

Improving Vocal Health and Safety in Industrial Work Place

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Research Article

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Abstract

Introduction: Employee exposure to harmful dust, heat, noise and hazardous chemicals might cause several occupational diseases and voice disorder is one of them. There is a limited research on vocal health and safety in workplaces. In addition, there is a lack of awareness among employees and employers about vocal health and safety in the working environment. Work-related voice disorders might cause sick leaves, stress, low productivity and in severe cases a permanent damage to the voice.

Objective: To detect work-related voice disorders in chlorine manufacturing industry. To improve vocal health and safety among employees in industrial workplace

Methods: Examining 50 employees in chlorine manufacturing industry using the occupational health assessment done by an occupational health physician and voice assessment done by a qualified voice therapist.

Results: The study identified the influencing factors for work-related voice disorders in chlorine manufacturing industry such as level and time of exposure and rest time during work. The types of voice disorders and the perceptual vocal characteristics were identified for each employee as well as the acoustic data of the voice. In addition, the effects of work-related voice disorders on the working environment were studied.

Conclusion: The study highlights the importance of examining the vocal health and safety among employees in chlorine manufacturing industry. It is important that the occupational health physician refer employees with occupational voice disorders to the voice therapy. Employees who are at risk of occupational voice disorder can follow a hygienic preventive program and employers might consider enhancing the working environment and the level of awareness about vocal health and safety and following rules and regulations of work-place health and safety.

INTRODUCTION

Employee exposure to harmful dust, heat, noise and hazardous chemicals might cause several occupational diseases and voice disorder is one of them. There is a limited research on vocal health and safety in workplaces. In addition, there is a lack of awareness among employees and employers about vocal health and safety in the working environment. Work-related voice disorders might cause sick leaves, stress, and low productivity and in severe cases a permanent damage to the voice. He types of occupational hazards that might affect the voice are: noise, chemicals, metals, toxins, dust, heat, and weight, air tight, vibration and stress. All occupational hazards might affect the voice negatively, but it is still unclear which hazards might be riskier and hazardous on the voice. The workplace risk factors that might affect the voice are: poor air ventilation, indoor smoking, work stressful issues (work relationships, long working shifts, low income, far workplace, challenging workplace, short-term contract)^[1]. The expected effect(s) of workplace on the voice are: vocal fatigue, hoarseness, dryness, dysphonia, vocal change, loud voice, laryngeal tension, and others^[1]. Many risk factors can contribute to a voice disorder, including: aging, alcohol use, allergies, Gastroesophageal Reflux Disease (GERD), illnesses, such as cold or upper respiratory infections, improper throat clearing over

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a long time, neurological disorders, psychological stress, scarring from neck surgery or from trauma to the front of the neck, screaming, smoking, throat cancer, throat dehydration, thyroid problems, voice misuse or overuse (mayo clinic website).

The voice disorders might cause negative effects on the work itself such as: sick leaves, absenteeism, low productivity and fatigue. Moreover, it might affect the worker's body functions, activity, participation and well-being [2]. Vocal loss leads to stress as the worker cannot express his thoughts, feelings and needs then might lead to sick leaves, risk of losing job, risk of not finding a new job and maybe recurrent vocal polyps and nodules. In the worst scenario WRVD might cause cancer and/ or complete aphonia [2].

A simple quick vocal screening is able to detect most kinds of voice disorders. The voice screening includes evaluation of vocal characteristics related to respiration, phonation, and resonance. The comprehensive voice assessment must be done by a physician and a SLP. According to the Evidence-Based Practice (EBP), the clinical voice assessment must include: screening, comprehensive exam, perceptual measures, acoustic measures, aerodynamic measures, imaging measures, QoL measures and self-reported measures [1]. There are a wide range of voice therapeutic techniques. The two main types of therapies are direct or indirect approaches. The therapist may choose both approaches and plan for a comprehensive treatment plan according to his clients' needs. Direct voice therapy might include: manual circumlaryngeal techniques and vocal Function Exercises (VFEs). On the other hand, the indirect therapy might include: identifying behaviours that are contributing to the voice problems, including unhealthy vocal hygiene practices (e.g., shouting, talking loudly over noise and poor hydration) and implementing healthy vocal hygiene practices (e.g., drinking plenty of water and talking at a moderate volume) and client's education and counselling [3].

