RECENT LEVELS OF KNOWN TUBERCULOSIS IN COLORADO

Statistical Indexes from Annual Summaries and Special Reports

And Comments Upon Existing Control Problems

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Colorado State Department of Public Health
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FOREWORD

The Research and Reports Service of the Colorado State Department of Public Health recently reviewed the Department's annual statistical summaries on tuberculosis and a number of special reports on this subject, in order to assist in efforts to measure recent levels of tuberculosis in Colorado and to evaluate case-finding and follow-up methods. Statistical indexes based upon the review, primarily for the period 1950-1956, are presented in a series of tables in the following report, together with text summaries.

It is hoped that the assembled information will be useful to individuals and agencies engaged in tuberculosis control and service activities.

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I. CONCLUSIONS FROM THE REVIEW

Tuberculosis mortality in Colorado decreased greatly in the past ten years, and the actual death rates per 100,000 population, for the state as a whole, now are lower than rates projected in 1945 as theoretical goals that might be reached by about 1955 if there were optimum application of the control and treament methods known in the middle 1940's. Rapid progress in reducing tuberculosis mortality characterized not only the past decade as a whole but also the years since 1950, the period primarily under review in the present report.

In Colorado, as in the United States, a large part of the decrease in tuberculosis mortality in recent years is attributable to new treatment methods that have greatly reduced the case fatalities. The reduction in mortality does not, however, assure correspondingly great decreases in the numerical prevalence of the disease or in the number of new cases; or even in the prevalence rates and the new case rates per 100,000 population.

The rapidly growing population of Colorado, especially in the major population centers, could mean that there are more tuberculous persons to be discovered, followed-up, and provided treatment and supervision, even if the prevalence rates and the new case rates per 100,000 population were remaining stable or were decreasing somewhat. A present need, therefore, is to learn as accurately as possible the actual prevalence and new occurrence of the disease, in terms of absolute numbers and also population rates. With such information, we could better estimate the amount of service and expenditures needed for the control and care of tuberculosis, now and in the future, and also better evaluate our future progress in preventing the disease.

From 1950 to 1956, the reported number of new cases of tuberculosis, among Colorado residents, per 100,000 population decreased steeply, or from 119.7 to 67.5. It is difficult, however, to estimate how much of the reported decrease was actual and how much was due to changes in the level and effectiveness of case-finding and in the percentage of new cases reported. Nevertheless, there probably was some actual decline in new cases per 100,000 population inasmuch as case-finding and case follow-up methods apparently improved in some ways.

If improvement in case-finding resulted in more complete reporting of known new cases, the reported decline in the morbidity rate would understate, not overstate, any actual decline that may have occurred in the incidence of new cases. The federal Public Health Service on analyzing newly reported tuberculosis case rates for the United States in relation to changes in reporting and recording practices of the states, 1948-1955, also concluded that there was some actual decline in tuberculosis incidence in recent years. 1/

OUR REVIEW OF STATISTICAL SUMMARIES AND SPECIAL REPORTS BEARING UPON A VARIETY OF TUBERCULOSIS CONTROL PROGRAMS IN COLORADO - WHEN CONSIDERED IN RELATION TO OBSERVED DEVELOPMENTS IN TUBERCULOSIS SERVICES AND RESULTS - INDICATED THAT REDUCTION OF TUBERCULOSIS IN THIS STATE CAN BE ACCELERATED IN THE FUTURE, PROVIDED:

THAT the tuberculosis funds, services, facilities, and personnel necessary for progressive control of the disease keep pace with the population growth.

THAT the case-finding, diagnostic, case follow-up, and contact follow-up programs are designed to cover adequately the groups in which tuberculosis is known or reasonably suspected to be disproportionately frequent, in relation to the size of the population segment.

THAT, therefore, the case-finding and control programs are directed especially toward groups such as: the older age groups; disadvantaged racial,

migrant, or other minority groups; residents of low-income neighborhoods and substandard housing areas; persons moving in and out of short-term correctional institutions; occupational groups at high risk of exposure to the disease, such as some hospital and laboratory personnel.

THAT pre-employment or admission examinations and periodic examinations are increased among personnel, such as public school staffs, working closely with numerous susceptible persons; among inmates of long-term institutions and hospitals and nursing homes who, if tuberculous, may expose many others; and among other groups who are in close contact with many other individuals, such as food handlers, barbers, and other personal service workers.

THAT eligibility of communities for health department assistance with chest X-ray surveys or other screening projects include definite arrangements and personnel for thorough diagnostic follow-up of a very high proportion of the suspected cases found in the screening, plus follow-up of contacts and effective referral of cases to physicians and clinics for medical attention.

THAT facilities and personnel are more readily accessible for differential diagnosis of suspected tuberculosis and other diseases of similar symptoms.

THAT tuberculosis hospital bed needs for the future are not underestimated - because of apparent downward trends in the disease and the shortened hospital stays under the new therapies - and unexpected bed shortages do not delay or curtail needed hospitalization.

THAT suitable hospitalization facilities are established in public institutions for use - if all other methods fail - in forcible isolation and detention of truly recalcitrant unhospitalized individuals with infectious tuberculosis who are a menace to the health of others; a public health protection measure possible under existing Colorado laws.

THAT adequate public health funds are made available for provision of appropriate hospital or other medical care to needy and medically needy persons with infectious tuberculosis who do not meet the means test and/or residence requirements of the tuberculosis care program of the State Department of Public Welfare; and for the public health supervision of contacts of such cases.

THAT definite arrangements are made, in every instance, for the medical supervision and follow-up of cases released from hospitals but needing continued drug or other therapy.

THAT state and local health departments are provided increased funds and personnel for public health nursing and medical-social follow-up programs to assist in supervision of the tuberculosis cases at home and their contacts, and to aid in effecting clinic care or hospitalization if needed.

