Completeness of tuberculosis records held on the Notifiable Health Conditions Information System (SINAN) in Santa Catarina, Brazil, 2007-2016*

Vanessa Baldez do Canto[1] – ◉ orcid.org/0000-0002-6644-0610
Fúlvio Borges Nedel[1] – ◉ orcid.org/0000-0002-8059-7358

[1]Universidade Federal de Santa Catarina, Centro de Ciências da Saúde, Florianópolis, SC, Brazil

Abstract

Objective: to describe the completeness of tuberculosis (TB) case records in Santa Catarina, Brazil, from 2007 to 2016. **Methods**: this was a descriptive study using Notifiable Health Conditions Information System data; completeness, consistency of notification form records and timely notification were analyzed in order to assess data quality. **Results**: completeness of notification form mandatory fields was considered good; essential fields were less complete, in particular the 'Schooling' field; low completeness of follow-up sputum smear microscopy and failure to update culture tests and HIV serology tests demonstrate weaknesses in follow-up records. **Conclusion**: the tuberculosis surveillance system data were considered adequate for guiding tuberculosis prevention and control actions; record monitoring and periodical evaluation, as well as adoption of strategies to improve follow-up report completeness are recommended.

Keywords: Tuberculosis; Public Health Surveillance; Epidemiology; Notification; Information Systems.

Correspondence:
Vanessa Baldez do Canto – Rua Desembargador Pedro Silva, No. 2202, Bloco 25, Apto. 23, Coqueiros, Florianópolis, SC, Brazil.
Postcode: 88080-901
E-mail: baldez.canto@gmail.com

Introduction

Tuberculosis (TB), despite being one of mankind's oldest diseases, continues to be considered to be a serious Public Health problem worldwide, as the communicable disease that most leads to death. Brazil is among the 30 countries with a high tuberculosis burden. This classification encompasses data on incidence, mortality and drug resistance.[1] In 2018, the TB incidence rate in Brazil was 34.8 cases/100,000 inhabitants, following mean annual reduction of 1.0% between 2009 and 2018.[2] These results are however insufficient for meeting the targets of the End Tuberculosis Strategy, an agenda approved by the World Health Assembly in 2014, when the objective of eliminating TB was a Public Health problem worldwide was defined, based on the following targets: (i) tuberculosis incidence below 10/100,000 inhab. by 2035, (ii) TB deaths reduced by 95% by 2035, in relation to TB deaths in 2015.[3]

The TB incident rate varies greatly between the Brazilian states. In 2018, Santa Catarina had 23.7 cases/100,000 inhab., which was lower than the national rate.[3] Its neighboring states, Paraná and Rio Grande do Sul, had rates of 19.7 and 40 cases/100,000 inhab. respectively.[2] Contrary to the falling trend found for Brazil as a whole, the Santa Catarina rate remained stable between 2005 and 2015.[4]

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In order to make progress towards achieving the proposed targets, it is essential to plan actions based on knowledge of the epidemiological status of the disease. As such, TB surveillance should provide recommendations and inform decision making, whereby its attributions are (i) investigation of suspected cases, (ii) notification of confirmed cases and (iii) production of data on treatment and follow-up of confirmed cases until treatment is finalized.[5]

Tuberculosis has been a compulsorily notifiable disease in Brazil since 1998.[6] Notification data are collected at heath establishments based on notification forms and monthly patient follow-up records. These data are then processed on the Notifiable Health Conditions Information System (SINAN).[7]

Studies have pointed to substantial challenges for TB surveillance, such as low contact investigation,[8] high proportion of treatment dropout,[3] poor completeness of notification form fields and precarious information on case diagnosis,[8-10] follow-up and closure.[8-13]

Low quality information, apart from compromising adequate knowledge of case epidemiological profile, prevents evaluation of surveillance actions, since it is not possible to identify whether failure to fill in fields arises from weakness of surveillance actions or weakness in recording them.[14]

Studies that evaluate SINAN TB databases focus on specific regions of the country.[9-12] The epidemiological bulletins prepared annually by the Ministry of Health and by the State Health Departments do not provide information on form data completeness nor on analyses of inconsistencies.

