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# National Health Statistics Reports

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## National Hospital Care Survey Demonstration Projects: Characteristics of Inpatient and Emergency Department Encounters Among Patients With Any Listed Diagnosis of Alzheimer Disease

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### Abstract

*Objective*—This report demonstrates the use of National Hospital Care Survey (NHCS) data using Alzheimer disease (AD) as an outcome. Inpatient discharges and emergency room encounters among patients with AD are described to demonstrate the use of NHCS. The capability of NHCS to link across hospital settings and to the National Death Index (NDI) is highlighted. The data are unweighted and are not nationally representative.

*Methods*—This study analyzed inpatient (IP) and emergency department (ED) data from the 83 nonchildren’s hospitals in the 2014 NHCS, out of a sample of 581 hospitals that provided Uniform Bill (UB)–04 administrative claims data for both the IP and ED settings. Encounters with any listed diagnosis of AD were identified using an *International Classification of Diseases, Ninth Revision, Clinical Modification* diagnosis code. Individual patients who had any encounter during calendar year 2014 were linked across different hospital-based settings during the same year and with NDI to identify deaths in 2014 or 2015.

*Results*—Analyses are presented on IP and ED encounters with any listed diagnosis of AD to highlight the analytical capabilities of NHCS not available in previous surveys. New data elements not available in the National Hospital Discharge Survey (NHCS’ predecessor survey) are analyzed, including intensive care use, and diagnostic and therapeutic services received. Linkage across hospital settings (IP and ED) allows for differentiation of patients who were admitted directly as inpatients from those who were admitted as inpatients from the ED, and allows for identification of patients with only an ED encounter. Linkage to NDI allows for analyses of the underlying cause of death for those deaths occurring in 2014 and 2015. Although these data are not nationally representative, NHCS provides unique analytical opportunities to examine health care utilization among patients with AD across settings.

**Keywords:** National Death Index • mortality • hospitalization • dementia

### Introduction

Dementia is a term for a group of symptoms characterized by a decline in memory or other thinking skills that affect a person’s ability to perform everyday activities (1). Alzheimer disease (AD) is the most common form of dementia, accounting for approximately 60% to 80% of dementia cases (1). Of these, about one-half have an exclusively Alzheimer pathology, while the remainder have more than one type of dementia with Alzheimer pathology, or mixed dementia (1). According to the National Institute on Aging, “Alzheimer’s disease is an irreversible, progressive brain disorder that slowly destroys memory and thinking skills and, eventually, the ability to carry out the simplest tasks” (2). With AD, the damage to and death of neurons eventually impairs a person’s ability to carry out basic bodily functions and is ultimately fatal (1). The Alzheimer’s Association estimates that 10% of people aged 65 and over have AD (1).

Cases of AD are expected to increase as the number of Americans over age 65 increases (3). By 2050, the number of those aged 65 and over with AD is projected to be about 14 million, almost triple the 2014 estimates (3).



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Estimates of the total cost of AD range from \$157 to \$215 billion in 2010 (4). Health care utilization of all types, including hospitalizations, and institutional and home-based long-term care, is greater among persons with AD and other dementias (1).

Understanding health care utilization patterns for patients with AD is important for informing policy and monitoring care quality and health outcomes for this group. The National Hospital Care Survey (NHCS) offers a new opportunity to examine patterns of care for those with AD across different hospital settings and to identify mortality among these patients. This report demonstrates how the NHCS linkage capabilities can be used to track patients across settings, identify the total number of encounters per patient across emergency department (ED) and inpatient (IP) settings, and examine cause of death for patients with AD.

## Methods

### Data source

#### National Hospital Care Survey

NHCS started in 2013, and integrates the National Hospital Discharge Survey, the National Hospital Ambulatory Medical Care Survey, and the Drug Abuse Warning Network, previously conducted by the Substance Abuse and Mental Health Services Administration. It was created to streamline data collection across health care settings and to begin collecting health care utilization data electronically. More information on NHCS is available from: [https://www.cdc.gov/nchs/nhcs/about\\_nhcs.htm](https://www.cdc.gov/nchs/nhcs/about_nhcs.htm). For detailed information on sample design, data collection, personally identifiable information (PII), claims deduplication, and patient identification, see the Methods and Technical Notes sections in “National Hospital Care Survey Demonstration Projects: Traumatic Brain Injury,” available from: <https://www.cdc.gov/nchs/data/nhsr/nhsr097.pdf>.

