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PROVISIONAL ESTIMATES OF SELECTED COMPARABILITY RATIOS BASED ON DUAL CODING OF 1966 DEATH CERTIFICATES BY THE SEVENTH AND EIGHTH REVISIONS OF THE INTERNATIONAL CLASSIFICATION OF DISEASES

Introduction

The International Lists of Causes of Death have been revised approximately every 10 years since 1900. Each decennial revision has produced some break in the comparability of cause-of-death statistics. As described below the Eighth Revision contains major modifications in several sections of the lists. Also, the rules for selecting the underlying cause have been simplified. In addition, changes have been introduced in the special rules and decisions which adapt the coding procedures to reporting practices in the United States. Consequently, measures of the resultant degree of discontinuity in cause-of-death statistics are essential to interpretation of mortality trends.

This report presents ratios to ascertain the effects of the *Eighth Revision International Classification of Diseases, Adapted for Use in the United States* (ICDA)[1] on the comparability of mortality statistics for selected causes for all age groups combined, and separately for infants (tables 1 and 2). The ICDA is based on the Eighth Revision of the International Classification of Diseases (ICD).[2]

Meaning of ratios.—These comparability ratios are based on coding the same deaths occurring in 1966 by both the Seventh and Eighth Revisions. More specifically, as described in the Appendix, these ratios are based on all deaths in 1966 coded according to the 1955 ICD (Seventh Revision) using the coding procedures in effect for that revision, and on a random sample of these same 1966 deaths stratified by cause of death (tables A and B) and coded according to the ICDA (Eighth Revision, 1967) using the coding procedures in effect for the latter revision. The year 1966 was selected because it was the most recent year for which final mortality statistics according to the Seventh Revision were available at the time of this study. The ratios are computed by dividing the numbers of deaths (estimated from the stratified random sample) assigned to particular causes according to the ICDA (Eighth Revision) by the numbers of deaths assigned to comparable causes under the Seventh Revision (tables 1 and 2).

A comparability ratio of 1.00 indicates that the same number of deaths were assigned to a particular cause or combination of causes whether the Seventh or Eighth Revision was used. A ratio showing perfect correspondence (1.00) between the two revisions does not necessarily indicate that the cause was unaffected by changes in classification and coding procedures because the changes may compensate for each other.

A ratio of less than 1.00 results from one of two situations: (1) a decrease in assignment of deaths to a cause in the Eighth Revision as compared to the Seventh, or (2) the cause as described by the Eighth Revision is not exactly the same cause as represented by the Seventh Revision titles with which it is compared; rather it is only a part of the Seventh Revision title with which it is compared.

Usually a ratio of more than 1.00 results from an increase in assignments of deaths to a cause in the Eighth Revision as compared with the Seventh. At times the increase may result, however, from the fact that the Eighth Revision cause is not the equivalent of that described by the Seventh Revision title with which it is compared. For example, see the

[1]U.S. Department of Health, Education, and Welfare, Public Health Service, National Center for Health Statistics, PHS Pub. No. 1693, issued Oct. 1967.

[2]World Health Organization, International Classification of Diseases (Eighth Revision), 1967.

discussion of Other diseases of arteries, arterioles, and capillaries in "Some Specific Examples" (page 3).

List of ratios in this report.—The first national mortality statistics coded according to the ICDA are based on a 10-percent sample of deaths for January 1968. These data appear in *Monthly Vital Statistics Report* (MVSR) of the National Center for Health Statistics, beginning with Vol. 17, No. 2. This Supplement to the MVSR presents the comparability ratios needed to adjust mortality data collected during the period 1958-67 when the Seventh Revision was in use. The causes or groups of causes for which comparability ratios are included are those to be regularly shown in the MVSR together with some of the major components of these causes.

Major Features and Changes in the Classification

The Detailed List of the Eighth Revision consists of 671 categories of diseases and morbid conditions, 182 categories for classification of the external cause of injury, and 187 categories for characterization of injuries according to the nature of the lesion. These detailed categories are designated by three-digit numbers. There are also four-digit subcategories in the ICDA that provide further specificity or more information regarding etiology or manifestations of the disease. The classification is arranged in 17 main sections or chapters. The important changes are summarized for each of these sections in the Introduction to the ICDA, pages xxiv-xxviii. Following are some of the many changes most pertinent to the causes shown in the MVSR.

Infective and parasitic diseases.—In the Seventh Revision, list titles for diarrheal conditions were scattered over several sections of the classification. In the Eighth Revision all of the Seventh Revision subdivisions for these conditions, including those for infants, are brought together under one category, Diarrheal disease (009).

Diseases of the nervous system and sense organs.—Vascular lesions affecting the central nervous system (330-334) in the Seventh Revision has been transferred in the Eighth Revision to Section VII, "Diseases of the circulatory system," where they appear as Cerebrovascular disease (430-438).

