Evaluation of Pulmonary Tuberculosis Case Detection in Huejutla, Hidalgo According to the Synthetic Case Location Indicator (ISILOC)

Ocampo-Torres Moses[1]*, Quevedo-Moraila Esteban[2], Carrillo-Alarcón Lourdes[1], Amador-Herrera Claudia[3] and Sánchez-Pérez Héctor Javier[4]

[1]*Coordination of Health Research, Hidalgo Health Services, Pachuca de Soto, Hidalgo, Mexico*
[2]*Health Research Area, Health Jurisdiction 10, Huejutla de Reyes, Hidalgo, Mexico*
[3]*State Program of Mycobacteriosis, Under Secretariat of Public Health of the State of Hidalgo, Pachuca de Soto, Hidalgo, Mexico*
[4]*The College of the Southern Frontier, San Cristobal de Las Casas, Chiapas; Mexico*

*Corresponding Author: Ocampo-Torres Moses, Coordination of Health Research, Hidalgo Health Services, Pachuca de Soto, Hidalgo, Mexico.

Abstract

Introduction: Pulmonary tuberculosis (PTB) is a health emergency. The low detection of cases of PTB has caused its spread; therefore, finding cases is essential to neutralize transmission. The Synthetic Case Location Indicator (ISILOC) contributes to effective and efficient detection.

Methods: From February to November 2018, participatory action research (PAR) was carried out. A baseline measure of the ISILOC was made and demographic data were collected: age, gender, years in the program and profession. Three focus groups were organized with personnel from the Mycobacteriosis program. Qualitative information was obtained following three sequential stages.

Results: A total of 40 physicians and nurses were included. The largest age group was 31 to 40 years (50%), 75% were women, 43% had more than 5 years in the program and 30% were doctors. The baseline measure of the ISILOC, 0.33, was deficient. In the group, 48% thought the program performance was poor. More than two-thirds of the participants considered that the low performance was due to deficiencies in detection. An action plan of three categories was made: Improvement of case detection, health personnel training and health education and dissemination in medical units. A second measurement of the indicator was a result of 0.70, very good.

Conclusion: The ISILOC methodology was effective, improving performance in the Mycobacteriosis program; its application has continued to date with a very good performance assessment.

Keywords: Indicators; Detection; Pulmonary Tuberculosis; Health Strategies; Health Program Performance

Introduction

The oldest evidence of human pulmonary tuberculosis (PTB) dates to half a million years ago and corresponds to *Homo erectus*, whose fossils were found in Turkey [1]. However, PTB is not a disease of the past. It is currently calculated that one-third of the world population is infected and more than 1.5 million people die annually because of this disease. The World Health Organization (WHO) considers it a health emergency. It is estimated that every year approximately 10 million new cases appear, which is paradoxical in essentially preventable and curable diseases [2]. The world program of the WHO has as its goal the detection of 70% of cases of bacilliferous TB and the cure of 85% of cases [3]. The principal weapon to achieve this is rapid detection and cure of infectious cases [3,4]. PTB is transmitted by contact with individuals who have active PTB [5]. It is known that the perpetuation of PTB depends on the number of individuals who excrete bacilli in the community, the time that they continue excreting them, and the number and intensity of effective contact with susceptible people in the community [4].

Evaluation of Pulmonary Tuberculosis Case Detection in Huejutla, Hidalgo According to the Synthetic Case Location Indicator (ISILOC)

112

Low detection of PTB cases is a problem that advances its spread [6]; therefore, carrying out an appropriate case-finding process is an essential strategy for its control and elimination. Periodic and continuous assessment is important to maintain or increase the effectiveness and quality of control programs [7].

Despite this, several authors have documented a sub-diagnosis of PTB cases, a situation that burdens control and its eventual eradication. In a study carried out in Chiapas with 221 patients with chronic cough who came for medical attention, a positive PTB diagnosis was found in 19.9%. Six were first-time appointments and 38 were subsequent; of these, two had already been diagnosed by baciloscopy. In this study, the authors concluded that there was a sub-registry of 9% of PTB [8].

