

## CHAPTER 1

# Medical Coding in History

## *The Black Death*

Medical coding in its earliest form started as an attempt to avoid the Black Death. Bubonic plague, caused by the bacteria *yersinia pestis*, arrived in Sicily via ship rats in 1347. It spread rapidly, reaching England in 1348. Almost half the city of London's population of 70,000 died of the disease over the next two years.

Given that life expectancy at the time was about 26 years and about 35% of children died before the age of 6, the Black Death contributed to the increased demise of the already death-ridden populace.

Italian author Giovanni Bocaccio lived through the plague in Florence in 1348. In his book, *The Decameron*, he describes how the Black Death got its name:

*"In men and women alike it first betrayed itself by the emergency of certain tumors in the groin or the armpits, some of which grew as large as a common apple . . . The form of the malady began to change, black spots or livid making their appearance in many cases on the arm or the thigh or elsewhere, now few and large, then minute and numerous. These spots were an infallible token of approaching death."*<sup>1</sup>

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The plague was highly contagious. As soon as people realized that contact with the sick could mean death, they isolated themselves. As Bocaccio describes:

*“Citizen avoided citizen, how among neighbors was scarce found any that showed fellow-feeling for another, how kinsfolk held aloof and never met. Fathers and mothers were found to abandon their own children, untended, unvisited, to their fate, as if they had been strangers.”<sup>1</sup>*

Once the initial scourge was over, isolated outbreaks of plague continued in Europe throughout the next three centuries. It became an increasingly urban disease, due to poor sanitation and crowded living conditions. The Great Plague of 1665 in London killed 25% of the population. It was at this point that the science of epidemiology, the study of epidemics, was born.

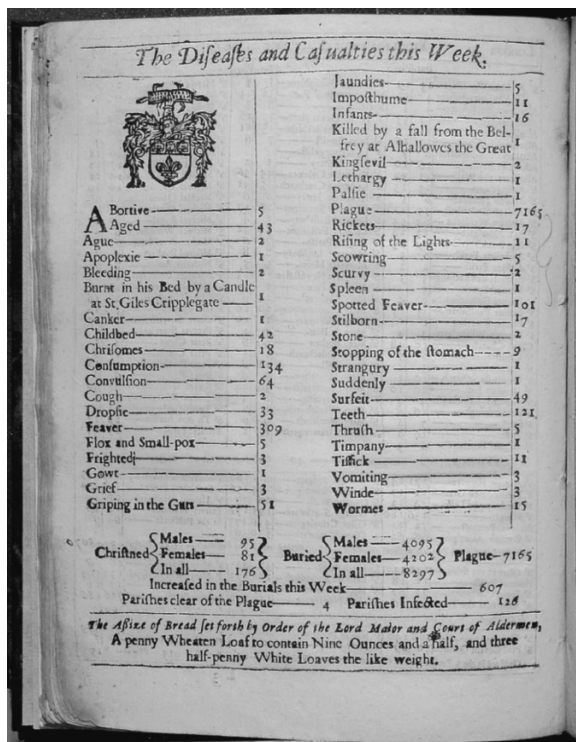


**Figure 1-1** Plague Doctor. The beak was filled with herbs, thought to ward off the black death.

The London Bills of Mortality were published weekly, and as of 1629 included the cause of death. Information was collected by parish clerks in various geographical areas. In order to determine which areas had the most cases of plague, Londoners purchased copies of the Bills and tracked the spread of the disease from one parish to another in order to avoid it. During one week in 1665, when the total number of London deaths was 8,297, bubonic plague accounted for 7,165 of those deaths.

Causes of death found in the Bills include diseases recognized today, such as jaundice, smallpox, rickets, spotted fever and plague. Other conditions have creative descriptions like “griping in the guts,” “rising of the lights” (croup), “teeth,” “king’s evil” (tubercular infection), “bit with a mad dog,” and “fall from the belfry.”

