The Effect of Hearing Loss on Anxiety and Insomnia

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This research investigated the relationship between insomnia, anxiety, and hearing loss, with a focus on determining whether hearing loss exacerbates anxiety and insomnia in individuals. Motivated by the pressing issue of chronic insomnia in adults, especially those with disabilities, the study sought to unravel the psychological dimensions of sleep disturbances in the context of hearing loss. Employing the Insomnia Severity Index (ISI) and Hamilton Anxiety Scale (HAM-A), data was collected from 100 participants with hearing loss through online support groups. Results indicated a substantial association between hearing loss and an elevated likelihood of insomnia (53%) and anxiety (61%). Notably, the data yielded a moderate correlation (r=0.4223) between anxiety and sleep patterns. These findings emphasize the imperative need to address mental health concerns in the hard-of-hearing and deaf community, highlighting the impact of chronic stress on sleep. The study underscores the necessity for tailored interventions and support systems for individuals with hearing loss. The research contributes valuable statistics to existing literature and prompts further exploration into the intricate connections among insomnia, anxiety, and hearing loss.

Keywords: Behavioral and Social Sciences; Cognitive Psychology; Insomnia; Anxiety; Hearing Loss.

Introduction

With chronic insomnia consistently remaining a pressing issue for 10% of adults, often linked to causing memory issues, absenteeism, depression, and frequent accidents, it has become increasingly relevant in a society that deeply values mental health as much as its physical counterpart. While insomnia can appear independently, it is often recognized as secondary to another circadian, sleep, medical, psychiatric, or neurological disorder present in the patient [1]. What distinguishes insomnia as chronic and a disorder rather than simply a symptom is if a sleep disturbance happens more than three times a week, the problem presents for a month or longer, is connected with daytime stress or impairment, and occurs despite there being an existing opportunity for sleep at an appropriate time [2]. In addition, prolonged periods of wakefulness, frequent nocturnal awakenings, long sleep latency, and impermanent arousals indicate insomnia. This impact on one's daily function characterizes insomnia as a disorder. Currently, the most impactful risk factors recognized for insomnia are age and biological sex, where insomnia presents more frequently in older individuals and females, but this raises the question of why these particular groups would suffer from an increased risk [1].

For females, insomnia is seen more commonly because of menstruation and menopausal onset, though they do not independently cause insomnia. Females over 45 years old have a nearly two times higher likelihood of having diagnosed insomnia than males and more often report sleep complaints to their physicians [3]. The increased rate of insomnia in older individuals is associated with dysregulation and a lessened function of sleep systems experienced with aging, and also an increase in medical issues in older adults, particularly seen with physical disabilities [4]. Chronic illnesses are another common risk factor for insomnia, and the majority of individuals with insomnia have an increased probability of having a comorbid medical disorder, which is especially relevant since chronic conditions have an increased onset rate later in life [5]. However, while there is no direct observed link between physical disabilities having a causal relationship with insomnia, the two could likely be connected through psychiatric disorders occurring as a result of chronic physical disabilities. This is emphasized by most common comorbid medical disorders associated with insomnia being psychiatric, with about 40% of people with insomnia having a coexisting psychiatric condition. Moreover, insomnia associates with psychiatric conditions more frequently than any other medical condition, and it indicates a significant risk for the development of a subsequent psychiatric disorder. In addition, professionals use this sleep disorder or its symptoms to diagnose depression, anxiety, and numerous other disorders. Because of the marked connection between anxiety and insomnia, the two are often associated with each other if an individual is diagnosed or at risk for both issues concurrently. Furthermore, the relationship between anxiety and insomnia are well-acknowledged and backed up by a number of studies in recent literature. As mentioned previously, anxiety can be the conduit through which hearing loss correlated with high insomnia rates [1].

Therefore, this study aims to evaluate the relationship between insomnia, anxiety, and hearing loss, specifically if hearing loss

exacerbates anxiety and insomnia, rather than the traditional model of depression causing insomnia in people with disabilities. The expectation is that hearing loss will lead to an increased likelihood of insomnia and anxiety. Understanding this connection directly addresses the real- world impact of not only having one of these conditions, but also experiencing these as comorbid issues. Connecting hearing loss, anxiety, and insomnia allows for healthcare professionals to address the root cause rather than prescribing a multitude of treatments that are not tailored to the patient's unique lived experience, which can lead to less time, energy, and finances needed to obtain a favorable outcome for the patient. Furthermore, recognizing how interconnected these issues are assists with cognitive-behavioral approaches that are used for anxiety and insomnia which can tackle the root of the problem, improving quality of life by directly improving social behavior and limiting symptoms.

