PREVALENCE OF THE PRISONERS' HEARING DISORDERS AND EAR HYGIENE IN 4 PENITENTIARIES IN BANGKOK BY SCREENING METHOD

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A THESIS SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR
THE DEGREE OF MASTER OF ARTS
(COMMUNICATION DISORDERS)
FACULTY OF GRADUATE STUDIES
MAHIDOL UNIVERSITY
2003

ISBN 974-04-4092-4

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was submitted to the Faculty of Graduate Studies, Mahidol University
For the degree of Master of Arts
(Communication Disorders)
on
September 26,2003

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ACKNOWLEDGEMENT

I would like to express my sincere gratitude and deep appreciation to Asst. Prof. Siriparn Sriwanyong my major advisor for his guidance, in valuable advice, supervision and encouragement throughout. I am equally grateful to Assoc. Prof. Krisna Lertsukprasert my co-advisor for her constructive comments, supervision and encouragement. They were never lacking in kindness and support which had enable me to carry on the thesis successfully.

I am grateful to Assoc. Prof. Montip Tiensuwan my co-advisor for her helpful guidance to the statistical analysis of the data. She was never lacking in kindness and support. I also would like to thank Dr. Pin Limmeechokchai, Otolaryngologist, my co-advisor he was always so nice and friendly. In addition, I would like to thank Lect. Assoc. Prof. Parinya Luangpithukchumphol my external examiner for his valuable critical comments on the thesis and wonderful friendships.

I would like to thank Assist. Prof. Cheamchit Thawil, Assist. Prof. Sumalee Dechongkit, Mrs.Usa Thanomsingh, and Assist. Prof. Chanchai Jariengprasert for their valuable advice and guidance in this research.

I wish to show my appreciation to Assist. Prof. Satit Chayarpham for his support in documents. I also would like to thank Assist. Prof. Wanphaen Setthavat and Dr. Jiravadee Chatuthasri for their guidance, assistance, and support throughout the research.

Special thanks to Miss. Worarat Chantiempetch, my friend, Mrs. Sivakorn Kurattanavej and the staff at the Department of Corrections, and also the staff at 4 penitentiaries in Bangkok. Their help made this thesis possible.

I am particularly indebted for the support in part by the Thesis Grant, Graduate Studies of Mahidol University Alumni Association, which enabled me to undertake this research.

Finally, I am extremely indebyted to my family for their understanding, supporting and encouragement in this research.

Suwaree Punlerudthai

PREVALENCE OF THE PRISONERS' HEARING DISORDERS AND EAR HYGIENE IN 4 PENITENTIARIES IN BANGKOK BY SCREENING METHOD

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ABSTRACT

The purposes of this study were 1. to study the prevalence of the prisoners' hearing disorders and ear hygiene 2. to study the severity and configurations of prisoners' hearing disorders 3. to compare the hearing disorders, middle ear disorders, and ear hygiene of prisoners in male and female prisoners. A review of literature highlights the anatomy and physiology of the human ear, classification of hearing impairments, disease of the ear, and prevalence of hearing loss in prisoners.

The instrumentation in this study were Otoscopic examination, Audiometer Fonix FA-12 Digital, Acoustic Immittance MAICO MA 630 series II, and Sound Level Meter Kamplex KM4. One thousand prisoners in 4 penitentiaries served as the subjects for this study. Their ages ranged from 18-74 years.The subjects were screened in a quiet room with ambient noise of less than 40 dB by audiometry and tympanometry. The statistical results were obtained by using number, percentage ,and Chi Square method.

The results of this study showed that the prevalence of the prisoners' hearing disorders was 44.65 % (mild hearing loss = 42.15 %, moderate hearing loss = 1.75%, moderate to severe hearing loss = 0.4 %, profound sensorineural hearing loss = 0.25%, and severe hearing loss = 0.1%).The configurations of prisoners hearing loss were classified into the following high frequency loss, 8.5 %; low frequency loss, 21.0 %; and flat hearing loss, 15.15 %. The prevalence of the prisoners' middle ear disorders was 9.05% (type C = 3.85%, type B = 3.7 %, type A_D = 1.35 %, type A_S = 0.15 %). The prevalence of prisoners' ear diseases was as follow: impacted cerumen(1.6%),monomeric membrane (1.55%),chronic otitis media (0.95%),otomycosis (0.5%),calcified tympanic membrane (0.45%) , and inflamation of external ear (0.3%).The comparison showed that the hearing disorders and middle ear disorders of male prisoners were higher significantly different than those of female prisoners at $p < 0.01$.However,there were in significant differences between male and female prisoners in all items on the questionnaire (the frequency of ear cleaning, the proper way to protect the ear from loud noise, the management of foreign body in the ear, management to remove insects, and health care of the ear).

The results of this study can be used as a guideline in planning for prevention, treatment and improvement of prisoners' ear hygiene in prisons.

KEY WORDS : PREVALENCE / PRISONERS / PENITENTIARY / HEARING DISORDERS / EAR HYGIENE / AUDIOMETRY / AND TYMPANOMETRY

84 P. ISBN 974-04-4092-4

ความชุกของความผิดปกติทางการได้ยินและสุขภาพหูของผู้ต้องขังในเรือนจำ 4 แห่งในเขตกรุงเทพมหานครโดยใช้วิธีการคัดกรอง (PREVALENCE OF THE PRISONERS' HEARING DISORDERS AND EAR HYGIENE IN 4 PENITENTIARIES IN BANGKOK BY SCREENING METHOD)

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บทคัดย่อ

งานวิจัยครั้งนี้มีวัตถุประสงค์เพื่อศึกษาถึงความชุกของความผิดปกติทางการได้ยินและสุขภาพหู ความรุนแรงและรูปแบบของความผิดปกติทางการได้ยินของผู้ต้องขังในเรือนจำ 4 แห่งในเขตกรุงเทพมหานครโดยใช้วิธีการคัดกรองเปรียบเทียบความผิดปกติทางการได้ยินและสุขภาพหูระหว่างผู้ต้องขังชายและหญิงจำนวน 1000 คนจาก 4 เรือนจำ ผู้ต้องขังมีอายุในช่วง 18 ถึง 74 ปี กลุ่มตัวอย่างได้รับการตรวจการได้ยินและวัดสมรรถภาพการทำงานของหูชั้นกลางภายในห้องเงียบซึ่งมีเสียงรบกวนไม่เกิน 40 เดซิเบล และเปรียบเทียบผลของการตรวจโดยใช้การวิเคราะห์ข้อมูลทางสถิติโดยจำนวนร้อยละ และไคสแควร์ ทำการทดสอบด้วยกล้องส่องหู (Otoscope) เครื่องตรวจการได้ยินรุ่น Fonix FA-12 Digital เครื่องตรวจวัดสมรรถภาพการทำงานของหูชั้นกลางรุ่น MAICO MA 630 Series II และเครื่องวัดระดับเสียงรุ่น Kamplex KM4

ผลการศึกษาในครั้งนี้พบว่า ความชุกของความผิดปกติทางการได้ยินในผู้ต้องขังมีถึงร้อยละ 44.65 (สูญเสียการได้ยินระดับเล็กน้อย ร้อยละ 42.15 สูญเสียการได้ยินระดับปานกลาง ร้อยละ 1.75 สูญเสียการได้ยินระดับปานกลางถึงระดับรุนแรง ร้อยละ 0.4 สูญเสียการได้ยินแบบหูหนวก ร้อยละ 0.25 และสูญเสียการได้ยินระดับรุนแรง ร้อยละ 0.1) รูปแบบของความผิดปกติทางการได้ยินของผู้ต้องขังแบ่งออกเป็น 3 แบบดังนี้ 1. มีความผิดปกติทางการได้ยินที่ความถี่สูง ร้อยละ 8.5 2. มีความผิดปกติทางการได้ยินที่ความถี่ต่ำ ร้อยละ 21.0 3. มีความผิดปกติทางการได้ยินแบบราบ ร้อยละ 15.15 ความชุกของความผิดปกติของหูชั้นกลาง ร้อยละ9.05 ความชุกของโรคหูของผู้ต้องขังมีดังนี้ ขี้หูอุดตัน ร้อยละ1.6 เยื่อแก้วหูมีชั้นเดียว ร้อยละ 1.55 หูน้ำหนวกเรื้อรัง ร้อยละ 0.95 เชื้อราในหู ร้อยละ 0.5 หินปูนเกาะที่แก้วหูร้อยละ 0.45 หูชั้นนอกอักเสบ ร้อยละ 0.3 เป็นต้น การเปรียบเทียบพบว่าความผิดปกติทางการได้ยินและความผิดปกติของหูชั้นกลางในผู้ต้องขังชายมีสูงกว่าในผู้ต้องขังหญิงอย่างมีนัยสำคัญทางสถิติ ($p<0.01$) อย่างไรก็ตามไม่มีความแตกต่างกันระหว่างผู้ต้องขังชายและผู้ต้องขังหญิงในการตอบแบบสอบถามทั้ง 5 ข้อ (ความถี่บ่อยในการทำความสะอาดหู การใช้เครื่องป้องกันเสียงเมื่อเข้าไปในสถานที่ที่มีเสียงดัง การดูแลจัดการเมื่อมีสิ่งแปลกปลอมและแมลงเข้าหู และการดูแลสุขภาพหู)

การศึกษาวิจัยครั้งนี้ทำให้ทราบถึงโรคหู ความผิดปกติของการได้ยิน และการดูแลสุขภาพหูของผู้ต้องขังในเรือนจำ4แห่งในเขตกรุงเทพมหานคร ซึ่งยังไม่มีผู้ใดเคยศึกษามาก่อน ทั้งยังเป็นฐานข้อมูลเพื่อการอ้างอิงและวางแผนเพื่อแก้ปัญหาและช่วยเหลือผู้ต้องขังเหล่านี้ต่อไป

84 หน้า. ISBN 974-04-4092-4

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CHAPTER I
INTRODUCTION

The statement of problems and its significance

The Department of Corrections in the Judicial Administration office is responsible for prisoner's detention, both physical and mental correction. Besides, it provides welfare such as four requisites for comfort of the prisoners during the period of detention. Basically, its tasks are to provide academic programs, vocational activities and Buddhist or moral teaching to prisoners. However, one of the most important department's tasks is to correct and rehabilitate the prisoners' minds in order to give them a chance to be good citizens and cause no more problems to other people and society after serving the sentence.

Hearing disorders is one of the health problems, although it is not a severe problem but it can affect the quality of life. There were many research studies concerning prevalence and incidence of prisoners' hearing disorders. Melnick W. (1) in 1979 studied hearing impairment in an adult penal institution in the State Penitentiary of Ohio. The results was found that 60 % of subjects passed the pure tone screening, while 40 % failed.

As the communication problems of inmates of adult penal institutions had been largely neglected, Nicholas Bountress and Jacqueline Richards (2) in 1979 decided to study the nature and extent of communicative disorders at Saint Bride's Correctional Unit in Chesapeake, Virginia, in order to investigate the feasibility of establishing a speech and hearing clinic at the institution. Of 200 inmates at Saint Bride's, 184 agreed to participate. Their mean age was 21.5 years with a range of 16 to 58 years. They were tested over four days by 12 graduate and advanced undergraduate students from a local university training program, each of whom held the Certificate of Clinical Competence from the American Speech-Language-Hearing Association in their respective area. Speech, language and hearing screening were conducted in a building on the grounds of Saint Bride's. The results of screenings showed articulation, fluency and voice disorders; however, they indicated a slightly lower prevalence of

stuttering among the inmates of Saint Bride's, but prevalence of articulation. Voice and hearing disorders that were two to five times as great as those found in the general population. It was recommended that for the future studies, there should be carefully examined the contribution of dialectal variations to articulation and language disorders statistics, investigation the type and duration of prison vocational programs to better assess the effects on inmates of exposure to high intensity noise and evaluation the quality of institutional academic programs to estimate their effect upon verbal abilities.

Belenchia and Crowe (3) in 1983 studied prevalence of speech and hearing disorders in a State Penitentiary population. The result was found that a total of 66 inmates, or 48.5 % of the total group failed hearing screening. Forty- two inmates, or 30.9 % of the subject group, failed hearing screening at an intensity level of 25 dB HL. At 30 dB HL, 23.9 %, or 32 inmates, failed hearing screening.

Claire A. Jacobson, John T. Jacobson and Thomas A. Crowe (4) in 1989 had investigated the incidence of hearing disorders in State Penitentiary prison inmates. The focus of this investigation was to assess peripheral hearing sensitivity and central auditory brain stem integrity in a select group of prison inmates who admitted to drug abuse. Of the 34 inmates, 20 (58.8%) subjects had normal bilateral peripheral hearing sensitivity. One (2.9%) subject exhibited a unilateral conductive hearing impairment, 8 (23.5%) showed some degree of bilateral sensorineural hearing loss (SNHL), and 1 (2.9%) displayed a unilateral SNHL. In addition, the conflicting results of elevated pure-tone sensitivity with normal immittance measures and normal ABR findings suggested that 4 (11.8%) inmates exhibited pseudohypacusic hearing loss. The percent of permanent hearing loss found in this study was almost four times as great as the general population figures reported by the National Institute of Neurological and Communicative Disorders and Stroke. Although, there were no other systematic investigations of hearing loss in admitted drug abuses, the probability was high that a proportion of inmates previously tested for hearing loss had similar educational, social and environmental background to those prisoners in this study. The results of this study supported the reported high incidence of hearing loss in the prison population. Evidence also suggested that illegal drugs were commonly used by prisoners prior to incarceration and routinely available in prison. The synergistic effects off drug abuse,

noise exposure, and head trauma and other unknown variables probably contributed to the high prevalence of SNHL in group and other institutionalized prisoners.

As mentioned above, the failure rates of hearing screening in adult penal institutions were two to five times than in the general population. In addition, the adolescent population was in the same high-risk group as the adult population. Alice E. Holmes et al (5) in 1996 had reported the results of a hearing screening in Juvenile Detention Centers. A total of 226 juvenile detainees (173 males and 53 females) were screened over an 8-month period. Subjects were incarcerated in two separate regional juvenile detention centers in north central Florida, and they were aged between 9 to 18 years old. The screening consisted of an orally presented yes/no questionnaire, otoscopic inspection, tympanometry, pure-tone screening and medical record review. All tests were completed in a quiet detention center classroom or in a corner of a cafeteria (when not in use) treated with sound reduction tile. Failure cases consisted of an inability to view the tympanic membrane on otoscopy, a negative peak pressure (≤ -200 mm H_2O) or noncompliant middle ear system (Jerger classification of Type C or B tympanogram) or no response at 25 dB HL to pure-tone stimuli for 1,000 through 6,000 Hz in either ear. A total audiologic screening failure (failing one, two or all tests) rate of 35.5 percent (80 subjects) was found. Twenty-two subjects (9.8%) failed the otoscopic inspection, 17 subjects (7.5%) failed tympanometry, and 59 subjects (25.3%) failed the pure-tone screening. The adolescent detained population, had a high rate prevalence of hearing loss up to 10 percent according to pure-tone screening at 25 dB at 1,000, 2,000, and 4,000 Hz. Previous studies on the incarcerated adult and juvenile populations revealed varying results. These studies however had demonstrated a much higher than "normal" failure rate of audiologic screening within this population. Moreover, there was a definitive need for increased health care within the centers and that further research was needed to determine why there was a high in audiologic screenings within this population.

At present, there are approximately 230,500 prisoners in Thailand. The approximate number of 43,600 prisoners in Bangkok is made up of 7,100 in Klong Prem Central Prison, 6,700 in Bangkwang Central Prison, 7,250 in Bangkok Remand Prison, 6,400 in Thonburi Remand Prison, 6,000 in the Central Correctional Institution

for Drug Addicts, 2,300 in Minburi Remand Prison, 6,400 in the Central Women's Correctional Institution and 1,600 in Thonburi Women's Correctional Institution (6).

Ear problem is one of the health problems occurring in prisoners due to individual healthcare behavior. However, the crowded environment in which prisoners have to live and poor hygiene can cause ear problems such as fungal infections, otorrhea, tympanic membrane perforation, inflammations of the external and middle ear, etc. Moreover, the starvation may cause the ear problem in some prisoners in the past.