THAT tuberculosis hospitals perfect all possible psychological and personal-relations skills in dealing with the patients in order to prevent their leaving against medical advice or being reluctant to be rehospitalized when necessary.

THAT tuberculosis case-finding, care, and follow-up services of all kinds - for the needy, the medically needy, and the general public - are better integrated by the state and local public welfare departments, public health departments, tuberculosis associations, and the medical profession.

THAT the physicians, hospitals, and clinics promptly report all new cases to the state and local health departments and keep the case registers informed of the movement and status of the cases under care.

In order to accomplish all this, it will be necessary to keep the general public, the suspected cases, and the confirmed cases aware of the continuing prevalence of tuberculosis, the seriousness of the disease for the individual if medical care is neglected, and the communicability of this controllable disease which - even with optimum foreseeable progress - will continue to menace public health for years to come.

A crude tuberculosis death rate of about 1.5 per 100,000 population in another decade is statistically predictable for the United States and, we believe, for Colorado residents - in comparison with the United States rates of 8.5 per 100,000 in 1956* and 39.9 in 1945, and the Colorado resident rates of 7.8 per 100,000 in 1956 and 32.3 in 1945. The crude tuberculosis daath rate of 1.5 per 100,000 population expectable about ten years from now is based upon the assumption that treatment methods and control activities will continue to reduce the mortality rate at about the same speed as in the past five years. If control methods can be made more effective and treatment methods further improved, progress toward new mortality and morbidity lows can be even more rapid.

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*Provisional, based upon a 10-per cent sample.

II. PROSPECTS FOR TUBERCULOSIS REDUCTION TEN YEARS AGO

Data made available to Dr. Florence R. Sabin by a national research organization in the middle 1940's indicated that tuberculosis morbidity and mortality could be reduced 75% or more in 10 to 15 years through full application of the then known methods of control and treatment.2/ When computed from the mortality rates for 1945, the potential 75% saving meant that the death rate from tuberculosis, all forms, per 100,000 population could be reduced from 40 to 10 in the United States; from 48 to 12 in Colorado, among residents and nonresidents considered together; and from 32 to 8 in Colorado, among usual residents of the state.

Actual and Projected Mortality Decreases

Doctor Sabin used the figures on potential reductions in tuberculosis rates for Colorado as symbols of the accelerated progress in tuberculosis control that she urged as chairman of the Health Committee of the Governor's Postwar Planning Committee, organized in 1944; as Manager of Health and Charity of the City and County of Denver; and as chairman of the board of the new Denver Department of Health and Hospitals, organized in 1951. In actuality, the tuberculosis mortality rates recorded for the state as a whole in 1955 were lower than the theoretical rates computed as 75% reductions of the 1945 levels. (Table 1.)

As will be noted from the bottom section of Table 1, the tuberculosis mortality rates have remained higher for some parts of the state than for others.

Morbidity Study Needs

The question of tuberculosis morbidity levels required further study in

1945. Some progress has been made in this field of inquiry since then, but we do not yet have the full answer to the question. There appears to be general agreement, however, that the actual morbidity trend in recent years was less steeply downward than the mortality trend.

Table 1. Tuberculosis Mortality Rates - United States and Colorado, 1945-1956

Basis of Rate	Recorded 1945 a/	Recorded 1950	Recorded 1955	Projected 1955 b/	Recorded 1956	% Change 1950-56
United States						
Tbc. deaths, per 100,000 pop. of U.S.....	39.9	22.5	9.1	10.0	8.5**	-62.2
Colorado						
Total tbc. deaths occurring in Colo. per 100,000 pop. of state.....	48.3	21.7	10.3	12.1	9.1	-58.1
Tbc. deaths of usual residents and others in Colo. a year or longer per 100,000 pop. of state	38.0	*	*	9.5	*	*
Tbc. deaths of usual residents, only, per 100,000 pop. of:						
Colorado.....	32.3	15.7	7.5	8.1	7.8	-50.3
Denver.....	40.4	20.9	12.5	10.1	13.4	-35.9
Tri-County Area.....	29.0 c/	16.9	5.7	7.3	5.7	-66.3
All other counties....	28.4	12.6	5.2	7.1	5.3	-57.9

a/ Revisions in classification of the primary causes of death under the Sixth Revision of the International List of Causes of Death, 1949, account for a minor fraction of the decrease in the recorded rates in the 1950's, as compared with 1945.

b/ Computed as 25% of the recorded 1945 rate to obtain a theoretical 75% reduction below the 1945 rate.

c/ For the individual counties in the Area the rates were: Adams, 13.6; Arapahoe, 27.7; and Jefferson, 39.9.

* Not available. ** Provisional, based on 10-per cent sample.

III. DENVER AND TRI-COUNTY MASS CHEST X-RAY SURVEY, 1949

When commenting upon tuberculosis problems in her presidential address to the Western Branch of the American Public Health Association in Salt Lake City in May 1948, Doctor Sabin said: "It seems to me imperative that we find out the zones of high incidence of this disease and start a ten year program to correct present conditions." 3/ This was the procedure she enthusiastically sponsored in Colorado and helped to implement through the Denver and Tri-County mass chest X-ray survey of 1949.

Size and Method

The tuberculosis mortality studies in the middle 1940's showed relatively high resident death rates from the disease in the 4-county Denver Metropolitan Area. This embraced the City and County of Denver and the surrounding Tri-County Area, including Adams, Arapahoe, and Jefferson counties. The studies also indicated that analysis of the problem in the 4-county area was complicated by case-notification and other control and service responsibilities related to tuberculous nonresidents in the area because of the numerous national tuberculosis hospitals and sanatoria situated there.

