CENTERS FOR DISEASE CONTROL

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Contents

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Contents

History of CDC Surveillance Activities

CDC has been actively involved in disease-surveillance activities since the formulation of the Communicable Disease Center in 1946. The original scope of the National Surveillance Program included the study of malaria, murine typhus, smallpox, psittacosis, diphtheria, leprosy, and sylvatic plague. In 1954, a surveillance section was established within the Epidemiology Branch of CDC, primarily concerned with planning and conducting continuing surveillance and making periodic reports. Occurrences such as the Asian influenza pandemic and the discovery of Legionnaires' disease prompted the involvement of CDC in additional surveillance activities. Over the years the surveillance activities of CDC have expanded to include not only new areas in infectious disease but also programs in human reproduction, injuries, environmental health, chronic disease, risk reduction, and occupational safety and health. Ongoing evaluation of these programs has led to new methods of data collection and analysis and has prompted examination of how data are disseminated to the public health community.

The publication titled *CDC Surveillance Summaries* was initiated in 1982 after a survey was made of CDC staff and state epidemiologists. Results of the survey suggested that improved coordination of surveillance reports with the *MMWR* and the *MMWR Annual Summary* (later titled *Summary of Notifiable Disease, United States*) would facilitate timely publication; provide greater uniformity in the acquisition, evaluation, and reporting of surveillance data; and encourage the use of these data.

In 1985, the CDC Surveillance Coordination Group was formed with representatives from all Centers/Institute/Program Offices and from the Council of State and Territorial Epidemiologists. The Group was charged with developing and implementing a policy for CDC's public health surveillance activities. State public health officials also actively participate in the activities of the Group. These activities, which are documented in regular reports, are directed toward achieving the following goals: 1) conducting epidemiologic surveillance of all health events considered to be of high priority, 2) evaluating regularly all CDC surveillance activities, 3) developing and evaluating improved methods for the collection, analysis, and dissemination of surveillance data, and 4) maintaining and improving the expertise of CDC staff and constituents in the development, implementation, and evaluation of systems of public health surveillance.

Data Source

Data on the reported occurrence of notifiable diseases are derived from reports supplied by the state and territorial health departments and by CDC program activities. These data are published weekly in the *MMWR,* and the final official numbers of cases are published in the annual *Summary of Notifiable Diseases.* Complementary data are provided in *MMWR* surveillance summaries and recommendations and reports. Data reported in the weekly *MMWR* and the more detailed data reported by individual CDC programs are collected independently; therefore, some numbers may be slightly different because of the timing of reports or because of refinements in case definition.

Data published in the *MMWR* series of publications should be interpreted with caution. Some diseases that cause severe clinical illness and are associated with serious consequences are probably reported quite accurately; however, diseases that are clinically mild and infrequently associated with serious consequences are less likely to be reported: Additionally, subclinical cases are seldom detected except in the course of epidemic investigations or special studies. The degree of completeness of reporting is also influenced by the diagnostic facilities available, the control measures in effect, and the interests and priorities of state and local officials responsible for disease control and surveillance. Finally, factors such as the introduction of new diagnostic tests and the discovery of new disease entities may cause changes in disease reporting independent of the true incidence of disease. Despite these limitations, the data in these reports have proven to be very useful in the analysis of trends.

Most Recent Reports Published in the *MMWR* Surveillance Summaries

Subject	Responsible CIO*	Most Recent Report
Abortion	CCDPHP	1990; Vol. 39, No. SS-2
AIDS/HIV		
Distribution by Racial/Ethnic Group	CID	1988; Vol. 37, No. SS-3
Among Black and Hispanic Children and Women of Childbearing Age	CEHIC	1990; Vol. 39, No. SS-3
Behavioral Risk Factors	CCDPHP	1990; Vol. 39, No. SS-2
Birth Defects		
B.D. Monitoring Program (see also Malformations)	CEHIC	1990; Vol. 39, No. SS-4
Contribution of B.D. to Infant Mortality Among Minority Groups	CEHIC	1990; Vol. 39, No. SS-3
Campylobacter	CID	1988; Vol. 37, No. SS-2
Coal Workers' Health (see also Mining)	NIOSH	1985; Vol. 34, No. 1SS
Congenital Malformations, Minority Groups	CEHIC	1988; Vol. 37, No. SS-3
Dengue	CID	1985; Vol. 34, No. 2SS
Dental Caries and Periodontal Disease Among Mexican-American Children	CPS	1988; Vol. 37, No. SS-3
Ectopic Pregnancy	CCDPHP	1990; Vol. 39, No. SS-4
Ectopic Pregnancy, Mortality	CCDPHP	1987; Vol. 36, No. SS-2
Elderly, Hospitalizations Among	CCDPHP	1991; Vol. 40, No. SS-1
Endometrial and Ovarian Cancers	EPO, CCDPHP	1986; Vol. 35, No. 2SS
Escherichia coli 0157	CID	1991; Vol. 40, No. SS-1
Foodborne Disease	CID	1990; Vol. 39, No. SS-1
Gonococcal Infection	CPS, CID	1984; Vol. 33, No. 4SS
Gonorrhea and Salpingitis, Teenagers	CPS, CID	1983; Vol. 32, No. 3SS
Hepatitis	CID	1985; Vol. 34, No. 1SS
Hepatitis, Viral	CID	1983; Vol. 32, No. 2SS
Homicide	CCDPHP	1983; Vol. 32, No. 2SS
Homicides, Black Males	CEHIC	1988; Vol. 37, No. SS-1
Hysterectomy	CCDPHP	1986; Vol. 35, No. 1SS
Infant Mortality (see also National Infant Mortality; Birth Defects)	CEHIC	1990; Vol. 39, No. SS-3
Injury		
Death Rates, Blacks and Whites	CEHIC	1988; Vol. 37, No. SS-3
Drownings	CEHIC	1988; Vol. 37, No. SS-1
Falls, Deaths	CEHIC	1988; Vol. 37, No. SS-1
Firearm-Related Deaths, Unintentional	CEHIC	1988; Vol. 37, No. SS-1
In the Home, Persons Under 15 Years of Age	CEHIC	1988; Vol. 37, No. SS-1
Motor Vehicle-Related Deaths	CEHIC	1988; Vol. 37, No. SS-1
Objectives of Injury Control, State and Local	CEHIC	1988; Vol. 37, No. SS-1
Objectives of Injury Control, National	CEHIC	1988; Vol. 37, No. SS-1
Residential Fires, Deaths	CEHIC	1988; Vol. 37, No. SS-1
Tap Water Scalds	CEHIC	1988; Vol. 37, No. SS-1
Lead Poisoning, Childhood	CEHIC	1990; Vol. 39, No. SS-4
Low Birth Weight	CCDPHP	1990; Vol. 39, No. SS-3
Malaria, Imported	CID	1983; Vol. 32, No. 3SS
Malformations (see also Birth Defects)	CEHIC	1985; Vol. 34, No. 2SS
Maternal Mortality	CCDPHP	1988, Vol. 37, No. SS-5
Mining (see also Coal Workers' Health)	NIOSH	1986; Vol. 35, No. 2SS

*All abbreviations are listed at end of inventory. Readers should check individual summaries when more than one CIO is responsible.

Most Recent Reports Published in the *MMWR* Surveillance Summaries — Continued

Subject	Responsible CIO*	Most Recent Report
National Infant Mortality (see also Infant Mortality; Birth Defects)	CCDPHP	1989; Vol. 38, No. SS-3
Nosocomial Infection	CID	1986; Vol. 35, No. 1SS
Occupational Injuries/Disease		
Among Loggers	NIOSH	1983; Vol. 32, No. 3SS
Hazards, Occupational	NIOSH	1985; Vol. 34, No. 2SS
In Meatpacking Industry	NIOSH	1985; Vol. 34, No. 1SS
State Activities	NIOSH	1987; Vol. 36, No. SS-2
Treated in Hospital Emergency Rooms	NIOSH	1983; Vol. 32, No. 2SS
Ovarian Cancer (see Endometrial and Ovarian Cancer)		
Pediatric Nutrition	CCDPHP	1983; Vol. 32, No. 4SS
Pelvic Inflammatory Disease	CPS	1983; Vol. 32, No. 4SS
Plague	CID	1985; Vol. 34, No. 2SS
Plague, American Indians	CID	1988; Vol. 37, No. SS-3
Pneumoconiosis, Coal Miners	NIOSH	1983; Vol. 32, No. 1SS
Pregnancy, Teenage	CCDPHP	1987; Vol. 36, No. 1SS
Psittacosis	CID	1983; Vol. 32, No. 1SS
Rabies	CID	1989; Vol. 38, No. SS-1
Racial/Ethnic Minority Groups	Various	1990; Vol. 39, No. SS-3
Reye Syndrome	CID	1984; Vol. 33, No. 3SS
Rocky Mountain Spotted Fever	CID	1984; Vol. 33, No. 3SS
Rubella and Congenital Rubella	CPS	1984; Vol. 33, No. 4SS
Salmonella	CID	1988; Vol. 37, No. SS-2
Salpingitis (see Gonorrhea and Salpingitis)		
Smoking	CCDPHP	1990; Vol. 39, No. SS-3
Sudden Unexplained Death Syndrome Among Southeast Asian Refugees	CEHIC, CPS	1987, Vol. 36, No. 1SS
Suicides, Persons 15-24 Years of Age	CEHIC	1988; Vol. 37, No. SS-1
Summer Mortality	CEH	1983; Vol. 32, No. 1SS
Toxic-Shock Syndrome	CID	1984; Vol. 33, No. 3SS
Trichinosis	CID	1988; Vol. 37, No. SS-5
Tubal Sterilization Among Women	CCDPHP	1983; Vol. 32, No. 3SS
Water-Related Disease	CID	1990; Vol. 39, No. SS-1

