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UNDETECTED HEARING LOSS IMPACTS LANGUAGE DEVELOPMENT AND ACADEMIC ACHIEVEMENT OF INDONESIAN CHILDREN

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ABSTRACT

The purpose of this research is to generate a greater awareness of mild hearing loss (MHL) and to expose its negative impact on the language development and academic success of Indonesian children. The research also seeks for practical solutions to reduce the impact of MHL. Three goals are to discover: 1) the causes and extent of MHL, 2) the extent of teacher awareness of MHL, and 3) the influence of the classroom environment on the learning process of MHL students. The first objective is achieved via a systematic literature review (SLR). The second objective is achieved through two surveys created in Google Forms. Survey I target active teachers in primary, middle, and secondary schools. Survey II targets prospective teachers in their eighth semester of training. The third objective is achieved by observing the classroom environment and teaching strategies of teachers. Findings: 1) The percentage of students with MHL is much higher than teachers estimate. 2) Teachers are not sufficiently aware of the extent and effects of MHL. 3) The classroom environment and teaching strategies can be made more favorable for MHL students. Conclusion: Greater awareness of MHL can generate changes that benefit Indonesian children who have MHL.

Keywords: *Cerumen impaction, mild hearing loss, noise-induced hearing loss, otitis media, undetected hearing loss.*

INTRODUCTION

Education is based on communication. The ability to hear is an important component of the communication process. The amount of information that students can receive is directly related to their ability to hear.

Hearing loss has become a world health crisis. Volumes of scientific data document an increase in all degrees of hearing loss (WHO–WROH, 2021). The World Health Organization (WHO) estimates that unaddressed hearing loss costs the world $980 billion annually (WHO et al., 2019), (WHO et al., 2023). Although hearing treatment and technology has dramatically advanced in recent years, only 17% of the world's population benefits from them. Developing countries are behind in addressing this crisis. For example, of all the regions of the world, Southeast Asia has the second highest percentage of population with hearing loss. It also rates next to the lowest in percentages of hearing specialists and services available to prevent, assess, and treat hearing loss. This data paints a bleak picture for millions of people who suffer from hearing loss. However, WHO affirms that 60% of hearing loss can be avoided through

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proper evaluation, assessment, and treatment (WHO-IPC-EHC, 2021), (WHO–WROH, 2021), (Daud et al, 2009).

Treatable causes of hearing loss include transient and chronic ear infections (otitis media), impacted ear wax (cerumen impaction), loud noises, and childhood diseases (WHO et al., 2023). Otitis media is an infection of the middle ear which may affect one or both ears. Southeast Asia has the highest prevalence rate of chronic ear infections of any area of the world (WHO–WROH, 2021).

Cerumen impaction is a major cause of hearing loss that is easily treated. Multiple studies in Nigeria documented prevalence rates of cerumen impaction from 8.9% to 20%. Mild conductive hearing loss is a consequence of the impaction (Martin et al, 2006). A 2019 study on six cities in Indonesia revealed that 30.5% of first grade students suffered from hearing loss caused by impacted ear wax (Ding et al, 2019). The prevalence of cerumen impaction in Nepalese school children averages 34.6%. Some groups that were tested had a prevalence of 62% (Maharjan et al, 2021).

Noise-induced hearing loss (acoustic trauma) is a growing problem. A study of 273 third grade children in the US revealed that 97% had been exposed to hazardous sound levels (Harrison, 2008). Another US study indicated that 12% to 15% of school-aged children have hearing deficits caused by noise exposure (Ding et al, 2019). The main source of noise-induced hearing loss is excessive volume settings on personal electronic devices (WHO et al., 2019; Ding et al, 2019).

Fevers caused by childhood diseases often produce permanent hearing damage. Vaccinations have proven to be effective in preventing these diseases (WHO et al., 2019).

For context, the method of sound measurement and the five degrees of hearing loss must be delineated. The human hearing apparatus receives sound waves of various frequencies and intensities and then transmits them to the brain for decoding. The frequency of sound waves is measured in hertz. The number of hertz represents the number of sound vibrations that occur in one second. The voices of songbirds are high because they emit thousands of vibrations per second. The sounds of a ship's horn or a large drum are low because they emit only hundreds of vibrations per second (Wikipedia contributors. 2023, May 11. Frequency), (Wikipedia contributors. 2023, May 28. Sound), (Wikipedia contributors. 2023, June 5. Decibel). An inability to hear certain frequencies is a form of hearing loss, but it is a sub-study that is not addressed in this project.

