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EFFECTIVENESS OF HEARING PROTECTION INTERVENTION ON USE OF HEARING PROTECTION DEVICES AMONG SELECTED MANUFACTURING WORKERS IN SELANGOR, MALAYSIA

SAM WEI YENG

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By

SAM WEI YENG

Thesis submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Doctor of Philosophy

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EFFECTIVENESS OF HEARING PROTECTION INTERVENTION ON USE OF HEARING PROTECTION DEVICES AMONG SELECTED MANUFACTURING WORKERS IN SELANGOR, MALAYSIA

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January 2017

Chair : Anita Abd Rahman, M.D, M. Comm Hlth
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Introduction: Industrial noise cause hearing loss (HL) and hearing impairment (HI) among workers. HL occurs when air conduction hearing threshold levels at different frequencies are ≥25dB. HI refers to ≥25dB shift for average hearing threshold level at 0.5-3k Hz compare to standard audiometric reference level.

Objective: Primary aim was to ascertain the effectiveness of hearing protection intervention to increase hearing protection devices use (HPDs) among selected manufacturing workers in Selangor.

Methodology: A Solomon four-group study was conducted among 420 workers of 9 manufacturing companies in Selangor using multistage sampling method. Respondents were randomly assigned into 4 groups: pretested and non-pretested intervention or control groups. A total of 37 respondents (8.8%) were lost to follow-up. Intervention included preliminary walkthrough survey, noise monitoring, audiometric testing, intervention program with training video and manual specially designed for manufacturing settings and HPDs use demonstration. Main outcomes measured were hearing status, intention to use HPDs, predictors of HPDs use (perceived self-efficacy, outcome value, perceived barriers, perceived benefit, availability of HPDs, interpersonal influence, work climate and perceived stress), HPDs use in the workplace (HPDs $_{\text{workplace}}$ use) and during high noise exposure (HPDs $_{\text{high noise}}$ use). Questionnaires were adopted from selected scale of use of hearing protection questionnaires and were in English and Malay version. Data were collected at baseline and 3 months after intervention. Data analysis included multiple linear regressions (MLR) with adjustment on personal factors and series of analysis designated for Solomon four-group using Statistical Package for the Social Sciences (SPSS).

Results: Prevalence for HL and HI was 73.3% and 23.3% respectively. More than 40% respondents suffered hearing problems at higher frequencies (4k and 6k Hz). HPDs use was correlated with perceived self-efficacy, interpersonal influence, perceived benefit, work climate, perceived barriers (p<.05). Age, gender, monthly income, education level, environmental noise exposure at home, work position, shift work, smoking status, sleep problem were related with hearing protection behaviour (p<.05), and were adjusted during MLR. Individually, MLR showed strongest predictors of HPDs $_{workplace}$ use was work climate, followed by interpersonal influence, perceived benefits, perceived self-efficacy, availability of HPDs and perceived barriers. Final model as a whole illustrated that significant predictors were perceived benefit and work climate. Perceived barriers and perceived benefits were significant predictors for HPDs $_{high\ noise}$ use, whereas for model as a whole, perceived barriers was the only significant predictor. Baseline mean HPDs $_{workplace}$ use was 38.1±31.8%, while baseline HPDs $_{high\ noise}$ use was 39.2±31.0%. Unexpectedly, 11.2% of respondents did not use HPDs at all. Based on short term outcome, intervention is effective in increasing HPDs $_{workplace}$ use and HPDs $_{high\ noise}$ use by 16.6% and 13.4% respectively. For immediate effect, score for intention to use HPDs before (70.0%) and after intervention (90.0%) were significantly different (p<.001). Intervention improved scores of perceived self-efficacy (3.4%), outcome value (4.4%), perceived barriers (-4.6%), perceived benefit (4.4%), interpersonal influence (4.2%) and work climate (3.3%).

Conclusion: Hearing protection intervention developed served as an effective tool in increasing HPDs use among manufacturing workers for immediate and short term outcome through improving scores of predictors.

Keywords: Hearing protection, intervention, hearing protection devices use, manufacturing, Solomon four-group

ABSTRAK

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

KEBERKESANAN INTERVENSI PERLINDUNGANPENDENGARAN UNTUK MENINGKATKAN PENGGUNAAN ALAT PERLINDUNGAN PENDENGARAN DI KALANGAN PEKERJA-PEKERJA INDUSTRI PEMBUATAN TERPILIH DI SELANGOR, MALAYSIA

Oleh

SAM WEI YENG

Januari 2017

Pengerusi: Anita Abd Rahman, M.D, M. Comm Hlth
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Pengenalan: Bunyi bising industri menyebabkan pekerja-pekerja menghidap penyakit kehilangan pendengaran (HP) dan kecacatan pendengaran (CP). HP berlaku apabila tahap ambang pendengaran konduksi udara frekuensi-frekuensi adalah ≥25dB. CP adalah peralihan ≥25dB pada purata tahap ambang pendengaran di 0.5-3k Hz berbanding dengan tahap piawai rujukan audiometrik.

Objektif: Kajian bertujuaan menentukan keberkesanan intervensi perlindungan pendengaran untuk meningkatkan penggunaan alat perlindungan pendengaran (APP) pekerja-pekerja industri pembuatan terpilih di Selangor.

Methodologi: Satu kajian Solomon Empat Kumpulan dijalankan di kalangan 420 pekerja dari 9 syarikat pembuatan di Selangor dengan kaedah pensampelan pelbagai tahap. Sebanyak 37 responden (8.8%) digugurkan kerana tidak berjaya mengikut susulan. Responden diagihkan secara rawak kepada 4 kumpulan: kumpulan intervensi atau kawalan yang diprauji atau tidak diprauji. Intervensi kajian termasuk pemantauan peringkat awal dan bunyi bising, ujian audiometrik, program intervensi dengan latihan video dan manual yang direka khas untuk industri pembuatan, dan demonstrasi cara penggunaan APP. Responden terlibat secara langsung dalam perfileman video sebagai pelakon. Hasil kajian utama yang diukur termasuk status pendengaran, niat untuk menggunakan APP dan peramal penggunaan APP (tanggapan kecekapan diri, nilai hasil, tanggapan faedah, tanggapan halangan, ketersediaan APP, pengaruh interpersonal, iklim kerja, tangaapan tekanan), penggunaan APP di tempat kerja ($APP_{tempat\ kerja}$) dan semasa pendedahan bunyi bising ($APP_{bunyi\ bising}$). Soal selidik diterima pakai daripada soal selidik penggunaan perlindungan pendengaran dengan versi bahasa Inggeris dan Melayu. Data dikumpulkan pada pra-intervensi dan pasca-intervensi, iaitu 3 bulan selepas program intervensi. Data dianalisa dengan regresi

linear pelbagai (RLP) dengan pelarasan kepada faktor-faktor individu dan siri analisa Solomon Empat kumpulan dengan menggunakan Pakej Statistik untuk Sains Sosial (SPSS).

Keputusan: Prevalens HP adalah 73.3% dan prevalens CP adalah 23.3%. Lebih daripada 40% responden mengalami masalah pendengaran pada frekuensi tinggi (4k dan 6k Hz). Penggunaan APP berkolerasi dengan tanggapan kecekapan diri, pengaruh interpersonal, tanggapan faedah, iklim kerja dan tanggapan halangan (p<.05). Umur, jantina, pendapatan bulanan, tahap pendidikan, pendedahan kepada bunyi persekitaran di rumah, jawatan, kerja syif, tabiat merokok, masalah tidur adalah berkaitan dengan tingkah laku penggunaan APP (p<.05), dan telah diselaraskan untuk RLP. RLP secara individu menunjukkan peramal berpengaruh terkuat kepada penggunaan $APP_{tempat\ kerja}$ adalah iklim kerja, diikuti oleh pengaruh interpersonal, tanggapan faedah, tanggapan kecekapan diri, ketersediaan APP dan tanggapan halangan. Untuk model secara keseluruhan, peramal yang signifikan termasuk tanggapan faedah dan iklim kerja. Tanggapan halangan dan tanggapan faedah adalah peramal yang signifikan bagi $APP_{bunyi\ bising}$ secara individu, manakala bagi model secara keseluruhan, tanggapan halangan adalah satu-satunya peramal yang signifikan. Purata penggunaan $APP_{tempat\ kerja}$ adalah 38.1±31.8%, manakala purata penggunaan $APP_{bunyi\ bising}$ adalah 39.2±31.0%. Sebanyak 11.2% responden tidak menggunakan APP sama sekali. Berdasarkan keputusan jangka pendek, intervensi dibukti efektif dalam meningkatkan penggunaan $APP_{bunyi\ bising}$ dan $APP_{tempat\ kerja}$ sebanyak 16.6% dan 13.4%. Kesan segera intervensi adalah signifikan memandangkan perbezaan antara niat untuk menggunakan APP sebelum (70.0%) dan selepas intervensi (90.0%) adalah signifikan (p<.001). Intervensi menambah baik purata skor tanggapan kecekapan diri (3.4%), nilai hasil (4.4%), tanggapan halangan (-4.6%), tanggapan faedah (4.4%), pengaruh interpersonal (4.2%) dan iklim kerja (3.3%).

Kesimpulan: Intervensi perlindungan pendengaran adalah efektif dalam meningkatkan penggunaan APP pekerja-pekerja industri pembuatan untuk jangka pendek dan segera melalui peningkatan skor peramal.

Kata kunci: Perlindungan pendengaran, intervensi, penggunaan alat pelindungan pendengaran, industri pembuatan, Solomon Empat Kumpulan

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I certify that a Thesis Examination Committee has met on 11th January 2017 to conduct the final examination of SAM WEI YENG on her thesis entitled "The Effectiveness of Hearing Protection Intervention to Increase Use of Hearing Protection Devices among Selected Manufacturing Workers in Selangor" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the (Doctor of Philosophy of Occupational Health and Safety).

