Variations in Heart Disease Mortality Among Counties of New York State

HELEN C. CHASE, Dr.P.H.

IN AN ANALYSIS of geographic variation in mortality due to coronary heart disease among the States of the United States, Enterline and Stewart (*1*) found that the rates were about twice as high in some States as in others and concluded that the geographic differences are probably not due to variation in diagnosis. High death rates from this cause did not appear to be associated with low death rates for possible alternative causes, and the two sexes were similarly affected.

Later publications, more limited in their age-sex-race groupings, examined more closely the quality of diagnostic information on the certificate (*2*), degree of urbanization (*3*), and geographic and ethnic groups (*4*). Among these factors, urbanization seemed to be the most significant, while the quality of the diagnostic information on the certificate and the variation among ethnic groups assumed minor roles.

Among the 48 States which comprised the United States in 1949–51, New York had the highest rate even after adjustment for differences in age distributions. The present study was undertaken to examine the rates for New York City and the remaining 57 counties of the State and to investigate correlations with demographic factors. Findings are compared with those of the nationwide study (*1*).

Definitions

The data for the States of the United States and for the counties of New York State are generally comparable, but the following differences and similarities are worth noting.

Time period. The nationwide data are based on 1950 mortality experience. To achieve greater stability in the mortality rates for counties, the New York State data are based on deaths in the 3-year period 1949–51.

Geographic divisions. Most of the present analysis concerns the 57 counties of upstate New York. For completeness, the rates for New York City are shown.

Diagnoses. The following major diagnostic groups, based on the sixth revision of the International Statistical Classification of Diseases, Injuries, and Causes of Death (1948) were examined: vascular lesions affecting the central nervous system (330–334), arteriosclerotic heart disease, including coronary disease (420), hypertension with heart disease (440–443), and hypertension without mention of heart disease (444–447). Detailed results are reported here only for cause 420. The nationwide study covered cause group 420 and, incidentally, also 330–334, 421 (chronic endocarditis not specified as rheumatic), and 422 (other myocardial degeneration).

Sex. Both the nationwide data and the present study are specific for sex.

Race. The nonwhite population in upstate New York constituted only 2.6 percent of the population in 1950. Therefore, no attempt is made to separate these data by race. The nationwide data are limited to the white race.

Age. Age groups in the two sets of data are the same except the terminal age groups: 75 years and over for the New York data, and 85 years and over in the nationwide data.

Method of adjustment. The same method of age adjustment is used in both studies. The rates were adjusted to the 1950 population of the United States using the direct method of adjustment (*5*). Age-specific county rates are based on noninstitutional county populations.

Dr. Chase is principal biostatistician for the New York State Department of Health.

Institutional inmates. In the New York data, the institutional populations were removed from the county populations before the county rates were computed, and wherever possible, deaths among institutional inmates were allocated to place of residence at time of admission to the institution. These institutions include State tuberculosis, mental hygiene, and correctional institutions, and Veterans Administration hospitals. This correction is necessary because of the undue influence of mortality in large institutions located in counties with relatively small populations. The summary data for New York State, New York City, and upstate New York include institutional deaths and populations.

Geography of New York State

Historically, New York State developed along its waterways, the Hudson and Mohawk Rivers, the Great Lakes, Lake George, and Lake Champlain. Associated with some of these waterways are leading industrial complexes, such as Buffalo and Niagara Falls, Rochester, Syracuse, Utica, Schenectady, Albany, and Troy, as well as New York City. Binghamton is the largest among a number of industrial cities in the southern tier bordering Pennsylvania. The populations of cities of 50,000 or more as given in the 1950 Census of Population are shown in table 1.

To a large degree, this list of cities also describes the geographic distribution of the medical schools in the State. These are located in Albany, Buffalo, New York City, Rochester, and Syracuse. They are associated with medical centers and serve as the nuclei of medical education for large geographic areas. Among the cities listed in table 1, only Binghamton and Utica are at a considerable distance from a medical center with a medical school (Syracuse).

New York is usually visualized as an industrial State, and at the time of the 1950 census had a population of 14.8 million. However, outside New York City, a considerable part of the land area is rural. These rural areas are generally farther from medical centers, and tend to depend on less concentrated hospital and medical facilities.

Mortality by Counties

The age-adjusted death rates per 100,000 population for arteriosclerotic heart disease (ISC 420) for both sexes and for males and females are given in table 2. The rates for New York City are consistently higher than those for upstate New York. For each of the 57 counties in upstate New York the rates for males are higher than for females. The rates for males in 56 of the 57 counties exceed the maximum rate for females (259.4). This sex differential in mortality has been commonly observed.

