

Prevalences of Tuberculosis and Other Respiratory Diseases among People over Age 15 in the Northeast Sector of Medellín, Colombia¹

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A survey was conducted in 1988 to estimate the prevalence of respiratory symptoms and pulmonary tuberculosis in people over age 15 in the Northeast Sector of Medellín, Colombia, an area suffering from severe socioeconomic depression. A cluster sample was selected for this purpose and 3,731 adults were interviewed in their homes. Those classified as respiratory symptomatics (ones reporting a cough lasting two weeks or more) were asked to provide samples for three sputum-smear examinations.

The prevalence of pulmonary tuberculosis found in this survey was 2.68 cases per 1,000 subjects, a rate substantially greater than the prevalence of tuberculosis cases recorded in the Northeast Sector, and the prevalence of respiratory symptomatics was 70 per 1,000 subjects. Of eight subjects whose cases had been diagnosed previously, three said they had abandoned treatment. The prevalence of respiratory symptomatics was higher among poorly educated subjects and among those sleeping in poorly ventilated and/or overcrowded quarters. Overall, the survey data suggest that the tuberculosis control program in Northeast Medellín confronts a spectrum of problems ranging from low case-detection rates and high rates of abandoned treatment to social conditions and behavior patterns that foster host vulnerability and disease transmission.

Tuberculosis continues to be a public health problem in poor countries, where the number of cases has increased over the last three decades and the population has doubled. The International Union Against Tuberculosis and the World Health Organization have indicated that a close relationship exists between so-

cioeconomic status and tuberculosis incidence, partly because malnutrition, strenuous work, and shortage of leisure time all tend to decrease individual resistance to the infection (1). Poor housing and working conditions involving overcrowding and poor ventilation also increase the tuberculosis risk. In this vein, it should be noted that during the 1850–1945 period preceding chemotherapy, countries such as the United Kingdom, Norway, Holland, and Sweden saw infant tuberculosis mortality drop from about 600 deaths per 100,000 live births to around 100 per 100,000. Socioeconomic development may have accounted for much of this decline (2).

It has also been suggested that socioeconomic factors typically account for 60–70% of the disparity between the tuber-

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culosis incidence in different countries, while the quality of health services delivered accounts for 10–20% and genetic and climatic factors, together with factors related to the natural history of the disease, account for the remaining 10–30% (2–5).

An epidemiologic analysis of various tuberculosis indicators in the city of Medellín, Colombia, during the years 1975–1988 (6, 7) suggests that the tuberculosis program in that city has had little success in reducing prevailing levels of the disease (Table 1).

During the period 1982–1986 Medellín's Northeast Sector registered successive annual tuberculosis incidences of 60, 61, 35, 52, and 40 (8). It was assumed that the risk of tuberculosis depended, among other things, on socioeconomic conditions. However, it was striking that the recorded incidence was lower in the Northeast Sector than in the rest of the city, since this subsection was characterized by major socioeconomic depression compared to the city as a whole (7). This suggested that insofar as tuberculosis was concerned, demand for medical care among the Northeast Sector's population far exceeded supply. It also suggested that the prevalence of respiratory symptoms and pulmonary tuberculosis in that district should be assessed, along with the level of treatment abandonment, and that the prevalence of tuberculosis and respiratory symptoms among different age, gender, and socioeconomic groups should be compared.

MATERIALS AND METHODS

In 1988 a total of 3,731 subjects were interviewed in order to estimate the prevalence of pulmonary tuberculosis and other respiratory disease among people over the age of 15 and of low economic status in Medellín's Northeast Sector. The size of the sample was based on a theoretical tuberculosis prevalence of 0.7 cases

per 1,000 inhabitants, a population of 203,734, a sample error of 0.9 per 1,000, and a 95% confidence level. A cluster sample method was used to select the survey population, considering each neighborhood within the sector as a cluster (6, 9). The text of the survey questionnaire is shown in the Annex. Answers to the questions posed were used to clinically classify the respondents according to whether or not they had respiratory/tuberculosis symptoms and how they had been or were being treated; to define the respiratory symptoms involved; and to assess the respondents' homes in terms of certain conditions fostering respiratory disease transmission.

