
Apparent Changes in Cancer Mortality, 1968

*A study of the effects of the introduction of the Eighth
Revision International Classification of Diseases*

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THE INTERNATIONAL CLASSIFICATION of Diseases (ICD) is revised decennially to improve its usefulness and to bring it up to date. Unfortunately, the revision of code books used for classification of diseases creates problems. Not only do code numbers change, but the categories sometimes include different entities. The resulting break in comparability of cause-of-death statistics presents a problem for those who study trends in mortality. The effects of changes on mortality statistics resulting from earlier revisions of the ICD have been reported previously (1-3).

Our concern is with the impact on the 1968 cancer mortality statistics of the introduction of

the eighth revision of the ICD in 1965 (4) that was adapted for use in the United States (5). When it was observed that U.S. lung cancer deaths had increased nearly twice as much from 1967 to 1968 as they had increased in the previous 4 or 5 years—from 5 to approximately 10 percent—a research project was devised to study all sites of cancer, as well as of the lung.

In this paper we show the increase or decrease in cancer mortality figures for each site of cancer from 1967, when the seventh revision of the ICD (6) was being used, to 1968, when the eighth revision (4) was used for the first time.

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Effect of Changes on Trends

Trends in cancer mortality have been studied for almost a century (7-11). In studying these trends, it has been difficult to determine if breaks in continuity of mortality from certain sites are real or a result of changes introduced by revised classifications or changes in coding rules. Changes in coding procedures have affected long-term trends for other causes of death in the past. For example, changes in the method of selecting the cause of death for primary mortality tabulations between the fifth and sixth revisions of the ICD resulted in a decline of approximately 50 percent in the number of deaths assigned to diabetes (2). Sometimes such changes make it difficult to trace the long-term trends for a cause of death, especially when minor changes occur that may be undetected without careful study.

The National Center for Health Statistics is concerned with such changes and tries to evaluate the effects of changes on mortality data. Comparison studies are made when the ICD is revised; a sample of death certificates is coded by the two different systems, and comparability ratios are published (3, 12). These studies enable public health workers to evaluate the net effects of changes in categories and coding procedures.

Selection of Primary Cause

Compilations of mortality statistics usually include only one cause of death in the tabulations. This cause is designated as the "underlying cause," and is defined in the ICD as "(a) the disease or injury which initiated the train of morbid events leading directly to death or (b) the circumstances

of the accident or violence which produced the fatal injury."

For about 25 percent of deaths, physicians record only one cause. A recent report by Armstrong and Israel (13) on U.S. deaths in 1968, the first recent year in which multiple causes were tabulated, showed that only one cause was mentioned in 24.5 percent of the more than 1 million death certificates studied; in the remaining 75 percent of the death certificates, generally a sequence of events or diseases was entered. In the Third National Cancer Survey's 1969-71 series of 172,510 deaths, where cancer was mentioned somewhere on the certificate, 40 percent showed cancer only (unpublished data, National Cancer Institute).

In the majority of instances, the physician who completes the death certificate indicates what he believes to be the underlying cause of death. Problems arise when (a) the physician mentions several diseases and fails to indicate which, in his opinion, was the underlying cause or (b) the physician uses ambiguous language.

To assist in the classification of the underlying cause of death, one section in the ICD for international use includes broad guidelines for the selection and interpretation of causes of death. These instructions are not very detailed. Concerning cancer, instructions are given only for multiple sites. Although the instructions for multiple sites are not included in the ICD adapted for use in the United States (ICDA), they are incorporated in the Vital Statistics Instruction Manuals prepared by the National Center for Health Statistics (14-17). These manuals contain highly specific coding rules accompanied by detailed examples.

