INVITED PAPER
글로벌 건강과 간호 제10권 제1호, 2020년 1월
Global Health Nurs Vol. 10 No. 1, 1-3, January 2020
pISSN 2233-5560
eISSN 2671-5554
https://doi.org/10.35144/ghn.2020.10.1.1

Nurses Drive Change in TB Control

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Despite continuous effort to eradicate tuberculosis (TB), TB is still the leading cause of infectious disease-related deaths worldwide [1]. It is a chronic disease caused by the *Mycobacterium tuberculosis* (Mtb) and transmitted from an infected person to a susceptible person through airborne particles. Although TB commonly affects the lungs, it can also affect other parts of the body, such as the brain, the kidneys, or the spine [2]. In many low- and middle-income countries, the incidence of TB is fueled by malnutrition, poor hygiene, overcrowded living condition, smoking, air pollution, human immunodeficiency virus (HIV) epidemic, social deprivation, and poor social capital. According to the most recent report from the World Health Organization (WHO), there were more than 10.4 million new TB cases, 1.0 million (approximately 10%) of these were among people living with HIV in 2017 [1]. Also, there were 1.3 million deaths from TB among HIV uninfected people (additional 374,000 deaths from HIV infected people), and about 82% TB deaths occurred in Asia and Africa regions [1].

1. Hidden Risks in Global Burden of TB

There are two types of TB associated conditions: latent TB infection and active TB disease. Latent TB infection (LTBI) is a state of persistent immune response stimulated by Mtb antigens exposure without clinical signs or symptoms of active TB disease [3]; whereas TB disease is a state that Mtb bacteria perturb the host immune system and begins to multiply, leading to TB associated symptom development and TB transmission to others [2]. After close contact with an individual with active pulmonary TB, most people develop LTBI. The best estimate is about one-quarter of the world's population has latent TB. People with immunocompromising conditions (e.g., HIV co-infection, children under 5 years of age, advanced age, diabetes, immunomodulatory drug use, or organ transplant, etc.) have increased risk of progression from LTBI to TB disease. Regular TB testing-using either tuberculin skin test (TST) or Interferon Gamma Release Assay (IGRA)-and preventive treatment are strongly recommended for those who have an increased risk of TB disease. However, the definitive diagnosis of LTBI is complicated and requires a thorough history taking due to its asymptomatic conditions [4].

Globalization influences refugee migration patterns, affecting TB control in receiving countries by significantly increasing disease burden and workload [5]. Poor living environment and scarce nutritious food resources in refugee camps increase the risk of TB infection and progression. Such displaced populations have special health needs and experience difficulties for accessing health care services due to language, stigmatization, poor cultural awareness, psychological distress, disruption of families and social networks, and economic difficulties [5]. There is no global standard for screening of TB and/or other infectious disease in displaced population entering another country. Asylum seekers rarely have a predetermined address for further follow-up surveillance or treatment even after TB case detection. To achieve health equity and to reach the Millennium Development Goals, a comprehensive TB control strategy needs to evaluate the needs of displaced persons, available services, and barriers to access [5]. Furthermore, for children, BCG vaccination should be considered as a part of the national childhood immunization program based on a country's TB epidemiology.

2. Challenges in TB Control

Although rapid and accurate detection of TB is a key to guide treatment, case detection rate remains low in most high TB burden counties. Case detection mostly relies on patient's presentation and self-reported symptoms to a health care facility, which delays access to effective treat-

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Received: Nov 12, 2019 | Accepted: Dec 30, 2019

ment and thus results in increased opportunity for transmission [6]. In addition, the confirmatory TB test is a lengthy process. Sputum microscopy is widely used to identify Mtb acid-fast bacilli despite low sensitivity. An advanced diagnostic technology-a polymerase chain reaction (PCR)-based nucleic acid amplification test-detects a high proportion of smear-negative cases and the presence of genetic markers for rifampicin resistance in less than two hours, but usage is limited in many TB facilities because of its cost. Sputum culture as a gold standard takes at least six to eight weeks to provide confirmative test results along with drug susceptibility of TB bacteria. Such a lengthy and costly diagnostic process hinders early detection of TB cases and drives the transmission of TB in communities.