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LIST OF ABBREVIATIONS

ANCOVA	Analysis of covariance
ANOVA	Analysis of variance
BAS/BES	Barrier/Benefit scale
BL	Baseline training
BLS	Bureau of Labor Statistics
BMI	Body mass index
CEE	Central and Eastern Europe
CONSORT	Consolidated Standards of Reporting Trials
DALYs	Disability-adjusted Life Years
DND	Daily noise dose
DOSH	Department of Occupational Safety and Health
DOSH	Department of Occupational Safety and Health
FDI	Foreign direct investment
HBM	Health Belief Model
HCP	Hearing Conservation Program
HCP	Hearing conservation programme
HI	Hearing Impairment
HL	Hearing Loss
HLPP	Hearing loss prevention programme
HPDs	Hearing protection devices
$HPDs_{high\ noise}$ use	Hearing Protection Devices Use during high noise exposure
$HPDs_{intention}$	Intention to use HPDs
$HPDs_{workplace}$ use	Hearing Protection Devices Use in the workplace
HPM	Health Promotion Model
HTLs	Hearing threshold levels
LOCF	Last observation carried forward
MDCIS	Michigan Department of Consumer and Industry Services
MIDA	Malaysian Investment Development Authority
MIOSHA	Michigan Occupational Safety and Health Administration
MLR	Multiple Linear Regression
NAICS	North American Industry Classification System
NHIS	National Health Interview Survey
NIHL	Noise-induced hearing loss
NIOSH	National Institute of Occupational Safety and Health
NIS	Newly Independent States
NLI	Noise level indicator
NSDC	National SME Development Council
OD	Occupational disease
OSH	Occupational safety and health
OSHA	Occupational Safety and Health Administration
OSHA	Occupational Safety and Health Act
OSH-MP 15	Occupational Safety and Health Master Plan for Malaysia 2015
OSH-MP 15	Occupational Safety and Health Master Plan for Malaysia 2015
PTA	Pure Tone Audiometry
PTS	Permanent threshold shift
RCT	Randomized controlled trials
SCT	Social Cognitive Theory
SD	Standard deviation
SEE	South-East Europe

SLM	Sound level meter
SMEs	Small and medium size enterprises
SOCSO	Social Security Organisation
STS	Standard threshold shift
TPB	Theory of Planned Behaviour
TTS	Temporary threshold shift
TWA	Time-weighted average
WHO	World Health Organization

CHAPTER 1

INTRODUCTION

1.1 Background

Advancement of technology in industry leads to a world of fast production in manufacturing sectors. Noise, a by-product of such advancement in industrial settings brings adverse health effect and contributes to the development of noise-induced hearing loss (NIHL) in people around the world (Basu, 2010). Effects of loud noise exposure are cumulative (Quaranta, Portalatini, & Henderson, 1998) and NIHL in workplace is undoubtedly extreme prevalent in industrial countries worldwide (Reddy, Welch, Thorne, & Ameratunga, 2012), with no exception for Malaysia as manufacturing is the dominant sector in this country.

In fact, variety of industrial hazards arose due to development, but none of them so common and widespread like noise pollution (Maisarah, 1989). By 2030, World Health Organization (WHO) estimated hearing loss would reach top 10 causes of burden of disease in high and middle income countries, moving up at least 3 places from the original ranking in 2002 (Mathers & Loncar, 2006). According to WHO, the magnitude of hearing loss for affected population worldwide was only 120 million in 1995 (El Dib, Mathew, & Martins, 2012), and slowly increased to more than 250 million people in 2000. The latest statistics showed that the magnitude of hearing loss increased to affected population of 360 million people in 2012. Highest prevalence of adult's hearing loss was reported from Asia Pacific, Sub-Saharan Africa and South Asia (WHO, 2015). WHO claimed that half of all hearing loss cases were actually avoidable with primary prevention. An estimation of annual incidence of worldwide NIHL cases was 1,628,000 new cases per year (Leigh, Macaskill, Kuosma, & Mandryk, 1999), which would be roughly 25 per 100,000 per year for world's population (El Dib et al., 2012).

Law and regulations were made to control occupational noise around the world. Occupational Safety and Health Administration (OSHA) in United States, Directive 2003/10/EC for noise in European Union and The Control of Noise at Work Regulations 2005 of Great Britain were among the few examples. In Malaysia, Factories and Machinery (Noise Exposure) Regulation 1989 refer hearing loss as hearing problem experienced by an individual where air conduction hearing threshold levels at different frequencies are 25dB and above. On the other hand, hearing impairment refers to a shift of 25dB and above for average hearing threshold level at 0.5-3k Hz compare to standard audiometric reference level. Professionals and authorities intended to control the severity of NIHL through implementation of Hearing Conservation Program (HCP). HCP is a series of organized measures mandatory for workplace with excessive noise exposure with the aim to tackle NIHL problems (Fonseca et al., 2016). However, global prevalence of NIHL and compliance to HCP were still at an unsatisfactory state (Martinez, 2012; Rosenman & Kalinowski, 2009;

Nelson, Nelson, Concha-barrientos, & Fingerhut, 2005; Reilly, Rosenman, & Kalinowski, 1998). Till now, occupational NIHL remains an urgent topic in safety, health and well-being of workers for employers in balancing hearing loss with prevention costs, as well as among policymakers in balancing burden of regulatory aspects (Martinez, 2012). Although the compliance with HCP was not up to expectations, most of the companies do provide free hearing protection devices (HPDs) to all the workers and it was one of the most complied elements of HCP among employers, of which up to 90% (Rosenman & Kalinowski, 2009, Nor Saleha & Noor Hassim, 2006). In view of this, much interventions targeted on improving hearing protection devices (HPDS) use were carried out by researchers in the recent years but theoretical interventions with powerful study design were still lacking (El Dib et al., 2012; Goldenhar & Schulte, 1994), particularly investigation on the actual percentage of time a worker use hearing protection.

1.2 Problem Statement

In Malaysia, Factories and Machinery (Noise Exposure) Regulation 1989 was in force since 27 years ago, demanded all workers exposed to noise level above action level of 85dB and above to be protected. An 85dB noise level refer to 85dB(A), which is A-weighted decibels that express the relative loudness of sounds in air as perceived by the human ear. Although employers were required to comply with HCP in workplace with loud noise exposure, the compliance level of such HCP in Malaysia were only 41.3% among the manufacturing, mining and quarrying workers (Nor Saleha & Noor Hassim, 2006).

Investigation on reported occupational disease (OD) and poisoning cases by Department of Occupational Safety and Health (DOSH) Malaysia revealed that the number of OD cases were increasing year by year. In 2015, there were 5960 cases reported and surprisingly 83.5% of the investigated cases were NIHL. The occupational diseases and poisoning cases increased twofold compared to 2648 cases reported in 2014, and increased fourfold compared to 1426 cases in 2010 (Department of Occupational Safety and Health, 2016). Selangor (46.5%), Johor (10.5%) and Penang (9%) have reported most number of occupational disease (OD) and poisoning cases for the year 2010 of a total of 1426 cases, with 70.4% of the cases investigated by DOSH in 2010 were NIHL cases. NIHL had always been the leading OD reported, it was long marked as the most severely widespread OD in workplace with loud noise exposure. In addition, Selangor recorded the highest number of registered Small and Medium Enterprises (SMEs) in Malaysia service, with the highest number of manufacturing industries of SMEs is located in Selangor (SME Corp Malaysia, 2012) as shown in Table 1.1.

Table 1.1: Distribution of SMEs by Industries and States

State	Services	Manufacturing	Agriculture	Mining & Quarrying	Construction	Total SMEs
Selangor	110,714	**8,314**	834	23	6,019	125,904
K. Lumpur	78,448	4,201	5	2	2,023	84,679
Johor	60,618	4,828	994	27	2,407	68,874
Perak	53,322	3,833	962	84	1,827	60,028
Sarawak	40,608	1,977	322	19	904	43,830
Sabah	37,612	1,382	812	24	1,054	40,884
P. Pinang	36,899	2,614	269	7	1,035	40,824
Kelantan	35,372	1,814	326	30	281	37,823
Kedah	33,123	2,809	603	17	540	37,092
Pahang	26,815	1,305	630	13	699	29,462
N. Sembilan	21,633	1,495	435	11	968	24,542
Terengganu	19,882	1,782	196	37	617	22,514
Melaka	19,694	1,107	252	4	618	21,675
Perlis	4,484	291	63	1	214	5,053
Labuan	1,761	109	5	0	77	1,952
Total SMEs	580,985	37,861	6,708	299	19,283	645,136

(Source: SME Corp Malaysia, 2012)

The Malaysian Employment Injury Scheme of Social Security Organisation (SOCSO) provides protection to the employees against occupational diseases such as NIHL. Reported OD cases in SOCSO annual reports indicated that there was an increasing trend in the number of OD cases. In 2012 revealed that 2109 OD cases were reported, and it increased by 37.22% compared to 2011 (1537 cases) and 42.39% compared to 2010 (1215 cases). In fact, there were only 949 OD cases reported in 2009. In general, 40.30% cases in 2012, 40.86% cases in 2011 and 76.60% cases in 2010 were OD cases caused by physical agents such as noise.

In 2014, NIHL was the second highest occupational diseases (358 cases) recorded (Figure 1.1). Compensations to the victims through The Employment Injury Scheme of SOCSO due to NIHL were RM255,207 in 2012 and RM299,457 in 2011. With the increase in NIHL cases each year, it will be soon that medical costs and compensation burden of SOCSO increase tremendously. NIHL had increased more than 100% in Malaysia from 1995- 2014 (Figure 1.2). It increased by 5.5 times in 2014 as compared to 1995.

Hence, there is an increasing need for the employers and government to reduce hearing loss among workers, especially to protect the hearing of younger generation among Malaysian workers by educating the importance of hearing protection.