1. *Clinical classification.* The survey participants were grouped into the following categories: those with respiratory symptoms, those who were undergoing tuberculosis treatment, those who had abandoned such treatment, those who had been cured of tuberculosis, those who had never been diagnosed as having tuberculosis, and those with cases that were diagnosed during the study (10). Irrespective of other symptoms, subjects who reported having a cough for two or more weeks were considered to have respiratory symptoms. Plans were made for all subjects with respiratory symptoms, as well as all others who said they had abandoned tuberculosis treatment, to be given three direct bacilloscopies. The sputum samples needed for these examinations were collected at home by the respondents, who were given instructions regarding their collection.

Subjects diagnosed as having pulmonary tuberculosis who were undergoing treatment, those who had interrupted treatment and continued to have symptoms, and those who had one or more positive bacilloscopies were classified as tuberculosis cases (see Annex). All the tuberculosis cases and respiratory symptomatics were classified as respiratory

Table 1. Trends in epidemiologic tuberculosis indicators in Medellín, Colombia, 1975–1988.

Indicator	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Positivity ^a	1.7	1.7	1.0	2.7	2.0	2.2	2.3	4.0	2.0	2.5	2.8	3.9	2.1	2.7
Respiratory symptomatics ^b							1.4	1.1	1.0	1.2	2.4	2.6	2.7	
Incidence of positive bacilloscopies ^c									13.6	9.2	9.0	16.2	19.1	19.1
Confirmed diagnoses ^d	26	27	29	38	21	24	29	33	27	44	53	57	62.7	65
Cure rate ^e	21.5	29.0	31.2	34.0	21.2	20.0	23.6	21.0	18.3	39.3	61.7	41.7	68.7	60
Loss rate ^f	8.5	13.2	14.0	14.6	21.4	27.6	14.0	11.8	8.9	16.0	18.0	15.6	13.0	16.3
Pulmonary tuberculosis incidence ^g	167	139	118	69	109	95	151	107	96	74	75	70	77	—
Pulmonary tuberculosis mortality ^h	11.9	6.6	7.2	6.2	5.4	6.2	6.3	6.8	3.6	3.2	4.8	4.4	3.4	—

^aTotal cases with positive bacilloscopy x 100/total number of cases diagnosed.

^bTotal respiratory symptomatics x 100/number of first consultations among people ≥ 15 years.

^cTotal tuberculosis cases with positive bacilloscopy x 100,000/general population as of 1 July.

^dTotal cases with positive bacilloscopy x 100/total number of people studied.

^eTotal leaving program cured x 100/number of existing patients + total leaving.

^fTotal abandoning treatment x 100/number of old patients + total leaving.

^gTotal pulmonary tuberculosis cases x 100,000/general population as of 1 July.

^hTotal pulmonary tuberculosis deaths x 100,000/general population as of 1 July.

Source: Instituto Metropolitano de Salud (6, 7).

cases. The latter group included all those who reported respiratory symptoms (two weeks with a cough, irrespective of other symptoms) but yielded no positive bacilloscopy results.

2. *Respiratory disease symptoms.* Answers provided by the respondents to a question (3.2 in the questionnaire) on respiratory symptoms were used to single out those with expectoration, subjective fever, weight loss, and loss of appetite (see Annex).

3. *Education and living conditions.* Answers to question 1.3 (see Annex) indicated the respondents' education (years of school completed), while answers to question 2 yielded information about two home conditions fostering respiratory disease transmission—these being overcrowding (defined as three or more people sleeping in the same bedroom, a definition taking into account the small size of most bedrooms in Northeast Sector homes) and poor ventilation (defined as cases where the number of windows in the housing unit divided by the number of bedrooms was less than one or where the bedroom was used for cooking). The evaluation of living conditions was done by means of direct observation in accordance with World Health Organization and Colombian Ministry of Health standards (11, 12).