Abbreviations

CCDPHP	Center for Chronic Disease Prevention and Health Promotion
CEHIC	Center for Environmental Health and Injury Control
CID	Center for Infectious Diseases
CIO	Centers/Institute/Offices
CPS	Center for Prevention Services
EPO	Epidemiology Program Office
NIOSH	National Institute for Occupational Safety and Health

Surveillance of *Escherichia coli* O157 Isolation and Confirmation, United States, 1988*

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Summary

In 1989, to examine patterns of testing for Escherichia coli *0157:H7 in state public health laboratories (SPHLs), CDC conducted a survey to determine the availability and type of* Escherichia coli *0157:H7 testing in SPHLs during 1988 and the number of isolates confirmed at SPHLs if such testing was available. The results were compared with information on isolates submitted for confirmatory testing at CDC in 1988. Thirty-nine (78%) of the 51 SPHLs were testing for* E. coli *0157:H7 in 1988; 26 confirmed at least one* E. coli *0157*† *isolate in that year. CDC confirmed isolates from three additional states. A total of 489* E. coli *0157:H7 or* E. coli *0157:NM isolates were identified, with the largest numbers being reported from Washington (156), Oregon (64), Minnesota (63), and Massachusetts (36). These results show that* E. coli *0157 has been detected in most areas of the United States. Infections are apparently concentrated in northern states; however, improved surveillance data are needed to determine regional incidence and trends.*

INTRODUCTION

In 1982, the enterohemorrhagic *Escherichia coli* (EHEC) were first recognized as a cause of bloody diarrhea affecting humans when two outbreaks of hemorrhagic colitis occurred in Michigan and Oregon (*1*). Since then, illnesses caused by EHEC have emerged as a public health problem throughout North America. Recognized infections caused by *E. coli* O157:H7, the predominant EHEC serotype, increased dramatically during the 1980s in Canada (*2*), where in some areas it is one of the most common bacterial causes of diarrhea (*3*). *E. coli* 0157:H7 infections are associated with most cases of hemolytic uremic syndrome (HUS) in at least two areas of North America (Calgary, Alberta and Seattle, Washington) (*4,5*); *E. coli* O157:H7 was isolated from 46% of Minnesota children with HUS when stool specimens were appropriately tested for the organism (*6*). In both Minnesota and Seattle, reported HUS incidence among children has increased over the last two decades (*6,7*). In both locations, the increase in HUS has been attributed to an increasing frequency of *E. coli* O157:H7 infections.

Despite the rapid emergence of *E. coli* O157:H7, little is known about its geographic distribution and frequency of occurrence in the United States, because no

*Enteric microbiologists at the 51 state public health laboratories provided data contained in this report.

†In this report, the term *Escherichia coli* 0157:H7 is used whenever the full serotype was known; the term 0157 is used when, for some isolates, the H antigen was not determined or the isolate was nonmotile.

nationwide surveillance system exists. However, two focused U.S. surveys have been performed. In 1985-1986, a survey in a Pacific Northwest health-maintenance organization established an *E. coli* O157:H7 isolation rate of 8.0/100,000 enrollees per year (*8*). In Washington, a 1987 statewide survey documented a reported yearly incidence of 2.1/100,000 population (*9*). In 1987, not all Washington clinical microbiology laboratories were testing for *E. coli* 0157:H7, partly explaining the lower statewide rate.

In 1989, the extent to which testing for *E. coli* O157:H7 was done at the state level was determined through a survey of 1988 testing and screening practices for EHECs in 51 state public health laboratories (SPHLs), including the District of Columbia. In addition to providing information on laboratory practices, the 1988 data also establish the geographic and temporal distribution of *E. coli* 0157:H7 in the United States.

METHODS

In June 1988, CDC distributed a survey form to directors of SPHLs and in March and April 1989, CDC conducted telephone interviews with personnel at all 51 SPHLs in the United States (public health laboratories in the U.S. territories were not contacted). SPHLs were asked whether they had tested for *E. coli* O157 in 1988; if so, procedural details were obtained, including information on the use of sorbitol-MacConkey agar, the availability and type of testing for the somatic and flagellar antigens, and whether the SPHLs tested for Shiga-like toxin (SLT, also known as verotoxin). The SPHLs provided information on the number of *E. coli* O157 isolates confirmed during 1988 and, if available, the month in which confirmed isolates were submitted.

These data were compared with data on isolates that were referred to the Enteric Bacteriology Laboratory at CDC. Since 1982, CDC has received isolates for *E. coli* O157:H7 confirmation from SPHLs, although many SPHLs do not routinely forward isolates to CDC. A small number of isolates from non-SPHL sources have also been received. The number of isolates reported by the SPHL was compared with the number confirmed at CDC. The total of *E. coli* O157 isolates identified in 1988 for each state was considered to be whichever number was larger, after an attempt was made to eliminate duplicate or repeat isolates from the same patient.

RESULTS

In 1988, 39 of the 51 SPHLs offered *E. coli* O157 testing (Table 1), and three (Hawaii, Kansas, and Kentucky) of the 12 that were not testing indicated that they would begin in 1989. Testing was available *throughout* 1988 in all but two of the 39 SPHLs.

All of the 39 SPHLs that did testing offered confirmation of suspect *E. coli* isolates submitted by other laboratories. All but four SPHLs (Connecticut, Pennsylvania, West Virginia, and Wyoming) would also test submitted stool specimens for primary isolation of *E. coli* 0157:H7. Seven of the 35 SPHLs tested all submitted stool specimens for *E. coli* O157, whereas the other 28 did so only if requested. Nine of these remaining 28 SPHLs indicated that stools or swabs submitted from a patient reported to have bloody diarrhea would routinely be tested for *E. coli* O157.

Sorbitol-MacConkey culture medium was used by 32 of the 39 SPHLs (Table 1). Testing for the somatic (O) antigen was done by 37 SPHLs; 18 used slide agglutination, 12 used tube agglutination, six used both, and one state used indirect fluorescence antibody (IFA) for the O antigen. Thirty-four of the SPHLs tested for the flagellar (H) antigen, with

most (*25*) using tube agglutination. The remainder used either slide agglutination or H7 immobilization. Four states (California, New York, Pennsylvania, and Utah) reported that they would test isolates for Shiga-like toxin (SLT) production if asked.

In 1988, a total of 489 *E. coli* O157:H7 or O157:NM isolates were reported from either the SPHLs or from CDC. Among the 39 SPHLs that did testing, 26 (67%) confirmed at least one isolate as *E. coli* O157. CDC received isolates confirmed as *E. coli* O157:H7 from three additional states. Among all confirmed CDC isolates, 94% were *E. coli* O157:H7, and the remainder were *E. coli* O157:NM. All of the *E. coli* O157:NM produced SLT.

The largest number of confirmed isolates came from northern states (Figure 1). Washington reported the most isolates (156), followed by Oregon (64), Minnesota (63), Massachusetts (36), and Wisconsin (34). Only Minnesota and Wisconsin reported outbreaks of *E. coli* O157:H7 illness during 1988, but isolates from the other states were reported as either sporadic or intrafamilial.

Seventeen states reported data by the month isolates were received at the SPHL. Most isolates were received during the summer months (Figure 2). This seasonal pattern was similar in all these states and for all isolates confirmed at CDC.

DISCUSSION

In most SPHLs, testing for *E. coli* O157 is available. Culture methods for isolating *E. coli* O157:H7 in the clinical laboratory have been previously reported (*10,11*), and a number of commercial manufacturers produce sorbitol-MacConkey agar and immunologic reagents for its isolation and identification.

