

MORTALITY BY CAUSE OF DEATH AMONG SELECTED CENSUS BUREAU SAMPLE COHORTS FOR 1979-1981

Eugene Rogot, Paul Sorlie, National Heart, Lung, and Blood Institute
 Norman J. Johnson, Claudia S. Glover, Bureau of the Census
 Diane Makuc, National Center for Health Statistics

This paper presents early findings by cause of death from the National Longitudinal Mortality Study (NLMS), a prospective study of cohorts derived from selected Census Bureau samples. The background, general goals, study design and other related details have been described in previous reports (1-4) and in the earlier paper in this session by Johnson, et al. (5). All study death certificates were coded by nosologists at the National Center for Health Statistics (NCHS). The underlying cause of death and secondary causes were coded using the Ninth Revision of the International Classification of Diseases.

The main objective in this present study is to compare NLMS results to those for the US, by cause of death. Some new data on characteristics of the decedents, by cause of death, will also be presented.

Some material to be presented is in terms of crude death rates. However, for Cohorts D and F--the April and August 1980 CPS cohorts--we were able to calculate age-standardized mortality ratios for cardiovascular deaths by state of residence and by place of birth, as was done in the previous paper for all causes of death. See earlier paper for definition of the 8 cohorts (5). Much of our data at this time has been studied in terms of proportionate mortality statistics, since these depend only on the deaths occurring in this first follow-up period.

Results

Table 1 presents proportionate mortality statistics for the 15 leading causes of death in the US in 1980 and for the 8 cohorts combined, for 1979-1981. Overall, the two distributions are quite similar, with the first 10 leading causes in the US ranked identically in the NLMS. Among these, the Census cohorts had relatively more deaths from heart disease and cancer, but less from stroke and pneumonia/influenza than the US. Other differences appeared to be fairly minor. The lower percents for stroke and for pneumonia/influenza are thought to arise from the fact that persons in nursing homes or other long-term institutions are not included in Census surveys (though they may have later moved to such an institution). The proportion of persons in nursing homes with these conditions is thought to be fairly high. The reason for the relative excess of cancer among the cohorts - 24% compared to 21% of US deaths - is not known. It is possible, however, that nursing homes and other long-term institutions, in this instance have relatively few cancer patients which would account for some of the observed difference.

Among the last 5 specified causes of death in Table 1, there are important differences

Table 1. Death rates and percent of total deaths for the 15 leading causes of death for the United States in 1980 and percent of total deaths for 8 cohorts in the NLMS 1979-1981.

Rank (Ninth Revision International Classification of Diseases, 1975)	Cause of death	U.S.		NLMS
		Rate per 100,000	Percent of total deaths	Percent of total deaths
...	All causes.....	878.3	100.0	100.0
1	Diseases of heart...390-398, 402, 404-429	336.0	38.2	40.0
2	Malignant neoplasms, including neoplasms of lymphatic and hematopoietic tissues...140-208	183.9	20.9	24.2
3	Cerebrovascular diseases...430-438	75.1	8.6	7.8
4	Accidents and adverse effects E 800- E949	46.7	5.3	5.1
...	Motor vehicle accidents...E810-E825	23.5	2.7	2.5
...	All other accidents and adverse effects...E800-E807, E826-E949	23.2	2.6	2.6
5	Chronic obstructive pulmonary diseases and allied conditions...490-496	24.7	2.8	3.0
6	Pneumonia and influenza...480-487	24.1	2.7	1.9
7	Diabetes mellitus...250	15.4	1.8	1.8
8	Chronic liver disease and cirrhosis...571	13.5	1.5	1.5
9	Atherosclerosis...440	13.0	1.5	1.3
10	Suicide...E950-E959	11.9	1.4	1.1
11	Homicide and legal intervention...E960-E978	10.7	1.2	.9
12	Certain conditions originating in the perinatal period...760-779	10.1	1.1	.0
13	Nephritis, nephrotic syndrome, and nephrosis...580-589	7.4	.8	.9
14	Congenital anomalies...740-759	6.2	.7	.2
15	Septicemia...038	4.2	.5	.4
...	All other causes.....	95.6	10.9	9.9
Total deaths		1,989,841		12,975