In a similar study [9] the authors documented 56% PTB cases in coughing patients who came for non-respiratory symptoms.

A third study [10] analyzed 590 patients from 32 rural communities in two medical units, one primary care, and one secondary care. In this work, a total of 66% PTB cases were detected in the hospital. Regarding the sensitivity of baciloscopy, in primary care, it was less than 50% and 60% in the hospital. In a study carried out in Hidalgo, this parameter was 30% [11].

Given this scenario, it is necessary to reinforce the detection and control of PTB in primary care. Raising awareness and providing health education to the general population would increase the demand for attention due to symptoms, as well as reduce the time between the start of coughing and the search for attention [12].

First of all, the detection process for PTB cases should be effective for control and elimination. The location (detection) of PTB cases is the fundamental activity of the project; its purpose is to rapidly find, the largest number of ill individuals that comprise the main source of infection; that is, cases with a positive baciloscopy. The detection (location) of cases implies a process with successively linked activities that are aimed at finding TB patients and adequately treating them. The goal is to neutralize real and potential transmission of *M. tuberculosis* to avoid new TB cases and unnecessary deaths.

In this sense, Armas-Pérez., *et al*. [13] have proposed a synthetic indicator to monitor and assess the quality of PTB case detection from PTB surveillance system data: the Synthetic Case Location Indicator (ISILOC) of pulmonary tuberculosis. This indicator responds to the need for a valid, reliable, feasible, simple, and accessible technical procedure in different local contexts that can also reveal, from a quantitative and qualitative point of view, the achievements and progress of case detection as an essential process of control strategies [14-16]. A weighing of values that result from basic arithmetic operations leads to the ISILOC score.

It is well known that the cornerstone of a PTB control program anywhere in the world is the opportune detection of cases (bacilli positive). The reasons for the sub-registry of PTB cases reported by different studies are diverse. Therefore, the idea of using a Synthetic Case Location Indicator (ISILOC) becomes a viable, effective, reliable and very low-cost proposal. Likewise, with better case detection, the control program improves and ensures cures.

After the application of the Synthetic Indicator, health personnel training should be carried out to improve epidemiological surveillance information to contribute to the correct location of cases and diagnostic opportunities in PTB [17,18]. It is not enough to estimate a case detection ratio if the delay in the processes of diagnosis, registration, and case notification is not considered [9].

Aim of the Study

The aim of this research was to assess the performance of the Mycobacteriosis program by detecting cases with the ISILOC in the Huasteca region of Hidalgo, Mexico.

Evaluation of Pulmonary Tuberculosis Case Detection in Huejutla, Hidalgo According to the Synthetic Case Location Indicator (ISILOC)

113

Methods

This was participatory action research (PAR) [19] with a mixed quantitative and qualitative design performed from February to November 2018. Health administrators and personnel from five (of seven) medical units affiliated with the Huejutla de Reyes, Hidalgo Health Jurisdiction, and users from the medical units, participated.

The quantitative component was the calculation of the ISILOC, using the following equation:

ISILOC = (A + B) X (G x H)/8

Where:

A = The proportion of individuals with respiratory symptoms >14 years (RS+14) detected.

B = The proportion of first baciloscopies performed in the SR+14.

G = Mean delay time between the first symptoms and the first consultation (days).

H = Mean delay time between confirmation of the diagnosis and control of the index case (contact investigation).

8.- The value 8 is a score constant that expresses the sum of the maximum values of A and B.

Component	Score	Consideration
A and B	≥ 9.9	4
	0.8 - 0.89	3
	0.7 - 0.79	2
	0.6 - 06.69	1
	≤ 0.59	0
G	<20	1
	20 - 29	0.9
	30 - 39	0.8
	40 - 49	0.7
	50 - 59	0.6
	60 - 69	0.5
	70 - 79	0.4
	80 - 89	0.3
	90 - 99	0.2
	100 - 110	0.1
H	≤ 2 days	1
	3 - 4	0.9
	5 - 7	0.8
	8 - 9	0.7
	10 - 12	0.6
	13 - 15	0.5
	16 - 18	0.4
	19 - 21	0.3
	22 - 25	0.2
	26 - 30	0.1
	>30	0.0