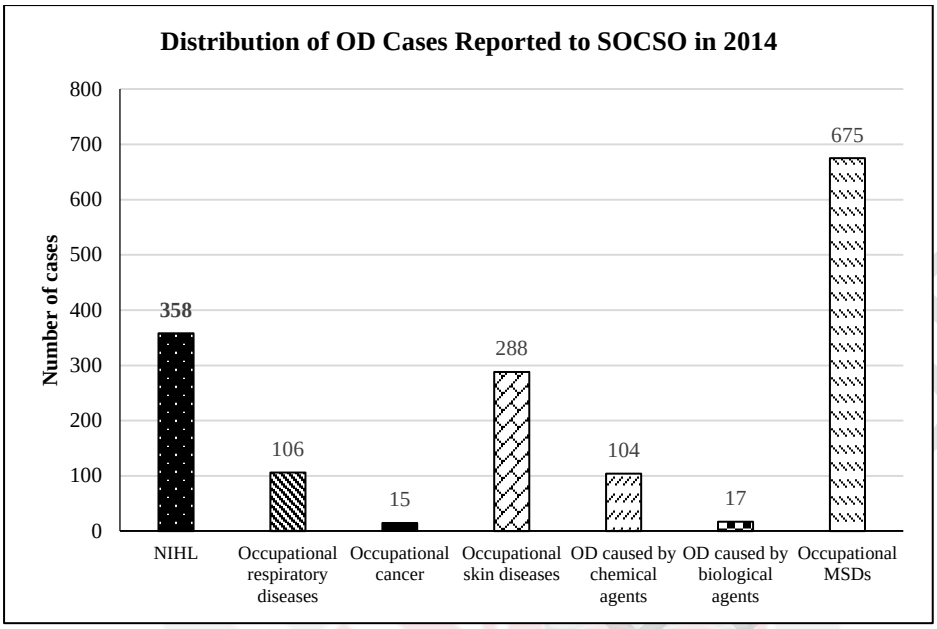

Figure 1.1 SOCSO Statistics of OD Cases in 2014

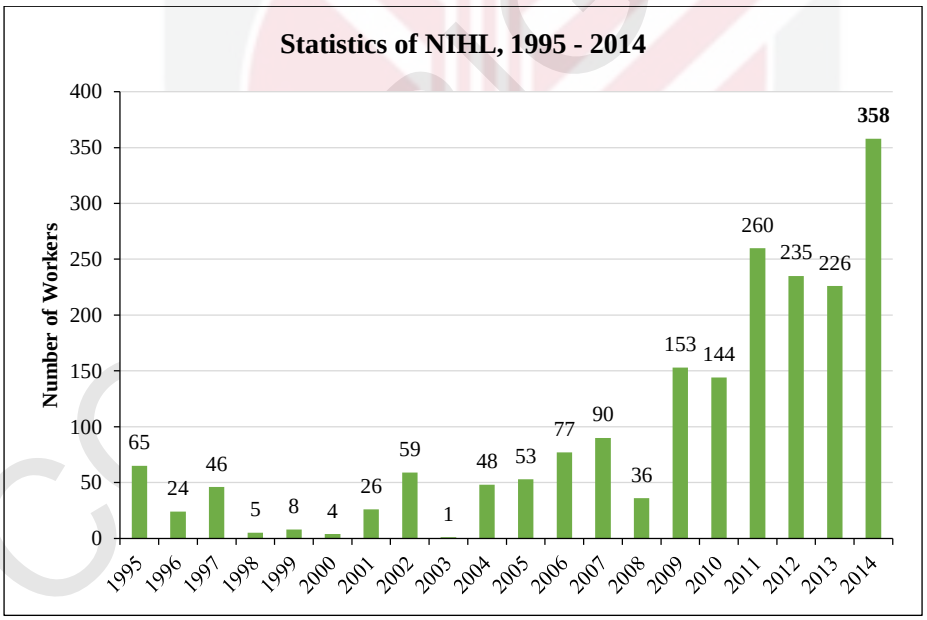

Figure 1.2. SOCSO Statistics of NIHL Cases from 1995 to 2014
(Source: SOCSO, 2014)

1.3 Significance of Study

Generally, manufacturing industry consists of establishments involved in the mechanical, physical, or chemical transformation of substances, components or materials into new products (Bureau of Labor Statistics, 2016). Malaysia is part of the world's manufacturer in Asia, with 2,096,197 man power in manufacturing industry for 2014 according to Department of Statistics, Malaysia. Manufacturing industry is a major sector in the foreign direct investment (FDI) (Tahir, Aljunid, Hashim, & Begum, 2014) and contributed approximately 28% of Malaysia Gross Domestic Product in 2013. The development created additional occupational safety and health issues especially additional noise sources. Manufacturing sector was reported to have the highest OD and poisoning cases in 2015 (DOSH, 2015).

NIHL is undoubtedly a major burden among Malaysian manufacturing workers. The risk of NIHL and incidence per 100,000 manufacturing workers projected is 8%, with the highest risk and incidence in motor vehicle parts industry (32%), followed by tobacco industry (23%) and fabricated metal industry (23%), with an estimation of 103,000 workers were potentially affected by NIHL in Malaysia (Tahir et al., 2014). Noise potentially affects a large portion of manufacturing workers, however data on prevalence of NIHL were not well captured especially in the small and medium size enterprises (SMEs) in Malaysia. There were small number of occupational diseases (Figure 1.1) compared to occupational accidents reported and few of the reasons could be underreporting from the industry, possibly due to failure to recognized the occupational related medical diagnoses, non-reporting of OD to government agencies and failure to discover OD in SMEs (Hashim, Amin, & Khalid, 2005). Although SOCSO reported 358 hearing loss cases in the latest 2014 annual report, DOSH on the other hand received 5,366 cases of NIHL in 2015.

Noise is pervasive in daily routines with auditory and non-auditory health effects (Basner et al., 2014). It is an irreversible impairment with significant monetary and personal costs. In addition to monetary costs, loss of hearing negatively affects quality of life and personal safety including those who relate with him or her (Hong, Ronis, Lusk, & Kee, 2006). Nevertheless, NIHL can be eliminated because it can be traced to a single causative agent-noise (Daniell et al., 2002), and it can be prevented by consistent use of hearing protection equipment (El Dib & Mathew, 2009; Brady & Hong, 2006; Lusk et al., 1999). In Malaysia, 92.8% of the employers preferred provision of hearing protection devices (HPDs) to protect the hearing of the industrial workers (Nor Saleha & Noor Hassim, 2006), therefore combination of effective HCP based on encouragement of HPDs use and a behavioural change in the workers could possibly reduce the risk of NIHL among manufacturing workers.

There is a need to develop an effective intervention to reduce NIHL. Although there are a broad range of interventions available for NIHL prevention which makes it hard to select the most effective strategy, intervention guided by a theoretical framework has the best potential to create a successful training program with desired effect and would have catered for all the need of a behavioural intervention program (Fishbein & Yzer, 2003; Lusk et al., 2003). Given that engineering controls are cost prohibitive for many

organizations and that hearing protection policies are often ineffective, workers must be educated about the hazards associated with exposures to high noise and the importance of protecting their hearing by using HPDs when exposed to loud noise.

With all these factors in mind, this study aimed to increase HPDs use with theory based intervention program of powerful study design. Behavioural change among workers is a proactive approach to occupational safety and health issues. The motive of conducting a theory-based intervention is in line with Occupational Safety and Health Master Plan for Malaysia 2015 (OSH-MP 15). The main aim of the OSH-MP 15 is to build a safe, healthy and productive pool of human capital by creating, cultivating and sustaining a safe and healthy work culture. MP 15 targeted that by 2015, there would be a major change in attitude and behaviour among employers especially and make them develop a more positive and proactive approach to OSH.

Data collected could act as a baseline for actual percentage of time of hearing protection use among manufacturing workers in Malaysia. Furthermore, the intervention program for hearing protection use will help to create a preventive workplace culture among workers. In addition, it is valuable to explore work climate influence on worker's perception and behaviour, and whether a supportive environment could be contribute to the increase of HPDs use. To ensure the success of the intervention, it is utmost important to study on predictors of HPDs use.

1.4 Research Questions

A. What are the prevalence of hearing loss and hearing impairment among respondents?
B. What are the scores of predictors of HPDs use (perceived self-efficacy, outcome value, perceived barriers, perceived benefit, availability of HPDs, interpersonal influence, work climate and perceived stress) and HPDs use of the respondents?
C. Is there any difference in HPDs use and scores of predictors of HPDs use by socio-demographics of the respondents?
D. Are there any relationships between predictors of HPDs use and HPDs use of the respondents?
E. Is the developed intervention effective in improving HPDs use and scores of predictors among manufacturing workers in terms of immediate and short term effect?
F. Is there any effect of pretest on intervention (pretest sensitization) if self-reported data are used?
G. Can we predict the scores of predictors of HPDs use and HPDs use of the respondents with intervention and pretest?
H. Is there any difference in intention to use HPDs in the future before and after hearing protection intervention?

1.5 Objectives

1.5.1 General Objective

To develop, implement and evaluate the effectiveness of hearing protection intervention on use of hearing protection devices (HPDs) among selected manufacturing industry workers in Selangor

1.5.2 Specific Objectives

A. To determine the prevalence of hearing loss and hearing impairment among respondents in the intervention groups (pretested and non-pretested intervention groups)
B. To compare the prevalence of hearing loss and hearing impairment by socio-demographics of respondents in the intervention groups
C. To determine the scores of predictors of HPDs use (perceived self-efficacy, outcome value, perceived barriers, perceived benefit, availability of HPDs, interpersonal influence, work climate and perceived stress) and HPDs use of the respondents
D. To compare the HPDs use and scores of predictors of HPDs use by socio-demographics of the respondents at pretest level (pretested intervention group and pretested control group)
E. To determine the relationships between predictors and HPDs use of the respondents at pretest level (pretested intervention group and pretested control group)
F. To develop and implement a theory based hearing protection intervention inclusive of training manual and training video tailored to manufacturing settings to improve HPDs use among respondents in the intervention groups
G. To investigate the effect of pretest on intervention (pretest sensitization) by comparing the relative change in posttest mean HPDs use of intervention (pretested intervention group and non-pretested intervention group) and control (pretested control group and non-pretested control group) groups of Solomon Four-group design
H. To predict scores of predictors of HPDs use and HPDs use of the respondents with intervention and pretest
I. To compare the intention to use HPDs in the future of the respondents in the intervention groups (pretested and non-pretested intervention groups) before and 3 months after hearing protection intervention
J. To investigate the effectiveness of hearing protection intervention on HPDs use and scores of predictors by a series of analyses designated for Solomon Four-group design

