

# Willamette Valley Chest X-ray Survey

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THE WILLAMETTE VALLEY chest X-ray survey in 1951 was the first attempt in the United States at conducting a large-scale rapid-tempo communitywide chest X-ray survey in a relatively sparsely populated, predominantly rural area. It was the 16th large-scale survey undertaken through use of the survey equipment and personnel available by loan from the Public Health Service.

This report is intended to be an objective appraisal of the findings of the Willamette Valley chest X-ray survey, based on a study of the final postsurvey diagnoses supplied by the private physicians examining survey cases referred for followup because of suspect chest X-ray findings.

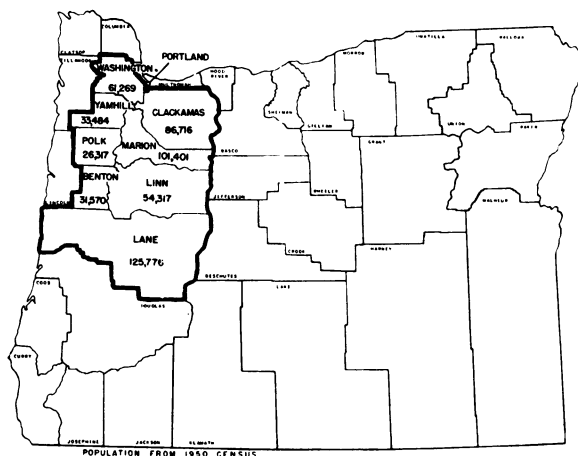
A number of rapid-tempo mass chest X-ray surveys have been reported in the past, including such large-scale operations as Los Angeles, Boston, and Cleveland. A similar report, in limited publication, was made shortly after conclusion of the Willamette Valley survey by the Report Committee of the Willamette Valley Chest X-ray Survey, Inc. Survey findings in that report were based on a statistical analysis of readings of 70-mm. and 14" x 17" retake screening X-rays taken during the survey, but it lacked the essential element of clinical appraisal for definitive diagnosis. The present report includes this all-important feature.

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The survey area included eight Oregon Willamette Valley counties: Benton, Clackamas, Lane, Linn, Marion, Polk, Washington, and Yamhill. Excluded, however, were Multnomah County and its county seat, the city of Portland. The eight counties chosen cover an area of about 13,000 square miles, larger by far than many States, and contained a population



of about 520,850 persons, almost wholly white and largely American born. The region lies between the coast range on the west, the Cascade Mountains on the east, and the foothills of these two mountain ranges on the south, and is traversed through its length by the Willamette River, emptying into the Columbia River which forms the valley's northern border. It has been called the garden of Oregon and was the lode-stone that drew and still draws thousands westward to its fertile soil.

Southernmost in the valley and largest of the

survey counties in area and population is Lane County with its city of Eugene, home of the University of Oregon. Lying north of Lane are Linn, Benton, Marion, Polk, Yamhill, Washington, and Clackamas Counties, the latter two extending to the Portland metropolitan area. Corvallis, county seat of Benton County, is the site of Oregon State College, while the Oregon College of Education is located at Monmouth in Polk County. Salem,

the State capital, is also the county seat of Marion County. The outline map of Oregon shows the survey area and the populations of the counties involved.

### The Operation

The actual survey operation time was between July 17 and October 24, 1951. Details on planning and operation of the survey were given

**Table 1. Number and percent of males X-rayed, by age and county,<sup>1</sup> Willamette Valley chest X-ray survey, 1951**

[Based on 10-percent sample of 70-mm. film registrations]

