
Results of a 29-State Survey of Tuberculosis in Nursing Homes and Correctional Facilities

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Lawrence Greenfeld of the Bureau of Justice Statistics, Department of Justice, Gladys Lavelle and Carmellia Nickens of the Bureau of Prisons, Department of Justice, and Kristina Rose of the Justice Statistics Clearinghouse provided information regarding correctional populations.

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Synopsis

A survey of the 15,379 cases of tuberculosis reported to the Centers for Disease Control and

Prevention by 29 State health departments in 1984 and 1985 revealed that 7.7 percent of the victims older than age 64 were living in a nursing home at the time of diagnosis and 1.8 percent between the ages of 15 and 64 were living in a correctional institution at the time of diagnosis.

Incidence rates of tuberculosis for residents of nursing homes and for inmates of Federal and State prisons and local jails were estimated using denominators derived from institutional population counts provided by the National Center for Health Statistics and by the Department of Justice, Bureau of Justice Statistics, and Bureau of Prisons. The aggregate tuberculosis incidence rate for nursing home residents in the 29 States was 1.8 times higher than the rate seen in elderly persons who were living in the community (95 percent confidence interval on the relative risk 1.64, 2.02). The aggregate tuberculosis incidence rate for inmates in correctional facilities was 3.9 times higher than the rate for persons of a similar age who were not incarcerated (95 percent confidence interval on the relative risk 3.35, 4.49).

Strengths and limitations of the design and implications of the first survey of tuberculosis incidence, in a large number of States, among residents of nursing homes and correctional facilities are discussed.

ALTHOUGH THE OVERALL INCIDENCE of reported tuberculosis (TB) in the United States in 1990 was 10.3 cases per 100,000 population (1), the risk in different population groups and geographic areas within the United States is quite disparate. In some groups and areas, incidence rates approach zero; in others, the epidemiologic pattern resembles that seen in developing countries (1-3). A major challenge in attempting to control TB today in the United States is to identify high risk groups and to

direct appropriate screening and casefinding activities toward them (4).

On a given day, more than 3 million Americans live in residential institutions. This total includes more than 1,700,000 in nursing homes, more than 850,000 in correctional facilities, more than 200,000 in psychiatric facilities, and more than 300,000 in other types of institutions (5-8). Residential institutions have long been associated with an increased risk of infectious diseases, including TB. In recent

Table 1. Characteristics of tuberculosis cases by percentages in 29 survey States and in the United States, 1984-85

Characteristics	Survey States	U.S.
Pulmonary major disease site	83.5	83.4
Culture positive	84.9	84.4
Reported at death	6.3	5.3
Cavitary disease	28.4	127.1
Male	66.1	65.0
Nonwhite	51.0	47.6
Foreign-born	15.5	119.6
Urban (city of 100,000 or more).....	33.7	45.7
Age (years):		
0-14	5.1	15.6
15-64	62.9	165.5
65 and older	32.0	128.9
Median age	53	50
Total cases	15,379	44,456
Case rate per 100,000 per year.....	8.48	9.36

¹ Information derived from 88 percent of U.S. cases for which this information is available. Other variables derived from 100 percent of U.S. cases.

years, TB outbreaks among residents and employees of residential institutions (9-14) have raised a number of important questions.

Is excess risk of TB in institutions a widespread phenomenon in the United States today? Should TB screening or casefinding programs be routinely conducted in these facilities even in areas where there is a low prevalence of TB? Our study examines TB incidence among residents of nursing homes and correctional facilities, the nation's two most populous types of residential institutions. The study was made possible by national disease surveillance for TB, coordinated by the Centers for Disease Control and Prevention (CDC), that includes detailed reporting of each individual case (1,2) and by the voluntary participation of State and local health departments.

Recommendations for prevention and control of TB in nursing homes and correctional institutions were developed in part as a result of a preliminary analysis of data from our survey and have been published (15,16). This report describes the survey methods and results and reviews information used in development of a rationale for the strategies advocated in the recommendations.