1.6 Research Hypothesis

A. There are significant differences in the prevalence of hearing loss and hearing impairment by socio-demographics of respondents in the intervention groups
B. There are significant differences between HPDs use and scores of predictors of HPDs use by socio-demographics of the respondents at pretest level (pretested intervention group and pretested control group)
C. There are significant relationships between HPDs use and predictors of HPDs use of the respondents at pretest level (pretested intervention group and pretested control group)
D. There is no effect of pretest on intervention detected, intervention is effective in improving HPDs scores with or without pretest
E. Scores of predictors of HPDs use and HPDs use of the respondents can be predicted with intervention and pretest
F. Intention to use HPDs in the future of the respondents in the intervention groups (pretested and non-pretested intervention groups) after hearing protection intervention is higher than before hearing protection intervention
G. Theory based hearing protection intervention is effective in improving HPDs use and scores of predictors of the respondents in the intervention groups

1.7 Definition of Variables

1.7.1 Conceptual Definition

i. Hearing Protection Devices (HPDs) Use
Frequency of wearing HPDs such as earplugs or earmuffs in workplace

ii. Predictors of HPDs Use
Factors found to positively and negatively influence the wearing of HPDs and were used to predict the wearing of HPDs. Predictors in this study consisted of perceived self-efficacy, outcome value, perceived barriers, perceived benefit, availability of HPDs, interpersonal influence, work climate and perceived stress.

iii. Hearing Protection Intervention
Sets of preventive measures for noise induced hearing loss which are usually combined into hearing conservation programs that are created specially to promote hearing protective devices use such as earplugs or earmuffs (El Dib et al., 2007)

1.7.2 Operational Definition

i. Hearing Protection Devices (HPDs) Use
HPDs use were obtained by the measuring the percentage of time (0-100%) of self-reported HPDs use in the workplace during past week, past month and past 3 months (Lusk, Ronis & Baer, 1995)

ii. Predictors of HPDs Use

Predictors of HPDs use in this study were referred to selected components in the individual characteristics and experiences and behaviour specific cognitions and affect factors of Health Promotion Model (HPM) as well as interested factors which influencing HPDs use. Predictors in this study consisted of perceived self-efficacy, outcome value, perceived barriers, perceived benefit, availability of HPDs, interpersonal influence, work climate and perceived stress. Data on components of HPM were measured by Use of Hearing Protection Scale (Lusk et al., 1997; Lusk & Kelemen, 1993) and perceived stress was measured by Perceived Stress Scale (PSS-10) (Cohen & Williamson, 1988). Use of Hearing Protection Scale measured beliefs and attitudes toward HPDs and PSS-10 measured the degree of stressfulness as evaluated by an individual during the past month.

iii. Hearing Protection Intervention

Hearing protection intervention was designed based on HPM (Pender et al., 2006) and could be divided into four phases (Refer Section 3.7.1). The procedures of intervention took about 15 months for one company:

Phase 1: Pretest and preliminary walkthrough survey at the workplace
Phase 2: Audiometric test, video production and preparation of training module
Phase 3: Intervention program
Phase 4: Evaluation

REFERENCES

Aghilinejad, M., Bahrami-Ahmadi, A., Kabir-Mokamelkhah, E., Sarebanha, S., Hosseini, H. R., & Sadeghi, Z. (2014). The effect of three ergonomics training programs on the prevalence of low-back pain among workers of an Iranian automobile factory: A randomized clinical trial. *International Journal of Occupational and Environmental Medicine*, *5*(2), 65–71.

Arezes, P. M., & Miguel, A. S. (2002). Hearing protectors acceptability in noisy environments. *The Annals of Occupational Hygiene*, 46(6), 531–6. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/12176768

Basner, M., Babisch, W., Davis, A., Brink, M., Clark, C., Janssen, S., & Stansfeld, S. (2014). Auditory and non-auditory effects of noise on health. *The Lancet*, *383*(9925), 1325–1332. http://doi.org/10.1016/S0140-6736(13)61613-X

Basu, D. K. (2010). Noise pollution in India. *Journal of the Indian Medical Association*, *108*(3), 139. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/21043349

Becker, B. J. (1987). Applying tests of combined significance in meta-analysis. *Psychological Bulletin*, *102*(1), 164–171. http://doi.org/10.1037/0033-2909.102.1.164

Bergström, B., & Nyström, B. (2009). Development of Hearing Loss During Long-Term Exposure to Occupational Noise A 20-year Follow-up Study. *Scandinavian Audiology*, *15*(4), 227–234. http://doi.org/10.3109/01050398609042148

Brady, J., & Hong, O. S. (2006). Hearing Protection: Work climate and hearing protection behaviors in construction workers - ProQuest. *Professional Safety*, *51.11*, 18–26. Retrieved from http://search.proquest.com/openview/4137b9240ed9f4d499426d8bfe4a0594/1?pq-origsite=gscholar

Braunger, P., Frank, H., Korunka, C., Lueger, M., & Kubicek, B. (2013). Validating a safety climate model in metal processing industries: A replication study. *International Journal of Occupational Safety and Ergonomics*, *19*(1), 143–155. http://doi.org/10.1080/10803548.2013.11076973

Braver, M. C. W., & Braver, S. L. (1988). Statistical Treatment of the Solomon Four-Group Design : A Meta-Analytic Approach, *104*(1), 150–154.

British Society of Audiology. (2011). Pure-tone air-conduction and bone-conduction threshold audiometry with and without masking. Retrieved from http://www.thebsa.org.uk/wp-content/uploads/2014/04/BSA_RP_PTA_FINAL_24Sept11_MinorAmend06Feb12.pdf

Browning, G. G., Gatehouse, S., & Lowe, G. D. (1986). Blood viscosity as a factor in sensorineural hearing impairment. *Lancet (London, England)*, *1*(8473), 121–3. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/2867347

Bureau of Labor Statistics. (2016). Industries at a Glance, Manufacturing: NAICS 31-33. Retrieved September 2, 2016, from http://www.bls.gov/iag/tgs/iag31-33.htm

Campbell, D. T., & Stanley, J. C. (1963). Chapter 5: Experimental and Quasi-Experimental Designs for Research. In *Handbook of Research on Teaching* (p. 55). Houghton Mifflin Company. http://doi.org/10.1016/0306-4573(84)90053-0

Campo, P., Morata, T. C., & Hong, O. (2013). Chemical exposure and hearing loss. *Disease-a-Month : DM*, *59*(4), 119–38. http://doi.org/10.1016/j.disamonth.2013.01.003

Carruth, A., Robert, A.E., Hurley, A., & Currie, P.S. (2007). The impact of hearing impairment, perceptions and attitudes about hearing loss, and noise exposure risk patterns on hearing handicap among farm family members. *AAOHN Journal*, 55, 227–234.

Chen, J.-D., & Tsai, J.-Y. (2003). Hearing loss among workers at an oil refinery in Taiwan. *Archives of Environmental Health*, *58*(1), 55–8. http://doi.org/10.3200/AEOH.58.1.55-58

Chua, Y. P. (2014). *Buku 2: Asas Statistics Penyelidikan*. Malaysia: McGraw-Hill.

Cocks, K., & Torgerson, D. J. (2013). Sample size calculations for pilot randomized trials: A confidence interval approach. *Journal of Clinical Epidemiology*, *66*(2), 197–201. http://doi.org/10.1016/j.jclinepi.2012.09.002

Cohen, S., & Williamson, G. (1988). Perceived Stress in a Probability Sample of the United States. *The Social Psychology of Health, The Clarem*, 31–67. Retrieved from http://www.researchgate.net/publication/264859940_Perceived_Stress_in_a_Probability_Sample_of_the_United_States

Conlee, J. W., Abdul-Baqi, K. J., McCandless, G. A., & Creel, D. J. (1986). Differential susceptibility to noise-induced permanent threshold shift between albino and pigmented guinea pigs. *Hearing Research*, *23*(1), 81–91. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/3733554

Costa, S., & Arezes, P. (2014). The influence of shift work in the use of hearing protection devices. In *Safety, Reliability and Risk Analysis: Beyond the Horizon. European Safety and Reliability Conference, ESREL 2013* (pp. 453–457). Taylor & Francis. Retrieved from http://repositorium.sdum.uminho.pt/handle/1822/33687

Cruickshanks, K. J., Wiley, T. L., Tweed, T. S., Klein, B. E., Klein, R., Mares-Perlman, J. a, & Nondahl, D. M. (1998). Prevalence of hearing loss in older adults in Beaver Dam, Wisconsin. The Epidemiology of Hearing Loss Study. *American Journal of Epidemiology*, *148*(9), 879–886. http://doi.org/10.1093/oxfordjournals.aje.a009713

Da Costa, E., Castro, J., & Macedo, M. (2008). Iris pigmentation and susceptibility to noise-induced hearing loss. *International Journal of Audiology*, *47*(3), 115–8. http://doi.org/10.1080/14992020701704776

Daniell, W. E., Swan, S. S., McDaniel, M. M., Stebbins, J. G., Seixas, N. S., & Morgan, M. S. (2002). Noise exposure and hearing conservation practices in an industry with high incidence of workers' compensation claims for hearing loss. *American Journal of Industrial Medicine*, *42*(4), 309–17. http://doi.org/10.1002/ajim.10124

Davies, H., & Marion, S. (2008). The Impact of Hearing Conservation Programs on Incidence of Noise-Induced Hearing Loss in Canadian Workers, *931*, 923–931. http://doi.org/10.1002/ajim.20634.