Review of Literature

Research within the body of knowledge addressing hearing loss most commonly defines hearing loss as an inability to hear as well as an individual with regular hearing. For this study, hearing loss will be defined the same way. Some clinical criteria for hearing loss are a reported difficulty with hearing, most often in noisy environments, tinnitus, a need for people to repeat themselves or for sounds to be louder in order to interpret them, and a history of being exposed to loud noises. An abundant amount of research studies have found a causal relationship between anxiety and hearing loss resulting as a biological or lifestyle factor, and a connection between insomnia and anxiety has also been well established. Roth[1] highlights that 40% of insomnia patients have a coexisting psychiatric disorder, with depression being the most common and well-recognized, but insomnia is a strong diagnostic criterion for both depression and anxiety, as seen in the Hamilton Anxiety Scale (HAM-A)[1]. Staner[6] found that sleep disorders, especially insomnia, are pervasive in anxiety disorders, specifically since hyperarousal is a common issue between anxiety disorders and insomnia, where it, in both cases, prevents relaxation. This is explained by the locus-coeruleus autonomic nervous system and the corticotropin-releasing hormone system, which contributes to the arousal response to stress, especially when it is repeated or prolonged, as seen in anxiety disorders. Therefore, insomnia can be seen as a risk factor for anxiety disorders[6].

In addition, it is acknowledged by Carmen & Uram[7] that hearing loss exacerbates anxiety in adults. For example, David G. Meyers, a social psychologist who has had personal mental health struggles with hearing loss, said when recounting his family experiences,

> "Not having understood what was said in a group, I would chime in and say the same thing someone else had just said—and everyone would laugh. I would be so embarrassed; I wanted to fall through the floor."

Highlighting the extensive stress deaf and hard-of-hearing people have to endure in regular social situations. This makes it distinct from examining disability as a whole, since hearing loss presents unique challenges that affect sensory perception, social function, and even cognitive function over time. This introduces an element of anxiety for people with hearing loss in the sense that hard-of-hearing people may feel an increased need for vigilance in social situations to "keep up" with conversation, leading to exhaustion or isolation. Aside from these personal life experiences, situations such as receiving medical care from a hearing provider, wearing assistive hearing devices like hearing aids and cochlear implants for the first time, or confronting deep issues regarding one's hearing loss can worsen anxiety. Also, since mental outlook is closely related to the development of hearing loss, one's stress and anxiety symptoms can indeed be worsened by a consistently decreased outlook in one's daily life[7].

In a nationwide study, Yeo et al.[8] identified a risk between sudden sensorineural hearing loss and insomnia in a nationwide study. The results were found through extensive data analysis and long-term follow-up of the participants with sudden sensorineural hearing loss, which linked it to insomnia after numerous reports of sleep disturbances and irregularities. However, the downfall of this study is that it did not measure the correlation between all forms of hearing loss. Though sensorineural hearing loss (SNHL) is the most common, people with conductive or mixed hearing loss represent another large portion of the hard-of-hearing population. The difference between the three types lies in the cause and reasoning behind the hearing loss. When sound waves cannot reach the inner ear, one has conductive hearing loss, and SNHL is more common and is defined by hearing loss caused by the cochlea, central nervous system, or auditory nerve. Mixed hearing loss is a combination of both of these forms[8]. To emphasize the relevance of addressing problems the hard-of-hearing and deaf communities endure, about 20% of the United States population over 12 has some form of hearing loss, and the likelihood of having it increases drastically in older age groups[9]. Furthermore, insomnia is one of the most common sleep disorders in older individuals, and the population of older adults is expanding from about 200 million now to an estimated two billion by the year 2050[10].

Addressing the other portion of the research, there is a lack of published research detailing the reasoning behind insomnia's connection to hearing loss aside from tinnitus, except in stating that people with hearing loss are more likely to experience insomnia than the average person[11]. Rather than addressing any inconsistencies or gaps in the two studies mentioned previously, this study's goal is to explore an alternate perspective of whether hearing loss contributes to sleep problems through

anxiety, which connects previous studies through an alternate line of reasoning.