Methods

We surveyed all TB cases reported from 29 States during 1984 and 1985. Demographic and clinical characteristics for each patient were collected on the CDC Report of Verified Case of Tuberculosis Form 72.9. Information for the study was collected on CDC Residential and Occupational Supplement Form 72.29 and was matched

with each case report by a unique case number.

The relative risk of TB in nursing homes and correctional facilities was estimated by comparing observed with expected incidence rates. Denominators for the observed rates were derived from estimates of the number of residents in facilities in the 29 States in 1984-85 obtained by other national surveys, with adjustments as recommended by the sponsoring agency (see box) (17-19). Observed incidence rates in the institutions are expressed in person-years of experience because of the dynamic nature of these populations, which are characterized by numerous admissions and discharges and variable lengths of stay. Nursing home populations were considered to be in "steady state" (20) because, according to unpublished data from the Long Term Care Statistics Branch, National Center for Health Statistics, CDC, the number of such residents increased by less than 3 percent per year. Correctional populations, which were increasing at a faster rate (19,21), were considered to be growing populations.

For nursing homes, numerators and denominators used in computing observed rates included only people older than age 64 (see box). For observed rates in correctional populations, however, it was not possible to include as a denominator only inmates ages 15-64 because State and local correctional population estimates were not available by age. Thus observed incidence rates among inmates are composed of a numerator of all TB cases among inmates, including 4 inmates (2 percent) who were ages 65 or older, and a denominator composed of the entire inmate population, of whom 99 percent nationally are reported to be between the ages of 15 and 64 (22).

The expected incidence rates were the rates for residents of the 29 States during the survey years who were in the same general age category and not living in nursing homes or correctional facilities. Numerators for expected rates in nursing homes included all reported TB cases in people ages 65 and older who were not living in nursing homes. Numerators for expected rates in correctional facilities were all nonincarcerated persons ages 15-64 with reported TB cases. Denominators for the expected rates were derived from age-specific general population estimates provided by the Bureau of the Census (1) with nursing home or correctional populations excluded.

Relative risks compared observed and expected aggregate incidence rates for all 29 States and for States grouped broadly according to relatively high, medium, or low expected TB incidence in the

Sources for Institutional Population Estimates for the 29 States and Factors for Which Adjustment was Performed

<i>Population and Data Base</i>	<i>Data Items</i>	<i>Factors</i>
Nursing home residents, ages 65 and older: 1982 National Master Facility Inventory (NMFI) (17)	Number of beds in nursing and related care homes with 3 or more beds, by State, 1982. (Includes beds in hospital based facilities as provided to NCHS by the American Hospital Association.)	National percent occupancy (91 percent). National proportion of residents who were ages 65 and older (87 percent). National change in size of nursing home population from 1982 to the study midpoint, Dec. 31, 1984 (increase of 5.44 percent in 2 years). (Personal communication, Long Term Care Statistics Branch, National Center for Health Statistics, CDC)
Federal prison inmates: Mandays Report (70.53), calendar years 1984-85, Bureau of Prisons, U.S. Department of Justice	Average daily population counts for selected Bureau of Prisons Institutions	Adjustment not required
State prison inmates: "Prisoners in Custody of State Correctional Authorities, 1984 and 1985": Bureau of Justice Statistics, U.S. Department of Justice	Single-day count of prisoners in custody, Dec. 31, 1984, and Dec. 31, 1985	Adjustment not required
Local jail inmates: 1983 National Jail Census (18).	Single-day count of persons held in local jails, June 30, 1983	National change in size of the jail population from the 1983 census to 1984 and 1985 (increase of 5 percent from 1983 to 1984 (19), increase of 22 percent from 1983 to 1985). (Personal communication, Bureau of Justice Statistics, U.S. Department of Justice)

general population. Confidence intervals for relative risks were estimated using the method of Katz and coworkers (23).

