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Tuberculosis surveillance and health information system in Brazil, 2001-2003

ABSTRACT

OBJECTIVE: To assess the quality of tuberculosis surveillance in Brazil.

METHODS: Local data from 2001 to 2003 were assessed according to the quality of detection and follow-up of the cases in the region, the quality of the information produced by the notification system, and the load of morbidity of tuberculosis. Cities were classified into four groups, according to tuberculosis epidemiologic stage and the quality of tuberculosis surveillance.

RESULTS: In the study period, about 8% of the Brazilian cities presented over 10% of the cases of tuberculosis notified by the health care services of another city. In about 950 cities, the frequency of patients with pulmonary tuberculosis undergoing sputum examination was lower than 90%. In the North region, Amazonas, Pará and Amapá presented more cities classified in the groups of poor tuberculosis surveillance. In the Northeast, Pernambuco, Ceará and Bahia presented the poorest surveillance. The South and Midwest regions presented greater number of cities with better tuberculosis surveillance.

CONCLUSIONS: One third of the Brazilian cities present poor tuberculosis surveillance. This picture is not homogeneous in Brazil, and the regions with highest tuberculosis incidence have a great number of cities with apparently insufficient control measures.

KEY WORDS: Tuberculosis, epidemiology. Morbidity. Diseases registries. Registries. Data source. Brazil.

INTRODUCTION

The purpose of tuberculosis (TB) surveillance is to be aware of the cases of the disease in the population, so that measures to stop transmission to susceptible individuals can be taken. However, cases diagnosed and notified by the health service may represent only a proportion of the TB cases.[1]

Estimating the number of TB cases in a certain population has been a challenge to epidemiologists and planners on TB control.* Current indirect methods of estimation depend on the accuracy on other TB data, such as the number of people infected by *Mycobacterium tuberculosis,* and the number of deaths. These data depend on the good work of health services.**,*** Studies on the

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* Braga UJ. O uso da modelagem espacial na estimativa dos dados da tuberculose no Brasil [doctorate thesis]. Rio de Janeiro: Instituto de Medicina Social da UERJ; 1997.

** Penna MLF. Dinâmica epidemiológica da tuberculose: um modelo matemático para simulação da efetividade do diagnóstico e tratamento dos casos [doctorate thesis]. São Paulo: Faculdade de Saúde Pública da USP; 1994.

*** Almeida MMMB. Vigilância epidemiológica da tuberculose no Município de São Paulo: uso de dados de mortalidade [doctorate thesis]. São Paulo: Faculdade de Saúde Pública da USP; 1990.

prevalence of TB cases are rare, complex in methodology and, therefore, not very often performed. In this context, methodological approaches to assess the actions on TB surveillance are welcome because they can identify situations in which data on TB notification are different from its actual incidence.

Even though all sick patients may be acknowledged by the health services, notification of these cases by the information system may not occur or the record may be incomplete. Thus, even with the diagnoses of the TB cases, the notification in the information system may be poor, preventing to know the incidence of the disease.[4] Therefore, the diagnosis ability and the complete notification of TB cases are necessary so that the data on epidemiological surveillance are accurate. Likewise, data on notification records must be good quality.

In Brazil, assessment of the actions to control TB is encouraged because the proportion of cure for the disease is below the goal of 85%.* Good quality of information is essential to assess the program, since it enables to see the magnitude of the disease transmission in the country, and to define the goal of how many cases will be treated. Poor quality of information does not enable to see whether actions have been taken or if the data have not been suitably entered onto the information system. Additionally, the quality of information may reflect on the disease surveillance. In these situations, it is not possible to clearly define if the problem of controlling TB lies on a poor surveillance, or if the problem is partial or total lack of data.

Regarding epidemiologic surveillance in itself, it is important to distinguish between two types of data. The first type concerns notification of the disease, that enable to assess if districts can detect and notify cases; and the second is the follow-up data of the district from notification until the patient is removed from the system. The present study did not aim at assessing the problems of TB underreporting, but rather the epidemiologic surveillance of TB in Brazil. The indicators assessed were based on the quality of detection and follow-up of cases in the region, the quality of information given by the information system of the cases, and the burden of morbidity.

METHODS

The ecological approach was used to assess the characteristics and quality of TB surveillance in the Brazilian districts, especially in priority ones. Apart from double notifications, all information was obtained in the data bank of *Sistema de Informação de Agravos de Notificação* (Sinan – Information System for Notifiable Diseases) from 2001 to 2003, made available in March 2005.** Measures that could best qualify these cities were selected, resulting in synthetic indicators.

Spatial smoothing of the rates was used to minimize the influence of underreporting. This procedure was to estimate built spatial averages, using as a neighboring criteria the nearness among the districts as geographical unities.[3,4,***]

Specific indicators for each of the three assessment dimensions of surveillance were: quality of detection and follow-up of cases (surveillance – ability to get cases and grant adherence to treatment); quality of treatment information (completeness of data of the system of information and duplicate reporting) and burden of morbidity (incidence rate). This last dimension was included in the assessment of TB surveillance because it considered that the magnitude of the disease (the intensity of its expression) may also influence its recognition by the health services. The quality of surveillance is believed to have different repercussion in regions with high and low number of TB notifications.