#### Uniform Bill–04 claims data

NHCS collects Uniform Bill (UB)–04 administrative claims data electronically from participating hospitals. The UB–04 is the administrative claim required by the Centers for Medicare and Medicaid Services and most commercial payers. The UB–04 claims contain physician and patient identifiers and data on patient demographics, diagnoses, procedures, and revenue codes. Using UB–04 claims data presents the challenge of deduplication of claims, because one discharge or ambulatory encounter can have multiple claims.

#### Personally identifiable information

NHCS uses the PII on the UB–04 to deduplicate claims and to allow linkage of patient data across hospital settings and with other data sources such as the National Death Index (NDI) and Medicare and Medicaid claims databases. For example, an individual can be traced from an initial encounter to the ED, to admission to the hospital, and discharge from the hospital. Another benefit of PII is that patients who return to the hospital after an IP discharge or an ED encounter can be identified. With the exception of the medical record number, which was used for sampling, the National Hospital Discharge Survey and National Hospital Ambulatory Medical Care Survey did not collect PII, and therefore linkages across hospital settings and discharge cannot be performed with those data.

PII also allows for linkage to NDI, a centralized database of death record information compiled from state vital statistics offices. These mortality data are provided by the states, under contract agreements with the National Center for Health Statistics. Linkage to NDI allows researchers to conduct a wide range of outcome studies (e.g., 30-, 60-, and 90-day mortality after discharge from a hospital) designed to investigate the association of a number of factors related to mortality. The methods for linking the NHCS data to NDI are detailed in the [Technical Notes](#). All of the hospitals included in this analysis provided patient personal identifiers. Information on NDI is available from: <https://www.cdc.gov/nchs/ndi/index.htm>.

#### Analytic population

The response rate for NHCS was 16% for 2014 (95 hospitals across all settings from 581 in the sample). Participating hospitals were asked to provide all encounters in IP and ambulatory settings (e.g., EDs) in 2014. This study is limited to the 83 nonchildren’s hospitals that provided both IP and ED claims to capture all IP and ED encounters for the given population. All encounters from children’s hospitals and those in which the patient was under age 50 years were excluded, because AD encounters are rare for this age group. After excluding these encounters, there were 1,521,610 ED encounters and 782,520 IP encounters.

To identify patients with AD, at least one diagnosis field on the claim, including admission diagnosis, had to include an *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD–9–CM) code for AD. Claims included 25 diagnosis fields and a separate field for admission diagnosis. Encounters with any listed diagnosis of AD were identified by the presence of ICD–9–CM code 331.0 in any of 25 diagnosis fields plus the admission diagnosis field. Underlying cause of death is determined from the death certificate and is coded with the *International Classification of Diseases, Tenth Revision*. Analyses of underlying cause of death examined all the underlying causes, not just AD.

For this report, deaths were identified through linkage to NDI and identification from the UB–04 administrative claim. The deaths identified from administrative claims include deaths that occurred at the hospital at the time of visit or deaths that occurred after the patient’s discharge and were reported to the hospital; these are termed “hospital-reported deaths.” These approaches for determining the number of deaths were deduplicated so no death was counted twice.

Throughout the report, ED and IP encounters refer only to those with any listed diagnosis of AD unless specified. ED encounters that did not lead to a hospital admission are referred to as “ED only.” Given NHCS’ capability for linking patients across hospital settings, this report is able to identify ED

encounters subsequently admitted to the hospital as inpatient. These are referred to as “ED and IP.” IP encounters that were admitted directly (i.e., not through the ED) are referred to as “IP only.”

