

Editorial

Tuberculosis load: reflections on a theme

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Pathogenic organisms, as part of a natural process, interact with the environment, searching for dynamic stability as well as for their ecological niches, whether internal or external to other organisms.

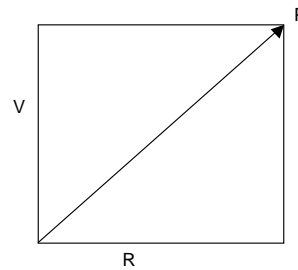
Elucidating the complexity of these interrelationships poses a real challenge for epidemiologists. Quantitative theoretical analysis has been insufficient because of the limitation imposed by questions such as “How much?” “Where?” and “Which one?” Although they succeed in quantifying, categorizing and correlating, the answers to these questions do not always provide a satisfactory explanation of the process. There is a real need for queries such as “Why?” and “How?”, representing the targets of qualitative methodology, which is an in-depth, holistic approach and encompasses interdisciplinary thinking, abstract meanings and subtle implications.

Answers to many questions related to the pathogenicity of tuberculosis may be found in quantitative analysis. Nevertheless, the dynamics of tuberculosis cannot be fully understood without also taking a qualitative approach. As an exercise, let us examine the disease and its dynamics.

The pathogenic power of an infectious disease has long been defined as a function of microbe virulence (V) and the resistance (R) of the infected organism, interrelated as follows:

$$V = \frac{1}{R}$$

Bier⁽¹⁾ pointed out that the pathogenicity (P) of the process should be a joint function of these two components. If we represent V and R as perpendicular vectors, the pathogenicity would be expressed by the angle of the vector resulting from the sum of the two, as represented in the diagram below:



Theobald Smith suggests the “formula”:

$$P = \frac{N.V}{R}$$

where N is the number of germs that penetrate the organism.

Rich adds yet another component: the tuberculin allergy, whose necrosis potential could aggravate the lesion. Therefore, the “formula” would be:

$$P = \frac{N.V.H}{R}$$

If we understand resistance (R) as being natural (n) or acquired (a), we would have:

$$P = \frac{N.V.H}{R(n + a)}$$

The expression above, which is well established in the literature,⁽²⁾ has the sole function of facilitating the analysis of pathogenicity. However, because it contains variables of a qualitative nature, it cannot be treated as a mathematical

expression that generates numerical solutions. Many hypotheses have been proposed in attempts to explain the physiopathology and immunity of TB. It has been suggested that the type of immune response (whether Th1 or Th2) is crucial. In addition, Beyer et al.⁽²⁾ emphasized the roles played by IL-4 and IL-12, Speller & Edwards⁽³⁾ suggested that IL-2 and INF- γ are involved, and Ellner⁽⁴⁾ implicated CD4 T cells, macrophages, IL-1, IL-6 and TNF- α . Nevertheless, certain questions pertaining to the human immunity to tuberculosis have yet to be answered. The most intriguing finding is that only 10% to 20% of the people infected with Mtb develop the disease, which means that 80% to 90% of those individuals are somehow protected. Why? On the other hand, it is important to point out that, in the case of TB, we can safely rely on easily performed diagnostic techniques and drug therapy regimens that have proven effective.

THE TUBERCULOSIS BURDEN

The World Health Organization (WHO) has recently declared tuberculosis to be a “global health emergency”, based on the finding that one-third of the world population has been infected⁽⁵⁾. The WHO, acknowledging its need for assistance in dealing with the question of TB control, has created a program called STOP TB. This program is a partnership among the WHO, the World Bank, the International Union Against Tuberculosis and Lung Disease, the Centers for Disease Control (Atlanta, GA, USA), the Royal Netherlands Tuberculosis Association and the American Thoracic Society.

This might be an opportune moment to re-examine the formulas previously shown and add or modify some of their components in order to propose new perspectives from which to view the tuberculosis burden as a global public health concern.

If an expression was previously used in order to present pathogenicity, the same could be done here, suggesting that the tuberculosis burden (Tb) be expressed as:

$$CTb \approx \frac{(DSOC).(PHIV).(PABT)(PR).(MMIG).(EPOP).)}{(DOSS).(DOT).N(EDU + NUT).(RHSS).(GPP)}$$

Notably, the most important of all components is social inequality, since poverty results in malnutrition, inadequate living conditions, limited education, etc., thereby influencing most of the other components.

We must also highlight the fact that the incidence of primary resistance is indicative of an epidemiological aggravating factor that is more significant than that of acquired resistance. In applying the expression above, we must bear in mind the fact that it does not generate numerical solutions but only facilitates our consideration of the problem.

The WHO estimated that 80% of all tuberculosis cases in the world are concentrated in 22 countries:⁽⁶⁾ India, China, Indonesia, Bangladesh, Pakistan, Nigeria, the Philippines, South Africa, Ethiopia, Vietnam, Russia, the Democratic Republic of Congo, Brazil, Tanzania, Kenya, Thailand, Myanmar, Afghanistan, Uganda, Peru, Zimbabwe and Cambodia. We can immediately perceive that, in some countries, the problem may be located at the numerator level, at the denominator level in others, and at both levels in some cases.

In Russia, the question of high incidence of multidrug-resistance is a matter of pressing concern. In African countries, all the components of both the numerator and the denominator are highly influential. Brazil may represent an intermediate situation, since the problem of multidrug-resistance is, for now, a minor one, although social inequality is pronounced and the other components of the formula are in flux. In Peru, there has been a subtle but progressive reduction in the tuberculosis burden over the past few years as a result of a reorganization of public health services, specifically in the tuberculosis field, involving implementation of supervised treatment, which has reduced the percentage of patients who abandon treatment. In Southeast Asian countries, despite the fact that all the components of both the numerator and the denominator of the expression are quite significant, there is marked social inequality and limited drug availability in public health clinics.

In the USA, there was a resurgence of tuberculosis in the 1990s, impelling public health authorities to attempt to diminish the denominator of the expression and thereby reduce the burden of this problem on the country.

Reflection on this new “formula” may make it possible to perceive that, while there have been advances in TB-related technical, biological, clinical and epidemiological knowledge, its social dimension must be considered, valued and used as a quality-of-life indicator. It would be worthwhile to introduce this formula in other forums of discussion such as, among others, the World Health Assembly, the International Labor Organization and the World Trade Organization.

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