Most of the SPHLs that did testing in 1988 reported at least one confirmed isolate. Over 90% of the *E. coli* O157 isolates tested at CDC were *E. coli* O157:H7. However, for isolates confirmed at SPHLs, determination of H antigen status was not available, because not all of these laboratories were testing for the flagellar antigen. The existence of other H types indicates the need for routine determination of H type by reference laboratories, using tube agglutination or H7 immobilization (*12*).

Most confirmed *E. coli* O157 strains were reported from northern states. Canada and Great Britain, countries where *E. coli* O157 infections are reported to be common (*2,13*), are also in northern latitudes, validating the geographic distribution of the isolates in our study. However, it is also possible that clinicians in these areas are more likely to request a specific test for *E. coli* O157:H7, or that clinical laboratories are more likely to screen stool specimens for the organism. Some of the testing states that reported few or no isolates stated that they had few requests for *E. coli* O157 testing.

Outbreaks of *E. coli* O157:H7 illness in the United States have also predominated in northern latitudes, including outbreaks occurring in the following states: Oregon (*1*), Michigan (*1*), Washington (*14,15*), Minnesota (*16*), Wisconsin (CDC, unpublished data), North Dakota (CDC, unpublished data), and Montana (CDC, unpublished data). However, outbreaks in other parts of the country have also occurred: Utah (*17*), Nebraska (*18*), North Carolina (*19*), and Missouri (CDC, unpublished data).

The number of SPHLs reporting confirmed *E. coli* O157 isolates in 1988 and the geographic distribution of outbreaks are evidence that this pathogen is widespread in the United States. The seasonal pattern of *E. coli* O157 isolation parallels that of other bacterial enteric pathogens such as *Campylobacter* (*20*) and *Salmonella* (*21*).

The limited surveillance data from Washington (*8,9*) suggest that the dimensions of this problem may be substantial. However, available nationwide information on

E. coli O157 isolates is insufficient to calculate infection rates or to determine adequately geographic distribution. At present, only a few states require reporting of cases of *E. coli* O157:H7 infection or of HUS. Because testing in most SPHLs is available, surveillance data may improve as recognition, screening, and reporting for this pathogen become routine.

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TABLE 1. *Escherichia coli* O157:H7 testing techniques used in state public health laboratories (SPHLs), United States, 1988

State	Testing available	Sorbitol-MacConkey agar used	O antigen test*	H antigen test*	SLT test*
Alabama	No				
Alaska	No				
Arizona	Yes	Yes	S	T	
Arkansas	No				
California	Yes	No	S,T	T	VC
Colorado	Yes	Yes	T	I	
Connecticut	Yes	No	S	I	
Delaware	No				
Dist. of Col.	No				
Florida	No				
Georgia	Yes	Yes	S	T	
Hawaii†	No				
Idaho	Yes	Yes	S	T	
Illinois	Yes	Yes	T	T	
Indiana	Yes	Yes	S	S,T	
Iowa	Yes	Yes	T	T	
Kansas†	No				
Kentucky†	No				
Louisiana	Yes	Yes	S		
Maine	Yes	Yes		T,I	
Maryland	No				
Massachusetts	Yes	Yes	S	S,T	
Michigan	Yes	Yes	S,T	T	
Minnesota	Yes	Yes	T	T	
Mississippi	No				
Missouri	Yes	Yes	T		
Montana	Yes	Yes	IFA	I	
Nebraska	Yes	Yes	S,T	I	
Nevada	No				
New Hampshire	Yes	Yes	S	I	
New Jersey	Yes	Yes	S,T	T	
New Mexico	Yes	Yes	S	T	
New York	Yes	No	S	T	VC
North Carolina	Yes	Yes	S	T	
North Dakota	Yes	Yes	T	T	
Ohio	Yes	No			
Oklahoma	Yes	Yes	S,T	T	
Oregon	Yes	Yes	S	T	
Pennsylvania	Yes	No	S		VC
Rhode Island	Yes	Yes	S	I	
South Carolina	Yes	Yes	S		
South Dakota	Yes	Yes	T	T	
Tennessee	Yes	Yes	T	I	
Texas	Yes	Yes	S	T	
Utah	Yes	Yes	S	I	VC
Vermont	Yes	Yes	S	S	
Virginia	Yes	Yes	T	T	
Washington	Yes	Yes	T	T	
West Virginia	Yes	No	T	T	
Wisconsin	Yes	Yes	S,T	T	
Wyoming	Yes	No	T	T	

*S = slide agglutination, T = tube agglutination, IFA = indirect flouresence antibody, I = H7 immobilization, VC = vero-cell cytotoxicity.
†State public health laboratory began testing in 1989.

FIGURE 1. The distribution of *Escherichia coli* 0157 isolates, by states, 1988

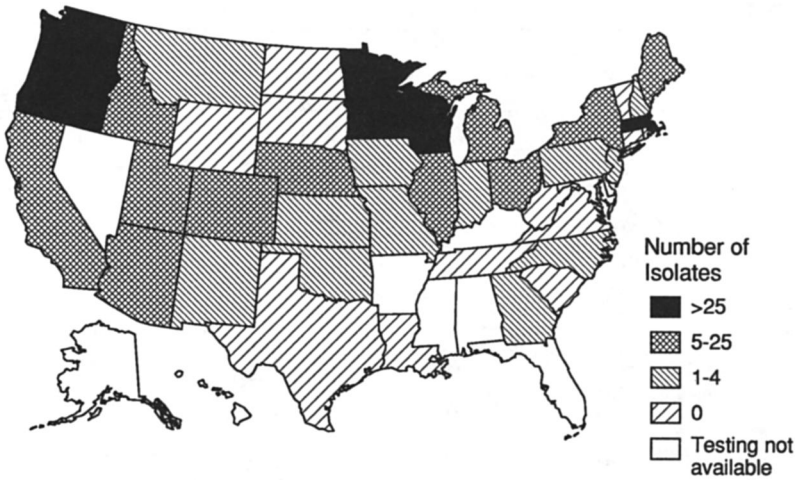
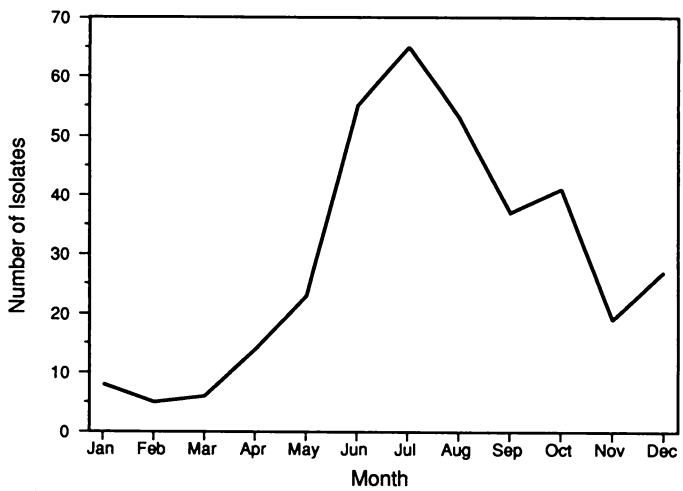


FIGURE 2. Submission of isolates confirmed as *Escherichia coli* 0157 in selected* state public health laboratories, by month, 1988



*The 17 states that submitted monthly data on *E. coli* 0157:H7 isolates are as follows: Arizona, Colorado, Illinois, Indiana, Iowa, Michigan, Montana, Nebraska, New Hampshire, New Mexico, New York, Oklahoma, Oregon, Pennsylvania, Utah, Washington, and Wisconsin.

Surveillance of Major Causes of Hospitalization Among the Elderly, 1988

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Summary

Medicare records represent a potential resource for surveillance data on hospitalizations among the elderly. Several features make these data useful for describing hospitalization patterns:

a) Medicare covers hospitalization expenses for approximately 95% of the U.S. population ⩾65 years, and these data are considered to represent accurately the hospitalization patterns of this group;

b) The comprehensive nature of the information about the beneficiary population provides public health researchers with data to generate accurate rates for well-defined demographic and geographic subgroups;

c) Because data for all covered hospitalizations have been included in the file since 1984, stable estimates for even relatively rare conditions can be generated for any years since then;

d) A unique personal identifier on each record permits the differentiation of first from subsequent hospitalizations, thereby permitting public health researchers to generate both counts and rates of hospitalizations by person and by event; and

e) Temporal trends in hospitalization can be generated for 1980 through 1988, because data are available in machine-readable form.*

This report presents surveillance data for elderly persons hospitalized in 1988 for several diseases of public health importance. In 1988, approximately 9.1 million hospitalizations covered by Medicare occurred among persons ⩾65 years. For major disease categories, the rates of persons discharged ranged from 7,448/100,000 for circulatory diseases to 274/100,000 for blood diseases. For the 49 discrete diseases and conditions studied, rates varied widely by gender, race, and age. Conditions also varied widely in the mean number of discharges per person and in the probability that the condition would be recorded as the principal diagnosis.