There were 19,600 ED encounters with any listed diagnosis of AD. Of these, 6,720 were ED only and were not admitted to the hospital as inpatients. There were 14,890 IP encounters with any listed diagnosis of AD. Of these, 12,430 were ED and IP, meaning they had a matching ED claim indicating they were admitted through the ED. Finally, 2,470 were IP only and did not have a matching ED claim, indicating they were not admitted through the ED. In total, this analysis examines 21,620 encounters (6,720 ED-only encounters, 2,470 IP-only encounters, and 12,430 ED and IP encounters). Since NHCS collects individual identifiers, it was possible to identify unique patients (see [Technical Notes](#)) in addition to encounters. Using these identifiers, it was possible to determine that the 21,620 encounters represented 16,240 unique patients. Based on the NDI linked data, 7,220 patients were identified as deceased in 2014 and 2015.

## Analysis

The data presented in this report are not nationally representative due to the low response rate of sampled hospitals and unweighted data. Counts are rounded to the nearest 10; percentages are rounded to the nearest whole number. Due to privacy and data disclosure concerns, cell counts based on fewer than 60 cases are not reported. No statistical comparisons were conducted because this report is meant to be an illustrative example of what can be done with the data, and not to produce official, representative estimates of IP and ED visits related to AD.

Revenue codes, collected through the claims data, are included in the record of an IP hospitalization or ED visit. These codes describe services provided during an encounter, from room and board to diagnostic and therapeutic services received by a patient. In this report, revenue codes are used to analyze intensive care unit (ICU) stay as well as services received.

To track the number of encounters per patient and mortality, patients were identified using a unique patient identifier.

The results are divided into two sections: encounter-level data and patient-level data. Encounter-level data include findings on demographics, diagnoses, services received, IP length of stay, and discharge disposition. Patient-level data include the number of encounters per patient, percentage of patients who died, and underlying cause of death. More information about revenue codes and linkage to NDI is in the [Technical Notes](#).

## Results

### Encounter-level data

#### Demographics

NHCS collects data on patient demographics for all settings in the same hospital.

Among ED-only, IP-only, and ED and IP AD encounters, the majority of encounters among men and women were by those aged 75–84 and 85 and over ([Figure 1](#)).

#### First-listed diagnoses

The first-listed diagnosis is generally considered the primary diagnosis or the main cause of the encounter. Encounters included in this report were identified based on any mention of AD in any of 26 diagnosis fields, including the first-listed diagnosis and the admission diagnosis. First-listed diagnoses for AD encounters are shown in [Table 1](#).

- The majority of ED-only AD encounters had first-listed diagnoses of signs, symptoms and ill-defined conditions (28%); injuries and poisoning (24%); or diseases of nervous and sense organs (10%).
- The majority of IP-only AD encounters had first-listed diagnoses of diseases of the nervous system and sense organs (21%), diseases of the circulatory system (16%), or injuries and poisoning (10%).

- The majority of ED and IP AD encounters had first-listed diagnoses of diseases of the circulatory system (17%), injuries and poisoning (15%), infectious and parasitic diseases (13%), diseases of the genitourinary system (11%), diseases of nervous system and sense organs (10%), or diseases of the respiratory system (10%).

