

## DEATHS OF NONRESIDENTS IN SYRACUSE<sup>1</sup>

by ELLIOTT H. PENNELL

THE importance of changing the present statistical practice of ascribing deaths to the locality in which they happen to occur by allocating them to the place of residence of the decedents has long been recognized. Dr. Otto R. Eichel's early paper, followed by Dr. Joseph V. DePorte's illuminating studies in New York State, have clearly demonstrated that death rates computed upon the present basis are usually erroneous and frequently are grossly misleading. With the increasing hospitalization of sick persons in centers where hospitals exist or in areas where sanatoria are provided, it is evident that the error due to this purely statistical procedure will increase rather than diminish. It is no longer possible to ignore residence as a factor in the accuracy of mortality rates by considering it as a compensating error, that is, on the assumption that the nonresident deaths are balanced by a corresponding number of residents dying elsewhere. Nor is it excusable to regard it as a potential error, the significance of which can not be determined for lack of available data, for some data are at hand and better data can be had.

<sup>1</sup>From the Division of Research, Milbank Memorial Fund. This is the fifth in a series of papers on the accuracy of vital statistics, the preceding papers being as follows:

Downes, Jean: The Accuracy of the Recorded Birth Statistics in Urban and Rural Areas. *Journal of the American Statistical Association*, March, 1929, xxiv, p. 165.

Wiehl, Dorothy G.: The Correction of Infant Mortality Rates for Residence. *American Journal of Public Health*, May, 1929, xix, pp. 495-510.

Sydenstricker, Edgar: The Trend of Tuberculosis Mortality in Rural and Urban Areas. *American Review of Tuberculosis*, May, 1929, xix, pp. 461-482.

Downes, Jean: The Accuracy of Official Tuberculosis Death Rates. *Journal of the American Statistical Association*, December, 1931, xxvi, pp. 393-406.

In spite of the manifest inaccuracy resulting from this procedure, the *official* mortality rates for the federal registration area, all states and nearly all cities, continue to be computed without adequate correction. Even such attempts as have been made relate to the gross death rates only with the notable exception of the work of DePorte in New York<sup>2</sup> and the interesting paper of Downes on tuberculosis in Cattaraugus County.<sup>3</sup> Other than these attempts the effect of failure to correct for residence of decedents upon *specific* death rates for sex, age, and cause has not been taken into account.

As a contribution to this desired information, the mortality records for a number of years of nonresidents dying in Syracuse, New York, were studied. Syracuse was selected partly because of familiarity with the records by reason of the Milbank Memorial Fund's interest in the development of public health activities there and partly because Syracuse is an excellent example of an urban area which may be said to attract deaths of nonresidents for various reasons. It should be noted that Syracuse is a city of approximately 200,000 inhabitants, is near the geographical center of New York State, and is the county seat for Onondaga County. It is connected with a large surrounding area by railroads, interurban railways, and bus lines, contains a large number of manufacturing enterprises, is the seat of Syracuse University, with 6,000 students and a medical school, is equipped with progressive health administration, and has good clinical and hospital facilities.

In the preparation of this paper the death certificates on file at the Syracuse Department of Health covering the years

<sup>2</sup>DePorte, J. V., M.D.: Reports of the Division of Vital Statistics, New York State Department of Health 1926-1929, and various papers on tuberculosis and cancer.

<sup>3</sup>Downes, Jean: The Accuracy of Official Tuberculosis Death Rates. *Journal of the American Statistical Association*, December, 1931, xxvi, pp. 393-406.

COUNTY	DEATHS	COUNTY	DEATHS	COUNTY	DEATHS
Albany	6	Herkimer	17	Rensselaer	4
Allegany	2	Jefferson	28	Richmond	3
Broome	10	Kings	5	St. Lawrence	20
Cattaraugus	1	Lewis	9	Saratoga	1
Cayuga	61	Livingston	1	Schenectady	2
Chautauqua	8	Madison	130	Schoharie	1
Chemung	3	Monroe	16	Seneca	10
Chenango	12	Montgomery	8	Steuben	3
Clinton	1	Nassau	5	Tioga	3
Columbia	3	New York	26	Tompkins	10
Cortland	23	Niagara	2	Ulster	1
Delaware	2	Oneida	45	Warren	1
Erie	9	Ontario	9	Washington	2
Essex	3	Orange	5	Wayne	23
Franklin	5	Oswego	193	Westchester	2
Fulton	2	Otsego	5	Wyoming	1
Genesee	1	Queens	1	Yates	8

Table 1. Distribution of nonresident deaths in Syracuse, New York, 1924-1929, by county of former residence.

