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Chapter 1

Tuberculosis (TB) and Human Rights in Chiapas, Mexico

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Additional information is available at the end of the chapter

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1. Introduction

Tuberculosis (TB) is a devastating disease from many points of view: from individuals suffering the disease through public health systems, and health cost services [1]. Although TB is a disease that can be prevented and cured, TB is worldwide spread [2]. Despite the universal adopted Directly Observed Therapy Short Course (DOTS) strategy, TB is now more prevalent than in any previous period of human history. According to the most recent report by World Health Organization (WHO) [2], there were an estimated 8.6 million (8.3-9 million) new cases and 1.3 deaths related to TB in 2013 [2]. Nevertheless, a recent study estimated that in 2013, including in HIV-positive individuals, all-form TB incidence was 7.5 million, prevalence was 11.9 million, and number of deaths was 1.4 million [3]. In the same year and in only individuals who were HIV-negative, all-form TB estimated incidence was 7.1 million, prevalence 11.2 million, and number of deaths was 1.3 million [3]. According with Stop Partnership TB Human Rights Task Force, in 2009 1.7 million people died from TB, including nearly 600,000 women, and 150,000 by multidrug-resistant TB (MDR-TB). The vast majority of deaths occur in developing countries. In the same year, there were 440,000 MDR-TB cases (3.3% of all new cases) [4].

In Latin America, 70% of the new cases are concentrated in five countries (Brazil, Peru, Mexico, Haiti and Colombia) [5]. WHO estimated in 2012 that there were 219,349 new and relapsed cases, 56% of them were smear-positives, 57% HIV positives and 1.35% MDR-TB cases [5].

Worldwide, co-infection with HIV-AIDS, co-morbidity with diabetes mellitus (DM), and the emergence of drug-resistant *Mycobacterium tuberculosis* strains –the causal agent of the disease- (DR-TB), MDR-TB, as well as the extensively drug-resistant TB (XDR-TB), and the most recent TB strains, totally drug-resistant TB (TDR-TB) are the most accepted factors that have contrib-

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uted enormously to the rise of TB [2]. A recent study has highlighted that even in places with substantial decreases in TB incidence, prevalence and deaths, DR-TB could reverse important gains in combatting TB [3]. In this regard, the emergence of DR-TB is iatrogenic and suggests that the current biomedical and public health approaches for TB are failing [6].

However, renaissance of TB in the present days is caused not only by the above-mentioned factors. It is a disease strongly associated with poverty and social inequality [7]. It affects first of all people who have little or no access to basic services such as education, health and food, among others. Furthermore, factors such as reduction to access to diagnostic, prevention and treatment services increase people's vulnerability to get TB.

Although the right to health is universally recognized and guaranteed through a range of international, regional and national laws and treaties that the majority of countries have ratified, the numerous evidences from all over the world indicate that it is ill implemented in the case of TB prevention and treatment [1]. Experts point out that control over TB will require both real compromise of governments to face the disease and the inclusion of people's ability to realize their human rights. However, there is little or poor discussion regarding to human rights and its association to the control and management of TB, perhaps given the complexity of this topic. Therefore, any health system and social security should prevent and control diseases, either chronic or infectious, in a holistic approach (opportune and adequate diagnosis, right treatment, and suitable rehabilitation), benefiting the person and his community.

The state of Chiapas lies in the southeast of Mexico and extends over an area of 74,415 square kilometers [8]. Its estimated population, for 2014, is 5,149,319 inhabitants distributed in 122 municipalities [8]. Chiapas is one of the poorest Mexican states whose majority of population lives in poverty. The state has important ethnographic, social, cultural, historical and socioeconomic characteristics. All these factors are combined and reflect poor health indicators such as: high maternal and child mortality, malnutrition, high prevalence of TB, lack or null access to health services [9,10].

Chiapas has significant indigenous population (27.2% of the total population) from Mayan groups such as Tseltal, Tsotsil, Ch'ol, Zoque and Tojolabal, among others, who are the most marginalized population. A significant percentage (32%) lives in extreme poverty and 54% in overcrowding conditions. Chiapas ranks in the last place among all Mexican states in terms of both infant and child mortality and has the country's highest maternal mortality ratio and the highest proportion of mortality due to infectious diseases [9]. Chiapas historically has been in the firsts places in the country, in mortality associated with diarrheal diseases, acute respiratory infections, maternal mortality and pulmonary tuberculosis (PTB) [9]. Although the state's largest cities have greatly increased in size, 51.3% of Chiapas's population still lives in rural areas (less than 2,500 inhabitants), compared to the national average (23.2%) [11]. In these rural areas, farming small parcels of collectively owned land or working as day laborers on larger plots offers a poor and precarious existence for most residents [9].

In this chapter, we aim to examine situation of human rights compliance in the case of TB patients residing in Chiapas, Mexico, taking into account the Mexican government's obligations to respect, protect and fulfill the right to health of all population. We will address the

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following topics: human rights, the right to health, principles of health rights, patient rights, TB in several vulnerable populations (children, elderly, women, indigenous groups and migrants); and legal health reforms in Mexico and its impact in DOTS strategy.

2. Chiapas: A brief description of epidemiological TB situation

In Mexico, in 2013 there were registered 21,381 cases of TB (in all its forms) with a incidence rate of 16.7 *per* 100,000 inhabitants [12], from which 92.3% were new cases; 81.7% were PTB; 21% were associated with DM and 5.6% with HIV/AIDS; 1.05% were drug-resistant (any forms) and 8.4% were pediatric [12]. Among the pediatric group, 68.2% were PTB and 31.8% extra-pulmonary-TB [12]. Chiapas, Guerrero, Veracruz, Puebla, and Tabasco, are Mexican states which contribute every year about 5,400 new cases of PTB, and this constitutes 36% of the total national average [12]. Factors that contribute to the high prevalence of PTB in these states are: (a) internal and external migration; (b) problems with accessibility to health services and social security; (c) significant presence of indigenous populations; (d) more than 90% of their municipalities are considered with low human development index [13,14]; (e) inadequate implementation of the DOTS strategy [10]; (f) little or null access to early TB diagnosis [10]. The above-mentioned factors, related to life styles and living conditions also contribute to health inequities increasing the high prevalence of TB in Chiapas and worldwide.

According to official data provided by the Mexican Ministry of Health, in 2012, Baja California, Guerrero and Tamaulipas, were states with the highest incidence rates of TB, all its forms, (54.8, 38.1 and 32.0, respectively, *per* 100,000 inhabitants), while Chiapas ranked eleventh place with an incidence rate of 24.4 *per* 100,000 in the same denominator [15]. On the other hand, Tlaxcala and the State of Mexico were ranked with the lowest incidence rates, 3.9 and 4.4 *per* 100,000, respectively [15]. Regarding to PTB, for the same year, the registered incidence rate for the whole country was 13.6 *per* 100,000 inhabitants, whereas Chiapas ranked eighth with 21.8 incidence rate for the same denominator [15].

For administrative purposes, Chiapas is divided into ten health districts or sanitary jurisdictions. For 2012, the three regions with highest registered incidence rates were Tapachula, Tonala and Pichucalco, having 59.3, 33.1 and 22.3 *per* 100,000 inhabitants, respectively, while San Cristobal and Comitan regions reported the lowest incidence rate with 11.7 and 12.7 *per* 100,000 people, respectively [16]. However, epidemiological studies carried out in the San Cristobal region[1], also known as the Highlands region, have reported high morbidity and mortality rates which doubles the state and national figures [9,10,17–25]. Furthermore, the official epidemiological data is based on notified cases by the health sector systems, and this could lead to under-quantification of cases in great part due to under-diagnosis. In Chiapas, the main and only method to diagnose PTB is bacilloscopy which is well known to have low sensitivity in rural and marginalized areas [26,17,19,9,23]. From the 122 municipalities located in Chiapas, 28 indigenous municipalities reported in 2012, 203 new TB cases, from which 178

1 San Cristobal region is an area with strong presence of Tsotsil and Tseltal population, characterized by high levels of poverty and social exclusion.

were PTB, and 29 deaths associated with the disease [16]. It is important to highlight that San Cristobal region is the place in Chiapas with highest number of smear positive cases with two and three crosses (over 80%), which means both delay in diagnosis and the potential transmissibility of TB in the region [16].

Regarding to TB mortality, official data for 2012, there were 2,253 deaths (in all its forms), representing a mortality rate of 1.9 *per* 100,000 inhabitants [15]. From these deaths, 1,761 were PTB with a rate of 1.5 *per* 100,000 people [15]. In the same year, Baja California, Sonora, Nayarit, and Chiapas were the states with the highest mortality rate associated with TB (all its forms) with 5.68, 4.38, 3.98 and 3.31 *per* 100,000 inhabitants[2] [15]. The states with lower mortality rate were Tlaxcala, State of Mexico, and Guanajuato with rates of 0.0, 0.57, and 0.69 *per* 100,000 inhabitants, respectively [15].

In 2011, the Prevention and Control TB Program reported 838 PTB cases, from which 90.1% were considered as an anti-TB treatment success, while treatment defaulting and failure rates were 4.1 and 1.31, respectively. However, health sector in Chiapas recognizes that between 2010 and 2013, 47 cases were multidrug-resistant (MDR-TB), one of which was extremely resistant [16]. It is alarming to note, that between 2008-2014, the Tapachula Jurisdiction[3] reported 73 cases of drug-resistant TB (DR-TB) (Dr. Julio Cesar de la Cruz, Coordinator of DR-TB and Leprosy, personal communication), from which 17 had died, 5 had defaulted, 4 had been reluctant to receive treatment, 22 were cured, 11 were still in treatment, 8 were awaiting treatment and 6 were served by another health institution (Social Security Mexican Institute) with no information regarding to their situation.