Evaluation of Pulmonary Tuberculosis Case Detection in Huejutla, Hidalgo According to the Synthetic Case Location Indicator (ISILOC)

114

The ISILOC produces values between 0 and 1. The results are valued according to a nominal qualitative scale. The values considered for each indicator are the following; therefore, the final performance evaluation of the synthetic indicator is:

- 0.9 - 1 = Excellent

- 0.7 - 0.89 = Very good

- 0.4 - 0.69 = Acceptable

- 0.1 - 0.39 = Deficient

- 0 = Poor.

The following demographic data were obtained from the participants: age, gender, years in the program and profession.

For the case detection process, the ISILOC integrates at least four components: 1. Group selection and individuals at risk of presenting PTB; 2. Perception and risk behaviors of the population; 3. Diagnosis and 4. Registration and notification.

The interpretation of the indicators used for construction of the ISILOC is: the proportion of individuals with respiratory symptoms detected reveals the effectiveness in the identification of subjects at risk of suffering PTB; the proportion of smears performed on symptomatic patients shows the scope of the diagnosis; the delay time from the beginning of symptoms of PTB cases until their first consultation in the medical unit is an expression of education, risk perception, and awareness that the community has about the disease; and the delay between the date of diagnosis and the date of carrying out the epidemiological investigation of the case and its contacts is a reflection of the effectiveness of notification and registration.

The qualitative research component was obtained from the discussions directed and presented in the three focal groups (FG) that were formed in the following way: GF1: State directors of the Mycobacteriosis program (9 people); GF2: Jurisdictional administrators (3 people) and GF3: Operational staff of the Jurisdictional Mycobacteriosis program (28 people), for a total of 40 service providers. Data were collected and analyzed sequentially in three stages:

- **Stage 1 diagnosis:** Using guided group discussions, know the opinion of the participants regarding the performance of the PTB control program, identifying the problems that impede better performance and detecting the needs of health personnel and users of medical units.

- **Stage 2 intervention:** With the same qualitative methodology of stage 1, in this stage, the participants agreed, in a consensual manner and through participative research action workshops, the actions to be followed to improve case detection, staff training, and health education of the users of medical units. With the information collected, in this stage, an action plan was designed with the contribution of all the participants for execution in the communities of the region.

- **Stage 3 implementation:** A second ISILOC measure was made and, according to the evaluation of the results, the model was replicated in the other state jurisdictions. Likewise, a report was prepared with the contributions and ideas of the group for state health authorities. In this study, four ISILOC measurements were made: the first, baseline, at the beginning of the project, the second at the end to evaluate performance changes (before and after), the third, four months after the end of the project, and the fourth, six months later. The latter two were done to assess the Hawthorne effect.

Evaluation of Pulmonary Tuberculosis Case Detection in Huejutla, Hidalgo According to the Synthetic Case Location Indicator (ISILOC)

115

All the information was captured in a database in Excel® version 2016. Quantitative data were analyzed by calculating simple frequencies and proportions, as well as an equation to assess ISILOC and its changes, measuring the indicator before and after the discussion workshops. Qualitative data were analyzed using the discourse analysis technique.

Results

During the study period, a total of 40 health service providers from seven primary care health centers in the state of Hidalgo, who integrated three focus groups according to their level of responsibility (state, regional and local) and 780 health system users participated.

In the quantitative component, the baseline measurement of the ISILOC had a score of 0.33, which represents poor performance.

In relation to demographic variables, the age distribution was < 30 years, 6 (15%); 31 to 40 years, 20 (50%) and > 40 years, 14 (35%). Gender was male 10 (25%) and female 30 (75%). The proportional distribution according to years in the Mycobacteriosis program was < 1 year, 8 (19%); 1 to 5 years, 15 (38%) and > 5 years, 17 (43%). Of the group, 30% were physicians and 70% nursing personnel.