Theoretical Framework

In reviewing existing theories that guided this research, the study referenced "A Cognitive Theory and Therapy for Chronic Insomnia" from the Journal of Cognitive Psychotherapy, which specifies the five processes to maintain insomnia: selective attention and monitoring, worry, unhelpful beliefs about sleep, counterproductive safety behaviors, and misperception of sleep and daytime deficits. This article acknowledges the comorbidity of insomnia with other conditions or disorders, emphasizing psychiatric health issues in particular. This observed relationship guided the line of reasoning behind the connection between insomnia and anxiety for this study. Furthermore, the insomnia mediator model illustrates that negative trait anxiety, which is anxiety that remains part of one's personality, affects sleep quality. This anxiety is demonstrated as affecting sleep patterns by beginning with trait anxiety, leading to a distortion of insomnia perception factors, then causing state anxiety, and lastly, resulting in the consequences of insomnia experienced as a result of the anxiety [12]. These two studies were connected to a worsening of insomnia symptoms in disabled people due to their emphasis on consistent anxiety traits associated with one's personality as a result of a lifestyle factor, which could be an adoption of anxious thought patterns in people living with a disability. Specifically, in people with hearing loss, issues with tinnitus, nervousness relating to auditory awareness in social situations, and the maintenance of and accommodations made when living with hearing tools such as cochlear implants or hearing aids can exacerbate anxiety [13].

Objective

Depression is most commonly associated with insomnia in people with chronic illnesses and disabilities, and it is because of this that the majority of disabled people seeking treatment for insomnia target depressive symptoms [14]. Unfortunately, there is a lack of research on anxiety contributing to insomnia and other sleep disorders in people suffering from chronic disabilities. What is known is that both depressed and anxious people have higher rates of insomnia. Still, the latter's specific forms of anxiety disorders, such as generalized anxiety disorder, social anxiety disorder, panic disorder, or adjustment disorders with anxiety, which are common in disabled people, are not observed independently [15]. Therefore, this study aimed to observe the link between the entire scope of anxiety symptoms and disorders and insomnia, particularly in people with hearing loss as a disability. Studying individuals specifically with hearing loss can be effective since ample stress-inducing situations may be prevalent in one's daily life, providing significant data. Frequently, irregular anxiety experienced with hearing loss is the result of an adjustment disorder, which is when anxiety surfaces because of identifiable stress and is more problematic and severe than anxiety considered appropriate for the stressor [6]. This stress occurs not because of the physical loss of hearing but as a result of the ensuing isolation one feels from one's community afterward or having a lack of community of other hard-of-hearing or deaf individuals as a support system. Many deaf individuals consider themselves to have a sense of community typically centered around American Sign Language use, and adjusting to losing one's hearing can present a difficult challenge of integrating or remaining static with one's culture.

About 73% of people who present with anxiety and insomnia had anxiety preceding insomnia. However, the opposite is true with comorbid insomnia and depression, where insomnia comes first, with depression following. In any case, the most common health issue following insomnia is depression, so it remains a risk factor for all people struggling with insomnia. Yet, since this anxiety often comes before insomnia, the line of reasoning that hearing loss causes anxiety, which leads to insomnia, is more likely to be accurate than depression leading to insomnia, as many claim it does for disabled people who have insomnia [6]. Therefore, this investigation's purpose is to address the question of whether an anxiety disorder or anxiety problems can lead to insomnia in people with disabilities. Specifically, people with hearing loss were a relevant group for the specific social and physical challenges, such as tinnitus, dizziness, and anxiety about awareness within social situations. This symptom of tinnitus is especially relevant when more significant sleep interference is associated with greater tinnitus severity [16]. However, this direct link will not necessarily be observed in this study; instead, it will be analyzed through a psychological and cognitive lens. The hypothesis for this investigation was, "If people with disabilities experience insomnia at a higher rate than the average population, then people with hearing loss are more likely than the average person to suffer from anxiety, either as a result of adjusting to the disability or insomnia.". In addition to this connection, the research observed the relationship between age and biological sex in insomnia prevalence.