In order to measure the morbidity problem in the 4-county area, the Denver Health Department, Tri-County Health Department, State Department of Public Health, and United States Public Health Service made an area-wide chest X-ray survey in 1949, with the cooperation of many community groups and agencies. 4/

Size

The screening was done by mobile unit methods. About 69% of the population aged 15 and older were X-rayed by 70 mm. films, and 324,906 technically satisfactory screening films were analyzed.

Diagnostic Follow-up

When the screening films indicated existence of pathology, the individuals promptly were referred, for further examination, to a Diagnostic Center operated in connection with the survey.

Under this plan, diagnostic follow-up could be completed for a high percentage of the suspected tuberculosis cases discovered by the screening films as follows: 80% of the suspected cases were diagnosed by the Center; 1% were diagnosed through the existing tuberculosis case registers; 4% through other sources such as private physicians, hospitals, sanatoria, and treatment clinics; and only 15% had to be classified as suspected tuberculosis on the basis of the screening films, alone, because other diagnostic follow-up could not be accomplished.

Types of Rates Computed

Conditions that were considered to be tuberculosis, on the basis of 14 x 17" X-ray films, sputum examinations, clinical studies, or other appropriate methods were classified as: active, questionably active, and inactive.

Case prevalence rates, however, were computed only for "active" tuberculosis, including the questionably active cases; for "inactive" tuberculosis; and for "all" tuberculosis.

Survey Findings

In broad summary, it was found that there are "a number of tuberculosis problems, not just one" and that "however one may divide up the population, there are different problems related to each population characteristic."

Population Concentration

Significant differences in the case prevalence rates for the surveyed populations in the individual 4 counties were "most likely attributable to population concentration and greater opportunity for infection." (See Table 2 for the county rates.) The differences lay primarily in the frequency of the inactive disease.

Race

There was more tuberculosis among the Spanish culture groups than among the other main racial groups surveyed - Whites other than Spanish-Americans, and Negroes. As to active tuberculosis, the Spanish-Americans had the highest prevalence and the Whites the lowest, the ratio being 3 to 1.

The prevalence of "all" tuberculosis was greatest in the Whites and least in the Negroes. The difference apparently was due to a lower rate of inactive tuberculosis in the Negroes, and the indications were that high tuberculosis death rates in Negro populations are related to high case fatality rather than to high overall tuberculosis morbidity.

Table 2. Selected Statistics from Denver and Tri-County Area X-Ray Survey, 1949

Screening films and results of follow-up of screening films indicating pathology a/	No.	%
Total technically satisfactory screening, 70 mm., films	324,096	100.0
Films indicating pathology	9,715	3.0
Screening film cases followed-up through Diagnostic Center etc. because pathology was indicated	9,715	100.0
Found to be:		
Negative or essentially negative	1,530	15.7
Tuberculosis	4,231	43.6
Active	366	3.8
Questionably active	544	5.6
Inactive	3,321	34.2
Other chest pathology	2,261	23.3
Cardio-vascular abnormalities	1,693	17.4

Tuberculosis case prevalence rates per 1,000 surveyed persons, according to county a/	Active & Quest. Active Tbc.	Inactive Tbc.
Denver	1.3	15.2
Adams	1.2	11.0
Arapahoe	.7	13.0
Jefferson	1.1	11.1

Range of the tuberculosis case prevalence rates per 1,000 surveyed persons for the socio-economic areas (13) of Denver County b/	Active & Quest. Active Tbc.	All Tbc.
Best quartile	Under .7	Under 11.0
Second quartile	.8 - 1.2	11.0 - 14.9
Third quartile	1.3 - 1.7	15.0 - 18.9
Fourth quartile	1.8 & over	19.0 & over

a/ From the printed survey report, Denver and Tri-County Chest X-Ray Survey, Inc. table on pp. 8-9. b/ Ibid. p. 6.

Sex

There was more tuberculosis among males than females, with the notable exception of the Spanish-Americans. The disproportion between males and females was most pronounced for active tuberculosis, the rate for all males being 2 times the female rate. This was true because it was so for the Whites, who made up more than 90% of the surveyed population.

Socio-Economic District

There was more tuberculosis in districts of low socio-economic status than in the others.

When case prevalence rates were computed for the 13 socio-economic districts into which the City and County of Denver was mapped, the highest prevalence was found in the oldest section of the city, a business and industrial area near the Platte River which contained much of the substandard housing. The districts with the second and third highest prevalence rates were the stockyards district and a low-income section in the vicinity of Denver General Hospital.

There was a considerable representation of the racial minority groups in each of the 3 neighborhoods. (For ranges in the case prevalence rates for the 13 socio-economic districts, see Table 2.)

Age

There was, "above all, a steady rise in tuberculosis with increase in age." Sixty per cent of the active tuberculosis and 73% of "all" tuberculosis was found in persons 45 and older. With the single exception of active tuberculosis in Negro females, all of the prevalence rates reached their maximum at the oldest age for which the number of persons surveyed made the rates reliable.

Continuing Utility of the Statistics

Because of the large population surveyed and the thorough diagnostic follow-up methods used, the Denver and Tri-County X-ray survey of 1949 provided unusually reliable statistical indexes on case-finding results achievable through mass X-ray surveys if there is prompt and complete follow-up of the cases of suspected pathology; and on the population groups and socio-economic areas that are at "undue risk of the disease" and toward which tuberculosis case-finding efforts should be primarily directed.

IV. RESIDENT MORTALITY AND MORBIDITY, 1950-1956

Changes in tuberculosis levels in a state and in the areas within a state are difficult to measure precisely, because of variations in case-finding and reporting from year to year; and also because of the difficulty of obtaining accurate population estimates in intercensal years. Nevertheless, some general conclusions can be drawn from the reported cases and deaths, and the rates computed from them per 100,000 population as shown by the decennial censuses and indicated by intercensal estimates.