In contrast, intensity is important to this research. The intensity (volume) of sound is measured in decibels by decibel meters. Loud sounds are given a higher number than quiet sounds. Table 1 below lists examples of sounds in the order of their intensity.

Table 1 – Data from Center for Disease Control and Prevention website

Sound Intensity (Volume)		
Decibels	Sound type	Response
0	Silence	No damage results from sounds at these levels
20	Ticking watch	
30	Quiet whisper	
40	Quiet conversation	
60	Normal conversation / air conditioner	
80-85	Traffic sounds (while riding inside car)	Sounds are annoying

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100	Crowd noise at soccer game	Damage can occur
120	Ambulance or police siren	Pain and injury
140+	Fire crackers	Instant injury

The five degrees of hearing loss are mild, moderate, moderate/severe, severe, and profound. The range of each category is defined by decibels. Table 2 below shows the boundaries of the five degrees of hearing loss expressed in decibels.

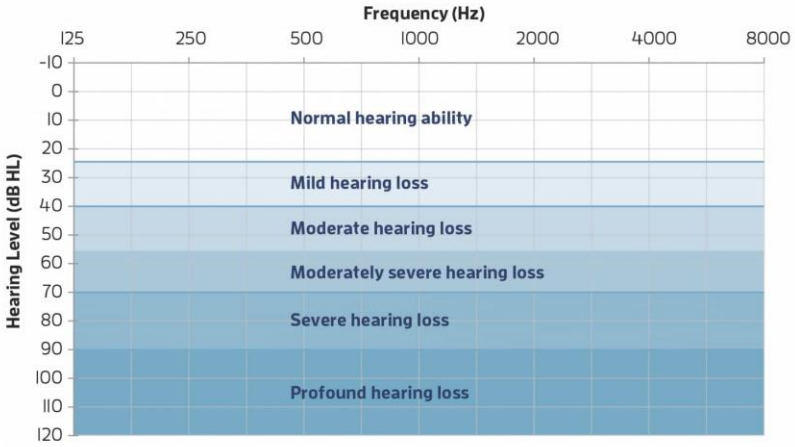

Figure 1. Degrees of Hearing Loss

Mild hearing loss is defined as an inability to hear and understand sounds below 40 decibels. MHL is a hidden problem that affects the academic achievement of school children (Clercq et al, 2019; Lieu et al, 2020; Wang et al, 2019). The problem is hidden because of a lack of awareness on the part of parents, teachers, and school administrations. In fact, 60% of parents who have children that are diagnosed with MHL are unaware of their child's disability (Elbeltagy, 2020; Purnami et al, 2022). Data gathered through the surveys of this project show that teachers are less aware of MHL than parents. A major reason for a lack of awareness of MHL is insufficient hearing tests performed on school students. Without a periodic screening program, it is difficult to identify MHL students (WHO–WROH, 2021). A study conducted in five Malaysian schools revealed that 11.3% of their students suffered from mild hearing loss (Daud et al, 2009). Early screening can identify at-risk students so that early assessment and intervention can improve their academic achievements. Unrecognized and untreated MHL negatively impacts educational outcomes and the national economy (WHO-IPC-EHC, 2021; WHO–WROH, 2021; WHO et al., 2019).

The purpose of this research is to discover how undetected mild hearing loss impacts the language development and academic achievements of certain at-risk students in Indonesian schools. It also makes suggestions that can help teachers more effectively communicate knowledge to MHL students. This research is vital because the extent and effects of mild hearing loss on Indonesian students is greatly underestimated. Indonesian students are citizens that have the right to achieve the highest possible standard of health and well-being. Governments that fail to provide

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adequate hearing screening, assessment, and treatment services for their citizens are depriving their citizens of this right (WHO et al., 2019).

While reading the source journals, a general theory is formed which posits that *a greater insight into MHL can stimulate positive changes*. Based on this theory, the following research question is crafted.

How can greater insight into mild hearing loss and the classroom environment facilitate improvements that will increase the language development and academic performance of Indonesian students with MHL?