The researcher has been working at the Correctional Institution Hospital for 11 years and the fact that there is no research so far has been conducted on the prevalence of the prisoners' hearing disorders and ear hygiene in all penitentiaries in Thailand, the researcher realized the importance of the problems and would like to conduct the research on this topic in order to report to the Department of Corrections. The results may be useful in preventing these problems and would yield great benefits to prisoners in the future.

Objectives

The objectives of this research were as follows:

1. To study the prevalence of the prisoners' hearing disorders and ear hygiene.

2. To study the severity and configurations of prisoners' hearing disorders.

3. To compare the hearing disorders, middle ear disorders, and ear hygiene in male and female prisoners.

Research Questions

The questions of this research were as follows:

1. Are there any differences in the prevalence of hearing disorders, middle ear disorders, and ear hygiene in 4 penitentiaries in Bangkok?

2. Are there any differences in the severity and configurations of prisoners' hearing disorders in 4 penitentiaries in Bangkok by screening method ?

3. Are there any differences in the prevalence of hearing disorders, middle ear disorders, and ear hygiene in male and female prisoners ?

The Expected Outcomes of This Research

The anticipated results of this research were as follows:

1. To know the prevalence of prisoners' hearing disorders, middle ear disorders and ear hygiene in 4 penitentiaries in Bangkok.
2. To know the severity and configurations of prisoners' hearing disorders.
3. To know the prevalence of prisoners' hearing disorders, middle ear disorders and ear hygiene in male and female prisoners.
4. The results of the study may be used as a guideline in planning for prevention, treatment and improvement of prisoners' ear hygiene in prisons in Thailand.

Definition of Terms

1. **Prison** means a place used for the keeping and confinement of prisoners as well as the appurtenant of such place including any other place determined by the Minister and notified in the Government Gazette with a clear determination of its boundaries (7).

2. **Correctional Institution** means a place used for the keeping of classified prisoners according to the Penitentiary Act, and is responsible for the penological operation of prisoners.

3. **Prisoner** includes a convict, detained person and entrusted person (7).

4. **Klong-prem Central Prison** is responsible for the custody of convicted prisoners with sentence term not exceeding 30 years .

5. **Central Correctional Institution for Drug Addicts** is responsible for the custody of drug offenders with sentence term not exceeding 30 years.

6. **Bangkok Remand Prison** is responsible for the custody of detained persons, remendies, and convicted prisoners with sentence term not exceeding 5 years.

7. **Central Women Correctional Institution** is responsible for the custody of women offenders consisting of detained persons, entrusted persons, and convicted prisoners of every sentence term including life imprisonment and capital punishment .

8. **Offences against property :** such as gang-robbery, robbery, snatching, receiving stolen property, etc.

9. **Offences against narcotic/inhalent act :** such as cocaine, heroine, opium, etc.

10. **Offences against life :** such as murder, attempt to commit murder.

11. **Offences against sexuality :** such as rape.

12. **Other offences:** such as forestry law/gambling/firearm/trespass. etc.

13. **Prevalence:** things which being evident, noticeable, predominant (dominating, influence over others), widespread, Existing generally common (8).

14. **Hygiene:** keeping oneself, etc clean, in order to prevent disease (8).

15. **Normal tympanogram:** has a peak (point of maximum admittance) at or near normal atmospheric pressure , within the range of +50 to –50 daPa. The peak may actually be slightly positive (e.g., +25 daPa)(9).

16. **Abnormal tympanogram:** has no distinct point of maximum admittance. As pressure in the ear canal is varied, there is relatively little change in admittance. There is a gradual increase in admittance with pressure change throughout the range of +200 to –400 daPa with out a peak(9).

CHAPTER II
LITERATURE REVIEW

This chapter reviewed the following information : anatomy and physiology of the human ear, classification of hearing loss, diseases of the ear, and prevalence of hearing loss in prisoners.

1. Anatomy and Physiology of the Human Ear (Figure.1)

Outer Ear

The outer ear consists of two primary components : the pinna and ear canal. The pinna is the most visible portion of the ear, which extends laterally from the side of the head . It is composed of cartilage and skin. The ear canal is the long, narrow canal leading to the eardrum. The entrance to this canal is called the external auditory meatus. The deep bowl-like portion of the pinna adjacent to the external auditory meatus is known as the concha (10).

The outer ear serves four primary functions. First, it protects the more delicate middle and inner ears from foreign bodies. Second, it boosts or amplifies high frequency sounds. For the ear canal of the adult, the resonant frequency is approximately 2,500 Hz, while that of the concha is roughly 5,000 Hz. The resonance of these cavities is such that each structure increases the sound pressure at its resonant frequency about 10-12 dB. Third, the outer ear provides the primary cue for the determination of the elevation of a sound's source. Fourth, the outer ear assists in distinguishing sounds that arise in front of the listener and those arise from behind the listener (10).

The tympanic membrane stretches across the inner end of the external ear canal separating the outer ear from the middle ear (11).

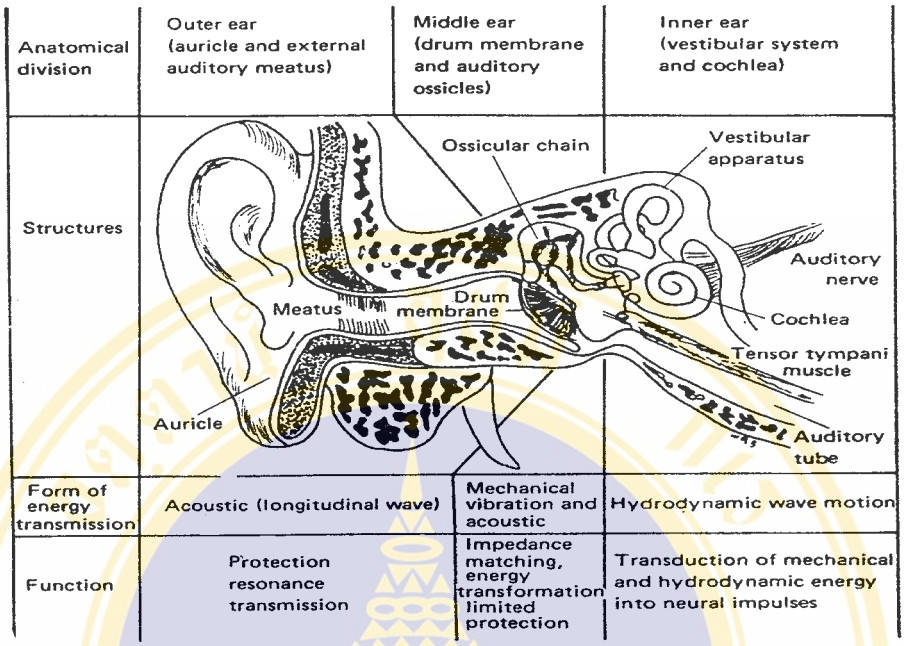

Figure 1 The anatomical divisions of the hearing mechanism and their functional roles (12)

Middle Ear

The middle ear is the tiny cavity in the temporal bone. The three auditiory ossicles, malleus, incus and stapes form a bony bridge from the external ear to the inner ear. The bony bridge is held in place by muscles and ligaments, the tensor tympani muscle and the stapedius muscle (10, 11) contraction of both muscles increases the stiffness and the damping of the ossicular chain. The response latency of this muscle reflex varies from 25 to over 100 milliseconds; consequently, it operates too slowly to provide protection against brief, impulsive sounds shorter than about 20 milliseconds (13). The middle ear chamber is filled with air and open in the throat through the Eustachian tube. The Eustachian tube helps to equalize pressure on both side of the eardrum (11, 14).

Inner Ear

The inner ear is a complex structure that resides deep within a very dense portion of the skull known as the petrous portion of the temporal bone. Because of the complexity of this structure, it is often referred to as a labyrinth. The inner ear consists of a bony outer casing, the osseous labyrinth. Within this bony structure is the membranous labyrinth. The osseous labyrinth, as shown in Figure 2, (10) can be divided into three major sections : the *semicircular canals* (*superior, lateral, posterior*), the *vestibule,* and the *cochlea.* The first two sections house the sensory organs for the vestibular system. The vestibular system assists in maintaining balance and posture. The focus here, however, will be placed on the remaining portion of the osseous inner ear, the cochlea. It is the cochlea that contains the sensory organ for hearing. The coiled, snail-shaped cochlea has approximately 2 3/4 turns in human beings. The largest turn is called the basal turn ; the smallest turn at the top of the cochlea is referred to as the apical turn. Two additional anatomic landmarks of the inner ear depicted in Figure 2 are the *oval window* and the *round window.* Recall that the footplate of the stapes, the medial-most bone of the three ossicles in the middle ear, is attached to the oval window (10,11, 15).

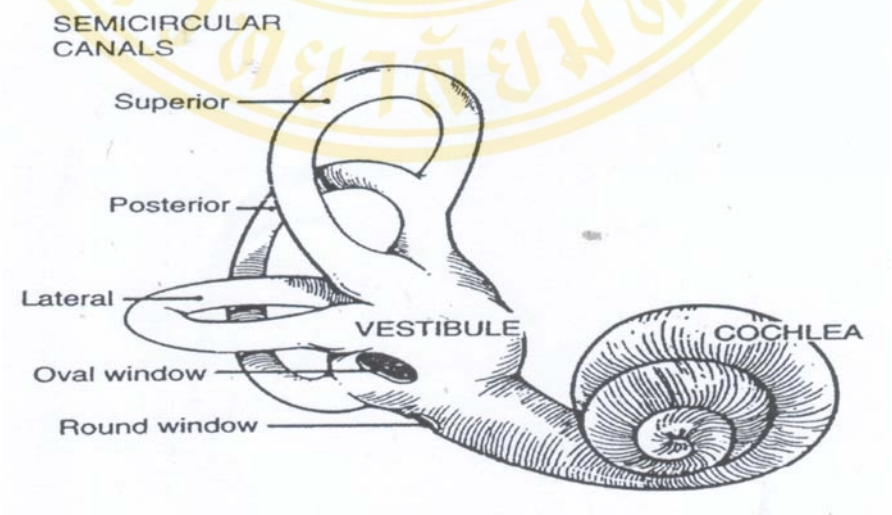

Figure 2 The osseous labyrinth and its landmarks (10)

The cochlea is cut in cross-section from top (apex) to bottom (base) in Figure 3. The winding channel running throughout the bony snail-shaped structure is seen to be further subdivided into three compartments. The compartment sandwiched between the other two is a cross-section of the membranous labyrinth that runs throughout the osseous labyrinth. All three compartments are filled with fluid.The middle compartment, known as the *scala media,* is filled with a fluid called endolymph. The two adjacent compartments, the *scala vestibuli* and *scala tympani,* contain a different fluid, called perilymph. At the apex of the cochlea is a small hole called the *helicotrema* that connects the two compartments filled with perilymph, the scala tympani and scala vestibuli. The oval window forms an interface between the ossicular chain of the middle ear and the fluid-filled scala vestibuli of the inner ear. When the oval window vibrates as a consequence of vibration of the ossicular chain, a wave is established within the scala vestibuli. Because the fluid - filled compartments are essentially sealed within the osseous labyrinth, the inward displacement of the cochlear fluids at the oval window must be matched by an outward displacement elsewhere. This is accomplished via the round window, which communicates directly with the scala tympani. When the oval window is pushed inward by the stapes, the round window is pushed outward by the increased pressure in the inner ear fluid (10).

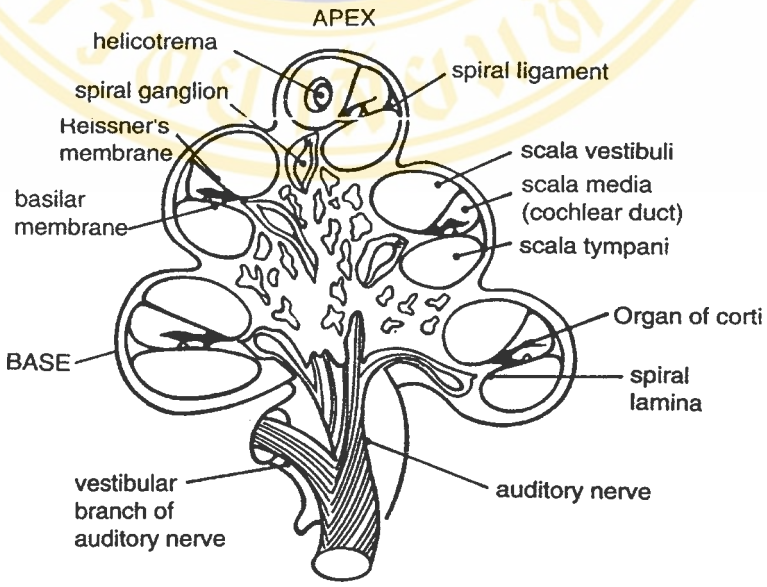

Figure 3 The modiolar cross-section of the cochlea (10)

When the stapes footplate rocks back and forth in the oval window, a wave is created within the cochlear fluids. This wave displaces the scala media in a wave like manner. This displacement pattern is usually simplified by considering the motion of just one of the partitions forming the scala media, the *basilar membrane.* The motion depicted for the basilar membrane, however, also occurs for the opposite partition of the scala media, *Reissner's membrane* (Fig. 3) (10).

A more detailed picture of the structures within the scale media is provided in Figure 4. The sensory organ of hearing, the organ of Corti , is seen to rest on top of the basilar membrane. The organ of Corti contains several thousand sensory receptor cells called *hair cells.* Each hair cell has several tiny hairs or cilia protruding from the top of the cell. As shown in Figure 4, there are two types of hair cells within the organ of Corti. The inner hair cells make up a single row of receptors located closest to the modiolus or bony core of the cochlea. The cilia of these cells are free-standing (*i.e.,* they do not make contact with any other structures). Approximately 90-95 % of the auditory nerve fibers that carry information to the brain make contact with the inner hair cells. The outer hair cells are much greater in number and are usually organized in three rows. The cilia of the outer hair cells are embedded within a gelatinous structure known as the *tectorial membrane,* draped over the top of the organ of Corti (16).

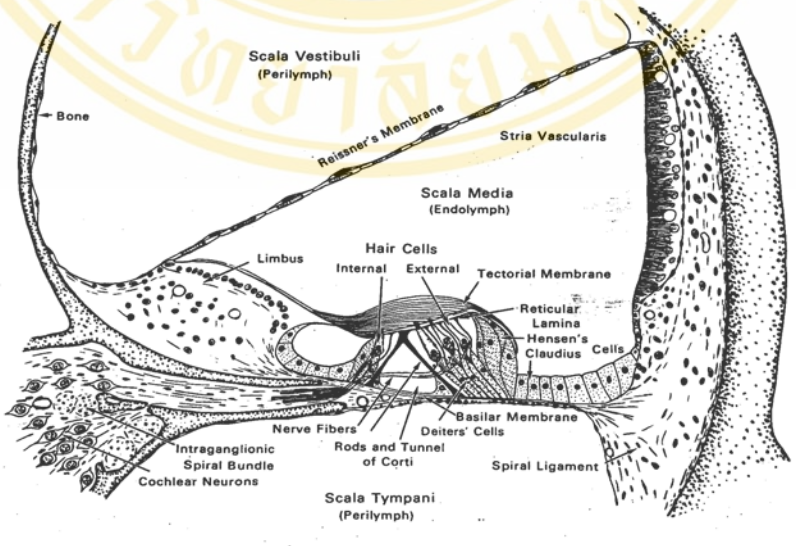

Figure 4 The detailed cross-section of the organ of Corti (16)

Note that the organ of Corti is bordered by two membranes : the basilar membrane below and the tectorial membrane above. When the basilar membrane is displaced in an upward direction (toward the scala vestibuli), the cilia of the outer hair cells embedded in the tectorial membrane undergo a shearing force in a radial direction (a horizontal direction in the figure). Displacement in a downward direction develops a radial shearing force in the opposite direction. This shearing force is believed to be the trigger that initiates a series of electrical and chemical processes within the hair cells, as shown in Figure 5. (10) This, in turn, leads to the activation of the auditory nerve fibers that are in contact with the base of the hair cell.