*The Diseases and Casualties this Week,*



<b>A</b> Bortive	5	Jaundice	5
Aged	43	Imposthume	11
Ague	2	Infans	16
Apoplexie	1	Killed by a fall from the Belfry at Alhallows the Great	1
Bleeding	2	Kingsevil	2
Burnt in his Bed by a Candle at St. Giles Cripplegate	1	Lethargy	1
Canker	1	Pallic	1
Childbed	42	Plague	7165
Chriomes	18	Rickets	17
Consumption	134	Rising of the Lights	11
Convulsion	64	Scowring	5
Cough	2	Scurvy	2
Droptic	33	Spleen	1
Feaver	309	Spotted Feaver	101
Flox and Small-pox	5	Stilborn	17
Frighted	3	Stone	2
Gowt	1	Stopping of the Stomach	9
Grief	3	Strangury	1
Griping in the Guts	51	Suddenly	1
		Surfeit	49
		Teeth	121
		Thrush	5
		Timpany	1
		Tifick	11
		Vomiting	3
		Winde	3
		Wormes	15

Christned	Males	95	Buried	Males	4095	Plague-7165
	Females	81		Females	4202	
In all		176	In all		8297	

Increased in the Burials this Week 607

Parishes clear of the Plague 4 Parishes Infected 128

*The Office of Bread set forth by Order of the Lord Mayor and Court of Aldermen,  
A penny Wheaten Loaf to contain Nine Ounces and a half, and three  
half-penny White Loaves the like weight.*

Figure 1-2 London Bills of Mortality, 1665.

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John Graunt, a London merchant, published *Reflections on the Weekly Bills of Mortality* in 1665. Its central theme was that deaths from plague needed to be examined in the context of all the other causes of mortality in order to understand the effects of all diseases. The sixty disease categories in the Bills constituted the first systematic attempt to analyze the incidence of disease.

During the eighteenth century, additional classifications were authored by Linnaeus in Sweden (*Genera Morborum*, 1763), Bossier de Lacroix in France (*Nosologia Methodica*, 1785), and Cullen in Scotland (*Synopsis Nosologic Methodicae*, 1785). Nosology is the branch of medicine that deals with classification of diseases.

#### *William Farr and the Cholera Studies*

As the first medical statistician for the General Register Office of England, Dr. William Farr revamped the Cullen disease classification to standardize the terminology and utilize primary diseases instead of complications. Farr incorporated additional data into his classification, enabling reporting and analysis of factors such as occupation and its effect on cause of death.

Farr's dedication to what he called "hygology," derived from hygiene, was evident in his analysis of the London cholera outbreak of 1849. More than 200 pages of tables, maps, and charts reviewed the possible influence of almost every conceivable death-related factor such as age, sex, rainfall, temperature, geography. Even day of the week and property value were examined.<sup>2</sup>

The single association consistently present was the inverse relationship between cholera mortality and the elevation of the decedent's residence above the Thames River. Unfortunately this led Farr to the conclusion that the air was more polluted lower by the river, causing the transmission of cholera. He later converted to the water-borne germ theory of disease after studying a second epidemic in 1866, including data about the source of drinking water for those who died.

### *International List of Causes of Death*

The need for a uniform classification of causes of death was recognized at the International Statistical Congress convened in Brussels in 1853. The Congress requested that William Farr prepare a classification for consideration at its next meeting in Paris in 1855. His classification was based primarily on anatomical site and consisted of 138 rubrics.<sup>3</sup> The list was adopted in 1864 and revised at four subsequent Congresses.

Farr died in 1883 and Jacques Bertillon, the chief statistician of the City of Paris, prepared a revised list which was adopted by the International Statistical Institute in 1893. Known as the Bertillon Classification, it was the first standard system actually implemented internationally. The American Public Health Association recommended its use in the United States, Canada and Mexico by 1898. Delegates from 26 countries adopted the Bertillon Classification in 1900 and subsequent revisions occurred through 1920.

### *Beyond Death*

After Bertillon's death in 1922, interest grew in using the classification to categorize not only causes of mortality, but also causes of morbidity. Morbidity is a diseased state or the incidence of disease in a population. As early as 1928, the Health Organization of the League of Nations published a study defining how the death classification scheme would need to be expanded to accommodate disease tabulation.

Finally, in 1949 at the Sixth Decennial Revision Conference in Paris, the World Health Organization (WHO) approved a comprehensive list for both mortality and morbidity and agreed on international rules for selecting the underlying cause of death. Known as the "Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death" it is generally referred to as ICD. From this point forward, the use of ICD was

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expanded, for indexing and retrieval of records and for data concerning the planning and evaluation of health services.

### *Modern Times*

The purpose of the ICD and of WHO sponsorship is to promote international comparability in the collection, classification, processing, and presentation of morbidity and mortality statistics. The United States implemented ICD-1 in 1900 and participated in every revision through ICD-7 until 1968. ICD was used for death classification until the sixth revision, when disease indexing began and ICD was used for both purposes. With the eighth revision, the US developed its own version, known as ICDA-8 or ICD Adapted, due to disagreements over the circulatory section of the international version.

The International Conference for the Ninth Revision was attended by delegations from 46 countries. The classification was being pushed in the direction of more detail by those who wanted to use it for evaluation of medical care or for payment purposes. On the other hand, users in less sophisticated areas did not need the detail in order to evaluate their health care activities. Steps were taken to assure the usefulness of the new revision for all users, and the World Health Assembly adopted ICD 9<sup>th</sup> revision in May 1976 for implementation effective January 1, 1979. As it did with ICD-8, the US adopted a clinical modification to the international version, and ICD-9-CM (clinical modification) is still in use in this country today.

### *Reflection of Society*

Changes to ICD-9-CM over the years mirror events in American society. The ICD-9-CM Coordination and Maintenance Committee, a joint effort of the National Center for Health Statistics and the Center for Medicare and Medicaid Services, considers codes changes yearly. Although it is possible to code any disease using ICD-9-CM, newly identified or newly concerning conditions often fall into an “other” category, and the assignment of new specific codes is necessary to identify and count those disease entities.

- 1986 New codes assigned for HIV and AIDS. These were previously coded to the “deficiency of cell-mediated immunity” category. By 1986, over 15,000 deaths due to AIDS related conditions had occurred in the United States and the need for codes was evident.
- 1989 Lyme disease hit the news, and was assigned an individual code. Although first observed in the U.S. in 1977 near Lyme, Connecticut, its identification as a tick-borne illness caused growing concern throughout the rest of the country.
- 1991 Kaposi’s sarcoma was previously coded in the “other malignant neoplasm” category. Its incidence in AIDS patients made the need to separately identify it more important.
- 1992 As the popularity of contact lenses grew among Americans, so did the problems associated with them. A new code for corneal disease due to contact lenses was implemented.
- 1992 What do cooking oil in Spain and L-tryptophan in New Mexico have in common? More than 300 people died in Spain in 1981 due to “toxic oil syndrome,” reportedly due to use of contaminated cooking oil. A similar situation occurred in New Mexico in 1989 and on that occasion, L-tryptophan was blamed. It was subsequently banned in the U.S. by the FDA. Both events involved eosinophilia myalgia syndrome, which got a new code in 1992. The Spanish epidemic is now thought to have been caused by organophosphate poisoning from insecticides.<sup>4</sup>
- 1993 A newly understood connection between some types of HPV, human papillomavirus, and cervical cancer results in the assignment of a separate code for HPV. Investigators have found evidence of HPV in more than 90% of cervical cancers.<sup>5</sup>