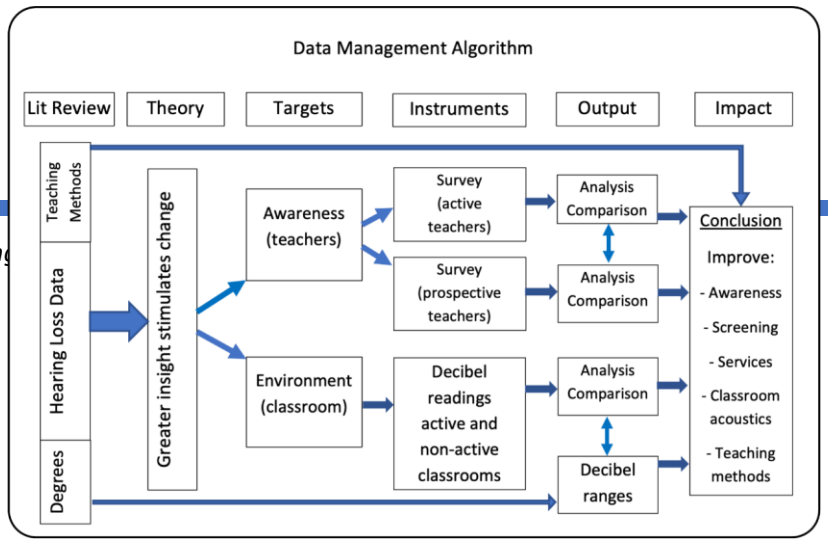
The three main objectives of this project are stated in the follow-up questions listed below. They serve as guides for this project. (1) What are the extents, impacts, causes, signs, and effects of mild hearing loss? (2) To what extent are teachers aware of the signs and effects of MHL on their students' language development and academic achievement? (3) How do classroom environments and teaching strategies impact the learning process of MHL students?

METHOD

This study seeks to discover data about the impact of MHL on students' language development and academic achievements. Students in Indonesian schools are a major focus. Based on the project theory, the research question, and the objectives listed above, a mixed method qualitative analysis is developed. A systematic literature review (SLR) and two instruments are used to gather data.

A systematic literature review gathers data for the qualitative analysis. Elicit, Google Scholar, and Google searches provide the search results. Searches are phrased as follows: percentage of students with mild hearing loss, effects of hearing loss on learning, causes of mild hearing loss, prevalence of hearing loss in school children, otitis media and school performance, cerumen impaction and hearing loss, cerumen impaction in Indonesian children, noise-induced hearing loss, classroom arrangements that benefit hearing impaired students, and best teaching methods for students with hearing loss. To build a sufficient background, search results for studies done during the past 25 years are scanned, but resource journals are limited to the past ten years. However, five articles published before 2013 are included because they contain the most recent data on topics that are relevant to this study. A total of 195 journals are considered as possible resources. Abstracts are evaluated for relevancy and redundancy. The number of citations is also considered as a factor to rate the credibility of the journals considered. Based on the afore stated criteria, 165 journals are rejected, and 31 journals are retained to form the corpus for this project. Three internet sources are also referenced.

The SLR achieves the first objective and provides data for the third objective. The first instrument consists of two cross-sectional surveys which target active and prospective teachers. These surveys accomplish the second objective. The second instrument gathers data from the physical classroom environment. Data collected



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includes decibel readings taken in active and non-active classrooms to determine the ambient noise levels. The second instrument accomplished the third objective. Data collection, management, and analysis follows the algorithm in Figure 1 below.

Figure 2 – Data Management Algorithm

Systematic Literature Review

Resource journals are selected from the internet services of Elicit, Google Scholar, and Google searches. Search phrases are listed above in the introduction under literature reviews. During the initial phases of the searches, articles published within the past 25 years are scanned to build a sufficient background of knowledge for this project. Journal entries before 2013 are excluded from the final selection. However, five pre-2013 articles are included based on the relevance of their data. Although this project focuses on Indonesian school children, insufficient articles are found to support the research. Therefore, articles from other countries are included. A total of 195 journals are considered. Abstracts are reviewed, and irrelevant and duplicate articles are excluded. Thirty-one articles are selected as resource documents. Three internet sources are also referenced. Bias is addressed by seeking multiple sources to verify the information in the articles which are selected. As noted previously, multiple documents in all areas are not available, therefore, triangulation is not possible in those cases.

First Instrument

Two surveys are prepared in Google Forms to gather data about the level of teachers' awareness of mild hearing loss in their students. Survey I contain eight questions and targets active teachers. Twenty-six responses are received. Survey II contains nine questions and targets prospective teachers who are in their eighth semester of study in the education program of Universitas Pendidikan Indonesia, Bandung. Eighteen responses are received. To address privacy issues, no personal data of the respondents is recorded or saved. Both surveys are limited to one response per person. Data is analyzed by Google Analytics.

