

UNIVERSITI TEKNOLOGI MARA

**ANALYSIS OF VENTILATION
EFFECT ON CHILDREN HEALTH
AT CHILD CARE CENTRES (CCCs)**

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ABSTRACT

Many studies have been conducted to assess the impact of indoor air quality (IAQ) on human's health. However, there is still a lack of literature available on the adverse health effect of children's respiratory health at child care centre (CCC). The goal of the study is to establish a holistic guideline to assist air-conditioning and mechanical ventilation (ACMV) designer, operator and maintenance for a better air quality in child care facilities. Modified American Thoracic Society and the Division of Lung Diseases (ATS-DLD-82) questionnaire was used to gather information from parents regarding their children's respiratory symptoms. IAQ parameters measured were air temperature, humidity, carbon dioxide, carbon monoxide, volatile organic compound (VOC), formaldehyde (HCHO), respirable particles (PM_{2.5}), bacteria and fungi count while information on CCC characteristics and potential surrounding air pollutants were collected via a combination of area monitoring, inspection and interviews. Then followed by the second phase where improvement on ventilation system is proposed at one child care centre. Among 620 respondents, 335 (53.9%) experienced coughing and/or cold and 178 (28.7%) had a productive cough in the last 12 months prior to the interview. Factors found to be significantly associated with respiratory symptoms were child's age, ventilation system, CCC location, floor area and high bacteria concentration. Children attending CCCs supplied with ACMV had the highest risk for persistent productive cough with adjusted odds ratio (AOR) 5.56 (CI 95%: 2.20; 14.00). With all the assumptions for multiple logistic regression had been fulfilled, predictive factors for persistent productive cough were children with age less than two years, ACMV, interaction between ACMV and temperature, and floor area of less than 3.5m². High PM_{2.5} and airborne bacteria concentration may contribute to the factors that trigger respiratory symptom. The result of intervention showed significant reduction for TVOC, HCHO, PM_{2.5} and bacteria concentration in about 61.9%, 63.6%, 84.5% and 30.4% respectively. Cough and/or cold experience among children reduced about 3.1%. The results also indicated positive correlation between bacteria concentration and moisture content in indoor air with observed correlation coefficient (r) of 0.466. This study has provided recommended guideline on ventilation and IAQ at CCC served by ACMV. Apart from that, the study provides baseline data on indoor air quality and root cause that may be influencing indoor air contaminants, which in turn aid policy makers in formulating good guidelines on ventilation and indoor air quality at CCC in Malaysia.

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CHAPTER ONE

INTRODUCTION

1.1 Introduction

Awareness regarding air quality has initially converged on outdoor air until the late 1960s, because outdoor air pollutants have been identified to create many acute and chronic health problems. In 1970, a scientist started to express concern and explored further on indoor environment, as there was a tremendous increment of complaints regarding indoor air quality. The United States Environmental Protection Agency (USEPA) found that exposure to indoor air pollutants are two to five-fold and sometimes more than one hundred folds higher than outdoor air (Zhang, 2004). The quality of indoor is a major public health interest because most of us spend more than 90% of our time inside the buildings. Preschool children spend longer time inside buildings compared to adults (Brasche & Bishof, 2005). By incorporating the concept in the constitution of the World Health Organization (WHO), the definition of indoor air quality is the nature of air that influences the human well-being and perceptions of the occupant. American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE) Standard 62.1-2013 defines acceptable indoor air quality as the air with acceptable levels of harmful concentrations of pollutants as determined by related authorities and in which more than 80% of the occupants are satisfied with the environment. Although there is no strict definition of indoor air quality, it is the term used to describe physical characteristics, chemical characteristics, and airborne constituents of air in buildings, with a special concern for the impact on the occupant's health and comfort. Good indoor air quality can decrease adverse health effects, decrease absenteeism, increase comfort, increase productivity and work performance within indoor environment. On the other hand, poor air quality increases the potential risk of respiratory diseases and infections.