The voice management aims to prevent the incidence of WRVD by following the vocal health and safety rules and regulations in the workplace along the guidance from the SLP. The Occupational Safety and Health (OSH) interventions at the workplace helps in preventing the occupational voice disorders via a wide range of practices such as: Pre-employment examinations for preventing voice diseases and sick leave in workers, periodic medical examination of occupational diseases, control of hazards: ex, buy Quiet as a means of reducing workplace noise, behavioural interventions to promote worker's use of respiratory, hearing and vocal protective equipment, stress management at work, smoke-free workplace, education for employers, employees and OHPs and media covering WRVD [1].

The occupational chlorine exposure considered to be a low level unintentional exposure [4-9]. Smoking increases the risk of being affected by chlorine [10]. The literature reported that the occupational diseases at a chlorine manufacturing industry might be: nose, throat, and eye irritation (<https://www.cdc.gov/niosh/topics/chlorine/default.html>). At higher levels, breathing chlorine gas may result in changes in breathing rate and coughing, and damage to the lungs [10]. In addition, the literature found that the prevention from the chlorine occupational diseases might be via wearing prevention equipment tools, lower exposure time, work break, pre-employment exam and periodic one [10].

There is a knowledge gap and limitation in the literature about WRVD and vocal health and safety in the industrial workplace [11,12]. The literature searched in occupational voice disorders among teacher [6] and telephone call agents [13], but only few studies investigated the voice disorders caused by industrial workplace. Moreover, the field of occupational health focuses on a wide range of occupational diseases such as hearing loss [6] but limited literature covered the area of vocal health and safety in the workplace [1].

This project aims to investigate the WRVD in chlorine manufacturing industry, in order to identify the hazards and risk factors that might cause voice disorders and to identify the types and characteristics of occupational voice disorders related to chlorine manufacturing industry. The study also aims to improve vocal health and safety among employees in industrial workplace.

MATERIALS AND METHODS

This is a cross-sectional quantitative study using health survey and clinical examinations. Both examiners; the researchers in this study are qualified and experts in their fields. The OH physician is a certified medical doctor with occupational health diploma and 4-year experience as OH physician. The SLP has a phd in speech therapy and 10-year experience in vocal health and its pathology. The OH physician completed a training course on the voice and its management. The SLP and the OH physician agreed on the inclusion and exclusion criteria for identifying the WRVD group and the related risk factors for that group [10-14].

The OH physician did the Occupational Health Assessment (OHA) for random 50 workers using general physical exam; blood pressure testing, respiration, hearing, throat, neuro and stress, hearing test using the audiogram to detect hearing problems, and lung function evaluation using the spirometer measure.

Then he used form Questions to be asked to the employees by the OH physician, to identify the WRVD group. The group of workers with WRVD is 12 workers out of 50. The 12 workers with WRVD were asked to provide the acoustic data to identify the type of VD by the voice therapist. At the end, the OH physician provided all workers with Form Occupational vocal health and safety in industrial workplace leaflet. This is a single blinded study as the OH physician recorded the voices and identifies the type of VD and the vocal characteristics without telling the SLP about the outcomes. The SLP listened to the recordings and identified the pathological voices along the type of VD and the vocal characteristics. Then the SLP and the OH physician checked the recordings together. The aim was to confirm that the voice change is due to the working environment and to try to identify the specific cause of the voice change, and to be able to differentiate between those with voice change or voice disorder.

The occupational health physician screened the voice by taking the case history, identifying the symptoms, using the Auditory-Perceptual Judgments: hoarseness, roughness, loudness, pitch, aphonia, dysphonia, voice quality. He also did the physical exam which covers the oral mechanism and the extrinsic laryngeal palpation. The SLP voice screening includes evaluation of vocal characteristics related to respiration, phonation, and resonance. The acoustic analysis done by the voice therapist: using the TF32 vocal software. The required task was to sustain the sound /a/ for as long as possible; Maximum Phonation Time (MPT), F0, Jitter, Shimmer and Noise to Harmonic Ratio (NHR). Exclusion criteria: workers were excluded if they have one or more of the following: non occupational vocal misuse or abuse, head and chest cold, VD due to GERD, any type of VD with clear identified aetiology that is considered as a non-occupational disease/disorder. The survey data were analysed using the O’Cathain and Thomas^[8] analysis method^[7-10].