Dobie, R. A. (1990). A method for allocation of hearing handicap. *Otolaryngology--Head and Neck Surgery : Official Journal of American Academy of Otolaryngology-Head and Neck Surgery*, *103*(5 (Pt 1)), 733–9. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/2148972

DOSH (2016). Occupational Diseases and Poisoning Investigation. Retrieved June 29, 2016, from http://www.dosh.gov.my/index.php/en/osh-info-2/occupational-health/392-occupational-diseases-and-poisoning-investigation

DOSH (2014) Occupational Diseases and Poisoning Investigation. Department of Occupational Safety and Health, Ministry of Human Resource Malaysia, Putrajaya. Accessed 3 March 2016. http://www.dosh.gov.my/index.php?option=com_content&view=article&id=392:occupational-diseases-and-poisoning-investigation&catid=349&Itemid=760&lang=en

Driessen, M. T., Proper, K. I., Anema, J. R., Knol, D. L., Bongers, P. M., & van der Beek, A. J. (2011). The effectiveness of participatory ergonomics to prevent low-back and neck pain - results of a cluster randomized controlled trial. *Scandinavian Journal of Work, Environment and Health*, *37*(October), 383–393. http://doi.org/10.5271/sjweh.3163

Dube, K. J., Ingale, L. T., & Ingale, S. T. (2011). Hearing impairment among workers exposed to excessive levels of noise in ginning industries. *Noise & Health*, *13*(54), 348–55. http://doi.org/10.4103/1463-1741.85506

Duthey, B. (2013). Priority Medicines for Europe and the World " A Public Health Approach to Innovation " *WHO Background paper*. *Hearing Loss*, 50.

Eakin, B. L., Brady, J., Lusk, S. L. (2001) Creating a tailored, multimedia computer-based intervention. *Computers in Nursing Journal 19(4)* 152-163.

Edelson, J., Neitzel, R., Meischke, H., Daniell, W., Sheppard, L., Stover, B., & Seixas, N. (2009). Predictors of hearing protection use in construction workers. *The Annals of Occupational Hygiene*, *53*(6), 605–15. http://doi.org/10.1093/annhyg/mep039

El Dib, R. P., Atallah, A. N., Andriolo, R. B., Soares, B. G. de O., & Verbeek, J. (2007). A systematic review of the interventions to promote the wearing of hearing protection. *São Paulo Medical Journal = Revista Paulista de Medicina*, *125*(6), 362–9. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/18317609

El Dib, R. P., & Mathew, J. L. (2009). Interventions to promote the wearing of hearing protection. *The Cochrane Database of Systematic Reviews*, (4), CD005234. http://doi.org/10.1002/14651858.CD005234.pub3

El Dib, R. P., Mathew, J. L., & Martins, R. H. G. (2012). Interventions to promote the wearing of hearing protection. *The Cochrane Database of Systematic Reviews*, *4*, CD005234. http://doi.org/10.1002/14651858.CD005234.pub5

Ellenbecker, M. J. (1996). Engineering controls as an intervention to reduce worker exposure. *American Journal of Industrial Medicine*, *29*(4), 303–7. http://doi.org/10.1002/(SICI)1097-0274(199604)29:4<303::AID-AJIM5>3.0.CO;2-P

EU-OSHA (2009) European Agency for Safety and Health at Work.Combined exposure to noise and ototoxic substances, 3–60.

Evans, G. W., Bullinger, M., & Hygge, S. (1998). Chronic Noise Exposure and Physiological Response: A Prospective Study of Children Living Under Environmental Stress. *Psychological Science*, *9*(1), 75–77. http://doi.org/10.1111/1467-9280.00014

Ewigman, B. G., Kivlahan, C. H., Hosokawa, M. C., & Horman, D. (1990). Efficacy of an Intervention to Promote Use of Hearing Protection Devices by Firefighters, *105*(1), 53–59.

Factories and Machinery (Nose Exposure) Regulations (1989). Malaysia. P.U.(A) 106/1989

Feder, K., Michaud, D., Ramage-morin, P., Mcnamee, J., & Beauregard, Y. (2015). Health Reports Prevalence of hearing loss among Canadians aged 20 to 79 : Audiometric results from the 2012 / 2013 Canadian Health Measures Survey. *Health Reports*, *26*(7), 18–25. http://doi.org/10.1017/CBO9781107415324.004

Filza Ismail, A., Daud, A., Ismail, Z., & Abdullah, B. (2013). Noise-induced hearing loss among quarry workers in a north-eastern state of Malaysia: A study on knowledge, attitude and practice. *Oman Medical Journal*, *28*(5), 331–336. http://doi.org/10.5001/omj.2013.96

Fishbein, M., & Yzer, M. C. (2003). Using Theory to Design Effective Health Behavior Interventions. *Communication Theory*, *13*(2), 164–183. http://doi.org/10.1111/j.1468-2885.2003.tb00287.x

Fives, A., Russel, A.W., Kearns, N., Lyons, R., Eaton, P., Canavan, P., Devaney, C., & O`Brien, A. (2013). The Role of Random Allocation in Randomized Controlled Trials: Distinguishing Selection Bias from Baseline Imbalance. *Journal of MultiDisciplinary Evaluation, 9* (20), 33-42.

Fonseca, V. R., Marques, J., Panegalli, F., Gonçalves, C. G. de O., & Souza, W. (2016). Prevention of the Evolution of Workers' Hearing Loss from Noise-Induced Hearing Loss in Noisy Environments through a Hearing Conservation Program. *International Archives of Otorhinolaryngology*, *20*(1), 43–7. http://doi.org/10.1055/s-0035-1551554

Gates, D., & Jones, M. S. (2007). A Pilot Study to Prevent Hearing Loss in Farmers. *Public Health Nursing*. Retrieved from http://digitalcommons.wku.edu/nurs_fac_pub/36

George, D., & Mallery, P. (2010). SPSS for Windows step by step. A simple study guide and reference (10. Baskı). GEN, Boston, MA: Pearson Education, Inc.

Geovanna, K., Crispim, M., & Ferreira, A. P. (2014). Incidence and Prevalence of Noise Induced Hearing Loss in Workers of a Metallurgical Company in Manaus – AM , Brazil Incidência e prevalência de perda auditiva induzida por ruído em, *16*(2), 1456–1462.

Ghate, D. (2001). Community-based evaluations in the UK: Scientific concerns and practical constraints. *Children and Society*, 15(1), 23- 32.

Ghazizadeh, A. H., Bakhshaee, M., Mahdavi, E., & Movahhed, R. (2012). Hair color and hearing loss: a survey in a group of military men. *Iranian Journal of Otorhinolaryngology*, *24*(69), 155–60. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/24303403

Gifford, R. (2016). Research Methods for Environmental Psychology. *John Wiley & Sons*, 440.

Goldenhar, L. M., & Schulte, P. A. (1994). Intervention research in occupational health and safety. *JOM. Journal of Occupational Medicine*, *36*(7), 763. Retrieved from http://libdata.lib.ua.edu:2048/login?url=http://proquest.umi.com/pqdlink?did=5889927&Fmt=7&clientId=31537&RQT=309&VName=PQD

Government Social Research Unit (GSR) (2007). *Magenta Book Background Papers. Paper 7: why do social experiments?* London: HM Treasury. Available at http://www.civilservice.gov.uk/Assets/chap_6_magenta_tcm6-8609.pdf

Gomzi, M. (2009). Noise-inducfed hearing impairment in sawmill workers. *Safety*, *51*(4), 295–300. Retrieved from http://hrcak.srce.hr/index.php?show=clanak&id_clanak_jezik=70146&lang=en

Hammer, L. B., Grigsby, T. D., & Woods, S. (1998). The Conflicting Demands of Work, Family, and School Among Students at an Urban University. *The Journal of Psychology*, 132 (2), 220-226. http://doi.org/10.1080/00223989809 599161

Hanidza, T. I. T., Jan, A. A. M., Abdullah, R., & Ariff, M. (2013). A Preliminary Study of Noise Exposure among Grass Cutting Workers in Malaysia. *Procedia - Social and Behavioral Sciences*, *91*, 661–672. http://doi.org/10.1016/j.sbspro.2013.08.467

Harrison, R. V. (2012). The prevention of noise induced hearing loss in children. *International Journal of Pediatrics*, *2012*, Article ID 473541, 13. http://doi.org/10.1155/2012/473541

Hashim, S., Amin, F., & Khalid, H. (2005). *Malaysia Country Report, WHO/ILO Meeting on strengthening occupational health and safety*. Kuala Lumpur, Malaysia.

Hasson, D., Theorell, T., Wallén, M. B., Leineweber, C., & Canlon, B. (2011). Stress and prevalence of hearing problems in the Swedish working population. *BMC Public Health*, *11*(1), 130.http://doi.org/10.1186/1471-2458-11-130

Hofmann, D. A., & Stetzer, A. (1996). A cross-level investigation of factors influencing unsafe behaviors and accident. *Personnel Psychology*, *49*(2), 307–339. http://doi.org/10.1111/j.1744-6570.1996.tb01802.x

Hong, O. (2005). Hearing loss among operating engineers in American construction industry. *International Archives of Occupational and Environmental Health*, *78*(7), 565–74. http://doi.org/10.1007/s00420-005-0623-9

Hong, O., Chin, D. L., & Ronis, D. L. (2013). Predictors of hearing protection behavior among firefighters in the United States. *International Journal of Behavioral Medicine*, *20*(1), 121–30. http://doi.org/10.1007/s12529-011-9207-0

Hong, O., Lusk, S. L., & Ronis, D. L. (2005). Ethnic differences in predictors of hearing protection behavior between Black and White workers. *Research and Theory for Nursing Practice*, *19*(1), 63–76. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/15989167

Hong, O., Ronis, D. L., Lusk, S. L., & Kee, G. (2006). Efficacy of a Computer-Based Hearing Test and Tailored Hearing Protection Intervention, *13*(4), 304–314.

Horner, K. . (2003). The emotional ear in stress. *Neuroscience & Biobehavioral Reviews*, *27*(5), 437–446. http://doi.org/10.1016/S0149-7634(03)00071-X

Hughson, G. W., Mulholland, R. E., & Cowie, H. A. (2002). Behavioural Studies of People's Attitudes to Wearing Hearing Protection and How These Might Be Changed, (Res. Rept. 028).https://www.researchgate.net/publication/257129191_Behavioural_studies_of_people's_attitudes_to_wearing_hearing_protection_and_how_these_might_be_changed

Hwang, S., Gomez, Ã. M. I., Sobotova, L., Stark, A. D., May, J. J., & Hallman, E. M. (2001). Predictors of Hearing Loss in New York Farmers, *Am J Ind Med*., *31*, 23–31.