Certain causes of perinatal morbidity and mortality.—This section represents an integration of the former Chapter X "Certain diseases of early infancy" and the "Classification of causes of stillbirth" (Y30-Y39) in the Seventh Revision. The age qualifications used in previous revisions to classify the same conditions in or outside this section have been deleted. For example, Pneumonia of newborn (763) of the Seventh Revision is no longer in this section. Instead, it is included in the Eighth Revision with Pneumonia (480-486), to which group pneumonias are assigned without regard to age.

Accidents, poisonings, and violence.—A new subsection (ICDA E980-E989) has been introduced for the classification of deaths where it was not possible for the certifier to determine whether the injuries were accidentally or purposely inflicted.

Selection of Comparable Titles

The purpose of the comparability ratio is to serve as a factor to adjust the data published during the Seventh Revision to the level which they would have had under the Eighth Revision. The Seventh Revision category numbers shown in tables A and B were selected from the List of 258 Selected Causes of Death and the List of 55 Selected Causes of Infant Deaths. These are the most detailed cause-of-death lists for which mortality statistics were regularly published by age, color, and sex during the period the Seventh Revision was in use (1958-67). Therefore the use of these two lists provides for the largest possible number of cause of death comparability ratios by age, color, and sex. These ratios by age, color, and sex will be presented in an enlarged study of comparability data that is now in preparation.

Each of the ratios in tables 1 and 2 has been computed by dividing the number of deaths assigned to a particular cause (or combination of causes) using the Eighth Revision (ICDA) by the number of deaths in 1966 assigned to the equivalent cause or combination of causes by the Seventh Revision.[3]

Precision of Estimates

The figures in columns 4 and 5 of tables 1 and 2 are pairs of positive numbers such that the probability that the true value of the comparability ratio is included in the interval defined by them is 95 percent.

Some Specific Examples

Hypertensive heart disease.—The Eighth Revision cause Hypertensive heart disease with or without renal disease (402, 404) is compared with the Seventh Revision cause Hypertensive heart disease (440-443), with a resulting ratio of 0.398 (table 1). All but a negligible part of this 60-percent reduction

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[3]The "Rules for Selection of Causes of Death for Primary Mortality Tabulation" used with the Seventh Revision are shown in *Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death*, Vol. I. World Health Organization, 1957, pp. 359-371.

in the number of deaths assigned to hypertensive heart disease by the Eighth Revision as compared with the number assigned to this cause by the Seventh Revision has resulted from changes in the International Classification of Diseases. The following table shows the results of coding by the Seventh and Eighth Revisions of a random sample of 2,389 of the 54,176 deaths in 1966 assigned to Hypertensive heart disease with or without renal disease (ICD Nos. 440-443).

Eighth Revision titles	Seventh Revision		Eighth Revision	
	Category numbers	Number of deaths	Category numbers	Number of deaths
Total	----------	2,389	---------	2,389
Hypertensive heart disease with or without renal disease	440-443	2,389	402,404	914
Hypertensive heart disease	440,441,443	1,855	402	467
Hypertensive heart and renal disease	442	534	404	447
Chronic ischemic heart disease with hypertensive disease	–	–	412.0	1,426
Other titles of Eighth Revision	–	–	–	49

As shown above, an estimated 60 percent of all deaths assigned in the Seventh Revision to Hypertensive heart disease (440-443) are transferred in the Eighth Revision to Chronic ischemic heart disease with hypertensive disease (412.0). Moreover, almost all of the deaths (447 out of 534) assigned to Hypertensive heart disease with arteriolar nephrosclerosis (442) in the Seventh Revision were assigned to the comparable category Hypertensive heart and renal disease (404) in the Eighth Revision.

Syphilis and its sequelae.—The Eighth Revision cause Syphilis and its sequelae (090-097) is compared with the Seventh Revision cause Syphilis and its sequelae (020-029). The resulting ratio is only 0.322 (table 1). This 68 percent difference is also, in great part, ascribable to a classification change. In the Seventh Revision "aneurysm of aorta, not otherwise specified" was assigned to ICD No. 022, a subgroup under Syphilis and its sequelae (020-029); whereas in the Eighth Revision, deaths are assigned to the subgroup ICDA No. ·093.0 under Syphilis and its sequelae (090-097) only if specified as syphilitic. If not specified as syphilitic these aortic aneurysms are assigned to Aortic aneurysm (nonsyphilitic) (ICDA No. 441), a category under the following group title in the List of 282 Selected Causes of Death: Diseases of arteries, arterioles, and capillaries (ICDA Nos. 440-448). The following table shows the results of coding by the Seventh and Eighth Revisions of a random sample of 780 of the 1,434 deaths in 1966 assigned to Aneurysm of aorta (ICD No. 022).