RESULTS

In The study identified the influencing factors for work-related voice disorders in chlorine manufacturing industry such as level and time of exposure and rest time during work. The types of voice disorders and the perceptual vocal characteristics were identified for each employee as well as the acoustic data of the voice. In addition, the effects of work-related voice disorders on the working environment were studied.

ID info and characteristics of 12 workers who have WRVD

The average start working date for the 12 workers with WRVD is 15.9 years. 11/12 workers were examined on the Pre-employment examination. 7/12 workers do their periodic medical examination annually on time, one worker his last periodic exam was 2 years ago, one worker was examined 4 years ago, 3 workers did their exam 5 years ago. 8 /12 workers are smokers, only 4 are non-smokers. None of the worker was given a vocal health and safety leaflet or a leaflet about the effects of worksite hazards on the voice by the employer. According to the workers and the OHA, the employer follows the vocal health and safety rules (facial mask, ear protectors, work break, water intake, and free-smoking workplace). The 12 workers suffer from hoarseness, dysphonia, and laryngeal tension as an effect of workplace on the voice. 12 workers identified the workplace hazards to be chemicals- the chlorine, stress and dust in their workplace. The only workplace risk factor that was determined by the OH physician along with the workers is the low income as a work stressful issue. The work time (hours) for the 12 workers is 8 hours. Workers did not tell their exposure time. The rest time during work for all workers is one hour. Employee's Occupational disease(s) for 12 workers are: 12 respiratory problems, 11 lung function problems, 11 throat problems, 12 breathing difficulties, coughing, 12 dysphonia, 2 asthma, 4 hearing problems, 12 stress. There are no sick leaves due to OH diseases. The researcher could not get information about the site characterization-hazards assessment. The 12 employee reported that they are unaware about vocal health and safety and about the effects of worksite hazards on the voice (**Figure 1**).

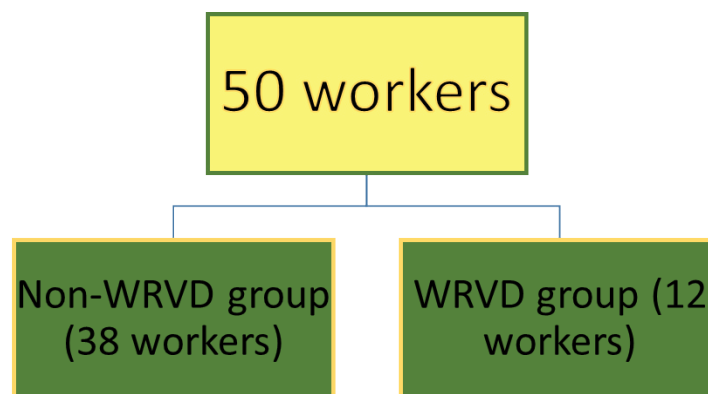


Figure 1. Study groups.

ID info and characteristics of 38 workers who do not have WRVD

The average start working date for the 38 workers who do not have WRVD is 8.1 years. 26/38 workers were examined on the Pre-employment examination. 12/38 workers were not examined on the Pre-employment examination. 26/38 workers do their periodic medical examination annually on time, one worker did not do the exam because he is a new worker, he only finished 6 months in the workplace, 4 workers did their exam 10 years ago, one worker did his exam 5 years ago, one worker did his exam 4 years ago, one worker did his exam 3 years ago. 13/38 workers are smokers and 25/38 are non-smokers. None of the worker was given a vocal health and safety leaflet or a leaflet about the effects of worksite hazards on the voice by the employer. According to the workers and the OHA, the employer follows the vocal health and safety rules (facial mask, ear protectors, work break, water intake, free-smoking workplace). 37/38 workers suffer from vocal fatigue and mild hoarseness; one worker suffer from vocal dryness as an effect of workplace on the voice. 38/38 workers identified the workplace hazards to be chemicals- the chlorine, stress and dust in their workplace. The only workplace risk factor that was determined by the OH physician along with the workers is the low income as a work stressful issue. The work time (hours) for the 38/38 workers is 8 hours. Workers did not tell their exposure time. The rest time during work for all workers is one hour. 0/38 employees have Occupational disease(s). There are no sick leaves due to OH diseases. The researcher could not get information about the site Characterization-Hazards