Trends in Lung Cancer Death Rates

Between 1963 and 1967 deaths from all sites of cancer in the United States increased about 2 percent each year, and cancer of the lung and bronchus increased approximately 5.7 percent annually (table 1). In 1968, however, the first year that the eighth revision of the ICD went into effect, the annual increase for primary lung and bronchus cancer rose to 9.6 percent and then fell to 4.1 percent in 1969 (table 1). Secondary cancer of the thoracic organs—secondary of lung, bronchus, pleura, and mediastinum—showed an average annual increase of 14.8 percent between 1963 and 1967, a drop of 61.5 percent in 1968, and an increase of about 16 percent in 1969,

Table 1. Total U.S. mortality for certain categories of malignant neoplasms and all sites, 1963–69

Year	Primary or unspecified lung, bronchus, trachea, pleura			Secondary thoracic organs ¹			Unspecified site			All sites		
	Number of deaths	Differences		Number of deaths	Differences		Number of deaths	Differences		Number of deaths	Differences	
		Number	Percent		Number	Percent		Number	Percent		Number	Percent
1963.....	43,568			1,220			13,587			285,362		
1964.....	45,838	+2,270	+5.2	1,411	+191	+15.7	13,938	+351	+2.6	289,577	+4,215	+1.5
1965.....	48,483	+2,645	+5.8	1,612	+201	+14.2	15,000	+1,062	+7.6	297,588	+8,011	+2.7
1966.....	51,478	+2,995	+6.2	1,859	+247	+15.3	14,789	-211	-1.4	303,736	+6,148	+2.1
1967.....	54,407	+2,929	+5.7	2,116	+257	+13.8	16,194	+1,405	+9.5	310,983	+7,247	+2.4
1968.....	59,656	+5,249	+9.6	815	-1,301	-61.5	14,936	-1,258	-7.8	318,547	+7,564	+2.4
1969.....	62,130	+2,474	+4.1	945	+130	+16.0	14,744	-192	-1.3	323,092	+4,545	+1.4

¹ Bronchus, lung, mediastinum, pleura, and other respiratory organs.

similar to what it had been before 1968. Although the number of deaths classified to cancer of other and unspecified sites had fluctuated from 1963 to 1967, a notable decrease of about 8 percent occurred in 1968. The relatively sharp increase in the number of primary lung and bronchus cancer deaths in 1968, coupled with the decreases in secondary cancer of thoracic organs and cancer of other and unspecified sites, suggested that these shifts were due in part to classification changes.

Comparison of Cancer Mortality, 1967–68

In evaluating changes in cancer mortality from 1967 to 1968, it is important to study the effect of secular trends in diseases independent of changes in classification. Table 2 shows the number of U.S. cancer deaths coded to the various sites in 1967, when the seventh revision of the ICD was used, and the number coded to these equivalent sites in 1968, when the eighth revision, adapted, was used. To make the 1968 figures comparable to the 1967 mortality figures, a conversion table prepared by the American Cancer Society was used to identify the comparable categories (18).

Table 2 also shows expected deaths (based on the average annual increase or decrease from 1963 to 1967) and the ratio of observed to expected deaths in 1968. The ratio of 1.04 for lung and bronchus cancer means that an additional 4 percent or 2,078 more lung cancer deaths than expected were recorded. If this difference was real, it would be a matter of considerable importance. However, the greatest decrease for any site occurred in cancer of the thoracic organs (lung, bronchus, mediastinum) specified as secondary—

a ratio of 0.45 or a 55 percent reduction. There was also a 12 percent decrease in cancer of other and unspecified sites. The observed decrease from 1967 to 1968 for these two categories suggested that something connected with the implementation of the eighth revision ICD could have accounted for at least part of the large increase in lung and bronchus cancer and could also have affected the changes for some other sites of cancer.

It should be pointed out that there is not always a one-to-one correspondence between the contents of the categories for a site of cancer in the seventh revision and that for the same site in the eighth revision ICD. In both the sixth (19) and seventh (6) revisions, a distinction was made in the classification of cancer of the lung specified as primary (162.1) and cancer of the lung unspecified as primary or secondary (163); this sometimes caused confusion in calculating the total number of lung and bronchus cancer deaths. Several followback studies (20,21) have revealed that in the vast majority of cases the physicians who reported cancer of the lung (and did not specify primary) as the cause of death meant that the lung was the primary site. Additionally, not all countries used these categories in the same way. An examination of mortality figures (22) shows four different ways of using these rubrics:

1. Using only rubric 162; for example, Israel and Denmark.

2. No separation between 162 and 163 or adding together 162 and 163; for example, France, Germany, and Chile.

3. Using both 162 and 163, but many more cases of 162; for example, Canada, Norway, and Great Britain.

Table 2. U.S. deaths from specific sites of cancer in 1967 and 1968 and ratio of observed to expected deaths in 1968