Despite the sex differential, there is correlation between the rates for males and females in the same counties (table 3). For 30 of the 57 counties the quartiles for males and females are

Table 1. Cities of New York State with population of 50,000 or more and location of medical schools

City	Population (1950 census)	Location of medical school
Albany (Albany County)	134, 995	Albany
Schenectady (Schenectady County)	91, 785	
Troy (Rensselaer County)	72, 311	
Buffalo (Erie County)	580, 132	Buffalo
Niagara Falls (Niagara County)	90, 872	
Mt. Vernon (Westchester County)	71, 899	New York City
New Rochelle (Westchester County)	59, 725	
New York City (Bronx, Kings, New York, Queens, and Richmond Counties)	7, 891, 957	
Yonkers (Westchester County)	152, 798	
Rochester (Monroe County)	332, 488	Rochester
Syracuse (Onondaga County)	220, 583	Syracuse
Binghamton (Broome County)	80, 674	(1)
Utica (Oneida County)	101, 531	(1)

[1] More than 50 miles away.

Table 2. Death rates per 100,000 population for arteriosclerotic heart disease (ISC 420), by county, New York State, average for 1949–51

County	Both sexes		Males		Females	
	Crude rate	Age-adjusted rate	Sex-specific rate	Age-adjusted rate	Sex-specific rate	Age-adjusted rate
New York State	316. 4	295. 9	396. 0	383. 9	240. 4	215. 2
New York City	329. 5	334. 1	414. 3	425. 9	250. 4	250. 4
Upstate New York	301. 1	260. 7	375. 5	345. 0	228. 8	183. 0
Albany	428. 6	365. 2	532. 5	487. 4	330. 9	259. 4
Allegany	255. 0	206. 9	307. 4	272. 9	202. 0	144. 7
Broome	303. 5	286. 4	384. 3	383. 3	227. 1	199. 9
Cattaraugus	260. 7	222. 1	332. 4	296. 0	185. 6	150. 3
Cayuga	334. 2	244. 4	398. 6	312. 9	271. 8	181. 6
Chautauqua	266. 3	202. 3	346. 3	277. 6	189. 7	132. 6
Chemung	294. 3	249. 0	363. 8	333. 6	229. 6	175. 4
Chenango	283. 5	216. 3	369. 2	298. 8	199. 2	139. 7
Clinton	229. 0	221. 7	278. 6	289. 0	179. 7	156. 0
Columbia	384. 4	249. 1	488. 6	340. 2	280. 5	162. 3
Cortland	289. 8	228. 0	359. 9	306. 8	222. 1	156. 5
Delaware	335. 7	250. 9	428. 2	344. 4	241. 9	163. 0
Dutchess	359. 7	296. 6	434. 8	383. 7	288. 2	216. 5
Erie	274. 4	274. 7	356. 1	367. 8	195. 3	188. 4
Essex	295. 5	243. 6	390. 1	336. 8	201. 7	150. 5
Franklin	314. 0	271. 1	431. 1	387. 7	194. 1	155. 2
Fulton	358. 1	246. 8	455. 6	338. 8	265. 8	164. 3
Genesee	279. 2	225. 0	343. 4	293. 5	215. 9	160. 6
Greene	404. 0	264. 6	498. 1	343. 1	311. 2	188. 2
Hamilton	323. 0	246. 6	412. 9	296. 9	232. 6	181. 8
Herkimer	289. 8	219. 3	372. 7	292. 9	208. 1	149. 2
Jefferson	329. 3	245. 3	417. 3	331. 9	245. 2	166. 3
Lewis	342. 6	260. 2	445. 2	353. 3	231. 7	162. 1
Livingston	289. 2	222. 1	357. 9	293. 7	221. 8	151. 9
Madison	283. 9	227. 1	353. 3	315. 0	210. 8	144. 0
Monroe	335. 8	283. 1	416. 7	370. 3	260. 3	205. 1
Montgomery	304. 9	226. 9	375. 7	302. 1	236. 2	160. 5
Nassau	238. 7	296. 8	293. 6	382. 3	185. 9	220. 1
Niagara	209. 4	215. 6	276. 6	288. 8	141. 9	143. 3
Oneida	269. 9	227. 8	353. 9	313. 6	187. 9	146. 5
Onondaga	332. 4	299. 1	403. 4	384. 2	263. 1	219. 7
Ontario	310. 3	236. 4	380. 6	320. 5	240. 7	158. 8
Orange	358. 1	282. 8	429. 8	373. 0	285. 4	199. 5
Orleans	321. 3	226. 8	359. 0	273. 3	283. 5	182. 3
Oswego	331. 0	265. 2	420. 3	352. 1	242. 9	181. 1
Otsego	346. 1	231. 1	420. 8	298. 4	274. 8	168. 2
Putnam	289. 2	221. 6	379. 1	299. 6	197. 7	141. 6
Rensselaer	378. 5	309. 7	471. 6	433. 9	288. 3	203. 0
Rockland	340. 8	314. 5	394. 0	404. 1	289. 4	239. 2
St. Lawrence	318. 5	283. 3	406. 8	387. 7	228. 4	180. 7
Saratoga	357. 3	290. 9	439. 6	372. 5	278. 3	213. 0
Schenectady	335. 6	291. 2	415. 6	379. 6	257. 2	208. 6
Schoharie	267. 2	190. 1	312. 9	231. 4	219. 9	147. 4
Schuyler	327. 1	240. 6	418. 1	321. 4	232. 2	160. 5
Seneca	298. 5	221. 2	358. 9	281. 2	239. 2	162. 0
Steuben	276. 1	226. 3	364. 0	319. 5	188. 2	138. 9
Suffolk	340. 1	305. 8	423. 5	400. 0	258. 8	218. 0
Sullivan	315. 0	236. 2	404. 3	307. 1	219. 7	161. 2
Tioga	311. 9	227. 7	389. 9	308. 1	234. 5	151. 9
Tompkins	256. 2	254. 3	303. 5	355. 4	204. 7	167. 7
Ulster	401. 1	282. 4	506. 4	380. 4	300. 6	192. 1
Warren	377. 9	284. 2	489. 0	389. 7	273. 7	191. 9
Washington	366. 0	273. 2	459. 2	367. 8	274. 7	186. 4
Wayne	316. 0	218. 0	388. 0	283. 8	245. 1	155. 4
Westchester	273. 8	257. 8	332. 7	335. 1	220. 3	192. 6
Wyoming	318. 0	226. 6	383. 0	296. 3	252. 7	162. 8
Yates	365. 0	231. 3	484. 1	326. 1	253. 7	145. 9