The two primary functions of the auditory portion of the inner ear can be summarized as follows. First, the inner ear performs a frequency analysis on incoming sounds so that different frequencies stimulate different regions of the inner ear. Second, mechanical vibration is amplified and converted into electrical energy by the hair cells. The hair cells are frequently referred to as mechanoelectrical transducers. That is, cells that convert mechanical energy (vibration) into electrical energy (receptor potentials). The organ of Corti functions as the switchboard of the auditory system. The eight cranial or acoustic nerve leads from the inner ear to the brain, serving as the pathway for the impulses to the brain will interpret as sound.

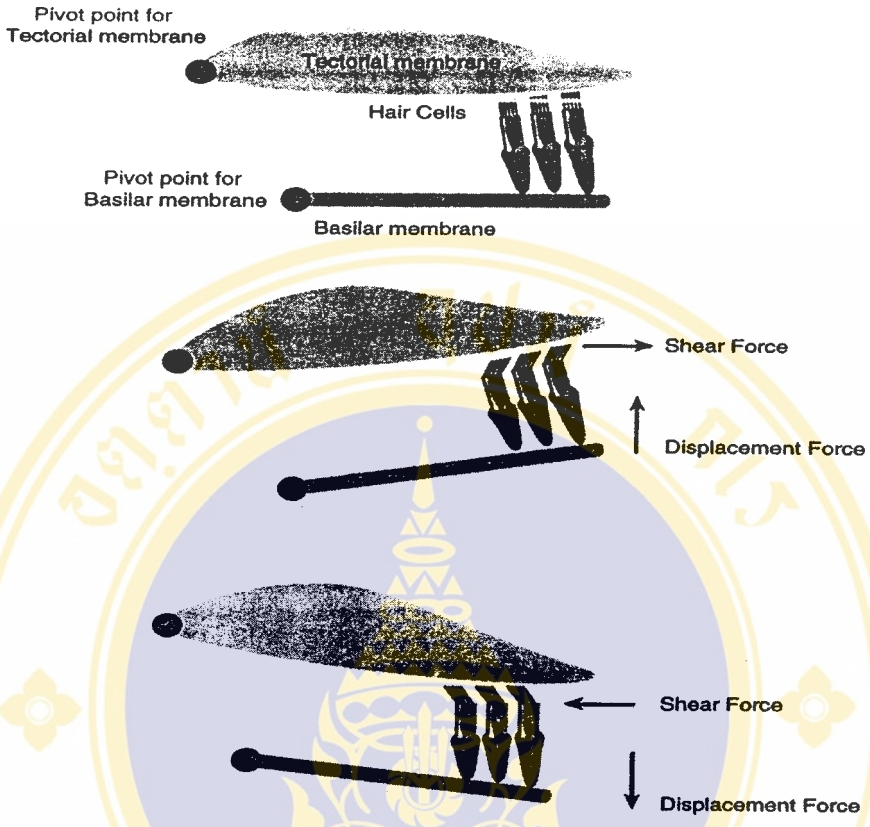

Figure 5 The mechanism responsible for the generation of shearing forces on the cilia of the outer hair cells (10)

Sound creates vibrations in the air somewhat similar to the 'wave', the outer ear collects these sound waves, and they are funneled down the external ear canal to the eardrum. As the sound waves strike the eardrum, they cause it to vibrate. The vibrations are transmitted by mechanism action through the middle ear over the bony bridge formed by malleus, incus and stapes. These vibrations, cause the membrane over the openings to the inner ear to vibrate, causing the fluid in the inner ear to set in motion. The motion of the fluid in the inner ear excites the nerve cells in the organ of Corti, producing electrochemical impulses that are gathered together and transmitted to the brain along the acoustic nerve. As the impulses reach the brain, we experience the sensation of hearing (11).

2. Classification of Hearing Impairment

There are five degree of hearing impairment in relation to handicap for speech recognition as shown in Figure 6. (10) It shows an example of a typical classification system based on the pure-tone average. This scheme, adapted from several other systems, reflects the different classifications of hearing loss as well as the likely effects of the hearing loss on an individual's ability to hear speech. The hearing loss ranging from mild to profound, are based on the pure-tone average at 500, 1000, and 2000 Hz (10).

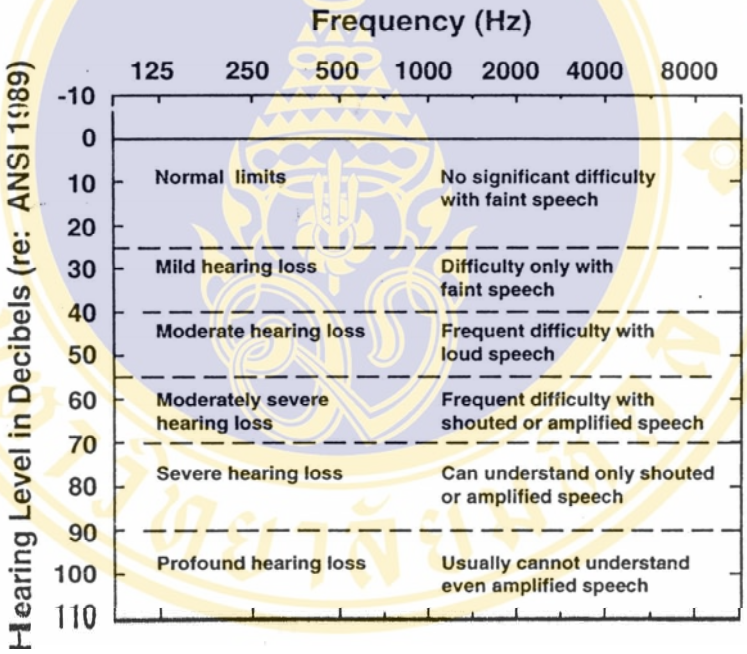

Figure 6 Classification of hearing impairment in relation to handicap for speech recognition (10)

3. Diseases of the ear

3.1 External Ear

Microtia and atresia

Microtia is gross hypoplasia or aplasia of the pinna of the ear, with or without a blind or abscent external auditory canal (17).

Atresia is congenital absence or closure of auditory canal (17).

The deformities may arise from genetic defects or from a virus or from toxic drugs acting during early pregnancy. Congenital causes may include atresia of the ear canal which is maldevelopment or lack of development of the external auditory canal and /or the auricle. This is seen in craniofacial syndrome. There is often an associated bony or atresia plate that occludes the ear canal. Associated ossicular malformations are not uncommon.

The pinna may be absent; it may be small and deformed or consist of a few skin tags only. The position of deformed pinna is also frequently abnormal. Microtia and atresia mostly are unilateral, but in bilateral 15-20% of cases are known to affect the right ear more frequently than the left, and are slightly more prevalent in males (18). The severity of the pinna deformity will sometimes offer an indication of the corresponding status of the middle ear space. A patient with microtia, for example can also exhibit malformations of the middle ear, ranging from minor deformities of the ossicles to a total absence of the middle ear cavity. The microtia is classified into 3 types, as shown in Figure 7 (19), type I is small pinna, rudimentary and often located in an abnormal position. The different parts of the pinna are still discernible. Type II is represented by a vertical curving ridge, resembling a primitive helix. Type III , the rudiment of the auricle has no resemblance to any portion of the pinna (19), and example of congenital atresia of the ear as shown in Figure 8 (20).

The hearing of these types can be represented conductive hearing loss or mixed hearing loss .

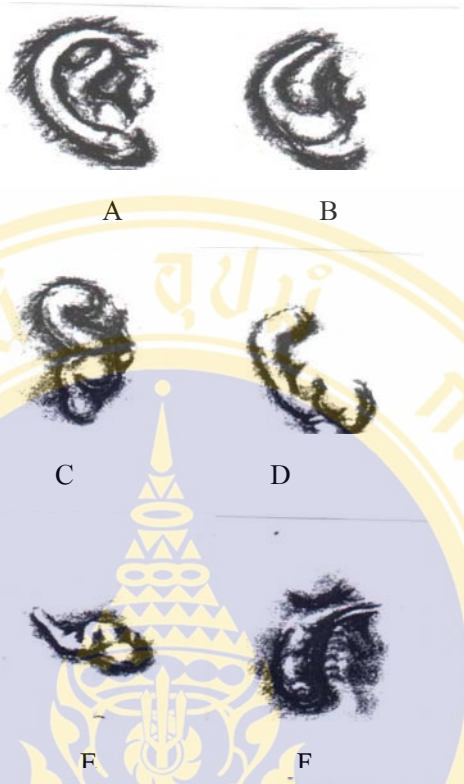

Figure 7 The examples of microtia type I (A and B) ,II (C and D) , and III (E and F) (19)

Figure 8 The example of congenital atresia of the ear. In spite of the severe deformity of the pinna and total bony occlusion of the external meatus, the middle ear and ossicles were relatively normal and the internal ear was entirely normal (20)

The management of these patients is always difficult. It is essential that hearing should be accurately assessed, even in apparently unilateral cases. Surgical reconstruction of the pinna is multi-staged and often unsatisfactory; a plastic prosthesis secured with an adhesive is probably preferable. Surgical reconstruction of the external meatus and middle ear is likewise complex and not always successful (20).

External Otitis

External otitis is generalized infection involving the whole skin of the external canal, including the surface of the tympanic membrane (20).

Certain conditions predispose to the infection, such as moist humid atmosphere. Dust and other irritants predispose by reason of the irritation which induces scratching of the ear. A wide variety of organisms are concerned, such as fungus(otomycosis), bacteria or virus. These organisms commonly gain entrance to the skin after abrasion of the protecting surface layers of the epidermis. Fungi are often present as secondary invaders. When otitis externa is associated with the growth of fungi in the meatus, the condition is known as otomycosis(20). Otomycosis is worldwide in distribution, and in various recorded series has accounted for 5-20% of all cases of infective otitis externa (20).

The clinical presentation is swelling, redness of the skin of the external meatus, aural fullness, itching and the canal may be filled with debris. The ear is tender to touch and the glands in front of the tragus may be enlarged (21). The tympanic membrane may or may not be visible. The audiogram showed normal hearing or mild conductive hearing loss .

Management is predicated on avoiding or reversing the promoting factors, controlling the infection, and decreasing inflammation. Gently cleaning the external auditory canal (EAC), avoiding water, decreasing humidity, and resisting digital manipulation discourage infection. Topical antibiotic mixed with steroids are suitable.

Cerumen Impaction

Wax, or cerumen, is the normal secretion of the ceruminous glands situated in the outer part of the external meatus (22). Two types of cerumen have been recognized in different populations. Wet and sticky cerumen is common in Caucasians and blacks; dry flaky cerumen is more common among Oriental races, the Eskimoes and some Indian tribes of North America (23).

Excessive wax may cause a variety of symptoms, the chief of which is hearing loss. Sometimes there may be a feeling of pricking or irritation in the ear. On rare occasion a fragment of wax may press on the eardrum and cause tinnitus(20). In some individual, the ear canal generates excessive amount of cerumen (earwax). If not removed on a periodic basis, this can accumulate and block the transmission of sound to the middle ear (23). Most of cases, the audiogram showed normal hearing. If ear canal is totally occluded, the audiogram showed mild conductive hearing loss. Treatment is removal of the wax. If it is unduly hard, then preliminary softening by the use of suitable drops three times a day for several days is recommended (10).

Foreign Bodies

A foreign body lodged in the external auditory canal is a frequently cause for referral to the otolaryngologist. Foreign bodies can be found in people of all ages, most common in the pediatric population. The foreign bodies can be many types and are only limited by size and imagination. Frequently a child will place a bead or fruit seed. Portions of these objects inserted by either children or adults can be lost in the ear canal and remain there for many years without symptom. The other cause that frequently occurred is insect in both children and adults. Sometime the foreign bodies may be impacted against the tympanic membrane result in inflammations and severe pain (21). Audiologic finding depends on the size of foreign bodies. The audiogram may be normal or complete conductive impairment with mild to moderate hearing loss.

Removal of solid material foreign bodies should be performed cautiously, and in the case of children usually under general anesthesia, to prevent additional tympanic membrane or ossicular trauma (24).

Trauma of external ear

There are many kinds of external ear trauma. First, sharp or blunt trauma to the external ear may produce a laceration of either skin and /or underlying cartilage. Complete avulsion of the auricle from the external canal may also occur. Surgical intervention may be relatively simple or most complex. Secondly, contusions and secondary hematoma usually follow blunt trauma to the auricle. If fluid has accumulated underneath the skin, surgical drainage is necessary. Third, abrasions result from contact of the auricle with a rough surface or object. If the abrasion is superficial, cleansing of the wound and observation for secondary infection are required .Finally, burns may be thermal, electrical, or chemical. Initially it may be difficult to determine the extent or depth of the thermal injury; eventually devitalized tissue should be debrided. Oral, parenteral, and topical antibiotics may be required during the management of these difficult conditions. Any reconstruction should be delayed until accurate assessment of tissue loss is possible and the remaining tissue is healthy (24).

The audiogram may be normal hearing or mild conductive hearing loss .

3.2 Middle Ear

Acute Otitis Media (AOM)

Acute otitis media is an acute inflammation of the lining of the middle-ear cleft. The membrane lining in the middle ear is continuous with that which passes through the aditus into the mastoid antrum and the mastoid cells. As in the nose, when the mucous lining of the nasal cavity is infected, the lining of the nasal sinuses, being in continuity with that of the nose, shares in the inflammatory reactions, so in the ear there is some reaction in the mastoid antrum and cells in most cases of middle-ear infection. Although extension

along the Eustachian tube is nearly always an extension of inflammation in the lining membrane, occasionally otitis media may result from infected secretions being forced up the tube by pressure changes associated with excessive nose-blowing , diving, underwater swimming or flying (20). *Streptococcus pneumoniae* and *Haemophilus influenzae* are the bacteria mainly responsible (20). Pain is the most prominent symptom. Hearing loss in also a constant sign in cases in which accumulation of fluid has taken place in the middle ear. Discharge is the other cardinal symptom. Other symptoms include tinnitus and voice resonance (20).

The audiogram shows mild or moderate conductive hearing loss. In general, the tympanogram showed type B. The aim of treatment is the preservation of normal hearing. Pain relief is also important and can be achieved by analgesics, oral decongestants and mucolytics (20).

Serous Otitis Media (SOM)

Serous Otitis Media is defined as sterile fluid that accumulates within the middle ear space. The etiology of the condition is varies. The mechanism of the effusion is related to Eustachian tube dysfunction. This results of abnormal middle ear ventilation which produces a negative pressure and the transexudation of fluid into the middle ear space. If the causative factors are temporary, the middle ear effusion is transient. However, chronic serous otitis media results from prolonged Eustachian tube obstruction that is seen with children with cleft palates and nasal allergies (25).

In adult, serous otitis media often appears to be secondary to allergies or upper respiratory infections. Adult patients without an antecedent history of barotrauma or upper respiratory infection must be suspected of possible nasopharyngeal carcinoma. A good indirect examination of the nasopharynx should be done for these adults, and x-rays of the nasopharynx and sinus films should also be ordered. It may be necessary in these patients to do a direct nasopharyngoscopy and biopsy of the nasopharynx under general anesthesia (25).

Chronic Otitis Media (COM)

Chronic otitis media is an infected middle ear space that drains through a tympanic membrane perforation. The size of perforation varies. Pus may be observed in the most dependent area of the middle ear (26).

Most common manifestation of chronic otitis media is otorrhea. The extent of hearing impairment depends primarily on the degree of ossicular involvement. In the absence of cholesteatoma, a conductive loss of 20 dB or less usually indicates that the ossicular chain is intact. Disruption or fixation of the chain results in an impairment of 30 dB or more. A progressive conductive impairment in the absence of active disease suggest ossicular fixation. Pain is not a frequent complaint and may indicate acute exacerbation of infection. Complications of chronic otitis media are petrositis, subperiosteal abscess, or lateral sinus thrombosis. Another complication in chronic otitis media is cholesteatoma which refers to the accumulation of cellular debris developed from perforation of the tympanic membrane. Sometimes this pseudotumor becomes infected and causes some erosion of the ossicles. There is no typical audiometric configuration associated with cholesteatomas, and the loss may vary from 15 to 55 dBHL (27). Minor degrees of postural vertigo are seen frequently in patients with chronic otitis media. Facial nerve paralysis occasionally develops in the case of chronic otitis media with cholesteatoma.