Studies conducted in Santa Catarina regarding SINAN data have not evaluated record quality.[15,16] No studies were found to have been conducted in Santa Catarina analyzing the quality of TB case records with regard to the filling in of form fields and follow-up records. A national study using municipal data conducted between 2001 and 2003 with the purpose of evaluating epidemiological surveillance quality, including the completeness of five notification form fields, found that Santa Catarina achieved the best levels in Brazil's Southern region.[14]

In view of the above, it is clearly important to analyze the quality of the SINAN TB database in Santa Catarina, in order to identify its status with regard to surveillance actions. The objective of this study was to describe the completeness of TB case records in Santa Catarina between 2007 and 2016.

Methods

This is a descriptive study using TB case data recorded on the Santa Catarina SINAN database for the period 2007-2016.

The state of Santa Catarina is located in Southern Brazil and has been comprised of 295 municipalities since autonomy was granted to the municipalities of Balneário Rincão and Pescaria Brava in 2013. In 2019 the state's population was estimated to be 7,164,788 inhabitants.[17]

The population studied was comprised of TB cases aged 18 years old or over, resident in the state of Santa Catarina, notified on the SINAN system, with diagnosis date between January 1st 2007 and December 31st 2016. The study's case exclusions criteria were: being under 18 years old; not being resident in the state of Santa Catarina; and diagnosis change during case investigation.

Completeness, record consistency and notification timeliness were analyzed to determine data quality. Completeness is understood to mean the proportion of non-null values of each record on an information system. Fields considered to be null or incomplete are those filled in as 'Unknown' and those left blank.[18] The classification proposed by the Brazilian Ministry of Health was used to analyze field completeness: good completeness, when equal to or greater than 75.1%; regular, between 75.0% and 50.1%; poor, between 50.0% and 25.1%; and very poor, when equal to or less than 25.0%.[5] Notification timeliness indicates the speed with which information is obtained in order to act,[19] and in this study it was evaluated by the difference – in days – between diagnosis date and notification date.

Among the fields on the form, we selected those with variables considered to be strategic by the National Tuberculosis Control Program (PNCT):[5]

a) Sex
b) Age
c) Type of Entry
d) Race/Color (skin color)
e) Schooling
f) Form (clinical form of TB)
g) HIV (human immunodeficiency virus)
h) Associated Diseases and Conditions (acquired immunodeficiency syndrome [AIDS], alcoholism and diabetes)
i) Sputum smear microscopy (diagnosis)
j) Follow-up smear microscopy (sputum) performed at the 2nd, 4th and 6th months of treatment
k) Case Closure Status

When analyzing follow-up smear microscopies, cases with the extrapulmonary clinical form of TB were excluded, as the sputum test is only performed on pulmonary TB cases. The concepts related to and the manner of filling in the notification form can be found in the Brazilian Tuberculosis Control Recommendations Manual and in the SINAN NET Data Dictionary.[5,20]

Analysis of essential field completeness was stratified by the state's health regions. The health regions covered by the study are defined as per the current Regionalization Master Plan.[21]

The records were retrieved from the Santa Catarina SINAN database on March 5th 2018, having been made available by the State Health Department after signing a Responsibility Commitment form.

During the study period, two TB notification forms were in use. Some fields of the version of the form used with effect from 2014 were included, excluded or altered, such as (i) Use of Illicit Drugs, (ii) Tobacco Smoking, (ii) Government income transfer program beneficiary, (iii) Antiretroviral Therapy during TB Treatment and (iv) Directly Observed Treatment (DOT). In view of these alterations, these fields were not analyzed.

Post-death notification consists of a tuberculosis case that had never been recorded on the SINAN system and was only discovered following death as a result of epidemiological investigation. This category was included in the 'Type of Entry' field on the form which came into force with effect from 2014.

For the purposes of analyzing consistency, two situations of inconsistent filling in of fields relating to the following were considered: (i) AIDS-associated condition (patient known to have AIDS) and negative HIV diagnosis; and (ii) positive first smear microscopy result and exclusive extrapulmonary form of TB.

Checking for duplicated records was done based on analysis of repeated entries focused on the following fields: Patient's Name (encrypted using the soundex method); Date Current Treatment Started; Sex; Type of Entry; Notification Date; and Diagnosis Date.

