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Introductory Chapter: Scientific Research on Mycobacteria and the Absence of Evaluation Processes

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1. Introduction

About 150 species belong to the *Mycobacterium* genus and are known as acid-fast bacillus. These bacteria are widely distributed in different ecosystems and it can be isolated from water, soil, or air. The *Mycobacterium* genus has a great metabolic diversity that has allowed them to adapt and survive in almost all environmental conditions. They are called slow-growing bacteria, because of their long generation times in comparison with other bacterial genus. Currently, there are new species which are being studied in order to be classified as new members of the *Mycobacterium* genus.

Some species of the *Mycobacterium* genus are known as nontuberculous mycobacteria (NTM). It can cause the mycobacteriosis disease in humans or animals. At present, it has not been established that mycobacteriosis is transmitted from person to person. This is one of the causes for not knowing precisely the number of cases of this disease and difficulties for an opportune diagnosis. The severity of the disease caused by NTM depends on multiple factors, the most relevant being the condition of the individual's immune system, the virulence characteristics of these bacteria, and the amount of NTM that is transmitted to the infected host. In the field of scientific research, there are studies on different aspects related to these microorganisms, nevertheless many characteristics of NTM and their implications in environmental processes, health or industrial use are not known in which given their great metabolic variety can help to solve environmental problems that threaten the human and animal's health and that compromise the quality of life of future generations.

Tuberculosis is an infectious disease caused by bacteria belonging to the *Mycobacterium tuberculosis* complex. Tuberculosis was declared a global emergency by the World Health Organization and it is considered a serious public health problem worldwide, given that it is

one of the infectious diseases that causes the most deaths worldwide along with the human immunodeficiency virus (HIV). Despite the strategies and efforts to achieve its control, the situation of tuberculosis is worrying and it is considered in several countries as an event of interest in public health. Therefore, the control implemented by each country is of vital importance to cut the chain of transmission. The foregoing evidences the priority need to conduct research on factors associated with tuberculosis control while continuing to produce new information in all areas of knowledge that may contribute to tuberculosis control.

Leprosy is a chronic disease, known as a peripheral neuropathy that can produce several and irreversible sequelae observed in the patient who has suffered from this disease, and as a consequence, it has generated a great stigma for all patients. Leprosy is an ancestral disease and has also been known as Hansen's disease, and there are currently studies documenting the great social and cultural component involved in the worldwide transmission and persistence of this infectious disease. The World Health Organization has declared leprosy as a disease in elimination due to the number of reported cases of patients, but there are countries that still report a recent transmission of the disease and in some of its provinces a larger number is diagnosed. A number of cases estimated by the World Health Organization consider that this country has reached the goal of elimination. *M. leprae*, the causative agent of leprosy, is not a cultivable microorganism in synthetic culture media, causing the diagnosis of the disease to be basically clinical even though there are currently molecular methodologies that can make an opportune diagnosis of the disease before the disability is observable in each individual affected by this alcohol-resistant acid bacillus.

The scientific research done on the species belonging to *Mycobacterium* genus can be classified into three groups. The following graph shows that a large number of publications in scientific research related to tuberculosis, leprosy, and some mycobacteriosis are produced. In the environmental field or application of mycobacteria to industrial processes, a smaller amount of new knowledge is produced that is useful for contribution to solving problems that threaten humanity but something very important is the little evidence generated by evaluation projects that must be carried out on the processes implemented in each country or region of the world so that the effect achieved can be attributed to the measure or knowledge implemented (Figure 1).

Given that tuberculosis, leprosy, and mycobacteria are diseases that affect a large population worldwide, control programs are performed in the regulatory framework of each country, and it is necessary and urgent that there is solid and incontrovertible evidence its impact and management in the control of these diseases that affect all individuals of different ages, genders, and social strata of a community, being of great importance the performance of periodic evaluations of the measures implemented by each government against the knowledge generated by the scientific investigation.

