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Hospital Discharges, Readmissions, and ED Visits for COPD or Bronchiectasis Among US Adults:

Findings From the Nationwide Inpatient Sample 2001-2012 and Nationwide Emergency Department Sample 2006-2011

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Abstract

BACKGROUND—Numbers and rates of hospitalizations and ED visits by patients with COPD are important metrics for surveillance purposes. The objective of this study was to examine trends in these rates from 2001 to 2012 among adults aged ≥ 18 years in the United States.

METHODS—Data from the Nationwide Inpatient Sample (NIS) and Nationwide Emergency Department Sample (NEDS) were examined for temporal trends in the numbers and rates of hospitalizations by patients with COPD or bronchiectasis, mean length of stay, in-hospital case-fatality rate, 30-day readmission rate, and numbers and rates of ED visits.

RESULTS—The national number of discharges with COPD or bronchiectasis as the principal diagnosis was about 88,000 higher in 2012 than in 2001, but the age-adjusted rate of discharges did not change significantly (range, 242.7-286.0 per 100,000 population, *P* trend = .554). In contrast, hospitalization rates for common cardiovascular disorders, pneumonia, and lung cancer decreased significantly by 27% to 68%, whereas the mean charge doubled and mean cost increased by 40%. From 2006 to 2011, the numbers of ED visits increased from 1,480,363 to 1,787,612. The age-adjusted rate increased nonsignificantly from 654 to 725 per 100,000 population (*P* trend = .072).

CONCLUSIONS—Despite many local and national efforts to reduce the burden of COPD, total hospitalizations and ED visits over the past decade have increased for COPD, and the age-adjusted rates of hospitalizations and ED visits for COPD or bronchiectasis have not changed significantly in the United States.

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COPD is an important source of morbidity and mortality despite major declines in the prevalence of smoking, the major cause of COPD. Because COPD lingers in most patients once they develop the condition, many are likely to require medical care for their condition during the remainder of their lifetime. National statistics from the United States suggest that the prevalence of COPD, the hospital discharge rate, and mortality rate may have declined from 2000 to 2010, whereas no clear trend was noted for the rate of ED visits.[1] These results were derived from datasets such as the National Hospital Discharge Survey (NHDS), National Ambulatory Medical Care Survey (NAMCS), and National Hospital Ambulatory Medical Care Survey (NHAMCS), which were designed to provide national estimates but contain limited numbers of records.

Because of the prominence of COPD as a chronic condition and the large economic costs associated with this condition,[2] tracking metrics such as the number and rate of hospitalizations and ED visits as well as readmissions among patients with COPD is critical to monitoring the dynamics, estimating costs, and measuring the burden of this disease. Therefore, the objective of this study was to examine trends in these metrics in adults using the largest all-payer inpatient care and ED databases that are publicly available in the United States.

Materials and Methods

The Healthcare Cost and Utilization Project (HCUP) comprises a series of national and state-level databases.[3] This study used data from the Nationwide Inpatient Sample (NIS) and the Nationwide Emergency Department Sample (NEDS) database. This study was exempt from institutional review.

The NIS is created by drawing a stratified probability sample of hospitals drawn from State Inpatient Databases that include hospitalizations by patients with Medicare, Medicaid, private insurance, and the uninsured. From 2001 to 2011, the numbers of participating states grew from 33 to 46, the number of sampled hospitals ranged from 986 to 1,049, and the number of unweighted discharges ranged from 7,452,727 to 8,158,381. In 2012, 44 states, 4,378 hospitals, and 7,296,968 discharges were included covering about 95% of the US population. Prior to 2012, approximately 20% of all community hospitals as defined by the American Hospital Association were sampled from strata created on the basis of ownership/control, bed size, teaching status, urban/rural location, and US region, and all discharges from each hospital were used.[4] In 2012, however, the NIS, renamed the National Inpatient Sample, selected a sample of 20% of all discharges from hospitals that were arranged in five strata.[5] Hospital definitions previously based on American Hospital Association were changed to reflect those used by states. Sampling weights were created to produce national estimates. Because the NIS implemented a systematic sampling design in 2012, new sampling weights for trend analyses were developed.

Results for number, rate, length of stay, case-fatality rate, cost, and charge of hospitalizations for COPD and bronchiectasis were produced. In addition, the 30-day readmission rate for the years 2009 to 2012 were examined using three metrics: readmissions with the same International Classification of Diseases 9th Revision-Clinical

Modification (ICD-9-CM) codes (see later discussion in this section) as the principal diagnosis, readmissions with the same ICD-9-CM codes as any diagnosis, and readmissions for any reason. Results were limited to nonneonatal, non-maternal discharges.