Results

During the 2-year study period, a total of 44,456 TB cases were reported in the United States. The 29 survey States reported 15,379 cases, or 34.6 percent of the total. Within the 29 States, completed study forms were available for 14,885 cases, a response rate of 97 percent. A comparison of demographic and clinical characteristics of survey cases with all cases reported in the United States (table 1) indicates that cases in the survey States were comparable with respect to most characteristics. In the survey States, persons with TB were slightly older (mean age 53 versus 50) and less likely to live in urban areas than those with TB in

the United States as a whole. Tuberculosis incidence in the survey States was lower than in the overall United States (table 1). The older median age of people with TB in the survey States is consistent with the epidemiologic pattern usually seen in areas of lower TB incidence (24,25).

Nursing homes. Among the 4,919 people with TB in the survey States who were ages 65 or older, 379 (7.7 percent) were living in a nursing home at the time of diagnosis. There were some differences between those ages 65 or older with TB in nursing homes and those with TB who were not in nursing homes (table 2). Those in nursing homes tended to be older (median age 82 versus 75) and more likely than persons in the community to have TB first reported at the time of death. The aggregate case rate for nursing home residents in the 29 States was 1.8

Table 2. Comparing characteristics of tuberculosis cases in nursing homes with those in the community in persons ages 65 and older and comparing characteristics of cases in correctional facilities with those in the community, ages 15-64, by percentages, 1984-85

Characteristic	Nursing homes		Correctional institutions	
	Nursing homes	Community	Correctional institutions	Community
Pulmonary major disease site	86.3	84.7	89.8	83.9
Culture positive	90.7	88.3	87.7	84.1
Reported at death ..	22.0	12.4	1.1	3.3
Cavitary disease ...	17.0	21.0	35.1	34.3
Male	53.3	64.3	96.6	68.2
Nonwhite	27.2	33.5	62.2	58.7
Foreign-born	4.2	8.8	5.7	19.8
Urban ¹	21.4	27.3	42.9	37.4
Age (years):				
15-34 .....	...	...	50.3	32.3
35-54 .....	...	...	40.7	43.2
55-64 .....	...	...	9.0	24.6
65-74	20.8	49.9	...	...
75-84	41.4	37.6	...	...
85 and older	37.7	12.6	...	...
Median age	82	75	34	43

¹ Population 100,000 or more.

times higher than the rate in elderly persons who were living in the community (95 percent confidence interval on relative risk 1.64,2.02). Rates varied widely among the 29 States, ranging from zero in 1 State to more than 100 cases per 100,000 population in 3 States (table 3). When the 29 States were grouped according to the incidence of TB in the general population in the States into high, medium, or low incidence States, similar aggregate excess risk (with relative risks ranging from 1.7 to 2.4) was seen in high, medium, and low incidence States (fig. 1).

Correctional institutions. Among 9,664 persons with TB who were ages 15-64, 177 (1.8 percent) were inmates of correctional institutions at the time of diagnosis. Another 4 inmates older than age 64 were reported with TB, resulting in a total of 181 cases among inmates. Inmates with TB included 3 in Federal prisons, 103 in State prisons, and 75 in local jails. They were more likely to be younger, male, and residents of urban areas and were less likely to be foreign-born than persons with TB ages 15-64 who were living in the community (table 2).

The aggregate case rate among correctional inmates in the 29 States was 3.9 times higher than the rate for persons of a similar age who were living in the community (95 percent confidence interval on relative risk 3.35,4.49). As with nursing homes, rates in correctional facilities varied widely among the 29 States (table 3). Correctional inmates were

found to have larger excess risk than nursing home residents when compared with persons of a similar age living in the community. As with nursing homes, similar levels of excess risk were seen among inmates in States with high, medium, and low overall TB incidence (fig. 2).

