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Development of Tuberculosis Vulnerability Assessment Conceptual Framework Using Automatic Content Analysis

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Abstract. The tuberculosis prevention and control model needs to be explored. This study aimed to create a conceptual framework for measuring TB vulnerability to guide the prevention program's effectiveness. SLR method was employed, resulting in 1.060 articles being analyzed with ACA Leximancer 5.0 and facet analysis. The built framework consists of five components: risk of TB transmission, damage caused by TB, health care facility, the burden of TB, and awareness of TB. Future research is required to explore variables in each component to formulate the degree of TB vulnerability.

Keywords. Tuberculosis, Automatic content analysis, facet analysis, automatic knowledge

1. Introduction

Tuberculosis (TB) is now becoming a health security issue [1]. The cause and treatment of TB are well understood but reaching TB elimination in 2030 still faces challenges [2]. Especially addressing TB prevention control and its association with multidrug resistance problems [3]. Even though the World Health Organization (WHO) released the TB prevention and control guidelines, the result differs for each country [4]. This indicates that each country has a different challenge and needs to overcome the TB burden.

Several publications showed that TB has a negative impact not only on the health but also on the socioeconomic of patients and families [5–7]. As a result, the infection makes people's environment more vulnerable and vice versa. Understanding the vulnerability will help guide the program effectively [8,9]. But the measurement of TB vulnerability is still not well developed.

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This study aimed to develop the TB vulnerability assessment conceptual framework with Automatic Content Analysis (ACA) to address the knowledge gap. Compared to others research, the use of ACA offers a new approach to public health research.

2. Method

This study employed a systematic literature review method (SLR). The search query was based on Medical Subject Heading (MeSH) on TB prevention and control. The PubMed database was chosen as the source of publication because considered an extensive resource for biomedical and health field literature. The inclusion criteria were published in English in the past 10 years (2012-2023), and any form of research articles in journals and conferences. Letter, correspondence, and short communication were excluded.

The 1.060 articles were analyzed by the Leximancer 5.0 to help automate the process and eliminate the bias and subjectivity of researchers in analyzing the data. Themes and concepts were automated by the text mining software Leximancer according to the degree of relationship between concepts and the frequency with which key-related terms of concepts and documents appear in close proximity in the text. This process has been described as spatial and relational analysis performed to determine semantic network relevance [10]. Once the analysis is completed, we set the configuration settings for the theme generation size, in the matter of theme size. This configuration influences the number of constructed themes. We got the optimal percentage of theme size was 32%. This consideration is based on the results of the resulting themes numbers. Neither too much nor too little.

Furthermore, we used facet analysis to build the tuberculosis vulnerability assessment framework. Specific criteria to perform facet analysis was that the concept listed in the topic guide represents a subject index for an extensive document collection. The second is listed concepts that are not topic-specific or highly related to research and writing terminologies, such as conjunctions, verbs, or adjectives.

This resulting concept collection is then organized into a logical classification, written as hierarchical structures. It is the process performed to construct tuberculosis prevention and control facets. Every structure represents a distinct aspect of a story related to the topic under discussion. Several alternative methods exist to develop a facet: drawing from Leximancer's topic guide as it is (clear description); structuring several concepts into a make-sense facet (need analysis), and digging deeper into sub-concepts to attain the meaning (need deeper analysis) [11].

3. Result and Discussion

Based on the heat map the Leximancer produced five main themes: *tuberculosis, patients, health, rate,* and *information*. The concept of *tuberculosis* showed that the study topic included tuberculosis risk of transmission and the burden for patients' therapy on tuberculosis infection, this theme represents to risk of tuberculosis transmission.

The second theme patients built by the concepts of patients, treatment, screening, diagnosis, factors, drugs, associated, and household. The theme also related to cost theme, which can be interpreted as a study that has been performed on the cost impact on patients' need to get access to diagnosis, treatment, and other medical stuff. This theme is related to damage caused by tuberculosis. The third theme was health which consists

of health, care, workers, facilities, public, and services. That means the study was about the healthcare facilities related to tuberculosis services, health workers including community health workers, private and public health facilities. This theme represents healthcare facilities.

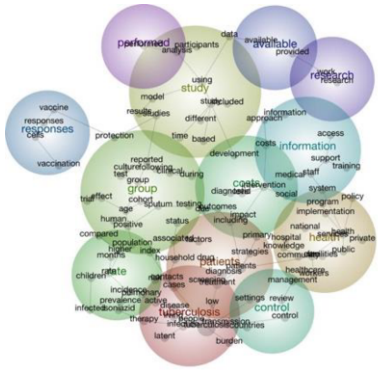

Figure 1. Concept Map

The fourth theme was rate which built on the concept of rate, children, incidence, population, isoniazid, higher, months, pulmonary, compared, prevalence, index, and infected. This concept showed that the study related to the rate of tuberculosis was about the incidence rate in population and children, the rate of prevention therapy with isoniazid, and the index of tuberculosis infection. This theme represented the burden of tuberculosis. The fifth theme was information, built by the concept: information, support, staff, access, medical, approach, and training. It can be interpreted that research on tuberculosis in the theme of information has been focusing on how to access medical help, training for staff to deliver information in the community, and the use education approach. This theme represents the awareness of tuberculosis.

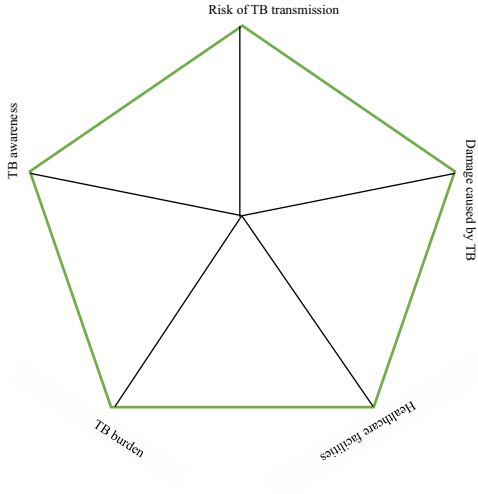

Figure 2. TB Vulnerability Assessment Conceptual Framework

Based on the result above, we developed a tuberculosis vulnerability assessment conceptual framework (see Figure 2). The framework consists of five components: risk of tuberculosis transmission, damage caused by tuberculosis, health care facility, the

burden of tuberculosis, and awareness of tuberculosis. Each component builds by several variables that will represent the degree of the component. We used a scale of 1 to 5 to measure the contribution from each component and connect it to each component. The connection of each component will build the degree of TB vulnerability. This proposed framework has more complex components for measuring vulnerability than other frameworks [12]. Future research will be performed to explore each component measurement and build the degree of TB vulnerability.

4. Conclusion

This study has been limited only to journal papers. Other sources that may be relevant to this topic were not included. This may affect the framework component results. However, to reduce the bias and subjectivity, we used automatization in qualitative data analysis using ACA and qualitative data interpretation using facet analysis. This framework will help to measure TB vulnerability and build the TB program based on the field's needs.

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