In order to check for updating of notified cases, the percentage of filling in as 'In Progress' was calculated for the 'Sputum culture' and 'HIV' variables, for cases closed as 'Cure'. The amount of unfilled in 'Closure Status' indicated failure to close cases in a timely manner, given that the database only contained records diagnosed as at December 2016. Considering that the database was retrieved in March 2018, 15 full months had gone by since the last diagnosis date. The deadline for closing TB case investigation is up to 90 days following the recommended period for ending treatment.[7]

Descriptive analyses were used to assess the quality of the database. All the variables were analyzed as to their completeness for each year from 2007 to 2016. Simple linear regression was used to analyze the trend of the filling in of essential fields. The Durbin-Watson (DW) test was used to verify observation autocorrelation.

Statistically significant linear trend was admitted when the regression coefficient reached a p-value <0.05 and when DW reached a p-value >0.05.

The analyses were performed with the aid of the Stata statistical package (Stata Corp., College Station, United States), version 14.0. The study was approved by the Federal University of Santa Catarina Human Research Ethics Committee (CEPSH/UFSC): Opinion No. 78648417.1.0000.0121, dated November 21st 2017.

Results

Between 2007 and 2016, 22,741 TB cases were diagnosed in Santa Catarina. People under 18 years old (999), those who were not resident in the state (46) and those whose diagnosis changed during case investigation (820) were excluded from the study population, so that 20,876 cases remained for analysis. These were comprised of 16,640 new cases, 1,576 relapse cases, 1,287 returns after dropout, 1,332 transfers, 34 cases with no information on entry type and 7 post-death notifications.

There were no duplicated records in the database. No inconsistencies were found related to the 'HIV' field. With regard to clinical form, 55 cases (0.3%) had positive diagnosis smear microscopy and exclusive extrapulmonary clinical form, characterizing inconsistency in the 'Form' field.

When analyzing completeness, 99.9% of the mandatory fields were found to be filled in (Sex; Type of Entry; Form; Diagnosis Smear Microscopy; Sputum Culture; HIV).

The proportion of filling in of the essential fields (Race/Color [skin color]; Schooling; and Associated Conditions) was lower, in particular the 'Schooling' field with 15.2% not filled in. The 'Closure Status' field of the follow-up report was 99.1% filled in. The fields relating to associated conditions (alcoholism; diabetes; AIDS) were found to have an increasing filled in trend over the period; while 'Schooling' had a falling trend (Table 1).

In the analysis by health region, four of the five essential fields analyzed were less than 91% filled in for the Greater Florianópolis and Northeast regions (Table 2). With regard to the 'Race/Color' field not being filled in, the Greater Florianópolis region accounted for 45.34% of non-filled in data, followed by the Northeast with 36.65% and the Middle Itajaí Valley with 6.55%. With regard to the 'Schooling' field, Greater Florianópolis accounted for 36.77% of non-filled in data, followed by

the Northeast with 24.95and the River Itajaí Estuary region with 9.07%. As for the 'Diabetes' field, 49.92% of non-filled in data related to the Greater Florianópolis region, followed by the Northeast with 31.23% and the River Itajaí Estuary region with 8.45%. Regarding the 'Alcoholism' field, the Greater Florianópolis region accounted for 44.57% of non-filled in data, followed by the Northeast with 30.11% and the River Itajaí Estuary region with 6.31%. With regard to the 'AIDS' field, Greater Florianópolis accounted for 41.10% of non-filled in data, followed by the Northeast with 15.51% and the River Itajaí Estuary region with 14.34% (Table 2).

In the period analyzed, 6.12% of records had sputum culture 'In Progress' and 2.13% had HIV test 'In Progress'. Fields filled in as 'In Progress' at the time when cases are notified can be updated as the follow-up report is filled in. With regard to cases closed as 'Cure' via the follow-up report, 1.84% showed the HIV result as still being 'In Progress' and 4.83% showed the sputum culture test as being in the same situation (Table 3).

Follow-up smear microscopies were less complete than diagnosis smear microscopies and percentage filling in of them decreased over the months of follow-up, reaching 29.5% non-filled in at the 6th month of treatment. Taking only cases with the pulmonary form of TB, the follow-up smear microscopies also had fields filled in as 'Not Applicable' and 'Not Performed', even though the 'Not Applicable' is for use only with extrapulmonary cases (Table 4).