Second Instrument

Decibel level readings are taken in four different school buildings to capture the ambient noise levels. Three buildings are on the campus of Universitas Pendidikan Indonesia. The fourth school building is located in downtown Bandung, Indonesia. Permission to take decibel readings in classrooms is sought and received from the appropriate authorities. The phone app "Sound Meter Pro" is chosen to record the decibel statistics. Reviews of this app praised its accuracy and ease of use. Ambient noise readings are taken in eight non-active classrooms where no students or teachers were present. Readings are also taken in 14 active classrooms with lessons in progress. Notations are made of the average decibel level over three minutes in both active classrooms and non-active rooms. A notation is also made of the highest decibel reading that occurred during the recording time. No audio recordings are taken to avoid any privacy infringement on either the students or the teachers. (Recording the ambient noise levels in classrooms is not fundamentally different from recording the

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temperature levels of the same rooms.) The average decibel reading for each classroom is used as the "hearing threshold" for that room. Comparisons are made between the hearing thresholds of the rooms and the decibel ranges included on Table 1 and 2 above. Conclusions are drawn from the comparisons and included in the discussion section.

FINDINGS AND DISCUSSION

Data is gathered through a systematic literature review, two surveys, and direct observation to fulfill the three research objectives mentioned in the INTRODUCTION. Findings for the first objective show the extent, causes, signs, and effects of MHL world-wide and in Indonesia specifically. Findings for the second objective reveal the level to which teachers and prospective teachers are aware of MHL. Findings for the third objective list data collected through the inspection of classrooms and the direct observation of teachers.

First Objective – Data about hearing loss in general and MHL specifically

Hearing loss of all degrees is becoming a health crisis world-wide. All people should have equal access to ear and hearing care because people have "the right to achieve the highest possible standard of health" (WHO-Integrated People-centered Ear and Hearing Care, pg 1-2, 2021). The World Health Organization (WHO) estimates that 60% of hearing loss in children can be prevented through appropriate public health care services (WHO-IPC-EHC, 2021), (WHO et al., 2023). At the present rates of increase, nearly 2.5 billion people will experience some degree of hearing loss by 2050. The global cost of unaddressed hearing loss is US $980 billion per year (WHO–WROH, 2021), (WHO et al., 2023). The South-East Asia region has the second highest prevalence of all levels of hearing loss of all the WHO regions of the world. It also has the highest prevalence rate of chronic ear infections of any area of the world. It also has next to the lowest density of ear, nose, and throat specialists of the WHO regions of the world. The density of speech therapists is also next to the lowest (WHO–WROH, 2021).

Extent of Mild hearing loss (MHL)

Mild hearing loss effects 1.16 billion people or 14.9% of the world's population. MHL can affect one or both ears and delay language and speech development. People who experience MHL cannot hear sounds that are below 40db. This means that quiet conversation and whispering are below the hearing ability of MHL students. A study of 1,483 Australian children shows that 9.2% had slight/mild bilateral hearing loss and 13.1% had unilateral hearing loss (Wang et al, 2019). In another study, 100 children were selected for hearing screening. Their parents considered these children to have normal hearing. The study concludes that 23% had MHL (Elbeltagy, 2020). Studies in India show that children from rural areas have much higher rates of MHL loss than children from urban areas (Parvez et al, 2016). An evaluation of students from five public schools in Malaysia reveals a prevalence of 11.3% in the general school population (Daud et al, 2009).

Causes of mild hearing loss

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Genetic factors are linked to about 50% of the cases of early childhood hearing loss. Symptoms of hearing loss caused by genetic factors may manifest during infancy or manifest later in childhood (Elbeltagy, 2020).

Otitis media is an infection of the middle ear. Infections can be transient (lasting a short time) or chronic and recurring. Recurring infections at an early age hinder the development of important auditory nerves. If this condition persists, the nerves may never fully develop resulting in permanent hearing loss and a delay in language development. Otitis media affects about 11% of the world's population (Yong, 2020), (Jamal et al, 2022), (Anggraeni et al, 2019; Anggraeni et al, 2014).

Mild hearing loss can also be caused by cerumen impaction (wax buildup). The buildup of wax in the ear canal causes conductive hearing loss because sound waves are partially blocked from reaching the eardrum (Jamal et al, 2022). Studies in Pakistan show cerumen impaction causing MHL to be between 9% and 20% (Hydri & Siddiqui, 2016). Some minority groups of Nepalese school children show rates as high as 62% (Maharjan et al, 2021).

Noise-induced hearing loss is a major cause of MHL. More and more school aged children are using headphones to listen to music on electronic devices. Prolonged exposure to sound intensity over 85 db can cause MHL (Ding et al, 2019). A large-scale American national health survey stated that 12% to 15% of school-aged children experience MHL induced by excessive noise. Data from Canada indicates that 13% of children up to 14 years of age are experiencing hearing disability attributed to noise exposure. The percentage of students suffering from noise-induced MHL is increasing every year (Harrison, 2008; Martin et al, 2006).