According to Dr. Julio Cesar de la Cruz, the main problems which account for follow-up DR-TB cases are: (a) the lack of mycobacteriological cultures; (b) the lack of adequate medical records by the physician treating the patients, which sometimes are incomplete and erroneous; (c) adverse reactions from the drugs used in anti-TB treatment along with the lack of request in time and form to treat such adverse reactions. Also, the main problems identified to defaulting treatment are: (a) the adverse reactions; (b) the lack of adequate follow-up to patients under treatment; (c) perception by patients who think they are cured; and (d) the lack of financial resources from the patients, who need to continue working.

Statistics by The Population and Housing Census conducted in 2010 in Mexico [11], 38.9% of households in Chiapas have moderate to severe food insecurity (FI)[4]. In 42% of households where the head of family or spouse mentioned speaking an indigenous language, were

2 Noteworthy to mention is that in official statistics, there is a discrepancy on the data regarding to TB mortality rate of Chiapas (all its forms); for 2011, when the mortality rate of Chiapas is compared with other states, the notified rate was 2.98 per 100,000 inhabitants (it is not indicated whether or not adjusted rate), but when a trend analysis is carried out for the last years, only for the state of Chiapas, the mortality rate is 3.5 per 100,000 inhabitants, with 163 deaths reported.

3 This Jurisdiction is located in the border with Guatemala and is one of the main migrant passages mainly from Centro American countries such as Guatemala, El Salvador, Honduras to United States of America. Lately is been reported migrants from Asian and African countries. Due to its geographical location, and the number of migrants who cross this region, a high number of TB cases is reported annually by this jurisdiction, which makes it one of the most important area in terms of public health because the migrants poverty and bad health conditions.

4 The Food and Agriculture Organization of the United Nations (FAO) states that food security exists when "all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their needs and preferences, to lead an active and healthy life". In contrast, no or uncertain access to food is defined as food insecurity (FI).

classified in the categories of moderate and severe FI. Moreover, 41.7% of population in Chiapas lacks any social security scheme, although this percentage decreased with respect to 2000 (when it was 77.8%) [27], which may be explained by the introduction of the System of Social Protection in Health (65.7%), called "Seguro Popular", a "basic package of health services". However, according to a recent study, this basic package has increased the inequality gap in health services use between indigenous and non-indigenous populations [28].

In Mexico there are 150 municipalities in extreme poverty, and 28 are located in Chiapas. The Highlands region has 11 of these municipalities, whose main characteristic is the important presence of indigenous groups [8,13]. In Chiapas, there are at least 925,000 children (32.86% of its population) aged between 0-14 years old [8] and the majority (60-74%) has not social security scheme [29]. According to a study by Network for the Rights of Children in Mexico [29], the number of children, mainly indigenous, with no social security scheme has increased which make them more vulnerable to acquire any infectious disease. Alarmingly, in Mazapa de Madero (a Chiapas municipality), 97.7% of its children have no access to health services [30].

In Chiapas, in 2013, there was 27,704 deaths from which 350 were children, with an infant mortality rate of 18.16 *per* 1,000 live births [29], the second highest in the country. The Ministry of Health has recognized that the infant mortality in indigenous population is 58% higher than the national average. This figure indicates twice the probability of death of an indigenous child before their first year of life compared to one non-indigenous. This situation is worse in rural and indigenous areas with high socio-economic marginalization in which the infant mortality rate has reached 75 *per* 1000 children, a number equivalent to those reported in Sub-Saharan Africa [31].

Regarding to education, it is estimated that the rate of illiteracy among indigenous peoples is four times higher (over 26% of the population aging 15 years and over) than the national average (6.88%) [32]. Moreover, two out of three indigenous schools are multi-grade, that is, their teachers attend more than one degree [32]. Noteworthy to mention is that in 2005 only 13% of indigenous students of sixth grade of primary school can read compared to that of the national average (33%). On the contrary, 51% of indigenous students of sixth degree are in the lowest level, while the national average is 25%. More alarmingly, indigenous children stop going to school because they are engaged in working at their early age due to socioeconomic issues [11].

3. Patients rights

3.1. What are human rights?

Human rights are universal and considered the birthright of every human being. Human rights are aimed to safeguarding the dignity and equal value of everyone. They are inalienable, they cannot be waived or taken away, and each one is closely related to and often dependent upon the realization of others, and they are indivisible. Human rights are articulated as entitlements of individuals and groups, thereby creating obligations of action and non-action, particularly

for states [32]. Universal human rights are often expressed and guaranteed by law, in the forms of treaties, customary international law, general principles and other sources of international law. International human rights law lays down obligations of Governments to act in certain ways or to refrain from certain acts, in order to promote and protect human rights and fundamental freedoms of individuals or groups. Human rights are inherent entitlements to all human beings without discrimination, whatever nationality, citizenship, place of residence, sex, ethnic origin, color, religion, language, or any other status [32].

Human rights involve economic, social, political, health and cultural issues and are guaranteed by law in national and international instruments, from local legislation to constitutions in countries. States assume obligations under international law to respect, protect and fulfill human rights as well as to refrain from interfering with the enjoyment of the right, prevent others from interfering and adopt appropriate measures towards the full realization of the rights [1,4].

The main international human rights treaties that involve the right to health, to which Mexico is a party, are:

- The International Covenant on Economic, Social and Cultural Rights (ICESCR).
- The Convention on the Rights of the Child (the Children's Convention, CRC);
- The Convention on the Elimination of All Forms of Discrimination against Women (the Women's Convention, CEDAW);
- The International Convention on the Elimination of All Forms of Racial Discrimination (Race Convention, ICERD);
- The Additional Protocol to the American Convention on Human Rights in the Area of Economic, Social and Cultural Rights (the Protocol of San Salvador), adopted in 1988, entered into force in 1999), provides for the right to health and the right to a healthy environment, and other health-related rights, such as social security.
- Convention 169 of the International Labor Organization Concerning Indigenous and Tribal Peoples in Independent Countries (ILO Convention 169)
- The Convention against Torture and Other Cruel, Inhuman or Degrading Treatment or Punishment (CAT);
- The International Covenant on Civil and Political Rights (ICCPR);
- The Convention on the Rights of Persons with Disabilities (CRPD);
- The American Declaration of the Rights and Duties of Man (1948), that in it's Article XI, refers to the "right to preservation of health".
- The International Convention on the Protection of the Rights of All Migrant Workers and Members of Their Families (ICRMW);

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On the other hand, in Latin American, the Inter-American Commission on Human Rights and the Inter-American Court of Human Rights, make up the Inter-American System of Human Rights.

4. The right to health

According with the ICESCR (Art. 12) the right to health is defined as "the right of everyone to the enjoyment of the highest attainable standard of physical and mental health" [34]. This right involves the right to be free from non-consensual and uninformed medical treatment, medical experimentation, forced HIV testing, and other forms of cruel, inhumane and degrading treatments [38]. In this sense, states have the obligation to provide adequate health services necessary for the realization of the highest attainable standard of health. This include the right to a system of protection (i.e. a system of prevention, treatment and control of diseases) for all population in equal conditions, access to information and education about health, regular provision of essential medicines, and sexual and reproductive health-care services. In fact, two of the main steps that states should take in fulfilling the highest attainable standard of health are the prevention, treatment and control of epidemic, endemic, occupational and other diseases, and the creation of conditions which would assure to all medical service and medical attention in the event of sickness [34]. In Mexico, Article 4 of its Political Constitution establishes that "every person has the right to health protection" [35].

The right to health is dependent on and contributes to enjoy of other human rights. In consequence also comprises the access to healthy occupational and environmental conditions, drinking water, food, housing, education, and protection against epidemic diseases and rights relevant to sexual and reproductive health [36]. The right to health is not an abstract aspiration; on the contrary, international human rights norms provide a concrete set of principles by which to evaluate the design and implementation of health policy-making and programming [1,33,34]. The basic components of the right to health, commit to the states to guarantee that health facilities, goods and services are: available, accessible, acceptable, of good quality and applicable to all sectors of the population, including migrants [1,4,34,37,38]:

Availability means functioning public health and health facilities, goods (general supplies, essential medicines and vaccinations, laboratory equipment, among others), services and programs in sufficient quantity and in a timely manner, as well as to avoid stock shortage. It includes drinking water, sanitation, and other determinants of health.

Accessibility includes several issues related to:

- Non-discrimination: all services and goods must be accessible to all population, especially the most vulnerable and marginalized groups, in law and in practice. This includes migrants, independently if they are regular or irregular, and not only emergence interventions.
- Physical accessibility: provision of safe access to health services and underlying determinants of health for all groups and subgroups of population. It must be considered the location and opening hours of health facilities.

- Economic accessibility: affordable health services (including basic medicines) and health insurance for all population, especially for individuals in poverty or in need of special assistance.
- Equity: that poorer households should not be disproportionately burdened with health expenses as compared to richer households [34].
- The right to seek, receive and impart information and ideas concerning health issues, which includes health information in indigenous languages [38].

Acceptability: respectful of medical ethics and culturally appropriate, sensitive to age and gender in order to reduce socioeconomic, cultural, gender and age barriers. It may include interpretation, translated written materials and cultural mediation in health facilities (both hospitals and health centers). Cultural acceptability requires respect for traditional medicines and practices which have not been shown to be harmful to human health [9]. Barriers can have negative effects on prevention, diagnostic (delays or mistakes) and medical care attention, and affect anti-TB treatment and adequate follow-ups. It is not uncommon that people feel distrust of government services and instances of outright denials of care or mistreatment due to such factors as: bureaucratic arguments, ethnic, social and gender discrimination.