The interviews were conducted by nurses who received prior training for this purpose from the staff of the Metropolitan Institute of Health (Instituto Metropolitano de Salud, also known as Metrosalud) and the authors. When the survey subject was not found at home, the interview information was obtained from the closest available family member. In a case where the survey subject had respiratory symptoms, material was left for the collection of sputum samples. Families in which respiratory symptoms were detected were visited on four successive occasions in order to retrieve spu-

tum samples. At the end of information collection, the families who did not provide samples were visited again with a view to determining the reason.

Bacilloscopies were conducted at Metrosalud's central laboratory, and patients diagnosed during the study were enrolled in the tuberculosis control program. Another bacilloscopy, a chest X-ray, and additional examinations directed at confirming a diagnosis were performed on subjects with negative bacilloscopies and clinical manifestations compatible with tuberculosis.

STATISTICAL ANALYSIS

Statistical analyses were carried out using the Statistical Package for the Social Sciences (SPSS). Data calculated included tuberculosis and respiratory disease prevalences, the index of treatment abandonment, and the percentage of subjects being treated. In addition, the observed prevalences of respiratory disease were compared for groups with different ages, genders, years of education, and living conditions. The chi-square test was used to assess observed differences and possible associations between the variables involved at the 95% confidence level. In order to analyze the differences between the values of binomial variables, a normal approximation was applied to the binomial distribution (*z* test), taking into account the large size of the sample studied.

RESULTS

Of the 3,731 subjects interviewed, 1,641 (44%) were men and 2,090 (56%) women. The interview subjects' distribution by age and sex did not differ significantly from that of the Northeast Sector's adult population, with the exception of the group over 70 years old (Figure 1).

The number of interview subjects found to have respiratory symptoms was 240

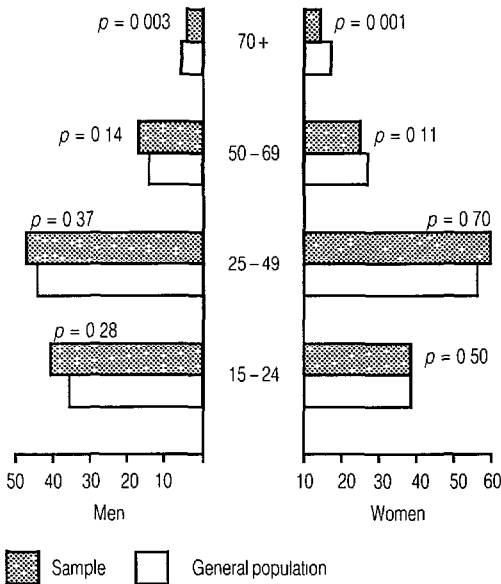


Figure 1. Distribution by age and sex of the study subject population sample and the general population of Medellín's Northeast Sector in 1988. The "p" values show the probability that the differences indicated are coincidental.

(6.4% of the total). Two or three bacilloscopies were performed on 172 (71.7%) of these subjects; while despite the effort to collect samples at subjects' homes on several occasions, only one bacilloscopy or none were performed on the remaining 68 subjects (28.3%).

Of these 68 people who abandoned the program, 32 (47.1%) were men and 36 (52.9%) women, a sex distribution that

was not statistically distinct at the 95% confidence level ($p = 0.31$) from that of the population studied. Likewise, no statistically significant differences were observed in the age distribution of the patients who were lost to follow-up as compared to that of the whole study population (Table 2).

In all, 10 tuberculosis cases were detected, making the observed tuberculosis prevalence in the study population 2.68 cases per thousand subjects. Two of these were new cases; six of the cases occurred in men and four in women. Regarding age, most (six) of the cases were found in the 25-49 year age group, with two cases each occurring in the 15-24 and 50+ age groups. Of the eight subjects whose tuberculosis cases had been diagnosed before the survey, three said they had abandoned treatment. In all, 260 (6.97%) of the interview subjects said they had been cured of tuberculosis.