Initially, eight indicators were established for quality of detection and follow-up of cases. Three of them were excluded, either because they were repeated information, or because of the low distinction among cities: proportion of pulmonary cases whose sputum shows bacilli on smear in the second month; proportion of smear positive pulmonary cases that underwent HIV test, and proportion of smear positive pulmonary cases with short term treatment information directly observed, called DOTS (*Directly Observed Treatment Short Course)*. Indicators of detection and follow-up of selected cases are listed in Table 1. As the TB surveillance systems are managed by the districts' authorities, it is hoped that, in the ideal situation, sick dwellers from one city are diagnosed and notified by the health service of their own city.

To assess the burden of information, 16 indicators were studied. An initial assessment of the data indicated that seven of them did not distinguish the districts satisfactorily and were excluded: proportion of cases with not informed situation when starting treatment (if it was a new case); cases with no information regarding the clinical form; extra pulmonary TB cases with no information regarding the clinical form; regarding the performance of sputum examination, or serum examination for HIV;

* Ministry of Health. Health Surveillance Secretariat. National Program on Tuberculosis Control. Brasília; 2004.
** Ministry of Health. Health Surveillance Secretariat. Guia para cálculo de indicadores básicos e de avaliação da base de dados de tuberculose do Sistema de Informação de Agravos de Notificação – SINAN. Brasília; 2004.
*** Anselin L. Spatial data analysis with Gis: an introduction to application in the social sciences [paper on the internet]. Santa Bárbara: National Center for Geographic Information and Analysis; 1992 [Accessed in April 2002]. (Technical Report, 92-10). Available at: http://www.ncgia.ucsb.edu/Publications/Tech_Reports/92/92-10.PDF

with no information on the date the treatment started. All districts had similar proportions of absence of information on control sputum examination in the fourth and sixth month, and the indicator of the outcome in the end was maintained, being more informative. Thus, the indicators of quality of information that remained were those of proportion of cases without information on: treatment surveillance, control sputum examination in the second, and outcome sputum examination when the treatment ended.

Based on the initial assessment, six indicators that recognized duplicate reporting were obtained from correlation of records (linkage). Three of them were excluded because they presented high collinearity with the others: real duplicate reporting proportion; proportion of duplicate reporting due to lack of information, and proportion of duplicate reporting with no explanation. Completeness indicators which discriminated well the situation of duplicate reporting are presented in Table 2.

Table 1. Indicators of quality of detection and follow-up of cases.

Indicator	Numerator/Denominator
Proportion of new cases reported by the district of residence	Number of cases reported by the district of residence X 100 Number of new cases
Proportion of pulmonary cases undergoing sputum examination	Number of cases with sputum examination X 100 Number of pulmonary cases
Proportion of smear positive pulmonary cases with information about the end of treatment	Number of smear positive pulmonary cases with info about the end in the 9 monthth X 100 Number of smear positive pulmonary cases
Proportion of smear positive pulmonary cases that abandoned treatment	Number of smear positive pulmonary cases with info about abandonment in the 9 month X 100 Number of smear positive pulmonary cases
Proportion of smear positive pulmonary cases undergoing DOTS therapy	Number of smear positive pulmonary cases under supervised treatment X 100 Number of smear positive pulmonary cases

DOTS: Directly Observed Treatment, Short Course

Table 2. Indicators of quality of information (completeness of cases).

Indicator	Numerator/Denominator
Proportion of cases lacking data on supervised treatment	Number of cases lacking data on supervised X 100 Number of new cases
Proportion of cases lacking control sputum examination in the 2nd month	Number of cases lacking sputum examination in the 2 month X 100 Number of new pulmonary cases
Proportion of cases lacking outcome on the end of treatment	Number of cases lacking outcome on the end of treatment X 100 Number of new cases
Proportion of duplicate reporting between the case	Total number of duplicates X 100 Number of duplicates
Proportion of duplicates due to transfer	Number of duplicates due to transfer X 100 Total number of duplicate reporting
Proportion of duplicates by a different notification unity	Number of duplication by notifying unity X 100 Number of total duplicate reporting

Table 3. Indicator of the burden of morbidity.

Indicator	Numerator/Denominator
Incidence rate of tuberculosis in all forms	Number of new cases in the year X 100.000 Population of the respective year
Incidence rate of smear positive pulmonary tuberculosis	Number of new cases with smear positive pulmonary tuberculosis in the year X 100.000 Population of the respective year
Proportion of HIV positive among new cases	Number of new cases with HIV positive test in the year X 100 Number of new cases in the year

Table 4. Cut-off points of the indicators of surveillance and magnitude of tuberculosis in Brazil.