1915, 1920, and 1924-1929 were examined with respect to residence of decedent. The certificates for nonresident deaths for 1915 and 1920 were extracted and then tabulated by sex, age, cause of death, et cetera. There were certain deaths, from chronic causes especially, of nonresidents whose residence in Syracuse had exceeded one year but did not exceed the duration given for the chronic condition. Certificates on which place of former residence was not given were included with the resident deaths. In classifying according to residence the rules used by Dr. Eichel<sup>4</sup> in his paper on nonresident deaths in certain cities and areas in New York, were essentially followed. Infant deaths, however, were allocated to residence of mother, as was done by Dr. DePorte in his later studies.

<sup>4</sup>Eichel, Otto R., M.D.: So-called Nonresident Deaths—A preliminary note on an experimental study of this subject in New York State. *American Journal of Public Health*, September, 1919, ix, No. 9, pp. 654-662.

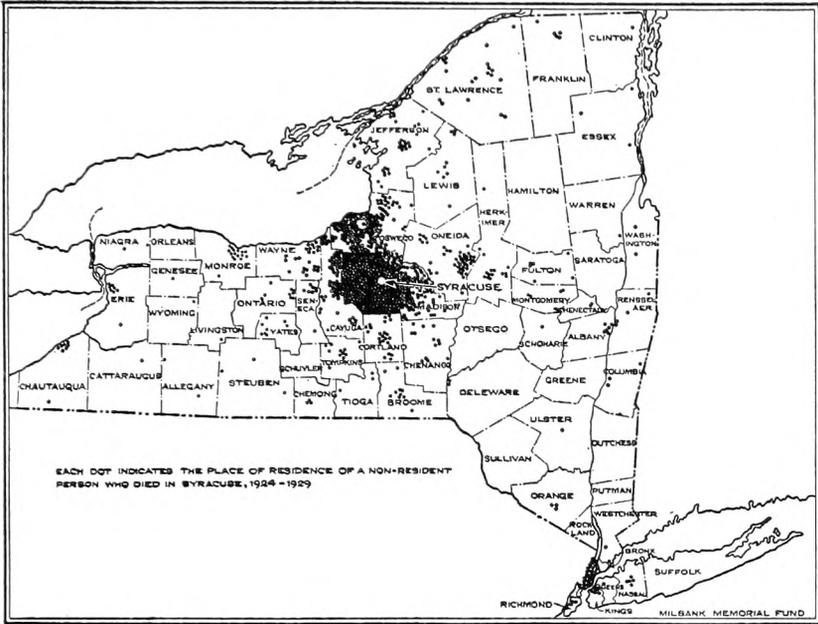


Fig. 1. Map showing the place of residence of nonresident persons who died in Syracuse, 1924-1929.

Of the 14,776 deaths recorded in Syracuse for the period 1924-1929, 2,133 or 14.4 per cent were classified as of non-residents. It was not practicable at the time to consider the deaths of Syracuse residents that occurred outside of that City, but Dr. DePorte in his annual reports has shown that these deaths by no means balance the deaths of nonresidents in Syracuse. For the years 1927-1929 his corrections for residence of decedents reduced the officially recorded rates by 0.6, 1.3, and 0.7 per 1,000 population, or an average of 6.7 per cent. These rates represented approximately 500 deaths for the three-year period. Although the present paper relates to only one side of the problem of correcting for residence, the data suggest the effects of failure to make this correction upon rates specific for sex, age, and cause in a locality where the deaths of nonresidents outbalance deaths of residents elsewhere.

YEAR	1915	1920	1924	1925	1926	1927	1928	1929	1924-29
Total deaths	2,011	2,640	2,253	2,280	2,506	2,417	2,701	2,619	14,776
Nonresident deaths	142	209	285	350	358	295	429	416	2,133
Per cent nonresident	7.1	7.9	12.6	15.4	14.3	12.2	15.9	15.9	14.4

Table 2. Total deaths occurring in Syracuse, New York, and numbers allocated to former residence for certain years, 1915-1929.

Before presenting the data for sex, age, and cause, it will be of interest to see where the nonresidents dying in Syracuse come from. (Table 1, Fig. 1.) As might be expected, Onondaga County, in which the City of Syracuse is located, contributed 1,245 nonresident deaths in Syracuse, or approximately 60 per cent of nonresident deaths in the period 1924-1929. Smaller concentrations appear in Oswego County, with 193 nonresident deaths; in Madison County, with 130; in Cayuga County, with 61; in Oneida County, with 45; and in Jefferson County, with 28. These concentrations were partly due to certain population centers located there. In fact, if we exclude Onondaga County, 27 per cent were from villages of 500 inhabitants or less, and 39 per cent were from places with populations of under 1,000. In Onondaga the greatest percentages were 28 and 39.