between the two data sources for the perinatal conditions and for congenital anomalies. For both causes, the Census cohorts are seriously underrepresented. For Cohorts D and F, for example, only 9 deaths were observed for these conditions. This may be contrasted to 67 deaths expected if the US proportions prevailed. This is consistent with the deficiencies noted in the earlier paper for the "under 1" and the "1 - 4" age groups since these two conditions together account for about 70% of all deaths under age 1 in the US, and about 14% of deaths in the 1 - 4 age group. We know that the Census surveys do not include neonates dying in the first day of life. Mortality in the first 24 hours accounts for about 40% of all infant deaths. Thus, part of the deficiency in infant deaths arises from this fact. In addition, there may be problems in ascertainment of death for the very young, due to the lack of a Social Security Number, and possible use of nicknames.

In the earlier paper, monthly death rates for 7 of the 8 cohorts pooled together were compared to the US over the three year follow-up period, 1979-1981. In similar fashion, we now compare monthly death rates for cardiovascular (CV) and non-cardiovascular (Non-CV) causes of death. The results for CV are shown in Figure 1.

The comparison for CV is very much like

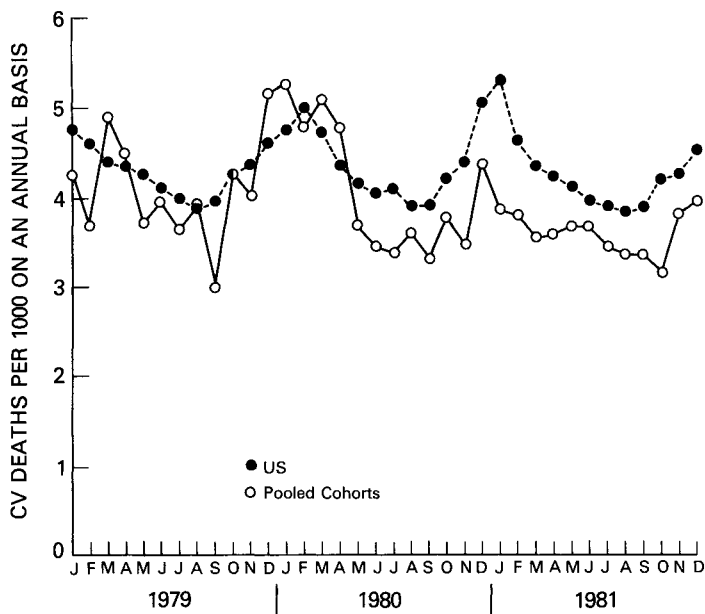
that seen for total deaths in the earlier paper. Overall, the two curves in Figure 1 show much the same cyclic pattern - high death rates in winter months and low death rates in summer months. There is more fluctuation seen for the pooled cohorts than for the US curve, as would be expected due to the much smaller N's for the cohorts than for the US, resulting in larger sampling errors. Another point of interest is that rates observed in 1979 and the first part of 1980 for the pooled cohorts are close to the US values, but from May 1980 on, are consistently lower than the US. The latter is expected due to the non-institutional character of these cohorts; the former may be due, in part, to Cohorts A and B dominating the early period. Cohorts A and B have older populations than the US and therefore may have higher CV rates. In the later period, Cohorts A and B do not dominate the picture.

The correlation in CV rates between the pooled cohorts and the US was .60.

Non-CV monthly rates were also compared. The correlation was positive, but not as strong as for CV ($r=.39$).

Another aspect studied was geographic variation in CV mortality. For the US, age-standardized mortality ratios (SMR's) were calculated for CV deaths by state of residence in 1980. SMR's were derived by an indirect age-adjustment using the US, 1980

Figure 1
**CARDIOVASCULAR DEATH RATES BY MONTH: US AND
 NLMS POOLED COHORTS, 1979-1981.**



age-specific CV death rates as standard rates. Five age groups were used: < 15, 15-44, 45-64, 65-74 and 75+. The standard rates were applied to the population at risk (in these age groups) for each state to obtain expected numbers of CV deaths. The SMR was defined as the observed number of CV deaths divided by the expected number. The SMR for the US for CV mortality was set at 100.