County	Under 15	15-24	25-34	35-44	45-54	55-64	65+	Unknown age	Total <sup>2</sup>
<i>Benton</i>									
Number.....	250	2,440	1,550	1,070	930	480	470	20	7,210
Percent.....	6.4	54.8	50.6	61.7	68.1	43.0	48.5	-----	43.5
<i>Clackamas</i>									
Number.....	580	2,790	2,290	2,920	2,170	1,520	1,520	100	13,890
Percent.....	4.6	53.8	37.9	45.7	40.4	34.4	37.1	-----	31.5
<i>Lane</i>									
Number.....	720	6,100	6,390	6,210	4,560	3,070	1,890	220	29,160
Percent.....	3.9	62.3	60.3	66.1	64.2	60.5	43.5	-----	45.1
<i>Linn</i>									
Number.....	180	2,450	2,880	2,470	1,780	1,210	830	20	11,820
Percent.....	2.1	68.2	68.0	60.5	61.1	53.4	41.0	-----	42.5
<i>Marion</i>									
Number.....	710	5,350	5,450	5,010	3,910	2,860	2,190	150	25,630
Percent.....	5.3	73.2	73.5	70.6	65.3	57.0	45.2	-----	50.1
<i>Polk</i>									
Number.....	160	1,500	1,500	1,180	950	800	660	60	6,810
Percent.....	4.0	75.1	78.7	63.3	65.1	67.9	61.9	-----	50.5
<i>Washington</i>									
Number.....	440	2,410	2,310	2,330	1,530	1,200	1,200	120	11,540
Percent.....	5.0	61.5	52.5	52.9	40.7	38.5	41.3	-----	36.9
<i>Yamhill</i>									
Number.....	50	1,740	1,380	1,440	1,340	1,140	920	40	8,050
Percent.....	1.1	68.2	61.1	66.0	71.2	72.8	52.7	-----	47.6
<i>Valley</i>									
Number.....	3,090	24,780	23,750	22,630	17,170	12,280	9,680	730	114,110
Percent.....	4.1	63.9	59.5	60.9	57.5	51.7	44.0	-----	42.9

<sup>1</sup> Estimated number X-rayed varies slightly from totals in tables 3 and 5, which are enumerated by the survey units. Discrepancies are mainly due to loss of approximately 850 registration cards in Clackamas County.

<sup>2</sup> These percentages are decreased by inclusion of the under age 15 group, who were X-rayed only on specific request of, and referral from, a physician.

in the report, "Viewing the Valley," published by the Willamette Valley Chest X-ray, Inc., in 1952. The Public Health Service supplied 18 mobile X-ray units, film, processing materials and operating personnel, physicians to read films, clerical staff for record and statistical services, and consultation. In addition, two X-ray units of the Oregon State Board of Health, with operating personnel, participated in the survey, and many professional and lay

individuals at both State and local levels participated on a full-time or part-time basis.

Each of the eight participating counties was separately and independently organized, each with its own county executive committee and chairman. The medical society, health department, and tuberculosis and health association in each county served as sponsoring agencies, inviting the active participation and help of all other groups, agencies, and individual citizens

**Table 2. Number and percent of females X-rayed, by age and county,<sup>1</sup> Willamette Valley chest X-ray survey, 1951**

[Based on 10-percent sample of 70-mm. registrations]