Quality: Health facilities, goods and services must be scientifically and medically appropriate and good quality. It implies: sensitive and trained health professionals at all levels, scientifically approved drugs, trustworthy laboratories, appropriate hospital equipment, adequate sanitation and safe drinking water. In Chiapas, many of the programs administered by the public health system are of inadequate quality [9-10, 17,19]. This situation is reflected in the high levels of subdiagnosis of TB cases, as well as constant lack of appropriate treatment for PTB [9-10, 17,19]

The perspective of human rights in the health services place people as the principal element of any activity, program, policy and legislation. Thus, human rights regarding to health is defined as: everyone should enjoy the highest possible standard of physical and mental health, which include access to timely, acceptable, satisfactory quality and affordable health care, and create conditions that allow people to live as healthy as possible. This is related and in function of access to housing, jobs, clean and drinkable water, food security and education services, among other basic services.

4.1. Principles of the right to health

The main principles of the right to health, are: principle of non-discrimination, principle of Non-retrogression and adequate progress, principle of meaningful participation, accountability and multi-sectorial strategies [9].

4.1.1. Principle of non-discrimination

This principle is the core for the full realization of the right to health, as for all human rights. In consequence all forms of discrimination create obstacles for the realization of the right to health. The ESC Rights Committee stated that: “By virtue of article 2.2 and article 3, the

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Covenant proscribes any discrimination in access to health care and underlying determinants of health [34]. Discrimination can adopt a lot of forms: sex, age, ethnic/race, color, language, national or social origin, economic, political, religion, migrant status, sexual orientation, property, physical or mental disability, health status (including HIV-AIDS, among other status, which has the intention or effect of nullifying or impairing the equal enjoyment or exercise of the right to health. Health personnel must not make distinction among persons in any form because international human rights specify that all individuals, without discrimination, must have access to health-care facilities, goods and services, especially the most vulnerable groups [39]. Governments are obligated to ensure it. In Mexico, the Political Constitution states the right to health in its Article 4 [35].

In addition, State responsibilities include: (a) ensuring equal protection and opportunity under the law, as well as in policies, programs, etcetera, for the enjoyment of rights, including to health and social security [36]; (b) to monitor the effects of their public health and social policies and actions; and, c) to ensure that these are anchored in a system which does not allow inequalities in the enjoyment of human rights. In order to achieve this, states are compelled to gather disaggregated data on the realization of the rights to health, social security and education, among others. The indicators under study must include special measures that recognize the diversity of population groups and assist states in meeting their human rights obligations by eliminating all forms of discrimination [38].

A study carried out in the conflict zones of Chiapas [9][5], found some of the effects of discrimination and structural inequalities faced by the largely indigenous populations. The fragmentation of communities and politicization of care and other governmental services has had serious implications for the accessibility and utilization of health services in the region, such as discrimination and denial of health services against patients on the basis of political and religious affiliation, as well as on the basis of indigenous ethnicity. In Chiapas, it is common that indigenous people feel discrimination in health services, and they claim that non-indigenous patients are treated better than indigenous patients with better quality care, more medicines, and a shorter wait time to be treated [10].

Other forms of discrimination are: (a) the availability of resources and programs –including of the health sector- depending on political filiation. The effects of these discriminatory policies have been the creation of a cycle of fragmentation and polarization among and within communities that affect the utilization and access to health services in opposing groups to the government; (b) the amazing differences among states in Mexico as well as between for the insured and uninsured population with respect to distribution of health resources and health care *per* capita spending: the allocation of health resources is inversely related to poverty, and levels of unsatisfied health needs [40]; (c) indigenous people are disproportionately represented among poor and uninsured, studies have shown that the availability of health care resources increases when the proportion of indigenous people in a county is very low [41]; and (d) the discrimination faced by women in Chiapas. The women's health is affected by structural

5 In January 1, 1994, the Zapatista Army for National Liberation (EZLN) staged an armed uprising in Chiapas, Mexico on behalf of the indigenous populations of the state, whose rights they claimed to be defending.

problems in the health system, for example, they not participate at all in planning of health services and the high levels of poverty in the majority of them in rural and indigenous areas, constitutes a serious obstacle to enjoyment their rights [9] Mexico's Constitution prohibits discrimination in the enjoyment of all rights, including the right to health protection, and recognizes that every person in the country shall enjoy the guarantees granted by this Constitution, and that "men and women are equal before the law", but in practice, in Chiapas it is not occurring. People with TB often are discriminated with exclusion and rejection, by both society and health personnel [10,15,17,19,20,31], mainly because they are considered as source of infection [10,23]. Health personnel avoid contact with patient with consequences in adequate timely diagnosis, treatment and follow up, and even refusal to provide health care [43].

4.1.2. Principle of non-retrogression and adequate progress

Realizing the right to health requires not only avoiding retrogression but also deliberate steps to make adequate progress. The ICESCR obligates States parties such as Mexico to take steps "toward the progressive realization" of all rights contained in the Covenant to the "maximum available extent of its resources" [34]. One of the principal governmental programs intended to address the health conditions of marginalized people in Chiapas and elsewhere is the "Prospera" program (firstly named Solidaridad, afterwards called Oportunidades and nowadays Prospera). The program serves individuals who are not covered by formal health insurance. It has an assistance perspective, which can have contradictory results since incentives do not lend recipients to have self-sufficiency or improve communal conditions. In order to receive funding from this program, recipients must continually demonstrate that they live in conditions of extreme poverty. As a result, women and families receiving benefits from the program often reject other programs aimed at the improvement of their standard of living, which may be community-oriented, so that they can continue benefiting from Oportunidades Program (recently named Prospera) [9].

4.1.3. Principle of meaningful participation

Realization of the right to health entails providing individuals and communities with an authentic voice in decisions defining, determining or affecting their well-being. According to the United Nations Development Program [44] "participating in the rules and institutions that shape one's community is a basic human right and part of human development. More inclusive governance can be more effective. When local people are consulted about the location of a health clinic, for example, there is a better chance it will be built in the right place". In Chiapas, the socioeconomic and health situation require meaningful participation by all its citizens, and should recognize indigenous autonomy and self-determination.

International instruments to which Mexico has voluntarily bound itself require inclusiveness and democratic participation. People have the right to participate in the design and management of their health care services, as set forth under relevant international law. The Mexican government has adopted international instruments related to genuine participation of indigenous people's in their own affairs, including health. The San Andrés Accords, an agreement between the government and EZLN issued in 1996, but never implemented, would

have provided some self-determination for indigenous communities in Chiapas and Mexico [45]. However, in contrast to other states in the region, the government of Mexico has never adopted national legislation to incorporate its international obligations into domestic law [9]. Nor has it recognized some meaningful degree of autonomy for indigenous communities, in relation to the organization and delivery of social services [9].

Under international human rights law, participation requires more than using local health promoters, on the contrary, states should provide resources and support for that communities be able to define their own health priorities, design, deliver and control their health services [9]. True rights-based participation requires programs that enable people to be active, informed and critical agents and citizens, rather than objects of charity [46].This include formulation, implementation and monitoring of health policies and programs. In Chiapas, genuine participation of population (indigenous, civil society, women, etcetera) in matters relating to health decisions, except Zapatistas communities, is poor or absent.

4.1.4. Principle of access to information

Three main aspects are important to have access to information. Firstly, every person must have accessibility to health information, that include the right to seek, receive impartial information and professional opinions in an accessible social and cultural format, easy to understand, and according to different groups of society. In the case of TB, breach of this right may result in misinformation about the disease, causing much greater probability of infection to closer, stigma, and social discrimination. As a consequence, chain of transmission of the disease is not interrupted, and increase the probabilities to defaulting because of lack of both family and social understanding and support, and with the possibility that patients are not cured, continue to infect other people, and even worse, die [10,24].

Secondly, social participation and monitoring health issues are impossible without access to information. In Chiapas, the compliance of this principle is inadequate. On the one hand, there is not transparency in information: government data is not easily accessible by the public, academics or interested non-governmental organizations. Public servants tend to not proportion health information because they feel that, if indicators for example, are "not good", they can be affected and be the cause that they have to leave their job. On the other hand, health data collected is usually no disaggregated by variables of great useful and interest. For example, in an study to analyze TB mortality, we reviewed the registers of the TB Prevention and Control Program, and data about ethnicity, occupation and schooling of patients, were absent [10].

Finally, in Chiapas there is a consistent pattern of under-diagnosis and under-reporting health data, including TB and others health problems as maternal deaths. In several studies carried out by our work team, we have detected cases of PTB at least three times than the official state level [9]. In addition, we have observed that many health workers do not keep any medical records of their patients –especially in those cases when patients come from other villages- and that patients complain of not being made aware of their most basic rights, such as their right to their medical records or to informed consent in medical procedures.

4.1.5. Principle of accountability

It is important that all states ratify international instruments which provide protection for the right to health, and of enacting and implementing legislation in domestic legal orders, as well as incorporate enables courts to adjudicate violations of the right to health to provide sanctions for violations to human rights and, in this case, the right to health. Additionally, accountability needs the adoption of a framework law to operationalize and monitoring the right to health. For example, a human rights ombudsman with authority to investigate and sanction perpetrators in cases of violations to the right to health. In Mexico, in spite of Mexico's General Health Law ensures health protection, and contains programmatic provisions, which commit the State to action on health matters, in practice there is no effective monitoring and oversight, as well as remedies for victims of violations [33]. Medical negligence cases are generally brought to the National Commission on Human Rights (CNDH), state human rights commissions, and the National Medical Arbitration Commission (CONAMED). Although they can review negligence claims brought against individual providers, these institutions only deliver mechanisms to enforce the patient rights against malpractice set out under Mexican law. Mechanisms such as the *amparo* (protection writ), which is commonly used in civil and political rights violations cases, would need to be reformed in order to: (1) provide people and groups with a collective remedy; and (2) establish precedent for other related cases. Even in individual cases, Mexican judges have been inappropriately reluctant to use the *amparo* to enforce the right to health under the apparent misconception that "programmatic rights" are not actionable [9].