Summary Comparisons

Tables 3-6 present annual numerical statistics, 1950-1956; rates per 100,000 population, percentage distributions, and other proportionate comparisons; and also 6-year averages for the period 1950-1955, inclusive. For persons engaged in tuberculosis control activities, the data doubtless will carry many implications and suggest numerous underlying explanations. Here, however, only a few of the comparative figures are summarized as an introduction to the tables.

Population Size

The number of people to be protected against tuberculosis in Colorado, that is, the entire population, increased from 1,325,089 in 1950 to 1,612,000 in 1956, a 22% increase. (Table 3.)

In areas of extremely rapid population growth, such as the Tri-County Area surrounding Denver, the increase may have been as much as 65%.

Tuberculosis Mortality

Despite the rapid population growth in the state, the resident tuberculosis deaths decreased from 208 to 125, or 40%, from 1950 to 1956; and the resident tuberculosis mortality rate per 100,000 population fell from 15.7 to 7.8, a 50% decline. (Tables 3 and 4.)

These statistics reflect the indisputably great progress that has been made in reducing tuberculosis fatalities.

Tuberculosis Morbidity

The number of newly reported resident cases decreased from 1,586 in 1950 to 1,088 in 1956, a 31% decline; and the newly reported resident case rate per 100,000 population dropped from 119.7 to 67.5, a 44% decrease. (Tables 3 and 4.)

How much of the reported morbidity decline was actual and how much was due to case-finding and reporting changes, we cannot say. There were, however, some statistical indications that the quality of the case-finding which underlay the reporting had improved. For example:

The proportion of newly reported resident cases for which the disease activity status was unknown or undetermined was much lower in 1956 than in 1952, or 11% compared with 20%. (Table 5; data not available for 1950.)

Numerically, the newly reported resident cases of unknown or undetermined activity decreased from 238 to 120 between 1952 and 1956; the active and probably active cases increased from 427 to 446; and all other cases declined from 541 to 522. (Table 5.)

The newly reported resident tuberculosis cases per resident tuberculosis death rose from 7.6 in 1950 to 8.7 in 1956, a 14.5% increase. (Table 4.)

The newly reported active and probably active resident cases per resident tuberculosis death rose from 2.6 in 1952 to 3.6 in 1956. (Data not available for 1950.)

Area Differences

Accurate intercensal population estimates for local areas are especially difficult to make. Nevertheless, the differences in the tentative resident tuberculosis mortality and morbidity rates computed for Denver, the Tri-County Area, and the other counties as a group merit attention. (Table 4.) The comparative rates suggest that the tuberculosis problem remains disproportionately great in Denver; and also in the Tri-County Areas as to morbidity, although less strikingly than in Denver.

More adequate diagnostic facilities and better case-finding programs in Denver and the Tri-County Area than elsewhere might account for some of the discrepancy between the morbidity rates for the 4 metropolitan counties and the rates for the other counties as a group.

Review of tuberculosis mortality and reported case statistics for the individual counties in the rest of the state also indicated considerable variation in the county rates per 100,000 population.

Age Distributions

Age distributions of the resident tuberculosis cases newly reported in Colorado in recent years show both numerical and proportionate rises in active and probably active cases past middle age. (Table 6.) This finding is in agreement with a trend emphasized in the tuberculosis literature, and also with the increased percentage of tuberculosis deaths, among Colorado residents, that occurred in the upper age ranges. (Table 6.)

It will be noted, however, that there was a concurrent increase in the number and proportion of newly reported cases in the age group 15-24, in Colorade, as regards active and probably active cases and also all types. The increase might be a reflection of increased population in the age group; or of intensified case-finding and reporting for the group; or of an actual rise in the frequency of new cases in proportion to the size of the youth group.

In 1956, the percentage of total reported resident cases, in Colorado, that were active or probably active was highest for the age group 15-24, or 52% (59 out of 113 reported cases aged 15-24). For the groups 25 and older, the percentages ranged from 39% to 43%. Although the newly reported case rate for the population aged 15-24 years is relatively low compared to the rates for the upper ages, tuberculosis still is a threat to youths as well as to older people. Case-finding in the youth group remains very important, because of the high percentage of active and probably active cases among those found in that group, and because of the great economic and personal benefits gained through inactivation of the disease early in life.

V. NONRESIDENT DEATHS AND CASES

The deaths from tuberculosis, all forms, that occurred in Colorado among nonresidents of the state varied as follows from 1950 to 1956:

1950.....70	1954.....28
1951.....89	1955.....43
1952.....34	1956.....22
1953.....40	

As to newly reported cases among nonresidents in the state, for various reasons including hospitalization at federal and other national tuberculosis hospitals, we have the following statistics:

	Total Cases	Active & Probably Active	All Other
1952.....	1,425	1,161	264
1953.....	1,415	1,165	250
1954.....	1,320	1,129	191
1955.....	1,116	986	130
1956.....	796*	716	80

*Reporting probably incomplete for one of the hospitals.

On the whole, reporting and other types of control cooperation by the national tuberculosis hospitals is excellent, but there are serious public health problems concerning nonresidents who are not hospitalized in those institutions. These include migrant laborers, newcomers who have not yet established Colorado residence, and ex-patients who remain in Colorado.

Table 3. Numerical Change in Population Size; Resident and Nonresident Tuberculosis Deaths; Resident and Nonresident Newly Reported Tuberculosis Cases; and Mobile Unit X-Ray Survey Coverage (Excl. Denver) Colorado, 1950-1956 x

x Except as noted in parentheses.