County	Under 15	15-24	25-34	35-44	45-54	55-64	65+	Unknown age	Total <sup>2</sup>
<i>Benton</i>									
Number.....	270	2,060	1,420	1,260	1,020	760	520	30	7,340
Percent.....	7.2	59.8	58.8	74.8	73.6	64.8	46.8	-----	49.0
<i>Clackamas</i>									
Number.....	650	3,180	3,330	3,000	2,140	1,480	1,130	160	15,070
Percent.....	5.5	58.9	52.2	46.8	42.6	38.1	30.8	-----	35.3
<i>Lane</i>									
Number.....	890	7,260	7,200	6,460	4,440	3,110	1,780	150	31,290
Percent.....	5.2	72.5	70.5	75.3	70.7	66.4	43.0	-----	51.2
<i>Linn</i>									
Number.....	150	3,020	3,260	2,460	1,620	1,170	810	40	12,530
Percent.....	1.8	80.0	76.2	66.2	64.5	59.4	42.4	-----	47.3
<i>Marion</i>									
Number.....	810	6,260	5,090	5,740	4,230	3,200	2,200	140	27,670
Percent.....	6.4	85.5	70.8	81.6	71.4	63.8	43.1	-----	55.1
<i>Polk</i>									
Number.....	170	1,690	1,270	1,100	990	670	500	10	6,400
Percent.....	4.4	85.4	65.8	63.9	74.4	63.2	50.0	-----	49.8
<i>Washington</i>									
Number.....	490	2,800	2,750	2,640	1,880	1,260	710	30	12,560
Percent.....	5.9	71.9	61.2	59.2	53.0	45.2	27.8	-----	41.8
<i>Yamhill</i>									
Number.....	60	2,180	1,440	1,750	1,290	1,100	970	50	8,840
Percent.....	1.3	88.7	63.3	81.9	71.2	68.6	58.5	-----	53.5
<i>Valley</i>									
Number.....	3,490	28,450	25,760	24,410	17,610	12,750	8,620	610	121,700
Percent.....	5.0	74.3	65.7	68.3	63.3	57.5	40.8	-----	47.8

<sup>1</sup> Estimated number X-rayed varies slightly from totals in tables 3 and 5, which are enumerated by the survey units. Discrepancies are mainly due to loss of approximately 850 registration cards in Clackamas County.

<sup>2</sup> These percentages are decreased by inclusion of the under age 15 group, who were X-rayed only on specific request of, and referral from, a physician.

**Table 3. X-ray findings, Willamette Valley chest X-ray survey, 1951**

Status	Valley total	Ben-ton	Clack-amamas	Lane	Linn	Mar-ion	Polk	Wash-ington	Yam-hill
Total small films taken	237, 229	14, 608	29, 816	60, 525	24, 446	53, 519	13, 233	24, 126	16, 956
Estimated number persons eligible for X-ray	375, 815	23, 911	62, 253	90, 245	37, 279	75, 271	18, 494	44, 235	24, 127
Small films taken as percentage of eligible	63. 1	61. 1	47. 9	67. 1	65. 6	71. 1	71. 6	54. 5	70. 3
Abnormal findings (70 mm.)	<sup>1</sup> 7, 415	327	961	1, 723	737	1, 687	508	636	578
Suspect tuberculosis	<sup>2</sup> 4, 222	202	574	1, 010	393	923	278	345	331
Suspect other chest pathology	<sup>3</sup> 2, 846	112	353	630	316	662	199	265	224
Suspect cardiovascular disease	<sup>4</sup> 347	13	34	83	28	102	31	26	23
Duplications, represented in abnormal total	22	0	1	6	1	3	4	3	4
Total individuals recalled	<sup>5</sup> 7, 393	327	960	1, 717	736	1, 684	504	633	574
Individuals responding	<sup>6</sup> 6, 686	307	860	1, 602	677	1, 551	482	584	539
Individuals not responding	<sup>7</sup> 707	20	100	115	59	133	22	49	35
Total individuals returning for retake	<sup>8</sup> 6, 822	307	866	1, 670	682	1, 576	506	589	541
Number with cardiac interview only (14" x 17" films)	<sup>9</sup> 262	9	18	72	22	74	30	19	15
Total confirmatory films read	<sup>10</sup> 6, 560	298	848	1, 598	660	1, 502	476	570	526
Essentially negative	<sup>11</sup> 1, 986	76	298	467	195	439	151	169	163
Evidence of old healed disease including nontuberculosis	<sup>12</sup> 1, 797	73	194	398	227	433	123	145	187

NOTE: Footnoted figures include the following numbers of persons with residence outside the valley: <sup>1</sup> 258; <sup>2</sup> 166; <sup>3</sup> 85; <sup>4</sup> 7; <sup>5</sup> 258; <sup>6</sup> 84; <sup>7</sup> 174; <sup>8</sup> 85; <sup>9</sup> 3; <sup>10</sup> 82; <sup>11</sup> 28; <sup>12</sup> 17.