Eighth Revision titles	Seventh Revision		Eighth Revision	
	Category numbers	Number of deaths	Category numbers	Number of deaths
Total	----------	780	---------	780
Syphilis and its sequelae	020-029	780	090-097	47
Aneurysm of aorta, specified as syphilitic	022	780	093.0	41
Diseases of arteries, arterioles, and capillaries	----------	–	440-448	681
Aortic aneurysm (nonsyphilitic)	----------	–	441	672

Also as shown above, an estimated 86 percent of all deaths assigned in the Seventh Revision to Aneurysm of aorta (022) under Syphilis and its sequelae (020-029) are assigned in the Eighth Revision to Aortic aneurysm (nonsyphilitic) (441).

Other diseases of arteries, arterioles, and capillaries.—In the *Current Mortality Sample* the following division of the Eighth Revision group title Diseases of arteries, arterioles, and capillaries (440-448) is shown: Arteriosclerosis (440); and Other diseases of arteries, arterioles, and capillaries (441-448). A ratio of 1.549 is obtained by comparing the group title corresponding to ICDA Nos. 441-448 with the combination of the following three titles in the Seventh Revision: Aortic aneurysm, nonsyphilitic and dissecting aneurysm (451); Gangrene of unspecified cause (455); and Other arterial diseases (452-454,456). The estimated number of deaths assigned to each of the three-digit subcategories in the Eighth Revision

Eighth Revision titles	Seventh Revision		Eighth Revision	
	Category numbers	Number of deaths	Category numbers	Number of deaths
Total	----------	15,213	---------	23,567
Other diseases of arteries, arterioles, and capillaries	451-456	15,213	441-448	[4]23,567
Aortic aneurysm (nonsyphilitic)	451	11,270	441	12,196
Gangrene	455	348	445	2,720
All other diseases of arteries, arterioles, and capillaries	452-454, 456	3,595	442-444, 446-448	8,555

[4]The subtotals do not add up exactly to the total because of the application of different sampling fractions.

under 441-448 together with the estimated number of deaths assigned to each of the comparable three-digit subcategories in the Seventh Revision are shown on the preceding page.

As these figures indicate, the large comparability ratio (1.549) results from an increase in assignments of deaths to each of the three subcategories in the Eighth Revision as compared with the corresponding assignments in the Seventh Revision. As stated above, 86 percent of the deaths assigned in the Seventh Revision to Aneurysm of Aorta (022) under Syphilis and its sequelae (020-029) are assigned in the Eighth Revision to Aortic aneurysm (nonsyphilitic) (441). Also, about 83 percent of the 2,342 deaths assigned in the Seventh Revision to General arteriosclerosis with mention of gangrene as a consequence (450.1) are assigned in the Eighth Revision to Arteriosclerotic gangrene (445.0).

Finally, about 21 percent of the 10,078 deaths assigned in the Seventh Revision to Hernia and intestinal obstruction (560,561,570) are transferred in the Eighth Revision to Arterial embolism and thrombosis of mesenteric artery (444.2).

Birth injuries.—Comparison of birth injuries in the Eighth Revision (764-768(.0-.3),772) with birth injuries in the Seventh Revision (760,761) results in a ratio of 0.330 (table 2). This 67-percent reduction in the number of deaths assigned to birth injuries reflects the transfer of conditions considered as birth injuries under the Seventh Revision to a number of causes under the Eighth Revision, including Other complications of pregnancy and childbirth (ICDA No. 769); Conditions of the placenta (ICDA No. 770); and Conditions of umbilical cord (ICDA No. 771).

Use of Ratios as Revision Factors

The following table illustrates the application of comparability ratios to determine whether changes for two death rates were real or resulted from the adoption of the Eighth Revision. The figures used are from the 10-percent sample for January-June 1967 and January-June 1968.

Eighth Revision titles	Comparability ratio	Death rate per 100,000 population: January-June		
		1968: Eighth Revision	1967: Seventh Revision	
			Reported	Revised by ratio in (1)
	(1)	(2)	(3)	(4)
Hypertensive heart disease with or without renal disease (402,404)	0.398	9.7	26.6	10.6
Active rheumatic fever and chronic rheumatic heart disease (390-398)	1:138	8.7	7.6	8.6

In each instance the reported death rate in column 3 was multiplied by the ratio in column 1 to obtain the death rate for January-June 1967 that is most nearly comparable to the death rate for January-June 1968. A comparison of the revised death rates for the earlier period with the corresponding death rates for January-June 1968 shows a small decrease in the death rate for hypertensive heart diseases and no significant change in the death rate for active rheumatic fever and chronic rheumatic heart disease.