The evaluation of the projects, plans, policies, and strategies implemented must include the commitment of the authorities of each country and of the different territorial entities, in order to determine the effectiveness, cost-effectiveness, and attributions of the results obtained to the extent implemented in the community or country. These scientific evaluation projects should be based on official data collected through the information and monitoring system

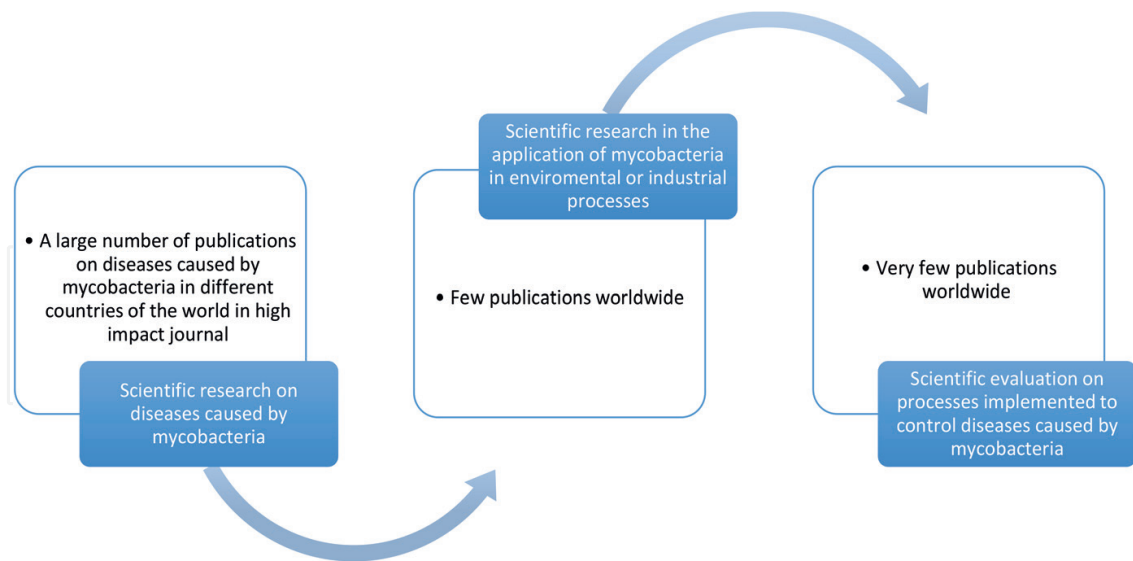


Figure 1. Research and scientific evaluation in mycobacteria.

of territorial entities for the measurement of performance and evaluation of the measures implemented. These evaluation projects make it possible to demonstrate the changes generated from the implementation of national or international policies, but especially should be evidence for decision-making and recommendations in health, public health, and international health.

One of the main limitations for the realization of scientific evaluation projects is to attribute the observed effect to the intervention implemented and evaluated. Because many of the processes in health, public health, or global health are assumed by the state governments through their national control programs, all control and surveillance activities must be authorized, assumed, and monitored by these control programs. Therefore, significant variations are only possible because of the implemented measures of an official nature or the sociocultural and political situation of each country that in any way affects the epidemiological situation of the disease independent of the adoption of measures or plans. In scientific research projects, many of the studies are conducted in environments and under highly controlled conditions and obtain reasonable cost-effectiveness levels, contrary to the result obtained in some situations on the costs that are required to reach the same level in the programmatic conditions of each country, requiring a large amount of human resources, infrastructure, and inputs that make the measure provided is not feasible to implement.

The great diversity of environments and social, cultural, and environmental determinants, scientific research and its evaluation in the species that make up the *Mycobacterium* genus, also presents the difficulty that its results and knowledge generated are representative for a community and applicable to other regions of the world. world that are similar in their conditions, it is almost imperative that each region or country performs its own evaluation processes to obtain evidence before implementing new control measures in their communities, complying with the provisions of the ethical considerations that shelter the population in the safekeeping of their human rights and a healthy environment.