INTRODUCTION

Among the elderly, defined as persons ⩾65 years, many diseases and injuries are more prevalent than among younger groups. Medicare, which covers hospitalization expenses for about 95% of the elderly population (*1*), is a potentially useful source of information for monitoring hospitalizations in this group.

*A 20% sample of the data is available for the years 1980 through 1983. All of the data is available for the years 1984-1988.

The Health Care Financing Administration (HCFA) has recently published an extensive presentation of 1986 Medicare discharge data for a number of selected conditions and procedures, by detailed geographic area (*2*).

This report presents an overview of the major causes of hospitalization among elderly persons who were eligible for Medicare in 1988 and demonstrates the use of the Medicare database for surveillance.

METHODS

The data in this analysis are from hospital discharge records (Medicare Part A [Hospitalization Insurance]) for 1988 for persons ≥65 years. Beneficiaries who were enrolled in a health maintenance organization (HMO) (approximately 3.3% of all beneficiaries [*1*]) were excluded from calculations, because the information received by the HCFA on hospitalization of HMO enrollees was incomplete.

Records were selected for 14 major disease categories and, within these categories, for 49 discrete conditions listed in the *International Classification of Diseases, 9th Revision, Clinical Modification* (ICD-9-CM) (*3*) (**Appendix**). Three categories of no or minimal importance among the elderly were excluded—obstetric complications, congenital anomalies, and perinatal conditions. Also excluded were the two supplementary classifications (V and E codes).

The 49 discrete conditions were selected by aggregating ICD-9-CM rubrics on the basis of two criteria. First, the groupings were narrowed to focus on recognized conditions of public health importance, many for which risk factors or potential interventions are known. Second, among such conditions, we chose those responsible for at least 0.03% (an arbitrarily chosen minimum proportion) of discharges.

Some analyses focused on only the principal[†] (first-listed) diagnosis, and others, on any of the possible diagnoses listed ("all-listed")–up to five possible. For each condition, the number of discharges and the number of persons discharged were counted. The number of persons discharged was obtained by using the unique personal identifier to eliminate readmission records for the same condition. Records in each category were aggregated by gender, race,[§] and age. Denominators for the calculation of rates were based on 1988 Medicare enrollment data, excluding HMO enrollees.[¶] To calculate the percentage of discharges, we included in the denominator the total number of discharges for each gender, race, and age category.

RESULTS

In 1988, approximately 9.1 million hospitalizations occurred among the elderly (Table 1). The 14 major categories of conditions accounted for 97.3% of all discharges, and the 49 discrete conditions accounted for 64.5% (Table 1).

[†]The principal diagnosis is that deemed, at discharge, to have been responsible for the patient's admission to the hospital.

[§]Medicare records race as white, black, other, or unknown, but race-specific results are reported here for whites and for blacks only. The other two categories are nonspecific and contain few records. Results reported for the total population or by gender or age are for all races.

[¶]For the five sex-specific conditions (breast, cervical, and prostate cancers; genital prolapse; and hyperplasia of the prostate), the denominator included only the population of the appropriate gender.

Ratios

We calculated the ratio of the number of discharge records that had any mention of a given condition to the number that had that same condition listed as the principal diagnosis (Table 1). A low value suggests that the condition was usually the cause of the hospitalization, such as with colorectal and breast cancers, affective psychoses, acute ischemic heart disease, hip fracture, and other conditions. A high value suggests that the condition usually relates to hospitalization as a contributing condition rather than as the main cause. Osteoporosis and hypertension are examples of common contributing conditions, each of which had a ratio of approximately 42. Osteoporosis was rare as a principal diagnosis, accounting for only 0.03% of all discharges. However, when all-listed diagnoses were considered, osteoporosis was involved in nearly 1.2% of discharges. The contribution of osteoporosis to hip fracture may account for the high ratio. Similarly, hypertension was the principal diagnosis for 0.37% of discharges, but, when listed in any position, it was involved in 15.7% of discharges. The contribution of hypertension to many cardiovascular and cerebrovascular conditions may account for the high ratio. Diabetes and chronic obstructive pulmonary disease (COPD) were also important comorbid conditions.

For each condition, we also calculated the ratios of discharges to the number of persons discharged when the condition was the principal diagnosis (Table 1), which resulted in the mean number of hospitalizations per person. A low value indicated that rehospitalization was infrequent (at least within the year), such as with breast cancer, abdominal hernia, and genital prolapse. Some of the highest values, approximately 1.25 (indicating approximately one readmission per four initial admissions), were for bladder and cervical cancers, affective psychoses, and congestive heart failure.

Ranks

The ranking of the 49 discrete conditions demonstrates the relative importance of each condition as a principal diagnosis (Table 2). The relative frequency of the conditions sometimes varied markedly by gender, race, or age. For example, among men, bladder and lung cancers, abdominal hernia, and aneurysms ranked considerably higher than they did among women, whereas hip fracture, intestinal obstructions and diverticula, and affective psychoses ranked substantially higher among women than among men. Hip fracture and osteoarthritis were more frequent among whites than blacks, but diabetes, renal failure, and hypertension ranked higher among blacks than among whites. Chronic ischemic heart disease, hyperplasia of the prostate, and asthma were less common in the oldest age group than in the youngest, whereas hip fracture, gastrointestinal hemorrhage, and septicemia accounted for proportionately more hospitalizations for the oldest group.

Rates

We also calculated rates of persons discharged, both crude and subgroup-specific, for each major disease category and discrete condition (Tables 3 and 4). The rate of persons discharged is the proportion of non-HMO beneficiaries hospitalized one or more times during the year.

Of all Medicare beneficiaries, 21% (21,418/100,000) were hospitalized at least once in 1988 (Table 3). Men and blacks were hospitalized at slightly higher rates than were women and whites. The all-cause rates for persons discharged for the oldest age group was nearly twice as high as that for the youngest.

The rates for many of the major categories of disease differed more by gender and race than did the all-cause rates (Table 3). The rates for neoplasms and for circulatory, respiratory, and genitourinary diseases were substantially higher for men than for women, whereas the rates for mental and musculoskeletal conditions and for injuries were notably higher for women. For infectious, endocrine, and nervous system diseases, and other conditions, the rates were higher for blacks than whites, whereas rates for musculoskeletal conditions and injuries were higher for whites than blacks. Rates increased with age for all major categories except neoplasms and diseases of the nervous and musculoskeletal systems; for these conditions, rates for persons ages 75-84 years were higher than for those ⩾85 years.

The rate of persons discharged for many of the 49 discrete conditions differed substantially by demographic subgroup (Table 4). For example, for lung cancer, acute ischemic heart disease, and COPD, rates were higher for men than for women, but, for affective psychoses, asthma, and gastroenteritis, rates were higher for women. For bladder cancer, aneurysms, and acute bronchitis, rates were higher for whites than for blacks, but for septicemia, cervical cancer, and hypertensive heart disease, rates were higher for blacks. Persons ⩾85 years were hospitalized more than persons 65-74 years old for septicemia, colorectal cancer, and hypertensive heart disease, whereas the rates were higher in the youngest group for lung cancer, chronic ischemic heart disease, and hyperplasia of the prostate.

Because of the large number of records, Medicare data can be used to generate stable rates that are simultaneously stratified by gender, race, and age. We selected seven conditions for their demographic patterns of hospitalization (Figure 1). The rates are for persons hospitalized for the condition that was listed as the principal diagnosis.

Bladder Cancer. The 35th highest crude rate among the 49 discrete conditions was for bladder cancer. Rates were higher for men than for women, with the gender difference more pronounced among whites than among blacks. Rates for white men were more than double those for black men; for women, little difference was noted between the races. Rates increased steadily with age for all groups.

Diabetes Mellitus. Diabetes had the 16th highest crude rate among the 49 discrete conditions. Rates for blacks were approximately double those for whites. Black women had higher rates than black men, whereas for whites, little difference was noted between the genders. No substantial change with age was apparent, except for a drop in rate for blacks in the oldest group.

Presenile and Senile Dementia. This condition had the 43rd highest crude rate among the 49 discrete conditions. Rates were higher for blacks than for whites, particularly in the youngest group, but they were similar for men and women. Rates increased sharply with age, especially among whites, so that the proportionate difference between the races declined with increasing age.

Chronic Ischemic Heart Disease. This condition had the fifth highest crude rate among the 49 discrete conditions. Rates dropped with age–steeply among white men, but only slightly in the other three groups. Rates for white men were higher than those for the other three groups, in which the rates were similar.