Table A. LIST OF COMPARABLE CATEGORY NUMBERS FOR SELECTED CAUSES OF DEATH ACCORDING TO THE EIGHTH AND SEVENTH REVISIONS, AND SIZE OF SAMPLE REQUIRED FOR SELECTED CAUSES BY THE SEVENTH REVISION: FOR MONTHLY VITAL STATISTICS REPORT AND ANNUAL SUMMARY OF PROVISIONAL STATISTICS

Strata	List title according to the Eighth Revision of the International Classification of Diseases, 1967	Category numbers according to the Eighth Revision, 1967 (1)	Category numbers according to the Seventh Revision, 1955 (2)	Number of deaths in 1966 (final count), by the Seventh Revision (3)	Number of deaths required in sample (4)
	All causes	----------	----------	1,863,149	95,168
1	Enteritis and other diarrheal diseases	008,009	571,764	3,336	1,429
2	Tuberculosis, all forms	010-019	001-019	7,625	1,883
3	Syphilis and its sequelae	090-097	020-029	2,193	1,168
4	Other infective and parasitic diseases	Remainder of 000-136	030-138	7,496	1,875
	Malignant neoplasms, including neoplasms of lymphatic and hematopoietic tissues	140-209	140-205		By addition:
5	Malignant neoplasm of buccal cavity and pharynx	140-149	140-148	6,800	1,828
6	Malignant neoplasm of digestive organs and peritoneum	150-159	150-156A,157-159	95,079	2,436
7	Malignant neoplasm of respiratory system	160-163	160-164	54,934	2,391
8	Malignant neoplasm of breast	174	170	27,533	2,292
9	Malignant neoplasm of genital organs	180-187	171-179	40,378	2,354
10	Malignant neoplasm of urinary organs	188,189	180,181	14,166	2,125
11	Malignant neoplasm of all other and unspecified sites	170-173,190-199	156B,165,190-199	35,032	2,333
12	Leukemia and aleukemia	204-207	204	14,012	2,121
13	Other neoplasms of lymphatic and hematopoietic tissues	200-203,208,209	200-203,205	15,802	2,159
14	Benign neoplasms and neoplasms of unspecified nature	210-239	210-239	4,923	1,658
15	Diabetes mellitus	250	260	34,597	2,332
16	Anemias	280-285	290-293	3,452	1,450
17	Meningitis	320	340	2,324	1,204
	Major cardiovascular diseases	390-448	330-334,400-456		By addition:
	Diseases of heart	390-398,402,404,410-429	400-443		By addition:
18	Active rheumatic fever and chronic rheumatic heart disease	390-398	400-402,410-416	15,012	2,143
19	Hypertensive heart disease with or without renal disease	402,404	440,441,442,443	54,176	2,389
20	Ischemic heart disease	410-414	420,422.1	615,126	2,490
21	Chronic disease of endocardium and other myocardial insufficiency	424,428	421,422.0,422.2	11,646	2,058
22	All other forms of heart disease	420-423,425-427,429	430-434	31,042	2,314
23	Hypertension	400,401,403	444-447	11,380	2,050
24	Cerebrovascular disease	430-438	330-334	204,841	2,470
25	Arteriosclerosis	440	450	39,907	2,349
26	Other diseases of arteries, arterioles, and capillaries	441-448	451-456	15,213	2,147
27	Acute bronchitis and bronchiolitis	466	500	987	709
	Influenza and pneumonia	470-474,480-486	480-483,490-493,763		By addition:
28	Influenza	470-474	480-483	2,830	1,327
29	Pneumonia	480-486	490-493,763	63,262	2,405
	Bronchitis, emphysema, and asthma	490-493	501,502,527.1,241		By addition:
30	Chronic and unqualified bronchitis	490,491	501,502	5,164	1,684
31	Emphysema	492	527.1	20,252	2,225
32	Asthma	493	241	4,324	1,584
33	Peptic ulcer	531-533	540,541	10,321	2,013
34	Hernia and intestinal obstruction	550-553,560	560,561,570	10,078	2,003
35	Cirrhosis of liver	571	581	26,692	2,286
36	Cholelithiasis, cholecystitis and cholangitis	574,575	584,585	4,592	1,619
37	Nephritis and nephrosis	580-584	590-594	11,540	2,055
38	Infections of kidney	590	600	9,498	1,980
39	Hyperplasia of prostate	600	610	3,217	1,407
40	Congenital anomalies	740-759	750-759	18,158	2,197
41	Certain causes of mortality in early infancy	760-769.2,769.4-772, 774-778	760-762,765-776	48,917	2,378
42	Symptoms and ill-defined conditions	780-796	780-795	23,960	2,264
43	All other diseases	Residual	By subtraction:	85,808	2,429
	Accidents	E800-E949	E800-E962		By addition:
44	Motor vehicle accidents	E810-E823	E810-E835	53,041	2,387
45	All other accidents	E800-E807,E825-E949	E800-E802,E840-E962	60,522	2,401
46	Suicide	E950-E959	E963,E970-E979	21,281	2,237
47	Homicide	E960-E978	E964,E980-E985	11,606	2,057
	All other external causes	E980-E999	-	-	-
48	Injury undetermined whether accidentally or purposely inflicted[1]	E980-E989	-	-	-
49	Injury resulting from operations of war	E990-E999	E990-E999,E965	74	74

[1]This is a new category according to the Eighth Revision. Based on a random sample of 195 deaths assigned to this new category, it includes terms which were classified in the Seventh Revision primarily under E800-E962 "Accidents," 76 deaths; and under E963,E970-E973 "Suicide," 100 deaths. The remaining 19 of the 195 deaths were distributed over homicide and other categories of the Eighth Revision.