identical, and no county fell in the lowest quartile for one sex and the highest quartile for the opposite sex. This observation is consistent with the findings for the States.

Table 3. Counties of upstate New York classified by mortality due to arteriosclerotic heart disease (ISC 420), for males and females by quartiles, 1949–51

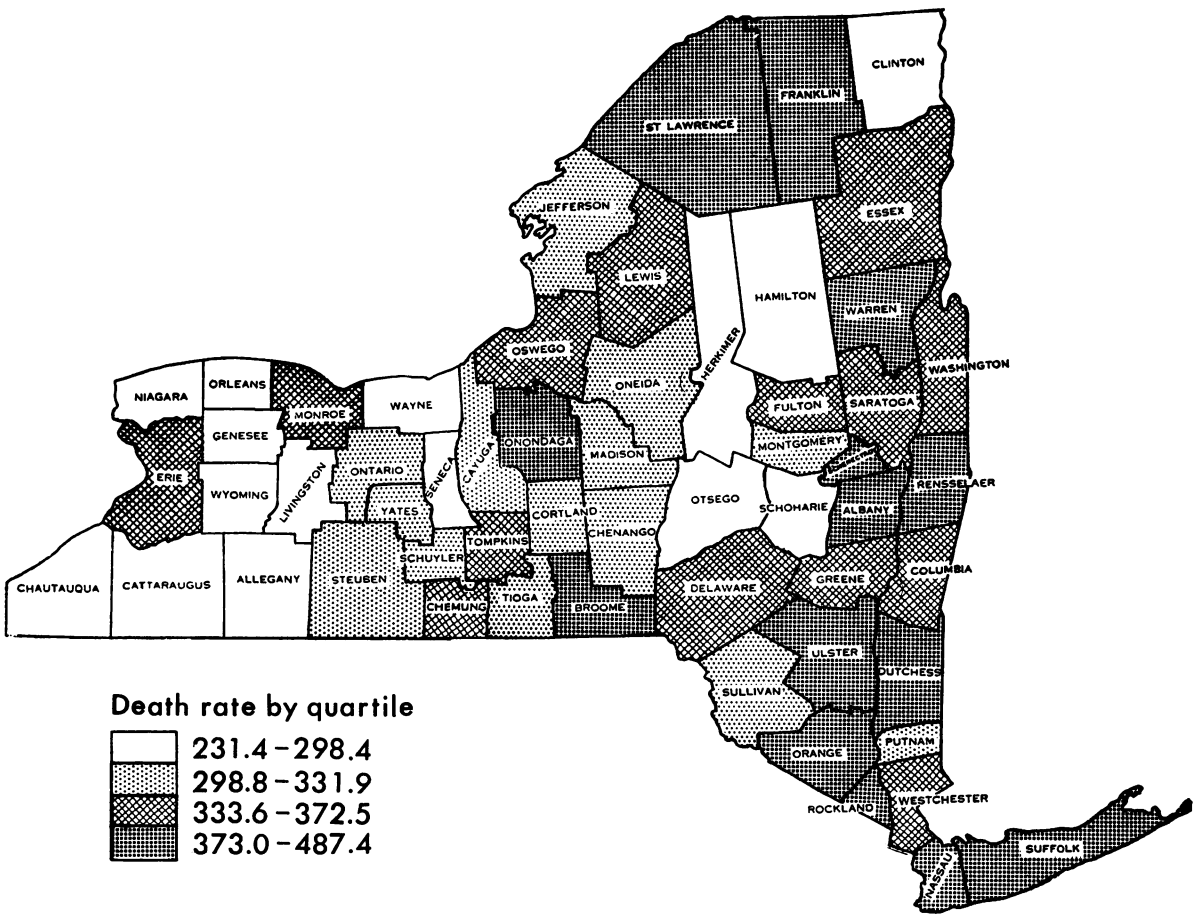
Quartile for males	Total number of counties	Quartile for females			
		1 (low)	2	3	4 (high)
Total	57	15	14	14	14
1 (low)	15	7	5	3	0
2	14	7	5	2	0
3	14	1	3	7	3
4 (high)	14	0	1	2	11