Indicator	Cut-off point
Proportion of new cases reported by the district of residence	0.90
Proportion of pulmonary cases undergoing sputum examination	0.80
Proportion of smear positive pulmonary cases with information about the end of treatment	0.80
Proportion of smear positive pulmonary cases that did not abandon treatment	0.90
Proportion of smear positive pulmonary cases undergoing DOTS therapy	0.33
Proportion of cases not lacking data on supervised treatment	0.70
Proportion of cases not lacking control sputum examination in the 2nd month	0.70
Proportion of cases not lacking outcome on the end of treatment	0.70
Proportion of non-duplicates among the cases	0.70
Proportion of non-duplicates by transference	0.70
Proportion of non-duplicates by different reporting unity	0.70
Incidence rate of tuberculosis in all forms	50 per 100,000 inhab.
Incidence rate of smear positive pulmonary tuberculosis	20 per 100,000 inhab.
Proportion of HIV positive among new cases	0.15

Table 5. Distribution of districts according to the classification of tuberculosis surveillance and burden of the disease. Brazil, 2001-2003.

Unity (region)	Classification of the epidemiological situation and quality of tuberculosis									
	GI		GII		GIII		GIV		Total	
	N	%	N	%	N	%	N	%	N	%
					Year 2001					
North	279	62.1	32	7.1	30	6.7	108	24.1	449	100.0
Northeast	1348	75.2	91	5.1	79	4.4	274	15.3	1792	100.0
Southeast	1425	85.4	75	4.5	68	4.1	100	6.0	1668	100.0
South	1011	85.0	41	3.4	24	2.0	113	9.5	1189	100.0
Midwest	380	82.1	47	10.2	10	2.2	26	5.6	463	100.0
Brazil	4443	79.9	286	5.1	211	3.8	621	11.2	5561	100.0
					Year 2002					
North	266	59.2	31	6.9	31	6.9	121	26.9	449	100.0
Northeast	1212	67.6	86	4.8	77	4.3	417	23.3	1792	100.0
Southeast	1229	73.7	138	8.3	80	4.8	221	13.2	1668	100.0
South	1030	86.6	54	4.5	22	1.9	83	7.0	1189	100.0
Midwest	363	78.4	51	11.0	13	2.8	36	7.8	463	100.0
Brazil	4100	73.7	360	6.5	223	4.0	878	15.8	5561	100.0
					Year 2003					
North	237	52.8	32	7.1	34	7.6	146	32.5	449	100.0
Northeast	1110	61.9	118	6.6	88	4.9	476	26.6	1792	100.0
Southeast	1030	61.8	87	5.2	124	7.4	427	25.6	1668	100.0
South	1032	86.8	65	5.5	20	1.7	72	6.1	1189	100.0
Midwest	380	82.1	40	8.6	8	1.7	35	7.6	463	100.0
Brazil	3789	68.1	342	6.1	274	4.9	1156	20.8	5561	100.0

GI – districts with regular epidemiological situation of tuberculosis (for example: moderate to low incidence) and good quality of surveillance; GII – districts with concerning epidemiological situation of tuberculosis (for example: high incidence) and good quality of surveillance; GIII – districts with concerning epidemiologic situation of tuberculosis (for example: high incidence) and poor quality of surveillance; GIV – districts with regular epidemiological situation of tuberculosis (for example: moderate to low incidence) and poor quality of surveillance.

Four indicators of morbidity were structured, presented on Table 3. Incidence rate of pulmonary TB was excluded because it was considered little discriminatory information.

Assessment of indicators considers the existence of minimum conditions of quality of surveillance, represented by the cut-off points presented on Table 4. According to this table, districts that met the criteria of at least three of the indicators of quality of detection, and at least four criteria of the indicators of quality of information, were considered as presenting "good quality of surveillance". Districts with at least two conditions of the indicators of burden of the expressed disease were considered as presenting "concerning epidemiological TB situation". Cities were classified according to the quality of epidemiological surveillance of the disease, compared and grouped according to federal unity and geographical region, resulting in four groups of districts:

- Group I (GI) – regular TB epidemiological situation (moderate to low incidence) and good quality of surveillance.
- Group II (GII) – concerning TB epidemiological situation (high incidence) and good quality of surveillance.
- Group III (GIII) – concerning TB epidemiological situation and poor quality of surveillance.
- Group IV (GIV) – regular TB epidemiological situation and poor quality of surveillance.

Table 6. Frequency of districts in the North according to classification of tuberculosis surveillance and burden of the disease. 2001-2003.

State/Region	Classification of the epidemiological situation and quality of tuberculosis surveillance									
	GI		GII		GIII		GIV		Total	
	N	%	N	%	N	%	N	%	N	%
					Year 2001					
Acre	15	68.2	4	18.2	2	9.1	1	4.5	22	100.0
Amazonas	29	46.8	9	14.5	7	11.3	17	27.4	62	100.0
Amapá	8	50.0	1	6.3	1	6.3	6	37.5	16	100.0
Pará	70	49.0	10	7.0	10	7.0	53	37.1	143	100.0
Rondônia	38	73.1	3	5.8	4	7.7	7	13.5	52	100.0
Roraima	12	80.0	1	6.7	1	6.7	1	6.7	15	100.0
Tocantins	107	77.0	4	2.9	5	3.6	23	16.5	139	100.0
North	279	62.1	32	7.1	30	6.7	108	24.1	449	100.0
					Year 2002					
Acre	20	90.9	1	4.5	1	4.5	0	0.0	22	100.0
Amazonas	21	33.9	3	4.8	13	21.0	25	40.3	62	100.0
Amapá	9	56.3	2	12.5	3	18.8	2	12.5	16	100.0
Pará	54	37.8	16	11.2	7	4.9	66	46.2	143	100.0
Rondônia	41	78.8	3	5.8	4	7.7	4	7.7	52	100.0
Roraima	10	66.7	3	20.0	0	0.0	2	13.3	15	100.0
Tocantins	111	79.9	3	2.2	3	2.2	22	15.8	139	100.0
North	266	59.2	31	6.9	31	6.9	121	26.9	449	100.0
					Year 2003					
Acre	15	68.2	0	0.0	3	13.6	4	18.2	22	100.0
Amazonas	17	27.4	6	9.7	7	11.3	32	51.6	62	100.0
Amapá	7	43.8	2	12.5	1	6.3	6	37.5	16	100.0
Pará	58	40.6	15	10.5	16	11.2	54	37.8	143	100.0
Rondônia	30	57.7	4	7.7	1	1.9	17	32.7	52	100.0
Roraima	9	60.0	2	13.3	1	6.7	3	20.0	15	100.0
Tocantins	101	72.7	3	2.2	5	3.6	30	21.6	139	100.0
North	237	52.8	32	7.1	34	7.6	146	32.5	449	100.0

Dispersion charts have been made to present the correlation between the incidence and the quality of TB surveillance. Incidence was represented by the quality of detection and follow-up of cases (surveillance – ability to capture cases and assure adherence to treatment). Quality of information was represented by completeness of data placed on the information system and duplicate reporting.

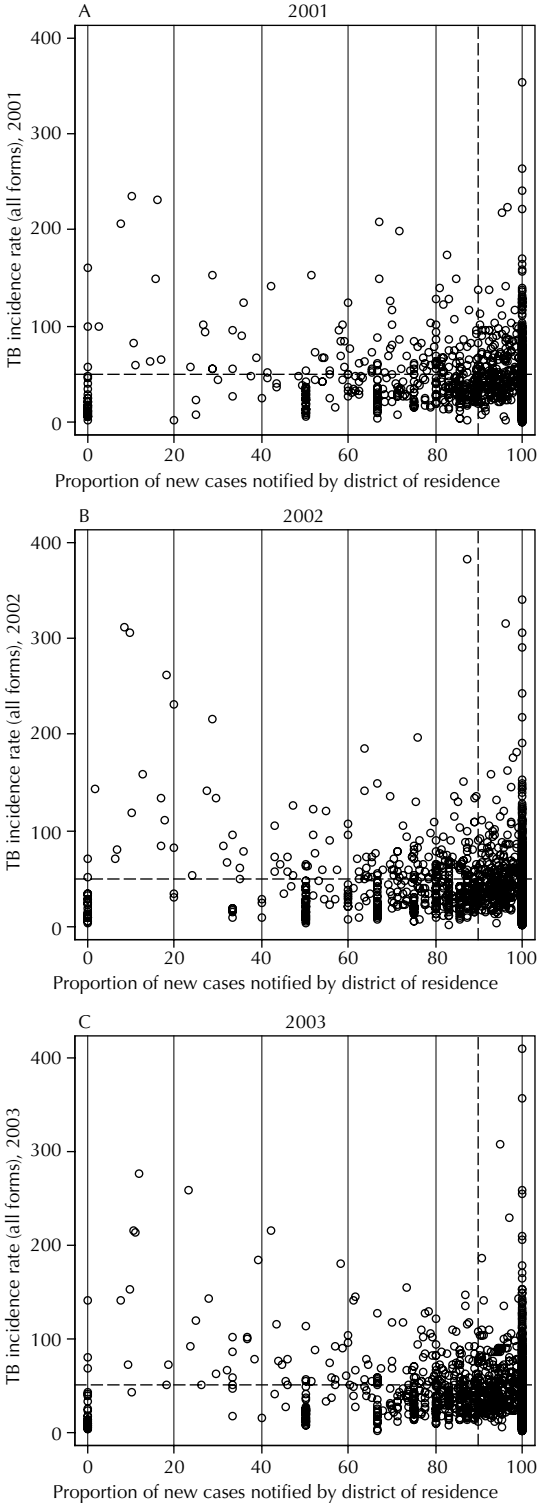

Figure 1. Classification of districts, according to notification by district of residence. Brazil, 2001-2003 (A-C).