Table B. LIST OF COMPARABLE CATEGORY NUMBERS FOR SELECTED CAUSES OF INFANT DEATH ACCORDING TO THE EIGHTH AND SEVENTH REVISIONS, AND SIZE OF SAMPLE REQUIRED FOR SELECTED CAUSES BY THE SEVENTH REVISION: FOR MONTHLY VITAL STATISTICS REPORT AND ANNUAL SUMMARY OF PROVISIONAL STATISTICS

Strata	List title according to the Eighth Revision of the International Classification of Diseases, 1967	Category numbers according to the Eighth Revision, 1967	Category numbers according to the Seventh Revision, 1955	Number of deaths in 1966 (final)	Number of deaths required in sample
	All causes	----------	----------	85,516	15,357
1	Certain gastrointestinal diseases	004,006-009,535,561,563	045-048,543,571,572,764	1,646	993
2	Influenza and pneumonia	470-474,480-486	480-483,490-493,763	9,438	1,977
3	Congenital anomalies	740-759	750-759	12,200	2,075
4	Birth injuries	764-768(.0-.3),772	760,761	7,088	1,848
5	Asphyxia of newborn, unspecified	776.9	762	13,956	2,120
6	Immaturity unqualified	777	776	13,228	2,103
7	Other diseases of early infancy	Remainder of 760-778[1]	765-774	14,609	2,135
8	All other causes (residual)	By subtraction: Total minus strata 1-7	By subtraction: Total minus strata 1-7	13,351	2,106

[1]Assumes the value of 773 will be zero.

Table 1. COMPARABILITY RATIOS FOR SELECTED CAUSES: BASED ON A STRATIFIED RANDOM SAMPLE OF 1966 DEATHS ASSIGNED ACCORDING TO THE EIGHTH REVISION AND ON ALL DEATHS ASSIGNED ACCORDING TO THE SEVENTH REVISION OF THE INTERNATIONAL CLASSIFICATION OF DISEASES: UNITED STATES