Site	Number of deaths			Ratio of observed to expected, 1968
	Observed, 1967	Observed, 1968	Expected, 1968 ¹	
Total malignant neoplasms.....	310,983	318,547	317,731	1.00
Buccal cavity and pharynx.....	6,718	7,294	6,773	1.08
Lip.....	143	184	135	1.36
Tongue.....	1,544	1,704	1,537	1.11
Salivary gland.....	596	595	591	1.01
Mouth and gum.....	1,525	1,645	1,549	1.06
Oropharynx.....	605	867	619	1.40
Hypopharynx.....	426	477	441	1.08
Other and unspecified pharynx.....	1,879	1,822	1,911	0.95
Digestive system.....	96,694	98,009	97,371	1.01
Esophagus.....	5,627	5,804	5,753	1.01
Stomach.....	17,050	16,901	16,530	1.02
Small intestine.....	715	665	705	0.94
Large intestine excluding rectum.....	33,082	34,030	33,727	1.01
Rectum.....	10,431	10,405	10,341	1.01
Liver and biliary passages, primary, NOS or secondary.....	11,255	11,251	11,410	0.99
Pancreas.....	16,886	17,381	17,301	1.00
Peritoneum and unspecified digestive organs.....	1,648	1,572	1,625	0.97
Respiratory system.....	60,202	64,300	64,320	1.00
Nose, nasal cavities, middle ear, and accessory sinuses.....	572	649	585	1.11
Larynx.....	2,797	2,836	2,865	0.99
Lung, bronchus, trachea, primary or unspecified.....	54,507	59,656	57,578	1.04
Mediastinum and thoracic organs, NOS and secondary lung and other thoracic organs.....	2,426	1,159	2,571	0.45
Genitourinary.....	55,064	55,728	55,444	1.01
Breast.....	28,217	29,081	28,968	1.00
Cervix uteri.....	7,411	7,108	7,216	0.99
Corpus uteri.....	1,743	1,756	1,831	0.96
Other parts uterus, uterus unspecified.....	3,989	3,895	3,884	1.00
Ovary, fallopian tubes, broad ligament.....	9,168	9,489	9,342	1.02
Other and unspecified female genital organs.....	805	878	780	1.13
Prostate.....	16,345	16,848	16,579	1.02
Testis, other and unspecified male genital organs.....	947	962	946	1.02
Kidney.....	5,894	6,117	6,060	1.01
Bladder and other urinary organs.....	8,762	8,675	8,915	0.97
Other specified sites and unspecified.....	33,271	31,986	34,219	0.93
Melanoma.....	2,872	2,976	2,980	1.00
Skin, excluding melanoma.....	1,852	1,424	1,838	0.77
Eye.....	344	363	341	1.06
Brain and other parts of nervous system.....	7,153	7,508	7,225	1.04
Thyroid gland, other endocrine glands.....	1,474	1,400	1,487	0.94
Bone.....	1,853	1,768	1,872	0.94
Connective tissue.....	1,374	1,423	1,447	0.98
Lymph nodes, secondary or unspecified.....	155	188	148	1.27
Other and unspecified sites.....	16,194	14,936	16,934	0.88
Lymphoma.....	16,481	16,692	17,045	0.98
Lymphosarcoma, reticulum cell sarcoma, and other forms of lymphoma.....	9,064	9,151	9,388	0.97
Hodgkin's disease.....	3,446	3,353	3,490	0.96
Multiple myeloma.....	3,879	4,088	4,080	1.00
Mycosis fungoides.....	92	100	100	1.00
Leukemias.....	14,336	14,375	14,552	0.99
Polycythemia vera ²	506
Myelofibrosis ²	576

¹ Expected deaths based on applying average annual percentage increase or decrease 1963-67 to observed deaths in 1967.

² Not considered malignant neoplasm in seventh revision ICD.

NOTE: NOS = not otherwise specified.

4. Using both 162 and 163, but many more 163 cases; for example, United States, Japan, and Finland. (In Nos. 3 and 4, the ratio of deaths from malignant neoplasms in 162 to the total in 162 and 163 varied widely among countries.)