Statistical Measure	1950	1955	Annual Aver: 1950-55	1956	% Change 1950-56
Total population a/					
State	1,325,089	1,549,000	1,437,045	1,612,000	+21.7
Denver	415,786	470,980	443,383	477,945	+15.0
Tri-County Area	148,046	211,060	179,553	243,795	+64.7
Other counties	761,257	866,960	814,109	890,260	+17.0
Resident tbc. deaths					
State	208	116	164	125	-39.9
Denver	87	59	72	64	-26.4
Tri-County Area	25	12	20	14	-44.0
Other counties	96	45	72	47	-51.0
Nonresident tbc. deaths					
State	79	43	52	22	-72.2
Newly reported resident tbc. cases					
State	1,586	1,144	1,350	1,088	-31.4
Denver	809	610	751	591	-27.0
Tri-County Area	241	193	189	166	-31.1
Other counties	536	341	410	331	-38.3
Newly reported nonresident tbc. cases - State	(1952) 1,425	1,116	1,319	796*	(1952-56) *
Persons X-rayed in mobile unit surveys, excl. Denver b/					
County Surveys	50,949	45,960	46,319	50,002	- 1.9
Tri-County Area c/	1,421	9,773	4,392	14,377	+911.8
Other counties, excl. Denver	49,528	36,187	41,927	35,625	-28.1
Institutional and other special resident groups by State Dept. of Public Health	(1951) 17,542	7,227	12,095	6,856	(1951-56) -60.9

a/ For the intercensal years, the population estimates for the state are those made by the U. S. Bureau of the Census, as of July 1. The estimates for the specified areas of the state are approximate proportions of the state total.

b/ Refers to surveys made by the State Department of Public Health, except those in the Tri-County Area after 1952. After 1952 the Tri-County Health Department made the Area surveys with a mobile unit on permanent loan to it by the State Department of Public Health.

c/ Including some institutional and special group surveys in the Area after 1952.

* 1956 reporting by one of the hospitals probably was incomplete.

Table 4. Proportionate and Other Comparative Changes in Resident Tuberculosis Deaths; Resident Newly Reported Tuberculosis Cases; and Mobile X-ray Survey Coverage and Results (Excl. Denver)
Colorado, 1950-56 x

x Except as noted in parentheses.

Statistical Measure a/	1950	1955	Annual Aver. 1950-55	1956	% Change 1950-56
Resident tbc. mortality rate per 100,000 pop.					
State	15.7	7.5	11.4	7.8	-50.3
Denver	20.9	12.5	16.2	13.4	-35.9
Tri-County Area	16.9	5.7	11.1	5.7	-66.3
Other counties	12.6	5.2	8.8	5.3	-57.9
Resident newly reported tbc. case rate per 100,000 pop.					
State	119.7	73.9	93.9	67.5	-43.6
Denver	194.6	129.5	169.4	123.6	-36.5
Tri-County Area	162.8	91.4	105.3	68.1	-58.2
Other counties	70.4	39.3	50.4	37.2	-47.2
Newly reported resident tbc. cases per resident tbc. death					
State	7.6	9.9	8.2	8.7	+14.5
Denver	9.3	10.3	10.4	9.2	- 1.1
Tri-County Area	9.6	16.1	9.5	11.9	+24.0
Other counties	5.6	7.6	5.7	7.0	+25.0
Per cent of state population excl. Denver, X-rayed in county mobile unit surveys excl. Denver	5.6	4.3	4.7	4.4	-21.4
Per cent of mobile unit screening films that indicated pathology, excl. Denver					
County surveys	1.7	1.4	1.6	1.2	-29.4
Tri-County Area	3.0	1.0 b/	1.5	1.0 b/	-66.7
Other counties	1.7	1.5	1.6	1.3	-23.5
Institutional and other special resident groups by State Dept. of Public Health	(1951) 1.1	1.3	1.3	2.1	(1951-56) +90.9
Per cent of the tbc. cases newly reported through all sources, INCLUDING Denver, that were first reported through mobile unit chest X-ray surveys					
State, including Denver	*	21.7	*	22.2	*

a/ For most of the numerical statistics used in computing the measures, see Table 3.

b/ Estimated from statistics for the period July 1, 1954 - June 30, 1956.

* Not available.

Table 5. Disease Activity Status of Newly Reported Resident Tuberculosis Cases Colorado, 1952-1956 *

Statistical Measure		1952	1955	Average 1952-55	1956
Activity status of resident tbc. cases newly reported to State Health Dept.					
State		1,206	1,144	1,214	1,088
Active & probably active:	No.	427	407	449	446
	%	35.4	35.6	37.0	41.0
Activity unk. or undeter:	No.	238	91	139	120
	%	19.7	8.0	11.4	11.0
All other:	No.	541	646	626	522
	%	44.9	56.4	51.6	48.0
Denver		690	610	690	591
Active & probably active:	No.	211	172	198	196
	%	30.6	28.2	28.7	33.2
Activity unk. or undeter:	No.	105	74	91	96
	%	15.2	12.1	13.2	16.2
All other:	No.	374	364	401	299
	%	54.2	59.7	58.1	50.6
Other counties		516	534	524	497
Active & probably active:	No.	216	235	251	250
	%	41.9	44.0	47.9	50.3
Activity unk. or undeter:	No.	133	17	48	24
	%	25.8	3.2	9.2	4.8
All other:	No.	167	282	225	223
	%	32.3	52.8	42.9	44.9
Newly reported resident tbc. cases that were newly reported to State Health Dept. through X-ray surveys					
State - Number		161	248	213	242
Active & probably active		*	37	**	45
All other		*	211	**	197
State - % of newly reported cases through all sources		13.4	21.7	17.5	22.2
Active & probably active		*	9.1	**	10.1
All other		*	28.6	**	30.7

* Data not available for 1950 or 1951. ** Not available.