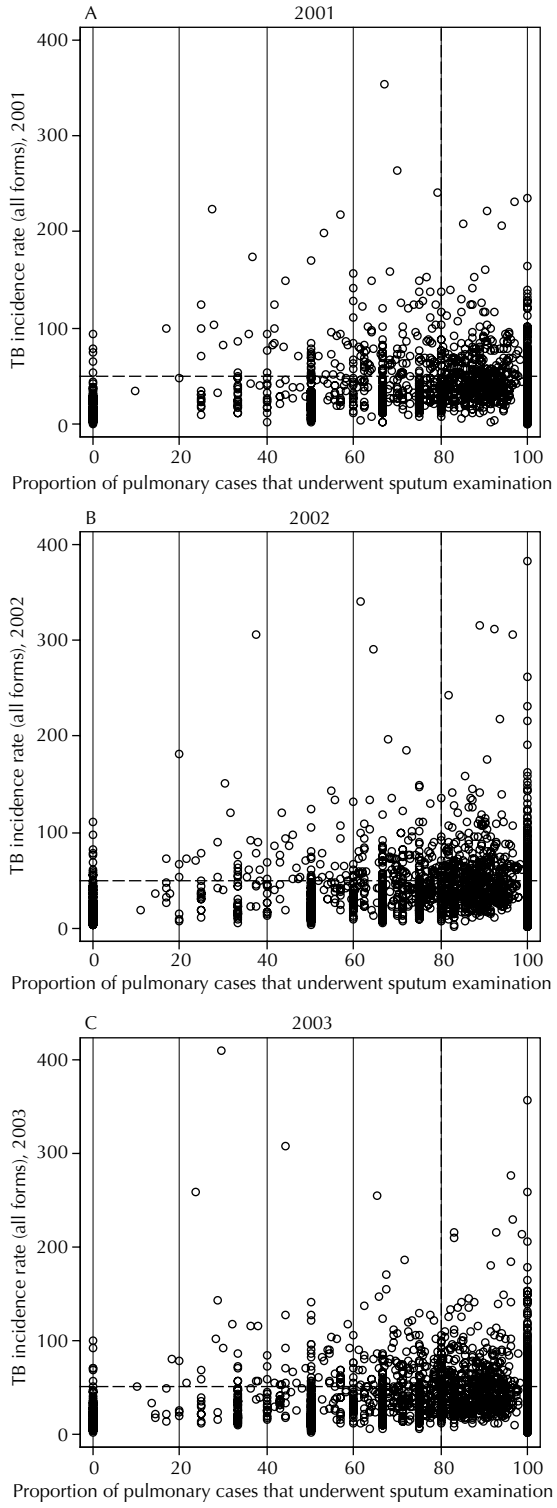

Figure 2. Classification of districts, according to sputum examination of pulmonary cases. Brazil, 2001-2003 (A-C).

RESULTS

Regarding patients seeking health services in other districts, over 10% of the reported cases of residents from 316 districts (7.5%) were notified by other city in 2001. This percentage was kept in the following years, suggesting a poor quality of TB surveillance (Figure 1).

Figure 2 shows the classification of districts regarding the proportion of new pulmonary TB cases that did not undergo sputum examination. Based only on the examination of the data bank, it was impossible to distinguish when examinations were not performed, and when the record was not placed on the report form. Indirectly, this measure reflects the ability to capture new cases, since if only a small proportion of pulmonary TB cases undergo sputum examination, the examination of respiratory symptoms may not be properly conducted. Figure 2 points up that many districts presented poor percentage of patients under-

Table 7. Frequency of districts in the Northeast according to classification of tuberculosis surveillance and burden of the disease. 2001-2003.