Therefore, when the ICD was revised for use in 1968 only one category (162.1) was provided for

malignant neoplasm of bronchus and lung. This change and others are shown in the conversion table mentioned earlier (18). Some details from this conversion table and the mortality figures for certain sites of cancer in 1967 and 1968 appear in table 3. As shown in this table, code numbers 162 (malignant neoplasm of bronchus, lung, trachea, and pleura, specified as primary) and 163 (malig-

Table 3. Comparison of U.S. mortality figures for certain sites of cancer in 1967 and 1968 showing corresponding categories in the seventh and eighth revisions ICD

7th revision ICD, category and site		1967 number of deaths	8th revision ICDA, category and site		1968 number of deaths	Differences	
						Number	Percent
<i>Malignant neoplasms of:</i>			<i>Malignant neoplasms of</i>				
162 Bronchus, trachea, and lung specified as primary			trachea, bronchus, and lung:				
162.0	Trachea.....	117	162.0	Trachea.....	131		
162.1	Lung and bronchus.....	21,336	162.1	Lung and bronchus.....	59,236		
162.2	Pleura.....	19	163.0	Pleura.....	289		
162.8	Multiple sites.....	7					
163	Lung, unspecified primary or secondary ¹	32,928					
Total.....		54,407	Total.....		59,656	+5,249	+9.6
164 Mediastinum and thoracic organs, NOS.....		310	163.1	Mediastinum.....	305		
			163.9	Respiratory and thoracic organs, NOS.....	39		
Total.....		310	Total.....		344	+34	+11.0
165 Thoracic organs (secondary).....		2,116	197.0	Lung, specified as secondary....	691		
			197.1	Mediastinum, specified as secondary.....	14		
			197.2	Pleura, specified as secondary....	99		
			197.3	Other respiratory organs specified as secondary.....	11		
Total.....		2,116	Total.....		815	-1,301	-61.5
199 Other and unspecified sites.....		16,194	195.0	Abdomen, intra-abdominal cavity.....	1,439		
			195.1	Pelvis, pelvic viscera, recto-vaginal septum.....	347		
			195.9	Other neoplasms of ill-defined sites.....	905		
			197.4	Small intestine, including duodenum, specified as secondary....	7		
			197.5	Large intestine and rectum, specified as secondary.....	41		
			197.6	Peritoneum, specified as secondary.....	108		
			197.9	Other digestive organs specified as secondary.....	42		
			198	Other secondary malignant neoplasm.....	2,304		
			199.0	Multiple (generalized) malignancy.....	8,507		
			199.1	Other (cancer, site not specified).	1,236		
Total.....		16,194	Total.....		14,936	-1,258	-7.8

¹ Since category 163 included pleura, NOS (not otherwise specified), it is impossible to tell how many of these 32,928 deaths were due to pleura. Therefore, no

direct comparison can be made of deaths in 1967 and 1968 from pleura.

nant neoplasm of lung unspecified as to whether primary or secondary) in the seventh revision are equivalent in the eighth revision to 162 (malignant neoplasm of trachea, bronchus, and lung) plus 163.0 (pleura). Detailed conversions like this must be applied in order to make valid comparisons. For example, in 1967 category 199 (other and unspecified sites) showed 16,194 deaths, while in 1968 this category showed only 9,743 deaths, a reduction of 6,451 deaths or 39.8 percent. This is not a correct comparison. Actually, the additional categories 195, 198, and part of 197, as shown in table 3, should be included; this would bring the total deaths in 1968 to 14,936, a decrease of only 7.8 percent.

Because of the nearly 10 percent increase in deaths from cancer of lung and bronchus and other changes in related categories, a meeting was convened of representatives of the National Cancer Institute, the American Cancer Society, and the National Center for Health Statistics to discuss the changes that had occurred. As a result of this meeting, a research project was conducted to (a) examine the effects of changes in coding rules between the seventh and eighth revisions in classifying malignant neoplasms and (b) code a sample of death certificates by the codes and rules of both revisions to determine the net effect of these changes. The findings of this research project are reported in this paper.

Revision in Coding Rules

Some of the international rules and the instructions issued by the NCHS for use in the United States are pertinent in studying changes in the classification of cancer deaths between the seventh and eighth revisions. The rules on cancer that appear in these revisions are as follows.

