

# CHAPTER I

## INTRODUCTION

### 1.1. BACKGROUND

Smoking has become a worldwide public health problem that still exist to this date. According to World Health Organization (WHO), smoking kills more than 8 million people each year.<sup>1</sup> Moreover, 80% of the world's smokers live in low- and middle-income countries.<sup>1</sup> Indonesia is a middle-income country and continues as one of the highest smoking rates country in the world.<sup>2, 3</sup>

Pneumonia is a lung infection that characterized by the present of microorganisms in the alveolar space and with an accompanying inflammatory response.<sup>4</sup> Currently there are no data provided for the rates of pneumonia globally. However, according to American Lung Association and American Thoracic Society it was estimated 1 million adults were hospitalized in the United States of America because of pneumonia.<sup>5, 6</sup> Cognition comprises the human ability to learn, problem solving, and memorizing.<sup>7</sup> Cognitive state can be graded with the help of Mini-Mental State Examination (MMSE) or Montreal Cognitive Assessment (MoCA) and these two assessment has been used widely among researchers.<sup>8, 9</sup>

A cross-sectional study conducted by Jie Lu et al with 1782 participants age 40 years and older found that smoking is associated with cognitive impairment.<sup>10</sup> Another study conducted by Momtaz YA et al found the association between smoking and cognitive decline in the population of 2553 participants age 60 years old and older.<sup>11</sup> Moreover, several other studies also found the association between smoking and cognitive impairment.<sup>12-15</sup>

On the other side, some studies have shown the association between pneumonia and cognitive impairment. A prospective cohort study conducted by Girard TD et al from January 2010 to June 2012 found that pneumonia

associated with cognitive impairment.<sup>16</sup> Another prospective cohort study conducted by Davydow DS et al with 1474 participants age 50 years old and older found the association between pneumonia and cognitive impairment as well.<sup>17</sup> Moreover, there are several studies that found the relationship between COVID-19 pneumonia and cognitive impairment.<sup>18-21</sup>

However, none exist with a specific focus on the effect of smoking and severity of cognitive impairment in pneumonia patients. Therefore, we proposed this cross-sectional study to investigate the effect of smoking on cognitive impairment severity of pneumonia patients assessed with MMSE and MoCA.

## **1.2. PROBLEM FORMULATION**

The problem formulation for this research is centered around understanding the complex interaction between smoking and cognitive impairment among pneumonia patients. Smoking has been associated with numerous health risks, including cognitive impairment and pneumonia, both of which pose significant health challenges worldwide. However, the precise nature and severity of cognitive impairment among pneumonia patients who smoke remain understudied.

The specific problems the research aims to address are:

1. What is the extent and severity of cognitive impairment, as measured by MMSE and MoCA, among these patients?
2. How does smoking influence the severity of cognitive impairment in pneumonia patients?
3. Are there disparities in MMSE and MoCA scores between smokers and non-smokers within the pneumonia patients?
4. How do other factors (e.g., age, gender, lifestyle status, co-morbidities) impact the relationship between smoking and cognitive impairment?

5. Is there a correlation between the length or intensity of smoking history and the severity of cognitive impairment?

### **1.3. RESEARCH'S OBJECTIVE**

#### General Objectives

The general objective of this research is to explore the influence of smoking on cognitive impairment severity in pneumonia patients. The study will use two standard neuropsychological tests, the MMSE and the MoCA, to assess cognitive function and impairment. The results will offer insights into the cognitive outcomes among pneumonia patients who smoke and provide the groundwork for targeted interventions.

#### Focused Objectives

1. To assess the cognitive function of pneumonia patients using the MMSE and MoCA tests and categorize the severity of cognitive impairment.
2. To investigate the association between smoking and cognitive impairment severity in pneumonia patients.
3. To examine any differences in MMSE and MoCA scores between smokers and non-smokers within the pneumonia patients.
4. To explore potential confounding factors (e.g., age, sex, lifestyle status, co-morbidities) that may influence the relationship between smoking and cognitive impairment.
5. To evaluate the correlation between the length or intensity of smoking history and the severity of cognitive impairment as assessed by MMSE and MoCA.
6. To provide evidence-based recommendations for healthcare interventions targeting smoking cessation among pneumonia patients, considering the potential benefits for cognitive health.

#### 1.4. STATE OF THE ART

As of the current year, 2023, various scientific investigations have explored the complex interconnections among smoking, cognitive impairment, and pneumonia. Nonetheless, an exhaustive and specific exploration into the degree of cognitive impairment due to smoking within pneumonia patients, particularly within the Southeast Asian population, remains an uncharted territory. This research aspires to bridge this knowledge gap.

Past research efforts, including those by Durazzo et al., (2014) and Barnes et al., (2015), have delineated an unsettling correlation between smoking—both active and passive—and cognitive impairment.<sup>22, 23</sup> Additionally, existing literature emphasizes the co-occurrence of more severe cases of pneumonia and a higher incidence of cognitive impairment (Shah et al., 2013).<sup>24</sup>

Moreover, scientific inquiry has begun unearthing the potential biological pathways through which smoking may intensify cognitive impairment, with a particular emphasis on the role of free radicals in harming brain cells and neural tissues (Barnes et al., 2015).<sup>23</sup> Compelling evidence also suggests that smoking could heighten the severity of pneumonia, which may lead to further cognitive decline (Bagaitkar et al., 2008).<sup>25</sup>

There is emerging evidence on the beneficial effects of lifestyle modifications and potential medications in mitigating the cognitive impairment effects associated with smoking, focusing on anti-inflammatory drugs and antioxidants (Anthenelli et al., 2016; Solfrizzi et al., 2018; He et al., 2022).<sup>26-</sup>

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The intricate role of socioeconomic determinants and regional disparities within Southeast Asia in relation to smoking prevalence and cognitive impairment incidence has also been recognized (Furber et al., 2007).<sup>29</sup>

Currently, the field boasts an expanding pool of research suggesting the multifaceted relationship between smoking, cognitive impairment, and pneumonia. However, there is a dearth of focused studies examining the direct effect of smoking on the severity of cognitive impairment in pneumonia patients, utilizing MMSE and MoCA tests as assessment instruments. The proposed research stands at the forefront of progress in this area.

### **1.5. HYPOTHESIS**

Null Hypothesis ( $H_0$ ): There is no significant effect of smoking on cognitive impairment severity in pneumonia patients assessed with MMSE and MoCA.

Alternative Hypothesis ( $H_a$ ): There is a significant effect of smoking on cognitive impairment severity in pneumonia patients assessed with MMSE and MoCA.

In this hypothesis, “smoking” is the independent variable, and “cognitive impairment severity” which represented with MMSE and MoCA score is the dependent variable. The null hypothesis assumes that there is no relationship between smoking and cognitive impairment severity in pneumonia patients, while the alternative hypothesis suggests that there is a significant relationship.