Materials and Methods

The materials used for the study were the Insomnia Severity Index, the Hamilton Anxiety Scale, internet connection, and online device access, such as a laptop, phone, or tablet, to use the online scales and questionnaire data. To begin the study, the owners of the Insomnia Severity Index (ISI) and the Hamilton Anxiety Scale (HAM-A) approved their scales for both usage in a study and in an online format, as well as being administered by both a scientific professional and a non-professional administrator [17]. Following the approval, the questionnaire was created, a three-part online form including the entire Insomnia Severity

Index and Hamilton Anxiety Scale, along with three personal inquiries about age, biological sex, and age of onset plus the severity of their hearing loss [18].

The procedure collected exactly 100 participants above the age of 18 through four different online hearing loss informative groups through a group message containing a link to the questionnaire that could only be viewed by members. Informative hearing loss groups were chosen because the hard-of-hearing population was determined to be more aware of their own self-reported symptoms regarding their hearing loss, making the study's results more accurate. The online setup also allowed for the collection of participants from geographically distinct populations. Participants were selected through this open invitation to participate in the study, and they were given a one-month period to respond. Participants were also permitted to participate regardless of the severity of hearing loss and concurrent conditions. Moreover, the severity of hearing loss was examined in the form, and the population selected had a range of every degree of hearing loss (severe or deafness to mild) while also having a mix of people with sensorineural, conductive, and mixed hearing loss. The study did not inquire on race, ethnicity, non-hearing related medical history, or other demographics aside from age and biological sex. After giving informed consent, the participants completed the forms, which were all analyzed for relevant trends through various statistical and data analyses, including but not limited to an R score, various bar graphs and tables, and percentages. Following the collection, no changes, modifications, or errors were found within or made to the data. The independent variable was anxiety patterns in people diagnosed with hearing loss, and the dependent variable that changed, as a result, was the likelihood and prevalence of chronic insomnia at the time of the study. This study did not include a control group since comparisons could be made to the average rate of anxiety in the adult population according to the Hamilton Anxiety Scale and Insomnia Severity Index, which the scale owners provided as data already available to the public in their user manual. The questionnaires given to participants, the time allotted to complete the forms, and the background information provided before filling out the form remained constant throughout the investigation.

For the context and validity of the two scales used, the HAM-A is one of the earliest rating scales to be created to gauge the intensity of anxiety symptoms, which is still extensively utilized in research and clinical contexts. The 14-item scale assesses both somatic anxiety (physical problems associated with anxiety) and psychic anxiety (mental agitation and psychological distress). A set of symptoms defines each item on the scale. While professionals criticize the HAM-A for its occasionally weak capacity to distinguish between somatic anxiety and somatic side effects, as well as between anxiolytic and antidepressant effects, it is still often used as an outcome measure in clinical trials and psychiatric settings. With a total score range of 0–56, each rated item is on a scale from 0 (not present) to 4 (severe), with ¡17 denoting mild severity, 18–24 suggesting mild to moderate severity, and 25–30 meaning moderate to severe.

As for the ISI, the seven-item survey quickly screens for insomnia, and participants score the severity and symptoms of their sleep issues using a Likert-style measure, making it easy to use and score. The questions focus on the subjective aspects of the respondent's sleep, such as the intensity of symptoms, the degree of distress caused by the sleep problem overall, the degree to which the respondent feels others can tell they have insomnia, and how satisfied they are with their sleep patterns as a whole. The validation of the scale was conducted on two distinct cohorts of insomnia patients, spanning an age range of 18 to 84 years. The study used the ISI over the other primary standard scale, the Sleep Quality Scale, since the ISI specifically measures insomnia as a disorder rather than a broader scope of sleep issues, allowing only the needed data to evaluate insomnia in this investigation. Additionally, the SQS takes an average longer amount of time to fill out [19].

Ethical Considerations

Participants who viewed sharing their experiences relating to their anxiety, depression, hearing loss, or insomnia as triggering or as something that would negatively impact their self-esteem, confusion, feelings of loss, or depression were advised not to take the form. However, the risk of these feelings arising in participants could have been unanticipated. Participants could misjudge their opinions before taking the questionnaire, presenting a minimal risk for the study. Aside from this, no other risks were identified.