Regarding the qualitative component developed in the focus group workshops, the opinions on program performance were grouped into five categories (Figure 1). Due to its high proportion, the opinion that the program was poor stood out with 48%. It is important to point out that opinion varied according to the level of responsibility; however, the three focus groups agreed to evaluate it as poor (50%, 53% and 47% respectively). More than two-thirds of the participants agreed that the main reason for this performance was related to deficiencies in case detection, listing at least nine causes for low performance (Table 1).
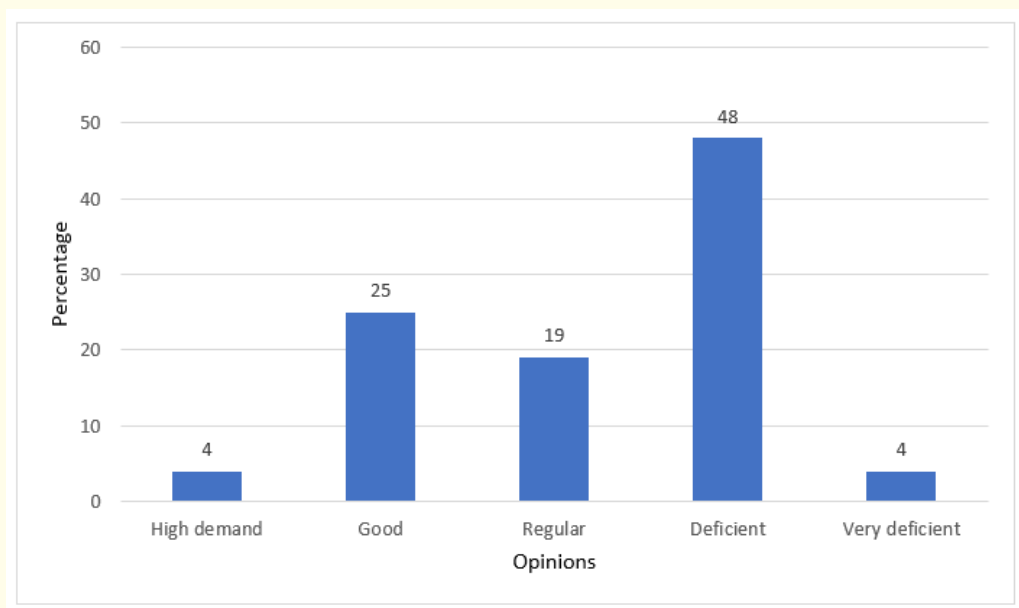

Figure 1: Opinion of performance in the Mycobacteriosis program.

Causes	Percentage
Lack of health personnel training	24
Deficient sampling	17
Deficient procedure standard	15
Socials determinants	13
Lack of health education	8
Delay in results delivery	7
Lack of supervision	7
Lack of resources	5
Lack of a local standard program	4

Table 1: *Causes of low performance in the Mycobacteriosis program.*

Also, with the participation of the three focus groups, an action plan was made for execution in the medical units. Forty-eight actions were issued that were grouped into three categories: Procedure correction, training of health personnel from the medical units of the Health Jurisdiction (doctors and nurses) and dissemination and health education in PTB for general population (Table 2), using mass media: radio and television.

Action Plan	Duration
Procedure correction	1 weeks
Health personnel training	4 weeks
Population training	10 weeks

Table 2: *Action Plan with the opinions of the participants of the three Focus Groups.*

Procedure correction

Roundtables were formed to analyze the current procedure, from patient reception in the medical unit to delivery of the smear result by the laboratory to the health personnel of the medical unit. The process that previously took up to 60 days, with the procedure correction, was reduced to less than one week.

The personnel training model was theoretical and practical, using the presentation technique, guided discussion, and workshops, in which case detection and correct sampling of pulmonary secretions were emphasized. This procedure, like the previous one, was not standardized; therefore, in the workshops of the focus groups, the medical and nursing staff was trained regarding correct fixation of the patient sample, precise labeling, and proper transportation to the laboratory.

