on 2017 Sep 04].
22. American Speech-Language-Hearing Association; 2014 Audiology Survey: Survey Methodology, Respondent Demographics, and Glossary. Audiology Survey: Methodology; 2015. Available from: http://www.asha.org/uploadedFiles/2014-Audiology-Survey-Demographics-Methodology-Glossary.pdf. [Last accessed on 2017 Sep 04].
23. King Saud University. College of Applied Medical Sciences: Students Statistics; 2016. Available from: http://www.cams.ksu.edu.sa/en/students/students-statistics.
24. Cell Scope Inc. Cell Scope; 2016. Available from: https://www.cellscope.com.
25. Sridhara SK, Brietzke SE. The "Spoke Sign." Arch Otolaryngol Head Neck Surg 2012;138:1059.
26. Stach BA. Comprehensive Dictionary of Audiology: Illustrated. 2nd ed. New York, United States: Thomson/Delmar Learning; 2003.
27. Starr A, Sininger Y, Nguyen T, Michalewski HJ, Oba S, Abdala C. Cochlear receptor (Micro phonic and summating potentials, otoacoustic emissions) and auditory pathway (Auditory brain stem potentials) activity in auditory neuropathy. Ear Hear 2001;22(2):91-9.
28. Hood L. Auditory neuropathy and dys-synchrony. In: Burkard RF, Eggermont J, Don M, Eggermont JJ, editors. Auditory Evoked Potentials: Basic Principles and Clinical Application. Philadelphia: Lippincott Williams and Wilkins; 2006. p. 1-16.
29. Hall JW. Application of ABR in Objective Assessment of Infant Hearing. Audiol Online; 2013. Available from: http://www.audiologyonline.com/articles/application-abr-in-objective-assessment-12079. [Last accessed on 2017 Aug 16].
30. Polonenko MJ, Scollie SD, Moodie S, Seewald RC, Laurnagaray D, Shantz J, *et al*. Fit to targets, preferred listening levels, and self-reported outcomes for the DSL v5.0a hearing aid prescription for adults. Int J Audiol 2010;49:550-60.
31. Rajkumar R, Muttan S, Jaya V, Vignesh S. Comparative analysis of different prescriptive formulae used in the evaluation of real Ear insertion gain for digital hearing aids. Unnes J Biol Educ 2013;1:32-41.
32. Abrams HB, Chisolm TH, McManus M, McArdle R. Initial-fit approach versus verified prescription: Comparing self-perceived hearing aid benefit. J Am Acad Audiol 2012;23:768-78.
33. American Speech-Language-Hearing Association. SLP Health Care Survey Report: Caseload Characteristics Trends 2005-2013; 2013. Available from: http://www.asha.org/uploadedFiles/2005-2013-SLP-Survey-Caseload-Characteristics-Trends.pdf. [Last accessed on 2017 Aug 23].
34. American Speech-Language-Hearing Association. 2015 SLP Health Care Survey: Methodology, Respondent Demographics, and Glossary; 2015. http://www.asha.org/uploadedFiles/2015-SLP-Health-Care-Survey-Demographics.pdf. [Last accessed on 2017 Sep 12].
35. Mosheim J. Men in Speech-Language Pathology; 2016. Available from: http://speech-language-pathology-audiology.advanceweb.com/Article/Men-in-Speech-Language-Pathology.aspx. [Last accessed on 2017 Aug 06].
36. Ministry of Education. The System of Recommended Universities; 2016. Available from: https://www.ru.moe.gov.sa/Search. [Last accessed on 2017 Sep 12].
37. American Academy of Audiology. AuD facts; 2017. Available from https://www.audiology.org/education-research/education/students/aud-facts. [Last accessed on 2017 Sep 26].

Appendices

Appendix A

Audiology survey

(A) Demography
1. What is your gender?
   Female
   Male
2. What is your age?
   21-30
   31-40
   41-50
   >50
3. In which city do you work?
   Makkah Al Mukaramh
   Al Madinah Al Munawarah
   Riyadh
   Jeddah
   Dammam
   Other (please specify)
4. What is your work place?
   Hospital
   University
   Private Practice School
   Other (please specify)
5. Do you work full- or part-time?
   Full-time
   Part-time
6. Your highest attained degree.
   Bachelor Au.D.
   Master Ph.D.
   Other (please specify)
7. Are you planning to complete your graduate study?
   No
   Not applicable
   Yes (please specify)
8. Years in practice?
   <5 years
   6-10 years
   11-15 years
   16-20 years
   >20 years
9. What is the nature of your patients?
   Adults
   Children
   Both
   Not applicable
10. How many patients do you see every day?
    1-3
    4-6
    7-10
    Not applicable
    Other (please specify)
11. What is the number of audiologists in your workplace?
    1-3
    4-6
    7-10
    Other (please specify)
12. Do you think the number of audiologists in your workplace is enough to cover the workload?
    Yes
    No
13. Do you have an in-house or local clinical protocol to follow?
    No
    Not applicable
    Yes (please specify)