Safety precautions to minimize this risk were complete anonymity and safeguarding of responses for participants to reduce their nervousness about being identified by their experiences. Also, there was a disclaimer and forewarning upon initial contact with participants and again when they began taking the form. Participants were made aware that they could stop at any time if they felt uncomfortable. Filling out the forms required permission from the participants. Informed consent was obtained by an informative text block at the beginning of the form that required participants to check "yes" to indicate their understanding of what the results would be used for and what they were asked to do. The average time the questionnaire should have taken participants was between five and twenty minutes, so it should not have significantly interfered with their daily lives. Participants were only needed once for the study as a whole, which was to fill out the questionnaire. No contact was maintained between the participants and the data collector, and individual results were not given to people in the sample. Additionally, before the study, IRB approval was obtained from the researcher's educational institution.

Results and Discussion

Using the data collected from the questionnaire on insomnia and anxiety patterns in people with hearing loss, a thorough analysis of the prevalence of the two disorders was conducted. Having 100 participants allowed easy percentage figuring for those scoring above a seven on the ISI and above a 17 on the HAM-A. It was determined that 53/100 (53%) of participants qualified for the ISI's definition of insomnia, but 86% reported some issue with sleep disturbances by mentioning some form of nonrestorative sleep, which the International Statistical Classification of Diseases Tenth Edition establishes as a highly relevant symptom of insomnia. Additionally, it was observed that 37/100 (37%) of participants reported problems with moderate anxiety, but 61% met the HAM-A's designation of mild anxiety or moderate to severe as a whole. This was calculated by adding columns Q, R, and S in the data collection sheet and having a number higher than the 17 total. Lastly, 23/100 (23%) of participants reported problems with both insomnia and anxiety, seen in the participants having the ISI category as seven or higher and the HAM-A category greater than 17 simultaneously. Other relevant information includes that 23/37 (62.162%) of people who reported having anxiety also had problems with some form of nonrestorative sleep patterns, and 23/53 (43.396%) of people who reported having sleeping problems also had problems with anxiety.

The R score, also known as r-squared, was another form of analysis used, which measures how well the data fits the graph and model, and scores in the mid-range (from 0.4 to 0.6 or -0.4 to -0.6) usually indicate a mild to moderate correlation. In addition, positive numbers mean that as one variable increases, so does the other. The data suggests that having an anxious mood does have a mild to moderate impact (r= 0.4223) on a person's ability to fall asleep, and as anxiety increases, so does insomnia, and vice versa. To complement the R score, the median score on the ISI was 15, and the average was 14.5, while the median score on the HAM-A was 20.5, and the average was 21.7. These results add to the correlation and credibility of the R score by showing that both increase together. Moreover, the data was interpreted using bar graphs to illustrate the biological sex and age differences. As seen in Figure 1, age did not have a significantly impactful influence on anxiety or sleep when all age groups had a chronic disability. This partially validates the claim that age has an increased likelihood of insomnia and anxiety because of a higher ratio of chronic illnesses or disabilities within the population. With the exception of the R score, the other statistics were calculated manually with multiple revisions.

As seen in Figure 2, an overwhelming majority of participants had a HAM-A score above 7. As established by the scale's creators, a score of 17 was evaluated for the HAM-A to assess for at least mild through severe anxiety symptoms. It was found that under the anxiety analysis, 61/100 (61%) of participants struggled with anxiety at some point in the past month.