Table 6. Age Distribution of Newly Reported Resident Tuberculosis Cases, by Activity Status of Disease; and of Resident Tuberculosis Deaths, Colorado, 1952-1956

Statistical Measure	1952		1955		1956	
	No.	%	No.	%	No.	%
Resident tbc. cases newly reported to St. Health Dept.						
State - All cases	1,206	100.0	1,144	100.0	1,088	100.0
Under 5	26	2.2	55	4.8	38	3.5
5 - 14	27	2.2	29	2.6	43	4.0
15 - 24	85	7.0	109	9.5	113	10.4
25 - 44	442	36.7	411	35.9	379	34.8
45 - 64	373	30.9	339	29.6	329	30.2
65 & older	198	16.4	161	14.1	136	12.5
Not specified	55	4.6	40	3.5	50	4.6
State - Active & probably active cases	427	100.0	407	100.0	446	100.0
Under 5	9	2.1	10	2.4	9	2.0
5 - 14	11	2.6	13	3.2	10	2.2
15 - 24	41	9.6	46	11.3	59	13.2
25 - 44	185	43.3	148	36.4	155	34.8
45 - 64	104	24.4	110	27.0	127	28.5
65 & older	49	11.5	65	16.0	59	13.2
Not specified	28	6.5	15	3.7	27	6.1
Resident tbc. deaths						
State	164	100.0	116	100.0	125	100.0
Under 5	4	2.4	2	1.7	0	0.0
5 - 14	1	0.6	2	1.7	0	0.0
15 - 24	5	3.1	2	1.7	0	0.0
25 - 44	45	27.5	27	23.3	20	16.0
45 - 64	63	38.4	39	33.6	55	44.0
65 & older	46	28.0	44	37.9	50	40.0
Not specified	0	0.0	0	0.0	0	0.0

VI. TUBERCULOSIS SURVEYING 1950-1956

After the mass X-ray survey of 1949 in Denver and the Tri-County Area, the Denver Health Department further systematized its expanded case register and continued to follow-up the cases. X-ray surveying also was continued in the City by the Denver Department and the Denver Tuberculosis Association by means of a mobile unit acquired from the U. S. Public Health Service through the State Department of Public Health. The surveys were directed primarily toward high incidence districts and population groups of the types indicated by the mass survey; and toward industries and special occupational and institutional groups.

Meanwhile the State Department of Public Health proceeded with its long-established program of community X-ray surveys in other counties. In addition, the State Department undertook surveys in some of the mental, correctional, and educational institutions and in occupational groups.

From 1950 through 1952, the State Department included Adams, Arapahoe and Jefferson counties in its survey schedule. In 1953, however, one of the two mobile units of the State Department was placed on permanent loan to the Tri-County Health Department. Since then the Tri-County Department has operated the unit but the State Department has read the films.

X-Ray Surveying Level

In recent years the three mobile X-ray units operated by the Denver, State, and Tri-County health departments have X-rayed about 100,000 persons annually, about 2/5 of them in Denver and 3/5 in other parts of the state.

Somewhat more than 1/5 of the total tuberculosis cases newly reported in the state in 1955 and 1956 were first reported through X-ray surveys. About 1/10 of the newly reported active and probably active cases were first reported through this source. (Tables 4 and 5.)

State Health Department Survey Programs

In addition to the community, institutional, and occupational-group X-ray surveys previously mentioned, the tuberculosis surveying activities of the State Department of Public Health, 1950-1956, included X-ray screening and follow-up projects among migrant agricultural workers and their families and also support or staffing of tuberculin testing programs in selected areas.

Community and Institutional X-Ray Surveys

The statisical reveiw of the community X-ray surveys, 1950-1956 excluding Denver, showed that the percentage of screening films that indicated pathology decreased, both in the Tri-County Area and the other surveyed counties. In the Tri-County Area, the percentage declined from 3.0% in 1950 to an estimated 1.0% in 1956. In the other counties the decrease was from 1.7% to 1.3%. (Table 4.)

The drop in the percentage of screening films indicating pathology might represent some actual decrease in tuberculosis prevalence but, on the other hand, many other factors should be taken into consideration. For example:

Detailed studies of the community X-ray survey findings in 1955, exclusive of the Tri-County Area and Denver, showed that the percentage of suspicious films varied from 0.6% to 2.7%, but the intercounty comparisons revealed no consistent association with other indexes of tuberculosis levels such as tuberculosis deaths and reported cases.[5] Furthermore, no pattern of correlation was found when year to year comparisons were made for the counties that had been resurveyed at intervals of several years.[6] It was concluded, therefore, that the percentage of screening films indicating pathology in any survey is largely influenced by the public response to the particular survey and the segments of the population X-rayed.

The percentage of suspicious screening films averaged high for the state mental institutions, and for agricultural migrants (see next section); moderate for the state penal and correctional institutions, and for employed groups such as workers at the Federal Center near Denver; and low for the college groups.

Another factor that should be considered is the relative number of the suspicious films that indicate pathology other than tuberculosis. In the 1955 surveys by the State Health Department, suspected tuberculosis represented only 74% of the suspected cases of pathology. The percentage, however, differs from year to year and from county to county.

Consideration also should be given to the percentage of suspicious screening films upon which diagnostic follow-up is made, and to the percentage of negative and positive findings on follow-up. The detailed studies of the 1955 X-ray surveys, excluding Denver and the Tri-County Area, revealed that only about half of the 484 suspected tuberculosis cases found by 70 mm. films were followed by 14 x 17" films. Of those followed by large films, 127 were found positive. The physicians and clinics to whom the 484 suspected cases were referred returned

reports on only 1/6 of the cases. Fifty-three were confirmed as tuberculosis, including 22 previously unknown cases of which 7 were active or probably active cases.

Even when there is fairly complete diagnostic follow-up of suspected cases discovered in surveys, there is the remaining serious problem of continuing medical supervision of the confirmed cases and contacts.