#### Services received

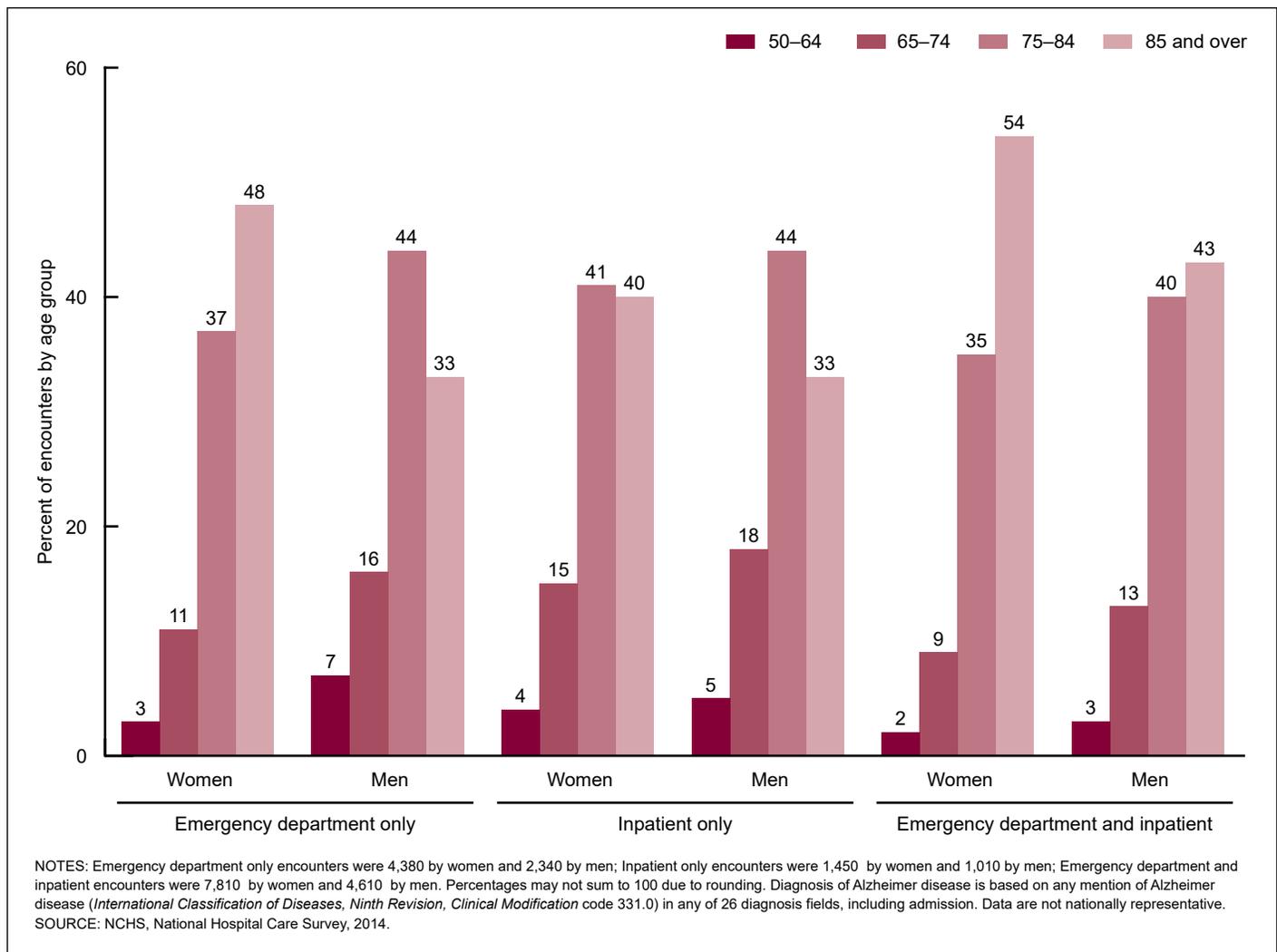
- Pharmacy or laboratory services were received at nearly all IP-only and ED and IP AD encounters ([Table 2](#)).
- For IP-only and ED and IP AD encounters, physical therapy was the second most reported therapeutic service received (55% and 62%, respectively) after pharmacy services. Among ED-only AD encounters, IV therapy was received at 20% of the encounters.
- For each type of AD encounter, computerized tomography and electrocardiogram were among the most common types of diagnostic service received after laboratory services.
- Twenty-nine percent of IP-only and 42% of ED and IP AD encounters received any type of ICU care. Twenty-seven percent of ED-only AD encounters had an observation unit stay.

#### Inpatient length of stay

- Among IP-only AD encounters, the average length of stay (ALOS) for patients with an ICU stay was 10.2 days, and 8.4 days for patients with no ICU stay ([Figure 2](#)).
- Among ED and IP AD encounters, the ALOS for patients with an ICU stay was 6.5 days, and 5.2 days for patients without an ICU stay.

#### Discharge disposition

- Among ED-only AD encounters, the majority of patients were discharged to home (76%), and 17% were discharged to a skilled nursing facility (SNF), intermediate care facility (ICF), or other nursing facility ([Table 3](#)).



**Figure 1. Distribution of age, by sex and encounter type among encounters with any listed diagnosis of Alzheimer disease, 2014**

- Among IP-only AD encounters, 40% of patients were discharged to home, and 47% were discharged to an SNF, ICF, or other nursing facility.
- Among ED and IP AD encounters, most patients were discharged to a SNF, ICF, or other nursing facility (54%) or home (38%).
- Four percent to 5%, respectively, of ED and IP and IP-only AD encounters resulted in death in the hospital.

### Patient-level data

The collection of individual identifiers allows for analyses of the number of IP or ED encounters per patient, and for analyses related to IP or ED AD encounters and mortality with linkage to NDI.

### Number of encounters per patient

- More than three-quarters of patients who had an AD encounter had only one encounter (78%), 15% had two encounters, and 7% had three or more encounters.
- Among patients who had one AD encounter, 61% had an ED and IP encounter, 12% had an IP-only encounter, and 27% had an ED-only encounter.

### Mortality

The collection of individual identifiers allows for the linkage of NHCS 2014 data with NDI to identify deaths in calendar years 2014 and 2015.

Overall, 44% of patients who had any type of AD encounter in 2014 died in 2014 or 2015.

### Underlying cause of death

Among patients who had an AD encounter of any type in 2014 and died in 2014 or 2015, the underlying causes of death included diseases of the circulatory system for 29% of deaths, diseases of the nervous system for 21%, and mental, behavioral, and neurodevelopmental disorders for 19% (Table 4).

## Discussion

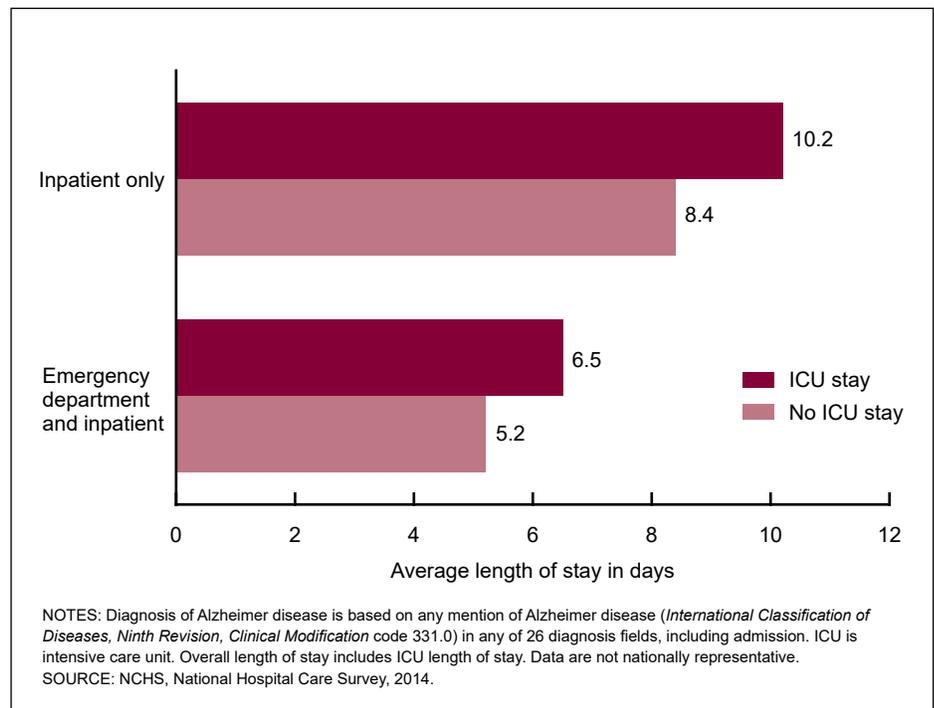
This report examines characteristics of IP and ED AD encounters as a demonstration of the capabilities of NHCS data. NHCS provides a unique opportunity to study the health care utilization of patients with specific conditions, and the care and services they received. In addition to the diagnostic and physical services received, NHCS data include information on ICU and

observation unit use. This allows for a full picture of service utilization, including the number and types of encounters.

The collection of personal identifiers provides the ability to link patients across settings, count the number of encounters per patient, and link to external data sources such as NDI. This demonstration report presents analyses that show how NHCS data may be linked both internally across settings, and to external databases such as NDI. Internal linkage across settings allows analysts to separate IPs that were admitted through the ED from IPs admitted directly. Linkage across settings also allows analysts to count the total number of encounters across all settings and to examine the association between patient characteristics and the number of encounters and encounter type. The analyses using linkage to NDI show how this linkage enables identification of the underlying cause of death and posthospital discharge deaths. All of these analyses help provide a more comprehensive and longitudinal picture of the pattern of hospital-related care for patients with AD.

Despite the strengths of the NHCS data, some limitations should be noted. The counts and percentages presented in this report are not nationally representative and therefore are not generalizable to the entire population. These analyses may represent an undercount of encounters and patients with AD. An existing diagnosis of AD may not be reported accurately at every encounter. In addition, if a person had multiple encounters but had an AD diagnosis on some of the claims only, then the longitudinal sequence of care and encounters may not be complete. The analysis of cause of death may undercount mortality due to AD. In NDI, the underlying cause of death is used (5). Acute complications, such as pneumonia, may be reported as the underlying cause of death rather than AD.

As NHCS continues to collect data from more hospitals and moves toward the collection of electronic health records, the benefit of NHCS data to researchers and the public will continue to grow.



**Figure 2. Average length of stay for inpatients with any listed diagnosis of Alzheimer disease, by ICU usage and encounter type, 2014**

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**Table 1. Percent distribution of first-listed diagnosis among encounters with any listed diagnosis of Alzheimer disease, by encounter type**

ICD–9–CM diagnosis code category	Emergency department only	Inpatient only	Emergency department and inpatient
Infectious and parasitic diseases . . . . . (001–139)	*	7	13
Neoplasms . . . . . (140–239)	*	4	1
Endocrine, nutritional, and metabolic diseases and immunity disorders . . . . . (240–279)	3	3	4
Diseases of blood and blood forming organs . . . . . (280–289)	1	*	1
Mental disorders . . . . . (290–319)	4	6	1
Diseases of nervous system and sense organs . . . . . (320–389)	10	21	10
Diseases of the circulatory system . . . . . (390–459)	6	16	17
Diseases of the respiratory system . . . . . (460–519)	3	6	10
Diseases of the digestive system . . . . . (520–579)	4	6	7
Diseases of the genitourinary system . . . . . (580–629)	6	7	11
Diseases of the skin and subcutaneous tissue . . . . . (680–709)	1	*	2
Diseases of the musculoskeletal and connective tissue . . . . . (710–739)	5	4	2
Signs, symptoms and ill-defined conditions . . . . . (780–799)	28	3	5
Injuries and poisoning . . . . . (800–999)	24	10	15
Supplemental . . . . . (V1–V91)	4	5	*

\* Estimate does not meet National Center for Health Statistics standards of reliability. Encounters had fewer than 60 cases and thus, are not reported.

NOTES: ICD–9–CM is *International Classification of Diseases, Ninth Revision, Clinical Modification*. Percentages may not sum to 100 due to rounding. Diagnosis of Alzheimer disease is based on any mention of Alzheimer disease (ICD–9–CM code 331.0) in any of 26 diagnosis fields, including admission. Alzheimer disease is included within diseases of the nervous system and sense organs (320–389). Signs, symptoms and ill-defined conditions (ICD–9–CM codes 780–799) may include syncope and collapse, malaise and fatigue, altered mental status, and chest pain. Data are not nationally representative.

SOURCE: NCHS, National Hospital Care Survey, 2014.

**Table 2. Percentage of encounters with any listed diagnosis of Alzheimer disease with receipt of selected therapeutic, diagnostic, and intensive services, by encounter type**

Type of service	Emergency department only <i>n</i> = 6,720	Inpatient only <i>n</i> = 2,470	Emergency department and inpatient <i>n</i> = 12,430
<b>Therapeutic</b>			
Pharmacy . . . . .	66	95	99
Respiratory . . . . .	4	23	31
Physical therapy . . . . .	11	55	62
Speech therapy . . . . .	2	20	28
Occupational therapy . . . . .	6	37	34
IV (Intravenous) therapy . . . . .	20	5	30
<b>Diagnostic</b>			
Laboratory . . . . .	76	94	100
EEG (electroencephalogram) . . . . .	2	6	8
CT (computed tomography) . . . . .	47	32	65
MRI (magnetic resonance imaging) . . . . .	3	8	11
EKG (electrocardiogram) . . . . .	50	46	83
Cardiology . . . . .	7	20	30
<b>Intensive</b>			
Any ICU (intensive care unit) . . . . .	*	29	42
CCU (cardiac or coronary care unit) . . . . .	*	7	12
Observation . . . . .	27	3	8

\* Estimate does not meet National Center for Health Statistics standards of reliability. Encounters had fewer than 60 cases and thus, are not reported.

NOTES: Diagnosis of Alzheimer disease is based on any mention of Alzheimer disease (*International Classification of Diseases, Ninth Revision, Clinical Modification* code 331.0) in any of 26 diagnosis fields, including admission. See Technical Notes in the report for the revenue codes used for each service. A patient may receive multiple services during an encounter. Data are not nationally representative.

SOURCE: NCHS, National Hospital Care Survey, 2014.

**Table 3. Percent distribution of discharge disposition among encounters with any listed diagnosis of Alzheimer disease, by encounter type**

Discharge disposition	Emergency department only n = 6,720	Inpatient only n = 2,470	Emergency department and inpatient n = 12,430
Home . . . . .	76	40	38
Transferred to other hospital . . . . .	4	5	2
SNF, ICF, or other nursing facility . . . . .	17	47	54
Died in hospital . . . . .	*	5	4
Other . . . . .	2	*	1

\* Estimate does not meet National Center for Health Statistics standards of reliability. Encounters had fewer than 60 cases and thus are not reported.

NOTES: Diagnosis of Alzheimer disease is based on any mention of Alzheimer disease (*International Classification of Diseases, Ninth Revision, Clinical Modification* code 331.0) in any of 26 diagnosis fields, including admission. Percentages may not sum to 100 due to rounding. Data are not nationally representative. SNF is skilled nursing facility. ICF is intermediate care facility.

SOURCE: NCHS, National Hospital Care Survey, 2014.

**Table 4. Percent distribution of selected underlying cause of death among patients who had an encounter with any listed diagnosis of Alzheimer disease in 2014, and died in 2014 or 2015**

Underlying cause of death by ICD–10 chapter <sup>1</sup>	Percent of total
Diseases of the circulatory system . . . . . (I00–I99)	29
Chronic ischemic heart disease . . . . . (I25)	9
Stroke, not specified as haemorrhage or infarction . . . . . (I64)	3
Acute myocardial infarction . . . . . (I21)	3
Heart failure . . . . . (I50)	2
All other diseases of the circulatory system . . . . .	11
Diseases of the nervous system . . . . . (G00–G99)	21
Alzheimer disease . . . . . (G30)	17
Parkinson disease . . . . . (G20)	2
All other diseases of the nervous system . . . . .	2
Mental, behavioral, and neurodevelopmental disorders . . . . . (F00–F99)	19
Unspecified dementia . . . . . (F03)	18
All other mental and behavioral disorders . . . . .	1
Diseases of the respiratory system . . . . . (J00–J99)	8
Other chronic obstructive pulmonary disease . . . . . (J44)	3
Pneumonia, organism unspecified . . . . . (J18)	2
All other diseases of the respiratory system . . . . .	3
Neoplasms . . . . . (C00–D48)	8
Malignant neoplasm of bronchus and lung . . . . . (C34)	2
All other neoplasms . . . . .	6
All other causes of death . . . . .	15

<sup>1</sup>Based on 7,220 deaths among 16,240 patients, who had 21,620 encounters.

NOTES: ICD–10 is *International Classification of Diseases, Tenth Revision*. Discharge dispositions for patients with hospital-reported deaths were matched to the National Death Index for calendar years 2014 and 2015. The category "All other causes of death" includes all cause-of-death chapters that individually accounted for 3% or fewer of the total deaths. See Technical Notes in the report for the chapters listed in this category. Specific subcategories of underlying cause of death are listed below the overall chapter percentage. Percentages may not sum to the total due to rounding. Data are not nationally representative.

SOURCE: NCHS, National Hospital Care Survey, 2014, linked to the 2014 and 2015 National Death Index.

## Technical Notes

For detailed information on sample design, data collection, claims deduplication, and patient identification, see the Methods and Technical Notes sections in “National Hospital Care Survey Demonstration Projects: Traumatic Brain Injury,” available from: <https://www.cdc.gov/nchs/data/nhsr/nhsr097.pdf>.

## Matching to the National Death Index

Through its data linkage program, the National Center for Health Statistics (NCHS) has been able to expand the analytic utility of the data collected from the National Hospital Care Survey (NHCS) by augmenting it with mortality data from the National Death Index (NDI). NDI, a component of the National Vital Statistics System, is a centralized database of death record information compiled from state vital statistics offices. In collaboration with state offices, NCHS established NDI as a resource for epidemiological follow-up studies and other types of health and medical research that require determination of the mortality status of study subjects. These mortality data are provided by the states under contract agreements with NCHS that specify how these data may be used, for what purposes, and at what cost. Currently, NDI contains about 85 million records from 1979 through 2014 from 50 states, the District of Columbia, New York City, Puerto Rico, and the U.S. Virgin Islands.

In order to match to NDI, patients had to be deemed linkage eligible. Linkage eligibility was defined as having usable information for two of three data element groups: social security number, name (first, middle, and last), and date of birth (year, month, and day). Mortality status was then determined using a combination of deterministic and probabilistic record linkage methods. The linkage method performed weighting and link adjudication as described in the Fellegi–Sunter paradigm (“A Theory for Record Linkage”), the foundational methodology used for record linkage. It estimates the likelihood that each pair is a match before selecting the

most probable match between a survey record and an NDI record. The linkage between the 2014 NHCS records and the 2014–2015 NDI records was based on both deterministic and probabilistic approaches, which was followed by the selection of the final pair included in the file. For detailed information on the linkage methodology, see the appendix in “The Linkage of the 2014 National Hospital Care Survey to the 2014/2015 National Death Index: Methodology Overview and Analytic Considerations,” available from: [https://www.cdc.gov/nchs/data/datalinkage/NHCS14\\_NDI14\\_15\\_Methodology\\_Analytic\\_Consider.pdf](https://www.cdc.gov/nchs/data/datalinkage/NHCS14_NDI14_15_Methodology_Analytic_Consider.pdf).

## Emergency department encounters admitted as inpatients

Emergency department (ED) encounters that were admitted as an inpatient (IP) did not have a separate ED record, therefore the IP record was duplicated in the ED file. To prevent overcounting services provided, services on the duplicated ED records are only counted in the IP setting.

## Definition of terms

“*All other causes of death*” category (Table 4)—The chapters included in this category are: Certain infectious and parasitic diseases (A00–B99); Congenital malformations, deformations and chromosomal abnormalities (Q00–Q99); Diseases of the musculoskeletal system and connective tissue (M00–M99); Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism (D50–D89); Diseases of the digestive system (K00–K93); Diseases of the genitourinary system (N00–N99); Diseases of the skin and subcutaneous tissue (L00–L99); Endocrine, nutritional and metabolic diseases (E00–E90); External causes of morbidity and mortality (V01–Y98); Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (R00–R99); and missing or unknown.

*Alzheimer disease (AD)*—Identified by the *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD–9–CM). Encounters with any listed diagnosis of AD (ICD–9–CM code 331.0) in the admission diagnosis or any of the 25 diagnosis fields were selected.

*First-listed diagnosis*—Generally understood to be the primary diagnosis, the main cause of the encounter.

*Revenue codes*—Four-digit numbers used on claims data that identify billable services provided during an IP stay or an ED encounter. The following revenue codes were used in this analysis.

- Pharmacy: 025x, 0631–0637
- Respiratory services: 041x
- Physical therapy: 042x
- Speech therapy: 044x
- Occupational therapy: 043x
- Intravenous therapy: 026x
- Laboratory: 030x
- Electroencephalogram: 0740
- Computerized tomography scan: 035x
- Magnetic resonance imaging: 061x
- Electrocardiogram: 073x
- Cardiology services: 048x
- Total intensive care: 020x
- Coronary care unit: 021x
- Observation services: 0762

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