Mortality due to arteriosclerotic heart disease is considerably higher in the counties of New York State than in States of the United States. This observation holds equally for males and females:

	Limits of rates	
Sex	*States of United States*	*Counties of upstate New York*
Male	191.1–393.8	231.4–487.4
Female	87.8–217.4	132.6–259.4

Despite the difference in the relative level of mortality, the ratios between the highest and lowest rates among the counties are similar to those found among the States. The highest rate among males was 487.4 (Albany County), while the lowest was 231.4 (Schoharie County). Among females, the highest rate was 259.4 (again, Albany County), while the lowest was 132.6 (Chautauqua County). These ratios of

Figure 1. Age-adjusted death rates per 100,000 population for arteriosclerotic heart disease (ISC 420) in males, average for 1949–51



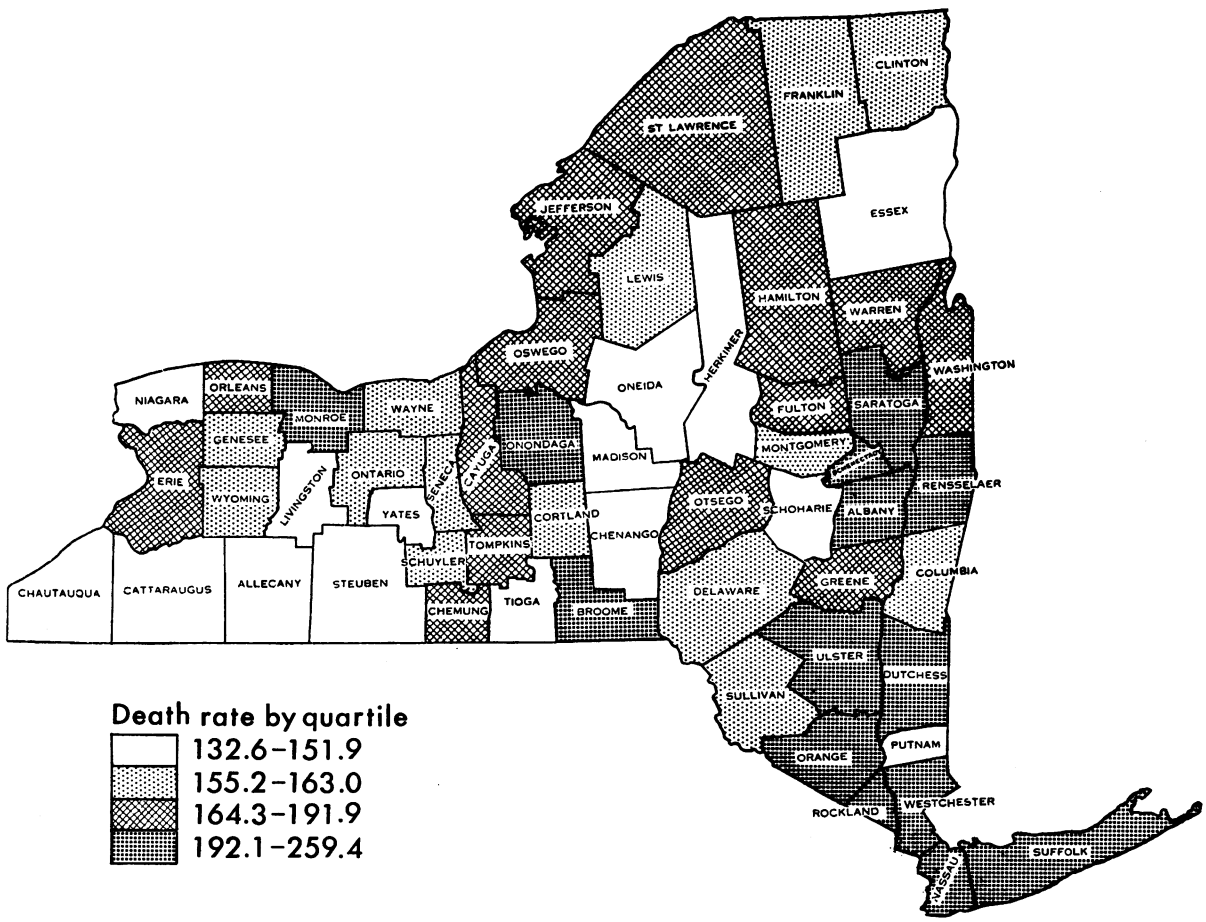
2:1 are similar to those found by Enterline and Stewart.