Migrant Labor Tuberculosis Surveys

Need for special methods of intrastate and interstate follow-up of suspected cases of tuberculosis discovered in X-ray screenings of migrant agricultural workers and their families is obvious. When such follow-up has been possible, the tuberculosis prevalence among this group has been shown to be high and medical care and continued supervision for the cases difficult to effectuate.

From time to time prior to 1954, X-ray screening was conducted by the United States and State health departments at the dispersal center and camp for migrant agricultural workers and their families at Fort Lupton, Weld County, but without conclusive findings by means of thorough diagnostic follow-up of the suspicious screening films. In 1954, however, a joint project of the United States, State, and local health departments included diagnostic clinic services at the camp, follow-up by special personnel as the migrants moved from place to place, and interstate communications regarding suspected cases.1/

Of 2,157 screening films of persons aged 12 and older, plus younger children in contact with tuberculosis cases, 104 or 4.8% indicated pathology of some sort. Seventy-one, or 3.3% of the total, indicated tuberculosis; and for some of the upper age brackets the percentage of films indicating tuberculosis was considerably higher. Of 252 children under 15 who were X-rayed, 6 or 2.4% had indications of the disease.

On further study, it was found that 55, or 2.6% of the 2,157 X-rayed migrants had significant tuberculosis that should be followed-up. Special arrangements were necessary for the cases requiring hospital diagnostic, bed, or outpatient services, because of the one-year residence requirement for care under the State Welfare Department's tuberculosis hospitalization program. The Jewish Consumptive's Relief Society Hospital, therefore, served as a special diagnostic and treatment facility for the 1954 migrant labor project. Excellent services were provided to the 32 tuberculosis cases referred to the hospital. Of these, 13 were hospitalized and 19 were followed as outpatients.

For the hospitalized patients, the stay varied from 1 week to 5 months. Unavailability of facilities for family members or departure of the family, to follow the crops in other states or to return to the state of origin, were the usual reasons for terminating hospital care.

Tuberculin Testing

In the period under review, the State Health Department provided financial assistance or staff for tuberculin testing programs in selected areas, for case-finding purposes and to provide indexes of infection rates in communities apparently needing study.

Tuberculin tests are considered valuable in diagnosis, in determining the status of tuberculosis control in community, and in some instances as a screening tool in case-finding. Tuberculin testing programs should be well planned and carefully evaluated, however, because they are costly in the use of professional time. To quote an abstract by the National Tuberculosis Association:8/

> "Although the individual tuberculin test may seem inexpensive, the cost of a program can be very high for the results obtained in the control of tuberculosis. Material costs are low but all those tested must be seen at least twice by someone with professional training and a variable number will require subsequent X-ray examinations. The follow-up of contacts also requires large amounts of professional time and travel."

Public Health Education Needs in Case-Finding and Follow-up

Analysis of the X-ray case-finding program of the State Department of Public Health for 1955 highlighted the importance of public information in connection with this and other types of tuberculosis case-finding and follow-up projects. As emphasized in a report published in the Rocky Mountain Medical Journal, the following factors deserve attention:9/

> The often small public response to tuberculosis examination opportunities.
>
> Apparent unawareness, on the part of the general public, of the seriousness of tuberculosis and its ramifications.
>
> Apparent unawareness, on the part of suspected tuberculosis patients, of the threat they create to themselves, their families, and the public.
>
> The continuous need for general public information on the tuberculosis problem.
>
> The need to provide, to the suspected tuberculosis cases, more effective health education and medical orientation regarding the disease.
>
> Generally speaking, the need for physicians to become more acutely aware of the role they play in tuberculosis control - that of urging suspected cases to submit to thorough examination and appropriate treatment and supervision; and of keeping the departments of public health informed concerning tuberculosis patients.

VII. STATUS OF THE CASES ON REGISTER 1956

The State Department of Public Health maintains a state tuberculosis case register, except of Denver cases; incorporates statistics from the Denver case register into annual reports to the federal Public Health Service; and provides guidance and some support to a number of local case registers. The purposes of the registers are to facilitate continued medical and nursing supervision, isolation, and follow-up of all known cases as long as may be necessary to prevent spread of the disease; to promote the examination of contacts of all known cases; and to provide statistical information for use in determining the extent and characteristics of the tuberculosis problem.

Reports are required on all cases admitted to and discharged from sanatoria and hospitals, as well as cases treated at home by private physicians. The cases are classified according to Colorado residence or nonresidence status. The statistics presented in the following summary pertain to the resident cases only.

Number and Status of Resident Cases

As of December 31, 1956, significant tuberculosis cases among Colorado residents - known resident cases on current register for continued follow-up - numbered 1,955 in the Denver case register and 1,453 in the state register for the other counties. The respective totals included 79 and 87 cases of nonpulmonary tuberculosis.

Disease Activity Status

Of the total 3,408 resident tuberculosis cases on the current Denver and state registers on December 31, 1956, 30% or 1,036 were active cases.

Conservative estimates indicate that the number of unknown cases of active or probably active tuberculosis equals or exceeds the known cases of this type. The known and unknown cases in this category, therefore, may have totaled 2,000 to 2,500.

Hospitalization Status

About half, or 521 of the 1,036 active or probably active cases on register at the end of 1956 were in tuberculosis hospitals and sanatoria, and the other 515 were at home. Also at home were 777 arrested cases and 262 cases of undetermined activity, both of which were classified as infectious or possibly infectious. Another 1,333 cases at home were considered noninfectious but still in need of follow-up from time to time.