(B) Audiology services
14. Do you perform.
    - Otoscopy?
      Routinely on all patients
      Most of the time rarely
      Not applicable
      Other (please specify)
    - Tympanometry and acoustic reflex measures?
      Yes on all patients
      Only tympanometry based on the patient
      Not applicable
      Other (please specify)
    - Otoacoustic emissions (OAEs)?
      Yes on all patients
      Most of the time
      Based on the patient
      No
      Not applicable
      Other (please specify)
    - Pure-tone audiometry?
      No
      Not applicable
      Yes (please specify transducer type):
      Headphones (e.g. supra-aural and circumaural)
      Insert earphones
      Both
      Not applicable
    - Speech audiometry?
      No
      Not applicable
      Yes (please specify speech assessment type):
      Speech reception (recognition) threshold (SRT)
      Speech awareness threshold (SAT)/speech detection threshold (SDT)
      Word recognition score (WRS)
      QuickSIN/other speech tests in the presence of background noise
      Other (please specify)

- Electrophysiological measurements?
  No
  Not applicable
  Yes (please specify)
- Vestibular assessments?
  No
  Not applicable
  Yes (please specify)
- Assessments and rehabilitation for auditory processing disorder (APD)?
  No
  Not applicable
  Yes (please specify)
- Assessments, counseling, and/or management for tinnitus?
  No
  Not applicable
  Yes (please specify)

15. Is there a newborn hearing screening (NHS) program in your work place?
    Yes
    No
    Not applicable
16. Are you fitting/dispensing hearing aids?
    No
    Not applicable
    Yes (please specify type, prescription formulae, verification)
    Type.....
    Prescription formula.....
    Verification.....
17. Do you provide aural re/habilitation services?
    Yes
    No
    Not applicable
18. Do you do any implantable devices fitting and programing?
    Cochlear implants (CIs)
    Bone-anchored hearing aid (BAHA)
    Middle ear hearing aids implants (e.g. Vibrant Soundbridge, Maxum, or Esteem)
    Auditory brainstem implant (ABI)
    Not applicable
19. Is there a hearing conservation/protection program in your workplace?
    Yes
    No
    Not applicable

(C) Audiologists' perspective

20. Do you think we need to have a nation-wide clinical protocol?
    Yes
    No
21. Please indicate your level of satisfaction with the services (e.g., professional education opportunities) provided by Saudi society of speech-language pathology and audiology (SSSPA)?
    Very satisfied neutral
    Dissatisfied
    Very dissatisfied
22. What does the profession of audiology in Saudi Arabia need to improve?

Appendix B

Speech-language pathology survey

(A) Demography

1. What is your gender?
   Female
   Male
2. What is your age?
   21-30
   31-40
   41-50
   51 and older
3. In which city do you work?
   Makkah Al Mukaramh
   Al Madinah Al Munawarah
   Riyadh
   Jeddah
   Dammam
   Other (please specify)
4. What is your work place?
   Hospital
   University/College
   Private Practice School
   Other (please specify)
5. Do you work full- or part-time?
   Full-time
   Part-time
6. Your highest attained degree.
   Bachelor SLP.D.
   Master Ph.D.
   Other (please specify)
7. Are you planning to complete your graduate study?
   No
   Not applicable
   Yes (please specify)
8. Years in practice.
   Less than 5 years
   6-10 years
   11-15 years
   16-20 years
   More than 20 years

9. What is the nature of your patients?
   - Adults children
   - Both
   - Not applicable
10. Your patients are
   - Outpatient
   - Inpatient
   - Both
   - Not applicable
11. How many patients do you see every day?
   - 1-3
   - 4-6
   - 7-10
   - Not applicable
   - Other (please specify)
12. What is the number of speech-language pathologists in your workplace?
   - 1-3
   - 4-6
   - 7-10
   - Other (please specify)
13. Do you think the number of speech-language pathologists in your workplace is enough to cover the workload?
   - Yes
   - No
14. Do you have an in-house or local clinical protocol to follow?
   - No
   - Not applicable
   - Yes (please specify)

   (B) Speech-language pathology services
15. In which of the following area/s do you serve?
   - Articulation/phonological disorders
   - Language disorders: Semantics, morphology, and syntax
   - Language disorders: Pragmatics/social communication
   - Reading and writing (literacy) difficulties
   - Fluency disorders
   - Auditory processing disorder (APD)
   - Autism spectrum disorders, including pervasive developmental disorder (PDD) and Asperger's
   - Nonverbal/augmentative and alternative communication (AAC)
   - Selective mutism
   - Cognitive communication disorders
   - Apraxia
   - Aphasia
   - Dysarthria
   - Dysphagia (swallowing/feeding)
   - Voice or resonance disorders
   - Aural re/habilitation
   - Prevention/wellness
   - Not applicable
   - Other (please specify)
16. Do you do group therapy?
   - Yes
   - No
   - Not applicable

   (C) SLPs' perspective
17. Do you think we need to have a nation-wide clinical protocol?
   - Yes
   - No
18. Please indicate your level of satisfaction with the services (e.g., professional education opportunities) provided by Saudi society of speech-language pathology and audiology (SSSPA)?
   - Very satisfied
   - Satisfied
   - Neutral
   - Dissatisfied
   - Very dissatisfied
19. What does the profession of speech-language pathology in Saudi Arabia need to improve?