In the period studied, 69.5% of cases were notified within 7 days following diagnosis. The median number of days of late notification was 0, demonstrating that half the cases were notified on the same day (50.2%). However, variability was considerable, with a 14-day interquartile range (IQR=0; Q3=14). When analyzing notification timeliness by entry type, percentage of cases notified in up to 7 days was 74.6% for new cases and 49.5% for the remaining entry types. Seven municipalities (2.4%) had no cases recorded during the period. In 88.4% of cases, notification was done in the individual's municipality of residence.

Discussion

Completeness of the Santa Catarina tuberculosis notification form fields analyzed was considered to be good, according to Ministry of Health parameters. Fields classified as essential were less complete when

Table 1 – Percentage and trend of completeness of tuberculosis notification form essential fields, Santa Catarina, 2007-2016

Essential fields	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2007-2016	Annual average change	p-valor	p-valor[a] DW
Race/Color	97.76 (1,746/1,786)	99.33 (1,914/1,927)	97.91 (1,878/1,918)	98.18 (1,941/1,977)	98.3 (2,076/2,110)	98.10 (2,066/2,106)	94.77 (2,103/2,219)	98.56 (2,262/2,295)	98.87 (2,188/2,213)	98.49 (2,290/2,325)	98.03 (20,464/20,876)	-0.02 (-0.35;0.30)	0.886	0.746
Schooling	87.79 (1,568/1,786)	84.43 (1,627/,927)	85.82 (1,646/1,918)	85.74 (1,695/1,977)	84.88 (1,791/2,110)	86.13 (1,814/2,106)	82.20 (1,824/2,219)	83.62 (1,919/2,295)	84.27 (1,865/2,213)	84.0 (1,953/2,325)	84.80 (17,702/20,876)	-0.33 (-0.65;-0.02)	0.041	0.31
Alcoholism	90.03 (1,608/1,786)	92.68 (1,786/1,927)	94.84 (1,819/1,918)	91.91 (1,817/1,977)	94.12 (1,986/2,110)	96.25 (2,027/2,106)	92.38 (2,050/2,219)	95.42 (2,190/2,295)	95.39 (2,111/2,213)	95.91 (2,230/2,325)	94.00 (19,624/20,876)	0.47 (0.08;0.86)	0.022	0.292
Diabetes	90.20 (1,611/1,786)	92.84 (1,789/1,927)	94.47 (1,812/1,918)	91.45 (1,808/1,977)	94.03 (1,984/2,110)	96.72 (2,037/2,106)	92.79 (2,059/2,219)	95.99 (2,203/2,295)	96.02 (2,125/2,213)	96.39 (2,241/2,325)	94.22 (19,669/20,876)	0.47 (0.08;0.86)	0.022	0.292
AIDS	84.94 (1,517/1,789)	86.35 (1,664/1,927)	88.43 (1,696/1,918)	89.12 (1,762/1,977)	88.67 (1,871/2,110)	89.27 (1,880/2,106)	88.06 (1,954/2,219)	92.51 (2,123/2,295)	93.81 (2,076/2,213)	94.58 (2,199/2,325)	89.78 (18,742/20,876)	0.95 (0.62;1.28)	<0.001	0.563

a) DW p-value: p-value calculated using the Durbin-Watson test.

Table 2 – Percentage completeness of essential fields of the tuberculosis notification form by health region, Santa Catarina, 2007-2016