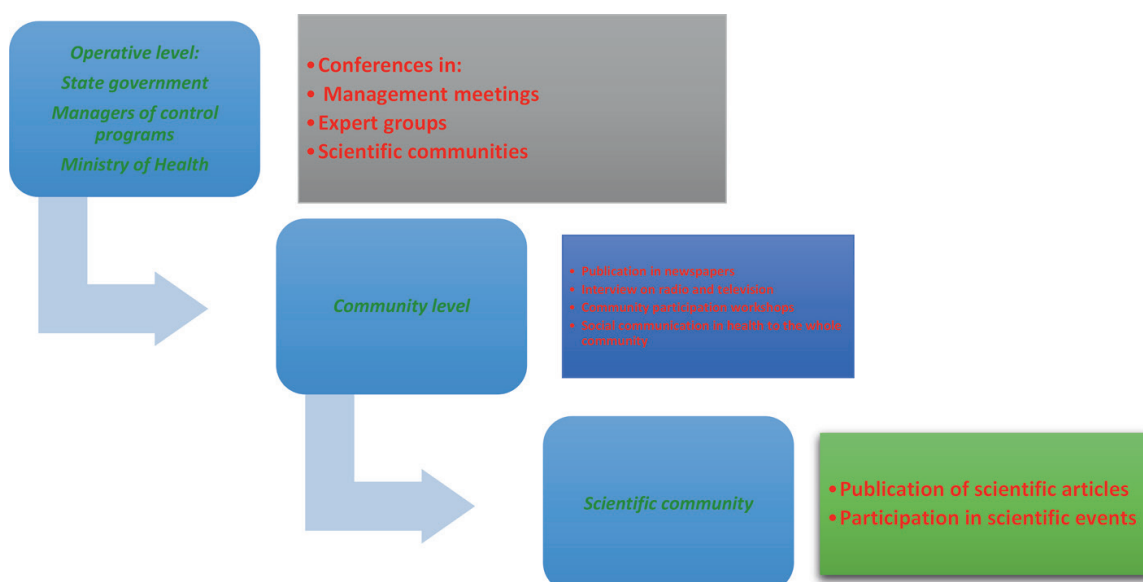


Figure 2. Flow of results of research and evaluation projects in mycobacteria.

The information obtained in the research and evaluation projects in the *Mycobacterium* genus should provide in the medium and long term that the results obtained contribute to the construction of new policies for the management and control of the disease, should serve as a critical input for the construction once again, knowledge must allow the evidence obtained to be able to reformulate or propose the operation of the indicators in time, form, and recourse. They should strengthen and contribute new knowledge in public health research and in the evaluation of broad coverage health programs.

The results of the research and evaluation projects must be translated into a language that is comprehensible to all through support provided by communicators with experience in health, politics, the environment, and the general community, who must objectively and appropriately carry out the adjustment of the vocabulary for dissemination in press, radio, television, and the general population.

The information must be widely disseminated and at all levels as illustrated in **Figure 2**.

The results obtained should be released to the community and the media in full report in large print and digital form, preferably with a slide presentation and a written guide to the presentation, to facilitate the management of information at management meetings and decision-making to finance new research or scientific evaluation projects, which leads to objective planning and decision-making based on the results of a rigorous scientific research or evaluation that will benefit the community and the different groups of policy-makers, decisions, and generators of knowledge.

2. Conclusion

This panorama and epidemiological record shows the difficult situation that is experienced worldwide against transmission, morbidity, and mortality caused by mycobacteria, and

despite the strategies and efforts made by different countries through their national control programs, the situation has a high impact on the world economy. Therefore, the control carried out by each country is of vital importance to cut the chain of transmission, requiring that operational research be prioritized and evaluations be made of the measures, plans, and policies implemented by each country to successfully advance in its control. It is also necessary to carry out scientific research on the species that make up the *Mycobacterium* genus to know the metabolic characteristics that allow its application in the process of great benefit for industry, health, and the environment.

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