4.1.6. Principle of multi-sectorial strategies

The right to health goes beyond the provision of medical care as well as the health sector. States must have institute coherent with development and food security policies, which incorporate health affairs. It includes the promotion of adequate living conditions, access to sufficient safe drinking water, to basic sanitation for disposal of excreta, access to educational opportunities (especially for women) and access to arable land, among other issues. In spite of Mexico's General Health Law sets out an integrated, multi-sectorial approach to health, calling on ministries of health, education, and labor to work jointly to, *inter alia*, to fulfill goals of the National Health System. This coordination efforts seeks to integrate biological and socioeconomic factors essential to good health, however, in practice this is not materialized. Evidence of this, are the high rates of diseases associated with poverty –including TB- in Mexico as a whole, but particularly in Chiapas, as a result of a failure of the Mexican government to establish a coherent rural development policy, which should incorporate health issues [9]. Therefore, coordination efforts among health, agricultural, educational, socioeconomic sectors should combat the unfavorable health conditions of vulnerable populations. Likewise, governments at different levels (Federal, State, and local) should coordinate efforts to strength social security programs that met communities' health needs and adopt approaches that encourage cooperation and capacity-building. In Chiapas there is not adequate coordination between health sector and government and non-government sectors. There are fragmentation, dispersion and, sometimes, objectives in one direction in some programs, and in other direction

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in others [9]. For example, the "Vida Mejor (Better life)" program focused for women and child in Chiapas, does have multi-sectorial components, and is directed towards the community. Its impact has been limited because it competes with the federal program Oportunidades (now named Prospera), which provides incentives for individuals and individual families to opt out of Vida Mejor in order to retain their benefits from the Oportunidades. The lack of coordination between these programs undermines potential progress in advancing the affected populations' right to health.

In summary, as we stated before, the perspective of human rights in the health services should place people as the principal element of any activity, program, policy and legislation. However, most human rights are far from being met for the majority of the population. The right to health is among rights which have tendency not to be considered as universal human right, but as a merchandise [47]. This view of right to health emphasize on lifestyles promoting health consumption, where individuals are victims and murders of their health-disease process.

5. The right to social security

According to the ICESCR, the States parties "recognize the right of everyone to social security, including social insurance (Art. 9)". This right encompasses the right to access and maintain benefits, whether in cash or in kind and without discrimination, in order to secure protection, *inter alia*, from (a) lack of work related income caused by sickness, disability, maternity, employment injury, unemployment, old age, or death of a family member; (b) unaffordable access to health care; and (c) insufficient family support, particularly for children and adult dependents [48].

Social protection strategies such as cash transfers, microcredit, and training might be harnessed to improve social and health conditions of vulnerable groups and therefore preventing and mitigating causes and effects of TB. However, in some regions of Chiapas health programs - including TB diagnosis and treatment- have been politicized threatening patients life and hindering prevention and control of disease transmission [9,10].

6. Patient rights and TB

The five elements of DOTS and the six components of the TB Stop strategy should ensure TB prevention, diagnosis and treatment to achieve early case detection and successful treatment [49,50]. Nevertheless, those elements are not satisfied due to inadequate implementation of DOTS in highly marginalized settings, where TB is often endemic or with high prevalence, such as in Chiapas, Mexico.

It might be considered that TB is a disease that can be "easily" diagnosed (mainly the pulmonary form), prevented, treatable and curable, but it may lead to death if neglected. How TB might be neglected? The failure of BCG to prevent *M. tuberculosis* infection, the appearance of

DR-TB *M. tuberculosis* strains, the lack of an effective and affordable diagnostic methods, and the growing HIV-AIDS as well as DM, threaten to overwhelm current TB control strategies in many endemic areas where resources, human and material, are scarce.

6.1. Right to prevent TB: The failure of the BCG vaccine

Active immunization is one of the essential components of TB control. The bacilli Calmette-Guérin (BCG) live vaccine was developed in 1909 by Albert Calmette and Camille Guérin and is still the only worldwide vaccine used to protect against TB [51]. Despite its global use, with over 100 million doses given annually, its efficacy remains controversial since in randomized controlled trials and case control-studies range from detrimental effect to 80% protective benefit [52], and 50% in a meta-analysis of the literature [53]. However, other studies have shown its efficacy against severe forms of childhood TB, principally milliary and meningitis [54], but limited benefit in preventing adult PTB, the form that is the most contagious and hence fuels the continuing epidemic [52]. This variation has been attributed to genetic and antigenic differences between BCG strains, geographic localization, and previous exposure to environmental mycobacteria and genetic variation of the human population [51].

The WHO recommends that BCG is given at birth, or shortly after birth [55]. However, some countries do not follow this guideline. BCG vaccination is not used at all in Netherlands and USA [52]. In Norway, BCG is given only to school age or older children, while in the United Kingdom, Sweden, and Switzerland is administered to risk groups only (health care workers, people with positive tuberculin skin test, etc.) [52]. The WHO also recommends applying BCG vaccination in countries with high burden of TB, including in HIV endemic areas, but vaccination of adults is not normally recommended [37, 38].

In Mexico, the BCG vaccine started to be used in 1951, but its massive application to the Mexican population was on 1973 [57]. Although BCG vaccination is part of the national childhood immunization program [57–59] and provided free by the state, its coverage remains uncertain and impact of BCG vaccination on transmission of *M. tuberculosis* is therefore limited, especially in regions such as Chiapas, with poor or null access to health services.

The Mexican National Council for Vaccination (Consejo Nacional de Vacunación, CONAVA) and the state vaccine programs organize the vaccination campaigns all over Mexico [58]. Application of vaccines is considered a universal human right, regardless whether children are engaged in an official health service. Thus, in Mexico and Chiapas children under five years old must have vaccination booklet, a certificate that documents all vaccines, including BCG, offered by official health services. According to official data, Chiapas' BCG vaccination coverage for children was 97.6% in 2012, while coverage at the national level in this year was 96.7% [27]. However, the percentage of vaccinated children might be lower due to several regions of the state have null or lack of access to health services as well as political or religious conflicts that act as barriers to the health services. To exemplify this situation, a study carried out in three regions of Chiapas (North, Highlands, and Jungle), between 2001 and 2002, only 76.4% children under five years old had received their complete scheme vaccination [9]. This study also documented that official health services did not vaccinate children because parents either were not registered in an official program or belonged to a distinct political affiliation

[19]. Furthermore, there was no BCG vaccine available because vaccine campaigns have ended at the time parents took their children to the clinic [19]. Unfortunately there is no a current study assessing the actual vaccination coverage in Chiapas.

Since there is uncertainty regarding to the protection time, some countries undertake BCG revaccination programs. However, such programs have been considered highly costly [60–62], because the price of preventing a single case of TB appears to be nine times greater than treating a single patient with PTB [61]. Furthermore, revaccination has been associated with the decrease childhood and adolescent TB in Hungary and Poland [52], but not in Chile [63] and Brazil [62].

Independently of benefit-cost ratio effectiveness, meningeal TB (MTB) sometimes yields a variety of complications, including permanent disability [64]. If BCG vaccine is a cost-effective intervention against severe childhood TB, as based *per* disability-adjusted life year (DALY), its prevention could be an important reason to continue revaccination [46].

One of the highest priorities of TB research is to develop vaccines that are more efficacious for preventing TB than BCG. Novel vaccine development has accelerated in the past years, with at least 16 candidates entering human trials, and a few vaccines have entered into Phase 2b efficacy studies. However, different vaccines may be needed due to the varying disease states (latently infected, or active), the ages affected (infants, adolescents, young and the elderly), and patient health status (HIV and immunocompromised patients especially) [65,66]. It has been argued that the development of a new vaccine is highly costly due to the relatively regional incidence of TB, despite the high worldwide prevalence. It has been estimated that proof-of-concept trials that use clinical endpoints are necessarily very large (1000-35,000 subjects) and highly expensive, a cost that countries with high incidence cannot afford in the development of a new vaccine [67].

On the other hand, the satisfaction of the following rights prevent vulnerability to TB: Non-discrimination, right to health, to work, to adequate housing, food and safe drinking water and sanitation, right to education and right to information [4].

6.2. Active case contact finding and prophylaxis

Clinical manifestations of TB are simply divided into a binary classification: active disease and latent infection. *M. tuberculosis* is transmitted to person to person through aerosols, but not all develop the active disease [68,69]. Healthy individuals might suppress *M. tuberculosis* following infection, with only a 10% lifetime risk of latent TB infection (LTBI) reactivating into active TB disease, most commonly within a few years after exposure [68,69]. Persons closely exposed to individuals with active infection (i.e. index case) are at higher risk for infection and to ultimately develop active TB [70]. Risk is largely determined by the frequency and duration of exposure to the index case, and increases in persons with HIV-AIDS, DM, and tumor necrosis factor (TNF) neutralization therapy for other diseases [68,69]. Identifying and prophylactically treating close contacts at higher risk, such as children and people with DM and HIV-AIDS, has therefore become priority to disrupt transmission chain.

Contact investigation involves the systematic evaluation of the contacts of known TB patients to identify active disease or LTBI [71]. The WHO has launched guidelines, which should be applied according to specific settings and among risk groups [53]. However, screening depends on many conditions: (a) capacity of health systems (availability of human and material resources as well as infrastructure); (b) focus risk group; (c) objective of screening; and (d) epidemiological situation.

WHO has recommended that screening should be carried out in settings where the TB prevalence in the general population is 100 *per* 100,000 population or higher and in subpopulations that have very poor access to health care, such as people living in urban slums, homeless people, people living in remote areas with poor access to health care, and other vulnerable or marginalized groups including some indigenous populations, migrants and refugees [53].