Discussion

The survey results indicate that excess risk of TB in nursing homes and correctional facilities is a widespread phenomenon, seen in groups of States with low TB incidence as well as in groups of States where TB is a greater problem. The importance assigned to this observed excess risk depends on a number of factors. Factors that challenge the validity of the study results include the potential for reporting bias and incompatibility of data bases. Other factors, related more directly to the geographic area and the population served, address the public health implications of the observed excess risk.

A strength of the survey is the large size of the study population. The effects of temporary factors, such as reported outbreaks, normal fluctuations in yearly events, and overreporting or underreporting due to temporary administrative situations, are minimized by the use of aggregate data for a large number of States. Conversely, conclusions drawn from the large sample do not address special issues that may be of concern to one State or a small number of States.

Reliance on routine case reporting, as opposed to active casefinding, for assessing the size of a problem can lead to an underestimation of disease incidence. The extent to which TB cases in institutions were unidentified or unreported during the survey years is unknown. Anecdotal reports suggest that in some correctional institutions, underreporting may have been a significant problem. An indication of underreporting from nursing homes comes from personal communications with Dr. William W. Stead, Arkansas Department of Health, and Mary Hamilton, Indiana State Board of Health. Arkansas and Indiana were not in the survey but had intensive nursing home TB screening programs in place. When observed and expected TB incidence rates in nursing homes in these two States were computed at CDC through a procedure identical to that used for the survey States, excess risk among nursing home residents was far greater in these States than in the survey States (table 4). It is also of note that Arkansas had a relatively high incidence of reported TB

Table 3. Reported age-specific incidence of tuberculosis among nursing home residents, community residents, and inmates of correctional institutions for States with high, medium, and low over overall tuberculosis incidence, 1984-85

Incidence category	Nursing home ages 65 and older		Community ages 65 and older		Correctional facility ages 15 and older		Community ages 15-64	
	TB cases	Case rate ¹	TB cases	Case rate ¹	TB cases	Case rate ¹	TB cases	Case rate ¹
<i>High incidence</i>								
Alabama.....	18	48.6	463	50.0	16	48.3	578	11.2
Alaska.....	3	175.0	26	85.9	2	55.1	110	15.7
Delaware.....	2	39.9	31	23.5	0	0.0	71	8.5
District of Columbia.....	7	157.7	88	60.0	5	45.8	246	28.3
Florida.....	33	45.3	604	15.7	40	43.1	1,976	13.9
Georgia.....	31	53.4	350	31.5	41	70.0	1,102	14.0
Hawaii.....	1	14.2	96	51.6	1	27.7	301	21.3
South Carolina.....	15	66.1	242	37.2	12	48.3	709	16.0
Tennessee.....	55	118.9	537	49.0	11	37.8	548	8.7
Totals.....	165	64.7	2,437	29.9	128	49.1	5,641	13.5
<i>Medium incidence</i>								
Arizona.....	7	41.0	212	28.3	2	8.2	299	7.5
Connecticut.....	14	28.0	89	11.6	1	7.3	217	5.1
Louisiana.....	34	77.6	156	18.8	9	22.0	546	9.5
Massachusetts.....	26	27.8	222	15.1	6	33.5	539	6.9
Michigan ²	17	25.1	273	18.8	4	7.8	346	3.3
New Mexico.....	5	91.7	82	30.5	1	13.7	96	5.2
Rhode Island.....	3	19.2	38	14.5	1	39.1	64	5.0
Virginia.....	29	53.6	382	34.6	6	17.3	499	6.4
Washington.....	10	19.1	100	10.6	10	47.6	273	4.7
West Virginia.....	8	37.8	117	23.8	0	0.0	111	4.4
Totals.....	153	36.4	1,671	20.0	40	18.0	2,990	5.8
<i>Low incidence</i>								
Colorado ³	1	6.8	28	10.6	1	15.4	59	2.7
Idaho.....	1	13.2	16	7.6	1	25.8	32	2.6
Iowa.....	7	10.4	43	5.7	0	0.0	75	2.0
Illinois ⁴	34	50.4	174	12.0	2	3.5	342	4.3
Maine.....	4	18.2	31	11.0	0	0.0	45	3.0
Minnesota.....	9	11.3	72	7.5	5	44.6	165	3.0
Nevada.....	0	0.0	19	10.8	2	21.3	54	4.2
South Dakota.....	2	13.8	14	7.4	2	74.9	34	3.9
Utah.....	2	22.1	27	10.9	0	0.0	41	2.1
Wyoming.....	1	26.8	8	10.0	0	0.0	5	0.8
Totals.....	61	21.0	432	9.4	13	11.9	852	3.2
Total 29 survey States.....	379	39.2	4,540	21.5	181	30.6	9,483	7.9

