AN OVERVIEW TUBERCULOSIS INFECTION; EPIDEMIOLOGY, PREVENTION, AND SURVEILLANCE

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Abstract:
Since the beginning of recorded history, people have been afflicted by tuberculosis (TB), which is linked to a number of factors including poverty, starvation, overcrowding, and impairment of immune function. To ensure that the objective of eliminating tuberculosis (TB) is achieved in a continuous manner, it is essential to have a solid understanding of the present monitoring activities as well as the problems that are being faced. Despite the fact that the global incidence rate of tuberculosis remains low, there is an urgent need for further initiatives to further reduce the disease's prevalence. At this point in time, the most important thing is to make sure that all of the vital components of the monitoring system are improved.

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Introduction:

Humans have been afflicted with tuberculosis (TB), an infectious disease that has been around for thousands of years and is caused by the bacillus Mycobacterium tuberculosis. It is the leading cause of death by a single infectious agent, ranking higher than HIV/AIDS among the major causes of death worldwide. It is the ninth leading cause of death worldwide. According to the World Health Organization (WHO), tuberculosis (TB) is a disease that affects about millions of people every year [1]. Through coughs, sneezes, and spit, tuberculosis can be transmitted from an infected person to a healthy person through the air.

According to estimates, ten million people around the world became infected with tuberculosis in the year 2017. There were 63 deaths for every 100,000 individuals in China, making it one of the 30 countries with a significant burden of tuberculosis (TB). China accounted for nine percent of all TB cases. South Africa, Mozambique, and the Philippines are the three countries that have the largest burden of tuberculosis, with more than 500 cases of the disease for every 100,000 inhabitants in each of these countries. Specific targets for 2030 that are outlined in the End Tuberculosis Strategy would result in a reduction of ninety percent in the total number of fatalities caused by tuberculosis and eighty percent in the incidence of tuberculosis (new cases per 100,000 persons per year) when compared with those in 2015 [1].

In individuals living with HIV (PWH), tuberculosis is the primary cause of death on a global scale. The advancement of tuberculosis disease in people who are pregnant or who are breastfeeding is effectively prevented by tuberculosis preventative treatment (TPT) [1], particularly in individuals who screen positive for latent tuberculosis infection (LTBI] [2]. As a result, the World Health Organization (WHO) suggests that tuberculosis testing (TPT) be administered to all people who have a positive screening result, provided that TB illness has been ruled out [3]. LTBI testing with the tuberculin skin test (TST) and/or the interferon gamma release assay (IGRA) is typically recommended in countries with a low incidence of tuberculosis (TB), and it is frequently administered selectively to those who are considered to be at a higher risk, such as immigrants [4]. On the other hand, a survey conducted among countries with a low TB burden revealed that only 75% of them had a national policy on LTBI, and that an additional 66% offered LTBI testing and treatment for people with HIV [5].

Review:

Patients who are infected with M. tuberculosis, patients who are unwell, and patients who have passed away can be distinguished from one another using the "iceberg" epidemiological model. people who are unwell or have passed away, often known as the tip of the iceberg, are simple to identify. On the other hand, it is challenging to identify people who are infected, which would require testing the entire population. The concealed and greater portion of the iceberg is represented by these patients who are infected. The tuberculin skin test conversion is one method that a clinician can use to determine tuberculosis infection. This method is utilized in the context of contact tracing. During the first few years following infection, people who are infected have the highest likelihood of acquiring tuberculosis (exogenous TB infection), which is approximately 5%. Additionally, another 5% of patients could develop tuberculosis during their lifetime, which is known as endogenous TB reactivation. Therefore, an increase in the number of people who are infected with tuberculosis will result in an increase in the number of future instances of tuberculosis, some of which will have severe clinical manifestations, such as meningitis caused by tuberculosis. A pediatrician plays a significant role in the early detection of tuberculosis (TB) infection and disease during childhood. Additionally, a pediatrician is responsible for ensuring that a kid adheres to an appropriate TB treatment regimen in order to prevent additional difficulties that may be experienced by the child throughout his or her whole life or possibly lead to the child's death at an earlier age. When it comes to sick people, the fatality rate of tuberculosis must always be less than one percent [6].