As cited earlier, we were able to

CV SMR's by State: U.S., 1980

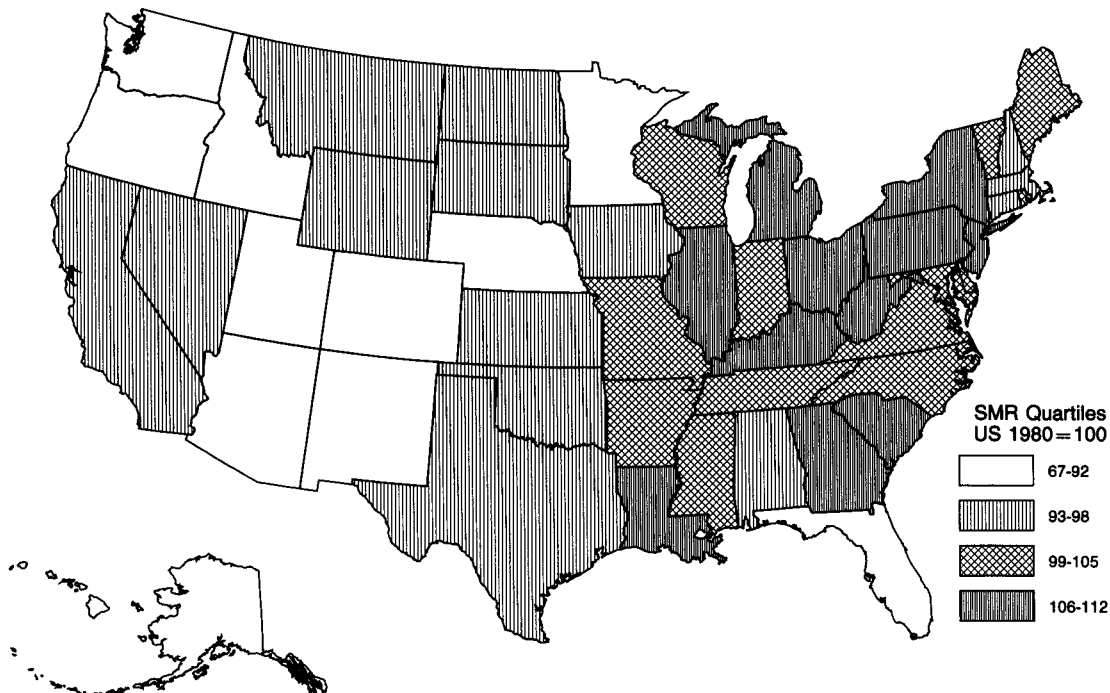


Figure 2

calculate SMR's for state of residence, and for nativity, for Cohorts D and F. This was done by applying the same standard rates just described to the numbers at risk in each state for each of these cohorts to obtain expected numbers of CV deaths by state. The latter was then adjusted for the different lengths of follow-up by multiplying by 1.72 for Cohort D and by a factor of 1.37 for Cohort F. Observed and expected numbers by state were then combined for the two cohorts