¹ Per 100,000 population per year.

² Exclusive of Detroit and Wayne County.

³ 1984 only.

⁴ Exclusive of Chicago and Cook County.

among elderly community residents, as previously reported by Stead (26), and Indiana had a relatively low incidence in the community (2).

Assignment bias from the way in which the data were collected may also have contributed to underreporting of institutional cases. Most survey forms were completed during an interview with the patient. In some locations, however, the forms were completed by office personnel who did not know the patient. For these locations, it is not known whether information regarding residence in a nursing home or prison was always captured.

Overreporting probably presented less of a problem than underreporting in this study. Clinical

criteria for reported TB cases in adults are well established, and all cases accepted into the reporting system by CDC must meet these criteria (27).

Each of the population denominators used in the survey came with its own set of potential limitations. As summarized in the box, institutional population estimates were obtained by imputation of data from surveys conducted by other agencies. For nursing homes, adjustments to reflect occupancy rate percentages, proportion of residents who were ages 65 or older, and the change in the size of the nursing home population between the 1982 National Master Facility Inventory of Nursing and Related Care Homes (NMFI) and the 1984-85

Table 4. Reported cases of tuberculosis among nursing home residents and among community residents, ages 65 and older, for Arkansas, Indiana, and 29 survey States, 1984–85

States	Nursing homes		Community		RR ²	95 percent C.I.
	TB cases	Case rate ¹	TB cases	Case rate ¹		
Arkansas	60	179.8	285	44.5	4.0	3.06,5.34
Indiana	76	97.9	207	17.2	5.7	4.38,7.40
Survey states	379	39.2	4,540	21.5	1.8	1.64,2.02

¹ Per 100,000 population per year.

² relative risk.

period, were based upon national estimates that may not have reflected accurately the characteristics of homes in the survey States. Furthermore, as reported by NCHS, 35 States obtained at least some data for the NMFI independently under an arrangement with NCHS. In these States, the timing of surveys did not always coincide with the NMFI, and licensing policies may have resulted in differing local opinions as to which facilities should be included in the survey (28). Other aspects of the survey may also have varied in these States (28). Because the nursing home population was growing at a rate of less than 5 percent per year, the impact of varied timing of surveys in these States is thought to be minimal.

Information on thousands of board and care homes, such as Adult Foster Care Homes in Michigan and Adult Congregate Living Facilities in Florida, was not complete in the 1982 NMFI (28). Every effort was made to exclude residents of these facilities from both numerators and denominators in calculating TB case rates. Patients who were reported as residents of these homes were recorded as living in "other" institutions rather than in nursing homes and not included in determination of nursing home rates.

Estimates of populations in correctional institutions, as provided by the Department of Justice, were obtained from average daily counts in Federal prisons and from 1-day annual counts conducted each December in State prisons (see box). The jail population was imputed from the 1983 Jail Census, adjusted to reflect the increase in the jail population nationwide between 1983 and 1984–85 (box). The authors were cautioned that there was great variety among States in the growth of jail populations and that estimates of the growth of these populations nationwide would be unreliable estimates for the growth of these populations in individual States, according to unpublished data from the Bureau of Justice Statistics, Department of Justice. Thus, incidence of TB among local jail

inmates in individual States is perhaps the most unreliable of all measures reported from this survey. Local jail population estimates, because of the extreme mobility of the population, are always suspect even without imputation to reflect growth, and other authors have reported similar difficulty in obtaining useful estimates (13,29).