The pulmonary type of tuberculosis is the most prevalent clinical presentation of the disease because it is transmitted through the airways. On the other hand, around fifteen percent of M. tuberculosis infections are extrapulmonary and do not involve concomitant pulmonary symptoms. This presents difficulties in both diagnostic and treatment procedures. An additional hard component of tuberculosis is the emergence of drug-resistant strains of the disease, most notably multidrug-resistant tuberculosis (MDR-TB), which presents a critical obstacle. In 2017, there were 558,000 new cases of tuberculosis that were resistant to rifampicin that were reported all over the world, with 82% becoming multidrug-resistant tuberculosis. Additional factors that contribute to treatment failures include delayed diagnosis, insufficient pharmacological access, and noncompliance on the part of the patient [7].

With the goal of putting an end to the tuberculosis epidemic by the year 2035, the World Health Organization (WHO) launched the end-TB plan in 2014. There are five-year milestones (2020, 2025, and 2030) and annual targets (a reduction in tuberculosis incidence of between four and five percent compared to the preceding year) that are included in this approach. The implementation of these aims is intended to take place at the national level [8]. As a consequence of this, the incidence of tuberculosis over the world started to gradually decrease at a pace of around 2% each year [6].

1970 marked the beginning of tuberculosis (TB) surveillance and reporting in Saudi Arabia, which at the time had a transmission rate of 1298.5 cases per 100,000 people. Following this, there was a gradual decrease in the incidence of tuberculosis, which reached 135 per 100,000 in 1980 and then dropped to 12 per 100,000 in 1997. The incidence of tuberculosis, on the other hand, reached a plateau between the years 2000 and 2009, amounting to roughly 15-16 instances per 100,000 people, while the total number of incident cases increased from 3,284 to 3,964 [8,9].

It is possible to trace the decrease in the incidence of tuberculosis to the adoption of vaccination programs as well as improvements in access to health services.8. Furthermore, in response to a call from the World Health Organization (WHO), the Saudi government increased the scope of the national tuberculosis control program (NTCP), which was already in place, in order to match it with the objectives and benchmarks of the end-TB plan. However, despite designated as a "low-to-middle TB burden country", Saudi Arabia possesses distinct qualities that could threaten the strategy's effectiveness. It is important to note that the annual influx of millions of pilgrims and the increased mobility of the population both contribute to the increased spread of tuberculosis [9,10].

Over the course of the last ten years, countries in the Middle East and Gulf region have also reported positive results regarding tuberculosis diagnostic indicators. As an illustration, the prevalence of tuberculosis (TB) in Oman decreased by an average of 5.7% annually during the years 2011 and 2016. In a similar vein, research conducted in Bahrain revealed a substantial reduction in the incidence of tuberculosis, which went from 34 per 100,000 in 2007 to 11 per 100,000 in 2016, with annual drops reaching up to 26.7% depending on the year. During the same time period, 2015-2019, the incidence of tuberculosis in the United Arab Emirates went from 0.78 to 1 per 100,000 people [11,12]. This is a reasonably significant increase.

In terms of mortality and disability adjusted life years (DALYs), the impact of tuberculosis (TB) on young age groups in Saudi Arabia was roughly equivalent to that of North America and Western Europe between the years 2015 and 2018. However, the impact of TB on Saudi Arabia was consistently and significantly lower than that of Asian countries. On the other hand, as of the year 2018, a little increase in the number of young people diagnosed with tuberculosis was observed among the younger demographics in Saudi Arabia, which is in agreement with our findings.4. This highlights how important it is to anticipate the future threat of tuberculosis in children by addressing growing risk factors such as the HIV epidemic or environmental exposure. The increased ratio of native-to-immigrant cases, on the other hand, may be the result of continuous reforms in foreign labor restrictions taken by the country. These policies are in line with the national plan to prioritize the Saudization of the workforce [13].