Health Region	Race/Color (%)	Schooling (%)	Alcoholism (%)	Diabetes (%)	AIDS (%)
Extreme West	100.00 (160/160)	93.75 (150/160)	98.13 (157/160)	98.13 (157/160)	94.38 (151/160)
West	100 (395/395)	97.22 (384/395)	97.72 (386/395)	98.99 (391/395)	92.66 (366/395)
Xanxerê	99.38 (160/161)	93.79 (151/161)	98.14 (158/161)	98.14 (158/161)	92.55 (149/161)
Upper Itajaí Valley	99.58 (238/239)	94.98 (227/239)	99.58 (238/239)	99.58 (238/239)	98.33 (235/239)
River Itajaí Estuary	99.72 (4,301/4,313)	93.32 (4,025/4,313)	98.17 (4,234/4,313)	97.64 (4,211/4,313)	92.91 (4,007/4,313)
Middle Itajaí Valley	98.50 (1,768/1,795)	89.30 (1,603/1,795)	98.22 (1,763/1,795)	98.55 (238/239)	94.93 (1,704/1,795)
Greater Florianópolis	96.73 (5,536/5,723)	79.61 (4,556/5,723)	90.25 (5,165/5,723)	90.95 (5,205/5,723)	84.68 (4,846/5,723)
Mid West	97.89 (278/284)	82.04 (233/284)	94.01 (267/284)	95.07 (104/107)	84.51 (240/284)
River Peixe Valley	100.00 (401/401)	81.80 (328/401)	96.01 (385/401)	96.51 (387/401)	92.77 (372/401)
Upper Uruguay	98.13 (105/107)	93.46 (100/107)	97.20 (104/107)	97.20 (104/107)	93.46 (100/107)
Northeast	95.30 (3,062/3,213)	75.35 (2,421/3,213)	88.27 (2,836/3,213)	88.27 (2,836/3,213)	89.70 (2,882/3,213)
Northern Plateau	99.69 (645/647)	80.53 (521/647)	95.67 (619/647)	95.36 (617/647)	90.42 (585/647)
Serra Catarinense	97.83 (450/460)	67.39 (310/460)	95.43 (439/460)	95.00 (437/460)	93.70 (431/460)
Extreme South	99.77 (440/441)	93.88 (414/441)	97.28 (429/441)	97.51 (430/441)	96.83 (427/441)
Coal Region	99.45 (1,449/1,457)	88.61 (1,291/1,457)	97.12 (1,415/1,457)	96.84 (1,411/1,457)	94.17 (1,372/1,457)
Laguna	99.63 (1,076/1,080)	91.48 (988/1,080)	92.58 (1,029/1,080)	97.04 (1,048/1,080)	81.02 (875/1,080)

Table 3 – Completeness of the HIV[a] and Culture test fields on the tuberculosis notification forms and SINAN follow-up records,[b] Santa Catarina, 2007-2016

Variable	Positive (%)	Negative (%)	In progress (%)	Not performed (%)	Not filled in (%)
Notification form					
HIV[a]	23.90 (4,989/20,876)	62.10 (12,963/20,876)	2.13 (444/20,876)	11.87 (2,477/20,876)	0.01 (3/20,876)
Sputum culture	31.35 (6,544/20,876)	18.15 (3,790/20,876)	6.12 (1,277/20,876)	44.37 (9,262/20,876)	0.01 (3/20,876)
Follow-up record[c]					
HIV[a]	17.48 (2,547/ 14,569)	70.14 (10,218/14,569)	1.84 (268/14,569)	10.54 (1,536/14,569)	–
Sputum culture	32.47 (4,730/14,569)	20.52 (2,989/14,569)	4.83 (704/14,569)	42.19 (6,146/14,569)	–

a) HIV: human immunodeficiency virus.
b) SINAN: Notifiable Health Conditions Information System.
c) Cases closed as 'Cure'.

Table 4 – Completeness of diagnosis smear microscopy and follow-up smear microscopy fields on the SINAN a tuberculosis databases, Santa Catarina, 2007-2016

Variable	Positive (%)	Negative (%)	Not applicable (%)	Not performed (%)	Not filled in (%)
Smear microscopy – diagnosis	49.95 (10,427/20,876)	31.48 (6,571/20,876)	0.58 (121/20,876)	17.98 (3,754/20,876)	0.01 (3/20,876)
Smear microscopy – 1st month	31.59 (5,576/17,651)	28.99 (5,117/17,651)	0.21 (37/17,651)	23.50 (4,148/17,651)	15.71 (2,773/17,651)
Smear microscopy – 2nd month	10.23 (1,805/17,651)	36.05 (6,364/17,651)	0.21 (37/17,651)	35.55 (6,275/17,651)	17.96 (3,170/17,651)
Smear microscopy – 3rd month	4.51 (796/17,651)	35.68 (6,298/17,651)	0.21 (37/17,651)	37.64 (6,643/17,651)	21.96 (3,877/17,651)
Smear microscopy – 4th month	2.48 (437/17,651)	36.68 (6,475/17,651)	0.21 (37/17,651)	37.03 (6,537/17,651)	23.60 (4,165/17,651)
Smear microscopy – 5th month	1.54 (272/17,651)	34.20 (6,037/17,651)	0.21 (37/17,651)	36.68 (6,474/17,651)	27.37 (4,831/17,651)
Smear microscopy – 6th month	1.12 (197/17,651)	39.75 (7,016/17,651)	0.21 (37/17,651)	29.44 (5,197/17,651)	29.48 (5,204/17,651)