Seventh revision, ICD, vol. 1., page 371

V. Malignant neoplasms of multiple sites

If malignant neoplasms of more than one site are entered on the certificate, the site indicated as primary should be selected. This indication may be the specification of one site as "primary", or of the other(s) as "secondary" or as "metastases", or an acceptable order of entry pointing to one site as the primary. Malignant neoplasm of liver or lymph nodes without specification as primary should be assumed to be secondary and assignment made to the other site mentioned, even if this is entered in Part II. *Malignant neoplasm of lung if selected as the presumptive primary site should be assigned to 163 unless specified as primary.*

If there is no indication as to which was the primary site (for example, if sites are entered on the same line or in a sequence which does not point to one as the primary), *assignment should be to malignant neoplasm of multiple sites (199), except where the classification provides specifically for multiple sites within three-digit categories (140.8, 141.8, etc.).*

Malignant neoplasm of multiple sites, specified as secondary, should be assigned to 199.

Eighth revision, ICD, vol. 1, page 435

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If there is no indication as to which was the primary site (for example, if sites are entered on the same line or in a sequence which does not point to one as the primary), *prefer a defined site to an ill-defined site in category 195 and of two or more defined sites prefer the first mentioned.*

Of two or more specified sites of secondary malignant neoplasm, prefer the first mentioned.

The italicized statements in the preceding rules point out the difference between the two versions. The last sentence of the first paragraph in the seventh revision rules was omitted in the eighth revision rules because category 163 (malignant neoplasm of lung unspecified as to whether primary or secondary) was dropped in the eighth revision. The italicized changes in the second paragraph of the eighth revision giving priority to a defined site or to the first-mentioned site would tend to increase the number of deaths coded to specific sites and decrease the number coded to the unspecified site category. For example, a certificate reporting "cancer of lung and breast" as the underlying cause would have been coded 199 (malignant neoplasm of other and unspecified sites) by use of the rules in the seventh revision ICD but would be coded 162.1 (malignant neoplasm of lung) by use of the rules of the eighth revision ICD.

Excerpts from the instructions developed for U.S. users of the seventh and eighth revisions for coding deaths follow.

The Vital Statistics Instruction Manual, Part 2, Cause-of-Death Coding, 1966, NCHS, page 55,

developed for the seventh revision, states:

Metastatic—Malignant neoplasm, “metastatic” or specified as “metastatic of” a site, with no other site mentioned, will be assigned to the category for the primary neoplasm of the site mentioned, unless the site is lung, pleura, liver or lymph nodes. In the latter case, the assignment is made to the secondary neoplasm of the specified site.

Based on this instruction, when a certificate read metastatic neoplasm of lung, pleura, liver, or lymph nodes, and another specific site, the other specific site was presumed to be primary in the United States during the use of the seventh revision ICD. For example, a death certificate reading “metastatic carcinoma of lung and breast” was coded to carcinoma of the breast as the primary site because, according to the instructions, lung was considered to be a metastatic site. On the other hand, when neoplasms of more than one of the sites listed—lung, pleura, liver, or lymph nodes—were qualified as metastatic, both sites were considered to be secondary. For example, a report of “metastatic cancer of lung and lymph nodes” was coded to category 199 which included malignant neoplasm of multiple secondary sites.

The Vital Statistics Instruction Manual, Part 2, Cause-of-Death Coding, 1968, NCHS, page 47, developed for the eighth revision, states:

Metastatic—The term “metastatic” or “metastatic of” qualifying a site of a malignant neoplasm does not affect the coding of the malignant neoplasm unless the site of the neoplasm is liver or lymph nodes. In the latter case, the assignment is made to the secondary neoplasm of the specified site (197.7 or 196) if it is the only site mentioned on the certificate of death.

The deletion of lung and pleura from this instruction about sites which are coded as secondary if qualified as “metastatic” would result in a reduction in the number of deaths classified to 165 (secondary malignant neoplasm of thoracic organs) and an increase in the number classified to 162.1 (malignant neoplasm of lung and bronchus). This helps to account for the large decrease in category 165 mentioned previously and shown in tables 1 and 3.