The declining trend in tuberculosis resistance to the prominent anti-TB medications was another discovery that was interesting to note. As a result of this, the incidence of intermediate sensitivity dropped across all five anti-TB medications, which led to a considerable reduction in the prevalence of PDR and MDR by nearly fifty percent between the years 2015 and 2019. Isoniazid (10.2%), ethambutol (3.8%), rifampicin (5.9%), and streptomycin (11.0%) were all found to have greater rates of resistance in the last national statistics from 2014-2015. It is necessary to have high levels of coordination, strategic planning, and effective clinical practice in order to combat drug-resistant tuberculosis, which is a recently emerging global problem that poses a threat to the outcomes of patients and healthcare systems. Moreover, individuals who have strains that are resistant or multidrug-resistant have a higher risk of treatment failure and are required to undergo treatment for a longer period of time. As a result, the better national data on drug resistance indicates that tuberculosis control has been improved, and it also presents a chance to further enhance the success of the national program [14.15].

The tuberculosis (TB) continues to be a global public health problem and the second most prevalent cause of mortality by an infectious agent in the world, following HIV. This is despite the fact that there is a wealth of knowledge about the natural history of the illness and that enough medications are available to treat the majority of patients. In 2008, the World Health Organization (WHO) reported that there were more than 9

million cases reported all over the world, with an incidence of 139 cases per 100,000 persons, which is somewhat lower than the incidence in 2007. Approximately fifty-five percent of these instances are recorded in Asia, while thirty-one percent are reported in Africa. Additionally, five nations account for fifty percent of the total number of cases: India, China, Indonesia, Nigeria, and South Africa. Four million of the newly diagnosed cases are smear-positive, which corresponds to an incidence of 61 per 100,000 people. Additionally, nearly one and a half million people are infected with HIV, with eighty percent of them residing in Africa. The global incidence rate started to decrease in 2004, with an annual decline of less than one percent [16]. This is despite the fact that the absolute number of cases is increasing in tandem with the growing total population around the world.

In spite of the fact that extrapulmonary (EP) forms of tuberculosis have become more prevalent in recent years among HIV-positive individuals and even more recently among various diverse groups of immigrants, pulmonary tuberculosis remains the most prevalent type of the disease. Due to the fact that isolated non-pulmonary illness is not communicable, pulmonary emphysema (EP TB) is more of a clinical problem than a public health problem. On the other hand, between six percent and twenty percent of patients who have EP TB also have an active lung infection. Furthermore, it is worth noting that around twenty percent of patients diagnosed with EP illness may have a positive sputum culture and forty percent of them may have a positive sputum smear, even when the chest X-ray findings are normal or not worrisome [17,18].

Over the course of the past ten years, a number of studies conducted in countries located in Europe, North America, and Asia have revealed that between 12 and 53 percent of tuberculosis patients present with a significant form of EP TB. Not only does the presence of well-characterized risk factors within the population play a role in determining the variability of EP TB, but the definitions, as well, play a role in this variability. Patients who have simultaneous pulmonary involvement, intrathoracic lymphadenopathy, pleurisy, or miliary illness, for instance, might or might not be included in the study. Due to a disproportionally slower drop in EP rates in comparison to pulmonary TB1 rates, longitudinal studies carried out in industrialized nations have demonstrated that the proportion of cases of ephemeral pulmonary disease (EP) has either stayed stable or continued to increase over the course of time. It's possible that this can be explained, at least in part, by the increasing number of people having ethnic backgrounds that are not European who are living in industrialized countries. On the other hand, there is a possibility that a new dynamic of disease reactivation comes into play, in which EP forms become more prevalent over the course of time since infection. It is important for doctors to be aware of this trend in order to appropriately diagnose end-stage tuberculosis (EP TB) among both certain high-risk groups and the native population. This is despite the fact that TB control is increasing. It was during the 1990s, when the incidence and mortality rates of tuberculosis continued to rise, that the current worldwide plan for tuberculosis control was initiated. In order to achieve the goal of curing more than 85 percent of tuberculosis patients, the World Health Organization (WHO) developed a strategy known as "Directly Observed Treatment, Short Course" (DOTS). This policy mandates that every nation must identify instances of smear-positive tuberculosis and provide standardized DOT.