Despite advances in TB treatment, the incidence of TB resistant to the first-line anti-TB drugs (i.e., isoniazid and rifampicin)--also known as drug-resistant TB (DR-TB)-is dramatically growing. DR-TB often occurs when patients stop their TB treatment prematurely or health care providers inadvertently prescribed the wrong treatment. Only about 50% of patients worldwide complete their TB treatment as prescribed, and one major challenge is promoting adherence to the 6~8 drug cocktail required for treatment for at least 9 months or longer [1]. Particularly in HIV endemic countries, co-morbidity adds to the already extensive medication burden of DR-TB and HIV treatment. Adherence to TB treatment is crucial to maximize bactericidal activities of anti-TB drugs, achieve cure and avoid drug resistance, relapse or death.

International and/or national funding for TB control continues to fall short of what is needed. Globally, the available funds range from US$ 6~7 billion since 2014; while about US$ 8 billion per year are required for TB prevention, diagnosis and treatment [1]. Funding for TB research and development of the tools, such as new drugs, diagnostics, and vaccines, is severely inadequate, while drug resistance threatens to further destabilize the pandemic. The current TB drug classes were almost all discovered between the 1940s and the 1970s, and only a couple of new TB drugs (i.e., bedaquiline and delamanid) have entered clinical practice in the past 40 years [7]. Due to a loss for TB drug research in the pharmaceutical industry, the TB field no longer benefits from development of new drug candidates [8]. There is no doubt that new TB treatments, consisting of shorter, simpler, and affordable regimens are desperately needed.

3. Nurse's Efforts to End TB

As healthcare personnel providing direct treatment and overseeing patients' symptoms and treatment responses, nurses are at the forefront of TB control. As mentioned earlier, TB is treated with four to six antimicrobial drugs, and treatment is prolonged (at least 6 to 9 months). The majority of TB cases can be cured when appropriate TB drugs are provided and taken properly, but treatment adherence is extremely challenging. Thus, a trained nurse should provide appropriate health care information and supervision to the patient on a regular basis to maximize treatment adherence. Directly Observed Therapy (DOT) is one strategy to ensure the prescribed course of medication is administered to the patient or taken by the patient under direct observation by healthcare workers (i.e., a patient may come TB clinic or visit made to patients' houses)[9]. DOT is especially critical and effective for those with DR-TB, HIV co-infection and those on intermittent treatment regimens (i.e., two to three times a week). In many national TB programs, trained public health nurses or nurse case managers are considered as the best-qualified healthcare personnel to provide DOT. Nurses do not just deliver the prescribed medication and watch the patient swallow the medication, but they also check for adverse drug reactions, document treatment progress, and provide ongoing patient/family education. Since many TB patients experience financial difficulties, nurse case managers can connect them with social services or transportation and offer incentives. Additionally, nursing research can be applied from the bedside to the community, inspiring nurse researchers to ask new questions, evaluate the effectiveness of nursing interventions and consider future directions for improved TB care and outcomes. Farley et al. [10] found that the provider adherence to national TB and HIV treatment guidelines was distinctively improved by nurse case management in South Africa. His further studies found that the nurse case management approach led to significant improvements in TB disease management and outcomes by showing greater treatment success rates than the South African national average ($z=3.70$, $p<.001$) [11]. TB control demands not only medical treatment but also comprehensive social and cultural attention. In this complex situation, nurses are the first point of contact a patient will have when seeking health care. Also, nurses are the main cadre of health professionals worldwide providing and overseeing a patient's daily care [12]. Thus, we argue that scaling up nursing roles in TB management as well as involvement in key policy and decision making is the cornerstone of effective TB control. To make this possible, it is necessary to provide an empowerment-oriented nursing education program emerged through the presence of policy entrepreneurs with access to resources.

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