Inaccuracies in Certification of Nonmelanoma Skin Cancer Deaths

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ABSTRACT

Nonmelanoma skin cancer is the most common cancer site in the United States, yet mortality from this cause is poorly understood. We sought medical records of the 116 reported deaths during 1979 through 1987 from this cause (*International Classification of Diseases,* 9th version [ICD-9], code 173) among Rhode Island residents to evaluate the accuracy of the reported cause of death. Of the 110 cases for which the cause of death could be classified as correct or incorrect, 59 (54%) were misclassified, 49 (83%) of which were mucous-membrane, squamous-cell carcinomas of the head and neck. For most of these, the written death certificate diagnosis was squamous-cell carcinoma of the head and neck, which was coded 173.4. Other problematic diagnoses were cancer of the head and neck and malignant fibrous histiocytoma. In response to a mailed survey, most health departments replied that squamous-cell carcinoma of the head and neck was coded under rubric 173 and malignant fibrous histiocytoma was coded under rubric 171, but there was no unanimity. The misclassification of other causes of death to ICD-9 rubric 173 is substantial. The vast majority were coded to rubric 173.4 and were due to a small number of diagnoses that are recognizable on examination of the death certificate. (*Am J Public Health.* 1992; 82:278–281)

Introduction

Nonmelanoma skin cancer (NMSC) is by far the most commonly diagnosed malignancy in the United States and is increasing rapidly in incidence.[1-5] Mortality from this cause has been poorly studied, however. Mortality rates based on death certificate data indicate that from the 1950s to the 1970s, there was a substantial decline in death due to NMSC.[6] However, these rates may be inaccurate.[6-8] We reviewed reported NMSC deaths (a) to estimate the accuracy of death certification, (b) to evaluate secular changes in accuracy, (c) to determine the reasons for inaccuracy, (d) to assess implications for the interpretation of national NMSC mortality rate statistics, and (e) to suggest improvements.

Methods

We reviewed certificates and sought medical records for all deaths among Rhode Island residents during 1979 through 1987 for which the underlying cause of death was coded as NMSC (*International Classification of Diseases,* 9th version [ICD-9], code 173). Appendix A describes our criteria for determining whether the cause of death code was correct.

Some of the underlying causes of death written on the death certificates by the physicians certifying the deaths were potentially ambiguous with respect to appropriate ICD-9 code. To aid in distinguishing problems of coding practice from problems in coding policy, we sent a short questionnaire in September 1990 to 53 health departments (50 states, New York City, the District of Columbia, and Puerto Rico). For six diagnoses, we asked "Which ICD-9 code would you use to classify a death certificate with the following underlying cause listed on the death certificate?"

We use the term "accuracy" herein to refer to the proportion of certificates correctly classified under ICD-9 code 173 among all evaluable certificates classified under that rubric. This is the "confirmation rate,"[8] that is, the (positive) predictive value of classification under this rubric if our evaluation of the medical records is taken as the standard of reference.

P values are two-tailed and were calculated using the Student's *t* statistic or linear regression.

Results

During 1979 through 1987, 116 deaths (including 4 out-of-state deaths) among Rhode Island residents were classified under ICD-9 code 173. Six deaths were excluded (see Appendix B). Fifty-nine (54%) of the 110 remaining deaths were incorrectly classified as NMSC. The mean age at death of the incorrectly classified group was lower (63.3 years) than the correctly classified group (74.5 years; $P < .00001$). There was a significant increase in misclassification over the 9-year period of study ($P = .02$). Autopsies were performed in only four cases, one of which (a noncutaneous, malignant fibrous histiocytoma) was misclassified. The incorrectly classified deaths did not differ from the correctly classified deaths with respect to gender or whether death occurred in a hospital (Table 1).

Table 2 displays the cause of death determined by examination of medical records of misclassified deaths. Striking trends were noted on comparison of the cause actually written on the death certificate by the certifying physician with the correctness of classification (see Table 3). If the problem categories of squamous-cell cancer or carcinoma of the neck or of the head and neck, cancer or carcinoma of the neck or of the head and neck, and malignant fibrous histiocytoma are eliminated, the accuracy of classification increases

from 46% to 88%, but only five (10%) of the correctly classified deaths are removed.

We received responses from 43 (81%) of the health departments to the single mailing of the questionnaire regarding actual coding practices. Two did not code cause of death themselves. There was no unanimity in coding for the three problematic categories described previously (squamous-cell cancer of the neck or of the head and neck, cancer of the neck or of the head and neck, and malignant fibrous histiocytoma), although for each the majority were consistent with the National Center for Health Statistics (NCHS) recommendations (see Table 4). Some states described inconsistencies in their coding of these diagnoses.

Fifty-five (50%) of the 110 deaths were classified under ICD 173.4 (scalp and neck). These included 48 (98%) of the mucosal carcinomas, the 1 lip carcinoma, and 6 (12%) of the correctly classified NMSC deaths.

Discussion

We noted inaccurate classification of cause for over half of the reported NMSC deaths among Rhode Island residents. The vast majority of the misclassified deaths were due to mucosal squamous-cell carcinoma of the head and neck region. The vast majority of these could be distinguished from true NMSC deaths by examination of the death certificate. Coding of certain diagnoses has been inconsistent among health departments. The policy of coding squamous-cell carcinoma of the head and neck with NMSC (ICD-9 code 173) accounted for more than half of the misclassified deaths. Most (83%) of the misclassified deaths were coded under ICD 173.4.

Our study was subject to certain limitations. Postmortem examinations were rarely performed, although results of histopathologic examinations of relevant surgical specimens were available for almost all deaths. The documentation available in the medical records was frequently suboptimal. We adhered to specific criteria that required some evidence that the NMSC contributed to death; stricter criteria would have resulted in a higher proportion of unclassifiable cases, but our estimates of accuracy then might be biased since these unclassifiable cases would have been primarily individuals with advanced stages of NMSC and no documentation of the events immediately leading to death.

TABLE 1—Proportion of ICD 173 Deaths Inaccurately Classified by Age, Gender, Race, Year of Death, and Location of Death: Rhode Island Residents, 1979–1987

	No. Misclassified	% Misclassified
Age (y)		
0–54	13	72
55–64	25	83
65–74	10	43
75–84	6	29
85+	5	28
Gender		
Male	43	57
Female	16	47
Race		
White	55	53
Black	4	67
Year of death		
1979–1981	8	35
1982–1984	24	57
1985–1987	27	60
Location of death		
In hospital	35	54
Out of hospital	24	53

Note. ICD = International Classification of Diseases.

TABLE 2—Cause of Death Determined by Review of Medical Records among Deaths Misclassified as Nonmelanoma Skin Cancer: Rhode Island Residents, 1979–1987

Cause	No.	%
Squamous cell carcinoma arising from mucosal sites in the head and neck (e.g., larynx, pharynx, oral cavity)	49	83
Malignant fibrous histiocytoma arising in soft tissues below the subcutaneous fat	5	8
Cancer of the lip	1	2
Cancer of the lung	1	2
Cancer of the kidney	1	2
Not cancer	2	3

TABLE 3—Cause of Death Listed on the Death Certificate and Correctness of Classification as Determined by Review of Records: Rhode Island Residents, 1979–1987

Diagnosis Listed on the Death Certificate	Misclassified Deaths	Correctly Classified Deaths
Squamous-cell (or epidermoid) cancer (or carcinoma):		
Of the neck or head and neck	33	3
Of other specific sites[a]	2	24
Not further specified	2	0
Cancer or carcinoma:		
Of the neck or head and neck	12	0
Of other specific sites[a]	1	7
Basal cell carcinoma	2	6
Malignant fibrous histiocytoma	6[b]	2
Other	1	9
Total	59	51

[a] Includes specific sites in the head and neck region (e.g., ear).
[b] Includes five deaths from malignant fibrous histiocytoma apparently arising deep to fascia.

The applicability of our findings to other areas of the United States is supported by the response of the Rhode Island Department of Health to our questionnaire. Their reported coding of cancer or squamous-cell cancer of the neck or of the head and neck was in accord with the practice reported by a majority of the health departments. A more thorough evaluation of the generalizability of our results awaits replication of our methods in other populations.

Prior investigations of the accuracy of NMSC death statistics are few. In 1970 through 1971, routinely coded death certificate diagnoses were compared with hospital diagnoses derived from the Third National Cancer Survey (TNCS).[8] Among the 67 deaths with the underlying cause NMSC (ICD-8 173) on the death certificate and with a hospital record of malignancy in the TNCS, only 18 (27%) were confirmed to have NMSC by the TNCS record abstract. These 18 also represented only 35% of the 51 deaths with any malignancy as the underlying cause and only NMSC noted in the hospital record abstract. Further evaluation of the medical records pertaining to these deaths was not performed.

Among 130 deaths coded as NMSC in California in 1959, 39 (30%) were determined to be due to NMSC, 73 (56%) were determined to be due to other causes, and, for 16 (12%), the cause could not be determined.[7] Among 133 NMSC deaths (i.e., coded under ICD-6 rubric 191) in Queensland, Australia, in 1960 through 1964, 95 (71%) on investigation were NMSC and 28 (21%) were other cancers.[9]

Most of the inaccuracies could be avoided by more consistent application of existing coding practices, by more uniform acceptance of the NCHS coding recommendations, and by changing the coding policy for squamous-cell cancer of the neck or head and neck to a rubric other than 173.

We must underscore the previously stated limitations in the interpretability of published NMSC mortality rates.[1,6,10,11]

TABLE 4—Coding Practices among the 41 Responding Health Departments[a] (United States, 1990)		
Underlying Cause on Death Certificate:	ICD-9 Code	No. (%):
Malignant fibrous histiocytoma	173[b]	9 (22)
	171[c]	28 (68)
	216	4 (10)
Squamous-cell cancer of the neck	173[b,c]	38 (93)
	195	2 (5)
	199	1 (2)
Squamous-cell cancer of the head and neck (same responses as squamous-cell cancer of the neck)		
Cancer of the neck	173	2 (5)
	195[b,c]	39 (95)
Cancer of the head and neck (same responses as cancer of the neck)		

Note. ICD-9 = International Classification of Diseases, 9th version.
[a] In response to the question "Which ICD-9 code would you use to classify a death certificate with the following underlying cause listed on the death certificate?"
[b] Response of the Rhode Island Department of Health.
[c] The National Center for Health Statistics interpretation of the ICD-9 classification (M. Burt, personal communication, October 1990).

To best track the present epidemic of this very common cancer site, we need to complement existing sources of incidence data with refinements in the use of our primary source of mortality data: the death certificate. □

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APPENDIX A—Criteria for Determining the Correctness of the Coded Cause of Death

Many of the records were traced and abstracted by a team of students (M.A., V.L., E.B., S.K.) in the last half of their final year of medical school. The remaining records were abstracted and the students' abstracts reviewed by a board-certified dermatologist (M.A.W.), who also adjudicated all ambiguities encountered by the medical student team and who was responsible for the final judgments regarding the correctness of the ICD classification according to the previously mentioned criteria. To resolve ambiguities in pathology reports, histologic specimens from certain biopsies were reviewed by a board-certified dermatopathologist (H.A.B.).

To accept a certificate as correctly coded under the ICD-9 rubric 173, we required that the diagnosis of nonmelanoma skin cancer be confirmed by medical records. We also required evidence from the record that the nonmelanoma skin cancer contributed significantly to the death. Some individuals did not die in medically supervised set-

tings, or records of the events immediately leading to death were unavailable, so evidence of unresectable metastatic or advanced local disease (such as invasion of the orbital bones) was accepted as indicative of a significant contribution of the tumor to death. If the patient's physician believed that resection of extensive tumor was not feasible or not indicated because of the patient's poor prognosis, we considered the disease unresectable. We did not require that the available documentation of symptoms, signs, and tests convince us that the nonmelanoma skin cancer was the most important underlying cause of death. This degree of detail was often absent from the available documentation.

We determined that a certificate was incorrectly coded under the ICD-9 rubric 173 if we concluded from the record that the malignancy responsible for death was melanoma or arose from a noncutaneous primary site, or if the nonmelanoma skin cancer appeared unrelated to the events leading to death.

APPENDIX B—Description of the Six Deaths Excluded from Analysis

Two of the deaths involved individuals with aggressive AIDS-associated Kaposi's sarcoma. Since the ICD classification for this cause had changed from 173 to 042, we excluded these from the analysis. We were unable to verify or disprove the coded cause of death on the basis of medical records for four deaths. Complete records were obtained for two of these cases, but the primary site of the malignancy that led to death was unclear. In another two cases, we were unable to obtain complete medical records, either because the records were lost or destroyed or because the source of medical care during that time could not be traced. The nursing home at which one of these two patients last resided refused access to her medical records.

Provider Compliance with Recommended Dietary Fluoride Supplement Protocol

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ABSTRACT

Proper dosage of dietary fluoride supplements is important for children without access to optimally fluoridated water to balance dental caries prevention and risks of dental fluorosis. Subsequent to water fluoride assay, compliance by physicians and dentists with the recommended dietary fluoride supplement dosage schedule was determined for 446 children. Approximately one third of child patients and 42% of siblings did not receive the recommended supplement dosage. (*Am J Public Health.* 1992;82:281–283)

Introduction

Community water fluoridation remains the most efficient and cost-effective method to receive the recommended levels of fluoride for dental caries prevention.[1] Dietary fluoride supplements are advocated[2] for children not served by optimally fluoridated water (46% in the United States).[3]

Before prescribing supplements, fluoride histories and assays of the major sources of drinking water should be obtained in order to establish a balance between dental caries prevention and increased risks of dental fluorosis (mottled enamel).[2] Dental fluorosis is an enamel hypoplasia caused by the ingestion of excessive fluoride during the years of tooth calcification.[4] Water fluoride assay as a tool in preventing dental fluorosis is especially important in light of recent evidence of an increased prevalence of dental fluorosis,[4–6] of substantial prevalence nationwide,[7] and of the association of dietary fluoride supplement use with increased fluorosis risks.[6,8–11] The need for water fluoride assay to help avoid fluoro-

sis has been emphasized recently in the US Department of Health and Human Services' review of the benefits and risks of fluoride.[12]

Table 1 shows the dietary fluoride supplement dosage schedule currently recommended.[13,14] Dosage is dependent on age and water fluoride level. There are many steps in the proper evaluation of dietary fluoride supplement need, dosage determination, and monitoring of patient compliance.[15] Many studies have reported difficulties with patient compliance,[16] but few have addressed provider compliance with recommended protocol.[17,18] A pilot study investigating the interactions that occurred between provid-