Institute of Education Sciences (2011). *What Works Clearinghouse.* Procedures and Standards Handbook. Version 2.1. Available at: http://ies.ed.gov/ncee/wwc/documentsum.as px?sid=19

Janz, N. K., & Becker, M. H. (1984). The Health Belief Model: a decade later. *Health Education Quarterly*, *11*(1), 1–47. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/6392204

Jenkins, P.L., Stack, S.G., Earle-Richardson, G.B., Scofield, S.M., & May, J.J. (2007). Screening events to reduce farmers' hazardous exposures. *Journal of Agricultural Safety and Health*, 13, 57–64.

Kasiulevičius, V., Šapoka, V., & Filipavičiūtė, R. (2006). Sample size calculation in epidemiological studies, *Gerontologija 7*(4), 225–231.

Kereszti, G., Verebelyi, T., & Ormai, G. (1974). The evaluation of the noise induced hearing loss in foundry workers. *Munkavedelem*, (20), 32–5.

Kerr, M. J., Savik, K., Monsen, K. A., & Lusk, S. L. (2007). Effectiveness of computer-based tailoring versus targeting to promote use of hearing protection. *The Canadian Journal of Nursing Research = Revue Canadienne de Recherche En Sciences Infirmières*, *39*(1), 80–97. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/17450706

Kim, Y., Jeong, I., & Hong, O.-S. (2010). Predictors of Hearing Protection Behavior Among Power Plant Workers. *Asian Nursing Research*, *4*(1), 10–18. http://doi.org/10.1016/S1976-1317(10)60002-3

Kitcher, E. D., Ocansey, G., Abaidoo, B., & Atule, A. (2014). Occupational hearing loss of market mill workers in the city of Accra, Ghana. *Noise & Health*, *16*(70), 183–8. http://doi.org/10.4103/1463-1741.134919

Knobloch, M. J., & Broste, S. K. (1998). A Hearing Conservation Program for Wisconsin Youth Working in Agriculture, *J Sch Health.*, *68*(8), 313–318.

Kouvonen, A., Kivimäki, M., Virtanen, M., Pentti, J., & Vahtera, J. (2005). Work stress, smoking status, and smoking intensity: an observational study of 46,190 employees. *Journal of Epidemiology and Community Health*, *59*(1), 63–69. http://doi.org/10.1136/jech.2004.019752

Kumar, A., Gulati, R., Singhal, S., Hasan, A., & Khan, A. (2013). The effect of smoking on the hearing status-a hospital based study. *Journal of Clinical and Diagnostic Research : JCDR*, *7*(2), 210–4. http://doi.org/10.7860/JCDR/2013/4968.2730

Kumari, P, L. (2013) Significance of Solomon four group pretest-posttest method in True Experimental Research. *IOSR Journal of Agriculture and Veterinary Science*, *5*(2), 51-58.

Laird, I., Johnston, K., McBride, D., Grimmer-Somers, K., Legg, S., Dickinson, P., & Hoek, J. (2010). Effective strategies in the prevention of noise induced hearing loss. *Injury Prevention*;18:A13.

Leigh, J., Macaskill, P., Kuosma, E., & Mandryk, J. (1999). Global burden of disease and injury due to occupational factors. *Epidemiology (Cambridge, Mass.)*, *10*(5), 626–31. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/10468442

Lin, F. R., Maas, P., Chien, W., Carey, J. P., Ferrucci, L., & Thorpe, R. (2012). Association of skin color, race/ethnicity, and hearing loss among adults in the USA. *Journal of the Association for Research in Otolaryngology* : *JARO*, 13(1), 109–17. http://doi.org/10.1007/s10162-011-0298-8

Lusk, S. L., Hagerty, B. M., Gillespie, B., & Caruso, C. C. (2002). Chronic effects of workplace noise on blood pressure and heart rate. *Archives of Environmental Health*, *57*(4), 273–81. http://doi.org/10.1080/00039890209601410

Lusk, S. L., Hong, O. S., Ronis, D. L., Eakin, B. L., Arbor, A., Kerr, M. J., & Early, M. R. (1999). Effectiveness of an Intervention to Increase Construction Workers ' Use of Hearing Protection, *41*(3), 487–494.

Lusk, S. L., & Kelemen, M. J. (1993). Predicting use of hearing protection: a preliminary study. *Public Health Nursing (Boston, Mass.)*, *10*(3), 189–96. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/8234157

Lusk, S. L., Kerr, M. J., & Kauffman, S. A. (1998). Use of hearing protection and perceptions of noise exposure and hearing loss among construction workers. *American Industrial Hygiene Association Journal*, *59*(7), 466–70. http://doi.org/10.1080/15428119891010217

Lusk, S. L., Kerr, M. J., Ronis, D. L., & Eakin, B. L. (1999). Applying the health promotion model to development of a worksite intervention. *American Journal of Health Promotion : AJHP*, *13*(4), 219–27. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/10351852

Lusk, S. L., Ronis, D. L., & Baer, L. M. (1995). A comparison of multiple indicators--observations, supervisor report, and self-report as measures of workers' hearing protection use. *Evaluation & the Health Professions*, *18*(1), 51–63. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/10140862

Lusk, S. L., Ronis, D. L., & Hogan, M. M. (1997). Test of the Health Promotion Model as a Causal Model of Construction Workers ' Use of Hearing Protection, Res. Nurs. Health, 20: 183–194. doi:10.1002/(SICI)1098-240X(199706)20:3< 183::AID-NUR2>3.0.CO;2-E

Lusk, S. L., Ronis, D. L., Kazanis, A. S., Eakin, B. L., Hong, O., & Raymond, D. M. (2003). Effectiveness of a tailored intervention to increase factory workers' use of hearing protection. *Nursing Research*, *52*(5), 289–95. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/14501543

Lusk, S. L., Ronis, D. L., Kerr, M. J., & Atwood, J. R. (1994). Test of the Health Promotion Model as a causal model of workers' use of hearing protection. *Nursing Research*, *43*(3), 151–7. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/8183656

Luxon, L. M., Furman, J. M., Martini, A., & Stephens, S. D. G. (2003). *Textbook of audiological medicine : clinical aspects of hearing and balance*. Martin Dunitz.

Mahmud, N., Kenny, D. T., Zein, R. M., & Hassan, S. N. (2011). Ergonomic training reduces musculoskeletal disorders among office workers: results from the 6-month follow-up. *Malaysian Journal of Medical Sciences*, *18*(2), 16–26.

Maisarah, S. Z. M. (1989). The Noise Exposed Factory Workers : The Prevalence of Sensori-neural Hearing Loss and Their Use of Personal Hearing Protection Devices, 280–285.

Maisarah, S. Z. M., & Said, H. (1993). The noise exposed factory workers. *Medical Journal of Malaysia*, *48*(3). Retrieved from https://ukm.pure.elsevier.com/en/publications/the-noise-exposed-factory-workers(d8188cdb-0689-43fb-adaa-448d6533cd30).html

Makerly, H. (2016). Occupational Safety and Health Master Plan for Malaysia 2015 (OSH-MP 15).

Manninen, O. (1983). Simultaneous effects of sinusoidal whole body vibration and broadband noise on TTS2's and R-wave amplitudes in men at two different dry bulb temperatures. *International Archives of Occupational and Environmental Health*, *51*(4), 289–297. http://doi.org/10.1007/BF00378341

Martinez, L. F. (2012). Can you hear me now? Occupational hearing loss, 2004-2010. *Monthly Labor Review*, *Vol. 135*(Issue 7), p48.

Masilamani, R., Rasib, A., Darus, A., & Ting, A. S. (2014). Noise-induced hearing loss and associated factors among vector control workers in a Malaysian state. *Asia-Pacific Journal of Public Health / Asia-Pacific Academic Consortium for Public Health*, *26*(6), 642–50. http://doi.org/10.1177/1010539512444776

Mathers, C. D., & Loncar, D. (2006). Projections of global mortality and burden of disease from 2002 to 2030. *PLoS Medicine*, *3*(11), e442. http://doi.org/10.1371/journal.pmed.0030442

Mathers, C., Smith, A., & Concha, M. (2000). Global burden of hearing loss in the year 2000. *Global Burden of Disease*, *18*(4), 1–30. Retrieved from http://www.who.int/healthinfo/statistics/bod_hearingloss.pdf\nhttp://www.who.int/entity/healthinfo/statistics/bod_hearingloss.pdf

McCambridge, J., Butor-Bhavsar, K., Witton, J., & Elbourne, D. (2011). Can research assessments themselves cause bias in behaviour change trials? A systematic review of evidence from Solomon 4-group studies. *PLoS One*, *6*(10), e25223. JOUR.

Mccullagh, M. C. (2011). Effects of a Low Intensity Intervention to Increase Hearing Protector Use Among Noise-Exposed Workers, *215*, 210–215. http://doi.org/10.1002/ajim.20884.

Mccullagh, M. C., Ronis, D. L., & Lusk, S. L. (2010). Predictors of Use of Hearing Protection Among a Representative Sample of Farmers, (October), 528–538. http://doi.org/10.1002/nur.20410

McFadden, S. L. (1998). Sex Difference in Susceptibility and Resistance to Noise-induced Hearing Loss in Chinchillas. *Storming Media Pentagon Reports, Washington, DC*, (Report number A676783). Retrieved from http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA368326

McGahee, T. W. & Tinger, M. S. (2009). The Use Of The Solomon Four-Group Design In Nursing Research. *Southern Online Journal of Nursing Research 9*(1).

McLauglin, F. E., & Marascuilo, L. A. (1990). *Advanced nursing and health Care research, quantification approaches.* Philadelphia : W. B. Saunders Co.