Assessment. The 38 employee reported that they are unaware about vocal health and safety and about the effects of worksite hazards on the voice. The SLP diagnosis for the 38 group is that they are at risk of developing the WRVD at any time, unless they take care of their voices by following a preventive vocal health program and by keep checking their vocal health. The factory has 180 workers. 50/180 workers were examined on the OHA. 12/50 has WRVD. 60/180 workers (50%) might have direct exposure to the chlorine. The chlorine in the factory is a liquid gas and it is considered to be thick and cause pulmonary choking agent. This study found that the influencing factors that might be responsible of causing WRVD in a chlorine manufacturing industry are: the start working date of the employer at his workplace and smoking. The study was able to identify one non influencing factor; the last periodic medical exam. The Occupational Health Assessment (OHA) for the WRVD group found that 4/12 workers have occupational hearing problem. 12/12 workers have WRVD-dysphonia. 11/12 workers have lung functions problem. The age average for the 12 worker is 41.6 years. The perceptual vocal characteristics for the 12/12 workers were: dysphonia, hoarseness and laryngeal irritation. The physical examination of the voice (OHA) found that the 12/12 workers have: Irritation of respiratory tract or throat, breathing difficulties and coughing. The measured acoustic data were: F0, jitter, shimmer, NHR and MPT. The average was calculated for each measure for the 11 male workers; F0: 164.88163636Hz/ jitter: 0.871/, shimmer: 8.9021818/, NHR: 0.30009090/ and MPT: 13.818181. The acoustic data for the only one female worker were: F0: 215.205Hz/ jitter: 0.501/, shimmer: 10.377/, NHR: 0.194/ and MPT: 19. General methods and results of the study (**Figure 2**).

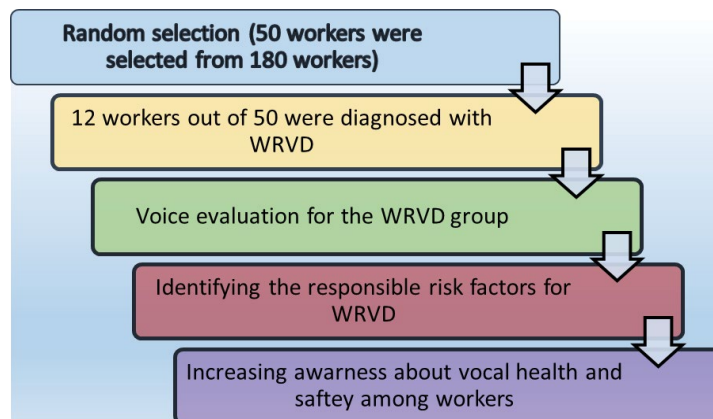


Figure 2. General methods and results of the study.

The most affected vocal acoustic measures by Chlorine were: F0, shimmer and MPT. The severity levels of the WRVD are mild to moderate and there are no severe cases which are considered as a good indicator of the occupational health and safety in the factory. The absence of severe pathological voice, such as polyps and nodules means that the employer and the employees are following the occupational health and safety regulations and guidelines. There was no effect of the WRVD on the working environment, as there were no sick leaves due to WRVD, absenteeism, low productivity, fatigue. Stress was a compound factor and needs more investigations to be able to identify the causes and their relatedness to the working environment and if the WRVD or any other occupational disease might be the cause of it or vice versa. This might be covered in future research to have a better understanding of the stress factor they reported (**Figure 3**).

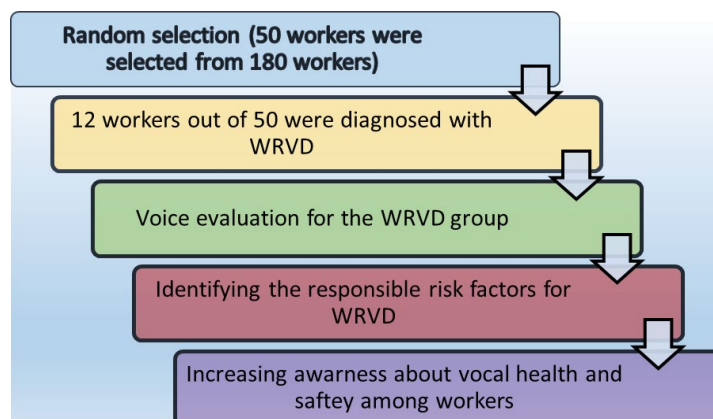


Figure 3. Detailed methods and results of the study.