The range of the rates in the nationwide data and the range in the present study are also similar for each sex: 202.7 (nationwide) and 256.0 (New York) for males, and 129.6 (nationwide) and 126.8 (New York) for females. Thus, the rates for the counties are generally higher than those for the States, but only as variable as those for the States.

Quartiles established from the mortality data for the individual counties are shown in figures 1 (males) and 2 (females). For males there are a few clusters of counties with high rates: those near the southeastern tip of the State, three counties in the general proximity of Albany, and two counties in the northernmost part of the State (St. Lawrence and Franklin). Other counties with high rates are isolated: Warren, Onondaga (which includes Syracuse City), and Broome (which includes Binghamton). Although some of the counties in the highest quartile include industrial centers, a number of them do not. St. Lawrence and Franklin Counties, for example, are nonurban. For females, there is greater clustering of counties with high rates: those near the southeastern tip of the State and the four counties in the Albany area. Three isolated counties (Monroe, Onondaga, and Broome) also are in the highest quartile.

For other diagnostic categories studied (vascular lesions affecting central nervous system, hypertension with heart disease, and hypertention without mention of heart disease) there was no clustering of highly urbanized counties among the counties with high mortality. For these causes, the large industrial counties and

Figure 2. Age-adjusted death rates per 100,000 population for arteriosclerotic heart disease (ISC 420) in females, average for 1949–51



rural counties seemed to appear in random order. The rates for arteriosclerotic heart disease including coronary disease were unique in presenting some semblance of order.

The present data represent one observation in time for each county-sex group. A rate for a large urban county, based on a large population, would have a small estimated variance, while the same rate, based on a much smaller population, would have a larger estimated variance. When the deviation of the county rate from the State rate is divided by its estimated standard deviation, the result may be used as an index of deviation. These indices, here termed standard deviates, were computed for each county, placed in rank order, and divided into quartiles. This device clarified some of the mixed grouping found earlier, and a new map was prepared for the males (figure 3). In the western half of the State, all four counties with large urban centers are now in the highest (fourth) quartile (Erie, Monroe, Onondaga, and Broome Counties). Erie and Monroe Counties which were previously in the third quartile are now in the fourth quartile. In northern New York, St. Lawrence County remains in the fourth quartile, but Franklin and Warren Counties are no longer included. There were no other changes among the counties in the fourth quartile. Thus, if cognizance is taken of the expected variability of a county's rate as well as the level of the rate, some of the confused grouping found earlier in the fourth quartile is reduced. This second approach, then, suggests some association between large industrial counties and high death rates due to arteriosclerotic heart disease including coronary heart disease.

A few of the counties in New York have

Figure 3. Quartiles of standard deviates of age-adjusted death rates for arteriosclerotic heart disease (ISC 420) in males, average for 1949–51