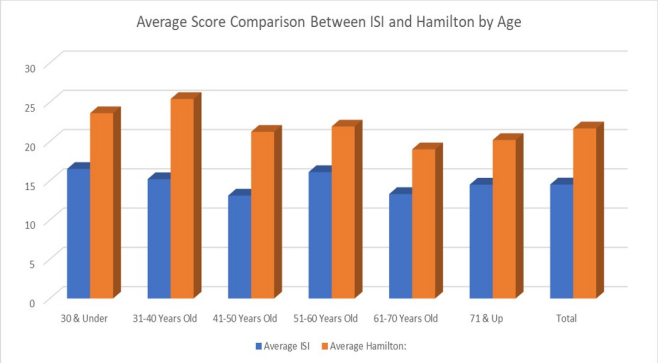

Fig. 1 Average Score Comparison Between ISI and Hamilton by Age

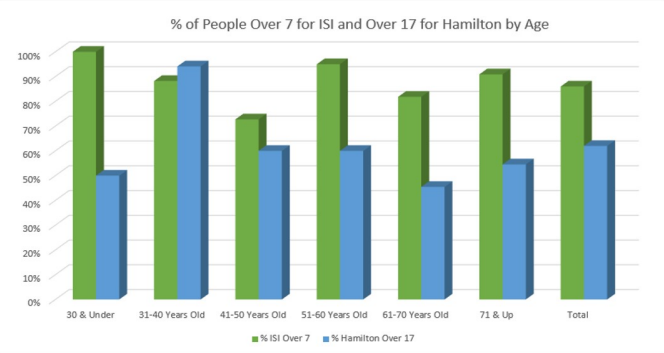

Fig. 2 Percentage of People

It is also important to note that in Figure 3, fewer males scored higher on anxiety throughout the HAM-A as compared to females. However, both reported relatively similar sleep issues on the ISI. Males also had a smaller range on both scales, meaning they responded more similarly to each other than females did despite not having a distinctly different ISI score from them. The entire group's responses on both scales, seen in the average on the yellow table, show that this study's sample of hard-of-hearing people is far more likely to have anxiety and insomnia than the average population's likelihood of 3.4% and 10%, respectively.

Also present in Figure 2 is a more significant portion of participants ages 51-60 out of the entire age range of 19 through 84 scoring high on both the ISI and HAM-A despite comprising a significantly smaller portion of the study population than the 41 through 70 age population, which is slightly higher than the other categories. As a whole, though, biological sex and age do not seem to have a significant impact on insomnia and anxiety in people who have hearing loss, except for adults ages 51 through 60. As a whole, the data and results support the hypothesis that anxiety is an indicator of insomnia in people with hearing loss, and that anxiety and insomnia are indeed more prevalent in

Males on the ISI and HAM-A

ISI		HAM-A	
Median	16	Median	14
Avg	14.8	Avg	18.4
Range	4 to 22	Range	4 to 39
%	85%	%	64%

Females on the ISI and HAM-A

ISI		HAM-A	
Median	15	Median	21
Avg	14.5	Avg	22.1
Range	0 to 28	Range	3 to 48
%	85%	%	64%

Entire Group on the ISI and HAM-A

ISI		HAM-A	
Median	15	Median	20.5
Avg	14.5	Avg	21.7
Range	0 to 28	Range	3 to 48
% All Gender	86%	% All Gender	62%

Fig. 3 Male/Female Comparison

	ISI	HAM-A
Standard Deviation	6.494	10.75
SD at 95% confidence	±8.77%	±9.85%
Standard Error	0.615	1.091
Mean Score	14.52	21.72
Variance	42.17	115.56
T-Statistic	7.158	9.565
Z Score	8.452	16.357
P value	<0.0001	<0.0001

Fig. 4 Statistical Results

disabled people. The results align by depicting an overall higher rate of anxiety and insomnia in the surveyed group while also showing that as either increases, the other increases in response.

Lastly, in Figure 4, which contains most of the statistical analysis methods used, a number of conclusions can be drawn.

The ISI's standard deviation shows that the data is expected to often fall within six to seven points, surrounding the mean score of approximately 14. For the HAM-A, the standard deviation is around nine to eleven points, surrounding the mean of about 22. As mentioned, both of these scales' mean scores in this study are above the minimum requirement for anxiety and insomnia. This standard deviation shows that most scores will fall near this significantly above-average score, showing the prevalence of these disorders in the study's sample population. This conclusion about the data is supported by the small standard error size for the ISI and HAM-A at 0.615 and 1.091, respectively.

Furthermore, the z-score, a key statistical measure, shows that the average population (people with no hearing loss) scores much differently, in this case, significantly lower than the sample of hard-of-hearing and deaf participants. This data leads to the null hypothesis for this investigation: There will be no difference between the study's sample and the average population, and the p-value and the t-statistic can contribute strong evidence against this null hypothesis. A p-value of less than 0.0001, which this investigation had, means that the probability of obtaining the observed results by random chance alone, assuming the null hypothesis is actual, is less than 0.01% (or less than 1 in 10,000 chance). To elaborate on the p-value, homogeneity of variance was used to average the sample variance to establish the population variance, which was also calculated in Figure 4. The assumption of normality was also made, meaning it was assumed that the populations the groups are drawn from have regular distributions. This, coupled with the high t-statistic, is strong evidence against the null hypothesis because of the difference between the sample and the average population's mean.