The patient is instructed to avoid getting water into the ear. If the ear is wet, the secretions can be removed with a fine sterile suction tip. Treatment with the appropriate antibiotic through the middle ear cleft may be tried. If the perforation remains dry permanently or for long periods and hearing loss is not a problem, the patient may choose the condition without treatment. However, the primary purpose of surgery may be any one or all of the following: elimination of infection, improvement of hearing and closure of a perforation (prevention of infection).

Surgical removal of cholesteatomas is indicated in order to stop the otorrhea and to prevent intracranial complications.

Adhesive Otitis Media

Adhesive Otitis Media is a thickening of the mucous membrane lining the middle ear cavity. It has been defined by Cawthorne (1956) as "a long-standing adhesive process as the result of inflammations," which is the sequence of chronic serous otitis media. It can cause fixation of the ossicles and subsequent hearing loss (10) and leading to serious deterioration of hearing.

Chronic adhesive otitis has been divided into two groups: the one developing after a long period of suppuration, and the other after chronic catarrhal changes.

Treatment of adhesive otitis media with hearing loss is surgery (ventilation tube insertion). The use of antibiotics in treatment of suppurative otitis media has sterilized the middle ear cleft but has not prevented the inflammatory chages, which, if repetitive, may ultimately result in a chronic adhesive process.

Otosclerosis

Otosclerosis is a primary and exclusive disease of the otic capsule (bony labyrinth) and the ossicles that is known to affect spontaneously only humans. There are evidences of one or more localized areas in which abnormal bone is deposited. The etiology of otosclerosis is unclear ; thus, multiple theories are available. None of them has established a definite cause. Suggested causes include hereditary, endocrine, biochemical, metabolic, and vascular factors. Infection and trauma, as well as anatomic and histologic anomalies of the otic capsule, have also been considered as causes. Approximately 10% of the white population have otosclerosis. It is not common in Negroes. Women are affected more often than men (28, 29).

Otosclerosis is the most common cause of conductive hearing loss in people between the ages of 15 - 50 years. Typically, the otosclerotic patient's audiogram shows a "dip" in bone conduction threshold at about 2,000 Hz, known as *Carhart's notch,* which appear to be depressed as much as 15 to 20 dB in this range. Tympanometry can be helpful. Classically, the tympanogram has a low, dampened peak (A_s) without shift in pressure measurement. One third of otosclerotic tympanograms, however, will be normal. Absent stapedial

reflex indicates conductive hearing loss. In some instances, the phenomenon of reversed reflex response to on/off stimulus will be demonstrated (30).

Stapedectomy is the current treatment of choice or the conductive component of otosclerosis. Surgery directed at correcting the auditory deficit incurred with fixation of the stapes footplate applies not only to patients with otosclerosis but also to patients with osteogenesis imperfecta, congenital footplate fixation, or fixation due to tympanosclerosis(30). The majority of patients with otosclerotic deafness can be helped by surgical methods or hearing aids (31).

Tympanosclerosis

This disease is the result of long-standing middle ear infection (26). Irritative factors such as infection and recurrent fluid and increased vascularity and transudation, as well as exudation as seen in the "glue ear", may precipitate the formation of such sclerotic changes. There may be a mild calcification, although frequently this is absent. Immature tympanosclerosis appears soft in consistency, whereas mature tympanosclerosis hardens and approaches the consistency of cartilage. Typically, when tympanosclerosis envelops the stapes, it does so in layers, as in an onion skin, and these flakes can be peeled off with a fine oval window hook to mobilize the stapes. Extensive tympanosclerosis, as is usually seen on the promontory, may invade the bone (32).

Audiometric studies reveal an air-bone gap, low compliance, and absent stapedial reflexes on immittance measurements.

Tympanosclerosis involving the middle ear is generally handled by removal of the tympanosclerotic lesions. Lesions with extensive involvement of the ossicles or stapes must be handled with tympanoplastic reconstructive techniques. If the hearing remains poor or improves and then decreases, a stapedectomy may be done (33).

Trauma of middle ear

Trauma to the middle ear can cause rupture ear drum , resulting in an irregular or stellate perforation and fresh blood in the ear canal and middle ear space (hemotympanum). Blasts can produce the same clinical picture and associated inner ear symptomatology. Occasionally, the tympanic membrane remains intact but the ossicular chain becomes disrupted (26).

Trauma of middle ear may cause fractures temporal bone, there are two type of fractures temporal bone, 1) Longitudinal fractures which produce a laceration of the external auditory canal (EAC) skin with fresh bleeding, exposure of bony fragments, tear tympanic membrane, and occasionally cerebrospinal fluid leak (26). 2) Transverse fracture (see trauma to the inner ear) (34).

Conductive hearing impairment in these patients should be evaluated andiometrically only after resorption of the hemotympanum (34).

3.3 Inner Ear

Inner Ear Infections

Labyrinthitis is generally of either bacterial or viral origin although otomycotic infections of the inner ear have been described rarely (34).

Viral Labyrinthitis

Documented among the causes of sudden sensorineural hearing loss are viral infections. The most vulnerable sites to viral damage appear to be inner ear neuroepithelium and the neural components of the cochleovestibular nerve. The mumps virus is also recognized for its ability to affect auditory function. Interestingly, the majority of patients who suffer with hearing loss are affected only unilaterally (34). Herpes Zoster Oticus, the first symptom associated with this disease is a burning pain close to the ear. Shortly thereafter, eruption of vessicles (small sac like bodies) occurs in

the ear canal and sometimes on the face, neck, or trunk. Common symptoms include facial paralysis, hearing loss, and vertigo. The loss is usually a severe bilateral high-frequency hearing impairment (10).

Bacterial Labyrinthitis

Bacterial labyrinthitis occurs in different forms. Serous labyrinthitis is an inflammatory process involving the tissues of the inner ear in the absence of direct bacterial invasion. The most common sources of infection are suppurative otitis media, cholesteatoma, and bacterial meningitis. Clinically, bacterial labyrinthitis presents as the quite sudden onset of tinnitus, unilateral hearing loss, and vertigo. Hearing loss usually becomes complete within a few hours and is permanent and uncorrectable (34).

Presbycusis

Presbycusis is the term used to describe a decrease in hearing sensitivity with advanced age. This term implies that hearing loss is caused by senile degeneration of the cellular structures of the auditory system. Senile degeneration, or " aging," generally is not abrupt in onset but may be highly variable in its age of onset and speed of progression (35).

Four distinct clinical patterns have been recognized in the aging population with typical histopathological correlates 1) Degeneration and loss of neural elements of "neural presbycusis". 2) Degeneration and loss of hair cells or "sensory presbycusis". 3) Inner ear biochemical defect or "metabolic presbycusis". 4) Degeneration or inefficiency of inner ear supportive elements or "mechanical presbycusis" (36).

Typically the hearing loss begins in the high tones progressively involving other frequencies. The audiogram demonstrates equal involvement of both ears. This hearing loss is usually accompanied by high pitched tinnitus. The physical examination is generally normal (37). Classic presbycusis is defined as bilaterally symmetric sensorineural hearing loss,

absent or partial recruitment, negative noise history, and poorer speech discrimination than indicated by pure-tone sensitivity. No single audiometric configuration is pathognomonic for presbycusis ; however, four classical patterns have been described as follow : Sensory Presbycusis, Neural Presbycusis, Strial Presbycusis, and Cochlear Conductive Presbycusis (35).

There is no medical treatment for the degenerative changes of the aging cochlea at present. (36) Hearing aids are commonly assumed to be of little value in presbycusis. The tendency of the elderly to leave their hearings aids in the bureau drawer is legendary and may be due in part to unrealistic expectations and in part to central auditory nervous system changes. Franks and Bechmann (1985) comment that there are estimated to be in excess of 6 million adults aged 65 years and older who have hearing problems that would justify consideration of hearing aid use, but that only about 20 percent of this number actually use hearing aids (38).

Drug ototoxicity

Ototoxicity is the tendency of certain therapeutic agents and other chemical substances to cause functional impairment and cellular degeneration of the tissues of the inner ear, and especially of the end organs and neurons of the cochlear and vestibular divisions of the VIIIth cranial nerve (39).

There are many kinds of ototoxic drug such as antibiotic (aminoglycosides e.g.streptomycin, dihydrostreptomycin, neomycin, and kanamycin), antimalarial drug (Quinine), antiinflamatory (salicylates), and others (Arsenic, Lead, and Nitrogen mustard). These drugs can damage cochlea and may cause both deafness and tinnitus. Dihydrostreptomycin is particularly dangerous since it produces cochlear damage before it gives rise to vertigo. Also, the deafness may not appear until the drug has been discontinued. Streptomycin usually gives rise to tinnitus or dizziness first.

Noise-Induced Hearing Loss

Noise-induced hearing loss is a significant problem for industrialized societies, and noise exposure in the workplace has received special attention. Clinically, noise-induced hearing loss begins with selective loss of hearing at around 4000 Hertz, with better thresholds at higher frequency especially around 8000 H_Z. This is recognized on an audiogram as a "notch" centered around 4000 H_z . If exposure is continued, this notch gradually deepens and widens.

Noise or acoustic trauma, is probably much more prevalent than most of our realize. Continuous exposure to sounds louder than 90 to 95 decibels may result in permanent hearing loss (35, 40).

The Committee on Hearing and Equilibrium of the American Academy of Otolaryngology-Head and Neck Surgery, established guidelines for initiating a hearing conservation program : (1) difficulty communicating by speech in the presence of noise, (2) head noises or ringing in the ears after working in noise for several hours, or (3) a temporary loss of hearing that has the effect of muffling speech and other certain sounds for several hours after exposure to noise. Although the severity of noise exposure depends on sound level, spectral distribution, duration, and cumulative noise exposure, the Department of Labor Occupational Noise Standards Committee now requires that 90 dB is the limit for eight hours per day (35).

Environmental controls to minimize noise include reduction of noise at the source, reduction of noise transmitted through the building structure, and revision of work procedures to minimize duration of noise exposure (40).

Ear protectors are issued in the light of environmental intensity and duration of exposure, and may consist of ear plugs, muffs , canal caps, or custom-fitted ear molds (35).

Noise-induced hearing loss has two phases. The first is known as temporary threshold shift (TTS). The term means that the human ear,

when exposed to sound loud enough to affect it, will show a loss of sensitivity to sound, that is, a raise in hearing threshold. If hearing returns to its previous level after the noise has been removed, the shift has been temporary and no permanent damage. On the other hand, if the hearing does not return to its previous level, permanent damage has ensued. This second phase of damage is the permanent threshold shift (PTS). A temporary threshold shift can be superimposed on permanent damage. However, some people are more susceptible to noise than others (41).

Meniere's Disease

Meniere's disease is associated with distension of the membranous labyrinth due to increased endolymphatic pressure. The underlying cause is not known though it has now been established that the biochemistry and electrolyte concentrations of the labyrinthine fluids may be abnormal. The onset usually occurs between 40 and 60 years of age; one ear is affected first, and in about 25 percent of cases the other ear becomes affected later (22). Most commonly characterized by episodic vertigo, fluctuating sensorineural hearing loss, tinnitus, and aural fullness. Although all of these symptoms are problematic for the patient, it is the episodes of vertigo that are most disruptive to life. Episodes are frequently violent and associated with nausea, vomiting, and inability to perform any type of meaningful activity. The onset of this disease typically occurs between the third and sixth decades. With females being slightly more affected than males. Careful historical evaluation reveals that up to 20% of patients will possess a family history of the disease, and bilateral involvement is encountered in up to 40% of patients (42).

Hearing loss due to meniere's disease is a fluctuating type of sensorineural hearing loss of low tones. As the disease progresses, the loss becomes greater, involves all tones, and may even total (42).

Medical management for Meniere's disease varies widely from one physician to the others. Usually it consists of a low-salt diet, diuretic, and vestibular suppressant (42).

Trauma of inner ear

Head trauma from blunt, blast, or whiplash injuries may cause damage to the inner ear. Most common cause of inner ear injury is fracture of temporal bone. Because a transverse fracture destroys the auditory and vestibular function, the patients have sensorineural hearing loss or vestibular response in that ear. Initially, they present with spontaneous nystagmus to the contralateral side and are severely vertiginous. Hence the patient may have high-frequency sensorineural hearing loss from the concommittant labyrinthine concussion. The patient complains of mild unsteadiness or light-headedness, particularly with change of head position (24). The transverse fracture is usually caused by a blow to the occiput. It runs translabyrinthine, traversing the internal auditory canal and cochlea, and ending in the foramen lacerum or spinosum. The external auditory canal is usually spared; but sensorineural hearing loss, facial nerve paralysis, nystagmus, and hemotympanum are the usual findings (34).

Treatment of temporal bone fracture is usually nonsurgical, with systemic antibiotics and careful cleansing of the external auditory canal when otorrhea is present. Facial nerve paralysis of immediate onset may dictate exploration (24).

4. Prevalence of Hearing Loss in prisoners.

Melnick W. (1979) studied the hearing impairment of 4858 adults in the state Penitentiary of Ohio. The tests were conducted in a double walled testing chamber (IAG 1203), which provides an adequate testing environment. The test equipment consists of a commercial two-channel audiometer (Beltone 14A), which included speech testing circuitry, narrow band noise generator ; and a SISI unit . The inmates had to filled out a questionnaire concerning their audiologic background, and they were given pure-tone sweep-check at 250-8,000 Hz. He found that sixty percent of 4858 men, passed the test while 40% failed, and 29.3% failed at two or more frequencies in the same ear, and 5.4% failed at two or more frequencies in the same ear and also failed at speech frequencies

(500, 1,000, and 2,000 Hz), and 5.6% failed at two or more speech frequencies in the same ear.

Seventy-five men were classified as bilateral impairment, while 160 men showed greater impairment in the right ear than in the left and 149 indicated more impairment in the left. Fifty eight percent of 384 men had mild hearing loss (26-40 dB).

He also found 143 ears (31.5%) had conductive hearing loss, 183 ears (40.3%) had sensorineural hearing loss, 18 ears had functional hearing loss, 89% of the subjects had same impairment (by pure-tone average at 500, 1,000 and 2,000 Hz and by speech reception threshold) in the left ear, and 87% in the right ear (1).

Bountress and Richards. (1979) studied speech, language and hearing disorders in an adult penal institution at Saint Bride's Correctional Unit in Chesapeake, Virginia, 184 of the 200 inmates incarcerated at Saint Bride's agreed to participate. Their mean age was 21.5 years with a range of 16 to 58 years. Hearing sensitivity of each inmate was screened at 500, 1,000, 2,000, 3,000, 4,000, and 5,000 Hz at a loudness level of 20 dBHL, using Beltone 10 G and 10 D portable audiometers, TDH 39 earphones, and a Madsen ZO-73 impedance audiometer to evaluate middle ear function. They found that 31 (16.8%) inmates presented significant hearing losses, 18 (9.7%) had hearing losses significant enough (greater than 35 dB HL at more than one frequency in at least one ear), while 13 (7.1%) had high-frequency (3,000, 4,000, and 8,000 Hz) hearing losses and self-reported histories of prolonged exposure to high-intensity noise without the consistent use of adequate ear protection. In addition, 10 (5.4%) inmates were found to have middle-ear problems (2).