Cause of death (Eighth Revision of the International Classification of Diseases, 1967)	Number of deaths assigned according to—		Provisional comparability ratio[2]	95 percent confidence limits[3]	
	Eighth Revision (estimated from sample)	Seventh Revision (total count)[1]		Upper	Lower
	(1)	(2)	(3)	(4)	(5)
All causes	----------	1,863,149	----------	--------	--------
Enteritis and other diarrheal diseases 008,009	3,954	3,336	1.185	1.265	1.106
Tuberculosis, all forms 010-019	7,244	7,625	0.950	0.981	0.919
Syphilis and its sequelae 090-097	707	2,193	0.322	0.341	0.304
Other infective and parasitic diseases Remainder of 000-136	7,369	7,496	0.983	1.023	0.943
Malignant neoplasms, including neoplasms of lymphatic and hematopoietic tissues 140-209	300,210	303,736	0.988	0.993	0.984
Malignant neoplasm of buccal cavity and pharynx 140-149	7,172	6,800	1.055	1.055	1.028
Malignant neoplasm of digestive organs and peritoneum 150-159	89,139	95,079	0.938	0.946	0.929
Malignant neoplasm of respiratory system 160-163	56,242	54,934	1.024	1.030	1.017
Malignant neoplasm of breast 174	27,293	27,533	0.991	0.996	0.986
Malignant neoplasm of genital organs 180-187	40,318	40,378	0.999	1.005	0.992
Malignant neoplasm of urinary organs 188,189	14,350	14,166	1.013	1.027	0.999
Malignant neoplasm of all other and unspecified sites 170-173,190-199	35,033	35,032	1.000	1.025	0.976
Leukemia and aleukemia 204-207	13,980	14,012	0.998	1.006	0.989
Other neoplasms of lymphatic and hematopoietic tissues 200-203,208,209	16,683	15,802	1.056	1.076	1.035
Benign neoplasms and neoplasms of unspecified nature 210-239	4,767	4,923	0.968	1.008	0.929
Diabetes mellitus 250	34,376	34,597	0.994	1.003	0.984
Anemias 280-285	3,259	3,452	0.944	1.008	0.881
Meningitis 320	2,229	2,324	0.959	1.003	0.915
Major cardiovascular diseases 390-448	995,985	997,343	0.999	1.002	0.995
Diseases of heart 390-398,402,404,410-429	727,348	727,002	1.000	1.004	0.996
Active rheumatic fever and chronic rheumatic heart disease 390-398	17,081	15,012	1.138	1.173	1.103
Hypertensive heart disease with or without renal disease 402,404	21,575	54,176	0.398	0.418	0.378
Ischemic heart disease 410-414	654,172	615,126	1.063	1.067	1.059
Chronic disease of endocardium and other myocardial insufficiency 424,428	9,644	11,646	0.828	0.878	0.778
All other forms of heart disease 420,423,425-427,429	24,876	31,042	0.801	0.826	0.776
Hypertension 400,401,403	9,336	11,380	0.820	0.847	0.794
Cerebrovascular disease 430-438	200,938	204,841	0.981	0.987	0.975
Arteriosclerosis 440	34,796	38,907	0.894	0.916	0.872
Other diseases of arteries, arterioles, and capillaries 441-448	23,567	15,213	1.549	1.617	1.481
Acute bronchitis and bronchiolitis 466	1,179	987	1.195	1.330	1.059
Influenza and pneumonia 470-474,480-486	65,627	66,092	0.993	1.004	0.982
Influenza 470-474	2,718	2,830	0.960	0.978	0.943
Pneumonia 480-486	62,909	63,262	0.994	1.006	0.983
Bronchitis, emphysema, and asthma 490-493	29,767	29,959	0.994	1.019	0.968
Chronic and unqualified bronchitis 490,491	5,513	5,164	1.068	1.170	0.965
Emphysema 492	21,243	20,252	1.049	1.059	1.038
Asthma 493	3,011	4,324	0.696	0.813	0.580
Peptic ulcer 531-533	10,106	10,321	0.979	1.047	0.912
Hernia and intestinal obstruction 550-553,560	7,633	10,078	0.757	0.780	0.734
Cirrhosis of liver 571	26,775	26,692	1.003	1.014	0.992
Cholelithiasis, cholecystitis and cholangitis 574,575	4,509	4,592	0.982	1.005	0.958
Nephritis and nephrosis 580-584	10,151	11,540	0.880	0.896	0.863
Infections of kidney 590	9,747	9,498	1.026	1.053	0.999
Hyperplasia of prostate 600	2,909	3,217	0.904	0.920	0.889
Congenital anomalies 740-759	18,304	18,158	1.008	1.025	0.991
Certain causes of mortality in early infancy 760-769.2,769.4-772,774-778	47,360	48,917	0.968	0.977	0.959
Symptoms and ill-defined conditions 780-796	23,815	23,960	0.994	1.022	0.966
All other diseases Residual	80,681	85,808	0.940	0.958	0.927
Accidents E800-E949	105,137	113,563	0.926	0.935	0.917
Motor vehicle accidents E810-E823	51,662	53,041	0.974	0.975	0.969
All other accidents E800-E807,E825-E949	53,475	60,522	0.884	0.900	0.868
Suicide E950-E959	19,990	21,281	0.939	0.950	0.929
Homicide E960-E978	11,527	11,606	0.993	1.004	0.983
All other external causes E980-E999	3,059	-	-	-	-
Injury undetermined whether accidentally or purposely inflicted E980-E989	2,959	-	-	-	-
Injury resulting from operations of war E990-E999	68	74	0.919	0.919	0.919

[1]Figures in this column are number of deaths in 1966 assigned to the categories in the Seventh Revision selected as the most nearly comparable to the Eighth Revision categories, as shown in table A.
[2]Ratio of deaths assigned according to the Eighth Revision to deaths assigned according to the Seventh Revision.
[3]The probability is 95 percent that the true comparability ratio will have a value between the upper and lower limits shown.

Table 2. COMPARABILITY RATIOS FOR SELECTED CAUSES OF INFANT DEATHS: BASED ON A STRATIFIED RANDOM SAMPLE OF 1966 INFANT DEATHS ASSIGNED ACCORDING TO THE EIGHTH REVISION AND ON ALL INFANT DEATHS IN 1966 ASSIGNED ACCORDING TO THE SEVENTH REVISION OF THE INTERNATIONAL CLASSIFICATION OF DISEASES: UNITED STATES

Cause of death (Eighth Revision of the International Classification of Diseases, 1967)	Number of deaths assigned according to—		Provisional comparability ratio[1]	95 percent confidence limits[2]	
	Eighth Revision (estimated from sample)	Seventh Revision (total count)		Upper	Lower
	(1)	(2)	(3)	(4)	(5)
All causes	----------	85,516	----------	--------	--------
Certain gastrointestinal diseases 004,006-009,535,561,563	1,770	1,646	1.075	1.113	1.038
Influenza and pneumonia 470-474,480-486	10,146	9,438	1.075	1.137	1.014
Congenital anomalies 740-759	12,644	12,200	1.036	1.073	1.000
Birth injuries 764-768(.0-.3),772	2,336	7,088	0.330	0.391	0.269
Asphyxia of newborn, unspecified 776.9	12,185	13,956	0.871	0.893	0.849
Immaturity unqualified 777	11,482	13,228	0.868	0.912	0.824
Other diseases of early infancy Remainder of 760-778[3]	21,571	14,609	1.477	1.505	1.448
All other causes Residual	13,410	13,351	1.004	1.025	0.984

[1]Ratio of deaths assigned according to the Eighth Revision to deaths assigned according to the Seventh Revision.
[2]The probability is 95 percent that the true comparability ratio will have a value between the upper and lower limits shown.
[3]Assumes the value of 773 will be zero.