Costs were calculated from charges that were billed by the hospitals using cost-to-charge ratios produced by the Centers for Medicare & Medicaid Services from hospital accounting reports. When a cost-to-charge ratio was available for a specific hospital, that ratio was used to estimate the cost. For other hospitals, average cost-to-charge ratios for strata defined on the basis of bed size, teaching status, location, ownership, and region were used.

The NEDS database, which is the largest all-payer ED database in the United States, was used to examine trends in the numbers and rate of ED visits from 2006 to 2011.[6,7] NEDS is created by drawing stratified probability samples from community, nonrehabilitation hospitals that are part of the State Inpatient Databases and State Emergency Department Databases. A 20% sample is drawn from strata defined on the basis of region, trauma designation, urban-rural location, teaching status, and hospital ownership or control. The number of participating states ranged from 24 in 2006 to 30 in 2011, and the number of unweighted records ranged from 25.7 million in 2006 to 29.4 million in 2011. Sampling weights were created to produce national estimates.

The principal diagnosis listing ICD-9-CM codes that are part of the Clinical Classifications Software (CCS) diagnostic category 127 (COPD and bronchiectasis) was used to identify hospitalizations and ED visits. This category includes the following ICD-9-CM codes: 490, 491.0, 491.1, 491.2, 491.20, 491.21, 491.22, 491.8, 491.9, 492.0, 492.8, 494, 494.0, 494.1, and 496. By using the principal diagnosis, confidence that the hospitalization or ED visit was for COPD or bronchiectasis was maximized.

To compare rates of hospitalization and ED visit for COPD and bronchiectasis with several other conditions, rates for acute myocardial infarction (CCS category 100 comprising ICD-9-CM codes 410.0, 410.00, 410.01, 410.02, 410.1, 410.10, 410.11, 410.12, 410.2, 410.20, 410.21, 410.22, 410.3, 410.30, 410.31, 410.32, 410.4, 410.40, 410.41, 410.42, 410.5, 410.50, 410.51, 410.52, 410.6, 410.60, 410.61, 410.62, 410.7, 410.70, 410.71, 410.72, 410.8, 410.80, 410.81, 410.82, 410.9, 410.90, 410.91, 410.92), coronary atherosclerosis and other heart disease (CCS category 101 comprising ICD-9-CM codes 411.0, 411.1, 411.8, 411.81, 411.89, 412, 413.0, 413.1, 413.9, 414.0, 414.00, 414.01, 414.06, 414.2, 414.3, 414.4, 414.8, 414.9, V45.81, V45.82), nonhypertensive congestive heart failure (CCS category 108 comprising ICD-9-CM codes 398.91, 428.0, 428.1, 428.20, 428.21, 428.22, 428.23, 428.30, 428.31, 428.32, 428.33, 428.40, 428.41, 428.42, 428.43, 428.9), pneumonia (CCS category 122 comprising ICD-9-CM codes 003.22, 020.3, 020.4, 020.5, 021.2, 022.1, 031.0, 039.1, 052.1, 055.1, 073.0, 083.0, 112.4, 114.0, 114.4, 114.5, 115.05, 115.15, 115.95, 130.4, 136.3, 480.0, 480.1, 480.2, 480.3, 480.8, 480.9, 481, 482.0, 482.1, 482.2, 482.3, 482.30, 482.31, 482.32, 482.39, 482.4, 482.40, 482.41, 482.42, 482.49, 482.8, 482.81, 482.82, 482.83, 482.84, 482.89, 482.9, 483, 483.0, 483.1, 483.8, 484.1, 484.3, 484.5, 484.6, 484.7, 484.8, 485, 486, 513.0, 517.1), and lung cancer (CCS category 19 comprising ICD-9-CM codes 162.2, 162.3, 162.4, 162.5, 162.8, 162.9, 209.21, 231.2, V10.11) were calculated.

The online query system HCUPnet (http://hcupnet.ahrq.gov/) was used to generate data for this analysis.[8] Analyses were limited to adults aged ≥ 18 years. Revised sampling weights that were produced as part of the 2012 redesign were used to generate national estimates for measures related to hospital discharges. Direct age adjustment to the projected year 2000 US population was performed using four age groups (18-44 years, 45-64 years, 65-84 years, and ≥ 85 years). Weighted least-squares regression was used to perform tests of linear trend for possible trends of the outcomes of interest. The online query system used the software SUDAAN (Research Triangle Institute) to generate SEs.