a) SINAN: Notifiable Health Conditions Information System.

compared to mandatory fields. Lower completeness of follow-up smear microscopies and failure to update fields filled in as 'In Progress' at the time when notification was made may indicate shortcomings in the use of the tuberculosis case follow-up records. A study conducted with SINAN data for the period 2001-2006 corroborates this finding, as it found unsatisfactory completeness (<80%) of variables relating to follow-up in Fortaleza, Salvador and Rio de Janeiro.[13]

Information system consistency, assessed in this study by means of the 'HIV' and 'Form' fields, was excellent. However, it should be noted that if the 'AIDS' field is filled as Yes, then SINAN automatically fills in the 'HIV' field as Positive.

Problems with regard to the completeness of sociodemographic variables have also been found by other studies.[10,13] Considering that socio-economic conditions, such as low schooling levels, are associated with poorer TB outcomes, such as dropout, treatment failure and death,[22] knowledge of the socio-economic conditions of TB cases is essential for analyzing the affected population.

Analysis as to information validity (where besides considering blank and 'unknown' fields, fields filled in as 'In Progress' are also considered when analyzing

completeness) can suggest that these matters have not been investigated or that case follow-up reports are not being updated. In the period analyzed, on more than 50% of forms the 'Culture' field was filled in as 'In Progress' or 'Not Performed'. Culture is a high specificity and high sensitivity TB diagnosis method. It is indicated, regardless of smear microscopy results, in cases of patients who have had prior treatment, immunosuppressed patients or those whose smear microscopy was positive at the end of the 2nd month of treatment.[5]

'Not Performed' or 'In Progress' accounted for 14.5% of records in the 'HIV' field. It should be noted that with effect from the new version of SINAN in 2014, cases for which 'In Progress' is input to the 'HIV' and 'Culture' fields are automatically altered to 'Not Performed' when they are closed.[20] In a study conducted in the state of Bahia, these codes accounted for more than 57% of records in the 'HIV' field.[11] Sanchez et al. reported that HIV serology was unavailable for 32% of TB cases notified in Brazil between 2003 and 2008,[23] even though offering HIV testing for all TB cases has been recommended since 1998.[24]

The difference found between the completeness of the 'HIV' and 'AIDS' fields may be related to the guidelines for filling in the forms: filling in the 'HIV'

field is mandatory when recording notifications on SINAN.[7] We recommend that technical documents relating the classification of mandatory variables on SINAN be revised, as a strategy aimed at increasing the completeness of non-mandatory fields. Of the 4,989 HIV positive cases, 90.1% were recorded with AIDS as an associated condition. This indicates untreated HIV leading to AIDS and, consequently, lower immunity.[20] Within this context, TB and HIV/AIDS control programs at the three levels of government should implement strategies to expand health care in this population, given that the risk of an unfavorable outcome (dropout, relapse, death) is approximately three times greater in patients with TB/AIDS coinfection.[23,24]

Completeness quality of the diagnosis smear microscopy field was found to be good. However, analysis of smear microscopies on the follow-up reports found that percentage completeness reduced.

A study conducted in urban centers with higher TB loads in Brazil identified that between 2001 and 2006, smear microscopy at the 2nd, 4th and 6th months was among the variables with the lowest proportion of completeness. That study's authors suggest that this fact may indicate, apart from shortcomings in filling in the forms, lack of TB case follow-up by health teams.[13] The Ministry of Health recommends monthly smear microscopy for pulmonary TB cases and that it is essential at the 2nd, 4th and 6th months. In view of the hypotheses raised by the study mentioned above, we recommend that cross-sectional studies be conducted to analyze case follow-up, as well as the recording of information about follow-up.