APPENDIX

BRIEF SUMMARY OF STATISTICAL DESIGN

The sizes of the strata in the random sample stratified by cause of death drawn to estimate the numerators of the comparability ratios are shown in tables A and B. The numbers of deaths in column 4 of these two tables are the sizes of samples estimated to be necessary to obtain results of the specified precision (with the maximum error to be tolerated set at about 5 percent).

General Plan for Deaths at All Ages

The strata, corresponding to the causes or groups of causes of death according to the Seventh Revision, into which the total number of deaths in 1966 are divided for the purposes of this report, are designated by L; the total number of deaths in 1966, by N; and the number of deaths in the general or hth stratum, by N_h. Therefore,

$$N = \sum_{h}^{L} N_h = N_1 + N_2 + \ldots + N_h \ldots + N_L. \qquad (1)$$

Similarly, the strata according to the Eighth Revision are designated by L'; and the number of deaths in the general or h'th stratum, by $N'_{h'}$. Thus, according to the Eighth Revision, the total number of deaths in 1966 may be represented as follows:

$$N = \sum_{h'}^{L'} N'_{h'} = N'_1 + N'_2 + \ldots + N'_{h'} \ldots + N'_{L'}. \qquad (2)$$

Let the number in the stratum according to the Eighth Revision to which the hth stratum according to the Seventh Revision is most nearly comparable (table A) be designated by $N'_{h'}$. Then the equation for the comparability ratio (designated by $R_{h'}$) that is to be estimated is:

$$R_{h'} = \frac{N'_{h'}}{N_h}. \qquad (3)$$

Let the estimate of $R_{h'}$ be denoted by $r_{h'}$; and the estimate of $N'_{h'}$ be denoted by $x'_{h'}$. Inasmuch as N_h is known, the problem of obtaining an estimate of $R_{h'}$ reduces to the problem of obtaining an estimate of $N'_{h'}$. This estimate $r_{h'}$ may be defined as follows:

$$r_{h'} = \frac{x'_{h'}}{N_h}. \qquad (4)$$

To obtain the estimate $x'_{h'}$, L random subsamples were drawn by the computer from the L strata into which the total number of deaths in 1966 were divided according to classification by the Seventh Revision. These L random subsamples were then classified according to the Eighth Revision.

The size of the random subsample drawn from the hth stratum of N is denoted by n_h; and the size of the stratified random sample drawn from all deaths in 1966, classified according to the Seventh Revision is:

$$n = \sum_{h}^{L} n_h.$$

The number of deaths in the stratum according to the Eighth Revision to which the hth stratum of the stratified random sample n, according to the Seventh Revision, is most nearly comparable, is designated by $n'_{h'}$; and the total number of deaths at all ages drawn in the stratified random sample, classified according to the Eighth Revision, is designated by n'. Thus, n' may be represented as follows:

$$n' = \sum_{h'}^{L'} n'_{h'}. \qquad (6)$$

where L' designates the strata in the sample according to the Eighth Revision.

Estimator of the numerator.—Inasmuch as the denominators of these comparability ratios (defined in equation 3) are the total counts of deaths in the stratum in 1966 according to the Seventh Revision, the only values estimated from the stratified random sample (n) are, as stated above, the numerators—the numbers of deaths that would be assigned to each of the strata if all deaths in 1966 were classified by the Eighth Revision. The estimator of these numerators is represented as follows:

$$x'_{h'} = \frac{N_h x_h}{n_h} + \sum_{j \neq h}^{J} \frac{N_j x_j}{n_j} \qquad (7)$$

where x_h is the number of deaths in the hth stratum of the sample—the stratum according to the Seventh Revision selected as most nearly comparable to the h'th stratum of the Eighth Revision, and where x_j represents the number of deaths in any except the hth stratum of the stratified random sample that were coded to the h'th stratum by the Eighth Revision. The total number of strata other than the hth that contained deaths that were assigned to the h'th stratum by the Eighth Revision is represented by J.

In equation 7 $x_h = \sum_{i=1}^{n_h} x_{hi}$, where x_{hi} takes on the value 1 if the death it represents was assigned by the Eighth Revision to stratum $N'_{h'}$; and takes on the value 0 if the death it represents was not assigned to stratum $N'_{h'}$. Similarly, in equation 7 $x_j = \sum_{j=1}^{n_j} x_{ji}$, where x_{ji} takes on the value 1 if the death it represents was assigned to stratum $N'_{h'}$; and takes on the value 0 if the death it represents was not assigned to stratum $N'_{h'}$.