Chiapas met all the above conditions to perform screening to search for active and latent TB infection. It is well known that marginal groups are the ones presenting the highest TB morbidity and mortality rates; however, their characterization is not usually considered in the design of programs for their prevention and control. Thus, TB continues to cause high rates of transmission, death and rising health costs in these marginalized groups, which represents a violation of their human rights as a consequence of the governmental incapability of preventing this situation. Our research team has performed active case finding in diverse regions of Chiapas and has found worrisome high morbidity and mortality rates due to PTB [13-15, 17-23] (Table 1). It is alarming to note that in some regions of Chiapas, high PTB incidence have reached 276.9 *per* 100,000 in inhabitants aged 15 and over [21], one of the highest in the world for 1998. It is also probable that PTB incidence in Chiapas is underestimated, in part due to under-diagnosis. TB cases, and therefore incidence rates notified by health sector systems, basically corresponds to cases detected in health services by smear microscopy examination, that it is well known, to have low sensitivity in rural and marginalized areas [9,10,17,19].

TB control programs are emphasized in adults. However, children contribute to the caseload related to the disease and experience morbidity and mortality. In 2013, Chiapas, reported 1,238 new TB cases, from which 129 (10.4%) were pediatric (defined as those aged ≤19 years old) (Dr. Alied Bencomo-Alerm, records of Prevention and Control TB Program at the Highlands region). Yet, these estimations might not reflect the real magnitude of TB in children because of the technical challenges in diagnosing pediatric TB. In an attempt to identify TB in children, the local TB prevention and control program performed a pilot study in the Highlands region using a point-based scoring system to aid in detecting TB in this vulnerable population. This pilot study detected two TB cases in children < 5 years old. However, the study was limited to only health services settings. This point-based scoring system has become an invaluable tool for detecting pediatric TB at the community level. Nevertheless, health staff and mothers should be trained and supervised through the application of this point-score system to ensure its reliability and validity (Dr. Alied Bencomo-Alerm, unpublished data)

Region studied[a]	Study population	Number of population studied	Prevalence of pulmonary tuberculosis (PTB)	Year	Reference
Border (Second level Hospital)	Considerable percentage were indigenous people (Mayan Tojolabal)	221	21% of chronic coughers studied, hospital users, aged 15 years and over,	1994	[18]
[b]Border	Considerable percentage were indigenous people (Mayan Tojolabal)	2,203	11.1% of chronic coughers studied users of primary care services	1997	[19]
[c]Border	19% indigenous (Tojolabal)	11,274	276.9 *per* 100,000 people aged 15 and over	1998	[22,26]
[d] Los Altos	Mainly indigenous (Tsotsil and Tseltal Mayan)	529	78 people deceased for whom the cause of death was associated with TB.	1998-2009	[10,24]
[e] Los Altos, Selva and Norte regions	Mainly indigenous (Tsotsil, Tseltal Mayan Lacandon, Chol)	2,997 households	161.2 *per* 100,000 persons aged 15 years and over.	2000-2001	[9]
[f] Soconusco		710,716[f]	59.3 *per* 100,000 inhabitants	2013	[16]
[g] Central		705, 201[g]	19.7 *per* 100,000 inhabitants	2013	[12]

[a] Local Ministry of Health divides Chiapas into ten administrative regions. In 1994, an armed uprising begun led by the Zapatista Army for National Liberation (EZLN or Zapatistas) on behalf of the indigenous population of the state, which claimed the compliance of their human rights, including health services. After twenty years, the socioeconomic situation of majority of indigenous people has not undergone significant changes.

[b] Active case finding of patients with chronic cough (15 days or more) was carried out among all patients aged over 14 years seeking consultation in a random sample of seven primary care centers; 573 coughers were found.

[c] The PTB incidence rate was extremely high in relation to official statistics reported during 1998 for Chiapas and Mexico (as a whole), 34.2 and 19.1 *per* 100,000 inhabitants. Authors also estimated that TB incidence rate might have reached 400 *per* 100,000 inhabitants aged 15 and over, if extrapulmonary cases were considered. The study included 32 communities.

[d] This study aimed to analyze the PTB mortality of a cohort of patients in Los Altos Region of Chiapas, who had been diagnosed with PTB from January 1998 to December 2002. The records of the TB Program were reviewed, and patients were located through a search attempting to locate them in their homes. Of the 40 deceased due to PTB found, 33 died without having received any medical care. Advanced age was associated with higher PTB mortality, and this indicates that among older patients, the accumulation of unfavorable living conditions (malnutrition and poverty) together with the probably deficient medical care by health services, make them an especially vulnerable group. Furthermore, only five of them had been treated via DOTS. The difference in the death proportion between those not treated via DOTS and those treated via DOTS was considerable (93.6% versus 6.4%, respectively).

[e] This study undertook the first comprehensive population-based health research in the conflict zone. The study carried out household survey in the municipalities most affected by the armed conflict among three types of communities: opposition, pro-government and divided communities, i.e. which contained both opposition and pro-government groups. The PTB rate found, at the time of the study, was at least three times greater that registered for Chiapas State as a whole.

[f] Data taken from Ministry of Health (Secretaría de Salud, SSA). In 2013, according to official statistics, the Soconusco and Central regions have the highest incidence rates of PTB in Chiapas, with 59.3 and 19.7 *per* 100,000 inhabitants, respectively. The Soconusco region is another border area and limits Mexico and Chiapas from Guatemala; it is characterized for its high migration of Centro American people crossing Chiapas to United States of America.

[g] In the Central region is located the capital of Chiapas; the high incidence might be explained due to centralized health services.

Table 1. Research projects carried out, from 1994 to 2010, at different regions of Chiapas, Mexico, to assess the epidemiological situation of TB.

On the other hand, the tuberculin skin test (TST) and interferon gamma release assays (IGRAS) have been proposed as a means to identify people with LTBI. Yet, in many countries including Mexico, efforts are focused in detecting active cases, despite the effect of isoniazid treatment for LTBI to reduce the risk of progression to active TB. In resource-poor settings TST is rarely available, and IGRAS are not even considered due to their high cost and complexity to interpret [68]. Downsides that are common to both TST and IGRAS are that they do not differentiate active from latent infection, nor do they provide any direct evidence of the presence of viable bacilli, and are not specific to *M. tuberculosis* (for example, *M. avium* may cause false positive test); all those factor hinders IGRAS useful in detecting LTBI in poor resource settings [72]. They simply determine that infection has at some point led to an acquired immune response that is detectable following re-challenge with antigen.

Mexico does not have an efficient program to follow-up close TB contacts; consequently, no reliable records exist to determine the prevalence of LTBI at national level. This situation is especially true in Chiapas, which is one of the poorest states of the country, as well as one of the most highly indigenous, marginalized, with high number of rural and dispersed communities, as well as presence of socioeconomic, political, and religious conflicts, and lack of health care resources. All these factors combine and reflect poor health indicators, including TB, for the state [9,10].

The Mexican official norm (NOM-006-SSA2-1993) continues to state that healthy adults with positive TST should not receive prophylactic treatment unless people are HIV positive and/or with DM [73]. TST is the only screening test used in Mexico to determine LTBI [74,75]. When resources are available, and when cost-effectiveness is assessed against a range of other expensive health interventions, TB screening in selected risk groups may be affordable and have relatively low opportunity costs. Whether a country is struggling to eliminate TB, and needs to invest additional resources to effectively provide those who are hardest to reach (see section: vulnerable populations), screening selected high-risk groups may be a key part of the response to tackle TB. In this regard, some studies have used IGRAS in Mexican population, but those studies have been focused in some risk groups such as injection drug users [76], migrant agricultural workers [77], PTB contacts [78,79], dairy farm and abattoir workers [80], and HIV-infected people [81,82]. Controversial results have emerged when comparing TST and IGRAS [83]. In Chiapas there is no a single study assessing the levels of LTBI, but it might be expected to be high due to endemic prevalence of the disease as we described previously.

Some studies suggest that use of IGRAS is indicative of an approximately eight-fold higher risk of progression to TB disease within two years on a cohort of adolescents in a high-TB burden setting [84] and in low income countries [85,86]. Although neither TST nor IGRAs has real value to diagnose TB among adults from low- and middle-income countries, TST appears to perform well to identify LTBI among close contacts of individuals with TB in Mexico. If the detection of people with active and LTBI is improved, as well as the adequate anti-TB treatment, situation of TB in Chiapas could be much better than today.

6.3. Right to receive free, timely and appropriate diagnosis and treatment

Due to the increase of TB worldwide during the 1990's, WHO launched the DOTS strategy which comprises free TB diagnosis and treatment specified in five components: (a) political commitment with increased and sustained financing by governments; (b) case detection through quality-assured bacteriology, (c) standardized treatment, with supervision and patient support, (d) an effective drug supply and management system, and (e) monitoring and evaluating system, and impact measurement [49]. National governments that have adopted this strategy, including Mexico, must ensure all the above elements in order to provide adequate TB diagnosis and treatment. However, there are hidden costs assumed by patients. In a study conducted in Malawi [87], the cost of obtaining diagnosis for TB could represent up to 244% of the total monthly family income. These expenses were related to transport and the loss of working hours.

Although DOTS has been the landmark of TB control, many people with TB remain undiagnosed or are diagnosed only after long delays. This strategy was developed only from a biomedical orientation without including other dimensions such as social, economic, cultural, linguistic and physical access to TB services as well as migration and stigmatization [10,17,19,21,23,26].

The high burden of undiagnosed TB causes much suffering and economic hardship, not only for the individuals who have TB but also their families [88]. This burden is determined by a range of factors, such as socioeconomic status, clinical needs, health system structure, TB service delivery model, distance to health services, insurance coverage, capacity to work, existence of any social protection scheme, and effectiveness of informal social networks supporting patients and families [88].