Introduction of ACME System

In addition to coding rule changes, there was a change in the method of coding causes of death in the United States in 1968. The National Center for Health Statistics developed and started to use

a computer system (called ACME) for selecting the underlying cause of death. Before 1968, selection of the underlying cause of death was made by trained coders. In 1968, coding clerks started assigning code numbers for each entry on the medical certification form.

The ACME system, an acronym for Automated Classification of Medical Entities, applies the rules for coding causes of death in a manner similar to that used in the manual coding process and selects the underlying cause. Detailed coding instructions and the “decision tables” used in the computer system are given in parts 2 and 2a of the Vital Statistics Instructor Manuals (15–17).

The ACME system has been favorably compared with the manual coding system by NCHS. In this paper, we report only on a sample of cancer deaths coded manually according to the seventh revision ICD and to the eighth revision ICDA by the ACME program. These same death certificates were also coded manually by the eighth revision. There was a difference of only 1.3 percent in the underlying cause selected by the ACME computer system and the manually coded results. A separate report on these cases was given to NCHS for use in making needed adjustments in the ACME program. It appeared that the ACME system was not quite as accurate as the manual system in selecting the underlying cause.

Coding a Sample of Cancer Deaths

A sample of 2,752 death certificates was drawn from the American Cancer Society’s Cancer Prevention Study (23) because these were readily available to us. From 1959 to 1960, the American Cancer Society had enrolled more than 1 million men and women in a long-term prospective study. The subjects filled out a detailed questionnaire about themselves, and they are being followed by Cancer Society volunteers. Death certificates for those who die are obtained from State health departments. When about half of the death certificates for deaths reported in the 1971–72 period of followup had been received, a sample was drawn for our study. This sample consisted of 25 percent of the death certificates with cancer mentioned, either as underlying or contributing cause, that had been received for persons who died during 1966 to 1971 in 10 States. Because of the particular interest in lung cancer, the sample was augmented by an additional 150 death certificates that mentioned lung cancer.

The death certificates were then coded according to the eighth revision ICDA, and the underlying cause of death was selected by both the ACME program and by manual coding. The certificates were then coded independently according

to the seventh revision by a coder familiar with the instructions in use with this revision. Table 4 shows the results of the manual coding by the seventh revision and of the ACME system according to the eighth revision ICDA. In general, the

Table 4. Results of sample survey: number of deaths coded for each site according to seventh and eighth revisions ICD

Site	Number of deaths coded by—		Percent increase or decrease	Site	Number of deaths coded by—		Percent increase or decrease
	7th revision ICD	8th revision ICDA computer (ACME) system			7th revision ICD	8th revision ICDA computer (ACME) system	
Buccal cavity and pharynx...	52	55	+5.8	Other and unspecified female genital organs.....	6	5	
Lip.....	0	0		Prostate.....	127	128	
Tongue.....	17	17		Testis.....	0	0	
Salivary gland.....	7	7		Other and unspecified male genital organs.....	0	1	
Mouth and gum.....	12	14		Kidney.....	43	43	
Oropharynx.....	0	1		Bladder and other urinary organs.....	78	74	
Nasopharynx.....	6	6					
Hypopharynx.....	2	2		Other specific sites and unspecified.....	226	211	-6.6
Pharynx, NOS.....	8	8		Melanoma.....	13	13	
Digestive system.....	742	736	-0.8	Skin, excluding melanoma..	7	7	
Esophagus.....	43	44		Eye.....	3	3	
Stomach.....	100	102		Brain and other parts of nervous system.....	70	69	
Small intestine.....	9	7		Thyroid gland.....	8	8	
Large intestine, excluding rectum.....	288	285		Other endocrine glands....	1	1	
Rectum.....	86	87		Bone.....	11	11	
Liver and biliary passage, primary.....	40	39		Connective tissue.....	13	16	
Liver, NOS or secondary..	26	26		Lymph nodes, specified or unspecified.....	1	1	
Pancreas.....	138	137		Other and unspecified sites.	99	82	-17.2
Peritoneum.....	6	5					
Unspecified digestive organs.....	6	4		Lymphoma.....	117	118	-0.8
Respiratory system.....	571	580	+1.6	Lymphosarcoma, reticulum cell sarcoma, and other forms of lymphoma.....	68	68	
Nose, nasal cavities, middle ear, and accessory sinuses.....	3	5		Hodgkin's disease.....	18	18	
Larynx.....	14	14		Multiple myeloma.....	31	32	
Bronchus, trachea, lung, pleura, specified primary.	194	548	+2.4	Mycosis fungoides.....	0	0	
Lung, unspecified primary or secondary.....	341			Leukemias.....	95	96	
Mediastinum, thoracic organs, NOS.....	1	4					
Bronchus, trachea, lung, pleura, specified secondary.....	18	9	-50.0	Total malignant neoplasms.....	2,458	2,447	-0.4
Breast.....	245	246	+0.4	Polycythemia vera ¹	2	2	
Genitourinary organs.....	408	402	-1.5	Myelofibrosis ¹	0	1	
Cervix uteri.....	29	27		Benign neoplasms ²	9	10	
Corpus uteri.....	13	13		Neoplasms of unspecified nature ²	9	13	
Other parts uterus, uterus unspecified.....	14	13		Non-neoplasms ²	276	282	
Ovary, fallopian tubes, broad ligament.....	98	98					