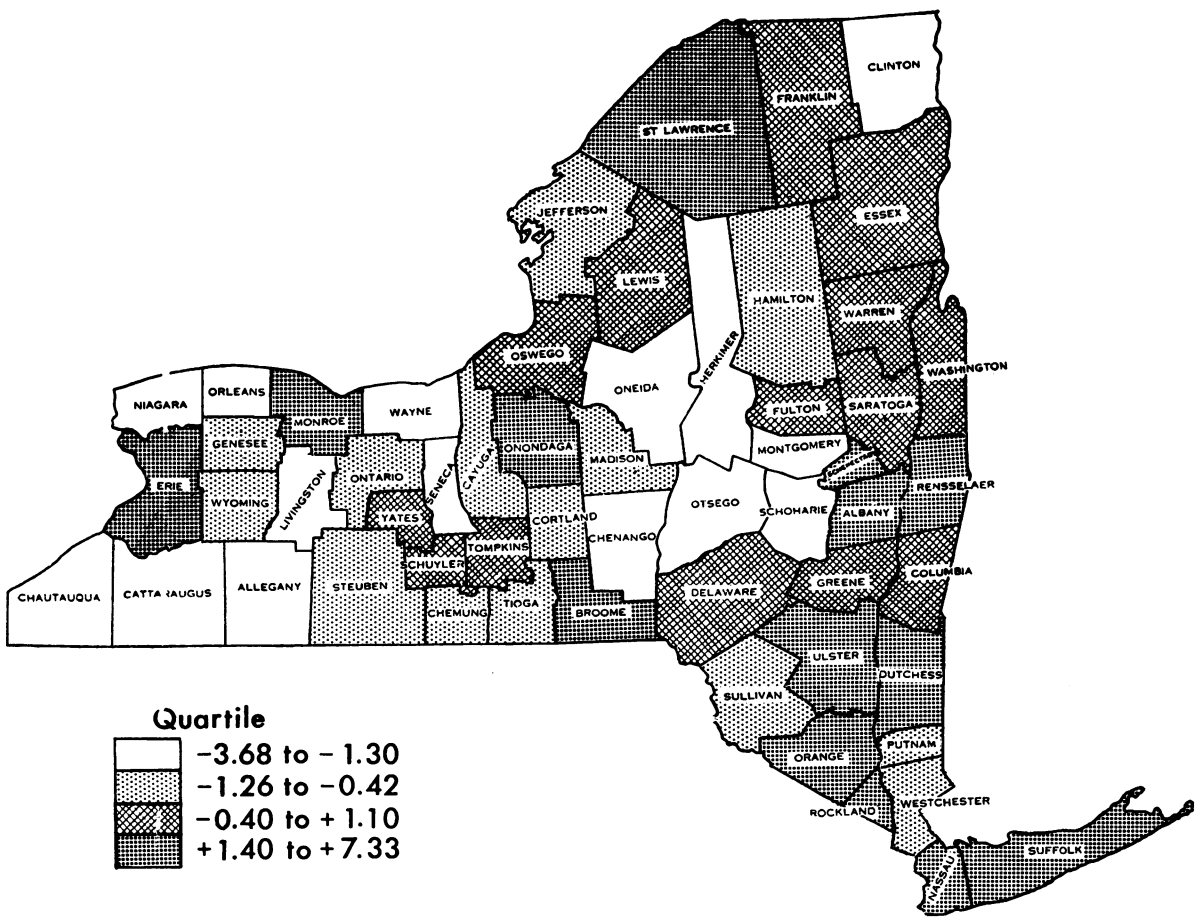


Table 4. Age-adjusted death rates for arteriosclerotic heart disease (ISC 420), for central cities and their counties, upstate New York, 1949–51

County and central city	Age-adjusted rates		Net difference between birth certificates and census [1] (percent)
	Males	Females	
Albany County	487. 4	259. 4	
Albany	543. 8	272. 5	6. 9
Broome County	383. 3	199. 9	
Binghamton	400. 5	203. 4	−3. 6
Erie County	367. 8	188. 4	
Buffalo	397. 1	200. 5	−. 2
Monroe County	370. 3	205. 1	
Rochester	388. 9	218. 8	2. 4
Oneida County	313. 6	146. 5	
Rome	267. 8	132. 4	7. 7
Utica	334. 9	162. 0	. 0
Onondaga County	384. 2	219. 7	
Syracuse	415. 1	236. 0	. 3
Rensselaer County	433. 9	203. 0	
Troy	503. 1	210. 0	14. 8
Schenectady County	379. 6	208. 6	
Schenectady	402. 6	212. 5	10. 8

[1] "Extent to which the total count of births to residents of a particular city, based on residence as reported on the birth record, differs from the total count based on residence as reported on the infant card" (*6*).

extremely small populations. Hamilton County has a population of less than 5,000; Schuyler and Yates Counties are in the 10,000–20,000 range; and Greene, Lewis, Orleans, Putnam, Schoharie, and Seneca Counties are in the 20,000–30,000 range. To reduce the variability of data for such counties, future studies might include data for 5 years instead of 3, or they might combine data for several contiguous counties. Also, the approach described in the preceding paragraph is subject to further manipulation and test with the increasing availability of computers. Without a computer, the computations are extremely lengthy and additional refinements are prohibitive.

Central Cities

One additional attempt was made to explore the relationship with urbanization. The age-adjusted rates for the nine central cities in upstate New York were computed and compared with the rates for the counties in which they are situated (table 4). For both males and females, the rates for the central cities exceeded those for the counties with one exception: Rome. This city is unusual in having an "inner district" and an "outer district," and has long been known to create problems in allocation of residence on vital records. Rome's unique divergence from the other cities may be related to this artifact.

These findings are presented merely as observations since the accuracy of the geographic allocation of deaths may be questionable. The 1950 study comparing matched birth and census records (*6*) has revealed sizable discrepancies in information on residence at time of birth (table 4) and suggests the need for a similar investigation of residence at time of death.

Nevertheless, if attention is restricted to those cities with good geographic allocation, the findings are consistent with an association (direct or indirect) between mortality from arteriosclerotic heart disease and urbanization. Additional definitive data will be needed to pursue the subject further. If air pollution, water supply, stress, or physical activity is to be studied, data for such factors will need to be gathered for communities with varying degrees of urbanization.