In spite of this, interventions that are aimed at improving the quality of life and health in general, such as improved housing, better diet, or lowering smoking, will also have an effect on the transmission of infections and the likelihood of disease development, regardless of whether or not DOTS is implemented. More specifically, enhanced socio-economic development was found to be the primary factor in explaining better TB evolution in the majority of countries, according to an analysis of the impact of particular actions for tuberculosis control in comparison to general country development characteristics (such as improved healthcare and economic growth, among other things) [20].

Despite the fact that the Global Plan calls for a coalition of different organizations to provide a variety of interventions that can be adopted, there has been a lot of criticism on how difficult it is to implement. The maintenance of the political commitment, the competition with other priorities, the risk of HIV, the quality of patient management to prevent medication resistance, the capacity to build human resources, the enhancement of diagnostic quality, and the promotion of operation research are some of the problems that must be overcome. Additionally, it is necessary to take into consideration the modification of field operations as well as the quantity and quality of information. A comprehensive understanding of the local tuberculosis situation, an acceptable evaluation system of control operations, and a surveillance

system that is operational are all necessary components for the implementation of the proper approach. In countries with a high incidence of tuberculosis, there is a significant amount of uncertainty regarding the indicators that are used to monitor progress toward the objectives of the Global Plan [21,22].

Conclusion:

An additional factor that should be taken into consideration in a situation with a low burden is the absence of clinical suspicion in the presence of symptoms that are compatible. When seen from the standpoint of public health, this results in an increase in diagnostic delays, the amount of time it takes for transmission, and the risk of epidemic outbreaks, particularly those that harm children. In the past few years, there has been a dramatic decrease in the incidence of tuberculosis, which has allowed the World Health Organization to reach its milestones and estimate that the end-TB goals would be achieved by the year 2035. There is also reason to be positive about the dramatic reduction in drug resistance, particularly multidrug resistance (MDR), which is a reflection of the improved prevention, diagnostic, and treatment practices. In addition, the characteristics of the tuberculosis epidemic are evolving, with a shifting focus towards younger age groups, cases of autochthonous transmission, and the sneaky danger of HIV coinfection. The changes that have taken place are a reflection of a transformation in society as well as other behavioral and environmental elements. They also foretell new challenges that need for an immediate and visionary plan.

References:

1. WHO. Global tuberculosis report 2022. Geneva: WHO, 2022.
2. Ayele HT, Mourik MS, Debray TP, Bonten MJ. Isoniazid prophylactic therapy for the prevention of tuberculosis in HIV-infected adults: a systematic review and meta-analysis of randomized trials. *PLoS One* 2015; 10:e0142290.
3. WHO. WHO consolidated guidelines on tuberculosis. Module 2: Screening - systematic screening for tuberculosis disease. Geneva: WHO, 2021.
4. de Vries G, van de Berg S, van Dam A, Hasanova S, Pareek M, van der Werf MJ, et al.. Collaborative tuberculosis/HIV activities in the European region. *ERJ Open Res* 2021; 7:00721-2020.
5. Hamada Y, Sidibe A, Matteelli A, Dadu A, Aziz MA, Del Granado M, et al.. Policies and practices on the programmatic management of latent tuberculous infection: global survey. *Int J Tuberc Lung Dis* 2016; 20:1566–1571.
6. Moule MG, Cirillo JD.. *Mycobacterium tuberculosis* dissemination plays a critical role in pathogenesis. *Front Cell Infect Microbiol* 2020; 10: 65.
7. World Health Organization. Stop tuberculosis.. Available from: https://www.emro.who.int/tuberculosis/infocus/world-tuberculosis-day-2011-campaign-on-the-move-against-tuberculosis.html
8. Singh R, Dwivedi SP, Gaharwar US, Meena R, Rajamani P, Prasad T.. Recent updates on drug resistance in *Mycobacterium tuberculosis*. *J Appl Microbiol* 2020; 128: 1547-1567.
9. Uplekar M, Raviglione M.. WHO's end TB strategy: from stopping to ending the global TB epidemic. *Indian J Tuberc*2015; 62: 196-199.
10. Yezli S, Memish ZA.. Tuberculosis in Saudi Arabia: prevalence and antimicrobial resistance. *J Chemother* 2012; 24: 1-5.
11. Abouzeid MS, Zumla AI, Felemban S, Alotaibi B, O'Grady J, Memish ZA.. Tuberculosis trends in Saudis and non-Saudis in the Kingdom of Saudi Arabia--a 10 year retrospective study (2000-2009). *PLoS One* 2012; 7: e39478.
12. National Library of Medicine. WHO consolidated guidelines on tuberculosis: Module 2: screening - systematic screening for tuberculosis disease.. Available from: https://www.ncbi.nlm.nih.gov/books/NBK569338/
13. World Health Organization. Global tuberculosis report.. Available from: https://apps.who.int/iris/rest/bitstreams/1312164/retrieve
14. Al Awaidy ST. Tuberculosis elimination in Oman: winning the war on the disease. *ERJ Open Res* 2018; 4: 00121-02018.
15. AlKhawaja S, Al Romaihi E, Al Jowder W, Abd El Moez Azam F, Saeed NK.. Epidemiology of tuberculosis in Bahrain and pre-employment screening. *J Tuberc Ther* 2018; 3: 113-114.
16. Al-Mozaini MA, Mansour MK, Al-Hokail AA, Mohmed MA, Daham MA, Al-Abdely HM, et al.. HIV-care outcome in Saudi Arabia; a longitudinal cohort. *J AIDS Clin Res* 2014; 5: 370.
17. Al Ammari M, Al Turaiki A, Al Essa M, Kashkary AM, Eltigani SA, Ahmed AE.. Drug resistant tuberculosis in Saudi Arabia: an analysis of surveillance data 2014-2015. *Antimicrob Resist Infect Control* 2018; 7: 12.

18. Mirzayev F, Viney K, Linh NN, Gonzalez-Angulo L, Gegia M, Jaramillo E, et al.. World Health Organization recommendations on the treatment of drug-resistant tuberculosis, 2020 update. *Eur Respir J* 2021; 57: 2003300.
19. Knight GM, McQuaid CF, Dodd PJ, Houben RMGJ.. Global burden of latent multidrug-resistant tuberculosis: trends and estimates based on mathematical modelling. *Lancet Infect Dis* 2019; 19: 903-912.
20. Lan Z, Ahmad N, Baghaei P, Barkane L, Benedetti A, Brode SK, et al.. Drug-associated adverse events in the treatment of multidrug-resistant tuberculosis: an individual patient data meta-analysis. *Lancet Respir Med* 2020; 8: 383-394.
21. Mota L, Al-Efraij K, Campbell JR, Cook VJ, Marra F, Johnston J.. Therapeutic drug monitoring in anti-tuberculosis treatment: a systematic review and meta-analysis. *Int J Tuberc Lung Dis* 2016; 20: 819-826.
22. Nathavitharana RR, Lederer P, Tierney DB, Nardell E.. Treatment as prevention and other interventions to reduce transmission of multidrug-resistant tuberculosis. *Int J Tuberc Lung Dis* 2019; 23: 396-404.