Other causes of MHL include exposure to toxins, injuries, and childhood diseases. Children who are continually exposed to cigarette smoke are prone to chronic ear infections. Certain medicines can cause MHL, so parents should check with health care professionals before giving medicine to their children. Physical injuries account for a small percentage of hearing loss. Childhood diseases produce high fevers which, in turn, cause hearing loss (WHO–WROH, 2021).

Signs and effects of mild hearing loss

Mild hearing loss is a hidden problem. Children with MHL usually do not have any specific physical symptoms (Daud et al, 2009). Because of the lack of symptoms, 60% of parents who have children with MHL are not aware of their children's disability (Elbeltagy, 2020; Purnami et al, 2022). This is partially due to the fact that many cases of MHL develop through the slow process of recurring ear infections and the slow buildup of ear wax. Students with MHL experience language deprivation because they do not have full access to comprehensible language input (Musyoka, 2023). The effects of MHL on language development is not usually noticed until abnormal language patterns emerge. The most common signs are lack of attention and interest, repeated requests, and poor academic achievement (Jamal et al, 2022). Improper responses to instructions, carelessness, and talking too loudly are also signs of MHL (Daud et al, 2009). Although these signs are frequently attributed to behavior problems, they may stem from an inability to hear normally. Frequently, these symptoms of hearing loss are mistaken to be an attention deficit disorder (Elbeltagy, 2020).

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A reduced ability to hear is a major cause of poor academic achievement and bad behavior in the classroom. When a speaker is more than one meter away from a MHL student, up to 10% of the speaker's words can be lost. The percentage of loss increases if background noise is present (Elbeltagy, 2020; Saleem et al, 2019). Students with MHL typically score lower on short-term and sequential memory, attention, language, and verbal and nonverbal IQ tests (Clercq et al, 2019; Wang et al, 2019). Almost every area of social development is adversely affected by mild degrees of hearing loss (WHO–WROH, 2021).

MHL at an early age hinders normal language development in children. This results in the language skills of MHL students being inferior to those of their peers (Lieu et al, 2020). Students who lag in language development are further frustrated by a shift in the focus of curriculum around the third or fourth grades. Up to the end of third or fourth grade, students "learn to read." After that point, they are expected to "read to learn." Students who cannot read well, cannot learn from their reading (Budjevac, 2019).

Second Objective – Data about teacher awareness of mild hearing loss

Findings from Survey I (26 respondents)

The target group for this survey is active primary, secondary, and high school teachers. Figure 2 below shows the distribution of the teachers throughout the Indonesian school system.

Table 2. Class levels taught by responding teachers and average students per class

Level respondents are teaching	Percentage of teachers	Class size
Primary school	11.1%	33
Middle school	44.5%	28
High school	29.6%	31
College	3.7%	35+
Vocational school	7.4%	35+
Special education	3.7%	10

The survey reveals that the respondents were trained at 16 different universities across Indonesia. Their average years of teaching experience is 14.5 years. When asked to estimate the prevalence of hearing loss in students, 92.3% of teachers estimate that less than 2% of students experience hearing loss. When asked about how often students at their schools are screened for hearing loss, responses are: 63% - Never, 33% - once per year, 4% - once every three years. When asked if printed materials about the signs and effects of hearing loss are available at their schools to be given to parents, 76% responded that materials are unavailable, or it is not known if materials are available. 24% responded that materials are available. Some teachers found one survey question to be confusing, and therefore it is excluded from the analysis.

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Findings from Survey II (18 respondents)

The target group for this survey is prospective teachers in the eighth semester of teacher training in the education program at Universitas Pendidikan Indonesia (Bandung). Figure 3 below shows the grade level for which the teachers are preparing.

Table 3 – Grade levels that prospective teachers are targeting

	Level	Percentage of teachers
1	Primary school	5.5%
2	Middle school	11.1%
3	High school	72.2%
4	College	5.5%
5	Undecided	5.5%

The survey reveals that 88.9% of the respondents believed that they have never met a student with hearing loss. When asked how many times their hearing was tested during the years that they attended primary, middle, and high school 72% stated that they were never screened for hearing loss. Twenty-two percent stated that their hearing was tested once during the years that they attended primary, middle, and high school. When asked if they felt that they were prepared to identify the signs of hearing loss in their students, 61% felt that they were not prepared.