Demographic Characteristics

The 1950 Census of Population provided data for demographic characteristics which could be correlated with the mortality rates for arteriosclerotic heart disease. In addition, the average number of physicians in 1949 and 1951 for each county was estimated from the medical directories for those years. Coefficients of rank correlation were computed between mortality rates and these variables. They are listed in descending order of magnitude for males in table 5, with values significant at the 1 percent and 5 percent level noted.

Among males, the characteristics significantly correlated in the positive direction with the mortality rates at the 5 percent level are all related to urbanization: average number of physicians, county population, percentage of population which is urban, population density, and percentage of population which is nonwhite. Conversely, the significant negative correlation coefficients are the number of per-

sons per physician and percentage of population which is rural farm.

Some nonsignificant coefficients are noted among other indices believed to be related to urbanization: percentage of males in the labor force and percentage engaged in manufacturing.

The five characteristics with significant positive correlations for males are also significantly correlated for females. In addition, median income and percentage of the female population in the labor force are significantly correlated with arteriosclerotic heart disease for females. Among the factors negatively correlated are two which are also negatively significant for males (persons per physician and percentge of population which is rural farm) and one other: percentage of families with incomes less than $2,000.

Table 5. Rank correlation coefficients between age-adjusted death rates for arteriosclerotic heart disease (ISC 420), 1949–51, and certain demographic characteristics, 1950, counties of upstate New York

Demographic characteristic	Coefficient of rank correlation with cause 420	
	Males	Females
Total physicians (average, 1949 and 1951)	[1]+0. 55	[1]+0. 48
Total population	[1]+. 47	[1]+. 47
Percent urban	[1]+. 42	[1]+. 46
Population density	[2]+. 33	[1]+. 49
Percent nonwhite	[2]+. 31	[1]+. 42
Percent of females in the labor force	+. 23	[2]+. 27
Median income for families and unrelated individuals	+. 23	[1]+. 39
Percent population increase (1940–50)	+. 20	+. 23
Median school years completed by all persons 25 years of age or over	+. 15	+. 13
Percent of all employed persons engaged in manufacturing	+. 03	+. 12
Persons per household	−. 04	−. 18
Percent of persons 1 year old or over in same house 1949–50	−. 11	+. 06
Percent of males in the labor force	−. 11	<+. 01
Percent rural nonfarm	−. 17	−. 21
Percent of all families and unrelated individuals with income less than $2,000	−. 21	[1]−. 38
Persons per physician	[1]−. 47	[1]−. 35
Percent rural farm	[1]−. 51	[1]−. 59

[1] $P<0.01$.
[2] $0.01<P<0.05$.

These observations indicate two possible broad fields for further exploration: factors related to urbanization (air pollution, water supply, stress, lack of physical activity, and many others) and factors related to medical care (for example, medical information supplied on death certificates).

Medical Certification

As noted by other workers, the association between mortality rates for males and females may be accounted for by some factor which affects both sexes similarly, and one such factor could be some artifact of recording the causes of death. In New York State, the high rates in the large, heavily populated counties, most of them with large medical facilities, might reflect better medical certification on the death certificates. To investigate this possibility, two recording practices were examined: (*a*) the number of causes of death entered on a certificate and (*b*) preference for recording certain causes of death among the diagnostic groups studied.

Deaths for February 1957 were used for this analysis. Although there is a considerable lapse in time between the mortality data for 1949–51 and the more detailed mortality coding for February 1957, no known significant changes in the location of medical schools or in processing or querying causes of death occurred during the interval to make the use of the later data unsuitable. There may have been a slight shift in the pattern of location of new physicians in favor of counties with large cities. A small cardiovascular health center for a selected age group of male State employees was established in Albany in 1952, and this fact needs to be kept in mind with regard to the 1957 data. The establishment of the center, however, would have had no effect on this county's unusually high mortality from this cause in the 1949–51 data.

Under standard coding procedures, one cause of death is selected from each death certificate in accordance with uniform coding instructions, and the death is allocated to that cause for statistical purposes. All official vital statistics tabulations in New York State are based on these coded causes of death. However, many more causes of death appear on the certificates. On the 6,729 death certificates for February 1957, there were 13,847 separate causes of death

after duplicate four-digit codes for any individual certificate were removed, an average of 2.1 causes per certificate. Among the 6,729 death certificates, 2,348 (34.9 percent) contained only a single cause of death. The distribution of certificates by number of causes is shown below:

Number of causes	*Number of certificates*	*Percent of certificates*
1	2,348	34.9
2	2,312	34.4
3	1,509	22.4
4	470	7.0
5	75	1.1
6 or more	15	.2
Total	6,729	100.0

If one assumes that better certification of causes of death is associated with entering more detailed information on death certificates, then counties with better reporting may have higher mortality due to arteriosclerotic heart disease because of more meticulous certification. Furthermore, if such practices are the result of some radial effect emanating from the cities with medical schools and medical centers, then some correlation should exist between the level of the mortality rate and the average number of causes per certificate. The average number of causes per certificate was computed for each county and cross tabulated with its crude death rate from arteriosclerotic heart disease. Each variable was divided at its median, and the observations were tabulated in a fourfold table (table 6). If an association between the variables exists, there should be a concentration of observations in the diagonally opposing quadrants. The results do not suggest such an association.