Timeliness of the surveillance system revealed good ability in obtaining information, with 69.5% of cases notified within 7 days following diagnosis. This result is in agreement with Ministry of Health recommendations.[18] 50.2% of cases were notified on the same day they were diagnosed. A study conducted in Brazil for the period from 2005 to 2008, revealed that around 55% of TB cases were notified on the same day they were diagnosed, indicating that the country's TB surveillance system is timely with regard to case notification.[25]

Not filling in certain fields may be related to the perception of some health workers that notification forms are a merely bureaucratic matter, disregarding production of data and information as being necessary for managing health actions and services.[9] In addition, a study conducted in five Brazilian municipalities in 2011

found weaknesses in the training of TB surveillance personnel.[26] In view of this, we suggest that studies be conducted capable of identifying gaps in the knowledge and competence of health workers with regard to surveillance records, with the aim of informing as to actions needed to improve notification. Changing this reality will enable programs to strengthen, as part of their routines, practices in keeping with those recommended by the PNCT, such as database linkage and analysis of data completeness and consistency.[8]

Over 10% of cases were notified in municipalities different to the municipality of residence. In order to improve the TB surveillance system, both with regard to case detection and also case follow-up, Primary Care needs to be strengthened and its responsibilities in controlling TB need to be made effective, especially identification of symptomatic respiratory cases, active tracing of dropout cases, as well as case treatment and follow-up. The Ministry of Health sees the National Health System (SUS), particularly the Family Health Strategy (ESF), as the main entry point to the Public Health system for symptomatic respiratory cases and people with TB. Primary Health Care attributes promote stronger links between patients and health workers and thus favor activities such as active tracing, contact investigation, directly observed treatment (DOT) and case follow-up.[27] Increased ESF team coverage in Curitiba between 2000 and 2009, for instance, was associated with a reduction in the proportion of TB treatment dropout.[28]

We recommend the establishment of targets for the State Plan to Combat TB, in order to enhance record quality and to return to having TB indicators in agreements between SUS levels, with the aim of reviewing the TB surveillance system. During the study period, seven Santa Catarina municipalities (São João do Oeste, Palma Sola, Sul Brasil, Águas de Chapecó, Cunhataí, Urupema and Marema) had no TB cases among their residents. They are municipalities with fewer than 10,000 inhabitants – four of them have fewer than 3,000 inhabitants –, located in regions with high TB rates. It is important to highlight that municipalities with no cases, located in areas of high risk of TB occurrence, need to be analyzed with caution, in view of the possibility of underreporting.[29] In cases such as these, monitoring of the proportion of symptomatic respiratory cases and contacts examined is recommended, in order to evaluate the quality of municipal surveillance systems with regard to case

detection. Carrying out population and health service surveys to identify symptomatic respiratory cases can assist in analyzing shortcomings in case detection.

Periodical checking of data completeness should be part of municipal surveillance actions, as well as analysis of inconsistency and duplicated records, as per Ministry of Health recommendations.[5]

The results of this study have enabled a panorama to be drawn of TB notification records in Santa Catarina. The Greater Florianópolis health region contributed most to essential fields not being filled in. This shows that specific attention needs to be paid to notification records in that region. Overall, the TB surveillance system data were adequate for guiding TB prevention and control actions. Nevertheless, they can be improved. In the period assessed, the fields relating to associated conditions (alcoholism, diabetes and AIDS) showed increased completeness, while completeness of the 'Schooling' field decreased, and completeness of the 'Race/Skin Color' field remained stable. Weaknesses were demonstrated in notification records and follow-up records.

This study provides original information for TB surveillance in the state of Santa Catarina, serving to inform health service managers and workers, both at state and municipal level, for making joint decisions seeking to improve health team work processes and improve information on tuberculosis, thus contributing to its control.

Authors' contributions

Canto VB and Nedel FB contributed to the study concept and design, data analysis and interpretation and drafting the first version of the manuscript. Nedel FB contributed, significantly, to critically reviewing the intellectual contents of the manuscript. Both authors have approved the final version and are responsible for all aspects thereof, including the guarantee of fits accuracy and integrity.

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