Third Objective – Environment of the classroom

Findings from ambient noise level data – Sound level readings are taken in 14 classrooms with active lessons in progress. Readings are taken in eight non-active classrooms with no students or teachers present. The test period is for three minutes with a handheld device using the Sound Meter Pro application to measure the ambient noise levels. Reviews of this application praised the accuracy of its decibel readings.

Table 4. Ambient and maximum noise levels in classrooms

Room	Classroom type	Ambient noise level	Maximum noise
1	Active	31 db	84 db
2	Active	50 db	93 db
3	Active	53 db	95 db
4	Active	51 db	82 db
5	Active	51 db	80 db
6	Active	38 db	56 db
7	Active	76 db	87 db
8	Active	78 db	87 db
9	Active	71 db	82 db
10	Active	71 db	84 db
11	Active	58 db	90 db

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12	Active	66 db	91 db
13	Active	43 db	67 db
14	Active	54 db	94 db
	Average - Active	56.5 db	83.7 db
1	Non-active	36 db	68 db
2	Non-active	40 db	75 db
3	Non-active	41 db	59 db
4	Non-active	61 db	77 db
5	Non-active	59 db	76 db
6	Non-active	57 db	77 db
7	Non-active	60 db	73 db
8	Non-active	56 db	67 db
	Average - Non-active	51.25	71.5
	Difference between averages of active and non-active classrooms	5.25 db	12.2 db

Findings from ambient noise decibel readings in active and non-active classrooms – High ambient noise levels are noted in non-active classrooms due to outside noise infiltration. Sound reverberation was noted in almost all classrooms. Coughing, laughing, sliding chairs or desks, dropping books created spikes from 70-85 db. The teacher's voice intensity frequently dropped below the hearing threshold of the room, and therefore, was not understandable. Spikes in outside noise were frequently above the intensity of the teacher's voice.

Findings from observations in classrooms

In the four different school buildings observed, whiteboards were mounted at the front of the room and windows were located on the side wall. From some positions in several classrooms, lighting produced a glare on the surface of the whiteboard. In a few classrooms, sunshine from the windows creating a very distracting glare on the surface of adjacent desks.

Findings from observing teaching methods

More than half of the teachers continued to talk as they wrote on the whiteboard. Approximately half of the teachers raised their voices a bit while writing, and half did not. Most teachers did not seem to be aware of outside noise. When outside noise was louder than the teacher's voice, few teachers paused for the noise to subsided before continuing. Few teachers repeated statements that were made during the event of the excessive outside noise. Teachers frequently stood near the window with their back to the window. This position silhouetted their faces and made viewing their mouths and lips more difficult.

Conclusions from the findings above are included in Practical Solutions section below. The discussion of the findings begins in the next paragraph.

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The discussion is divided into three parts. The first part estimates the prevalence of MHL among Indonesia students and examines an assumption that may contribute to the low awareness of MHL. The second part presents practical solutions to raise public awareness, expand hearing health services, improve aspects of the learning environment, improve teaching strategies, and add needed teacher training. The third part considers variables, limitations, and topics for future study.

State of Affairs

Before the true situation in Indonesia can be realized, a common false assumption must be identified and addressed. The assumption or commonly held belief is that hearing loss is not a factor that affects normal Indonesian school children. This assumption is deduced from personal conversations with several teachers and data collected from the two surveys. The similar statements of the teachers are paraphrased as follows: "Children with 'hearing loss' attend special schools for the deaf. We do not have any of these children in our classrooms." This assumption does not recognize the degrees of mild and moderate hearing loss in any practical way. For example, Survey I polled 26 active teachers. The average years of teaching experience for this group was 14.5. To evaluate their awareness of hearing loss, the teachers were asked to estimate the number of students that they felt experienced hearing loss. 92.3% of the teachers estimated the number of students who experienced hearing loss to be less than 2%. The remainder of the teachers (7.7%) estimated the percentage of hearing loss to be between 3% to 5%. In Survey II, prospective teachers were asked if they had ever met a student that they felt had hearing loss. 88.9% indicated that they had never met such a student. The responses from each group indicate that nearly all respondents have a similar underlying assumption. Whether the assumption causes the lack of awareness, or the lack of awareness is the basis for the assumption could be a topic for future study. However, the summary of the data previously presented paints a much different picture than that which is presently assumed about MHL.

To effectively increase awareness about MHL, hard data must be considered. Seven causes for hearing loss were identified under FINDINGS. Because MHL is not well studied or documented in Indonesia, no recent data could be found that establishes an accurate prevalence rate of MHL in Indonesia. However, data from the three main causes of MHL can be used to extrapolate a prevalence rate. According to data from WHO, otitis media (ear infections) effects 11% of the world's population under 5 years of age. Because Southeast Asia has the highest prevalence of chronic ear infections of any WHO region in the world, the percentage of Indonesian primary students with otitis media would likely be above the world average of 11%. In the coastal area of North Semarang, a 30.5% prevalence rate of cerumen impaction was documented in Indonesian elementary students. Volumes of research show that noise-induced hearing loss affects 12% to 15% of all school children, and the prevalence is raising every year.