The fact that the proportion of total deaths in Syracuse

Table 3. Per cent of deaths annually occurring in Syracuse, New York, in 1924-1929 that were of nonresidents, by sex.

SEX	1924	1925	1926	1927	1928	1929	1924-29
Male	12.6	16.6	15.1	13.1	17.0	16.3	15.2
Female	12.6	14.1	13.5	11.3	14.7	15.5	13.6

has been increasing,<sup>5</sup> as shown by Table 2, indicates the growing importance of allocating deaths according to place of residence of decedents rather than to the places where they happen to die. This is fully realized by the New York State Department of Health which is annually publishing the rates corrected for residence for all causes and for some of the important causes. The increase in the nonresident deaths in a city such as Syracuse is largely due to the fact that the use of the hospitals and other institutions which exist there has increased. Throughout the six years under consideration, 79 per cent of the nonresident deaths occurred in hospitals and there was no significant deviation from this proportion in any of the six years.

Table 4. Per cent of deaths occurring in Syracuse, New York, 1924-1929, that were of nonresidents, by sex and age.

AGE GROUP	PER CENT OF DEATHS THAT WERE OF NONRESIDENTS			TOTAL			OF NONRESIDENTS		
	Both Sexes	Males	Fe-males	Both Sexes	Males	Fe-males	Both Sexes	Males	Fe-males
Under 1	14.9	14.7	15.2	1,579	882	697	236	130	106
1	15.6	12.1	20.2	250	141	109	39	17	22
2- 4	16.9	12.5	22.2	261	144	117	44	18	26
5- 9	21.6	24.4	18.0	227	127	100	49	31	18
10-19	24.7	28.2	20.8	361	188	173	89	53	36
20-29	21.3	23.1	19.6	611	294	317	130	68	62
30-39	19.1	17.6	20.7	971	516	455	185	91	94
40-49	16.5	16.2	16.8	1,470	816	654	242	132	110
50-59	14.9	14.5	15.3	2,163	1,157	1,006	322	168	154
60-69	12.9	13.6	12.2	2,884	1,523	1,361	373	207	166
70-79	11.5	14.7	8.6	2,599	1,218	1,381	298	179	119
80 +	9.0	9.8	8.5	1,400	561	839	126	55	71

<sup>5</sup>Dr. Eichel, studying the records for the first six months of 1918, found that the deaths of nonresidents in Syracuse and of Syracuse residents elsewhere were almost equal. Deaths of nonresidents in Syracuse in later years thus became a more important factor in the accuracy of crude rates for the later years.

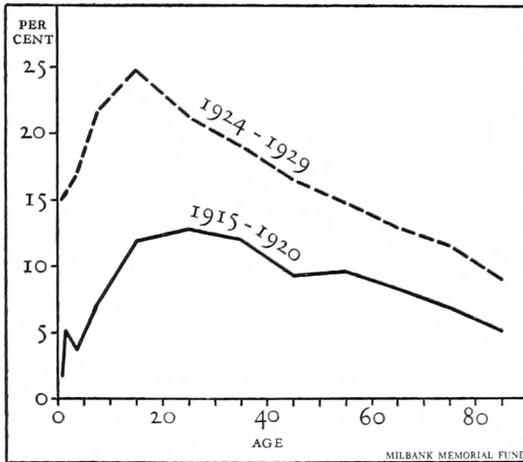


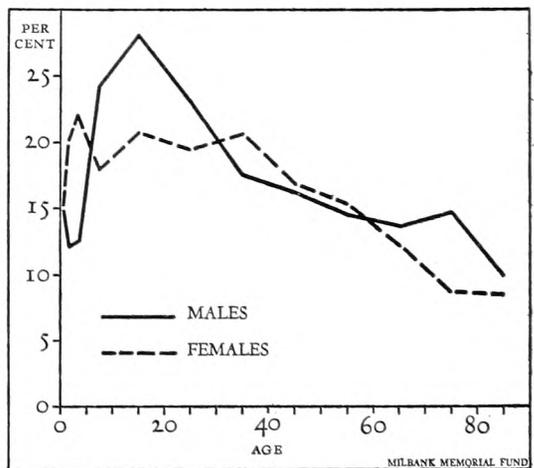
Fig. 2. Per cent of deaths at different ages registered in Syracuse that were found to be of nonresidents: average of 1915 and 1920 compared with average of 1924-1929.

From the point of view of the distribution of the nonresident deaths according to sex, it appears that 15.2 per cent of all male deaths and 13.6 per cent of all female deaths occurring in Syracuse were of nonresidents. For each of these years, except for 1924 when the percentages were the same, the male deaths

showed a higher percentage of total deaths than the female, as is shown in Table 3.