Observations and Limitations

From the percentage data, it can be concluded that the majority (86%) of people with hearing loss have some form of sleep trouble. Of those people, 53% qualified for insomnia, according to the ISI evaluation. Furthermore, people with hearing loss have a higher likelihood (61%) of developing mild to severe anxiety symptoms compared to the average population (around 3.4%). Along with people with hearing loss being significantly more likely to have symptoms of sleep issues and anxiety, it can also be deduced through the data using an R score that having anxiety moderately impacts a participant's sleep patterns, and the

same could apply to sleep patterns affecting anxiety or overall stress. This observation also connects to the percentage analysis revealing that 23% of participants struggled with both sleep and anxiety concurrently. However, overall, insomnia presented as a significantly more difficult issue for those surveyed.

Lastly, the data affirmed prior studies' observations that females are more likely to report or suffer from anxiety issues within the context of disability and especially insomnia, and people at advanced ages also experience hearing loss and surrounding mental health issues at a higher rate. These results are significant because they detail the extent of the correlation between sleep and anxiety issues in people with hearing loss, which both severely impact daily function. In addition, Figure 1 and Figure 2 show that people between the ages of 51 and 60 experience a more significant average number of symptoms. The likelihood of concurrent chronic disorders and disabilities at advanced ages could explain this significance. Aside from the age and biological sex data, which no predictions were made for leading up to the investigation, the overall results are not unexpected from the initial hypothesis or prior studies' assumptions on the effect of psychological disorders on sleep, specifically insomnia. These age-related differences may indicate that rather than this psychological problem being mainly biological, it could be a combination of cognitive and behavioral factors since these behaviors seem to be influenced by resilience and enduring hardships in one's life, such as hearing loss or other health conditions.

Conversely, symptoms of insomnia and anxiety can be worsened by conditioning, which can be seen through fear of going to bed out of worry of having another sleepless night. Lastly, for the age-related figures (1 and 2), insomnia rates were higher than anxiety rates for the identified 23% of people with insomnia and anxiety in Figure 2. At the same time, it was the opposite in Figure 1, which surveyed the entire study's group rates of insomnia and anxiety. This difference is explained by Figure 2, representing the 23% of people with both issues, reflecting the average population ratio of chronic insomnia at 10% of the population, prevailing more than anxiety at 3 to 4% of the population, and the reason Figure 1, the entire study's composition, is reversed with anxiety being more prevalent is because deaf and hard-of-hearing people experience anxiety at about an 11.1% rate, regardless of insomnia. Therefore, if people are not guaranteed to struggle with both, the prevalence of either in this population can fluctuate [20].

Another significant portion of Figure 2's graph is the clearly different expression of a higher pervasiveness of anxiety over insomnia in the age group of 31 to 40, which can be explained by a variety of lifestyle factors that occur at this age. While there are many anxiety or stress-inducing life events at any time in one's life, people in this age range specifically experience mentally strenuous events with career development or midlife crises while also enduring the onset of various age-related physical issues.

One potential factor that could impact biological sex statistics and data analysis is the overrepresentation of female participants in the study. While this was considered when analyzing the differences between biological sexes, a larger sample size of males could have provided more precise insight into hearing loss patterns among males. Additionally, it is worth noting that the study was conducted internationally rather than starting with a more localized population and expanding from there. This approach could have allowed for a more nuanced statistical analysis of how geographical location might affect the relationship between anxiety, insomnia, and hearing loss.

Similarly, race or ethnicity could have had a prominent role, which may be a relevant topic for future studies—in addition, having a control group of people with average hearing taking the form in similar circumstances and including depression as a comparison to anxiety rates to build on the study and differentiate between people with average hearing and hard-of-hearing or deaf people. Though existing data shows how regular people respond to the two scales/indexes, it may be more accurate to isolate people with ordinary hearing in the exact same situation, specifically. In addition, it may be relevant to use an alternate scale than the ISI because though the International Statistical Classification of Diseases Tenth Edition establishes Insomnia as only needing a month of symptoms for a diagnosis, the Diagnostic Systems Manual Fifth Edition now says insomnia must occur for three months, rather than one, to be classified as insomnia. Lastly, building upon this study, the relationship between insomnia being exacerbated by anxiety in people with hearing loss can be further studied by measuring rates of initial, middle, or terminal insomnia to assess which is most prevalent [12].