Variance of the numerator.—The variance of $x'_{h'}$, the estimated total of deaths that are coded by the Eighth Revision to the category numbers comprising $N'_{h'}$,[5] is:

$$\sigma^2_{x'_{h'}} = N_h^2 (1 - f_h) \frac{S_h^2}{n_h} + \sum_{j \neq h}^{J} N_j^2 (1 - f_j) \frac{S_j^2}{n_j}; \qquad (8)$$

where f_h is the sampling fraction (n_h/N_h), and f_j is the sampling fraction (n_j/N_j). For a variate, such as in this study, that takes on only the value 0 or 1,

$$S_h^2 = N_h P_h Q_h / (N_h - 1), \qquad (9)$$

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[5] *Cf.* Hansen, Hurwitz, and Madow, *Sample Survey Methods and Theory*, Vol. I, Chap. 4, p. 122, second printing, 1957.

where P_h is the proportion of deaths in N_h that would take on the value 1, that is, that would be assigned to $N'_{h'}$ if coded by the Eighth Revision, and where $Q_h = 1 - P_h$. The sample variance for stratum h may be expressed as follows:

$$s_h^2 = (n_h p_h q_h)/(n_h - 1). \tag{10}$$

Similarly, the sample variance for the general term among all the strata in the stratified random sample that include deaths assigned to stratum h' by the Eighth Revision may be written:

$$s_j^2 = (n_j p_j q_j)/(n_j - 1). \tag{11}$$

Substituting the right-hand members of equations 10 and 11 for S_h^2 and S_j^2, respectively, in equation 8 gives the following as the estimate from the sample of $\sigma^2_{x'_{h'}}$:

$$s^2_{x'_{h'}} = \frac{N_h(N_h - n_h)}{n_h - 1}(p_h q_h) + \sum_{j \neq h}^{J} \frac{N_j(N_j - n_j)}{n_j - 1}(p_j q_j). \tag{12}$$

Inasmuch as $p_h = (x_h/n_h)$; $q_h = 1 - p_h$; $p_j = (x_j/n_j)$; and $q_j = 1 - p_j$, we have

$$s^2_{x'_{h'}} = \frac{N_h(N_h - n_h)}{n_h}\left(\frac{x_h}{n_h - 1} - \frac{x_h^2}{n_h(n_h - 1)}\right) + \sum_{j \neq h}^{J} \frac{N_j(N_j - n_j)}{n_j}\left(\frac{x_j}{n_j - 1} - \frac{x_j^2}{n_j(n_j - 1)}\right). \tag{13}$$

Standard error of the estimate of the ratio.—Inasmuch as the variance of a constant times a random variable is the constant squared times the variance of the random variable, it follows that

$$s^2_{r_{h'}} = \left(\frac{1}{N_h}\right)^2 s^2_{x'_{h'}}. \tag{14}$$

Taking the square root of the left-hand member of the above equation gives the estimated standard error of $r_{h'}$, denoted $s_{r_{h'}}$:

$$s_{r_{h'}} = \left(\frac{1}{N_h}\right)\left(s^2_{x'_{h'}}\right)^{1/2} s_{x'_{h'}}\left(\frac{1}{N_h}\right). \tag{15}$$

Confidence interval for the ratio.—Once the standard error of the estimate of the comparability ratio (denoted $s_{r_{h'}}$) is known, confidence intervals for $R_{h'}$, the true value of the comparability ratio as defined in equation 3 may be computed. The required degree of confidence that a range will cover the true value of $R_{h'}$ has been specified for this study to be 95 percent.

Employing the usual notation in the table for the normal distribution[6] it may be stated that for a given percentage p (equal to 5 percent in the present study) the p% value λp of the normal distribution is defined by the condition:

$$\text{Probability}\ (|r_{h'} - R_{h'}| > \lambda p\, s_{r_{h'}}) = \frac{p}{100}. \tag{16}$$

With the 5-percent value λp of the normal distribution equal to 1.9600 this gives:

$$r_{h'} - 1.9600\ s_{r_{h'}} < R_{h'} < r_{h'} + 1.9600\ s_{r_{h'}}.$$

To illustrate, let $r_{h'} = 1.1852$; and $s_{r_{h'}} = 0.0406$. This gives the relation:

$$(r_{h'} - 1.9600\ s_{r_{h'}}) < R_{h'} < (r_{h'} + 1.9600\ s_{r_{h'}});$$

$$\text{or}\ \ 1.1056 < R_{h'} < 1.2648.$$

Thus, we have two positive numbers (1.1056, 1.2648) such that the probability that the true value of $R_{h'}$ is included in the interval defined by them is 95 percent.

General Plan for Infant Deaths

The plan for infant deaths (table B) is analogous to that for deaths at all ages. For infant deaths, however, there are only 8 strata in the stratified random sample, as compared with 48 strata in the stratified random sample for deaths at all ages.

[6] *Cf.* Harald Cramer, *Mathematical Methods of Statistics*, table II, p. 558.

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