Population health education and dissemination was carried out by the health personnel of the medical units, who organized various health promotion activities with the participation of users; namely, planning together with the users the promotional activities in the medical unit, in the streets, and in public places of the communities in order to inform and raise public awareness about the importance of going to the medical unit as soon as possible as soon as the first symptoms begin. Also, to have a larger scope, two massive communication media were used (radio and TV), where in addition to disseminating health education messages, interviews related to the topic of PTB were transmitted to health professionals.

Evaluation of Pulmonary Tuberculosis Case Detection in Huejutla, Hidalgo According to the Synthetic Case Location Indicator
(ISILOC)

117

After concluding the workshops, training, and action plan, a second measurement of the indicator was made, obtaining a score of 0.70, which is equivalent to very good (Figure 2). However, because of the possibility of a Hawthorne effect, a third measurement of the ISILOC was made three months after the second with a score of 0.80, staying within the range of very good (Figure 2).
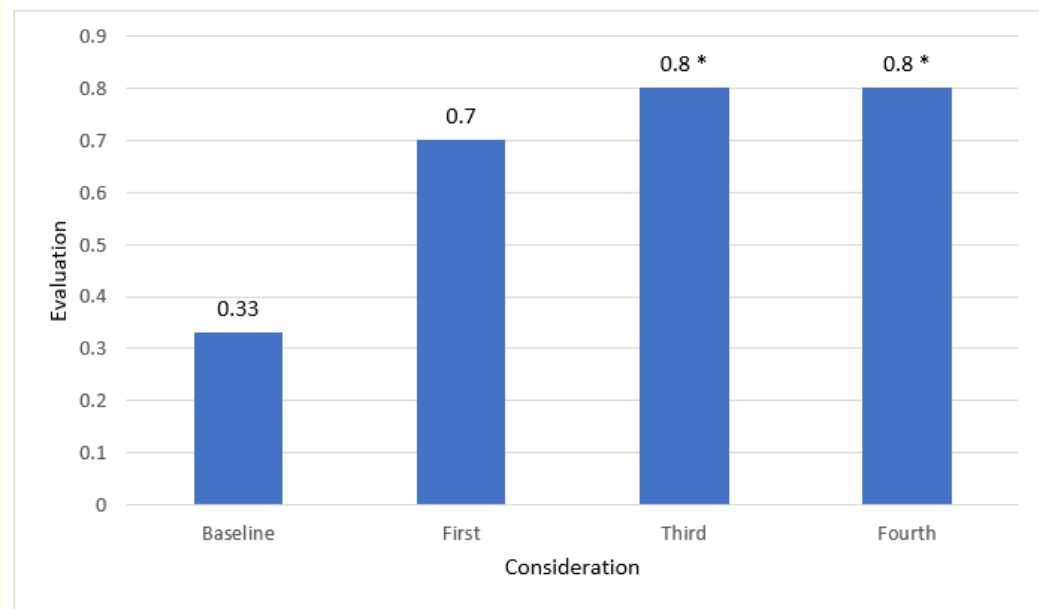

Figure 2: Evaluation of the performance of the Mycobacteriosis program with the ISILOC indicator. Four moments.
*: To measure the Hawthorne effect: Third, at 4 months and fourth, at 8 months.

Discussion and Conclusion

According to the WHO Global TB Programme, national control programs of this chronic infectious disease must have as a detection goal 70% of bacilliferous TB cases and a cure rate of these cases of 85% [3]. The principal weapon to achieve this is rapid detection and cure of infectious cases [3,4].

Since this is the strategic key for the location of suspicious cases and starting treatment, rapid detection of cases should be as efficient and effective as possible. In this sense, the application of the ISILOC was effective in increasing the detection of cases as was demonstrated in 2018 by Águila-Rodríguez., *et al.* [20] in a study that evaluated the quality of the Prevention and Control Program in Cuba that documented the effectiveness of applying the ISILOC. Like them and due to the actions carried out consensually with the health services providers, the authorities and the users of the state health system, we were also able to improve case detection by applying the ISILOC methodology.