Belenchia and Crowe (1983) studied the prevalence of speech and hearing disorders in a state penitentiary population. Speech and hearing screening was conducted with 136 inmates (84 male and 52 female) incarcerated at the Mississippi State Penitentiary. The screening sessions were conducted at the penitentiary in available rooms housed in or adjacent to inmate living facilities and in examination rooms in the penitentiary hospital by using portable audiometers. (Maico Model MA 27, Series 101). They found that prevalence of

articulation disorders among the general population was 3%; fluency disorders, 1%; voice disorders 1%, and hearing loss among adults, aged 18-70 years 7-8%. The results of screening at the Missisippi State Penitentiary indicated that the prevalence of voice disorders (5.9%) was appreciably higher than the prevalence reported by ASHA for the general population. The prevalence of hearing impairment among this inmate group, based on the percentage of those who failed hearing screening, was five to six times higher than general population figures. (66 inmates, or 48.5% of the total group failed hearing screening). In summary, the prevalences of articulation and fluency disorders were comparable to prevalence figures reported for the general population, whereas the prevalence figures for voice and hearing disorders among the sample group were appreciably higher (3).

Claire Jacobson et al (1989) had investigated the incidence of hearing disorders in state penitentiary prison inmates. A total of 34 male prison inmates (State Penitentiary Parchman, MS) were tested using behavioral and electrophysiological measurement. The inmates were randomly selected from a computer list generated by prison officials. Subjects ranged from 18 to 35 years with a mean age of 26.5 years. The duration of subjects incarceration ranged from 2 month to 4 years (mean. 1.1 years). Consideration was given to inmate accessibility with respect to security regulations and individual school/work schedules at the time on testing. Each inmate was interviewed for medical, drug, and hearing history. Then, an otoscopic examination was performed and immittance measures were conducted with Grason-Stadler Middle Ear Analyzer No. 1723 including tympanometry, acoustic reflex thresholds (ART) at 500, 1,000, and 2,000 Hz (crossed and uncrossed), and acoustic reflex decay at 10 dBSL above the ART at 1,000 Hz. Audiometric pure-tone testing was administered under quiet listening conditions with a calibrated audiometer (ANSI 53.6,1969) using a screening level of 20 dBHL at 500, 1,000, 2,000, 4,000, and 6,000 Hz. A total of 20 (58.8%) subjects had normal bilateral peripheral hearing sensitivity. One (2.9%) subject exhibited a unilateral conductive hearing imparirment, 8 (23.5%) presented with some degree of bilateral sensorineural hearing loss (SNHL), and 1 (2.9%) displayed a unilateral

SNHL. In addition, the conflicting results of elevated pure-tone sensitivity with normal immittance measures and normal ABR findings suggested that 4 (11.8%) inmates exhibited pseudohypacusic hearing loss. A summary of impairment by ears results in a total of 42 (61.8%) normal,17 (25%) with SHL, 1 (1.5%) with conductive pathology, and 8 nonorganic hearing loss (11.8%) (4).

Alice E. Holmes et al (1996) studied the results of a hearing screening completed in Juvenile Detention Centers. A total of 226 juvenile detainees (173 males and 53 females) were screened over an 8-month period. Subjects were incarcerated in two separate regional juvenile detention centers in north central Florida, and they were aged between 9 to 18 years old. Screenings consisted of an orally presented yes/no questionnaire, otoscopic inspection, tympanometry, pute-tone screening and medical record review. Pure-tone screenings were completed with portable audiometers (Maico models 24 and 39). The outputs of the audiometers were routed to TDH-39 earphones housed in 41/AR cushions. The audiometers were electroacoustically calibrated at biweekly intervals according to ANSI standards (ANSI, 1969). All testing was completed in a quiet detention center classroom or in a corner of a cafeteria (when not in use) treated with sound reduction tile. From the questionnaire, 31 of the subjects noted that they felt they might have a hearing loss. One hundred and thirty of the subjects (58%) reported head trauma (concussion or hard blow to the head) during their lifetimes. Noise exposure would appear to be endemic in this population, with over 70 percent of the subjects reported listening to music with a boom box or "loud" car stereo often and over 40 percent noted using firearms. Thirty percent admitted to work in noisy environments, with 42 percent stated that they engaged in noisy hobbies. Thirty-seven percent reported using street drugs. A positive family history of hearing loss was reported by 22 percent of the subjects (5).

Subjects were screened with otoscopy, tympanometry, and pure-tone evaluation. A total abnormal audiologic screening rate of 35.4 percent (80 subjects) was found. Twenty-two subjects (9.7%) failed the otoscopie inspection, 17 subjects (7.5%) failed tympanometry, and 59 subjects (26.1%) failed the pure-tone screening. The medical records of 212 subjects were reviewed. Fourteen records were not reviewed as they were unavailable at the time of the review. Of

the 212 records reviewed, 76 (36%) reported a history of drug used, 40 (19%) reported a history of physical abuse, and 32 (15%) had a sexually transmitted disease (chlamydia, gonorrhea, genital warts). Employment history was found in only 100 of the 212 records reviewed. 23 subjects worked in a noisy environment (lawn mowing, auto mechanic).

CHAPTER III
MATERIALS AND METHODS

Four penitentiaries were selected in this study from eight penitentiaries in Bangkok by using simple random sampling technique (43).

Subjects

The study group comprised of one thousand prisoners from two prisons and two correctional institutions : Klong-Prem Central Prison , the Central Correctional Institution for Drug Addicts, Bangkok Remand Prison, and the Central Women's Correctional Institution. There were 750 male prisoners and 250 female prisoners in this study . Their age ranged from 18-74 years.

Instrumentations

The instruments used in this study were the following:

1. An otoscope.
2. A quiet room with ambient noise less than 40 dB.
3. A questionnaire " Prevalence of the prisoner's hearing disorders and ear hygiene in 4 penitentiaries in Bangkok by screening method" (see Appendix B).
4. An Fonix FA-12 Digital audiometer and Audiocups (Amplivox TDH-39P) (see Appendix C).
5. An acoustic immittance instrument –MAICO MA 630 *series* II. (see Appendix C).
6. A sound level meter –Kamplex KM 4. (see Appendix C).

Procedures

1. Two hundred fifty prisoners were randomly chosen from each of these four places: the Klong-Prem Central Prison, the Central Correctional Institution for Drug Addicts, Bangkok Remand Prison, and the Central Women's Correctional Institution by using random number table (43).

2. Noise levels of test room were measured by using a sound level meter to be sure that noise level does not exceed the accepted limit.

3. The objectives of this study were explained to each subject and then the prisoners were asked to fill out the questionnaire related to prisoner's personal data included past history, hearing status and ear hygiene.

4. Otoscopic examination was examined by the otorhinolaryngologist prior to pure tone audiometry.

5. Pure tone air conduction thresholds were tested at 250-8,000 Hz. The auditory threshold was determined by descending technique. Masking was applied to the non test ear when there was a difference of 40 dB or more in hearing acuity between the two ears.

6. Acoustic immittance measures were used to evaluated the middle ear function.

Data analysis

The following statistical methods were applied to analyse the obtained data:

1.1 To calculate the number and percentage of each variable of prevalence of the prisoner's hearing disorders, middle ear disorders, and ear hygiene in 4 penitentiaries in Bangkok.

1.2 To calculate the number and percentage of each variable of prevalence of the prisoner's ear diseases in 4 penitentiaries in Bangkok.

1.3 To compare the different scores of each variable of prevalence of the prisoners' hearing disorders, middle ear disorders, and ear hygiene in male and female prisoners by using chi-square.

The statistical package SPSS for windows was used to analyse data in this research.

CHAPTER IV
RESULTS

The purpose of this study was to investigate the nature of prisoners' hearing disorders and ear hygiene in 4 penitentiaries in Bangkok by screening method. The results were analyzed as follows 1) general information and history of hearing and diseases 2) prevalence of prisoners' hearing disorders and middle ear disorders by screening method 3) prevalence of prisoners' ear hygiene 4) prevalence of prisoners' ear diseases 5) severity and configurations of prisoners' hearing disorders 6) comparison of prisoners' hearing disorders and middle ear disorders in male and female prisoners by screening method .

1. General Information and history of hearing and diseases

The subjects consisted of 1,000 prisoners from 4 penitentiaries in Bangkok (Prison I – Klong-prem Central Prison, Prison II – Central Correctional Institution for Drug Addicts, Prison III – Bangkok Remand Prison, Prison IV - Central Women Correctional Institution). Two hundred and fifty prisoners were selected from each penitentiary by simple random sampling technique. The results were demonstrated as in Table A-1 (see Appendix). All subjects were male (prison I, II, and III) except prison IV was female. The subjects' age ranged from 18 to 74 years (mean age = 34.23, SD = 10.35). The percent of subjects in each age range were 19.7 % (15-25 years), 40.5 % (26-35 years), 24.8 % (36-45 years), 11.0 % (46-55 years), 2.8 % (56-65 years), and 1.2 % (66-75 years). The subjects' education were ranged from no education to higher than bachelor degree, and most of them (54.5%) had primary school education, while 0.1 % had education higher than bachelor degree. For the occupation, most of subjects were employees (51.4 %), while the least percent (0.7 %) were state enterprise. Most of subjects (61.9%) were born in the upcountry and 84% of all the subjects had current residence in central Thailand. Seventy three point one percent of the subjects were charged with narcotic drug/inhalant act offences, and 0.3 % were charged with causing public dangers.

The results of prisoners' health history (Table A-2 in Appendix) showed that most of subjects had no symptoms and ear diseases. The subjects that had symptoms and ear diseases were as follows: earpain 28.1% (unilateral 23.7%, bilateral 4.4%), ringing sound 41.9% (unilateral 29.4%, bilateral 12.4%), history of discharge or pus from ear 15.7% (unilateral 11.5%, bilateral 4.2%), current discharge 4.2% (unilateral 3.0%, bilateral 1.2%), vertigo 29.6%, vomitting 7.5%, related headache to ear problem 9.5%, mumps 38.4%, post auricular abscess 2.1%, hearing problem after medication taken 3.3%, tuberculosis 5.7%, diabetes melitus 1.4%, meningitis 0.2%, chicken pox 61.3%, sorethroat and frequently common cold 32.1%, allergic for dust and pollen and sinusitis 26.6%, ear injury and head injury 41.3%, others 21.4%.

2. Prevalence of prisoners' hearing disorders and middle ear disorders in 4 penitentiaries in Bangkok by screening method

All subjects were assessed by using audiometry and tympanometry. The prevalence of the disorders were calculated by using number and percentage. The results were shown in Table 1, 2, and 3

Table 1 The number and percentage of prisoner's hearing disorders in 4 penitentiaries in Bangkok by screening audiometry

Hearing disorders	Prison I	Prison II	Prison III	Prison IV	Total
	number (%)	number (%)	number (%)	number (%)	number (%)
Unilateral	60 (12.0)	87 (17.4)	84 (16.8)	64 (12.8)	289 (14.45)
Bilateral	72 (14.4)	128 (25.6)	338 (67.6)	60 (12.0)	604 (30.2)
Total hearing disorders	132 (26.4)	215 (43.0)	422 (84.4)	124 (24.8)	893 (44.65)

From Table 1, the results showed that 44.65 % of the prisoners had hearing disorders . Fourteen point forty-five percent had hearing disorders in one ear and 30.2 % had hearing disorders in both ears. The highest percentage (84.4 %) of hearing disorders were found in Prison III – hearing disorders in one ear (16.8 %) and hearing disorders in both ears (67.6 %). The lowest percentage (24.8 %) of hearing disorders were found in Prison IV – hearing disorders in one ear (12.8 %) and hearing disorders in both ears (12.0 %).

Table 2 The number and percentage of prisoners' abnormal tympanogram in 4 penitentiaries in Bangkok by screening tympanometry

Abnormal tympanogram	Prison I	Prison II	Prison III	Prison IV	Total
	number (%)	number (%)	number (%)	number (%)	number (%)
Unilateral	20 (4.0)	29 (5.8)	31 (6.2)	23 (4.6)	103 (5.15)
Bilateral	14 (2.8)	40 (8.0)	18 (3.6)	6 (1.2)	78 (3.9)
Total abnormal tympanogram	34 (6.8)	69 (13.8)	49 (9.8)	29 (5.8)	181 (9.05)

From Table 2, the results showed that 9.05 % of the prisoners had abnormal tympanogram. Five point fifteen percent had abnormal tympanogram in one ear and 3.9 % had abnormal tympanogram in both ears. The highest percentage (13.8 %) of abnormal tympanogram were found in Prison II – abnormal tympanogram in one ear (5.8 %) and abnormal tympanogram in both ears (8.0 %). The lowest percentage (5.8 %) of abnormal tympanogram were found in Prison IV - abnormal tympanogram in one ear (4.6 %) and abnormal tympanogram in both ears (1.2 %).

Table 3 The number and percentage of types of tympanogram from prisoners in 4 penitentiaries in Bangkok by screening tympanometry

Abnormal tympanogram	Prison I	Prison II	Prison III	Prison IV	Total
	Number (%)	number (%)	number (%)	number (%)	number (%)
Type B					
Unilateral	12 (2.4)	11 (2.2)	16 (3.2)	11 (2.2)	50 (2.5)
Bilateral	6 (1.2)	14 (2.8)	2 (0.4)	2 (0.4)	24 (1.2)
Total type B	18 (3.6)	25 (5.0)	18 (3.6)	13 (2.6)	74 (3.7)
Type C					
Unilateral	7 (1.4)	25 (5.0)	15 (3.0)	4 (0.8)	51 (2.55)
Bilateral	6 (1.2)	10 (2.0)	6 (1.2)	4 (0.8)	26 (1.3)
Total type C	13 (2.6)	35 (7.0)	21 (4.2)	8 (1.6)	77 (3.85)
Type A_D					
Unilateral	3 (0.6)	6 (1.2)	7 (1.4)	7 (1.4)	23 (1.15)
Bilateral	- (-)	2 (0.4)	2 (0.4)	- (-)	4 (0.2)
Total type A_D	3 (0.6)	8 (1.6)	9 (1.8)	7 (1.4)	27 (1.35)

Table 3 The number and percentage of types of tympanogram from prisoners in 4 penitentiaries in Bangkok by screening tympanometry (continued)

Abnormal tympanogram	Prison I	Prison II	Prison III	Prison IV	Total
	number (%)	number (%)	number (%)	number (%)	number (%)
Type A_S					
Unilateral	- (-)	1 (0.2)	1 (0.2)	1 (0.2)	3 (0.15)
Bilateral	- (-)	- (-)	- (-)	- (-)	- (-)
Total type A_S	- (-)	1 (0.2)	1 (0.2)	1 (0.2)	3 (0.15)
Total abnormal tympanogram	34 (6.8)	69 (13.8)	49 (9.8)	29 (5.8)	181 (9.05)

From Table 3, 3.7 % of the prisoners had type B tympanogram. Two point five percent had type B tympanogram in one ear and 1.2 % had type B tympanogram in both ears. The highest percentage (5.0 %) of type B tympanogram were found in Prison II – type B tympanogram in one ear (2.2 %) and type B tympanogram in both ears (2.8 %). The lowest percentage (2.6 %) of type B tympanogram were found in Prison IV – type B tympanogram in one ear (2.2 %) and type B tympanogram in both ears (0.4 %).

There were 3.85 % of the prisoners who had type C tympanogram. Two point fifty-five percent had type C tympanogram in one ear and 1.3 % had type C tympanogram in both ears. The highest percentage (7.0 %) of type C tympanogram were found in Prison II – type C tympanogram in one ear (5.0 %) and type C tympanogram in both ears (2.0 %). The lowest percentage (1.6 %) of type C tympanogram were found in Prison IV – type C tympanogram in one ear and both ears (0.8 %).

There were 1.35 % of the prisoners who had type A_D tympanogram. One point fifteen percent had type A_D tympanogram in one ear and 0.2 % had type A_D tympanogram in both ears. The highest percentage (1.8 %) of type A_D tympanogram were found in Prison III – type A_D tympanogram in one ear (1.4 %) and type A_D tympanogram in both ears (0.4 %). The lowest percentage (0.6 %) of type A_D tympanogram were found in Prison I – type A_D tympanogram in one ear (0.6%) and not found in both ears.

There were 0.15 % of the prisoners who had type A_S tympanogram. Point fifteen percent had type A_S tympanogram in one ear and not found in both ears. The highest percentage (0.2 %) of type A_S tympanogram were found in Prison II, III, and IV, while abnormal tympanogram was not found in prisoners in Prison I.