CV SMR's by State: Combined Cohorts D and F, 1980-1981

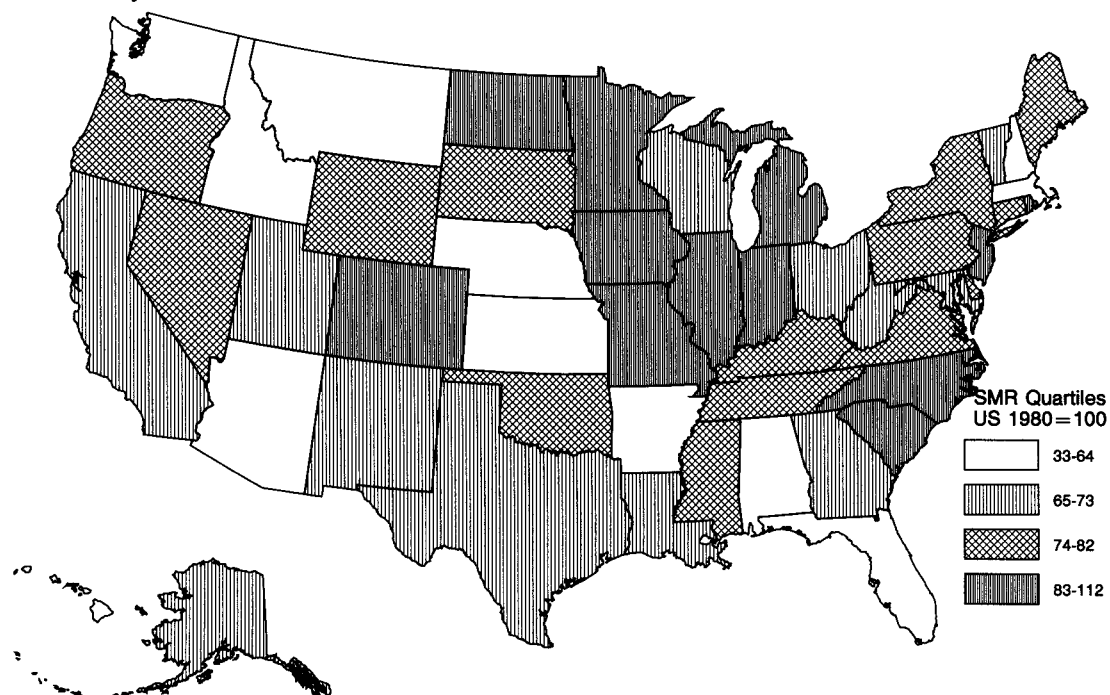


Figure 3

Table 2. Observed (O) and expected (E) deaths from cardiovascular diseases (ICD 390-459) by sex and nativity: NLMS cohorts D and F combined, 1980-1981

	<u>Males</u>				<u>Females</u>		<u>Total</u>		
	O	E	O/E	O	E	O/E	O	E	O/E
Total of combined cohorts (D & F)	1040	926.81	112	731	1365.77	54	1771*	2292.58	77
Native born	943	796.52	118	644	1165.69	55	1587*	1962.21	81
Foreign born	96	99.93	96	84	154.49	54	180	254.42	71
Unknown	1	30.31	--	3	45.56	--	4	75.87	--
US, 1980			128			82			100

Table 3. Percent distribution of deaths from selected causes by place of death and status of decedent when death occurred in hospital or medical center: 8 cohorts in the NLMS, 1979-1981 and 39 reporting areas in the U.S., 1979

		<u>Percent distribution</u>						
Total # of deaths		<u>Hospital or medical center</u>			Other at hosp. Instit. or med. center	DOA at hosp. or med. center	Other places	Place unknown
		Inpatient	Outpat. or emergency room	Status unknown				
		<u>All causes</u>						
NLMS	10,109	53.7	5.2	1.7	9.1	8.1	21.9	0.4
US	1,348,083	53.7	4.4	1.6	13.4	9.0	17.7	0.1
		<u>Malignant neoplasms (140-208)</u>						
NLMS	2,391	69.4	0.7	1.8	7.7	3.0	17.1	0.2
US	282,511	69.8	1.1	1.5	11.3	3.0	13.3	0.1
		<u>Major cardiovascular (390-448 US; 390-459 NLMS)</u>						
NLMS	5,154	47.0	7.6	1.7	10.8	10.0	22.5	0.3
US	684,864	46.8	5.8	1.6	17.0	10.7	18.1	0.1
		<u>Ischemic heart (410-414)</u>						
NLMS	3,167	42.9	10.0	1.6	8.3	12.5	24.5	0.3
US	404,547	42.6	7.5	1.5	13.6	13.0	21.6	0.1
		<u>Cerebrovascular (430-438)</u>						
NLMS	780	65.3	2.1	1.3	18.1	2.6	10.4	0.4
US	118,152	59.2	1.5	1.7	26.3	2.9	8.5	0.1
		<u>Chronic obstructive pulmonary disease (490-496)</u>						
NLMS	295	64.7	3.4	2.0	7.5	3.4	19.0	0.0
US	35,033	65.9	2.9	1.7	10.8	5.2	13.4	0.1
		<u>Accidents (E800-E949)</u>						
NLMS	526	24.7	9.3	1.7	1.9	19.4	40.7	2.3
US	71,487	28.1	9.3	1.7	2.2	23.0	35.0	0.7

and the SMR calculated. States were ranked by SMR and quartile maps are given in Figure 2 for the US and in Figure 3, for Cohorts D and F combined. Some similarities are evident as are differences. The correlation in the CV SMR between the two combined cohorts and the US is a weak positive one with $r = .37$. This correlation, however, is significantly different from zero, and is in the expected direction.