State/Region	Classification of the epidemiological situation and quality of tuberculosis surveillance									
	GI		GII		GIII		GIV		Total	
	N	%	N	%	N	%	N	%	N	%
					Year 2001					
Alagoas	79	77.5	9	8.8	3	2.9	11	10.8	102	100.0
Bahia	383	91.8	4	1.0	0	0.0	30	7.2	417	100.0
Ceará	117	63.6	30	16.3	7	3.8	30	16.3	184	100.0
Maranhão	132	60.8	13	6.0	23	10.6	49	22.6	217	100.0
Paraíba	186	83.4	7	3.1	5	2.2	25	11.2	223	100.0
Pernambuco	117	63.2	3	1.6	14	7.6	51	27.6	185	100.0
Piauí	176	79.3	11	5.0	11	5.0	24	10.8	222	100.0
Rio Grande do Norte	91	54.5	10	6.0	16	9.6	50	29.9	167	100.0
Sergipe	67	89.3	4	5.3	0	0.0	4	5.3	75	100.0
Northeast	1348	75.2	91	5.1	79	4.4	274	15.3	1792	100.0
					Year 2002					
Alagoas	88	86.3	5	4.9	0	0.0	9	8.8	102	100.0
Bahia	293	70.3	14	3.4	7	1.7	103	24.7	417	100.0
Ceará	100	54.3	15	8.2	19	10.3	50	27.2	184	100.0
Maranhão	125	57.6	21	9.7	15	6.9	56	25.8	217	100.0
Paraíba	183	82.1	4	1.8	2	0.9	34	15.2	223	100.0
Pernambuco	124	67.0	7	3.8	9	4.9	45	24.3	185	100.0
Piauí	166	74.8	13	5.9	8	3.6	35	15.8	222	100.0
Rio Grande do Norte	65	38.9	2	1.2	17	10.2	83	49.7	167	100.0
Sergipe	68	90.7	5	6.7	0	0.0	2	2.7	75	100.0
Northeast	1212	67.6	86	4.8	77	4.3	417	23.3	1792	100.0
					Ano 2003					
Alagoas	63	61.8	7	6.9	6	5.9	26	25.5	102	100.0
Bahia	246	59.0	42	10.1	18	4.3	111	26.6	417	100.0
Ceará	93	50.5	17	9.2	12	6.5	62	33.7	184	100.0
Maranhão	122	56.2	17	7.8	17	7.8	61	28.1	217	100.0
Paraíba	158	70.9	4	1.8	9	4.0	52	23.3	223	100.0
Pernambuco	100	54.1	6	3.2	13	7.0	66	35.7	185	100.0
Piauí	160	72.1	13	5.9	5	2.3	44	19.8	222	100.0
Rio Grande do Norte	108	64.7	6	3.6	8	4.8	45	26.9	167	100.0
Sergipe	60	80.0	6	8.0	0	0.0	9	12.0	75	100.0
Northeast	1110	61.9	118	6.6	88	4.9	476	26.6	1792	100.0

going sputum examination: 12.8%, 17.7% and 20.4% for 2001, 2002 and 2003, respectively.

Figure 3 shows the proportion of pulmonary TB cases with positive smear and information about the end of the

Table 8. Frequency of districts in the Southeast according to the classification of tuberculosis surveillance and burden of the disease. 2001-2003.

State/Region	Classification of the epidemiological situation and quality of tuberculosis surveillance									
	GI		GII		GIII		GIV		Total	
	N	%	N	%	N	%	N	%	N	%
					Year 2001					
Espírito Santo	61	78.2	9	11.5	0	0.0	8	10.3	78	100.0
Minas Gerais	846	99.2	0	0.0	0	0.0	7	0.8	853	100.0
Rio de Janeiro	21	22.8	16	17.4	30	32.6	25	27.2	92	100.0
São Paulo	497	77.1	50	7.8	38	5.9	60	9.3	645	100.0
Southeast	1425	85.4	75	4.5	68	4.1	100	6.0	1668	100.0
					Year 2002					
Espírito Santo	58	74.4	8	10.3	1	1.3	11	14.1	78	100.0
Minas Gerais	693	81.2	59	6.9	19	2.2	82	9.6	853	100.0
Rio de Janeiro	31	33.7	28	30.4	17	18.5	16	17.4	92	100.0
São Paulo	447	69.3	43	6.7	43	6.7	112	17.4	645	100.0
Southeast	1229	73.7	138	8.3	80	4.8	221	13.2	1668	100.0
					Year 2003					
Espírito Santo	54	69.2	6	7.7	3	3.8	15	19.2	78	100.0
Minas Gerais	646	75.7	49	5.7	29	3.4	129	15.1	853	100.0
Rio de Janeiro	16	17.4	12	13.0	28	30.4	36	39.1	92	100.0
São Paulo	314	48.7	20	3.1	64	9.9	247	38.3	645	100.0
Southeast	1030	61.8	87	5.2	124	7.4	427	25.6	1668	100.0

Table 9. Frequency of districts in the South according to the classification of tuberculosis surveillance and burden of the disease. 2001-2003.

State/Region	Classification of the epidemiological situation and quality of tuberculosis surveillance									
	GI		GII		GIII		GIV		Total	
	N	%	N	%	N	%	N	%	N	%
					Year 2001					
Paraná	337	84.5	17	4.3	7	1.8	38	9.5	399	100.0
Rio Grande do Sul	409	82.3	22	4.4	13	2.6	53	10.7	497	100.0
Santa Catarina	265	90.4	2	0.7	4	1.4	22	7.5	293	100.0
South	1011	85.0	41	3.4	24	2.0	113	9.5	1189	100.0
					Year 2002					
Paraná	319	79.9	16	4.0	12	3.0	52	13.0	399	100.0
Rio Grande do Sul	442	88.9	31	6.2	5	1.0	19	3.8	497	100.0
Santa Catarina	269	91.8	7	2.4	5	1.7	12	4.1	293	100.0
South	1030	86.6	54	4.5	22	1.9	83	7.0	1189	100.0
					Year 2003					
Paraná	338	84.7	20	5.0	11	2.8	30	7.5	399	100.0
Rio Grande do Sul	428	86.1	34	6.8	8	1.6	27	5.4	497	100.0
Santa Catarina	266	90.8	11	3.8	1	0.3	15	5.1	293	100.0
South	1032	86.8	65	5.5	20	1.7	72	6.1	1189	100.0

treatment. It is possible to observe that many districts did not record the conditions in the end of the treatment, in 9.9% of the district in 2001, and another 35% in 2003. The assumption is that this increasing frequency of districts reveals the poor capacity of following-up patients undergoing treatment in the health unities.