The average monthly number of cases receiving care under the tuberculosis treatment program of the State Welfare Department in the fiscal year July 1, 1955 to June 30, 1956 was 209. About 9 sanatoria participated in the care of an average monthly load of 192 hospitalized cases, and 17 cases were receiving care at home although this type of treatment was considered "less effective than hospitalization" by the Welfare Department. Expenditures for the program for the fiscal year amount to $459,278, financed by state and county funds on a 50-50 basis. The annual average per case was $2,198.[10]

Problem of the Unhospitalized Cases

The active and probably active cases at home constitute a major public health problem. Both continuous studies and special surveys of such cases in Colorado indicate the situation to be as follows:[11]

The active and probably active cases at home are composed to a large extent of individuals who have had previous hospital experience and have left against advice. Most of them resist all efforts for hospitalization. Some would not benefit from hospitalization. Some, because of age or other conditions, should not be hospitalized. There are others who have never been hospitalized and will not accept hospitalization. Another group is composed of those who, by virtue of the more modern trends in the hospital treatment of tuberculosis, are discharged after a brief but adequate period of hospitalization but should be continued on drug therapy under close medical supervision. Definite post-hospital treatment plans are not made for many of this latter group.

Under existing Colorado laws, the 1% to 3% of the unhospitalized cases who are truly recalcitrant could be forcibly isolated and detained, but there are no facilities for compulsory hospitalization other than a few beds in the Denver General Hospital. The only other public institutions where isolation and detention could be enforced, at present, are the local jails and the State Hospital in Pueblo. Certainly it would seem advisable, before attempting forcible methods, to use every means of persuading the problem cases to accept home treatment under medical supervision, if not hospitalization. With home treatment and medical supervision, some would be cured and the remainder would be rendered less infective to others in the community.

As yet, Colorado has not reached a solution to the problem cases. With the exception of Denver, the health departments are not provided funds for the treatment of tuberculosis. The Welfare Department program is primarily a

hospitalization program, circumscribed by a means test and a residence requirement. The few cases provided home medical care under this program to date and other cases at home are demonstrating the need for additional social worker and public health nursing personnel to help supervise and guide the patients for whom home care is appropriate, as well as for more physician services for persons in this group.

Of interest in this connection are statistics on 147 unhospitalized tuberculosis cases in Colorado, exclusive of Denver, which were studied in 1954.[12] These cases included 139 active or presumably active cases; 7 that were arrested but on drug therapy; and 1 that was arrested or inactive but on pneumotherapy. Nearly 4/5 of the 147 cases, or 114, had been hospitalized previously. Of the 114 previously hospitalized, 57 had left against medical advice, according to the latest discharge record; 48 had left with medical advice; and for 9 the type of discharge was unknown.

As to medical supervision, it was found that of the total 147 cases, 26 had had no supervision within a year and another 14 were without known supervision. The remaining 107 were known to have received some supervision within a year, and were distributed as follows:

Type of Supervision Within One Year	No.	%
Total cases under known supervision	107	100.0
Private physician	62	57.9
Health Department chest clinic	20	18.7
Veterans Administration chest clinic	11	10.3
Sanatorium outpatient department	10	9.4
General hospital outpatient department and/or other clinic	3	2.8
X-ray clinic only	1	0.9

In these days of chemotherapy and shortened hospital stays, the need for supervision of discharged cases is increasing, as remarked in a recent article in the Public Health Reports:[13]

> "Today, most patients discharged from the sanatorium are discharged with arrested or inactive disease. A substantial proportion of these patients continue to receive chemotherapy at home for a period of months or years after sanatorium discharge. Thus, even though the number of known active cases at home may be declining, the demands upon health department services are actually increasing. These cases, arrested but continuing on drug therapy, will actually require more public health supervision from health department staffs, public health nurses in particular, than corresponding patients received a decade ago."

VIII. FUTURE GOALS

The difficulty of determining actual recent levels of tuberculosis and of estimating the rate of change in the past has been emphasized in preceding parts of this report. Certainly, therefore, it is "hazardous" to risk predictions of future trends, to use words of the author of the article quoted at the end of Part VII. Yet, as he said, "The future is a lure difficult to resist." We, therefore, quote his forward looking remarks below because they appear very applicable to the situation in Colorado.[14]/

> "So marked has been the decline in the death rate of tuberculosis in the past 10 years that to many its disappearance as a public health problem seems an eventuality of an immediate tomorrow. Such optimism is a trap into which even the most guarded minds have fallen, and from them frequently comes the question 'How much longer shall we continue to exert tuberculosis control efforts?'
>
> "Despite the unreality of setting an end point for tuberculosis as a public health challenge, an intermediate goal can arbitrarily be selected for the sake of argument, and time limits can be drawn to emphasize the continuing magnitude of the problem.
>
> "Even in terms of death rates alone the future task is large and prolonged. It will require years of effort to achieve a death rate of only 1.5 per 100,000 population, which is about the current death rate from acute rheumatic fever, appendicitis, arthritis, poliomyelitis, and several other diseases which are still considered to be of public health import. The maternal mortality rate is about at that level. Measles, whooping cough, and infectious hepatitis combined do not exceed it. When the death rate from tuberculosis drops to the level of these important diseases, then tuberculosis control programs and needs should be re-examined.
>
> "Indeed, if conditions remain the same, and if control activities are so maintained that the rate of decline in mortality will equal that of the past 5 years:
>
> "It will be 11 years before the crude tuberculosis death rate is 1.5 per 100,000 population; 7 years before this death rate is achieved for white females; between 10 and 15 years, for nonwhite males and females, and white males; and 25 years before the age group over 65 has a death rate of 1.5 per 100,000 population.
>
> "The task of defeating tuberculosis is plainly not done. Persisting cases of tuberculosis, especially those out of hospitals, challenge every ingenuity in planning the content and scope of control programs of tomorrow."

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Research and Reports Service records, reference materials, and collaborative studies during the past ten years.

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