Adding the figures together for the three causes mentioned above might seem logical. However, doing so would not produce a credible estimate of the prevalence of MHL because of the obvious overlapping of the causes. For example, one child may have not only ear infections, but also have wax buildup and damage from loud noises. However, it would be logical to deduce from the figures that the prevalence of MHL in Indonesian students would, at the very least, be 12%. In reality, the rate is more likely

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to be closer to the rate documented in Malaysia – 15%. This means that 12 to 15 out of every 100 Indonesian students are at-risk of delayed language development and poor academic achievement. This percentage is not acceptable and can be reduced. A greater awareness of MHL can generate changes that reduce the number of at-risk students.

Practical Solutions

This section is divided into five parts. The first part suggests solutions to increase the general awareness of MHL. The second part suggests the expansion of available hearing health services. Part three makes suggestions to improve audio and visual aspects of the learning environment. Part four suggests teaching strategies that will benefit MHL students. The last part suggests additions to teacher training curriculum that should be incorporated into teacher training programs.

Public Awareness

Data presented earlier shows that parents and teachers of Indonesian students lack an adequate understanding of the causes, signs, and effects of MHL. As a result, MHL has become a hidden problem that affects 12% to 15% of Indonesian school children. Because most cases of MHL are preventable, it is imperative that public awareness of MHL be increased to an adequate level. It is necessary for appropriate administrations within the government of Indonesia to take steps to raise public awareness of mild hearing loss.

The populace can be educated about MHL through printed materials made available in hospitals, clinics, doctor's offices, and schools. Public health announcements can reach the masses through public media. The same methods and systems that informed Indonesian citizens about COVID-19 can be used to broaden the awareness of MHL.

Expansion of Services

One of the most important first steps to be taken is the implementation of annual hearing screening in all schools. Early screenings will identify at-risk students so that proper treatment can stop long-term damage from occurring. However, screening alone will do little more than expose the extent of MHL. Hearing care services must be prepared to treat children with MHL. Since Southeast Asia has a very low density of ear, nose, and throat specialists, more must be trained. The same is true for speech and language therapists.

WHO has developed a comprehensive plan to reduce the avoidable causes of hearing loss and ensure that all people have equal access to quality ear and hearing care. A policy brief entitled Integrated People-Centered Ear and Hearing Care gives a brief outline of the plan which includes education, prevention, identification, and treatment of all forms of hearing loss (IPC-EHC), (WHO-IPC-EHC, 2021).

At the first consideration, implementation of an effective awareness program with supporting hearing services might seem to be a financial burden on the national health services budget. However, WHO claims that conservative estimates of scaling up hearing care services is a good financial investment. Early testing and treatment have shown to reduce the financial burden on the national budget (WHO–WROH, 2021).

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Audio and Visual Improvements to the Learning Environment

MHL students cannot hear sounds below 40 db. This means that quiet conversation is not accessible to them. Figure 4 shows that the difference between the ambient noise levels of active and non-active classrooms is only 5.25 db. This means that the voice intensity of the teacher is barely above the ambient noise level of an empty room. This is largely due to the infiltration of outside noise into the classroom. When a teacher's voice intensity drops below the level of the hearing threshold (ambient noise level) of the room, MHL students are unable to hear the teacher's speech. Further, noise spikes from within or from without the classroom that are greater than the intensity of the teacher's voice overpower the teacher's voice. In order for audio signals that contain teaching content to reach the brain, they must not be overpowered by louder audio signals that do not contain educational content. Therefore, the reduction of sounds that have greater intensity than the teacher's voice should be a priority. The teacher's voice is the most important sound in the educational environment. In the audio world of the classroom, it should be given the place of prominence. Classrooms should be evaluated for outside noise infiltration and inside reverberation. Sound deadening strategies should be employed to improve the listening environment.