Most countries aim to provide TB diagnosis and treatment free of charge within public health services. Access to free TB care has expanded substantially over the past two decades through national efforts and global financial support [88]. However, many TB patients and their families are still facing very high direct and indirect costs due to TB illness and care-seeking, hampering access and putting people at risk of financial ruin or further impoverishment. Total costs for TB diagnosis and treatment might range from 55 to 8,198 United States Dollars (USD), which include the following components: direct medical costs (consultations, tests, medicines and hospitalization, etcetera), direct non-medical cost (transport, food, and accommodation during healthcare visits) and indirect costs (lost income) [88].

The following rights increase access to quality TB diagnosis, treatment, care and support: Non-discrimination, access to health services and anti-TB treatment, right to participation, information, education, right to social security and financial protection, right to privacy, freedom of movement, right to body integrity and freedom from torture and inhuman or degrading treatment, right to due process protection, Siracusa principles, and right to enjoy the benefits of scientific progress and its applications [4].

Chiapas was one of the first Mexican states which adopted DOTS strategy [89] and therefore Mexican and state governments assumed the responsibility to provide free diagnosis and treatment. Although it is stipulated that the anti-TB treatment is free for all population, it is

quite often that anti-TB drugs supply is not available for local TB programs during large periods of time, even weeks. Chiapas is considered a high priority for prevention and control of TB due to the presence of many DR-TB cases [16]. Moreover, a study carried out in three different regions of Chiapas identified serious deficiencies in both the detection and treatment of PTB, as well as alarming conditions that expose people to risk to PTB [9]. This study found 29 cases of PTB, from which four had not received any medical care. Of the 25 that had received medical care, 22 had done in government health services and three in private services. Of these 25 cases, ten had not received any diagnosis, thirteen had been diagnosed with PTB, and two received diagnosis other than PTB. From the 13 who were diagnosed by health services, one had not received any treatment, six were receiving anti-TB drugs, and six had failed to comply due to several irregularities and deficiencies in their treatment [9]. Furthermore, the study also highlighted that patients with PTB did not seek health care due to lack of money, great walking distance to nearest clinic, denial of health service, and mistreat by health personnel [9]. Whether TB patients receive free and adequate treatment by health services, their socioeconomic conditions (poverty, malnutrition, overcrowding, marginalization, etcetera) makes them at high risk for defaulting treatment, either by the need to work and support their family, or by the adverse effects of anti-TB drugs [10,19,23,90].

Economically productive people affected by TB are unable to work, and this has immediately consequences for the family. Patients with TB and their family are condemned to a higher level of poverty that often has a negative impact on their living conditions. Incapacity to work reduces access to food, and forces other members of the family into the labor market. In many occasions, children become the work force for the family and drop out their education. WHO [1] has stated that if the social determinants of disease such as poverty, social exclusion, poor working conditions and food insecurity, are not tackled, TB will remain a major public health. Poverty has strongly been associated with prevalence of TB. In Mexico, in 2012, almost half (45.5%) of its population lives in poverty [91], whereas Chiapas has 74.7% of its population in poverty conditions [92]. The fact that Chiapas is one of poorest Mexican states and the considerable shortage of health resources in the country, suggests that TB is, and will continue to be a serious public health issue in terms of morbidity and mortality with impact in health costs care. Our studies reflect this epidemiological situation in which we have reported high incidence and mortality rates (See Table 1).

6.4. Public or individual health rights?

TB is transmitted to person to person and this implies and requires both individual and public rights [93,94]. A fundamental function of government is public health protection that requires formulation and implementation of policies in order to prevent transmission of diseases such as TB [93,94]. Public health is sometimes used by States as a ground for limiting the exercise of human rights. In the case of TB, governments have traditionally focused on preventing transmission of disease by controlling the movement of infected persons [93,94]. However, this causes a tension between individual rights and public health security, because governments must protect public health as well as safeguard legal rights of individuals [93,94]. PTB

poses a serious demonstrable threat to the public health, especially when any DR-TB strains are being transmitted from endemic to global settings [95].

International law provides rights-limiting principles, which might justify enforcing compulsory measures against TB patients who refuse to have diagnostic procedures or who refuse to be monitored and treated once disease is confirmed [93,94]. Restrictions of human rights are permitted, on limited duration and subject to review, if there is a need to protect public health, but these limitations must fulfill the five criteria of the Siracusa Principles [96]:

a. The restriction is provided for and carried out in accordance with the law;

b. The restriction is in the interest of a legitimate objective of general interest;

c. The restriction is strictly necessary in a democratic society to achieve the objective;

d. There are no less intrusive and restrictive means available to reach the same objective;

e. The restriction is based on scientific evidence and not drafted or imposed arbitrarily i.e. in an unreasonable or otherwise discriminatory manner.

Since interaction between infectious people and those susceptible to infection is a strategy to interrupt TB transmission, some countries have adopted two approaches: (a) isolation, the segregation of presently infectious people; and (b) quarantine, the segregation of people exposed to TB but who are not yet infectious [97]. Isolation might be acceptable under appropriate and effective means of preventing transmission if patients are released as soon as transmission becomes unlikely [97]. However, quarantine is unethical for TB [97]. Either way there are implications in both individual and collective human rights. The high incidence rates of MDT-TB and XDR-TB in South Africa has challenged both points of view [98].

7. TB in several vulnerable populations: Children, elderly, indigenous groups, migrants, and women

All societies are vulnerable in several ways and factors that contribute to this are: physical, economic, social, cultural, ethnicity, religious, language, and political, among others. All these conditions might determine people´s level of vulnerability. Poverty is one of the major contributors to vulnerability, because poor people are more likely to live and work in areas exposed to potential hazards, while they are less likely to have resources to affront such hazards. Since the vast majority of people living with TB are from the poorer and vulnerable segments of the society, the global TB control goals cannot be met unless these populations segments have sufficient social and economic empowerment [1]. Key social determinants of TB that include food insecurity, malnutrition, hunger, poor housing and environmental conditions, as well as financial, geographical, cultural and linguistic barriers to health care access, should also be addressed in order to achieve TB control and management [99]. Thus, TB is deeply associated with vulnerability conditions such as: (a) poverty because of the low socioeconomic status which implies legal, structural and social barriers that impede access to health services and, in consequence, difficult TB prevention, diagnosis and treatment care; (b)

demographic factors like age, sex and ethnic group; and, (c) socioeconomic issues as migration, among others.

7.1. TB in children

In Chiapas, as in worldwide, TB in children is a crucial issue that has not received enough attention despite that this state has a very high TB mortality rate among adult population –as was stated before- and adult persons with TB can transmit the bacteria to their family members, including children.

In 2012, WHO estimated that TB incidence among children (aged <15 years old) was 530,000, from which the total number of deaths from TB among HIV-negative children was estimated to be 74,000 [2]. However, these figures do not show the real burden of TB in children because TB prevention and control programs are emphasized in adults, who mainly having the PTB form. In this regard, TB in children is not considered a source of infection and therefore they are a vulnerable population whose rights are violated for not receiving appropriate diagnosis and treatment. TB diagnosis and treatment for children is difficult due to the following reasons: (a) non-specific symptoms and problems in confirming diagnosis, requiring more expensive diagnostic methods and experienced physicians; and (b) treatment is challenging due to the lack of child-friendly formulations and difficulties in monitoring toxicity [100].

Globally, TB in children represents 5% to 30% of all cases, but regions with incidence greater than 15% indicates poor TB control [2]. In Mexico, 8.4% new cases registered in 2013 were pediatric [15]. The most common forms of TB in children in Mexico are pulmonary, lymphatic, renal and meningeal, while miliary TB continues to be present. From these, miliary and meningeal forms of TB are the most dangerous to the child. The risk of developing the disease varies according to age, increasing overall for those 10 years and over, while severe forms predominate among children under five. The Mexican states that reported highest incidence rates of TB among children in 2013, were: Baja California (18.5%), Chiapas (12%) Guerrero (8.5%), Tamaulipas (8.5%), and Nuevo Leon (7.7%) [15]. However, the Highlands region, which is characterized by large presence of indigenous groups, the incidence rate of TB in children has reached up to 22% [101]. The latter figure contrasts to that reported by official statistics, in which this region had the lowest incidence rate (11.7 *per* 100,000 inhabitants), even below the national rate [16]. Despite these numbers, the burden of TB in children for Chiapas and Mexico is unknown and is expected to be much greater due to the high prevalence of disease, lack or null access to health services, and problems in diagnosis, preventing and treating patients [9,10].

Finally, it is important to remember that in the "International Childhood Tuberculosis Meeting" [102] carried out in 2011, were set out, among others, the next key aspects:

- Children with TB infection today represent the reservoir of TB disease tomorrow.
- Children are more likely to develop more serious forms of TB such as meningeal and miliar, resulting in high morbidity and mortality.

- Despite policy guidelines, the implementation of contact tracing and delivery of isoniazid preventive therapy (IPT) to young and HIV-infected children is often neglected by public health programs.
- Most public health programs have limited capacity to meet the demand for care and high-quality services for childhood TB.
- BCG, the only licensed TB vaccine, has limited efficacy against the most common forms of childhood TB and its effect is of limited duration.
- Due to inadequate case detection it is estimated that a large number of children suffering from TB are not appropriately treated. This is further compounded by drug stock outs and the lack of child-friendly formulations of drugs for TB treatment and prevention.
- Children are rarely included in clinical trials to evaluate new TB drugs, diagnostics or preventive strategies.