The SLP clinical recommendations were firstly to provide an educational preventive vocal program for all employers and employees, to establish and increase the level of awareness about vocal health and safety in the industrial workplace. The second recommendation is to provide a voice therapy for those who are at risk of developing WRVD. Thirdly, to treat the WRVD group with intensive voice therapy to overcome the current pathological vocal disorder and to decrease the probability of having severe VD, as this might lead to surgical medical interfere and/or negative effects on the working environment and the job post stability of the employee.

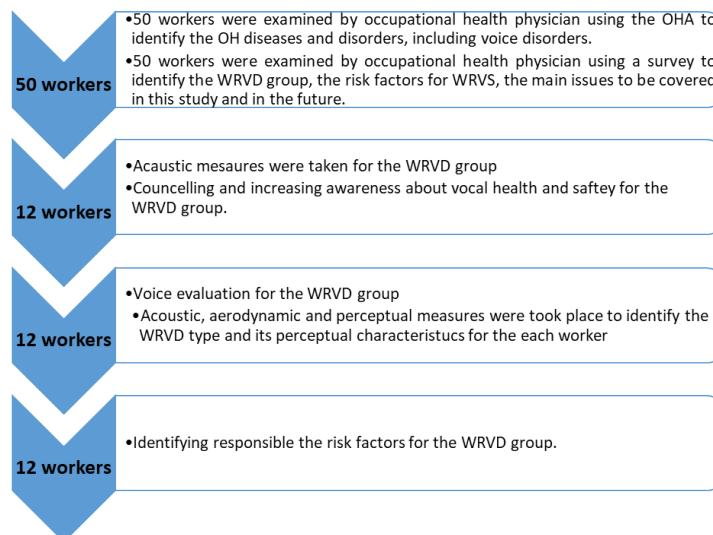


Figure 4. Detailed methods and results of the study.

This might direct us to conclude that the mild and moderate levels of WRVD have no effect on the working environment, while the severe WRVD might lead to negative effects for both the employer and the employee. A larger sample size might provide clearer understanding and help in identifying the expected influencing factors of WRVD in Chlorine industry.

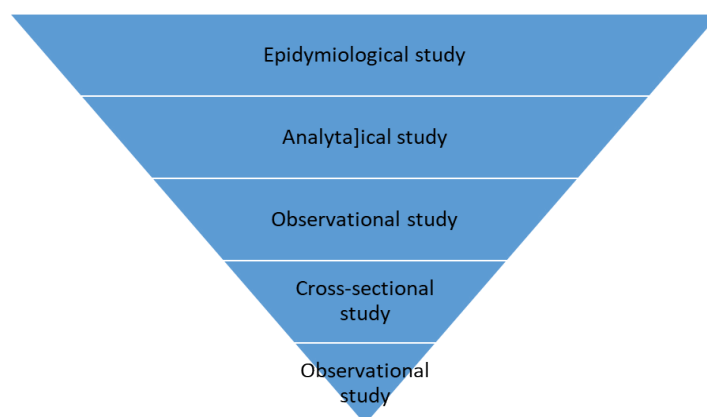


Figure 5. Study design ^[2].

CONCLUSION

The study increased the level of awareness about Occupational VD among OHPs, employers, employees and SLPs. The study highlighted the importance of voice examination within the OI. The study resulted in better evidence-based and transparent decision-making about occupational VD by Ops. Improving access to the voice therapy for workers with occupational voice disorders. The study highlights the importance of examining the vocal health and safety among employees in chlorine manufacturing industry. It is important that the occupational health physician refer employees with occupational voice disorders to the voice therapy. Employees who are at risk of occupational voice disorder can follow a hygienic preventive program and employers might consider enhancing the working environment and the level of awareness about vocal health and safety and following rules and regulations of work-place health and safety.

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