\* Includes 136 individuals with unsatisfactory or negative 70-mm. films who came in for a 14" x 17" film.

in the community. Valleywide coordination and cooperation was obtained by setting up the Willamette Valley Chest X-ray Survey, Inc., with headquarters in Salem and a board of directors consisting of the chairmen of the principal valleywide committees and the general chairman from each participating county, plus State representation from the Oregon State Board of Health, Tuberculosis and Health Association, Heart Association, and Cancer Society. A survey director for the entire valley was appointed to direct and coordinate operations.

### The Policy

Overall survey policy was established by the executive committee and board of directors of Willamette Valley Chest X-ray Survey, Inc. Professional policy regarding criteria for interpretation of X-ray films, criteria for recall for 14" x 17" film retakes, interview procedures in retake centers, and referral methods were developed by a Professional Policies Committee, with representation from the county medical societies and health departments involved and chaired by a member of the Tuberculosis Committee of the Oregon State Medical Society.

All suspect chest pathologies except cardiovascular were recalled for 14" x 17" film recheck. All suspects on 14" x 17" film retakes were referred to their private physicians for further study and definitive diagnosis. Epidemiological followup was a responsibility of the local health department in the area of residence of the suspect. Chest pathology other than tuberculosis was followed only to the point of establishment of medical consultation although all physicians of referral were queried through a specially developed epidemiological report form to obtain final diagnosis. Diagnoses other than tuberculosis were supplied by physicians on a purely cooperative basis since the majority of conditions involved (such as neoplasm and heart disease) are not reportable in Oregon.

### The Population Involved

The aim of the survey was to obtain a chest X-ray of every person in the valley 15 years of age and over. Children under age 15 were X-rayed only on specific request and referral from a physician.

To determine the makeup of the population X-rayed, every tenth registration card of all individuals registered for 70-mm. film X-rays

was checked. This sample served as a basis for studying the suspect cases reported through 14'' x 17'' film retakes and the diagnosed cases reported through epidemiological followup. General makeup of the participating survey group with respect to age and sex, by county, is shown in tables 1 and 2, and breakdown of the total valley population by age and sex is shown in table 7.

### Statistical Analysis

The 1950 census of the 8 valley counties showed a combined population, age 15 years and over, of 375,815. The total of 237,229 70-mm. films taken during the survey would indicate a coverage, ignoring duplications and nonresidents, of approximately 63 percent of those eligible (table 3).

A total of 7,415 small films were read as showing abnormalities. Of these 4,222 were suspect tuberculosis, 2,846 other chest pathology and 347 suspect cardiovascular disease. Twenty-two of the 7,415 were duplications, which left 7,393 individuals for recall to retake centers (table 3).

Seven hundred seven individuals of the 7,393 recalled did not respond. Small films of these persons were reviewed, and 206 were classified as not sufficiently significant to warrant further followup. One hundred seven, who were visitors to the area or had moved since X-ray, were referred to the health departments of their jurisdictions for followup, and 192 were referred to valley health departments. The remainder were found already under care, or referred to physicians or State institutions, or were deceased (table 4).

A total of 6,822 individuals returned for retakes, including 136 with unsatisfactory or negative 70-mm. films. Of these, 6,560 had confirmatory 14'' x 17'' films taken while 262 received cardiac interview only, with referral to their physician (table 3).