A general assessment of all aspects of quality of surveillance enables a summary of TB control in Brazil, presented in Table 5. In this table the number of districts is classified into the four groups, according to levels of surveillance and TB severity. The frequency of districts classified in group II and IV (poorer quality of surveillance) increased from 2001 to 2003. At the same time, the number of cities with good surveillance and regular level of incidence decreased.

The trends were different among the regions: while North, Northeast, and Southeast worsened, the South improved and the Midwest kept similar conditions in the period.

The States of Amazonas, Pará, and Amapá presented more districts in the group of poor quality of surveillance (groups III and IV) than the other states in the North. Lower frequency of districts with low disease burden and good surveillance was observed in the Amazonas, with high incidence rate. The states of this region presented the worst conditions of TB control with little more than half (62% in 2001 and 53% in 2003) of the districts in group I. The state of Tocantins presented the best surveillance performance and a reduced number of cases (Table 6).

In the Northeast, the states with greater disease burden were also those which presented poorer quality of surveillance: Pernambuco, Ceará, Bahia, Maranhão, and Rio Grande do Norte. On the other hand, Sergipe presented most of the districts classified as group I, with good level of surveillance and regular incidence rate (Table 7).

The States of the Southeast region presented decrease in the capacity of surveillance and probably in TB control. In Rio de Janeiro, high incidence rates of the disease with low capacity to capture cases and poor quality of data reporting and follow-up of reported cases. The State of Espírito Santo was the one that reduced less its quality of TB surveillance in the Southeast (Table 8).

In the South a clear trend of worsening TB surveillance was not seen. The State of Rio Grande do Sul presented the less suitable conditions, and Santa Catarina presented the best situation (Table 9).

Similar to the South, the Midwest also has states with good levels of TB surveillance. However, the regional levels of the indicators were influenced by Mato Grosso

Table 10. Frequency of districts in the Midwest according to the classification of tuberculosis surveillance and burden of the disease. 2001-2003.

State/Region	Classification of the epidemiological situation and quality of tuberculosis surveillance									
	GI		GII		GIII		GIV		Total	
	N	%	N	%	N	%	N	%	N	%
					Year 2001					
Distrito Federal	1	100.0	0	0.0	0	0.0	0	0.0	1	100.0
Goiás	225	91.5	7	2.8	2	0.8	12	4.9	246	100.0
Mato Grosso do Sul	56	72.7	8	10.4	4	5.2	9	11.7	77	100.0
Mato Grosso	98	70.5	32	23.0	4	2.9	5	3.6	139	100.0
Midwest	380	82.1	47	10.2	10	2.2	26	5.6	463	100.0
					Year 2002					
Distrito Federal	1	100.0	0	0.0	0	0.0	0	0.0	1	100.0
Goiás	207	84.1	7	2.8	8	3.3	24	9.8	246	100.0
Mato Grosso do Sul	50	64.9	15	19.5	3	3.9	9	11.7	77	100.0
Mato Grosso	105	75.5	29	20.9	2	1.4	3	2.2	139	100.0
Midwest	363	78.4	51	11.0	13	2.8	36	7.8	463	100.0
					Year 2003					
Distrito Federal	1	100.0	0	0.0	0	0.0	0	0.0	1	100.0
Goiás	217	88.2	10	4.1	2	0.8	17	6.9	246	100.0
Mato Grosso do Sul	49	63.6	14	18.2	2	2.6	12	15.6	77	100.0
Mato Grosso	113	81.3	16	11.5	4	2.9	6	4.3	139	100.0
Midwest	380	82.1	40	8.6	8	1.7	35	7.6	463	100.0

do Sul. In this state, lower frequencies of districts in group I, and greater frequency of districts in groups III and IV were observed. In Distrito Federal the best levels of surveillance and disease control were observed (Table 10).

DISCUSSION

Approximately one third of the Brazilian districts presented poor conditions of TB surveillance. In 2003, one in each four districts presented poor capacity to capture new TB cases or to record properly notification and follow-up data.

This is not a homogeneous picture in Brazil, and the regions with more cases of the disease presented several districts with apparently poor control actions. This may indicate the presence of important areas with underreporting of TB and poor performance of state programs to control the disease.

The profile designed by the present study indicates that the more critical situation was concentrated in the states of the North, Northeast, and Southeast regions, where there are more TB cases in Brazil. However, other states with less increased reporting had many districts classified as low level of surveillance such as Maranhão. The development of TB control actions more intensively by the teams of family health in Paraíba, Sergipe, and Alagoas explains the different situation of these states. In the other states, a low level of surveillance was observed.