Other authors have discussed, in detail, both the strengths and weaknesses of Census Bureau estimates of the general population, as used in this study (30). Undercounting or overcounting of the general population could, of course, affect the validity of the survey results.

Estimates of the general population and the nursing home population required adjustment to compensate for a lack of participation in the study by two large areas in the survey States—Cook County (Chicago) in Illinois and Wayne County (Detroit) in Michigan. In each of the two States, an estimate of the general population in the ages 65 and older and ages 15–64 groups for the State, *exclusive of the non-participating area*, was needed. Age-specific general population estimates for the survey years for Cook county and Chicago were provided by the Illinois Department of Health. Age-specific general population estimates for the survey years, however, were not available for Wayne County or Detroit. The assumption was made that the proportion of the Wayne county and Detroit population that were in the 65 and older and 15–64 age groups was similar to the proportion of these age groups in Cook County (another large urban area). A similar set of assumptions was used to estimate the size of the nursing home population in each of the two States exclusive of non-participating counties. No adjustments of this type were needed for correctional populations, because local jail population counts are provided by county.

Public Health Implications

Our survey is the first to examine TB incidence in the two largest institutional populations in the United States—residents of nursing homes and correctional facilities. The large size of the sample population and the finding of homogeneity in the extent of excess risk in each of the two types of institutions in low, medium, and high incidence States, (figs. 1,2), suggest a real association between crude TB incidence and residence in these institutions. No conclusions can be drawn from these data regarding the causes for the association (31,32).

It is evident that there are demographic differences between the institutional populations and the best available community populations used for comparison. Demographic characteristics may account for a significant proportion of the excess risk seen, especially in correctional facilities. Nursing home residents nationwide are older (suggesting a higher expected case rate) but much more likely to be female (suggesting a lower expected case rate) than elderly persons living in the community (1,2,28). Correctional inmates nationwide are much more likely to be male and nonwhite than persons ages 15-64 in the community, both of which are factors suggesting a higher expected case rate (1,2,22).

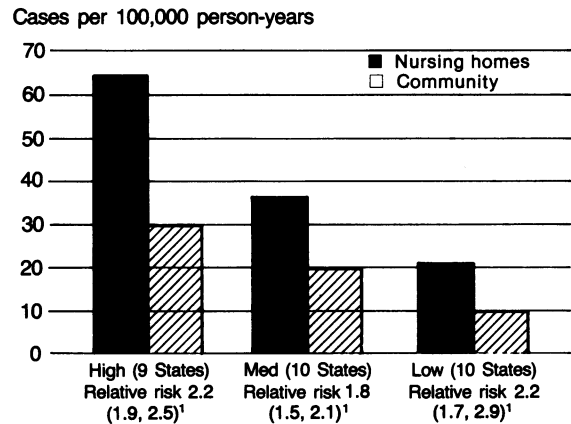
Because detailed enumeration of age, race, and sex in these institutions in survey States during the survey years is not available, according to unpublished data from NCHS and the Department of Justice, the extent to which age, race, and sex may account for the observed excess risk is not precisely known.

The public health implications of the observed excess risk of TB appear to be quite different for the two types of institutions. The survey results indicate that TB can be disproportionately more common in these institutions in any State, regardless of the background incidence of the disease. In the design of intervention strategies, however, factors such as the number of expected cases, the extent of excess risk, unique characteristics of the two institutional populations, changes that have occurred since the time the survey was conducted, and local and State issues are important.