Of the 240 subjects classified as having respiratory disease symptoms, 190 (79.2%) reported expectoration, 100 (41.7%) subjective fever, 86 (35.8%) loss of appetite, and 107 (44.6%) weight loss. In general, our data suggest that the risk of respiratory disease increased with age among adult subjects of both sexes. However, no significant differences were found between the respiratory disease symptom prevalences in men as compared to women (Table 3).

Compared to the respiratory disease

Table 2. Percent distribution by age of the 3,731 survey subjects and of those who were lost to follow-up. Observed differences in the sizes of comparable age groups were not statistically significant.

Age in years	Study participants		Subjects lost to follow-up		z	p
	No.	%	No.	%		
15-24	1,405	37.7	21	30.9	1.12	0.1314
25-49	1,718	46.0	31	45.6	0.07	0.4721
≥50	608	16.3	16	23.5	1.39	0.0823
Total	3,731	100.0	68	100.0		

Table 3. Prevalences (cases per 1,000) of respiratory symptoms among men and women of different ages within the survey population.^a

Age (in years)	Men		Women		z	p
	No.	Prevalence	No.	Prevalence		
15-24	25	39.2	38	49.6	0.94	0.17
25-49	56	74.9	62	63.8	0.98	0.18
≥50	28	109.8	50	141.6	1.16	0.12

^a $\chi^2 = 213.6$; $p < 0.001$ for the differences between the recorded prevalences in the indicated age groups.

prevalence in the whole survey population, significantly higher respiratory disease prevalences were found among subjects who cooked in their bedrooms ($p = 0.03$), among those whose bedrooms had no windows opening to the outside ($p = 0.0007$), and among those sleeping in overcrowded dwellings ($p = 0.05$) (Table 4). In addition, a negative relationship was observed between the subjects' educational level and the respiratory disease prevalence ($p < 0.0001$).

DISCUSSION AND CONCLUSIONS

As the data in Table 1 show, tuberculosis constitutes a major public health

problem in Medellín, one that has posed serious difficulty for the existing control program. This tuberculosis endemic can be explained by the presence of factors maintaining the chain of transmission. Among them:

- a high prevalence of sources of infection (bacilloscopy-positive tuberculosis cases) combined with a low rate of case detection;
- social conditions that facilitate exposure (poor sanitary habits, overcrowding, inadequate dwellings);
- immune conditions increasing host vulnerability (including age, malnutrition, and accompanying diseases) (13-17).

Table 4. Likelihood of respiratory disease symptoms being detected among members of high-risk groups in the population studied.

Risk factor	Present	No. of	No. of cases	z	p
		subjects ^a	per 1,000		
Food cooked in bedroom	Yes	618	89.9	1.88	0.03
	No	3,098	65.9		
Bedroom with no outside window	Yes	692	101.2	3.18	0.0007
	No	3,037	62.3		
Overcrowding: residents sleeping three or more to a room	Yes	1,176	76.4	1.58	0.05
	No	1,963	63.2		
Years of school successfully completed ^b	0	271	124.1		
	1-4	1,034	96.7		
	5-10	807	73.1		
	≥10	331	18.1		

^aThe data on education and overcrowding are incomplete because the information was collected by means of interviews, and some subjects declined to answer certain questions.

^b $\chi^2 = 22.3$; $p < 0.0001$.

It seems evident that the degree of program coverage provided in the zone studied was low. As of 31 December 1988, Metrosalud reported that it was treating 125 cases in this sector (6). However, the results of the study reported here indicate that an estimated 109 people in the sector had undiagnosed tuberculosis cases and an estimated 164 people with diagnosed cases had abandoned treatment. This situation was maintaining the chain of transmission, making disease control difficult.