¹ Classified as malignant neoplasms in eighth revision ICDA, but not in seventh revision ICD.

² Some certificates mentioned cancer as a contributing

cause.

NOTE: NOS = not otherwise specified.

results for most sites agreed with the data reported for the United States. The sample showed a 2.4 percent increase in deaths coded to lung cancer, a 50 percent decrease in secondary cancer of the thoracic organs, and a 17.2 percent decline in cancer of other and unspecified sites.

Of particular interest was analysis of the decrease in cases coded to secondary cancer of the thoracic organs and of cancer coded to other and unspecified sites. Of the 18 deaths coded to 165 (secondary cancer of thoracic organs) by the seventh revision, 12 were coded to 162.1 (primary lung cancer) by the eighth revision adapted, 1 was coded to 492 (emphysema), 4 were coded to 197.0 (secondary lung cancer), and 1 was coded to 197.2 (secondary cancer of pleura). In other words, of the 18 cases in this sample which were coded as secondary cancer of the thoracic organs by the seventh revision rules, 12 (67 percent) were coded as primary lung cancer by the eighth revision rules. This would produce an overall increase in primary lung cases when applied to the total U.S. deaths. Of the four cases coded to secondary lung cancer by the eighth revision, one was coded 191 (skin cancer), and three were coded to 199 (other and unspecified sites) by the seventh revision.

Of the 99 death records coded to 199, cancer of other and unspecified sites, by the seventh revision, only 82 were coded to an equivalent category by the eighth revision. Two cases were coded to primary lung cancer. Some examples of cases that were not coded to equivalent categories in the two revisions follow.

Example 1:

I (a) Pulmonary edema—CHF

(b) Metastatic carcinoma liver and lung

This case was coded to 199, cancer of other and unspecified sites by the seventh revision, and to 162.1, cancer of lung by the eighth revision. The U.S. coding rules in use with the seventh revision provided for the specification of malignant neoplasm of certain sites, including the liver and lung, as secondary if qualified as "metastatic." The international rules in use with the seventh revision specified that malignant neoplasm of multiple secondary sites should be coded to 199. When the eighth revision went into effect in 1968, the U.S. rule for coding "metastatic" neoplasm of lung was changed. Lung was omitted from the list of sites considered to be specified as secondary when qualified as "metastatic." Liver was not

omitted from this list. As a result of this change, this death was assigned to the site of cancer not considered to be specified as secondary, that is, to cancer of lung (162.1). (See previous discussion under "Revision in Coding Rules, Vital Statistics Instruction Manuals, Metastatic," 1966 and 1968.)

Example 2:

I (a) Bronchopneumonia

(b) Carcinomatosis of brain

(c) Carcinoma of palate and tonsil

The seventh revision code assignment for this case was 199, carcinoma of other and unspecified sites, and the eighth revision code was 145.1, carcinoma of palate. These code assignments differed because there was a change in the international rule governing the classification of malignant neoplasm of multiple sites entered on the same line on the death certificate with no indication as to which was primary. The seventh revision rule provides for assignment to 199; the eighth revision rule provides for assignment to the first-mentioned site.