3. Prevalence of prisoners' ear hygiene in 4 penitentiaries in Bangkok

The knowledge about ear hygiene was interviewed by using questionnaire reviewed by researcher. The questionnaire included 5 items that assessed ear health care of subjects. The results were calculated by using number and percentage as shown in Table 4.

Table 4 The number and percentage of prisoner's ear hygiene in 4 penitentiaries in Bangkok

Variables	Prison I	Prison II	Prison III	Prison IV	Total
	number (%)	number (%)	Number (%)	number (%)	number (%)
The frequency of ear cleaning					
- every time when itching	138 (55.2)	143 (57.2)	145 (58.0)	152 (60.8)	578 (57.8)
- every time after taking a shower	17 (6.8)	14 (5.6)	22 (8.8)	13 (5.2)	66 (6.6)
- once a week	37 (14.8)	60 (24.0)	61 (24.4)	24 (9.6)	182 (18.2)
- never	11 (4.4)	16 (6.4)	15 (6.0)	29 (11.6)	71 (7.1)
- others	47 (18.8)	17 (6.8)	7 (2.8)	32 (12.8)	103 (10.3)
Management of foreign bodies in the ear					
- applying a small pick in to the ear	34 (13.6)	30 (12.0)	26 (10.4)	29 (11.6)	119 (11.9)
- applying water into the ear	164 (65.6)	116 (46.4)	124 (49.6)	146 (58.4)	550 (55.0)
- tapping the ear	16 (6.4)	17 (6.8)	18 (7.2)	12 (4.8)	63 (6.3)
- seeing a physician immediately	35 (14.0)	85 (34.0)	82 (32.8)	59 (23.6)	261 (26.1)

Table 4 The number and percentage of prisoner's ear hygiene in 4 penitentiaries in Bangkok (continued)

Variables	Prison I	Prison II	Prison III	Prison IV	Total
	Number	number	number	number	number
	(%)	(%)	(%)	(%)	(%)
- others	1	2	-	4	7
	(0.4)	(0.8)	(-)	(1.6)	(0.7)
The proper way to protect the ear from loud noise					
- putting the cotton rolls in their ears	76	49	38	57	220
	(30.4)	(19.6)	(15.2)	(22.8)	(22.0)
- closing the ears with hands	54	66	54	57	231
	(21.6)	(26.4)	(21.6)	(22.8)	(23.1)
- wearing an ear protector	76	110	125	99	410
	(30.4)	(44.0)	(50.0)	(39.6)	(41.0)
- doing nothing	42	25	33	36	136
	(16.8)	(10.0)	(13.2)	(14.4)	(13.6)
- others	2	-	-	1	3
	(0.8)	(-)	(-)	(0.4)	(0.3)
Management to remove insects					
- applying oil into the ear	132	176	148	155	611
	(52.8)	(70.4)	(59.2)	(62.0)	(61.1)
- seeing a physician	83	47	79	53	262
	(33.2)	(18.8)	(31.6)	(21.2)	(26.2)
- asking a friend or a barber to take it out.	27	17	21	34	99
	(10.8)	(6.8)	(8.4)	(13.65)	(9.9)
- leaving it until the insect comes out	1	6	2	4	13
	(0.4)	(2.4)	(0.8)	(1.6)	(1.3)
- others	7	4	-	4	15
	(2.8)	(1.6)	(-)	(1.6)	(1.5)

Table 4 The number and percentage of prisoner's ear hygiene in 4 penitentiaries in Bangkok (continued)

Variables	Prison I	Prison II	Prison III	Prison IV	Total
	number (%)	number (%)	number (%)	number (%)	number (%)
Health care of the ear					
- cleaning with cleaned cloth every time after taking a shower	31 (12.4)	33 (13.2)	22 (8.8)	31 (12.4)	117 (11.7)
- cleaning with cotton bud every time after taking a shower	32 (12.8)	56 (22.4)	58 (23.2)	112 (44.8)	258 (25.8)
- cleaning with hydrogen per oxide	159 (63.6)	136 (54.4)	141 (56.4)	100 (40.0)	536 (53.6)
- asking a barber to clean every time after having the hair cut	28 (11.2)	25 (10.0)	29 (11.6)	5 (2.0)	87 (8.7)
- others	- (-)	- (-)	- (-)	2 (0.8)	2 (0.2)
Total	500 (100)	500 (100)	500 (100)	500 (100)	2000 (100)

From Table 4, in the category of the frequency of ear cleaning, the results showed that the highest percentage (57.8 %) of subjects cleaning their ear every time when itching, the lowest percentage (6.6 %) of subjects cleaning their ear every time after taking a shower. In the category of management of foreign bodies in the ear, it showed that the highest percentage (55.0 %) of subjects apply water into the ear when there were foreign bodies in the ear, the lowest percentage (0.7 %) of subjects used other methods. In the category of the proper way to protect the ears from loud noise, it showed that the highest percentage (41.0 %) wore an ear protector to prevent loud

noise, the lowest percentage (0.3 %) of subjects used other methods. In the category of management to remove insects, it showed that the highest percentage (61.1 %) of subjects applying oil into the ear to remove insect, the lowest percentage (1.3 %) of subjects leaving it until the insect come out. And in the category of health care of the ears, it showed that the highest percentage (53.6 %) of subjects cleaning the ears with hydrogen peroxide, the lowest percentage (0.2 %) of subjects used other methods.

4. Prevalence of prisoners' ear diseases in 4 penitentiaries in Bangkok

The ear diseases and ear conditions were examined by otoscopic examination from otolaryngologist. The results were calculated by using number and percentage as shown in Table 5.

Table 5 The number and percentage of prevalence of prisoners' ear diseases in 4 penitentiaries in Bangkok by otoscopic examination

Otoscopic examination	Prison I	Prison II	Prison III	Prison IV	Total
	number (%)	number (%)	number (%)	number (%)	number (%)
1. Monomeric Membrane	14 (2.8)	6 (1.2)	7 (1.4)	4 (0.8)	31 (1.55)
2. Calcified Tympanic Membrane	1 (0.2)	1 (0.2)	3 (0.6)	4 (0.8)	9 (0.45)
3. Chronic Otitis Media	2 (0.4)	8 (1.6)	7 (1.4)	2 (0.4)	19 (0.95)
4. Impacted Cerumen	6 (1.2)	5 (1.0)	12 (2.4)	9 (1.8)	32 (1.6)
5. Preauricular Cyst	- (-)	- (-)	1 (0.2)	- (-)	1 (0.05)
6. Otomycosis	5 (1.0)	2 (0.4)	2 (0.4)	1 (0.2)	10 (0.5)

Table 5 The number and percentage of prevalence of prisoners' ear diseases in 4 penitentiaries in Bangkok by otoscopic examination (continued)

Otoscopic examination	Prison I	Prison II	Prison III	Prison IV	Total
	number (%)	number (%)	number (%)	number (%)	number (%)
7. Inflammation of the external auditory canal	3 (0.6)	3 (0.6)	- (-)	- (-)	6 (0.30)
8. Tympanic Membrane could not be visualized	1 (0.2)	- (-)	- (-)	2 (0.4)	3 (0.15)
Total	32 (6.4)	25 (5.0)	32 (6.4)	22 (4.4)	111 (5.55)

From Table 5, the results by otoscopic examination were as follows: monomeric membrane was found 1.55 % ; calcified tympanic membrane was found 0.45 %; chronic otitis media was found 0.95 %; impacted cerumen was found 1.6 %; preauricular cyst was found 0.05 %; otomycosis was found 0.5 %; inflammation of the external auditory canal was found 0.30 %; and tympanic membrane could not be visualized was found 0.15 %.

5. Severity and configurations of prisoners' hearing disorders in 4 penitentiaries in Bangkok by screening method.

The severity of hearing disorders of all subjects were investigated by using audiometry. The results were calculated by using number and percentage as shown in Table 6 and 7.

Table 6 The number and percentage of severity of prisoners' hearing disorders in 4 penitentiaries in Bangkok by screening audiometry

Severity of hearing disorders	Prison I	Prison II	Prison III	Prison IV	Total
	number (%)	number (%)	number (%)	number (%)	number (%)
Mild hearing loss					
Unilateral	51 (10.2)	78 (15.6)	67 (13.4)	55 (11.0)	251 (12.55)
Bilateral	72 (14.4)	128 (25.6)	336 (67.2)	56 (11.2)	592 (29.6)
Total mild HL	123 (24.6)	206 (41.2)	403 (80.6)	111 (22.2)	843 (42.15)
Moderate hearing loss					
unilateral	4 (0.8)	6 (1.2)	15 (3.0)	4 (0.8)	29 (1.45)
Bilateral	- (-)	- (-)	2 (0.4)	4 (0.8)	6 (0.3)
Total moderate HL	4 (0.8)	6 (1.2)	17 (3.4)	8 (1.6)	35 (1.75)
Moderate to severe HL					
unilateral	2 (0.4)	2 (0.4)	- (-)	4 (0.8)	8 (0.4)
Bilateral	- (-)	- (-)	- (-)	- (-)	- (-)
Total moderate to severe HL	2 (0.4)	2 (0.4)	- (-)	4 (0.8)	8 (0.4)

Table 6 The number and percentage of severity of prisoners' hearing disorders in 4 penitentiaries in Bangkok by screening audiometry (continued)

Severity of hearing disorders	Prison I	Prison II	Prison III	Prison IV	Total
	number (%)	number (%)	number (%)	number (%)	number (%)
Severe hearing loss					
unilateral	1 (0.2)	- (-)	- (-)	1 (0.2)	2 (0.1)
Bilateral	- (-)	- (-)	- (-)	- (-)	- (-)
Total severe HL	1 (0.2)	- (-)	- (-)	1 (0.2)	2 (0.1)
Profound SNHL					
unilateral	2 (0.4)	1 (0.2)	2 (0.4)	- (-)	5 (0.25)
Bilateral	- (-)	- (-)	- (-)	- (-)	- (-)
Total profound SNHL	2 (0.4)	1 (0.2)	2 (0.4)	- (-)	5 (0.25)
Total number and percentage of severity of prisoners' hearing disorders	132 (26.4)	215 (43.0)	422 (84.4)	124 (24.8)	893 (44.65)

From Table 6, there were 42.15 % of subjects who had mild hearing loss (12.55 % in one ear and 29.6 % in both ears). The highest percentage (13.4 % in one ear and 67.2 % in both ears) were in prison III, while the lowest percentage (11.0 % in one ear and 11.2 % in both ears) were in prison IV.

There were 1.75 % of subjects who had moderate hearing loss (1.45 % in one ear and 0.3 % in both ears). The highest percentage (3.0 % in one ear and 0.4 % in both ears) were in prison III, while the lowest percentage (0.8 % in one ear and not found in both ears) were in prison I.

There were 0.4 % of subjects who had moderate to severe hearing loss (0.4 % in one ear and not found in both ears). The highest percentage (0.8 % in one ear and not found in both ears) were in prison IV, while unilateral and bilateral moderate to severe hearing loss could not be identified in prison III.

There were 0.1 % of subjects who had severe hearing loss (0.1 % in one ear and not found in both ears). The highest percentage 0.2 % in one ear were in prison I and IV while unilateral and bilateral severe hearing loss could not be identified in prison II and III.

There were 0.25 % of subjects who had profound sensorineural hearing loss (0.25 % in one ear and not found in both ears). The highest percentage 0.4 % in one ear were in prison I and III , while unilateral and bilateral profound sensorineural hearing loss could not be identified in prison IV.

Table 7 The number and percentage of configurations of prisoners' hearing Disorders in 4 penitentiaries in Bangkok by screening audiometry

Configurations of hearing disorders	Prison I	Prison II	Prison III	Prison IV	Total
	number (%)	number (%)	number (%)	number (%)	number (%)
High frequency loss	60 (12.0)	42 (8.4)	52 (10.4)	16 (3.2)	170 (8.5)
Low frequency loss	23 (4.6)	107 (21.4)	233 (46.6)	57 (11.4)	420 (21.0)

Table 7 The number and percentage of configuration of prisoners' hearing Disorders in 4 penitentiaries in Bangkok by screening audiometry (continued)

Configurations of hearing disorders	Prison I	Prison II	Prison III	Prison IV	Total
	number (%)	number (%)	number (%)	number (%)	number (%)
Flat hearing loss	49 (9.8)	66 (13.2)	137 (27.4)	51 (10.2)	303 (15.15)
Total configuration of hearing disorders	132 (26.4)	215 (43.0)	422 (84.4)	124 (24.8)	893 (44.65)

From Table 7, the results showed that there were 8.5 % of prisoners with high frequency hearing loss. The highest percentage 12.0 % in prison I, while the lowest percentage 3.2 % in prison IV. There were 21.0 % of prisoners with low frequency hearing loss. The highest percentage 46.6 % in prison III, while the lowest percentage 4.6 % in prison I. There were 15.15 % of prisoners with flat hearing loss. The highest percentage 27.4 % in prison III, while the lowest percentage 9.8 % in prison I. In Summary, there were 44.65 % of prisoners with total configuration of hearing disorders. The highest percentage (84.4 %) of total configuration of hearing disorders were in prison III , while the lowest percentage (24.8%) were in prison IV.

6. Comparison of prisoners' hearing disorders and middle ear disorders in male and female prisoners by screening method.

The prisons in this study were divided into 2 groups (male-prison I, II,and III; female-prison IV). The comparison of hearing disorders, middle ear disorders, and ear hygiene in male and female prisoners were calculated by using Chi-square. The results were shown in Table 8, 9 and 10.

Table 8 Chi-square and p-value to compare hearing disorders between male and female prisoners in 4 penitentiaries by screening audiometry

	Sex			
	Male	**Female**	**Chi-square**	**p-value**
Hearing disorders (ears)	320	34	40.646	0.000*
Total of prisoners (ears)	1500	500		

*Significant at p <0.01

From Table 8, the results by audiogram showed that the hearing disorders of male prisoners were higher significantly different than female prisoners at p<0.01.

Table 9 Chi-square and p-value to compare middle ear disorders between male and female prisoners in 4 penitentiaries by screening tympanometry

	Sex			
	Male	**Female**	**Chi-square**	**p-value**
Abnormal tympanogram (ears)	152	29	7.282	0.007*
Total of prisoners (ears)	1500	500		

*Significant at p <0.01

From Table 9, the results by tympanogram showed that the middle ear disorders of male prisoners were higher significantly different than female prisoners at p<0.01.

Table 10 Chi-square and p-value to compare prisoners' ear hygiene in male and female prisoners in 4 penitentiaries by questionnaire

	Sex			
	Male	**Female**	**Chi-square**	**p-value**
The frequency of ear cleaning				
Wrong answers (prisoners)	708	221	0.383	0.536
Total of prisoners	750	250		
Management of foreign bodies in the ears				
Wrong answers (prisoners)	548	191	0.161	0.689
Total of prisoners	750	250		
The proper way to protect the ear from loud noise				
Wrong answers (prisoners)	439	151	0.069	0.792
Total of prisoners	750	250		
Management to remove insect				
Wrong answers (prisoners)	294	95	0.050	0.823
Total of prisoners	750	250		
Health care of the ear				
Wrong answers (prisoners)	664	219	0.010	0.921
Total of prisoners	750	250		

From Table10, the results showed that all items of questionnaire (the frequency of ear cleaning, management of foreign bodies in the ear, the proper way to protect the ear from loud noise, the management to remove insect, and health care of the ear) were not significant difference between male and female prisoners.

CHAPTER V
DISCUSSION AND CONCLUSIONS

The discussion of this chapter is based on the following topics: 1.) the prevalence of prisoners' hearing disorders and middle ear disorders by screening method 2.) the severity and configurations of prisoners' hearing disorders by screening method 3) the prevalence of prisoners' ear diseases by otoscopic examination 4.) the comparison of hearing disorders, middle ear disorders, and ear hygiene in male and female prisoners.

1. The prevalence of prisoners' hearing disorders and middle ear disorders by screening method

1.1 Hearing loss classified by screening audiogram

The prevalence of abnormal hearing in 4 penitentiaries was 44.65 %, from which 24.8 % was in prison IV, 26.4 % in prison I, 43.0 % in prison II, and 84.4 % in prison III, respectively.