Table 6. Counties of upstate New York by average number of causes per death certificate, February 1957, and death rates for arteriosclerotic heart disease, 1949–51

Average number of causes per certificate	Total number of counties	Cause-specific rates per 100,000	
		Less than 316.0	316.0 or more
Total	57	28	29
Less than 2.0	27	12	15
2.0 or more	30	16	14

NOTE: $\chi^2=0.5$; $d=1$; $0.50<P<0.70$.

The period between 1949–51 and 1957 saw greater attention to heart disease nationwide. Therefore, it seems reasonable to assume that use of this cause in certifying causes of death did not decline during the intervening period. Any increase in its use in counties with medical schools should have increased any positive correlation which might have existed in 1949–51. With no association demonstrated in 1957, it seems unlikely that one existed in 1949–51.

As a second index, if high mortality due to arteriosclerotic heart disease is associated with medical certification, then counties with high rates should tend to have higher proportions of their certificates allocated to this cause. Examination of the data from this point of view again provided no evidence of an association ($\chi^2=0.01$, $d=1$, $P>0.90$).

From another viewpoint, if medical certification practices artifically produce high rates in counties with more developed medical facilities, then other causes should be under-reported in those counties. The alternate cause which is particularly suspect here is vascular lesions affecting the central nervous system (ISC 330–334). Again, no evidence of such selection could be found in the data. Rank correlation coefficients for these two causes were -0.14 for males and -0.01 for females, neither of which is significant at the 5 percent level (critical value $=0.26$). This observation is consistent with that of Enterline and Stewart for the States of the United States.

Discussion

The geographic variations in arteriosclerotic heart disease mortality among the counties of upstate New York and among the States of the United States are similar. Both studies show high rates in highly industrialized areas. Lew (7) has suggested that a considerable proportion of the excess in these areas may be due to differences in medical practice across the United States. However, the range in rates for the counties of upstate New York was as large as the range among the States. Moreover, examination of two indices of medical certification in New York State gave no evidence of an

association with high mortality rates for arteriosclerotic heart disease.

Among the highest positive correlations was that between mortality and average number of physicians. This correlation was highly significant for males as well as for females. At first glance this would tend to contradict the observations in the previous paragraph. However, since World War II, there has been a tendency toward specialization and an attendant gravitation of physicians toward urban centers. The less urban areas of the State are chronically short of physicians. Therefore, the correlation noted probably reflects the gravitation of physicians toward urban centers and of specialists toward medical centers.

Mortality for males and females tended to be higher in counties with higher proportions of nonwhite individuals. Mortality from this cause is generally lower among nonwhite males than among white males, while the reverse is true among females (*7*). The nonwhite population of upstate New York, however, is a small proportion of the population, and any effect on the rates would, therefore, be relatively minor. Also, the nonwhite population is largely concentrated in large industrial centers. The correlation, therefore, probably reflects the urban concentration of nonwhite individuals. In view of the increase in the upstate nonwhite population between 1950 and 1960 and its continued gravitation toward urban centers, future studies of heart disease may need to be race specific.

The other variables which were correlated significantly for both sexes can also be related to the urban character of the counties: total population, percentage of population which is urban, and population density. While these observations by themselves do not pinpoint the the etiology of the disease, any ultimate explanation must be consistent with demographic and geographic variations.

Summary

A study was undertaken to determine geographic variations in mortality due to arteriosclerotic heart disease within New York State. Age-adjusted, sex-specific rates for this cause (ISC 420) for New York City and the remaining 57 counties were examined, and demographic characteristics were studied for correlation with the mortality rates. Part of the analysis covered, in addition to cause 420, three other cause groups: vascular lesions affecting the central nervous system (ISC 330–334), hypertension with heart disease (ISC 440–443), and hypertension without mention of heart disease (ISC 444–447).

Among the causes examined, only arteriosclerotic heart disease showed a clustering of counties with major industrial centers among the counties with high rates. This was true for both males and females.

Statistically significant positive rank correlation coefficients were found between mortality due to arteriosclerotic heart disease and several indices of urbanization: percentage of population which is urban, percentage of population which is nonwhite, and average number of physicians.

Examination of medical certification practices yielded no evidence to substantiate a hypothesis that high rates were associated with "better" certification.

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