7.2. TB in elderly population

The demographic transition worldwide has resulted also in an ageing population. A weakening in immunity and age related physiological changes leads to an increased burden of communicable and non-communicable diseases in the elderly. Hence, elderly population is the group that most suffer TB, independently of development degree and the efficacy of the fight against TB in the past. At present, as the elderly population's growth in numbers, there has been an increase in number of TB cases among this vulnerable group. In elderly patients, many clinical features of TB are subtle or absent, making diagnosis difficult. Autopsy among the elderly suggests that TB often remains unrecognized [103,104]. This population group is also at greater risk for re-activation of LTBI and for acquisition of new TB infection. Furthermore, the elderly also present challenging to receive treatment due to adverse effects (i.e. hepatoxicity), and the poor outcome of treated TB in this age group warrants more aggressive treatment [103,104]. Therefore, it is not surprising that compared with younger individuals, the mortality rate of TB in elders is six times higher [103,104].

In Mexico, there are 10 million older adults (≥ 60 years old) representing 9% of the total population [11]. Its annual growth rate is 3.8%, which means that there will be 14 million in 2018. A recent report has highlighted that there is an increase of up to 5% of chronic diseases, primarily DM in this age group [105]. In 2012, there were 2,253 deaths associated to TB from which 34.7% were people aged ≥ 65 years old, both women and men. However, epidemiological studies carried out in different regions of Chiapas have found that people aged ≥45 years old are in high risk to die due to PTB [10,24]. Factors that might explain why TB affects the elderly are: (a) the cumulative prevalence of TB through their lifetime; (b) their immune system become weak as they grow up older; (c) the presence of other diseases, mainly chronic such as DM, which form comorbidities with TB.

DM is one of the leading causes of deaths in Mexico, and has significantly increased the number of TB cases in the elderly. The association between DM and TB is 20.9% in TB cases, versus 5.6% people infected with HIV [15]. Patients with DM respond late to the anti-TB treatment,

and they have higher risk to become DR-TB [106]. It has been stated that DM increases three times the risk of PTB, either by reactivation or new infections. However, a study carried out in southeast of Mexico, people having DM had ten times risk to be infected by TB, than patients having HIV. This study also found that the incidence rate was significantly higher in patients with DM compared to the rest of the population (209.5 versus 30.7 *per* 100,000 inhabitants/year) [107]. In Chiapas, the elderly group is the most affected by TB. Thus, in 2013, 15.44% of the reported cases were people aged over 65 years old, and the association of TB and DM among elder people was 18% [16]. However, the real burden determined by both diseases is unknown because not all people have access to health services to measure its glucose levels.

7.3. TB in women

Worldwide, women have more probabilities to be poor than men because they suffer the more generalized discrimination, more assistance work non remunerated, violence, violation of their rights and less levels of income, among others gender inequalities [108].

Globally, in 2012, there were an estimated 2.9 million new cases of TB among women, from which more than half (1.5 million) neither were diagnosed nor treated. Of the 2.9 million, it was estimated that 410,00 died, of which 54% occurred in Africa [2]. In this sense, a study carried out in Bangladesh, India and Malawi, identified gender and illness related factors of diagnostic delay of TB [109] Furthermore, TB is one of the main causes of women's death in reproductive years, and kill more women that all causes of maternal mortality [110]. In fact, in the age group 15-44 years, TB figures in the top three causes of death, and represents 9% of deaths in this age group, versus 3% for HIV and heart diseases [4].

However, the burden of TB morbidity and mortality among women is larger than often realized. Gender discrimination, even when not directly related to health care (for example denying girls and women access to education, information, and various forms of economic, social and political participation) can create increased health risk. Even if the best public health services are available, a woman has to be able to decide when and how she is going to access them, and that implies that she must have the ability to control and make decisions about her life [111]. Unfortunately, in practice, TB-related stigma and discrimination affect women's access to health care, delaying seeking care [4].

Stigma associated with TB may be greater for women than men, and its consequence include ostracism, abandonment by the husband and/or her family, divorce or the husband's taking of a second wife, and loss of social and economic support, housing, access to one's children, etc. [1]. Marriage chances may be affected if women are known to have TB, or even if they have a family member with TB, since stigma associated with the disease may affect all household members. In situations of poverty, women have the least access to food, health, education, training and opportunities for employment and other basic needs [1]. This highlights the social structural inequalities resulting from the arbitrary assignment of biological, cultural, political, and economic roles to women, which make them vulnerable in different situations, and particularly the gain to access to health [111].

The natural history of TB is different in both sexes. Women in reproductive age (15-40 years old) are more susceptible to developing TB with twice the probability to progress to an active phase after the infection, than men. Maternal and neonatal complications increase in pregnant women with TB, who require up to 12 times more hospitalizations compared to women who do not have the disease [110]. Risks of perinatal and neonatal deaths increase ten times in women with TB, and risk of transmission of VIH from mother to child increases 2.5 times [110].

In Mexico, in 2013, of 19,738 new cases registered of TB (in all its forms), 38% were women, with a ratio men/women of 1.6:1 [15] and a similar trend also observed in Chiapas [16]. Regarding to mortality, from the total number of deaths (2,253) related to TB reported in 2012, 652 were women [15]. However, the exact numbers of morbidity and mortality is unknown among women because of the stigma associated with the disease with consequences in delays in diagnosis and treatment, as well as null or lack of family support.

In a study of gender differences regarding to social support networks among people with PTB in the State of Veracruz, Mexico, concluded that women struggle to receive either diagnosis or treatment due to their family role (housekeeping, care of child, they have to attend sick persons, go out to work, they are very busy and have no time to go to the doctor), fear to be stigmatized, and lack of family support [112].

Another study [113] documented that men can influence women –negative or favorably- for receiving diagnosis and adequate treatment, because their lack of empowerment to make decisions about their health. Furthermore, the same study also documented more deficiencies in care quality in women than men, such as: (a) they were not examined properly; (b) they were not informed of the causes of and the required treatment for TB; and (c) their diagnosis took a considerable amount of time [113]. A study carried out in the Highlands of Chiapas, documented the case of an indigenous woman whose husband did not let her to take anti-TB treatment [23].

In summary, It may be considered that female deaths due to TB is a form of gender and structural violence given the high number of women TB-deaths avoidable, because a lot of them occur as consequence of differences constructed by gender roles created by society. It is necessary to examine disaggregated data of TB morbidity and mortality by age and sex in order to emphasize the nature and extent of inequality between men and women [114]. The differences in the prevalence of TB among women and men might be explained in terms of socio-economic and cultural factor such as: (a) Level and time exposure and risk of infection; (b) delay in seeking care; (c) difference in quality services; (d) compliance with treatment; (e) impact of disease on individuals and their families [114].

7.4. TB in indigenous people

Disparities in health, including differences in TB risk and burden, between indigenous and non-indigenous people, are the result of the complex interplay between the individual, the community, and the social determinants of health. In Mexico, as in many Latin American countries, the majority of indigenous people live in extreme poverty. Official statistics estimates that in the country there are 13.7 million indigenous people, from which 76.1% live

in conditions of poverty [13]. This socio-economic situation has favored migration from rural areas to urban centers, where the population tends to settle on unfavorable living conditions.

Mexico has 2,443 municipalities of which 871 (35.7%) are considered indigenous or with presence of indigenous population. Among these 871, 75.2% (655) have 40% and over of indigenous population, and almost are classified as high or very high poverty level [115].

Studies have estimated that municipalities with over 70% indigenous populations contain approximately 80% of the population living below the poverty line. Additionally, some of the indigenous groups in Chiapas face even greater degrees of poverty than others in the country. For example, 58% of the Mixtec population (in Central Mexico) live in municipalities classified as having "very high" marginalization, compared with 93% of the Tseltal population in Chiapas [9].

Chiapas, Oaxaca, Veracruz, Yucatan and Puebla, are Mexican states having large indigenous population [11]. Indigenous populations represent 27% of the Chiapas population [11]. Most of indigenous settlements are in remote communities, which have a negative impact on the realization of human rights of these populations [9,10]. Indigenous condition in Mexico is not only a demographic indicator, but also a socioeconomic one, because reflects socioeconomic condition and level of accessibility to health services with quality, as well to social security, among other basic human rights.

The life expectancy in indigenous population is 65 years, while in the general population is 74.70 [11]. In Chiapas, infant mortality is greater compared to other states and national average. For example, the likelihood of one infant from Chiapas die before his first year of life is 80% greater than one child from Mexico City and Nuevo Leon. Furthermore, 79% of indigenous infant deaths could be prevented [116]. These statistics show that indigenous people are highly vulnerable in terms of right to access to any social security, including health services [117]. In this sense, there is strong evidence that poverty influence in the utilization of health services and delay in seeking care [118,119].

Health coverage apparently increased among Mexican indigenous people due to the implementation of the so-called "Seguro Popular", however, this did not reflect in health services utilization, neither better living conditions for indigenous populations [28]

Although northern Mexican states, such as Baja California, Tamaulipas, Sinaloa, reported high number of new TB cases [15], a great number of cases are from indigenous people who have migrated from southern states, such as Chiapas. Therefore, the burden of TB in northern Mexican states is influenced due to migratory movements from the south of the country, a region with high proportion of indigenous population.