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- 1993 With the increasing use of potent antibiotics and other drugs to combat infection, the crafty bugs also developed resistance to those drugs. A series of codes to identify infection with drug-resistant microorganisms was created.
- 1995 As “couch potatoes” got fatter, the condition of “morbid obesity” got a separate code to distinguish it from other obesity. Morbid obesity is defined as greater than 125% over normal body weight.
- 1995 Sensational news reports about “flesh-eating disease” described the effects of Group A *streptococcus* manifested as necrotizing fasciitis, a severe soft tissue infection that can result in gangrene. A new code was assigned.
- 1996 As more premature infants survive due to better medical care, the incidence of RSV bronchiolitis increases. This is due to the respiratory syncytial virus. A new code is assigned for identification purposes.
- 1996 A sign of the times was the addition of a new code for adult sexual abuse.
- 1997 Cryptosporidiosis and cyclosporiasis got their own codes. These previously rare parasites began showing up more often. An outbreak in Wisconsin where 403,000 people were affected by their drinking water, and additional outbreaks a few years later thought to be caused by imported raspberries, pointed to the need for separate codes.
- 2002 Although toxic shock syndrome was identified in 1980, it did not receive its own code until 2002. Originally diagnosed in women using high-absorbency tampons, toxic shock syndrome is now identified in other patients, both male and female, who are infected with *Staph aureus*.



- 2002 Newly arrived in the US, the mosquito-borne West Nile Virus is assigned its own code.



- 2002 Codes for the external causes of injury are also part of ICD-9-CM. A new code was needed to identify injuries from paintball guns.
- 2002 Codes for coronary atherosclerosis had been around for years, but a new code was implemented to identify coronary atherosclerosis in a transplanted heart.
- 2002 An entire series of codes was added to classify the external causes of injury and death due to terrorism. Among them were codes for terrorism involving biological weapons and terrorism involving destruction of aircraft, including aircraft used as a weapon.
- 2003 The evening news showed international air travelers wearing surgical masks. The reason—fear of contracting SARS, severe acute respiratory syndrome. This viral illness appeared in southern China in November 2002. Within 8 months, more than 8,000 people had contracted SARS, with almost 800 dying of the disease. SARS was assigned a new diagnosis code in 2003.
- 2004 "Dermatitis due to other radiation" is added. It includes tanning beds as radiation sources.

As new breakthroughs are made in medical science, and better diagnostic tools developed, additional codes will be required.

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### *What About ICD-10?*

ICD-10 represents a radical departure from the previous 100 years of disease classification. Although it is still organized along body systems, it contains about 8,000 causes of death, almost double the 4,000 in ICD-9. It uses 4 to 6-digit alphanumeric codes instead of the 4-digit numeric codes from ICD-9. In the United States, ICD-10 has been used to classify mortality data since 1999, while we continue to use ICD-9-CM for all other purposes, such as billing and morbidity statistics.

The impact of changes in coding systems can be analyzed through a comparability study. This means coding the same deaths twice: once using the old coding system and once using the new coding system. The ratio of new system to old in terms of categories of deaths demonstrates the effect of the coding system change on death rates. In 1979, for example, the data for nephritis, the 11<sup>th</sup> leading cause of death had a comparability ratio of 1.74, which means that 74% more deaths occurred from this cause solely due to the change in coding systems.<sup>6</sup>

In 2001, the *Journal of the American Medical Association* published a research letter describing the effect of coding on AIDS mortality statistics in Florida.<sup>7</sup> For 1999, AIDS mortality rose by 6.7% using ICD-10 coding, while it decreased by 6.6% when the same cases were coding using ICD-9. If health services analysts are not aware of these effects, data can be misinterpreted.

Government agencies, health care insurers, and providers are studying the implications of switching to ICD-10-CM. A study by the Robert E. Nolan Company, commissioned by the Blue Cross and Blue Shield Association, estimated a \$6 billion to \$14 billion price tag on such a change. Other implications cited by the study are:

- A short-term “data fog” due to lack of data continuity
- Delays and backlogs in payment of claims<sup>8</sup>

If and when a determination is made to change to ICD-10-CM, it will be at least two years from the date of publication of notice in the *Federal Register* before the change is implemented.

## References

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