The prevalence of communicative disorders compiled by ASHA (1981) from figures gathered by the National Institute of Neurological and Communicative Disorders and Stroke (1979) showed that the prevalence of hearing loss among the general adult population is approximately 8 %. Further, the most comprehensive census of the prevalence for hearing impairment of noninstitutionalized residents in the United States reported similar findings (Schein and Delk, 1974). These authors found that the prevalence of significant bilateral hearing impairment in adults is 66/1000 or 6.6 %, a similar figure to that reported by the National Institute. The percent of permanent hearing loss found in the present study was almost four times as great as the general population figures reported in either of the previously cited surveys.

The results of this research agreed with those of Melnick W (1), Belenchia and Crowe (3), and Jacobson et al (4). In the study of Melnick W (1), he studied hearing impairment in an adult penal institution.The results showed that 40.0 % of subjects had abnormal hearing. In the study of Belenchia and Crowe (3), they studied the prevalence of speech and hearing disorders in a state penitentiary population. The results showed that 48.5 % of subjects had abnormal hearing. In the study of Jacobson et al (4), they studied hearing loss in prison inmates. The results showed that 41.2 % of subjects had abnormal hearing. The results indicated that hearing disorders are still common problems in population which should be taken into consideration for management and prevention.

1.2 Middle ear disorders detected by screening tympanogram

The evaluation by tympanometer was found that the prevalence of middle ear disorders in 4 penitentiaries was 9.05 %, from which 5.8 % in prison IV, 6.8 % in prison I, 9.8 % in prison III, and 13.8 % in prison II, respectively. A majority of the prisoners exhibited middle ear disorders from a lack of proper care of personal hygiene, chronic otitis media, otomycosis, and impact cerumen.

The results of this study indicated that most of the prisoners had normal tympanogram (90.95 %). There were only 9.05 % of prisoners who had abnormal tympanogram. The results agreed with those of Bountress and Richard (2). Holmes et al (5). In the study of Bountress and Richard (2), their subjects had 94.6% of normal tympanogram and 5.4% of abnormal tympanogram. In the study of Holmes et al (5), their subjects had 92.5 % of normal tympanogram and 7.5% of abnormal tympanogram.

However, the tympanogram evaluation in this study was only screening (not including bone conduction and acoustic reflex), so some subjects might have been misdiagnosed such as those with otosclerosis (tympanogram type A).

1.3 Ear hygiene detectd by questionnaire

The prisoners in 4 penitentiaries responded the questions concerning ear hygiene with equally low correct scores in 3 items (the frequency of ear cleaning, the management of foreign bodies in the ear, and health care of the ear), except 2 items (the proper way to protect the ear from loud noise and the management to remove insects). The results might indicate that prisoners need more knowledge in ear hygiene.

2. The severity and configurations of prisoners' hearing disorders in 4 penitentiaries in Bangkok by screening method

The severity of hearing loss of all prisoners were classified into six categories (see Figure 6). Most of the prisoners had normal hearing (44.65 %). The other five categories were classified according to the severity as follows : mild hearing loss (42.15 %), moderate hearing loss (1.75 %), moderate to severe hearing loss (0.4 %), severe hearing loss (0.1 %), and profound sensorineural hearing loss (0.25 %), respectively. The percentage of mild hearing loss in each prison was as follows : 22.2 % in prison IV, 24.6 % in prison I, 41.2 % in prison II, and 80.6 % in prison III, respectively. The results showed that the percentage of the prisoners with mild hearing loss were more than other severity of hearing loss.

The results of this research agreed with those of Melnick W(1). Which showed that most of prisoners had normal hearing (92.1 %). The other degree of hearing loss were classified as follows : mild hearing loss (3.56 %), moderate hearing loss (1.24 %), severe hearing loss (0.27 %), and profound sensorineural hearing loss both ears (0.45 %).

The configurations of prisoners' hearing loss were classified into the followings: high frequency loss was found 8.5 %; low frequency loss was found 21.0 %; and flat hearing loss was found 15.15 %.

3. The prevalence of prisoners' ear diseases by otoscopic examination

The prevalence of prisoners' ear diseases in 4 penitentiaries was as follows: monomeric membrane, 1.55 %; calcified tympanic membrane, 0.45 %; chronic otitis media, 0.95 %; impacted cerumen, 1.6 %; preauricular cyst, 0.05 %; otomycosis, 0.5 %; inflamation of external auditory canal, 0.30 %; and tympanic membrane could not be visualized, 0.15 %. However some of these otologic findings were not considered to cause difficulty in hearing in these prisoners.

4. Comparison of hearing disorders, middle ear disorders, and ear hygiene in male and female prisoners

4.1 By screening audiogram and tympanogram

The hearing disorders and middle ear disorders of male prisoners were higher significantly different than female prisoners at $p<0.01$. This might be due to the fact that the female prisoners had a better hygiene of ear than male prisoners.

4.2 By questionnaire

There were not significant differences in the answers of all items on the questionnaire (the frequency of ear cleaning, management of foreign bodies in the ear, the proper way to protect the ear from loud noise, the management to remove insects, and health care of the ear). between male and female prisoners. This might be due to the fact that male and female prisoners had equal understanding and education about ear hygiene.

All of these discussions related to prisoners' ear hygiene in male and female prisoners cannot be compared with other research findings since there have not been any investigations on this topic at the time of this research.

Conclusions

1. The results of this research showed that the prevalence of the prisoners with hearing disorders were 44.65 %, the middle ear disorders were 9.05 %. The middle ear disorders were classified as type C – 3.85 %; type B – 3.7 %; type A_D – 1.35 %; and type A_S – 0.15 %. The understanding of ear hygiene of the prisoners administered by questionnaire showed that most of the prisoners had poor ear hygiene. Most of prisoners did not have adequate understanding of frequency of ear cleaning, management of foreign bodies in the ear, and health care of the ear.

2. The prevalence of hearing disorders severity were: mild hearing loss = 42.15 %, moderate hearing loss = 1.75 %, moderate to severe hearing loss =0.4 %, profound sensorineural hearing loss = 0.25 %, and severe hearing loss = 0.1 %. The configurations of prisoners' hearing loss were classified into the following: high frequency loss was found 8.5 %; low frequency loss was found 21.0 %; and flat hearing loss was found 15.15 %.

3. The prevalence of prisoners' ear diseases were as follow: impacted cerumen (1.6%), monomeric membrane (1.55%), chronic otitis media (0.95%), otomycosis (0.5%), calcified tympanic membrane (0.45%), and inflamation of external ear (0.3%).

4. The results showed that the hearing disorders and middle ear disorders of male prisoners were higher significantly different than female prisoners at $p < 0.01$. However, there were in significant differences between male and female prisoners' ear hygiene in all items on the questionnaire (the frequency of ear cleaning , the proper way to protect the ear from loud noise, the management of foreign bodies in the ear, management to remove insects, and health care of the ear).

Recommendations

The recommendations from this study concerning further research and application are as follows:

1. More detailed hearing test including bone conduction should be conducted to evaluate types and severity of hearing loss.

2. A mobile unit with sound proof room should be used in hearing evaluation.

3. Acoustic reflex test should be done to confirm the middle ear pathology in accordance to hearing loss.

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APPENDIX A

Prisoner's Personal and Health History Data

APPENDIX

Table A-1 : The number and percentage of prisoner's personal data in 4 penitentiaries in Bangkok by screening audiometry

Variables	Prison I	Prison II	Prison III	Prison IV	Total
	number (%)	number (%)	number (%)	number (%)	number (%)
Gender					
male	250 (100)	250 (100)	250 (100)	- (-)	750 (75.0)
female	- (-)	- (-)	- (-)	250 (100)	250 (25.0)
Age (years)					
15-25	25 (10)	101 (40.4)	35 (14.0)	36 (14.4)	197 (19.7)
26-35	97 (38.8)	106 (42.4)	125 (50.0)	77 (30.8)	405 (40.5)
36-45	82 (32.8)	27 (10.8)	63 (25.2)	76 (30.4)	248 (24.8)
46-55	29 (11.6)	13 (5.2)	20 (8.0)	48 (19.2)	110 (11.0)
56-65	11 (4.4)	3 (1.2)	4 (1.6)	10 (4.0)	28 (2.8)
66-75	6 (2.4)	- (-)	3 (1.2)	3 (1.2)	12 (1.2)

Table A-1 : The number and percentage of prisoner's personal data in 4 penitentiaries in Bangkok by screening audiometry (continued)

Variables	Prison I	Prison II	Prison III	Prison IV	Total
	number (%)	number (%)	number (%)	number (%)	number (%)
Education					
no education	6 (2.4)	6 (2.4)	21 (8.4)	7 (2.8)	40 (4.0)
primary school	149 (59.6)	120 (48.0)	156 (62.4)	120 (48.0)	545 (54.5)
secondary school	71 (28.4)	97 (38.8)	52 (20.8)	101 (40.4)	321 (32.1)
vocational certificate	7 (2.8)	21 (8.4)	16 (6.4)	20 (8.0)	74 (7.4)
bachelor degree	7 (2.8)	5 (2.0)	5 (2.0)	2 (0.8)	19 (1.9)
higher than bachelor degree	- (-)	1 (0.4)	- (-)	- (-)	1 (0.1)
Occupation					
civil servant	11 (4.4)	7 (2.8)	3 (1.2)	1 (0.4)	22 (2.2)
state enterprise	2 (0.8)	3 (1.2)	- (-)	2 (0.8)	7 (0.7)
private company	7 (2.8)	16 (6.4)	3 (1.2)	10 (4.0)	36 (3.6)
employee	115 (46.0)	158 (63.2)	103 (41.2)	138 (55.2)	514 (51.4)
others	115 (46.0)	66 (26.4)	141 (56.4)	99 (39.6)	421 (42.1)

Table A-1 : The number and percentage of prisoner's personal data in 4 penitentiaries in Bangkok by screening audiometry (continued)

Variables	Prison I	Prison II	Prison III	Prison IV	Total
	number (%)	number (%)	number (%)	number (%)	number (%)
Place of birth					
Bangkok	53 (21.2)	110 (44.0)	70 (28.0)	148 (59.2)	381 (38.1)
other provinces	197 (78.8)	140 (56.0)	180 (72.0)	102 (40.8)	619 (61.9)
Current residence					
central Thailand	165 (66.0)	241 (96.4)	184 (73.6)	250 (100)	840 (84.0)
eastern Thailand	17 (6.8)	2 (0.8)	7 (2.8)	- (-)	26 (2.6)
northeastern Thailand	20 (8.0)	3 (1.2)	4 (1.6)	- (-)	27 (2.7)
northern Thailand	39 (15.6)	3 (1.2)	44 (17.6)	- (-)	86 (8.6)
southern Thailand	9 (3.6)	1 (0.4)	11 (4.4)	- (-)	21 (2.1)
Offences					
offences against property	33 (13.2)	90 (36.0)	16 (6.4)	- (-)	139 (13.9)
offences against narcotic/inhalent act	147 (58.8)	114 (45.6)	220 (88.0)	250 (100)	731 (73.1)
offences against life	45 (18.0)	18 (7.2)	7 (2.8)	- (-)	70 (7.0)
bodily harm	1 (0.4)	3 (1.2)	- (-)	- (-)	4 (0.4)

Table A-1 : The number and percentage of prisoner's personal data in 4 penitentiaries in Bangkok by screening audiometry (continued)

Variables	Prison I	Prison II	Prison III	Prison IV	Total
	number (%)	number (%)	number (%)	number (%)	number (%)
offences against sexuality	15 (6.0)	7 (2.8)	- (-)	- (-)	22 (2.2)
offences relating to causing public dangers	2 (0.8)	1 (0.4)	- (-)	- (-)	3 (0.3)
Others	7 (2.8)	17 (6.8)	7 (2.8)	- (-)	31 (3.1)

Table A-2 The number and percentage of prisoner's health history data in 4 penitentiaries in Bangkok by screening audiometry.

Problem concerned with	Prison I	Prison II	Prison III	Prison IV	Total
	number (%)	number (%)	number (%)	number (%)	number (%)
earpain					
yes	66	51	98	66	281
	(26.4)	(20.4)	(39.2)	(26.4)	(28.1)
unilateral	48	40	90	59	237
	(19.2)	(16.0)	(35.4)	(23.6)	(23.7)
bilateral	18	11	8	7	44
	(7.2)	(4.4)	(3.2)	(2.8)	(4.4)
never	184	199	152	184	719
	(73.6)	(79.6)	(60.8)	(73.6)	(71.9)
ringing sound					
yes	105	81	134	99	419
	(42.0)	(32.4)	(53.6)	(39.6)	(41.9)
unilateral	70	56	103	65	294
	(28.0)	(22.4)	(41.2)	(26.0)	(29.4)
bilateral	35	25	30	34	124
	(14.0)	(10.0)	(12.0)	(13.6)	(12.4)
never	145	169	117	151	582
	(58.0)	(67.6)	(46.8)	(60.4)	(58.2)

Table A-2 The number and percentage of prisoner's health history data in 4 penitentiaries in Bangkok by screening audiometry (continued)

Problem concerned with	Prison I	Prison II	Prison III	Prison IV	Total
	number (%)	number (%)	number (%)	number (%)	number (%)
any discharge or pus from ear.					
yes	45 (18.0)	33 (13.2)	38 (15.2)	41 (16.4)	157 (15.7)
unilateral	26 (10.4)	30 (12.0)	27 (10.8)	32 (12.8)	115 (11.5)
bilateral	19 (7.6)	3 (1.2)	11 (4.4)	9 (3.6)	42 (4.2)
never	205 (82.0)	217 (86.8)	212 (84.8)	209 (83.6)	843 (84.3)
current discharge					
yes	8 (3.2)	9 (3.6)	11 (4.4)	14 (5.6)	42 (4.2)
unilateral	4 (1.6)	7 (2.8)	9 (3.6)	10 (4.0)	30 (3.0)
bilateral	4 (1.6)	2 (0.8)	2 (0.8)	4 (1.6)	12 (1.2)
never	38 (15.2)	24 (9.6)	27 (10.8)	27 (10.8)	116 (11.6)

Table A-2 The number and percentage of prisoner's health history data in 4 penitentiaries in Bangkok by screening audiometry.(continued)

Problem concerned with	Prison I	Prison II	Prison III	Prison IV	Total
	number (%)	number (%)	number (%)	number (%)	number (%)
vertigo					
yes	76	45	139	36	296
	(30.4)	(18.0)	(55.6)	(14.4)	(29.6)
- vertigo	26	17	84	18	145
	(10.4)	(6.8)	(33.6)	(7.2)	(14.5)
- dizziness	13	6	19	1	39
	(5.2)	(2.4)	(7.6)	(0.4)	(3.9)
- dysequilibrium, unstableness	29	20	33	17	99
	(11.6)	(8.0)	(13.2)	(6.8)	(9.9)
- others	8	3	-	1	12
	(3.2)	(1.2)	(-)	(0.4)	(1.2)
never	174	111	214	205	704
	(69.6)	(44.4)	(85.6)	(82.0)	(70.4)
vomitting					
yes	12	7	6	50	75
	(4.8)	(2.8)	(2.4)	(20.0)	(7.5)
never	238	243	244	200	925
	(95.2)	(97.2)	(97.6)	(80.0)	(92.5)

Table A-2 The number and percentage of prisoner's health history data in 4 penitentiaries in Bangkok by screening audiometry.(continued)

Problem concerned with	Prison I	Prison II	Prison III	Prison IV	Total
	number (%)	number (%)	number (%)	number (%)	number (%)
related headache to ear problem					
yes	23 (9.2)	10 (4.0)	43 (17.2)	19 (7.6)	95 (9.5)
never	227 (90.8)	240 (96.0)	207 (82.8)	231 (92.4)	905 (90.5)
mumps					
yes	81 (32.4)	83 (33.2)	121 (48.4)	99 (39.6)	384 (38.4)
never	169 (67.6)	167 (66.8)	129 (51.6)	151 (60.4)	616 (61.6)
post auricular abscess					
yes	6 (2.4)	3 (1.2)	6 (2.4)	6 (2.4)	21 (2.1)
never	244 (97.6)	247 (98.8)	244 (97.6)	244 (97.6)	979 (97.9)
hearing problem after medication taken					
yes	13 (5.2)	7 (2.8)	10 (4.0)	3 (1.2)	33 (3.3)
never	237 (94.8)	243 (97.2)	240 (96.0)	247 (98.8)	967 (96.7)