SMR's for CV deaths were also calculated for Cohorts D and F combined, by nativity and sex. These data are shown in Table 2. No comparable current data for the US are available.

For males, the foreign born have a lower SMR than the native born - 96 compared to 118. For females, there was no essential difference between foreign born and native born. These results need to be investigated in more detail, especially by country of birth and by race. Somewhat similar results were reported by Kitagawa and Hauser (6) for a sample of deaths in the U.S. in 1960.

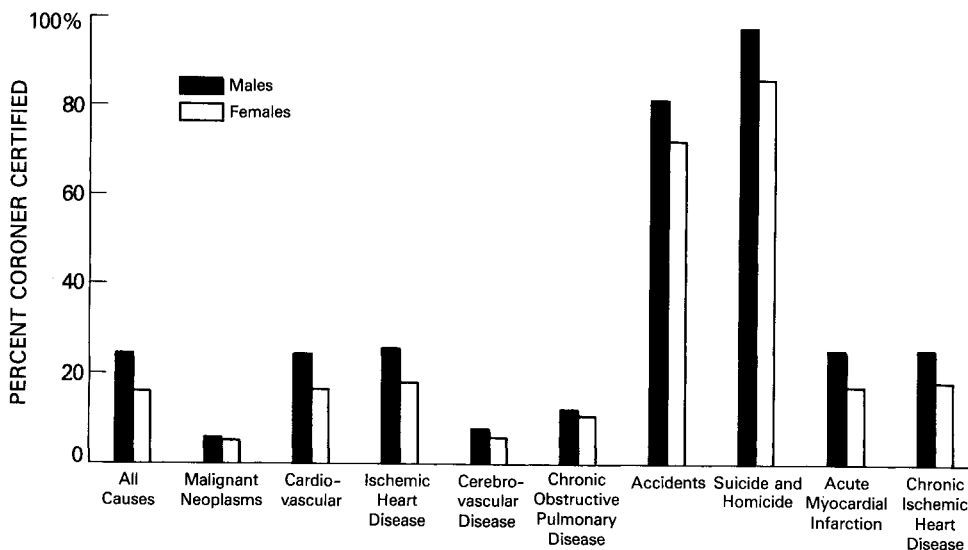
Characteristics of Decedents

Using information recorded on the death certificate, the decedents can be characterized by place of death and by whether the death was certified by a coroner or by a practicing physician. The detailed information on place of death was available from 39 states in 1979 and from 40 states in 1980 and 1981. Thus, the total number of deaths characterized by place of death is less than the total of 12,975 deaths observed in the complete National Longitudinal Mortality Study (NLMS).

In Table 3, the percent distribution of place of death among the NLMS deaths in 1979-1981 is presented along with the similar distribution of place of death for those deaths occurring in the U.S. in the 39 states in 1979. For all causes, the distributions are similar except for the lower percentage of "Other institution" (mainly nursing home) deaths in the NLMS and the higher percentage of deaths occurring in "Other places" in the NLMS sample. This is not surprising since

Figure 4

PERCENT OF DEATHS CERTIFIED BY CORONERS FOR SELECTED CAUSES BY SEX: NLMS, 1979-1981



the NLMS sample consists of noninstitutionalized individuals (except for Cohort E). The distribution of place of death is also given for the major causes of death. For each cause shown there are fewer nursing home deaths and more at home and street deaths in the NLMS sample. Except for the differences probably due to inclusion of the institutional population, the place-of-death distributions are similar.