Discussion

Certainly, the changing of codes every 10 years, as well as ground rules, makes it difficult to study trends in specific diseases. A more difficult problem arises in studying trends in death rates in long-term prospective epidemiologic studies. While changes in coding procedures may have little effect on overall cause-of-death statistics, these changes can have a noticeable effect on the number of deaths assigned to individual categories. Therefore, in a long-range study it might be advisable to use the same coding rules even though the international rules change in the interim. This would also apply in comparing death rates for several different studies that were conducted in different periods of time, as well as to epidemiologic studies in which international comparisons are made.

The World Health Organization has recognized the problem of international comparisons in previous years. In 1959, a three-way comparison of coding (24) in the General Register Office of England and Wales, the Dominion Bureau of Statistics in Canada, and the National Office of Vital Statistics of the United States was made under the direction of the WHO Center for Classification of Diseases. For this study a comparison deck was made up of 6,000 death certificates—2,000 certificates from each of the participating countries.

The certificates were drawn by a systematic sampling of deaths occurring in 1958. The certificates in the comparison deck were coded independently by a cause-of-death coder in each of the three offices according to the regular procedures in use in the particular office in 1958. The results of this study showed a 6.3 percent difference in overall cause-of-death code assignments. The 6.3 percent difference consisted of cases for which at least one of the three offices disagreed with the other two.

In the sample of 6,000 deaths, there was the usual percentage of cancers (16 percent) or about 1,000 deaths from malignant neoplasms. For 3 percent of these cancer deaths, there were coding discrepancies between one or more of the three countries. Of the 32 certificates with differences, 11 were assigned to cancer by two countries but to a noncancerous condition by the third country. Usually, the United States coded these to a cardiovascular disease rather than to the cancer. Three of the cases differed only in assignment of the fourth digit. In 11 of the remaining 18 certificates one or more of the countries coded to 199, other and unspecified site of cancer, while the other countries coded to a specific cancer site. When the study was completed, the persons engaged in the study in the three countries met with WHO and tried to arrive at a uniform interpretation. The results of the study obviously indicate that the three countries did not always use the same ground rules, nor did they interpret the medical terms in a similar manner.

One reason for having a standard international code is to allow the countries participating in its use to compare their statistics, to discover real differences, and to determine the reason for these differences.

There is no value in having an international agreement to use the same classification system for mortality comparisons between countries if the rules in each country for applying these codes are so different that comparisons are not valid. Precise rules for selecting the underlying cause should be spelled out by the World Health Organization in its next revision of the ICD. More detailed instructions for coding cancer, especially metastatic cancer, are necessary to eliminate ambiguity in interpretation of these rules by the various countries. Only then can accurate international comparisons be made.

Additionally, it would be desirable to repeat a study, such as the one described, with more than

three participating countries, using the eighth revision rules as interpreted in each country. After the results of this study are analyzed, WHO would know how to better present the rules for choosing underlying cause of death, especially as to cancer, for its forthcoming ninth revision of the ICD.

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Between 1963 and 1967, U.S. lung cancer deaths increased about 5.7 percent annually. This rate nearly doubled to 9.6 percent in 1968 when the Eighth Revision International Classification of Diseases was used for the first time. At the same time, it was also observed that malignant neoplasms of thoracic organs, specified as secondary, decreased 62 percent, and malignant neoplasms of other and unspecified sites decreased 8 percent.

It was suspected that these differences were not real and might be caused by changes in classification or coding rules introduced by the eighth revision ICD. A

research project was conducted to evaluate the effects of this revision on cancer mortality for all sites. A sample of cancer deaths was coded by both the seventh and eighth revisions. The results showed an increase of 2.4 percent in lung cancer due to changes in classification and coding rules. Of the 18 cases coded to secondary cancer of the lung in the seventh revision, 12 or 67 percent were coded to primary lung cancer when the eighth revision was used. Also, 2 of 99 cases classified as cancer of unspecified site in the seventh revision were coded to lung cancer by the eighth revision. Based

on this study, it can be assumed that most of the departures from previous trends that occurred in cancer mortality between 1967 and 1968 reflect classification changes rather than an actual increase or decrease in deaths.

The results of previous comparisons of cause-of-death coding for three countries indicate that another comparison should be made by using the eighth revision ICD in as many countries as possible. The results of such a study should be considered when the rules are revised for the ninth revision so that international comparisons would become more valid.