Table A-2 The number and percentage of prisoner's health history data in 4 penitentiaries in Bangkok by screening audiometry.(continued)

Problem concerned with	Prison I	Prison II	Prison III	Prison IV	Total
	number (%)	number (%)	number (%)	number (%)	number (%)
tuberculosis					
yes	29 (11.6)	14 (5.6)	3 (1.2)	11 (4.4)	57 (5.7)
never	221 (88.4)	236 (94.4)	247 (98.8)	239 (95.6)	943 (94.3)
diabetes melitus					
yes	2 (0.8)	- (-)	12 (4.8)	- (-)	14 (1.4)
never	248 (99.2)	250 (100)	238 (95.2)	250 (100)	986 (98.6)
meningitis					
yes	- (-)	1 (0.4)	1 (0.4)	- (-)	2 (0.2)
never	250 (100)	249 (99.6)	249 (99.6)	250 (100)	998 (99.8)
chicken pox					
yes	121 (48.4)	148 (59.2)	164 (65.6)	180 (72.0)	613 (61.3)
never	129 (51.6)	102 (40.8)	86 (34.4)	70 (28.0)	387 (38.7)

Table A-2 The number and percentage of prisoner's health history data in 4 penitentiaries in Bangkok by screening audiometry.(continued)

Problem concerned with	Prison I	Prison II	Prison III	Prison IV	Total
	number (%)	number (%)	number (%)	number (%)	number (%)
sorethroat, frequently common cold					
yes	90 (36.0)	49 (19.6)	101 (40.4)	81 (32.4)	321 (32.1)
never	160 (64.0)	201 (80.4)	149 (59.6)	169 (67.6)	679 (67.9)
allergic for dust, pollen , sinus					
yes	83 (33.2)	59 (23.6)	74 (29.6)	50 (20.0)	266 (26.6)
never	167 (66.8)	191 (76.4)	176 (70.4)	200 (80.0)	734 (73.4)
ear injury, head injury					
yes	103 (41.2)	134 (53.6)	65 (26.0)	111 (44.4)	413 (41.3)
never	147 (58.8)	116 (46.4)	185 (74.0)	139 (55.6)	587 (58.7)
others					
yes	54 (21.6)	32 (12.8)	95 (38.0)	33 (13.2)	214 (21.4)
never	196 (78.4)	218 (87.2)	155 (62.0)	217 (86.8)	786 (78.6)

APPENDIX B : Questionnaire

แบบสอบถาม

เรื่อง ความชุกของความผิดปกติทางการได้ยินและการดูแลสุขภาพหู ของผู้ต้องขังในเรือนจำ 4 แห่ง ในเขตกรุงเทพมหานคร

<u>ตอนที่ 1</u> ข้อมูลส่วนตัว เฉพาะเจ้าหน้าที่วิเคราะห์

1. แดน_____ ☐☐

2. เพศ ❑ ชาย ❑ หญิง ☐

3. อายุ (นับเต็ม).....ปี.....เดือน ☐☐

   วัน เดือน ปี เกิด..... ☐☐☐

4. การศึกษาสูงสุด ☐

   1. ไม่ได้เรียน 2. ประถมศึกษา
   3. มัธยมศึกษา 4. อาชีวศึกษาหรือเทียบเท่า
   5. ปริญญาตรีหรือเทียบเท่า 6. สูงกว่าปริญญาตรี
   7. อื่นๆ (ระบุ).....

5. อาชีพก่อนต้องโทษ

   1. รับราชการ 2. รัฐวิสาหกิจ
   3. เอกชน 4. รับจ้าง
   7. อื่นๆ (ระบุ).....

6. ภูมิลำเนาเดิม

   ❑ กรุงเทพฯ

   ❑ ต่างจังหวัด ระบุ_____

7. จังหวัดที่อยู่ปัจจุบันก่อนต้องโทษ_____

8. ลักษณะความผิด
   1. ประทุษร้ายต่อทรัพย์ เช่น ปล้นทรัพย์, ชิงทรัพย์, วิ่งราวทรัพย์ รับของโจร ฯลฯ
   2. พ.ร.บ. ยาเสพติด/สารระเหย เช่น โคเคน, เฮโรอีน, ฝิ่น ฯลฯ
   3. ประทุษร้ายต่อชีวิต เช่น ฆ่า, พยายามฆ่า
   4. ประทุษร้ายต่อร่างกาย เช่น ทำร้ายร่างกาย
   5. ประทุษร้ายต่อเพศ เช่น ข่มขืน
   6. ภยันตรายต่อประชาชน
   7. อื่นๆ (รวมหลายประเภท เช่น พ.ร.บ.ป่าไม้/การพนัน/อาวุธปืน/บุกรุก ฯลฯ

9. กำหนดโทษ.....ปี.....เดือน ☐☐
   ต้องโทษครั้งที่..... ☐
   ระยะเวลาอยู่ในเรือนจำ.....ปี.....เดือน ☐☐

ตอนที่ 2 ข้อมูลประวัติการเจ็บป่วย

1. เคยมีอาการปวดหูหรือไม่? ☐
   ❑ เคย ❑ หูซ้าย ❑ หูขวา ❑ หูทั้งสองหู
   ❑ ไม่เคย
2. เคยมีเสียงรบกวนในหูบ้างหรือไม่? ☐
   ❑ เคย ❑ หูซ้าย ❑ หูขวา ❑ หูทั้งสองหู
   ❑ ไม่เคย
3. ถ้าเคยเสียงรบกวนนี้เกิดขึ้นเป็นมานานเท่าไร?_____ปี_____เดือน ☐☐
4. เคยมีของเหลวหรือหนองไหลจากหูหรือไม่? ☐
   ❑ เคย ❑ หูซ้าย ❑ หูขวา ❑ หูทั้งสองหู
   ❑ ไม่เคย
   ขณะนี้ยังมีน้ำไหลทางหูหรือไม่? ☐
   ❑ เคย ❑ หูซ้าย ❑ หูขวา ❑ หูทั้งสองหู
   ❑ ไม่เคย

5. ท่านเคยมีอาการเวียนศีรษะด้วยหรือไม่?

❑ เคย ❑ ไม่เคย ❑ นานๆ ครั้ง

ลักษณะอาการเวียนศีรษะเป็นแบบ ❑ บ้านหมุน ❑ มึนงง ❑ โคลงเคลง,เดินเซ ❑ อื่นๆ (ระบุ)

มีอาการอาเจียนร่วมด้วยหรือไม่? ❑ มี ❑ ไม่มี

6. ถ้ามีอาการทางหูมีอาการปวดศีรษะร่วมด้วยหรือไม่?

❑ มี ❑ ไม่มี

7. ท่านเคยเป็นโรคหรือมีประวัติต่อไปนี้หรือไม่?

1.	คางทูม	❑ เคย	❑ ไม่เคย	❑ ไม่ทราบ
2.	เป็นฝีที่หลังกกหู	❑ เคย	❑ ไม่เคย	❑ ไม่ทราบ
3.	ใช้ยากินหรือยาฉีดมากจนหูตึง	❑ เคย	❑ ไม่เคย	❑ ไม่ทราบ
4.	วัณโรค	❑ เคย	❑ ไม่เคย	❑ ไม่ทราบ
5.	เบาหวาน	❑ เคย	❑ ไม่เคย	❑ ไม่ทราบ
6.	เยื่อหุ้มสมองอักเสบ	❑ เคย	❑ ไม่เคย	❑ ไม่ทราบ
7.	อีสุกอีใส	❑ เคย	❑ ไม่เคย	❑ ไม่ทราบ
8.	คอเจ็บเป็นหวัดบ่อยๆ	❑ เคย	❑ ไม่เคย	❑ ไม่ทราบ
9.	แพ้อากาศฝุ่นละอองไซนัส	❑ เคย	❑ ไม่เคย	❑ ไม่ทราบ
10.	อุบัติเหตุที่หู หรือศีรษะ	❑ เคย	❑ ไม่เคย	❑ ไม่ทราบ
11.	อื่นๆ (ระบุ)_____			

<u>ตอนที่ 3</u> ข้อมูลประวัติการรับฟังเสียง

1. การรับฟังเสียงในปัจจุบันนี้

❑ ปกติ ❑ ผิดปกติ ❑ ไม่แน่ใจ

ถ้าผิดปกติจะมีความผิดปกติของหูข้างขวามาเป็นเวลานานเท่าไร?

_____ปี _____เดือน

ถ้าผิดปกติจะมีความผิดปกติของหูข้างซ้ายมาเป็นเวลานานเท่าไร?

_____ปี _____เดือน

ถ้าผิดปกติจะมีความผิดปกติของหูทั้งสองข้างมาเป็นเวลานานเท่าไร?

_____ปี _____เดือน

2. ในครอบครัวของท่านมีญาติพี่น้องที่หูเสียแต่กำเนิดหรือไม่? ☐

❑ มี ❑ ไม่มี ❑ ไม่ทราบ

3. ท่านเคยได้ยินเสียงระเบิดหรือเสียงดังมากๆ จนหูอื้อบ้างหรือไม่? ☐

❑ เคย ❑ ไม่เคย

สาเหตุที่ทำให้เกิดเสียงหูอื้อ ☐

❑ ระเบิด ❑ ปืน

❑ ปะทัด ❑ อื่นๆ (ระบุ)_____

การปฏิบัติตัว

1. ท่านแคะหูบ่อยเพียงใด?

❑ แคะทุกครั้งเมื่อมีอาการคัน ❑ แคะทุกครั้งหลังอาบน้ำ

❑ สัปดาห์ละ 1 ครั้ง ❑ ไม่เคยแคะเลย

❑ อื่นๆ (ระบุ) _____

2. ถ้ามีสิ่งแปลกปลอมเข้าหูท่านจะทำอย่างไร ☐

❑ รีบอาไม้แคะหูแคะออกทันที ❑ เอาน้ำหยดใส่หูข้างนั้นแล้วเอียงน้ำออก

❑ แคะที่หูข้างนั้นเบาๆ ❑ ไปพบแพทย์ทันที

❑ อื่นๆ (ระบุ) _____

3. ท่านจะปฏิบัติตัวอย่างไรจึงจะดีที่สุดถ้าต้องเข้าไปในสถานที่ที่มีเสียงดัง ☐

❑ เอาสำลีปิดหูทั้ง 2 ข้าง ❑ เอามือปิดหูทั้ง 2 ข้าง

❑ ใส่เครื่องป้องกันเสียง ❑ ไม่ทำอะไรเลย

❑ อื่นๆ (ระบุ) _____

4. ถ้ามีแมลงเข้าหู ท่านควรจะปฏิบัติอย่างไรจึงจะดีที่สุด ☐

❑ ใช้น้ำมันพืช, น้ำ, น้ำมันมะกอกหยอดหู ❑ ไปพบแพทย์ให้แพทย์คีบออกให้

❑ ให้เพื่อนหรือช่างตัดผมแคะให้ ❑ ปล่อยทิ้งไว้ให้แมลงออกเอง

❑ อื่นๆ (ระบุ) _____

5. ท่านดูแลหูของท่านอย่างไร? ☐

❑ เช็ดหูของท่านด้วยผ้าสะอาดทุกครั้งหลังอาบน้ำ

❑ เช็ดหูของท่านด้วยไม้พันสำลีทุกครั้งหลังอาบน้ำ

❑ ใช้ไฮโดรเจนล้างหู

❑ ให้ช่างตัดผมแคะหูทุกครั้งเมื่อไปตัดผม

❑ อื่นๆ (ระบุ) _____

APPENDIX C : Instrumentations

Figure 9 FONIX FA – 12 Digital Audiometer (Mod C 196.001)

Figure 10 AUDIOCUPS (AMPLIVOX TDH-39P)

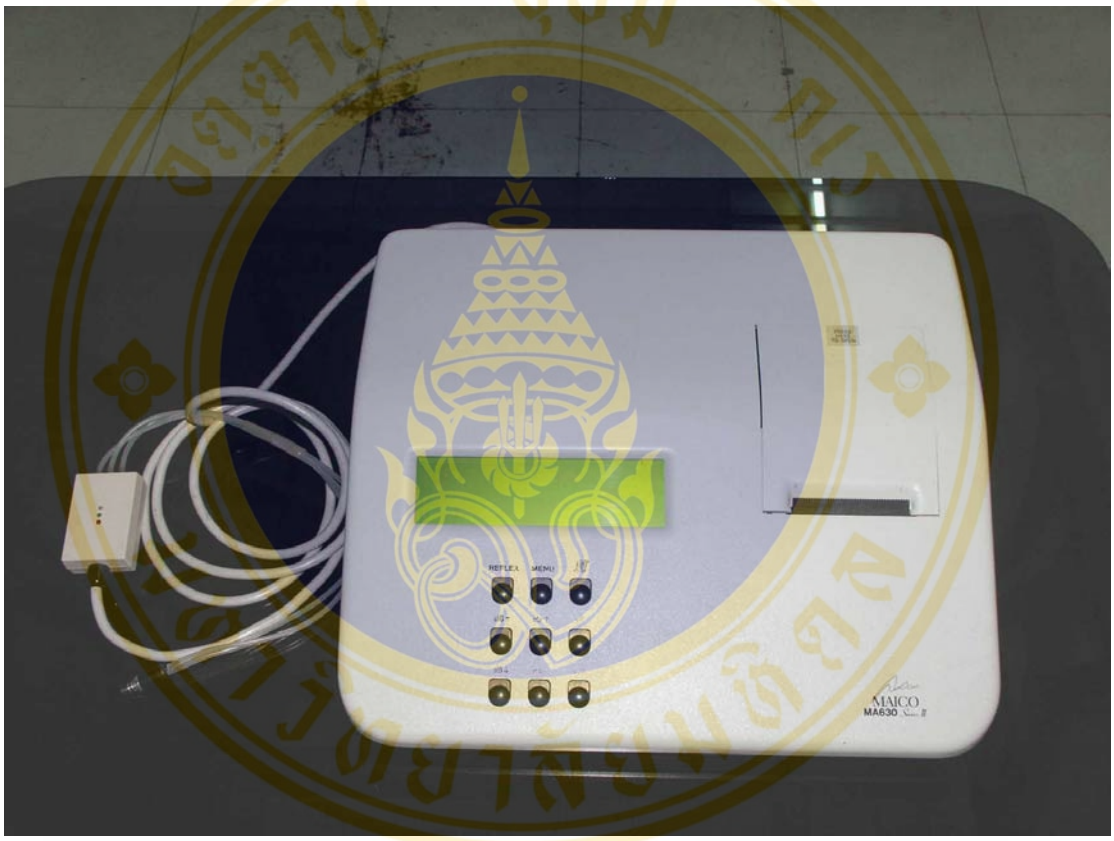

Figure 11 Acoustic Immittance Instrument (MAICO MA 630 *Series* II)

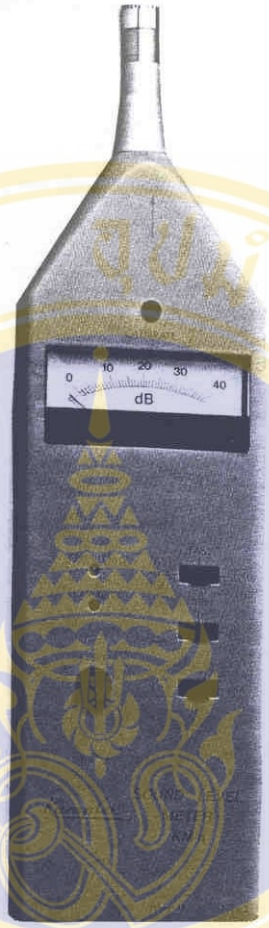

Figure 12 Sound Level Meter (Kamplex KM4)

BIOGRAPHY

NAME	Miss Suwaree Punlerudthai
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