The distribution of place of death for the major causes reflects the different natural history and progression of each disease. As shown in Table 3, approximately half of the deaths for ischemic heart disease occur outside of the hospital and over 20% occur at home or street ("Other places"). For accidental death, over 60% occur outside of the hospital. Fewer than 30% of malignant neoplasm deaths occur outside of the hospital. While a large proportion of stroke deaths occur in hospital (over 60%), many of the remaining deaths occur in a nursing home setting (over 20% in US).

The complete NLMS death file was characterized by whether the death was certified by a coroner or medical examiner, or by an attending physician (Figure 4). Only a small percentage of deaths were lacking this information. These were principally deaths occurring in the state of Alaska. There are no published data from the US which can be compared to these data.

Coroner and medical examiner certified deaths comprise a unique group in terms of medical documentation. While the coroner's or medical examiner's function is to rule out foul play, the coroner seldom performs the necessary procedures to determine with precision the particular natural cause of death. Thus, natural causes of death with a high frequency of coroner certification, such as ischemic heart disease, may be subject to more uncertainties in diagnosis than those diseases that are rarely certified by coroners, such as cancers.

Approximately 24 percent of the male deaths and 16 percent of the female deaths were certified by a coroner or medical examiner. In Figure 4, for short, the coroner or medical examiner is designated as "coroner". As expected, this percent varied considerably by cause of death. Few of the long term chronic diseases were certified by a coroner. For malignant neoplasms, stroke and chronic obstructive lung disease, around 10% or fewer deaths were certified by a coroner. For more acute manifestations of disease like acute myocardial infarction, 25% of the men and 17 percent of the women were certified by a coroner. For motor vehicle accidents, suicide, and homicide, deaths were certified for the most part by a coroner, though even for these deaths, fewer female deaths were so certified. Coroners do not certify 100 percent of these deaths since some of them are likely to be deaths occurring much later than the event producing the injury.

To sum up -- We compared mortality by cause for our Census cohorts in the 1979 to 1981 follow-up period with standard cross-sectional mortality data, as collected by the NCHS for this same period. The two sets of data were quite similar in terms of proportionate mortality for most of the leading causes of death. However, serious deficiencies were noted in the NLMS for perinatal conditions and for congenital anomalies.

Seasonal patterns for CV disease were compared and found to be similar. This was also the case for non-CV disease.

Geographic patterns in CV mortality by state were examined for two of the eight cohorts and compared to the U.S. A weak positive correlation of .37 was found. Small numbers may be a problem here. We expected a much higher correlation.

Place of death was studied for all eight cohorts for major causes of death and compared to the U.S. These distributions were similar.

Mortality data were also available from the NLMS by type of certifier. About 20% of all deaths were certified by a coroner or medical examiner. This percent varied widely by cause of death.

REFERENCES

- (1) Rogot, E., Feinleib, M., Ockay, K.A., Schwartz, S.H., Bilgrad, R. and Patterson, J.E. On the Feasibility of Linking Census Samples to the National Death Index for Epidemiologic Studies: A Progress Report. American Journal of Public Health Vol. 73, No. 11:1265-1269, November 1983.
- (2) Rogot, E., Schwartz, S.H., O'Connor, K.V. and Olsen, C.L. The Use of Probabilistic Methods in Matching Census Samples to the National Death Index. 1983 Proceedings of the Section on Survey Research Methods, American Statistical Association, 319-324.
- (3) Makuc, D., McMillen, M., Feinleib, M., McMillen, D., Schwartz, S. and Rogot, E. An Overview of the U.S. National Longitudinal Mortality Study. 1984 Proceedings of the Section on Social Statistics, American Statistical Association.
- (4) Rogot, E., Sorlie, P. and Johnson, N. Probabilistic Methods in Matching Census Samples to the National Death Index. Manuscript submitted to the Journal of Chronic Diseases.
- (5) Johnson, N., Rogot, E., Glover, C., Sorlie, P. and McMillen, M. General Mortality Among Selected Census Bureau Sample Cohorts for 1979-1981. Manuscript for 1985 Proceedings of the Section on Survey Research Methods, American Statistical Association.
- (6) Kitagawa, E.M. and Hauser, P.M. Differential Mortality in the United States: A Study in Socioeconomic Epidemiology. Vital and Health Statistics Monographs. American Public Health Association. Harvard University Press, 1973.