Nursing homes. Excess risk of TB among nursing home residents, compared with persons of a similar age living in the community, was relatively small (relative risk 1.8). Elderly persons, the population used for comparison, however, are themselves a group at high risk for TB (1,2,33). In most areas of the United States today, TB case rates are higher among the elderly than among any other age group. The elderly make up a large reservoir of tuberculous infection. The incidence of TB observed among nursing home residents, 39.2 cases per 100,000 population, was higher than among prison inmates, and nursing home residents produced twice as many TB cases as did correctional inmates.

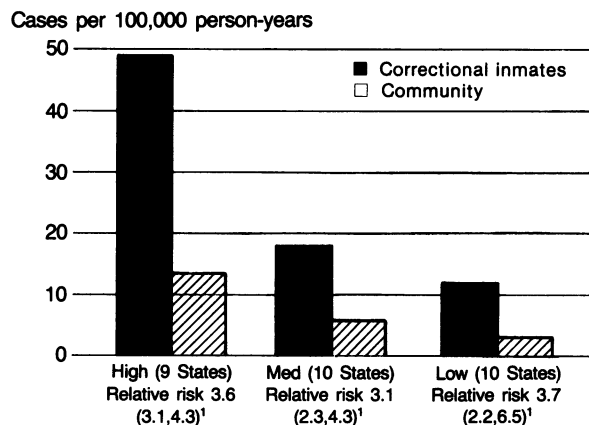
Lengths of stay in nursing homes tend to be variable, with a significant proportion of residents staying for short periods (34). Thus, tuberculous infection, if acquired in nursing homes, can result in TB cases in the community, in nursing homes,

Figure 1. Reported tuberculosis incidence rates among nursing home residents and community residents, ages 65 and older, for States with high, medium, and low overall tuberculosis incidence



¹ 95 percent confidence interval.

Figure 2. Reported tuberculosis incidence rates among inmates of correctional institutions, ages 15 and older, and community residents, ages 15-64, for States with high, medium, and low overall tuberculosis incidence



¹ 95 percent confidence interval.

or in acute care hospitals. In each of these settings the risk of exposure and infection of persons in all age groups has been amply demonstrated in reported outbreaks (9-11).

At the time of the 1980 Census, more than 2 million persons, 9 percent of all elderly persons, were older than age 85. By the year 2000, this number is expected to more than double, to more than 5 million, or 15 percent of elderly persons. This is the fastest growing segment of the United States population (35). It is certainly expected that greater numbers of very elderly persons will create greater demands for care related to chronic disabil-

ity (36). With rising costs of institutionalized care and the availability of numerous community- or home-based alternatives, such as personal care homes, congregate housing, life care, adult day care, and home health care, however, the effect of the aging of the population on the size and characteristics of nursing home populations is unknown (36,37). Thus, although there appears to be a current need for public health intervention to prevent and control TB in nursing homes, the future public health impact of TB in nursing homes is difficult to determine. For the greatest benefit, future TB control interventions for the elderly may need to focus on other settings where care is provided to the elderly, in addition to nursing homes.

Correctional institutions. Correctional institutions present a serious challenge for TB control during the 1990s. A major change has occurred in the TB problem in correctional facilities since the survey was conducted. The epidemic of human immunodeficiency virus (HIV) has disproportionately affected residents of correctional facilities (12,29,38) and has been associated with a corresponding increase in TB in correctional facilities. The incidence of TB in New York State prisoners increased from 15.4 per 100,000 during the 1976–78 period to 116 per 100,000 in 1986–88 (12,38). In 1990–91, an outbreak of multidrug-resistant TB occurred among New York State inmates (39). All State prison systems have identified some HIV among inmates, usually in association with a history of intravenous drug use (29). The dual risk for both TB and HIV among inmates will undoubtedly have a major impact on TB epidemiology in the 1990s (40,41).