Cerebrovascular Disease. Cerebrovascular disease had the second highest crude rate among the 49 discrete conditions. Rates were higher for blacks in the youngest age group, but racial differences diminished with increasing age. Little difference between the genders was apparent.

Pneumonia. Pneumonia had the third highest crude rate among the 49 discrete conditions. Rates for men were higher than those for women, and rates for whites were higher than those for blacks, except in the youngest age group. Rates increased significantly with age, particularly in the case of white men, among whom a fivefold increase from white men ages 65-74 to white men ages 85 or older was noted.

Hip Fracture. This injury had the seventh highest crude rate among the 49 discrete conditions. The rate increased markedly with age in all combinations of gender and race groups. For each age group, rates were higher for whites than for blacks, and higher for women than for men.

DISCUSSION

Medicare Part A discharge data are available in machine-readable form from 1980 through 1988. For 1980 through 1983, the data set is a systematic sample of 20% of discharges, always based on the same identification numbers so that persons can be followed over the years. Subsequent to 1983, all discharge records are available (about 10 million per year, 90% of them for persons $\geq$65 years).

Medicare and the National Hospital Discharge Survey (NHDS) both provide national data on the diagnosis and treatment of discharged patients. Estimates may differ between the two because of different methods of abstracting hospital records and because of NHDS sampling procedures. Advantages of Medicare data are that they represent most persons $\geq$65 years, they can be used in studies and epidemiologic surveillance of persons as well as hospital discharges (because of the unique personal identifier), they include area of residence of hospitalized persons (including county and zip code), and a denominator data file is available that allows for accurate estimation of rates by race. Advantages of NHDS include a longer period of data collection (since 1964), coverage of persons of all ages, inclusion of seven rather than five discharge diagnoses, and the smaller size of the data set, which allows for easier processing.

The number of hospital discharges, listed by principal diagnosis (Table 1) indicate the burden of hospitalization attributable to each. Further studies can be done using other information about hospitalization burden contained in the Medicare data set, such as length of hospital stay, hospital charges and reimbursement, and in-hospital mortality.

The contribution of comorbid conditions to hospitalization is probably underestimated by the ratio of all-listed diagnoses to principal diagnosis presented in Table 1. The Medicare Part A files can accommodate only five diagnostic codes, and all five are used on nearly half of the hospital discharge records. Many of the original hospital records probably contained more than five diagnoses; the omission of diagnoses beyond the fifth would result in a downward bias in the ratio of all-listed to principal diagnosis.

Our disease classification system influences the rankings (Table 2). Some of the ICD-9-CM rubrics that were excluded because they were responsible for fewer than 0.03% of hospital discharges could have been aggregated into closely related groups of disease entities. These aggregated groups then might have contained enough

hospital discharges to be listed. On the other hand, some of the 49 conditions on the list could have been split into two or more precisely defined categories, each with a smaller number of hospital discharges, which would have lowered their ranking, or may have even excluded them from the list. Therefore, Table 2 must not be regarded as the only possible list of the 49 leading causes of hospitalization.

The rates of persons hospitalized presented in Tables 3 through 5 may be preferable to hospital discharge rates (ratio of hospital discharges to beneficiaries) for estimating person-based measures of morbidity such as prevalence. Hospital discharge rates measure events and cannot distinguish between many persons having one hospitalization each and few persons each having many hospitalizations. The rates of persons hospitalized for all-listed diagnoses from aggregated consecutive years of Medicare data might be used to estimate the prevalence of certain conditions. Such estimates could be validated by comparison with established sources of prevalence data, such as the National Health Interview Survey. Preliminary results (CDC unpublished data) suggest that this approach provides a good estimate of prevalence for ischemic heart disease. This method would allow disease prevalence estimates to be made at the state level, because state of residence is recorded on the Medicare file.

Mortality data commonly have been used for describing disease patterns, but, due to the increase in life expectancy, the need for morbidity surveillance of the elderly has grown. No national surveillance is done for diseases and conditions prevalent in this subgroup of the population, except for cancer. Although Medicare's hospital-data system was not designed for surveillance purposes, the data can be used to complement mortality statistics to obtain a more complete assessment of the burden of disease among the elderly.

References

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3. Health Care Financing Administration. The international classification of diseases. Ninth revision: Clinical modification. 2nd ed. Washington DC: US Department of Health and Human Services, Public Health Service, 1980; DHHS publication no. (PHS)80-1260.

TABLE 1. Number and percent distribution of hospital discharges, ratio of all-listed diagnoses to principal diagnosis, and ratio of hospital discharges to persons discharged, for major categories and discrete conditions, Medicare beneficiaries, United States, 1988

Condition*	Principal diagnosis		Ratio of all-listed diagnoses to principal diagnosis	Ratio of hospital discharges to persons discharged
	Number	Percent		
Total hospital discharges	9,133,330	100.00		
Infectious/parasitic	165,294	1.81	4.55	1.05
Septicemia	103,878	1.14	2.19	1.05
Neoplasms	767,891	8.41	1.84	1.20
Oral cancer	10,570	0.12	1.81	1.14
Colorectal cancer	96,532	1.06	1.43	1.07
Lung cancer	84,909	0.93	2.46	1.18
Breast cancer	66,362	0.73	1.34	1.03
Cervical cancer	4,077	0.04	2.16	1.27
Prostate cancer	82,542	0.90	1.79	1.10
Bladder cancer	48,001	0.53	1.46	1.25
Endocrine/metabolic	373,198	4.09	7.44	1.11
Diabetes mellitus	121,637	1.33	10.20	1.13
Fluid/electrolyte	189,215	2.07	6.58	1.07
Blood diseases	87,489	0.96	10.18	1.17
Anemias	36,388	0.40	14.21	1.18
Mental disorders	232,230	2.54	3.67	1.26
Pre/senile dementia	26,871	0.29	4.05	1.12
Affective psychoses	79,315	0.87	1.36	1.29
Nervous system	209,441	2.29	4.37	1.09
Alzheimers	3,346	0.04	17.56	1.03
Cataracts	25,094	0.27	1.93	1.05
Circulatory diseases	2,739,778	30.00	2.08	1.35
Hypertension	34,112	0.37	41.94	1.06
Hypertensive heart disease	35,951	0.39	6.20	1.10
Acute ischemic heart disease	604,739	6.62	1.38	1.21
Chronic ischemic heart disease	297,034	3.25	5.59	1.14
Cardiac dysrhythmias	276,588	3.03	5.40	1.11
Congestive heart failure	486,288	5.32	2.68	1.25
Cerebrovascular disease	547,159	5.99	1.71	1.12
Atherosclerosis	34,858	0.38	5.82	1.10
Aneurysms	46,820	0.51	2.03	1.09
Embolism/thrombosis	50,223	0.55	1.69	1.09
Thrombo/phlebitis	34,326	0.38	1.69	1.04
Respiratory diseases	1,007,970	11.04	2.49	1.24
Acute bronchitis	133,881	1.47	1.59	1.12
Pneumonia	456,107	4.99	1.55	1.10
COPD	82,120	0.90	14.66	1.21
Asthma	80,289	0.88	2.20	1.24
Pneumonitis	41,030	0.45	2.11	1.10
Digestive diseases	1,034,576	11.33	1.86	1.14
Ulcers	115,846	1.27	1.93	1.04
Gastritis/duodenitis	44,802	0.49	3.59	1.03
Abdominal hernia	125,740	1.38	2.55	1.03
Gastroent/colitis	54,669	0.60	2.29	1.03
Intestinal obstruct	106,647	1.17	2.09	1.11
Intestinal diverticula	93,753	1.03	2.51	1.07
Chronic liver/cirrhosis	16,837	0.18	4.48	1.22
Cholelithiasis	143,369	1.57	1.63	1.06
G.I. hemorrhage	93,429	1.02	3.04	1.08
Genitourinary diseases	607,226	6.65	3.20	1.10
Renal failure	46,371	0.51	6.66	1.11
Kidney/ureter stones	59,225	0.65	3.30	1.15
Hyperplasia of prostate	176,031	1.93	1.61	1.02
Genital prolapse	43,608	0.48	1.28	1.01
Skin diseases	133,510	1.46	3.02	1.10
Musculoskeletal/connective	396,846	4.35	2.74	1.11
Osteoarthritis	124,734	1.37	3.14	1.06
Intervertebral disc	41,802	0.46	1.75	1.09
Osteoporosis	2,569	0.03	41.61	1.02
Symptoms & signs	429,821	4.71	3.81	1.06
Injuries/poisoning	698,606	7.65	1.75	1.10
Hip fracture	204,390	2.24	1.08	1.05
Complications	170,737	1.87	3.01	1.14
Total major categories	8,883,876	97.30		
Total discrete conditions	5,884,821	64.50		

*Shorthand designation below defined more fully in Appendix.