As shown by Picketts [21] in a study conducted in Chile in 2012, the need to control the transmission of PTB in the population requires the detection of suspicious cases. The 1994 to 2008 analysis of PTB contacts concluded that the study of contacts is probably the activity with the highest performance for PTB detection in a control program. In this sense, timely detection of new cases allows adequate treat-

Evaluation of Pulmonary Tuberculosis Case Detection in Huejutla, Hidalgo According to the Synthetic Case Location Indicator (ISILOC)

118

ment and interrupts the chain of transmission. In this research, we improved this indicator. Before carrying out this project, service providers started studying contacts two to three weeks after knowing the patient´s result and the study of contacts was below the goal. After the research, the study of contacts was carried out one to two days after receiving a positive PTB result, and a median of seven contacts was studied, when before only three were studied.

The Huasteca region of Hidalgo, for many years, has maintained the greatest number of PTB cases in the state and the greatest number of multi-drug resistance. Therefore, it is very probable that a history of chronic PTB infection exists in a family; this is important for preventive, therapeutic and epidemiological surveillance decision making. This was demonstrated in a study performed from 1991 to 2010 by Santana Cabral Silva., *et al.* [22] who published in 2018 about factors with associated PTB in Brazil. Thus, it is concluded that the presence of one or more cases of retreatment and more than one case of contact at home is associated with a greater probability of suffering PTB. We recommend that all intra-residential contacts be investigated and treated, as was done in this research.

The lack of detection of suspicious cases, the deficient study of contacts, and unconcluded and unanalyzed treatment increase the probability of multi-drug resistant cases, as was documented by Torres-Chang., *et al.* [23] in a study about risk factors associated with multi-drug resistant PTB (MDR- PTB). In this work, the authors concluded that there is a greater risk of MDR-PTB if incomplete treatment has been received and if there has been contact with patients that have a multi-drug resistant *M. tuberculosis* strain. In this regard, one limitation of our research was the failure to include aspects of treatment; however, in this first scientific study focused on the problem of PTB in the Huasteca region, we were able to discover that indeed the analysis of PTB is incomplete without the study of therapeutic aspects, a situation that will be addressed in a second report.

The application of the ISILOC methodology is only one component of the PTB control strategy that the state Mycobacteriosis programs must implement. Herrera and Farga [24,25], in a historical analysis of the TB Control Program in Chile, one of the most successful in Latin America, indicate that the effectiveness of a control program should evolve according to the scientific findings that are being obtained; in other words, based on the research studies carried out and the reported results, always adapting the actions of the program to improve its performance and thus contribute to the eradication of PTB.

Another limitation of our study was to have carried it out in only one of the 17 health regions in which the state of Hidalgo is divided. However, given the success of the intervention carried out in this research–action regarding the performance of the Mycobacteriosis program in this region, it is intended to extend this successful experience for gradual implementation in other regions of the state.

Acknowledgments

Bibliography

1. Kappelman J., *et al.* "First Homo erectus from Turkey and implications for migrations into temperate Eurasia". *The American Journal of Physical Anthropology* 1.135 (2007): 110-116.

2. Vah K. "Informe de la Directora General, 2008". Washington DC: Organización Panamericana para la Salud (2009).

3. WHO Global Tuberculosis Control. "Survillance, planning, financing". WHO Report Geneva: Word Health Organization (2006).

Evaluation of Pulmonary Tuberculosis Case Detection in Huejutla, Hidalgo According to the Synthetic Case Location Indicator (ISILOC)

119

4. Rieder H. "Bases epidemiológicas del control de la tuberculosis". Paris: Unión Internacional contra la Tuberculosis y Enfermedades Respiratorias. Organización Mundial de la Salud, 1st Edition. Geneva: World Health Organization (1999).

5. Machado LPH., *et al.* "Riesgo de enfermar de tuberculosis de los convivientes adultos de enfermos bacilíferos". *Revista Cubana de Medicina Tropical* 59.1 (2007).

6. Severo TJ., *et al.* "Assessment of the detection of tuberculosis cases by means of a synthetic indicator in two municipalities of Havana City". *Revista Cubana De Higiene Y Epidemiología* 46.3 (2008).

7. Gómez MF., *et al.* "Detection of symptomatic respiratory in Havana of January to April of 2016". *RCIM* 9.2 (2017): 144-150.