In terms of TB morbidity and mortality, there are three important sanitary jurisdictions in Chiapas: the Soconusco region (main region of migratory movements from Central America to USA), the Centre (where is located the capital of the state) and the Highlands (with strong presence of indigenous people). It is interesting to highlight that the incidence rate of TB for these regions, in 2013, were: 59.3, 19.7, and 11.7 *per* 100, 000 inhabitants, respectively; the latter figure was the lowest incidence rate reported for the whole state [16]. The TB epidemiological

situation in these regions is controversial. Apparently the Soconusco and the Centre regions hold the TB burden for the state, which might be explained as follows: (a) the Soconusco region, which is a border with Guatemala, favors the continuous transmission of TB between countries; (b) the Centre region is becoming rapidly urbanized without planning, with many poverty surroundings. The marked difference of incidence rates of TB between the Soconusco and the Centre regions with respect to the Highlands is unlikely because the latter one possesses socioeconomic conditions that favors high TB burden. Our epidemiological studies show this affirmation (See Table 1). The main factors that can contribute to explain such asymmetry, is precisely the ethnic composition of each region: the Highlands is mainly indigenous, with low human index, and the other ones are "mestizos". This situation is the result of significant differences in levels of under-diagnosis due to inequalities of health resources allocation, both material and human, which violate people's right to health. Noteworthy to mention is that in a study carried out by our work team in the Highlands, we found that the only variable "protective" in people with PTB to avoid MDR-TB form, it was being indigenous due to less contact with health services compared to non-indigenous population [25].

The International Labour Organization (ILO) Convention 169, of which Mexico is party, specifies in its Art. 25 the rights of indigenous persons to health: "Government shall ensure that adequate health services are made available to the peoples concerned, or shall provide them with resources to allow them to design and deliver such services under their own responsibility and control, so that they may enjoy the highest attainable standard of physical and mental health". In Chiapas, these obligations are not being honored in practice [9].

7.5. TB and migrants

Migration, just after poverty, is one of the principle aspects that contribute to the continue spread of TB [120]. Many migrants are likely to move into social and economic conditions characterized by overcrowded, substandard housing, poor sanitation, and lack of access to medical services [1]. Migrants often fall to the lower end of the social structure where they may be at high risk to get TB, together with HIV-AIDS, DM, and the abandonment of programs of TB prevention and control [1,6,37].

Chiapas is an important route of migration. The state shares more than 660 kilometers border with Guatemala [8]. A large number of Central Americans and South Americans people pass through this state on their way to the United States of America (USA). Many peasants and indigenous people from Chiapas have migrated to the USA. Migration from the southern Mexican states of Chiapas, Oaxaca, Guerrero and Veracruz is an important factor for the high morbidity and mortality rates found in the northern states of Mexico, such as Baja California [15,101].

In Chiapas, international migration is an evident phenomenon in the last years [121]. Migration is commonly linked to an image of prosperity and well-being, however, not always international migration increases the ability of migrants and their families to overcome poverty [122]. Migrants from Chiapas, who recently begun migratory movements, are considered a vulnerable subgroup due to their inexperience in migration. They neither have networks nor the

resources to guarantee successful border crossings into the USA, they are unfamiliar with the strategies and operations of the border guards, and they are ignorant of the climate, orography and geography of the border region [123].

Additionally, a considerable number of migrants do not recuperate the expenses paid out for their trip, resulting in increased debt. In these circumstances, migration represents a net loss in various senses: monetary, labor, and health. Therefore, the family continues to worsen further into poverty and into conditions of great vulnerability, which only are remedied when the remittances begin to arrive with regularity. The vulnerability of the family can worse when the unsatisfied needs have to be attended for all household members –including children and the elderly- into the work force, or with the sale of the few belongings the family possesses. For a great number of migrants, the conditions of the trip itself, and of the housing available upon arrival, as well as work conditions, reinforce the vulnerability at each step in the process [124].

As we can see, in general terms, migrants suffer conditions of vulnerability. So, states must take into account this condition, and guarantee their human rights, in this case, in the access to TB prevention, diagnosis and treatment without discrimination of any kind, either countries of origin, transit or destination [1,4,44].

The main human rights issues associated with TB with regard to migrants, refugees and internally displaced persons, are [4]:

- Migrants in irregular situations often fall to the lower end of the social structure. Migrants, refugees and internally displaced persons may be at risk of TB due to poor housing (crowed living conditions), inadequate nutrition, lack of access to health facilities, information and services and/or exploitative working conditions;
- Migrants may be denied access to diagnosis and treatment for TB because of their legal status. They may avoid accessing health services for fear of deportation and delay seeking treatment because of lack of education and information;
- Continuity of care is often unavailable to forcibly returned migrants.
- Prevention, diagnosis and continuity of TB care, can be affected in the context of protracted humanitarian emergencies.

Unfortunately, despite the existence of national and international laws that protect their human rights, many states constrain the effective and full realization of the right to health of migrants, particularly those in an irregular situation. These practices include [4]:

- Legal barriers to accessing health services, based on the view that: it would be expensive for taxpayers to shoulder the costs of irregular migrants health, and that excluding this particular group from receiving social benefits would deter future irregular migration.
- Excluding migrants and their families from national health systems, limiting migrants' access to emergency care, with which increases their susceptibility to ill health, but on the other hand, may pose a public health risk to host communities. A person with active TB can infect 20 people each year. Migratory movements facilitate the dissemination of the

infection, especially when the migrant works and lives in overcrowded and in unsanitary places, which greatly complicates its control. In addition, a person undergoing anti-TB treatment who migrates will most likely abandon the treatment and not conclude it. At the same time, migrants can contaminate each other with TB, either during transit to their destination (many migrants travel in subhuman conditions of overcrowding) [125].

- Deny admission and residence to migrants with bad health conditions.
- Lack of health workers sensitized and trained in intercultural issues as well as on migrants' rights. From a human rights perspective, accurate communication and, if necessary, the use of professional interpretation services, are essential when obtaining consent for health interventions and treatment and guaranteeing confidentiality and privacy about health information [126].
- Involve health professionals in migration control. Due to the lack of financial and legal protection in accessing health services, many migrants postpone seeking medical care until they are seriously ill.

8. Legal health reforms in Mexico: Any impact in DOTS strategy?

In Mexico, the socioeconomic situation has led to setbacks in people's to have right to health due to the implementation of neoliberal economy policies followed by structural adjustments. Such policies are driven by structural reforms, economic regulations, trade opening and law markets, instead of health needs [40]. From 2009 to 2012, there was a reduction of 6.5% to 6.1% of gross domestic product (GDP) in the total health expenditure [127]. The immediate consequence is the deterioration of public institutions, which provide services to the Mexican people, and this includes the delivery of health services. These policies are impacting all structural bases, from legal reforms to the substantial reduction of budget [128]. The structural reforms in health sector only seek to reduce financial cost, but not to improve people living conditions [40]. Our epidemiological studies investigating diverse epidemiologic and public health issues in many regions of Chiapas show that the proposal changes by the Mexican government will worsen the so-called social determinants for TB. Therefore, such reforms will impact in the enjoyment of Human Rights to the majority of population, including the right to health. It is highly probably that reduction of financial expenditure on health (worse if expenditures are solely based on political and administrative criteria) will affect local prevention and control TB programs, due to lack of resources such as: physicians, shortage of anti-TB drugs, low resources to follow up TB patients, scarcity of equipment to prevent and diagnosis of TB, among others.

9. Conclusions

Health is a human right, and the right to health is indispensable to the exercise of other human rights, that is, it is also closely related to and dependent upon the realization of, among others

rights. The right to health is equally tied to the key principle of non-discrimination, which recognizes the "inherent dignity" of every human being. Through Mexico's General Health Law, and the National Health System theoretically guarantees both the availability and quality of health services, particularly to vulnerable groups, such as indigenous persons. However, in practice health care is not sufficiently available or accessible to many persons in Chiapas. In consequence, the high levels of incidence, mortality and MDR-TB cases, are the reflection that health services is not functioning adequately, and that the right to health in Chiapas is far away to achieve. Therefore, it is necessary:

a. To guarantee that all federal, state, and municipal government programs and activities related to health, be carried out without discrimination.

b. In keeping with the fulfillment of its obligations under the International Covenant on Economic, Social and Cultural Rights, the Mexican federal and Chiapas state governments should improve the availability, accessibility, acceptability and quality of health facilities, goods and services in Chiapas. To achieve this, it is necessary to train and sensitize health personnel about human rights considering local differences such as ethnic, culture, language, social and political structures, among others social determinants of the disease. Including these factors in DOTS strategy, it would be possible to improve diagnosis and treatment and view people with respect and dignity.

c. To improve surveillance and detection systems related to prevention and control of TB on disaggregated basis, so that disparities based on gender, socioeconomic indicators, and ethnicity may be detected and addressed in order to review either progress or failure of the local and regional TB programs.

d. The program of TB Prevention and Control in Chiapas should be strongly reinforced, with more resources, sensitizing, training, supervising, evaluating a comprehensive DOTS program, and incorporating mechanisms to ensure adequate follow-up of patients in accordance with international standards.

Nomenclature

DR-TB (drug resistant-TB): TB strains that are resistant to the one or more drugs used to treat it.

MDR-TB (multidrug-resistant TB): defined as TB that is resistant to at least rifampicin and isoniazid, the most powerful first-line anti-TB drugs [129].

PTB (pulmonary TB): it is the common and most infectious form of TB affecting primarily the lungs [130].

TDR-TB (totally drug-resistant TB): is defined as TB strains that showed *in-vitro* resistance to all first and second line drugs tested (isoniazid, rifampicin, streptomycin, ethambutol, pyrazinamide, ethionamide, para-aminosalicylic acid, cycloserine, ofloxacin, amikacin, ciprofloxacin, capreomycin, kanamycin) [131]. TDR-TB has been identified in the following countries: India, Iran, and Italy. However, it is not yet recognized by WHO.

XDR-TB (extensively drug-resistant TB): is defined as TB that has developed resistance to at least rifampicin and isoniazid (resistance to these first line anti-TB drugs defines MDR-TB) as well as to any member of the quinolone family and at least one of the following second-line anti-TB injectable drugs: amikacin, capreomycin or kanamycin [132].

TB: this term usually does not define the kind of TB. Since *Mycobacterium tuberculosis* primarily infects the lungs, this form is called pulmonary TB, while extrapulmonary TB involves the infection of other organs or tissues [130].

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