TABLE 2. Rank of principal diagnoses of discrete conditions, by number of hospital discharges, Medicare beneficiaries, United States, 1988

Condition	Number of discharges	Rank							
		All beneficiaries	Gender		Race		Age group (years)		
			Male	Female	White	Black	65-74	75-84	⩾85
Acute ischemic h.d.	604,739	1	1	1	1	3	1	2	5
Cerebrovascular dis	547,159	2	2	2	2	1	2	1	3
Congestive heart fail	486,288	3	4	3	3	2	4	3	2
Pneumonia	456,107	4	3	4	4	4	5	4	1
Chronic ischemic h.d.	297,034	5	6	7	5	9	3	7	12
Cardiac dysrhythmias	276,588	6	7	6	6	7	6	5	7
Hip fracture	204,390	7	20	5	7	21	23	6	4
Fluid/electrolyte	189,215	8	11	8	9	5	14	8	6
Hyperplasia of prostate	176,031	9	5		8	11	7	9	19
Complications	170,737	10	8	10	10	8	8	10	13
Cholelithiasis	143,369	11	14	9	11	22	9	12	16
Acute bronchitis	133,881	12	12	13	12	23	12	11	14
Abdominal hernia	125,740	13	10	23	13	24	11	15	20
Osteoarthritis	124,734	14	21	11	14	28	10	13	26
Diabetes mellitus	121,637	15	16	12	16	6	13	16	21
Ulcers	115,846	16	15	17	15	16	16	14	11
Intestinal obstruct	106,647	17	22	14	17	15	21	17	10
Septicemia	103,878	18	19	18	18	10	27	18	8
Colorectal cancer	96,532	19	17	22	19	20	20	19	18
Intestinal diverticula	93,753	20	27	16	20	25	22	21	15
G.I. hemorrhage	93,429	21	23	20	21	13	28	20	9
Lung cancer	84,909	22	13	27	22	19	15	25	39
Prostate cancer	82,542	23	9		25	14	24	22	23
COPD	82,120	24	18	26	24	27	19	23	33
Asthma	80,289	25	28	21	26	12	17	26	32
Affective psychoses	79,315	26	31	19	23	38	18	24	37
Breast cancer	66,362	27		15	27	33	26	27	34
Kidney/ureter stones	59,225	28	24	34	28	37	25	32	40
Gastroent/colitis	54,669	29	36	25	29	34	33	28	22
Embolism/thrombosis	50,223	30	29	29	31	31	32	31	28
Bladder cancer	48,001	31	25	42	30	40	35	29	27
Aneurysms	46,820	32	26	41	32	41	31	33	41
Renal failure	46,371	33	30	33	36	17	36	30	24
Gastritis/duodenitis	44,802	34	35	28	34	32	34	35	29
Genital prolapse	43,608	35		24	33	44	29	40	44
Intervertebral disc	41,802	36	34	30	35	42	30	44	43
Pneumonitis	41,030	37	32	37	37	35	43	34	17
Anemias	36,388	38	37	36	39	30	41	37	25
Hypertensive h.d.	35,951	39	38	32	41	18	40	36	31
Atherosclerosis	34,858	40	33	39	40	29	38	42	35
Thrombo/phlebitis	34,326	41	39	35	38	43	39	39	38
Hypertension	34,112	42	41	31	42	26	37	41	42
Pre/senile dementia	26,871	43	40	40	43	36	45	38	30
Cataracts	25,094	44	43	38	44	39	44	43	36
Chronic liver/cirrhosis	16,837	45	42	43	45	45	42	45	
Oral cancer	10,570	46	44	44	46	47	46	46	45
Cervical cancer	4,077	47		45	47	46	47	48	49
Alzheimers	3,346	48	45	47	48	48	48	47	47
Osteoporosis	2,569	49	46	46	49	49	49	49	48

TABLE 3. Rate of persons discharged, per 100,000 population, for 14 major disease categories listed as principal diagnosis, Medicare beneficiaries, United States, 1988

Category	No. of persons	All beneficiaries	Gender		Race		Age group (years)		
			Male	Female	White	Black	65-74	75-84	≥85
All causes	5,849,275	21417.9	22732.2	20537.2	21526.5	21821.0	17147.0	25421.9	32600.5
Infectious/ parasitic	156,690	573.7	567.3	578.1	560.6	756.5	364.4	720.6	1269.1
Neoplasms	641,595	2349.3	2867.4	2002.1	2357.5	2441.0	2115.8	2765.0	2374.5
Endocrine/ metabolic	336,267	1231.3	1054.6	1349.7	1139.3	2352.7	852.2	1517.4	2430.5
Blood diseases	74,861	274.1	258.3	284.7	268.4	370.1	188.4	345.5	525.6
Mental disorders	185,006	677.4	623.1	713.8	680.2	723.8	584.6	803.3	804.7
Nervous system	192,383	704.4	695.1	710.7	698.4	812.0	580.0	893.4	814.5
Circulatory diseases	2,034,110	7448.2	8314.6	6867.6	7459.2	7985.3	5681.2	9237.8	11678.0
Respiratory diseases	810,509	2967.8	3398.2	2679.4	3006.8	2756.2	2072.0	3625.8	5855.0
Digestive diseases	908,577	3326.9	3453.3	3242.2	3365.6	3095.8	2665.1	3957.0	5030.7
Genitourinary diseases	550,604	2016.1	2957.4	1385.3	2006.4	2254.6	1689.8	2330.9	2844.1
Skin diseases	121,769	445.9	413.8	467.4	431.1	646.4	304.3	536.9	941.1
Musculoskeletal/ connective	357,120	1307.7	1063.9	1471.0	1351.8	905.4	1234.7	1489.4	1160.8
Symptoms & signs	404,956	1482.8	1480.9	1484.1	1466.8	1764.3	1199.9	1761.7	2182.8
Injuries/ poisoning	635,416	2326.7	1866.6	2635.0	2401.6	1719.1	1479.3	2891.6	5228.7

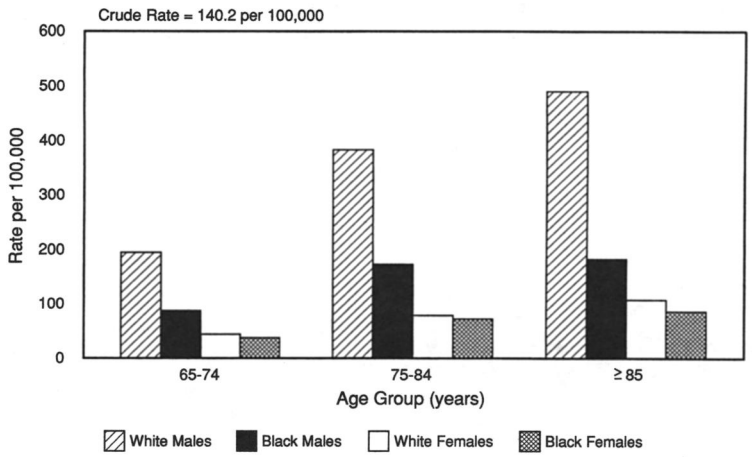
TABLE 4. Rate of persons discharged, per 100,000 population, for 49 discrete conditions listed as principal diagnosis, Medicare beneficiaries, United States, 1988