Meira, T. C., Santana, V. S., Ferrite, S., Meira, T. C., Santana, V. S., & Ferrite, S. (2015). Gender and other factors associated with the use of hearing protection devices at work. *Revista de Saúde Pública*, *49*, 1–8. http://doi.org/10.1590/S0034-8910.2015049005708

Melamed, S., & Bruhis, S. (1996). The effects of chronic industrial noise exposure on urinary cortisol, fatigue and irritability: a controlled field experiment. *Journal of Occupational and Environmental Medicine / American College of Occupational and Environmental Medicine*, *38*(3), 252–6. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/8882096

Melamed, S., Rabinowitz, S., Feiner, M., Weisberg, E., & Ribak, J. (1996). Usefulness of the protection motivation theory in explaining hearing protection device use among male industrial workers. *Health Psychology*, *15*(3), 209–215. http://doi.org/http://dx.doi.org/10.1037/0278-6133.15.3.209

Melamed, S., Rabinowitz, S., & Green, M. S. (1994). Noise exposure, noise annoyance, use of hearing protection devices and distress among blue-collar workers. *Scandinavian Journal of Work, Environment & Health*, *20*(4), 294–300. http://doi.org/10.5271/sjweh.1395

Mizoue, T., Miyamoto, T., & Shimizu, T. (2003). Combined effect of smoking and occupational exposure to noise on hearing loss in steel factory workers. *Occupational and Environmental Medicine*, *60*(1), 56–9. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/12499458

Morata, T. C., Dunn, D. E., Kretschmer, L. W., Lemasters, G. K., & Keith, R. W. (1993). Effects of occupational exposure to organic solvents and noise on hearing. *Scandinavian Journal of Work, Environment & Health*, *19*(4), 245–54. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/8235513

Morata, T. C., Fiorini, A. C., Fischer, F. M., Colacioppo, S., Wallingford, K. M., Krieg, E. F., … Cesar, C. L. (1997). Toluene-induced hearing loss among rotogravure printing workers. *Scandinavian Journal of Work, Environment & Health*, *23*(4), 289–98. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/9322820

Morrison, K. (2001). Randomised controlled trials for evidence-based education: Some problems in judging "What Works." *Evaluation and Research in Education*, 15(2), 69-83.

Murdaugh, C., & Hinshaw, A. S. (1986). Theoretical model testing to identify personality variables effecting preventive behaviors. *Nursing Research*, *35*(1), 19–23. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/3632841

Musiba, Z. (2015). The prevalence of noise-induced hearing loss among Tanzanian miners, (April), 10–14. http://doi.org/10.1093/occmed/kqv046

Nasir, H. M., & Rampal, K. G. (2012). Hearing loss and contributing factors among airport workers in Malaysia. *The Medical Journal of Malaysia*, *67*(1), 81–6. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/22582554

Neitzel, R., Meischke, Ã. H., Daniell, W. E., Trabeau, M., Somers, S., & Seixas, N. S. (2008). Development and Pilot Test of Hearing Conservation Training for Construction Workers, *129*, 120–129. http://doi.org/10.1002/ajim.20531.

Neitzel, R., & Seixas, N. (2005). The effectiveness of hearing protection among construction workers. *Journal of Occupational and Environmental Hygiene*, *2*(4), 227–38. http://doi.org/10.1080/15459620590932154

Nelson, D. I., Nelson, Ã. R. Y., Concha-barrientos, M., & Fingerhut, M. (2005). The Global Burden of Occupational Noise-Induced Hearing Loss, *458*, 446–458. http://doi.org/10.1002/ajim.20223.

NIOSH. (1986). *A proposed national strategy for the prevention of workrelated, noise-induced hearing loss.* Unpublished manuscript, National Institute of Occupational Safety and Health, Cincinnati, Ohio.

Ng, S. (2013). Validation of the 10-item Chinese perceived stress scale in elderly service workers: one-factor versus two-factor structure. *BMC Psychology*, *1*(1), 9. http://doi.org/10.1186/2050-7283-1-9

Nomura, K., Nakao, M., & Morimoto, T. (2005). Effect of smoking on hearing loss: quality assessment and meta-analysis. *Preventive Medicine*, *40*(2), 138–44. http://doi.org/10.1016/j.ypmed.2004.05.011

Noorhassim, I., & Rampal, K. G. (1998). Multiplicative effect of smoking and age on hearing impairment. *American Journal of Otolaryngology*, *19*(4), 240–3. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/9692632

Nor Saleha, I. T., & Noor Hassim, I. (2006). A study on compliance to hearing conservation programme among industries in Negeri Sembilan, Malaysia. *Industrial Health*, *44*(4), 584–91. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/17085919

Oakley, A., Strange, V., Toroyan, T., Wiggins, M., Roberts, I., & Stephenson, J. (2003). Using random allocation to evaluate social interventions: Three recent U.K. examples. *The ANNALS of the American Academy of Political and Social Science*, 589(1), 170-189.

Ologe, F. E., Akande, T. M., & Olajide, T. G. (2006). Occupational noise exposure and sensorineural hearing loss among workers of a steel rolling mill. *European Archives of Oto-Rhino-Laryngology : Official Journal of the European Federation of Oto-Rhino-Laryngological Societies (EUFOS) : Affiliated with the German Society for Oto-Rhino-Laryngology - Head and Neck Surgery*, *263*(7), 618–21. http://doi.org/10.1007/s00405-006-0043-9

Palmer, K. T., Griffin, M. J., Syddall, H. E., & Coggon, D. (2004). Cigarette smoking, occupational exposure to noise, and self reported hearing difficulties. *Occupational and Environmental Medicine*, *61*(4), 340–4. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/15031392

Pawlaczyk-Luszczynska, M., Dudarewicz, A., Zaborowski, K., Zamojska, M., & Sliwinska-Kowalska, M. (2013). Noise induced hearing loss: research in Central, Eastern and South-Eastern Europe and Newly Independent States. *Noise & Health*, *15*(62), 55–66. http://doi.org/10.4103/1463-1741.107157

Pekkarinen, J. (1995). Noise, impulse noise, and other physical factors: combined effects on hearing. *Occupational Medicine (Philadelphia, Pa.)*, *10*(3), 545–59. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/8578418

Pender, N. J., Murdaugh, C. L., & Parsons, M. A. (2006). Health promotion in nursing practice. *Prentice Hall*, 367.

Pender, N. J., Walker, S. N., Sechrist, K. R., & Frank-Stromborg, M. (1990). Predicting health-promoting lifestyles in the workplace. *Nursing Research*, *39*(6), 326–32. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/2092305

Prince, M. M., Stayner, L. T., Smith, R. J., & Gilbert, S. J. (1997). A re-examination of risk estimates from the NIOSH Occupational Noise and Hearing Survey (ONHS). *The Journal of the Acoustical Society of America*, *101*(2), 950–63. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/9035391

Quaranta, A., Portalatini, P., & Henderson, D. (1998). Temporary and permanent threshold shift: an overview. *Scandinavian Audiology. Supplementum*, *48*, 75–86. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/9505300

Quick, B. L., Stephenson, M. T., Witte, K., Vaught, C., Booth-Butterfield, S., & Patel, D. (2008). An examination of antecedents to coal miners' hearing protection behaviors: A test of the theory of planned behavior. *Journal of Safety Research*, *39*(3), 329–338. http://doi.org/10.1016/j.jsr.2008.02.032

Rarey, K. E., Gerhardt, K. J., Curtis, L. M., & ten Cate, W. J. (1995). Effect of stress on cochlear glucocorticoid protein: acoustic stress. *Hearing Research*, *82*(2), 135–8. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/7775279

Reddy, R. K., Welch, D., Thorne, P., & Ameratunga, S. (2012). Hearing protection use in manufacturing workers: a qualitative study. *Noise & Health*, *14*(59), 202–9. http://doi.org/10.4103/1463-1741.99896

Reilly, M. J., Rosenman, K. D., & Kalinowski, D. J. (1998). Occupational noise-induced hearing loss surveillance in Michigan. *Journal of Occupational and Environmental Medicine / American College of Occupational and Environmental Medicine*, *40*(8), 667–74. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/9729748

Rhodes F, Fishbein M, Reis J. (1997). Using behavioral theory in computer-based health promotion and appraisal. *Health Educ Behav*. 1997 Feb;24(1):20–34.

Ronis, D. L., Hong, O., & Lusk, S. L. (2006). Comparison of the Original and Revised Structures of the Health Promotion Model in Predicting Construction Workers ' Use of Hearing Protection, 3–17. http://doi.org/10.1002/nur

Rosenman, K. D., & Kalinowski, D. J. (2009). *2008 Annual Report on Work-Related Noise-Induced Hearing Loss in Michigan*. Michigan. Retrieved from http://www.oem.msu.edu/userfiles/file/AnnualReports/Hearing/08NIHL_Report.pdf

Rossi, P. H., Lipsey, M. W., & Freeman, H. E. (2004). *Evaluation: A Systematic Approach*. Seventh edition. London: Sage.

Rus, R. M., Daud, A., Musa, K. I., & Naing, L. (2008). Knowledge, Attitude and Practice of Sawmill workers towards noise-induced hearing loss in Kota. *Malaysian Journal of Medical Sciences*, *15*(4), 28–34.

Ryan, P. (2009). Integrated Theory of Health Behavior Change: background and intervention development. *Clinical Nurse Specialist CNS*, *23*(3), 161-70–2. http://doi.org/10.1097/NUR.0b013e3181a42373

Ryan, P., & Lauver, D. R. (2002). The efficacy of tailored interventions. *Journal of Nursing Scholarship : An Official Publication of Sigma Theta Tau International Honor Society of Nursing / Sigma Theta Tau*, *34*(4), 331–7. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/12501736

Rybak, L. P., Whitworth, C. A., Mukherjea, D., & Ramkumar, V. (2007). Mechanisms of cisplatin-induced ototoxicity and prevention. *Hearing Research*, *226*(1–2), 157–67. http://doi.org/10.1016/j.heares.2006.09.015

Schneider, B., Ehrhart, M. G., & Macey, W. H. (2013). Organizational Climate and Culture. *Annual Review of Psychology*, *64*(1), 361–388. http://doi.org/10.1146/annurev-psych-113011-143809

Schneider, B., Gunnarson, S. K., & Niles-Jolly, K. (1994). Creating the climate and culture of success. *Organizational Dynamics*, *23*(1), 17–29. http://doi.org/10.1016/0090-2616(94)90085-X

Schulz, K. F., Altman, D. G., & Moher, D. (2010). CONSORT 2010 Statement: updated guidelines for reporting parallel group randomised trials. *BMC Medicine*, *8*(1), 18. http://doi.org/10.1186/1741-7015-8-18

Seixas, N. S., Neitzel, R., Stover, B., Sheppard, L., Daniell, B., Edelson, J., & Meischke, H. (2011). A multi-component intervention to promote hearing protector use among construction workers. *International Journal of Audiology*, *50*(S1), S46–S56. http://doi.org/10.3109/14992027.2010.525754

Shah, M., Hasan, S., Malik, S., & Sreeramareddy, C. T. (2010). Perceived Stress , Sources and Severity of Stress among medical undergraduates in a Pakistani Medical School. *BMC Medical Education*, *10* (1) pp: 2

Shallcross, A. J., Ford, B. Q., Floerke, V. A., & Mauss, I. B. (2013). Getting better with age: the relationship between age, acceptance, and negative affect. *Journal of Personality and Social Psychology*, *104*(4), 734–49. http://doi.org/10.1037/a0031180

Siegelaub, A. B., Friedman, G. D., Adour, K., & Seltzer, C. C. (1974). Hearing loss in adults: relation to age, sex, exposure to loud noise, and cigarette smoking. *Archives of Environmental Health*, *29*(2), 107–9. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/4835178

Simpson M, Bruce R. (1981). Noise in America: Extent of the Noise Problem. (Report 550/9-81-101). Washington, DC:U.S. Environmental Protection Agency.