There is a difference between correctional inmates and nursing home residents that has particular importance for public health—correctional inmates are younger. The median age for the more than 200,000 prison inmates who are released to the community each year is 27 (42,43). One-third of released prisoners are younger than age 25 (43). Young adults are in the age group that has the greatest opportunity to expose and infect children if they develop TB after incarceration. The potential for infection of children and other household members, coupled with the long duration of risk for reactivation TB in these young adults themselves after incarceration, suggests a relatively large future public health impact related to correctional TB today. A strong association between TB in correctional facilities and TB in the community has been previously reported by Stead (14).

While nursing home populations may be growing

slowly, inmate populations are experiencing explosive growth, with many facilities operating at well over capacity (6). This growth, with attendant crowding and increased potential for airborne spread of infection if TB cases occur and remain unidentified, is expected to continue (44). Additional inmates also means more releases to the community where the previously mentioned longer term impact may occur.

Based on these observations, a strong current and future need for strategies to prevent and control TB among correctional populations is apparent.

Recently published recommendations for prevention and control of TB in nursing homes and correctional institutions call for the following activities (15,16):

1. immediate diagnostic measures, including sputum examinations and a chest radiograph for inmates, residents, or employees, including newly admitted or hired persons, who have signs and symptoms of infectious pulmonary disease;
2. TB screening for all at entry or on employment with the Mantoux tuberculin skin test, or with a chest radiograph for those who have a positive tuberculin skin test or HIV infection or both;
3. routine repeat tuberculin skin testing at least annually in most geographic areas for skin-test negative prisoners, prison and jail staff members who work with prisoners, and for nursing home employees;
4. reporting of all cases of active TB to the local or State health department;
5. use of appropriate isolation precautions (45) for patients who have active TB that may be infectious;
6. contact examinations following exposure to active pulmonary TB; and
7. provision of treatment and preventive therapy according guidelines established by the American Thoracic Society and CDC.

The recommendations also emphasize the need for participation by the health department in policy development, training, outbreak investigations, examination of community contacts to active TB cases, medical followup for persons released while on treatment or preventive therapy, and maintenance of a case registry to include cases reported by nursing homes and correctional institutions.

The results of our survey provide a baseline measure of TB risk associated with residence in

nursing homes and correctional institutions in the United States during the mid 1980s. Consideration of the unique characteristics of the two institutional populations, combined with other issues of importance for specific geographic areas, provides a rationale for development of strategies to prevent and control TB in these institutions.

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Disability and Cognitive Impairment Are Risk Factors for Pneumonia-Related Mortality in Older Adults

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Synopsis

The role of functional and cognitive limitations in the risk of pneumonia-related mortality in older adults was examined. As part of a cohort study in 3 communities (East Boston, MA; New Haven,

CT; and Iowa and Washington Counties, IA), 6,234 women and 4,035 men ages 65 or older completed baseline interviews between 1981 and 1983 and were followed for up to 6 years. Sex-specific Cox proportional-hazards regression models were used to examine the association of baseline physical and cognitive functioning with report of pneumonia (ICD9 480-486) as an underlying, immediate, or contributing cause of death.

During followup, a total of 243 men and 160 women died with pneumonia. Adjusting for age, race, education, evidence of five chronic diseases, and smoking status, a significantly increased risk of pneumonia mortality ($P < 0.05$) was found for limitations in activities of daily living and cognitive impairment among both men and women. Inability to walk a half mile, climb stairs, or perform heavy housework was significantly associated with increased risk of pneumonia mortality for women but not for men in the same multivariate models. Men and women whose body-mass index was above the median had significantly lower risk of pneumonia mortality compared with those in the lowest quartile. Further elucidation of the sequence between physical and cognitive impairment and risk of pneumonia will be important in reducing pneumonia-associated morbidity and mortality.

DESPITE GREAT PROGRESS against infectious disease in this century, pneumonia remains the leading infectious cause of death, particularly among older

adults. Pneumonia-influenza is the fifth leading cause of death among persons ages 65 and older in the United States. More than 65,000 older persons