Condition	No. of persons	All beneficiaries	Gender		Race		Age group (years)		
			Male	Female	White	Black	65-74	75-84	≥85
Infectious/parasitic									
Septicemia	98,537	360.8	370.3	354.5	348.5	530.0	198.6	460.1	942.9
Neoplasms									
Oral cancer	9,240	33.8	49.4	23.4	34.2	31.5	34.3	35.1	27.5
Colorectal cancer	89,909	329.2	380.4	294.9	333.0	313.5	252.1	425.3	460.4
Lung cancer	71,834	263.0	417.2	159.7	261.5	300.1	284.8	270.2	124.2
Breast cancer	64,678	236.8		395.3	243.0	181.0	231.1	261.4	194.9
Cervical cancer	3,217	11.8		19.7	9.9	33.2	11.8	11.5	12.8
Prostate cancer	74,838	274.0	682.9		267.9	379.2	220.0	361.9	304.5
Bladder cancer	38,291	140.2	256.3	62.4	147.5	80.6	105.4	183.6	199.6
Endocrine/metabolic									
Diabetes mellitus	107,880	395.0	364.0	415.8	352.0	874.2	370.5	444.7	379.8
Fluid/electrolyte	177,546	650.1	533.6	728.2	617.9	1093.4	339.2	838.8	1770.5
Blood diseases									
Anemias	30,723	112.5	109.3	114.7	107.8	179.4	73.0	144.2	231.9
Mental disorders									
Pre/senile dementia	24,079	88.2	85.0	90.3	85.7	131.8	38.3	140.8	201.6
Affective psychoses	61,698	225.9	161.2	269.3	237.8	114.0	227.4	252.1	139.8
Nervous system									
Alzheimers	3,262	11.9	11.6	12.2	11.8	15.2	5.2	20.0	24.4
Cataracts	23,906	87.5	66.1	101.9	85.8	107.7	50.3	129.3	164.6
Circulatory diseases									
Hypertension	32,257	118.1	86.0	139.6	104.9	276.0	108.4	136.2	116.8
Hypertensive H.D.	32,769	120.0	101.5	132.4	101.9	335.6	84.3	158.1	199.7
Acute ischemic H.D.	499,820	1830.2	2148.2	1617.0	1877.2	1432.4	1566.8	2212.5	2116.5
Chronic ischemic H.D.	259,886	951.6	1244.3	755.5	983.4	647.2	1038.2	915.5	590.7
Cardiac dysrhythmias	248,797	911.0	992.0	856.7	925.2	857.9	669.3	1190.1	1387.7
Congestive heart failure	388,308	1421.8	1514.6	1359.7	1401.8	1798.9	826.9	1882.3	3269.4
Cerebrovascular disease	490,269	1795.2	1862.9	1749.8	1773.0	2216.3	1150.3	2405.5	3466.5
Atherosclerosis	31,667	116.0	147.5	94.8	107.8	222.4	98.6	129.6	169.2
Aneurysms	43,107	157.8	285.0	72.7	165.4	84.5	149.5	187.1	115.6
Embolism/thrombosis	46,205	169.2	205.4	144.9	169.2	188.3	145.3	193.8	225.2
Thrombo/phlebitis	33,146	121.4	104.9	132.4	125.2	89.8	103.0	146.6	145.7
Respiratory diseases									
Acute bronchitis	119,171	436.4	490.7	400.0	452.8	292.4	365.9	522.2	562.0
Pneumonia	413,741	1515.0	1785.7	1333.6	1539.8	1361.2	862.0	1907.4	3879.3
COPD	68,120	249.4	334.6	192.4	253.1	227.1	236.6	294.7	184.2
Asthma	64,741	237.1	199.9	262.0	230.5	312.3	236.8	253.8	188.7
Pneumonitis	37,267	136.5	168.1	115.3	135.6	154.9	48.6	178.9	485.8
Digestive diseases									
Ulcers	110,982	406.4	449.8	377.3	409.7	389.5	300.2	515.8	655.1
Gastritis/duodenitis	43,506	159.3	144.0	169.6	157.7	187.8	128.4	192.0	229.3
Abdominal hernia	122,511	448.6	720.1	266.6	463.8	312.5	414.5	515.8	432.9
Gastroent/colitis	53,224	194.9	137.4	233.4	198.4	166.8	145.3	240.7	327.0
Intestinal obstruct	96,141	352.0	323.0	371.5	352.4	383.4	233.5	448.5	706.3
Intestinal diverticula	88,011	322.3	242.1	376.0	327.1	303.4	234.6	407.3	543.5
Chronic liver/cirrhosis	13,812	50.6	65.1	40.9	51.2	42.9	58.3	45.8	23.1
Cholelithiasis	134,811	493.6	458.1	517.5	508.8	319.9	468.5	528.6	525.4
G.I. hemorrhage	86,421	316.4	326.0	310.0	311.6	393.7	186.9	404.6	754.9
Genitourinary diseases									
Renal failure	41,589	152.3	189.8	127.2	135.8	347.7	101.4	193.7	304.2
Kidney/ureter stones	51,418	188.3	288.1	121.4	194.6	127.9	207.0	179.5	113.2
Hyperplasia of prostate	172,900	633.1	1577.8		646.1	53.9	614.6	732.7	436.7
Genital prolapse	42,992	157.4		262.9	166.8	51.1	186.2	142.5	45.9
Musculoskeletal/connective									
Osteoarthritis	117,132	428.9	364.6	472.0	446.8	263.2	418.9	510.8	239.1
Intervertebral disc	38,285	140.2	139.3	140.8	145.3	87.2	163.8	123.9	60.9
Osteoporosis	2,517	9.2	2.3	13.9	9.9	2.1	4.7	13.2	21.7
Injuries/poisoning									
Hip fracture	194,270	711.4	369.4	940.5	754.9	327.9	238.0	966.5	2512.5
Complications	150,006	549.3	669.6	468.6	549.5	586.0	505.8	623.6	563.2

APPENDIX. ICD-9-CM Shorthand Designations and Conditions Used

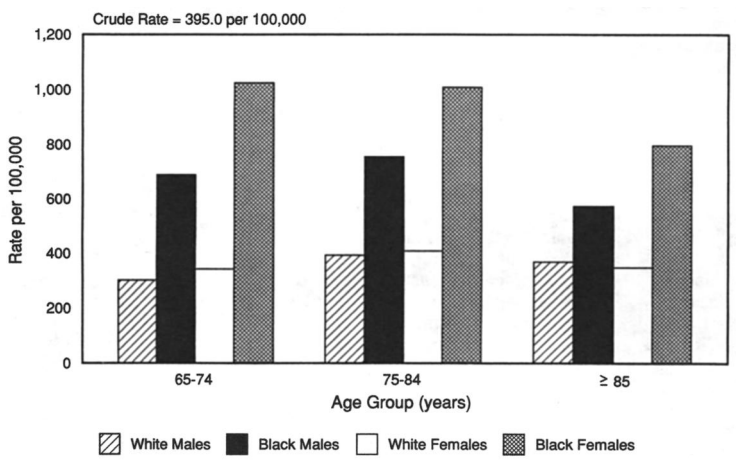
Shorthand Designation	Condition	ICD-9-CM Rubric
Infectious/parasitic	Infectious & parasitic diseases	001-139
Septicemia	Septicemia	038
Neoplasms	Neoplasms	140-239
Oral Cancer	Malignant Neoplasm of Lip, Oral Cavity, & Pharynx	140-149
Colorectal Cancer	Malignant Neoplasm of Colon & Rectum	153-154
Lung Cancer	Malignant Neoplasm of Trachea, Bronchus, & Lung	162
Breast Cancer	Malignant Neoplasm of Female Breast	174
Cervical Cancer	Malignant Neoplasm of Cervix Uteri	180
Prostate Cancer	Malignant Neoplasm of Prostate	185
Bladder Cancer	Malignant Neoplasm of Bladder	188
Endocrine/Metabolic	Endocrine, Nutritional, Metabolic, & Immunity Disorders	240-279
Diabetes Mellitus	Diabetes Mellitus	250
Fluid/Electrolyte	Disorders of the Fluid, Electrolyte, & Acid-Base Balance	276
Blood Diseases	Diseases of Blood & Blood-Forming Organs	280-289
Anemias	Non-Deficiency Anemias	282-285
Mental Disorders	Mental Disorders	290-319
Pre/Senile Dementia	Senile, Presenile, & Arteriosclerotic Dementia	290.1-290.4
Affective Psychoses	Affective Psychoses	296
Nervous System	Diseases of Nervous System & Sense Organs	320-389
Alzheimers	Alzheimer's Disease	331.0
Cataracts	Cataract	366
Circulatory Diseases	Diseases of the Circulatory System	390-459
Hypertension	Essential & Secondary Hypertension & Hypertensive Renal Disease	401,403,405
Hypertensive H.D.	Hypertensive Heart (& Renal) Disease	402,404
Acute Ischemic H.D.	Acute Ischemic Heart Disease	410,411
Chronic Ischemic H.D.	Chronic Ischemic Heart Disease	412-414
Cardiac Dysrhythmias	Cardiac Dysrhythmias	427
Congestive Heart Fail	Congestive Heart Failure	428.0
Cerebrovascular Dis	Cerebrovascular Disease	430-438
Atherosclerosis	Atherosclerosis	440
Aneurysms	Aneurysm	441-442
Embolism/Thrombosis	Arterial Embolism & Thrombosis	444
Thrombo/Phlebitis	Phlebitis & Thrombophlebitis	451
Respiratory Diseases	Diseases of the Respiratory System	460-519
Acute Bronchitis	Acute Bronchitis & Bronchiolitis	466
Pneumonia	Pneumonia	480-486
COPD	Chronic Bronchitis, Emphysema, & Chronic Airway Obstruction	491-492,496
Asthma	Asthma	493
Pneumonitis	Pneumonitis	507
Digestive Diseases	Diseases of the Digestive System	520-579
Ulcers	Gastrointestinal Ulcers	531-534
Gastritis/Duodenitis	Gastritis & Duodenitis	535
Abdominal Hernia	Hernia of Abdominal Cavity	550-553
Gastroent/Colitis	Non-Infectious Gastroenteritis & Colitis	558
Intestinal Obstruct	Intestinal Obstruction without Hernia	560
Intestinal Diverticula	Diverticula of Intestines	562
Chronic Liver/Cirrhosis	Chronic Liver Disease & Cirrhosis	571
Cholelithiasis	Cholelithiasis	574
G.I. Hemorrhage	Gastrointestinal Hemorrhage	578
Genitourinary Diseases	Diseases of the Genitourinary System	580-629
Renal Failure	Acute and Chronic Renal Failure	584-586
Kidney/Ureter Stones	Calculus of Kidney, Ureter, & Lower Urinary Tract	592,594
Hyperplasia of Prostate	Hyperplasia of Prostate	600
Genital Prolapse	Genital Prolapse	618
Skin Diseases	Diseases of the Skin & Subcutaneous Tissue	680-709
Musculoskeletal/Connective	Musculoskeletal & Connective Tissue Disorders	710-739
Osteoarthritis	Osteoarthritis	715
Intervertebral Disc	Intervertebral Disc Disorders	722
Osteoporosis	Osteoporosis	733.0
Symptoms & Signs	Symptoms, Signs, & Ill-defined Conditions	780-799
Injuries/Poisoning	Injuries & Poisoning	800-999
Hip Fracture	Fracture of Neck of Femur	820
Complications	Complications of Surgical & Medical Care	996-999

FIGURE 1. Rate of persons discharged, per 100,000 population, for bladder cancer listed as principal diagnosis, Medicare beneficiaries, United States, 1988



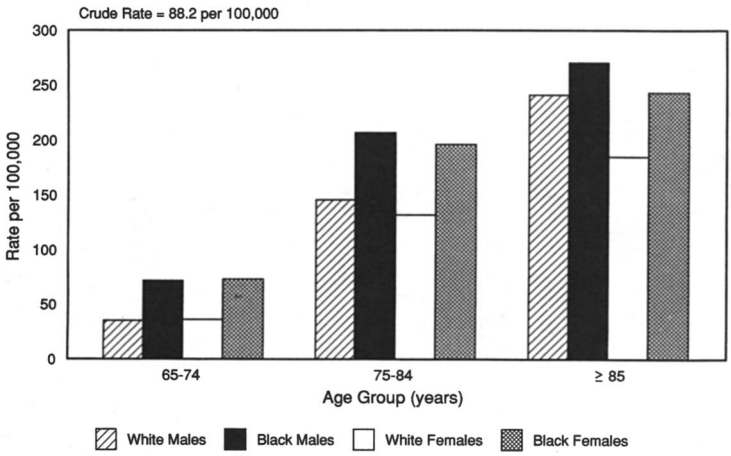
Medicare, 1988.

FIGURE 2. Rate of persons discharged, per 100,000 population, for diabetes mellitus listed as principal diagnosis, Medicare beneficiaries, United States, 1988



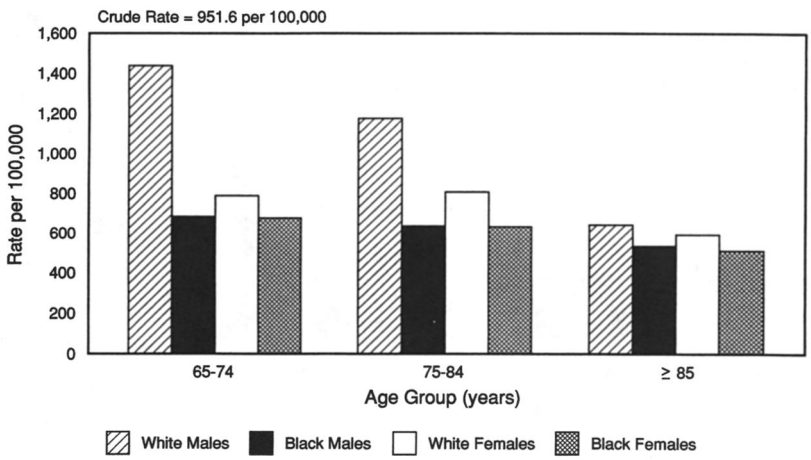
Medicare, 1988.

FIGURE 3. Rate of persons discharged, per 100,000 population, for presenile and senile dementia listed as principal diagnosis, Medicare beneficiaries, United States, 1988



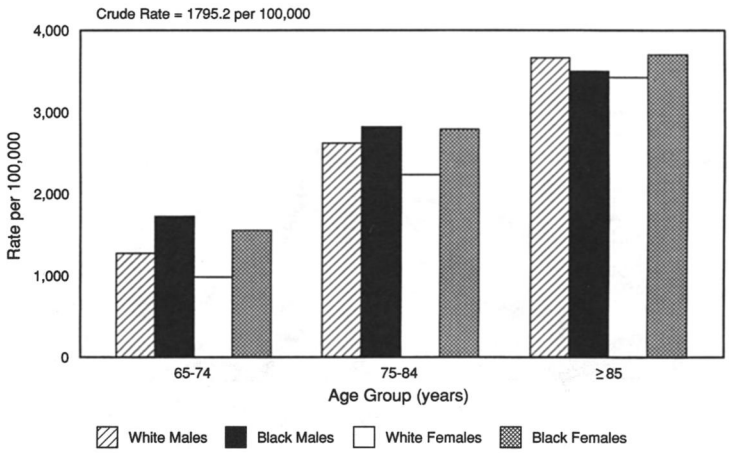
Medicare, 1988.

FIGURE 4. Rate of persons discharged, per 100,000 population, for chronic ischemic heart disease listed as principal diagnosis, Medicare beneficiaries, United States, 1988



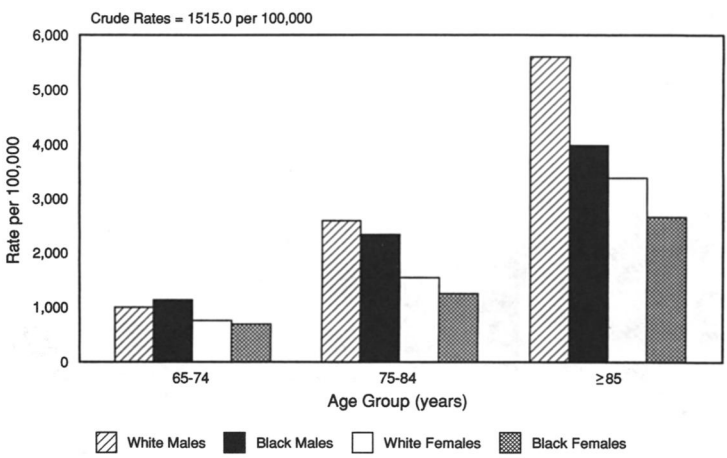
Medicare, 1988.

FIGURE 5. Rate of persons discharged, per 100,000 population, for cerebrovascular disease listed as principal diagnosis, Medicare beneficiaries, United States, 1988



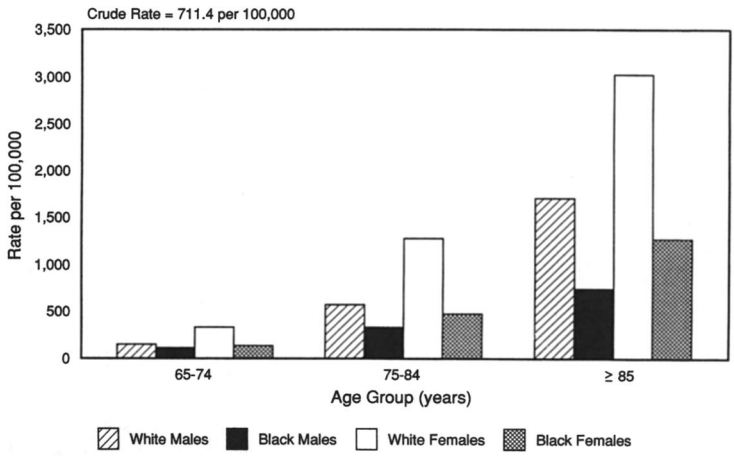
Medicare, 1988.

FIGURE 6. Rate of persons discharged, per 100,000 population, for pneumonia listed as principal diagnosis, Medicare beneficiaries, United States, 1988



Medicare, 1988.

FIGURE 7. Rate of persons discharged, per 100,000 population, for hip fracture listed as principal diagnosis, Medicare beneficiaries, United States, 1988



Medicare, 1988.

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Source: Association for Vital Records and Health Statistics

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