Still, taking the information gathered into account, these findings contribute to an understanding of insomnia, anxiety, and their relationship with behavioral patterns in people with hearing loss by emphasizing the risk of excessive stress experienced with a disability, leading to eventual sleep disturbances. The results can hopefully direct an influx of research and awareness toward anxiety's relevance with chronic insomnia and in disabled people. However, future studies should consider if the effect is causal or simply correlational, as the complexity of this study, being crossectionally designed, did not effectively evaluate such.

As for how this relates to existing literature, the study affirms Roth's [1] commonly accepted finding that insomnia is often associated with a coexisting psychiatric disorder by determining the number of 0.4223 on the R score, which means there is a mild to moderate correlation between anxiety and sleep patterns, and one will increase as the other does. In addition, Yeo et al. [8] studied a relationship between sensorineural hearing loss and onset of anxiety, which, when tied with the previous research from Roth's [1] study, may relate to a connection between all three variables of insomnia, hearing loss, and anxiety. Since this study particularly observed and collected responses from people with

hearing loss, the higher quantity of people determined as having anxiety issues is representative of people with hearing loss as a whole having a higher rate than the national average. Therefore, Yeo et al.'s discovery is also supported by the findings of this study. As a whole, this study's results support the majority of previous research conducted in this field and connect them to offer a more specific and extensive explanation.

Lastly, an important limitation to consider is the possibility of self-selection bias, also known as volunteer bias. Since the volunteers for this study chose to participate rather than actively being sought out by the researcher, they may be more likely to have differing characteristics from the rest of the population.

Conclusion

This research aimed to explore the relationship between insomnia, anxiety, and hearing loss, mainly focusing on whether hearing loss exacerbates anxiety and insomnia and whether anxiety and insomnia can act as indicators for each other in the midst of a chronic disability. The study revealed that a significant majority of individuals with hearing loss experience some form of sleep trouble and have a higher likelihood of developing mild to severe anxiety symptoms compared to the average population. The data suggested a moderate correlation between anxiety and sleep patterns, supporting the hypothesis that anxiety is an indicator of insomnia in people with hearing loss. While the study contributes to the existing literature on the association between insomnia, anxiety, and hearing loss, it further highlights the need for further research to delve into the intricate connections and mechanisms underlying these relationships.

The findings supported the hypothesis, emphasizing that anxiety and insomnia are more prevalent in individuals with hearing loss, adding depth to existing knowledge by providing specific insights into these disorders' psychological and cognitive aspects in the context of hearing loss and deafness. The results emphasize the importance of addressing the mental health challenges faced by the deaf and hard-of-hearing communities in adjusting to the social changes that occur with the loss of one's hearing, shedding light on the impact of chronic stress associated with disability on sleep disturbances.

To improve the investigation, future studies could consider a more balanced biological sex representation, as the study had a slightly higher number of female participants in the sample. Additionally, a more detailed geographical analysis and inclusion of a control group with average hearing tested under the same circumstances rather than pulled from existing data would enhance the accuracy and generalizability of the findings. Furthermore, exploring the relationship between different types of insomnia (initial, middle, or terminal) and anxiety in people with hearing loss could provide a more detailed and nuanced understanding of the interplay between these variables. Lastly, evaluating the socioeconomic status and geographic location can also play a role in the affordability or accessibility of necessary medical support or a more defined cultural need to hear in face-to-face communication.

This study not only supports existing literature, such as Yeo et. al's, but also opens avenues for further research, raising questions about the complex relationships among insomnia, anxiety, and hearing loss. Understanding these connections is crucial for developing targeted support for individuals facing these challenges. The conclusions contribute to the growing awareness of the mental health implications of hearing loss and advocate for a holistic approach to address the well-being of individuals with hearing loss. Hopefully, this research will contribute to an understanding of the interconnectedness between physical and mental health conditions and allow for more targeted cognitive behavioral therapy approaches addressing lifestyle and biological factors like hearing loss in the context of mental health issues.

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