Together with abandonment of treatment, these findings suggest that a low case detection rate has been one of the biggest problems facing the control program in this zone. Contact research has been limited by a suspension of home visits prompted by the lack of personal safety prevailing in the zone and a high rate of delinquency. The problem was brought home in our study by realization that in 27.3% of the cases with respiratory symptoms it was impossible to collect a sample to confirm the diagnosis. Such lack of cooperation by study participants can be attributed partly to low socioeconomic status (high rates of illiteracy, unemployment, and delinquency), partly to other sometimes related factors such as alcoholism, drug addiction, and nighttime employment (of musicians, watchmen, prostitutes, waiters, etc.), and partly to fear of diagnosis.

But the problem goes deeper. If the tuberculosis control program is to be effective, detection of respiratory symptoms is not enough. A rapid procedure must be available for confirming the diagnosis and commencing treatment; for we know that in many cases slow reporting of bacilloscopy results is the factor responsible for failure to begin treatment (17).

At the same time, it should be noted that all the reasons cited by our study patients' families for abandoning treat-

ment were social in nature (prostitution, addiction to drugs or alcohol, delinquency, and homelessness). It thus seems clear that besides case detection and disease treatment, care provided to tuberculosis patients must include environmental control measures and modification of the social behavior patterns of those affected (18).

The high prevalences of pulmonary tuberculosis (2.68 cases per 1,000 population) and respiratory symptoms (67 cases per 1,000 population) can also be attributed in part to the low socioeconomic status of people living in the Northeast Sector, the high rate of unemployment (11.8%), the high rate of mortality linked to homicides (215 per 100,000 population), and the fact that some 49% of the sector's families lack an adequate supply of food.

The fight against tuberculosis must be waged on all fronts. Partial detection of cases, exacerbated by a high rate of abandoned treatments, will not permit control, much less eradication, of this disease from the community (19). Rather, the occurrence of tuberculosis will only fall substantially when effective case detection and treatment solutions are integrated with measures taken in other fields of public action such as education, public works, and economics.

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ANNEX. Text of questionnaire used in the survey of tuberculosis and other respiratory diseases, Northeast Medellín, 1988.

1. **Demographic data:** first and family names, telephone no., neighborhood, name of head of household
 - 1.1. Age (years completed)
 - 1.2. Sex (male, female)
 - 1.3. Years of school completed
2. **Residence:**
 - 2.1. Average number of people sleeping per room (number of people divided by number of rooms)
 - 2.2. Food prepared within the bedroom (yes, no, no information)
 - 2.3. Number of windows per bedroom (number of windows divided by number of bedrooms)
3. **Clinical picture:**
 - 3.1. Cough present during two or more weeks (yes, no, no information)
 - 3.2. If yes, ask if the following symptoms present:
 - 3.2.1. Expectoration (yes, no, no information)
 - 3.2.2. Subjective fever (yes, no, no information)

- 3.2.3. Weight loss (yes, no, no information)
- 3.2.4. Loss of appetite (yes, no, no information)

Ask if pulmonary tuberculosis has been diagnosed, and if treatment has been received, abandoned, or completed. Consider symptomatic anyone who answers "yes" to question 3.1.

If pulmonary tuberculosis was diagnosed, ask:

- First and family names
- Institution where it was diagnosed and number of clinical history

3.3. With this information classify the respondent as: respiratory symptomatic, case in treatment, case of abandoned treatment, cured case, never diagnosed, diagnosed during the study.

If the respondent was classified as a respiratory symptomatic or an abandoner of

treatment, order bacilloscopy. (Explain how the sample is taken: Drinking liquids the night before is recommended. The sample should be collected first thing in the morning, while fasting. Inhale deeply and then cough to expel secretions. Label the container with full name [do not use a red marker]. Put it in a cool place beyond the reach of children.)

3.4. Bacilloscopy ordered (yes, no, no information)

4. Results:

- 4.1. First sample (positive, negative, inadequate, no information)
- 4.2. Second sample (positive, negative, inadequate, no information)
- 4.3. Third sample (positive, negative, inadequate, no information)

Reasons the sample was not collected:

Interviewer's name: