

UNIVERSITI TEKNOLOGI MARA

**RELATIONSHIP BETWEEN
OCCUPATIONAL HAZARDS EXPOSURE
AND RESPIRATORY HEALTH AMONG
SEWAGE WORKERS IN THE
PENINSULAR MALAYSIA**

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ABSTRACT

Occupational lung diseases among sewage workers remain a major health issue given their significant association with exposure to hydrogen sulphide (H₂S) and Particulate Matter 2.5 (PM 2.5) that exist in Sewage Treatment Plants (STPs). Nevertheless, studies that explore the relationship between the exposure duration and the hazard concentration, as well as its effect on respiratory health, are limited. Therefore, this study was performed to investigate the association between occupational hazards exposure and respiratory health among Indah Water Konsortium (IWK) sewage workers. The cross-sectional study was carried out at 11 STPs located in the Peninsular Malaysia involving 191 sewage workers. The participants were assessed via the British Medical Research Council (BMRC) questionnaire and the spirometry test. Moreover, the area air sampling was collected at three different working sites in each STP to evaluate the physical air quality and concentration of PM 2.5 and H₂S. The determinants for the prevalence of work-related respiratory symptoms were identified using the Logistic Regression (LR), while the linear regression analysis was employed to determine the predictors for the deterioration of lung function. The correlation analysis was conducted between the individual cumulative PM 2.5 and H₂S exposures and their effects on the lung function of sewage workers. Based on the results, chronic cough (34.0%) was the most frequent symptom among the sewage workers, followed by chronic phlegm (26.2%), shortness of breath (7.9%), and chest tightness (3.7%). Additionally, workers working at Sludge Treatment Facility (STF) and non-STF sites exhibited a higher H₂S and PM 2.5 exposure compared to office workers. Five significant determinants of the prevalence of respiratory symptoms among sewage workers were identified comprising shift work (Adjusted Odds Ratio (AOR), 95% CI: 23.50, 1.90–616.52), working at an STF site (25.46, 2.06–314.29), a longer working duration (in years) (1.21, 1.01–1.44), and individual cumulative exposure to PM 2.5 (9.01, 1.98–83.33), and H₂S (1.04, 1.01–1.07), respectively. Besides, four final predictors of the lung function deterioration were identified, namely individual cumulative H₂S exposure, workplace safety compliance, history of cardiopulmonary diseases, and daily exposure duration to hazards. Ultimately, the cumulative H₂S exposure recorded a significant negative exposure-response correlation with %FEV1 ($p < 0.001$), %FVC ($p = 0.025$), and FEV1/FVC ratio ($p < 0.001$). In conclusion, the exposure-response relationships were identified between the cumulative PM 2.5 and H₂S exposure and the prevalence of respiratory symptoms and lung function parameters among the IWK sewage worker.

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CHAPTER ONE

INTRODUCTION

1.1 Introduction

Extensive research has been conducted to study the impact of occupational lung diseases, which have become a global concern as it is viewed as a substantial cause of morbidity and mortality. The International Labour Organisation report stated that occupational lung diseases and lung cancers have claimed almost a million death annually (Niu, 2018). In fact, the American Thoracic Society revealed that respiratory disorders were the most frequent occupational diseases among sewage workers (66%), followed by dermatological problems (31%) and noise-induced auditory impairment (3%) (Chandran Achutan, 2003).

Occupational lung disorders have a severe economic impact on workers and industries. One of the possible consequences is reduced labour participation and a shortage of workforce. Given that work-related disability is a major source of labour market exclusion, workers with respiratory disease upon enrolment have a 2.4-fold increased probability of disability pension over the follow-up period in five longitudinal studies (Van Rijn, Robroek, Brouwer, & Burdorf, 2014). As evidenced in the Norwegian disability registry, workers receiving benefits related to respiratory disorders lost a staggering 11 years of work time before reaching the age of 67, signifying the detrimental implication on working careers (Knudsen, Øverland, Hotopf, & Mykletun, 2012). A growing number of studies have pointed out the combined and collateral impact of occupational exposure and respiratory disease on the ability to work. According to the European Community Respiratory Health Survey (ECRHS) II, workers with physician-diagnosed asthma and who are exposed to harmful gases, fumes, or biological dust at their workplace had a 3.5-fold increased risk of switching jobs due to respiratory healthcare concerns over seven years (Toren *et al.*, 2009).

In another study, it was shown that workers with uncontrolled asthma had significantly more sick days and decreased work productivity compared to those with medication-controlled asthma. Additionally, psychological discomfort at the workplace appeared to further amplify the effect of asthma on work performance (Moullec, FitzGerald, Rousseau, Chen, & Sadatsafavi, 2015). The revelation of such evidence