In studying the age distribution of nonresident deaths, our chief interest is not in the actual number of these deaths in each age group but in their relation to the total. Table 4 and Figure 2 show the percentages that nonresident deaths were of total deaths for certain age and sex-age groups. The percentage of female nonresident deaths exceeds that of males in the age

Fig. 3. Per cent of male and female deaths at different ages registered in Syracuse in 1924-1929 that were found to be of nonresidents.



group "under five" and 30-59 years, while for all other ages a larger proportion of male deaths is shown. However, the differences are either not great or are based on small numbers, although the preponderance of males in the age group 5-29 years, where one-fourth of all male deaths were of nonresidents, is consistent and somewhat pronounced.

The percentage of total deaths which were of nonresidents in different age groups for 1915 and 1920 combined, is compared with those for the period 1924-1929 in Table 5 and Figure 3. Increases in the proportion of deaths which were of nonresidents appeared in all age groups. These increases were fairly uniform for all ages, being in a ratio of about 1.6, 1.7, 1.8 to 1, except in childhood when the percentage of nonresident deaths in 1924-1929 was over three times the average for 1915 and 1920.

Table 5. Per cent of deaths occurring in Syracuse, New York, in 1915 and 1920, and in 1924-1929 that were of nonresidents, by age.

AGE GROUP	PER CENT OF DEATHS THAT WERE OF NONRESIDENTS		NUMBER OF DEATHS			
	1915, 1920	1924-1929	1915, 1920		1924-1929	
			Total <sup>1</sup>	Of Non-residents	Total <sup>2</sup>	Of Non-residents
Under 1	1.8	14.9	785	14	1,579	236
1	5.3	15.6	131	7	250	39
2-4	3.7	16.9	135	5	261	44
5-9	7.2	21.6	83	6	227	49
10-19	12.0	24.7	133	16	361	89
20-29	12.8	21.3	335	43	611	130
30-39	12.1	19.1	406	49	971	185
40-49	9.3	16.5	442	41	1,470	242
50-59	9.6	14.9	572	55	2,163	322
60-69	8.3	12.9	661	55	2,884	373
70-79	6.9	11.5	594	41	2,599	298
80 and over	5.1	9.0	374	19	1,400	126

<sup>1</sup>From Mortality Statistics, Bureau of the Census.

<sup>2</sup>From tabulations of death certificates on file in the Department of Health, Syracuse, New York.

The importance of nonresident deaths in considering mortality according to cause is clearly shown. For example, the highest proportion of deaths which were of nonresidents is found in puerperal causes, although the deaths from these causes were only about 1 per cent of total deaths. On the other hand, of deaths from diseases of the circulatory system, which constitute the largest number, about 10 per cent were nonresidents. The details are given in Table 6.

It is thus quite evident that it is necessary to make corrections for residence of decedents not only for computing gross mortality rates but also for specific rates for sex, age, and cause before accurate comparisons between geographic areas and localities can be made.

Table 6. Per cent of deaths occurring in Syracuse, New York, 1924-1929 that were of nonresidents, by groups of causes.

GROUP OF CAUSES (with International List Numbers)	PER CENT OF DEATHS THAT WERE OF NONRESIDENTS			NUMBER OF DEATHS					
	Both Sexes	Males	Fe- males	Total			Of Nonresidents		
				Both Sexes	Males	Fe- males	Both Sexes	Males	Fe- males
Epidemic, endemic, and infectious (1-42)	14.2	13.4	15.1	1,074	597	477	152	80	72
General diseases (43-69)	16.6	18.0	15.7	2,243	917	1,326	373	165	208
Diseases of the nervous system and of the organs of special sense (70-86)	10.5	11.3	9.8	1,551	734	817	163	83	80
Disease of the circulatory system (87-96)	9.8	10.8	8.8	3,780	1,949	1,831	372	211	161
Disease of the respiratory system (97-107)	12.5	13.6	11.1	1,554	897	657	195	122	73
Disease of the digestive system (108-127)	23.3	22.7	23.9	937	510	427	218	116	102
Nonvenereal diseases of the genito-urinary sys- tem and annexa (128-142)	14.8	16.0	13.7	1,306	626	680	193	100	93
The puerperal state (143- 150)	32.1	...	32.1	165	...	165	53	...	53
Malignancies (159)	16.5	19.2	13.3	182	99	83	30	19	11
Early infancy (160-163)	15.3	14.7	16.1	738	422	316	113	62	51
External causes (165-203)	21.8	23.1	19.0	1,100	752	348	240	174	66
All other causes (151-158, 164, 204, 205)	21.3	26.6	17.1	146	64	82	31	17	14



*Interior view of one of the buildings at Ray Brook Sanatorium near Saranac, for the treatment of tuberculous patients.*



*A typical sewage disposal plant  
in Nassau County, New York*