8. Sánchez PHJ and Frisch DH. "Problemas de diagnóstico de tuberculosis pulmonar: el caso de la región fronteriza de Chiapas (México)". *Atención Primaria* 19.5 (1997): 237-242.

9. Sánchez PHJ., *et al.* "Tuberculosis pulmonar y uso de servicios del primer nivel de atención en zonas de alta marginación socioeconómica de Chiapas, México". *Gaceta Sanitaria* 12.4 (2000): 268-276.

10. Sánchez PHJ., *et al.* "Detection of pulmonary tuberculosis in Chiapas, Mexico". *Annals of Epidemiology* 12.3 (2002): 166-172.

11. Ocampo TM., *et al.* "Caracterización epidemiológica de la tuberculosis pulmonar en el estado de Hidalgo, México". *Gaceta Hidalguense de Investigación en Salud* 7 (2015): 2-5.

12. González E and Armas L. "New indicators proposed to assess tuberculosis control and elimination in Cuba". *MEDICC Review* 14.4 (2012): 40-43.

13. Armas PL., *et al.* "Un indicador sintético (ISILOC) para valorar la calidad de la detección de casos de tuberculosis". *Revista Cubana de Medicina Tropical* 6.1 (2009): 63-69.

14. Gómez MPR., *et al.* "Evaluación de la detección de casos de tuberculosis mediante un indicador sintético (ISILOC). Provincia de Matanzas". *Revolutionary Regenerative Medicine* 31.4 (2009).

15. Díaz DDY., *et al.* "Evaluación del diagnóstico de tuberculosis según indicador sintético de localización de casos". *Revista de Ciencias Médicas* 18.3 (2014): 401-413.

16. Mediavilla M and Salvat ME. "Propuesta de un Indicador Sintético de Desarrollo Endógeno. Una aproximación para la Región Metropolitana de Barcelona". Congreso de la Asociación Española de Ciencias Regionales Barcelona (2004).

17. López LE., *et al.* "Cobertura efectiva del programa de tuberculosis en el estado de Hidalgo". *Gaceta Hidalguense de Investigación en Salud* 7 (2015): 6-9.

18. González OE., *et al.* "Eliminación de la tuberculosis en Cuba: contribuciones recientes, resultados y desafíos". *Revista Cubana de Medicina Tropical* 69.3 (2017).

19. Martí J. "La Investigación Acción-Participativa. Estructura y Fases". Documentos del Seminario realizado con Tomás Villasante, en la Universidad Autónoma de Barcelona y Universidad Complutense de Madrid (2000).

20. Aguila RN., *et al.* "Evaluación de indicadores sintéticos del programa de tuberculosis. Áreas de salud I y II. Cienfuegos 2013". *Medisur* 16.4 (2018): 522-530.

21. Pickett SV. "Evaluación del estudio de contactos de tuberculosis. Servicio de Salud Metropolitano Occidente. 1994-2008". *Revista Chilena de Enfermedades Respiratorias* 28 (2012): 249-254.

Evaluation of Pulmonary Tuberculosis Case Detection in Huejutla, Hidalgo According to the Synthetic Case Location Indicator (ISILOC)

120

22. Cabral SAPS. "Factores asociados a la ocurrencia de tuberculosis y su distribución espacial en una ciudad brasileña, 1991-2010". *Salud Colectiva* 14.1 (2018): 77-91.

23. Torres CHJ., *et al.* "Factores de riesgo en la aparición de multidrogoresistencia en pacientes con tuberculosis pulmonar". *Revista Médica Panacea* 4.2 (2014): 31-35.

24. Herrera MT and Farga CV. "Historia del Programa de Control de la Tuberculosis de Chile". *Revista Chilena De Enfermedades Respiratorias* 31 (2015): 227-231.

25. Herrera MT. "La situación de la tuberculosis en Chile y los actuales desafíos. Visita de la OPS al programa de control de la tuberculosis de Chile". *Revista Chilena De Enfermedades Respiratorias* 29 (2013): 46-49.

Volume 9 Issue 7 July 2020