Out of 6,560 confirmatory 14'' x 17'' films taken, 11 were technically unsatisfactory and were referred for further followup. An additional 2,766 individuals were referred for further study on the basis of X-ray interpretation, 1,264 for tuberculosis and 514 for suspect tuberculosis. The remaining X-ray referrals were 988 for other chest diseases including 89 cardio-

**Table 4. Referrals for followup, Willamette Valley chest X-ray survey, 1951**

Referrals	Valley total	Benton	Clackamas	Lane	Linn	Marion	Polk	Washington	Yamhill
Individuals referred for followup.....	<sup>1</sup> 2,777	149	356	733	238	630	202	256	176
Tuberculosis.....	1,778	107	246	454	158	376	131	168	107
Total reinfection type.....	1,264	71	147	306	116	286	116	112	92
Minimal.....	840	50	99	198	81	195	73	71	59
Moderately advanced.....	348	18	40	86	29	75	35	31	30
Far advanced.....	39	2	5	7	3	8	6	6	2
Unclassified.....	37	1	3	15	3	8	2	4	1
Suspect tuberculosis.....	514	36	99	148	42	90	15	56	15
Cardiovascular.....	89	5	13	26	7	19	3	7	8
Other chest diseases.....	899	37	95	252	73	230	66	80	61
Technically unsatisfactory.....	11	0	2	1	0	5	2	1	0
Individuals not responding.....	<sup>2</sup> 707	20	100	115	59	133	22	49	35
Already under care for tuberculosis.....	13	0	4	5	0	4	0	0	0
Referred to physician.....	87	2	19	24	4	23	5	6	4
Referred to State health departments as suspect tuberculosis (visitor or moved).....	107	0	2	5	3	4	1	1	1
Visitor, nontuberculosis, not referred.....	78	0	0	2	1	1	1	1	0
Deceased.....	10	0	5	0	0	2	2	1	0
Small film reclassified as not significant.....	206	7	40	43	24	39	5	22	14
No disposition, referred to health department.....	192	11	30	36	27	46	8	18	16
Referred to State institutions.....	14	0	0	0	0	14	0	0	0

<sup>1</sup> Includes 37 persons with residence outside the valley.

<sup>2</sup> Includes 174 persons with residence outside the valley.

**Table 5. Followup and final diagnosis and active tuberculosis and neoplasm cases per 1,000 70-mm. films, Willamette Valley chest X-ray survey, 1951**

Status and rate	Valley total	Benton	Clackamas	Lane	Linn	Marion	Polk	Washington	Yamhill
Followup and final diagnosis									
Referred for followup.....	1 2, 777	149	356	733	238	630	202	256	176
Followup completed.....	2, 234	131	328	564	206	461	166	231	147
Percent followup completed.....	80. 4	87. 9	92. 1	76. 9	86. 6	73. 2	82. 2	90. 2	83. 5
Final diagnosis as:									
"Register" tuberculosis <sup>2</sup> .....	251	10	21	50	35	74	16	20	25
Inactive tuberculosis <sup>3</sup> .....	875	65	136	195	89	139	84	97	70
Neoplasm.....	125	6	20	19	13	38	10	12	7
Cardiovascular <sup>4</sup> .....	26	2	1	12	3	2	2	3	1
Other chest diseases.....	542	20	52	152	49	129	45	68	27
Negative.....	415	28	98	136	17	79	9	31	17
Active tuberculosis and neoplasms									
Number small films taken.....	237, 229	14, 608	29, 816	60, 525	24, 446	53, 519	13, 233	24, 126	16, 956
Number active tuberculosis cases per 1,000 small films.....	0. 55	0. 34	0. 60	0. 55	0. 57	0. 47	0. 68	0. 50	0. 88
Number neoplasms per 1,000 small films.....	. 53	. 41	. 67	. 31	. 53	. 71	. 76	. 50	. 41

<sup>1</sup> Includes 37 persons with residence outside the valley.

<sup>2</sup> Cases requiring public health supervision. Includes (1) active; (2) arrested less than 2 years; (3) activity undetermined.

<sup>3</sup> Inactive or arrested 2 years or more.

<sup>4</sup> Bulk of cardiac suspects (70 mm.) not included.

**Table 6. Category of diagnoses after referral to physician, by age and sex, Willamette Valley chest X-ray survey, 1951**

Diagnosis	Total	Under 15	15-24	25-34	35-44	45-54	55-64	65+	Unknown
Negative.....	415	4	20	32	58	89	97	114	1
Male.....	216	1	10	14	30	47	49	65	0
Female.....	199	3	10	18	28	42	48	49	1
"Register" tuberculosis <sup>1</sup> .....	251	0	13	41	43	38	51	65	0
Male.....	156	0	5	18	29	25	30	49	0
Female.....	95	0	8	23	14	13	21	16	0
Inactive tuberculosis.....	875	3	20	81	134	171	210	255	1
Male.....	447	1	11	33	62	93	115	132	0
Female.....	428	2	9	48	72	78	95	123	1
Neoplasms.....	125	1	3	7	12	27	24	49	2
Male.....	71	0	1	6	5	17	16	24	2
Female.....	54	1	2	1	7	10	8	25	0
Cardiovascular.....	26	0	0	0	4	5	5	12	0
Male.....	16	0	0	0	2	1	5	8	0
Female.....	10	0	0	0	2	4	0	4	0
Other chest diseases.....	542	2	24	38	65	88	154	171	0
Male.....	256	1	11	21	34	39	70	80	0
Female.....	286	1	13	17	31	49	84	91	0
All diagnoses.....	2, 234	10	80	199	316	418	541	666	4
Male.....	1, 162	3	38	92	162	222	285	358	2
Female.....	1, 072	7	42	107	154	196	256	308	2

<sup>1</sup> Cases requiring public health supervision. Includes: (1) active; (2) arrested less than 2 years; (3) activity undetermined.

**Table 7. Population participation,<sup>1</sup> active tuberculosis cases, and neoplasm cases, by age and sex, Willamette Valley chest X-ray survey, 1951**

Cases and rates	Total <sup>2</sup>	Under 15	15-24	25-34	35-44	45-54	55-64	65+	Unknown
Total population in survey counties.....	520, 850	145, 035	77, 089	79, 098	72, 904	57, 657	45, 930	43, 137	-----
Male.....	266, 019	74, 539	38, 803	39, 919	37, 167	29, 846	23, 747	21, 998	-----
Female.....	254, 831	70, 496	38, 286	39, 179	35, 737	27, 811	22, 183	21, 139	-----
Number participating in survey..	235, 810	6, 580	53, 230	49, 510	47, 040	34, 780	25, 030	18, 300	1, 340
Male.....	114, 110	3, 090	24, 780	23, 750	22, 630	17, 170	12, 280	9, 680	730
Female.....	121, 700	3, 490	28, 450	25, 760	24, 410	17, 610	12, 750	8, 620	610
Percent participating.....	45. 3	4. 5	69. 1	62. 6	64. 5	60. 3	54. 5	42. 4	-----
Male.....	42. 9	4. 1	63. 9	59. 5	60. 9	57. 5	51. 7	44. 0	-----
Female.....	47. 8	5. 0	74. 3	65. 7	68. 3	63. 3	57. 5	40. 8	-----
Number of active tuberculosis cases found.....	131	0	8	29	23	17	24	30	0
Male.....	84	0	3	13	14	12	16	26	0
Female.....	47	0	5	16	9	5	8	4	0
Number of active tuberculosis cases per 1,000 participants..	. 56	0	. 15	. 59	. 49	. 49	. 96	1. 64	0
Male.....	. 74	0	. 12	. 55	. 62	. 70	1. 30	2. 69	0
Female.....	. 39	0	. 18	. 62	. 37	. 28	. 63	. 46	0
Number of neoplasm cases found..	125	1	3	7	12	27	24	49	2
Male.....	71	0	1	6	5	17	16	24	2
Female.....	54	1	2	1	7	10	8	25	0
Number of neoplasm cases per 1,000 participants.....	. 53	. 15	. 06	. 14	. 26	. 78	. 96	2. 68	1. 49
Male.....	. 62	0	. 04	. 25	. 22	. 99	1. 30	2. 48	2. 7
Female.....	. 44	. 29	. 07	. 04	. 29	. 57	. 63	2. 90	0

<sup>1</sup> These data are based on a 10-percent sample of original report cards. Estimated numbers X-rayed vary slightly from totals shown in tables 3 and 5, which are totals enumerated by the survey units. Discrepancies are mainly due to loss of approximately 850 registration cards in Clackamas County.

<sup>2</sup> Percentages are decreased by inclusion of the under age 15 group, who were X-rayed only on specific request of, and referral from, a physician.

vascular. Reported essentially negative were 1,986 (tables 3 and 4).

Of the 2,777 individuals referred for further study, a total of 2,234, or 80.4 percent, were followed to completion of diagnosis (table 5). The remaining 543 individuals were followed by field visit, mail query, and by contacting the physician named at time of X-ray, but for various reasons, such as moving out of area, non-cooperation, and death, final diagnosis was not obtained. Completion of followup to diagnosis varied from 73.2 percent in Marion County to 92.1 percent in Clackamas.

Final diagnosis on the above 2,234 individuals, as supplied by the attending physician, is shown by county in table 5. Diagnosis was accepted only on signed report of the attending physician and no case was tabulated as tuberculosis on the basis of X-ray interpretation or positive sputum findings, or both, without clin-

ical appraisal and report. An arbitrary cut-off date of 2 years postsurvey was adopted, and survey cases reported after this date were not credited to the survey. Only previously unreported active tuberculosis cases were credited to survey discovery.

On these bases there were 131 previously unknown active pulmonary tuberculosis cases reported and 125 neoplasms. One hundred twenty individuals, including 90 with activity undetermined at time of report and 30 arrested or inactive less than 2 years, were also reported and added to the tuberculosis followup register. In addition, 542 individuals were reported for other miscellaneous chest diseases and 26 for cardiovascular disease.

Table 5 shows by county the yield of newly discovered active tuberculosis cases and neoplasms per 1,000 70-mm. films taken. On the basis of 237,229 70-mm. films for the entire val-

ley, 0.55 active tuberculosis cases and 0.53 neoplasms were found for each 1,000 small films. The 899 individuals referred on 70-mm. and 14" x 17" films for other chest diseases, and approximately 351 for cardiovascular disease, undoubtedly included many with previously undiagnosed conditions who benefited by further study, but no attempt is made to tabulate or break down for further study these cases reported.

As might be expected, significant differences were revealed for diagnosis of tuberculosis and neoplasms in individuals of various age groups and different sex. Variation was also found in occurrence rates in different counties. Break-down of physician diagnosis by age and sex is shown in table 6, while table 7 shows the find-

ings of active tuberculosis and neoplasms by 10-year age groups, and the number of cases per 1,000 small films taken of participants. cursory examination reveals that while the survey participation was poorest in the age group 65 and over the returns per 1,000 70-mm. films taken were highest in this group both in active tuberculosis cases and neoplasms found. This would seem to indicate a need for increased emphasis on the older age groups in future surveys.

Clackamas, Linn, Marion, and Yamhill Counties seemingly had the highest overall tuberculosis case yields. The relatively high rate per 1,000 miniature films may be particularly significant in Marion County in view of the low percentage of completed followup. Similarly,

**Table 8. Tuberculosis cases by county and sex, according to stage and activity, Willamette Valley chest X-ray survey, 1951**

Stage and activity	Valley total		Benton		Clackamas		Lane		Linn		Marion		Polk		Washington		Yamhill	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
<b>Minimal:</b>																		
Active.....	17	15	0	1	2	4	4	0	3	1	3	2	3	1	0	4	2	2
Activity undetermined.....	25	16	0	0	0	0	2	1	6	3	15	11	0	0	1	1	1	0
Arrested or inactive less than 2 years..	10	4	0	0	1	0	3	1	2	1	0	1	2	0	0	0	2	1
<b>Moderately advanced:</b>																		
Active.....	56	28	2	2	8	1	18	6	4	5	10	8	4	1	4	2	6	3
Activity undetermined.....	16	11	3	0	0	1	0	1	2	2	5	4	2	0	3	1	1	2
Arrested or inactive less than 2 years..	6	5	0	0	1	0	1	1	0	1	1	2	1	0	0	0	2	1
<b>Far advanced:</b>																		
Active.....	9	4	0	0	1	1	3	2	1	0	1	1	0	0	2	0	1	0
Activity undetermined.....	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Arrested or inactive less than 2 years..	1	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0
<b>Unspecified stage:</b>																		
Active.....	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0
Activity undetermined.....	12	9	1	1	0	0	4	2	3	0	4	4	0	1	0	1	0	0
Arrested or inactive less than 2 years..	2	1	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0
<b>Inactive:</b>																		
Minimal.....	321	321	27	30	40	36	59	75	45	27	59	45	25	35	42	40	24	33
Moderately advanced.....	86	61	3	3	15	7	29	19	6	7	15	7	9	10	5	4	4	4
Far advanced.....	11	6	0	1	3	0	1	0	0	1	3	1	3	0	1	2	0	1
Unspecified.....	29	40	1	0	15	20	5	7	2	1	3	6	0	2	1	1	1	3



**Table 9. Year of last prior chest X-ray according to category of definitive diagnosis, Willamette Valley chest X-ray survey, 1951**

Category of definitive diagnosis	Total patients	Within 1 year	1 to 2 years	2 to 3 years	3 to 5 years	5 years or more	Date unknown	No prior chest X-ray	Not stated
Tuberculosis.....	1, 126	29	104	187	193	269	23	268	53
Neoplasms.....	125	4	14	15	18	25	1	42	6
Other.....	568	12	37	89	90	139	6	167	28
Total.....	1, 819	45	155	291	301	433	30	477	87

the low overall participation in Clackamas County may largely nullify the comparative case-finding results in that county in view of the claim by some that the proportion of positive tuberculosis findings increase as coverage approximates 100 percent of eligibles. Further study of findings by age group and sex by county may prove of value.

The arbitrary 2-year diagnostic followup and report period, adopted to permit as full a completion of diagnostic study and completion of reporting as reasonably possible, doubtless does have a tendency to increase the ratio of moderately and far-advanced cases over minimal. Stage of disease of all survey cases at time of reporting is shown by county in table 8. Of the 131 reported active cases, approximately 24.5 percent were reported as minimal, and 64.1 percent as moderately advanced. Only 13 cases in all, or 9.9 percent, were reported as far advanced. In 1.5 percent the stage of disease was not indicated. These figures compare favorably with available Oregon data on routinely reported pulmonary cases for 1953, which show of 320 such cases only 15.3 percent were minimal, 36.6 percent moderately advanced, and 26.2 percent far advanced. In 21.9 percent, the stage was undetermined.

At the time of registration for miniature chest X-ray, a history was obtained of the length of time since previous chest X-ray. Among the tuberculosis cases diagnosed, almost

one-fourth had had no chest X-ray in 5 years, while an equal number had never had a prior chest X-ray. Among neoplasm cases, 20 percent had had no chest X-ray in 5 years, while one-third had never had prior chest X-rays. Exact figures according to diagnosis are shown in table 9. Considering all diagnoses together, almost exactly one-half the cases had no prior X-rays or had none within 5 years.

#### Conclusion

Results of this survey definitely indicate the value of mass chest X-ray of apparently healthy people. The discovery of slightly more than one previously unknown active case of tuberculosis for every 2,000 participants would alone justify the survey without considering the cases of neoplasm and cardiovascular and other chest diseases revealed as an extra dividend. It is recognized that other procedures such as routine chest X-ray of hospital admissions will reveal higher numbers of cases per 1,000 chest films, but such surveys dealing with ill people are complementary and not a substitute for surveys of the apparently well. Cases discovered before symptoms force medical consultation are found in earlier stages of disease although many suspects screened by routine chest X-ray go a distressingly long time before final definitive diagnosis.