Because of hearing loss, MHL students are naturally oriented more toward visual means of learning than their peers. However, some studies suggest that students with hearing loss do not develop visual skills that exceed those of their peers (Marschark, 2017). Nonetheless, the visual needs of MHL students must be considered. Students with MHL should be seated close to the teacher's position. Students with hearing loss in one ear should be seated with their good ear toward the teacher. Teachers should be sensitive to the emotional and social needs of MHL students as seating is arranged. Students should not be made to feel inferior or embarrassed because of their disability. MHL students should not be seated near doors, windows, or places of higher noise levels. In certain situations, desks may be arranged in a semicircle. The teacher's desk should be centered at the front of the classroom (Guardino & Antia, 2012). To manage the sound environment of the classroom, reverberation time should be checked (Gheller et al, 2020; Millet, 2009).

Teaching Strategies

The clear pronunciation of all words is a simple but very important part of communication for MHL students (Cawthon, 2001). Teachers should not speak when students cannot see their faces, and they should never stand with their faces in a shadow. Standing in front of a window while facing the class silhouettes the teacher's face and makes viewing the teacher's mouth and lip movements more difficult. If a microphone is used, it should be placed below the lips so that the speaker's lips can be seen. Teachers should be alert for MHL students that also have visual disabilities and seat them accordingly. When questions are asked by other students in the class, the teacher should repeat the questions before responding to them. Teachers should avoid pacing back and forth in front of their classes while teaching as this disrupts the view of the teacher's face (Saleem et al, 2019).

Teacher Training

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School teachers have a unique position in combating MHL. They are the first professionals outside the family unit that can observe the manifestations of MHL in students. During the education process, students are tested to measure their assimilation of knowledge. Low test scores identify students who struggle to assimilate the knowledge received during classroom instruction. MHL students often perform poorly on tests because of their reduced ability to hear. Teachers who are trained to identify the signs of MHL can evaluate low achieving students and suggest professional assessment and treatment if MHL is suspected. However, teachers will not be able to address MHL in the classroom unless they receive focused training. Therefore, it is necessary that teacher training facilities develop MHL training curriculum and integrate it into their educational programs. Minimum training standards should include awareness of all aspects of MHL, management of the learning environment, optimal teaching methods, and resources for assessment and treatment of MHL. The practices that benefit MHL students will benefit all students.

CONCLUSION

Mild hearing loss is a hidden cause that disrupts the language development and academic achievement of 12% to 15% of Indonesian school students. The three main causes for MHL are ear infections, wax buildup, and noise-induced trauma. Because the effects of these causes slowly increase over time, symptoms of MHL do not quickly appear. The slow manifestation of symptoms helps to hide the presence of MHL. The three main causes of MHL can be easily prevented and treated so that they do not affect the language development and academic achievement of students.

The first step in increasing awareness of MHL is a nationwide program of annual hearing screening for Indonesian school students. This can only be accomplished by coordinated efforts between appropriate ministries of the Indonesian government. Public awareness can be increased by the distribution of printed materials through hospitals, clinics, doctor's offices, and schools. Public health service ads broadcast via public media are effective in reaching the masses. However, nation-wide testing and awareness programs will only identify the scope of hearing loss in school children. Steps must also be taken to address the easily preventable causes mentioned above – ear infections, wax buildup, and ear trauma from excessive noise.

Indonesia already has a nationwide network of hospitals and health clinics capable of treating ear infections and removing excessive wax buildup. However, since Indonesia has a high rate of chronic ear infections that result in long term hearing damage, the reasons for this phenomenon should be investigated. A greater awareness by parents may generate earlier treatment for ear infections. An environmental study in high impact areas may reveal causes for the high rate of infections. Because an increase in testing and awareness will increase the workload on medical facilities, more ear, nose, and throat specialists should be trained. More speech and language therapists should also be trained to meet the needs of children who experience permanent hearing loss.

Teachers play an extremely important role in helping MHL students achieve their academic goals. When teachers are sufficiently trained to recognize signs and symptoms of MHL, they can suggest assessment and treatment options to parents. This can be accomplished simply by the teacher handing a government prepared brochure to

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the parents that informs them about available testing and treatment options. Increasing parent awareness can facilitate early treatment. The ultimate benefit will be better student performance. This benefit will not be obtainable without sufficient teacher training about MHL. Educational institutions should create and integrate curriculum into their teacher training programs to prepare prospective teachers to deal with mild hearing loss.

In the classroom, teachers can employ the strategies that are listed in discussion under teaching strategies. These methods are not a financial burden and will benefit all students.

In articles referenced previously, WHO predicts that scaling up ear and hearing care services can yield financial returns by reducing the load of preventable cases on the medical system. WHO's policy brief entitled *Integrated People-Centered Ear and Hearing Care, 2021* outlines a comprehensive plan for developing nations to reduce the impact of all levels of hearing loss. Also, WHO's publication entitled *World Report on Hearing, 2021* provides 252 pages of valuable information and resources.

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