Sliwińska-Kowalska, M., Dudarewicz, A., Kotyło, P., Zamysłowska-Szmytke, E., Pawlaczyk-łuszczyńska, M., & Gajda-Szadkowska, A. (2006). Individual susceptibility to noise-induced hearing loss: choosing an optimal method of retrospective classification of workers into noise-susceptible and noise-resistant groups. *International Journal of Occupational Medicine and Environmental Health*, *19*(4), 235–45. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/17402219

SME Corp Malaysia. (2013). Guideline for New Sme Definition. *Economics and Policy Planning Division, SME Corp. Malaysia*, (October), 1–5.

SME Corp Malaysia. (2012). *SME Statistics*. Retrieved from http://www.smecorp.gov.my/index.php/en/policies/2015-12-21-09-09-49/sme-statistics

Smith, R. J., Shearer, A. E., Hildebrand, M. S., & Van Camp, G. (1993). *Deafness and Hereditary Hearing Loss Overview*. *GeneReviews(®)*. University of Washington, Seattle. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/20301607

SOCSO. (2015). *2014 Annual Report of Social Security Organization*. Retrieved from http://www.perkeso.gov.my/images/Laporan_Tahunan_2014.pdf

Solecki, L. (2008). [Relationship between the level of total exposure to noise among private farmers and the degree of hearing loss]. *Medycyna Pracy*, *59*(2), 149–58. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/18652140

Stansfeld, S. A., & Matheson, M. P. (2003). Noise pollution: non-auditory effects on health. *British Medical Bulletin*, *68*(1), 243–257. http://doi.org/10.1093/bmb/ldg033

Stawski, R. S., Sliwinski, M. J., Almeida, D. M., & Smyth, J. M. (2008). Reported exposure and emotional reactivity to daily stressors: The roles of adult age and global perceived stress. *Psychology and Aging*, *23*(1), 52–61. http://doi.org/10.1037/0882-7974.23.1.52

Stephenson, M., Shaw, P., Stephenson, C., & Graydon, P. (2011). Hearing loss prevention for carpenters: Part 2 - Demonstration projects using individualized and group training. *Noise and Health*, *13*(51), 122. http://doi.org/10.4103/1463-1741.77213

Stevens, G., Flaxman, S., Brunskill, E., Mascarenhas, M., Mathers, C. D., & Finucane, M. (2013). Global and regional hearing impairment prevalence: an analysis of 42 studies in 29 countries. *European Journal of Public Health*, *23*(1), 146–52. http://doi.org/10.1093/eurpub/ckr176

Sudo, A., Nguyen, A. L., Jonai, H., Matsuda, S., Villanueva, M. B., Sotoyama, M., … Nguyen, S. (1996). Effects of earplugs on catecholamine and cortisol excretion in noise-exposed textile workers. *Industrial Health*, *34*, 279–286. http://doi.org/10.2486/indhealth.34.279

Sulkowski, W. J., & Lipowczan, A. (1982). Impulse Noise-Induced Hearing Loss in Drop Forge Operators and the Energy Concept. *Noise Control Engineering*, *18*(1), 24. http://doi.org/10.3397/1.2832197

Sułkowski, W., Kowalska, S., Lipowczan, A., Prasher, D., & Raglan, E. (1999). Tinnitus and impulse noise-induced hearing loss in drop-forge operators. *International Journal of Occupational Medicine and Environmental Health*, *12*(2), 177–82. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/10465907

Suter, A. H. (2002). Construction Noise: Exposure, Effects, and the Potential for Remediation; A Review and Analysis. *AIHA Journal*, *63*(63), 768–789. http://doi.org/10.1080/15428110208984768

Tahir, N., Aljunid, S. M., Hashim, J. H., & Begum, J. (2014). Burden of Noise Induced Hearing Loss among Manufacturing Industrial Workers in Malaysia. *Iranian Journal of Public Health*, *43*(3), 148–153. Retrieved from https://www.researchgate.net/publication/271208271_Burden_of_Noise_Induced_Hearing_Loss_among_Manufacturing_Industrial_Workers_in_Malaysia

Tak, S., & Calvert, G.M. (2008). Hearing difficulty attributable to employment by industry and occupation: an analysis of the National Health Interview Survey–United States, 1997 to 2003. *Journal of Occupational and Environmental Medicine*, 50, 46–56. DOI:10.1097/JOM. 0b013e3181579316

Tak, S., & Davis, R. R. (2009). Exposure to Hazardous Workplace Noise and Use of Hearing Protection Devices Among US Workers — NHANES , 1999 – 2004, *371*, 358–371. http://doi.org/10.1002/ajim.20690.

Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education*, *2*, 53–55. http://doi.org/10.5116/ijme.4dfb.8dfd

Tay, P. (1996). Severe noise-induced deafness--a 10-year review of cases. *Singapore Medical Journal*, *37*(4), 362–4. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/8993132

Taylor, P., Griffin, S. C., Neitzel, R., Daniell, W. E., Seixas, N. S., Griffin, S. C., … Seixas, S. (2010). Indicators of Hearing Protection Use : Self-Report and Researcher Observation Indicators of Hearing Protection Use : Self-Report and Researcher Observation, (April 2012), 37–41. http://doi.org/10.1080/15459620903139060

Tizard, C. A. Health and Safety in Employment Regulations 1995 (1995). New Zealand.

Torgerson, D. J. (2001). Contamination in trials: is cluster randomisation the answer? *BMJ (Clinical Research Ed.)*, *322*(7282), 355–357. http://doi.org/10.1136/bmj.322.7282.355

Ueyama, T., Sakaguchi, H., Nakamura, T., Goto, A., Morioka, S., Shimizu, A., … Lechene, C. P. (2014). Maintenance of stereocilia and apical junctional complexes by Cdc42 in cochlear hair cells. *Journal of Cell Science*, *127*(Pt 9), 2040–52. http://doi.org/10.1242/jcs.143602

van Sluijs EM, van Poppel MN, Twisk JW, van Mechelen W (2006) Physical activity measurements affected participants' behavior in a randomized controlled trial. *J Clin Epidemiol, 59*: 404–411.

Van Teijlingen, E., & Hundley, V. (2002). The importance of pilot studies. *Nursing Standard*, *16*(40), 33–36. JOUR.

Verbeek, J. H., Kateman, E., Morata, T. C., Dreschler, W. A., & Mischke, C. (2014). Interventions to prevent occupational noise-induced hearing loss: a Cochrane systematic review. *International Journal of Audiology*, *53 Suppl 2*, S84-96.

Verdel, B. M., van Puijenbroek, E. P., Souverein, P. C., Leufkens, H. G. M., & Egberts, A. C. G. (2008). Drug-related nephrotoxic and ototoxic reactions : a link through a predictive mechanistic commonality. *Drug Safety*, *31*(10), 877–84. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/18759511

Vink, P., Koningsveld, E. A. P., & Molenbroek, J. F. (2006). Positive outcomes of participatory ergonomics in terms of greater comfort and higher productivity. *Applied Ergonomics*, *37*(4), 537–546. http://doi.org/10.1016/j.apergo.2006.04.012

Vos, T., Flaxman, A. D., Naghavi, M., Lozano, R., Michaud, C., Ezzati, M., … Memish, Z. A. (2012). Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet*, *380*(9859), 2163–96. http://doi.org/10.1016/S0140-6736(12)61729-2

Waghachavare, V. B., Dhumale, G. B., Kadam, Y. R., & Gore, A. D. (2013). A Study of Stress among Students of Professional Colleges from an Urban area in India. *Sultan Qaboos University Med J*, *13*(August), Vol. 13, ISS. 3, PP. 429-436, EPUB. 25th Jun 13.

Willson, V. L., & Putnam, R. R. (1982). A meta-analysis of pretest sensitization effects in experimental design. *American Educational Research Journal*, *19*(2), 249–258. JOUR.

WHO. (2015). Deafness and hearing loss. Retrieved May 5, 2016, from http://www.who.int/mediacentre/factsheets/fs300/en/

WHO. (2013). Prevention of blindness and deafness. Grades of hearing impairment. Geneva: World Health Organization. Retrieved 29 February 2016. http://www.who.int/pbd/deafness/hearing_impairment_grades/en/

WHO. (2012). Global estimates on prevalence of hearing loss. Geneva: World Health Organization. Accessed 29 February 2016. http://www.who.int/pbd/deafness/estimates

WHO. (2004). Occupational Noise: Assessing the burden of disease from work-related hearing impairment at national and local levels. Environmental Burden of Disease Series, Number 9. Geneva.

Yong, A., & Nee, H. (2011). Factors Affect Safety and Health Behavior of Logistics Workers in Malaysia : A Conceptual Framework, 1225–1232.

Zhang, Z. L. (2010). Guidelines for diagnosing occupational noise-induced hearing loss part 2. Epidemiological review: some risk factors of hearing loss Executive summary Background.