The best situations observed in the South and Midwest regions are expected, since these states have reached more suitable levels of TB control. However, the state of Mato Grosso did not present quality in TB surveillance compared to the other states of the region. A plausible explanation for what occurs in Mato Grosso – and possibly in the other states of the North region – is that a great number of afflicted people are indigenous people, and that surveillance in this population is known to be more difficult than in the general population.

Classification (or stratification) of the districts enabled to reveal those which should be more carefully assessed. The districts with low TB notification and evidence of poor quality of surveillance may have high disease burden and still be "quiet", preventing being acknowledge as a priority.

Studies on the assessment of TB surveillance in Brazil that could be compared with our outcomes have not been found. However, some assumptions have been made from the assessment of the epidemiological behavior of TB. The first is: if TB is determined by poor socioeconomic conditions, it is expected that the low level of surveillance would be an explanation for the absence of cases reported in some Brazilian districts.

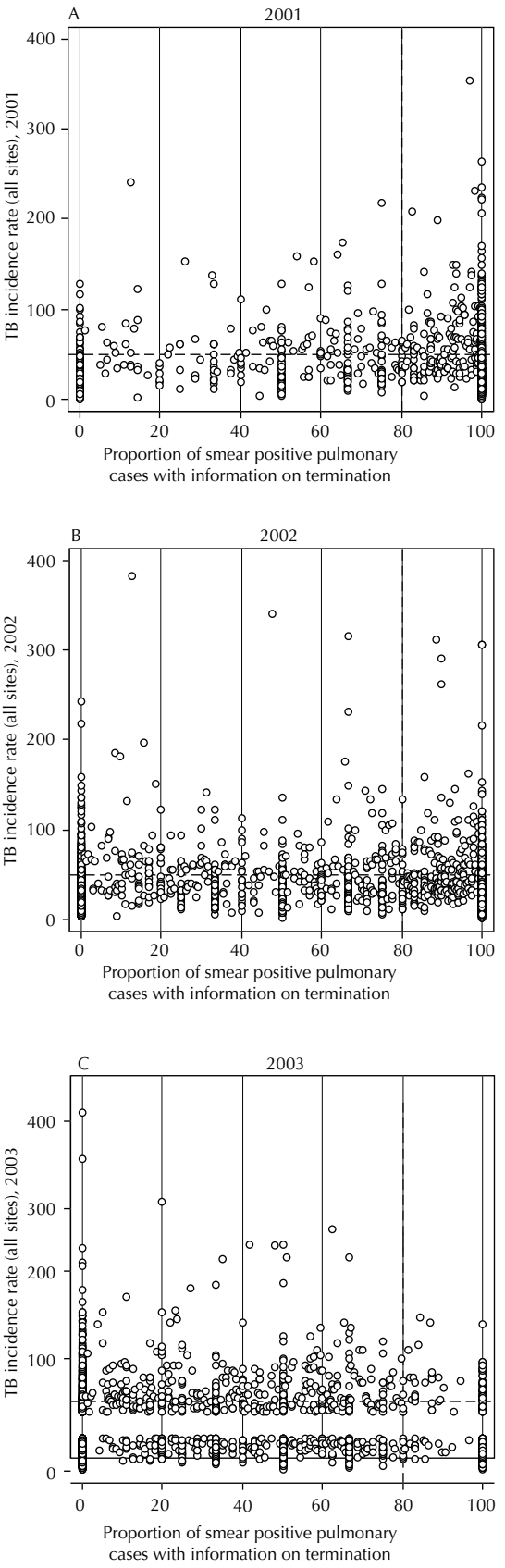

Figure 3. Classification of districts, according to information of ending of pulmonary cases. Brazil, 2001-2003 (A-C).

Another assumption is that, if the spatial distribution of TB is according to the distribution of its determinants in the space, the existence of places free from the disease in areas where a high rate is expected is not justified. The low level of surveillance justifies this fact.

The approach used in the present study is an attempt to know the level of TB control in the districts, but some limitations must be considered. The first is the use of data available in the system of TB information, rather than a field investigation that included the observation of local conditions of TB surveillance in the districts. As previously mentioned, data were not extracted from charts that could distinguish failure to perform surveillance procedures, from failure to record on report forms, and follow-up. The second limitation refers to the arbitrariness of the cut-off points used in the criteria to classify districts. The third refers to the complete underreporting, that is, absence of report, making it impossible to calculate the quality of data indicators. In this case, the absence of problems with the quality of these data was assumed. Last, the use of spatial smoothing tried to minimize severe underreporting, enabling to recognize high and low rate situations, and different levels of quality of epidemiological TB surveillance. Although the classification of the district does not change when spatially smoothened rates were used, evidences of spatial dependence of TB suggest that some level of underreporting has been corrected.

Consistency of the outcomes may be confirmed by the agreement between the levels of capture of cases and the quality of data in the studied districts, these aspects formed the assessment of the quality of surveillance.

To conclude with, the outcomes of the present study enabled to stratify the Brazilian districts according to their quality of surveillance. This classification may help building control strategies in areas that have not been seen as priority, such as the improvement of surveillance actions.

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