Results

The weighted number of hospital discharges for COPD and bronchiectasis ranged from 534,398 to 692,364 (Fig 1). Of the numbers of combined COPD and bronchiectasis hospitalizations, 98.1% to 98.6% were for COPD (ICD-9 codes 490, 491, 492, 496). The average annual number of discharges was about 100,000 higher from 2008 to 2012 than from 2001 to 2007. The age-adjusted rate of discharges ranged from 242.7 to 286.0 per 100,000 population and showed no clear trend (*P* trend = .554) (Table 1). Significant decreases were noted for participants aged 18 to 44 years and 65 to 84 years, whereas a significant increase was noted for those aged 45 to 64 years. The mean length of stay decreased overall and in all age groups except in the youngest adults. The age-adjusted case-fatality rate dropped from 2.5% to 1.1%, and significant decreases occurred in all age groups. In contrast to COPD and bronchiectasis, the age-adjusted rates for discharges for acute myocardial infarction (*P* trend < .001), coronary atherosclerosis and other heart disease (*P* trend < .001), congestive heart failure (*P* trend < .001), pneumonia (*P* trend < . 001), and lung cancer (*P* trend < .001) declined significantly (Fig 2).

Aggregate charges for inpatient stays increased progressively from $8,023,983,422 in 2001 to $18,112,392,566 in 2012 (Fig 3) as did the mean and median charge per inpatient stay (Table 1). Mean and median costs increased as well but less sharply than charges.

The numbers of ED visits increased steadily from about 1,480,363 in 2006 to 1,787,612 in 2011 (Table 2). The age-adjusted rate increased mildly, driven by a significant increase in the rate among adults aged 45 to 64 years. Of those who had an ED visit, about 19% to 21% of these patients were admitted to the hospital. The age-specific mortality in the ED ranged from 0.1% to 0.3%.

Compared with COPD and bronchiectasis, the age-adjusted rate of ED visits declined for acute myocardial infarction (*P* trend = .002), coronary atherosclerosis and other heart disease (*P* trend < .001), congestive heart failure (*P* trend = .001), pneumonia (*P* trend = . 044), and lung cancer (*P* trend < .001) (Fig 4).

Of patients with an index diagnosis of COPD or bronchiectasis, about 7% were readmitted within 30 days with COPD or bronchiectasis as the principal diagnosis, 18% were readmitted within 30 days with COPD or bronchiectasis listed as any diagnosis, and 21% were readmitted within 30 days for any reason (Table 3). The most recent estimates from 2012 suggested some improvement in readmission rates.

Discussion

The current study, which provides the most up-to-date statistics, shows no significant trend in the age-adjusted rates of hospital discharges from 2001 to 2012 or ED visits from 2006 to 2011 for COPD or bronchiectasis. The persistence of these rates in the face of large declines in the prevalence of smoking is a bit perplexing but underscores the protracted nature of COPD. Significantly decreasing trends were found for mean length of stay and for the in-hospital case-fatality rate.

The lack of declining trend in the rate of hospital discharges in the NIS data contrasts with results from the NHDS that showed a decline in the age-adjusted rate from 402 per 100,000 in 1999 to 322 per 100,000 population in 2010. If 2001 is used as a starting point, however, the rate declined from 366 to 322 per 100,000 population in 2010.[1] It is noteworthy that the age range in the NHDS analysis was ≥ 25 years compared with ≥ 18 years in the present study. The lack of a significant trend in the age-adjusted rate of ED visits agrees with results from the NHAMCS.[1]

The present study found a decline in mean length of stay from 4.5 days in 2001 to 4.0 days in 2012 among patients hospitalized for COPD or bronchiectasis. Limited information on temporal trends in length of stay among US patients with COPD has been published. In greater metropolitan Cleveland, Ohio, the mean length of stay for COPD hospitalizations decreased from 7.5 days in 1991 to 5.4 days in 1997.[9] These declines could be due to improved outpatient and inpatient treatment, less severe forms of the disease, and pressures to reduce the costs of hospitalizations.

The NIS data showed a substantial decline in the in-hospital case-fatality rate from 2001 to 2012. A few reports have previously examined temporal changes in the in-hospital case-fatality rate in the United States. Data from the US Veterans Administration system showed that the in-hospital case-fatality rate among patients with COPD rose from 4.3% in 1970 to 7.9% in 1987.[10] In greater metropolitan Cleveland, the unadjusted in-hospital mortality rate following a hospitalization for COPD among Medicare patients decreased by 49.6% from 1991 to 1997.[9] Adjusted in-hospital and 30-day mortality rates decreased by 53.7% and 26%, respectively. The reasons for the large decline in the in-hospital case-fatality rate for hospitalizations for COPD or bronchiectasis could be due to improved treatment or to less severe forms of the disease. Some of the decline may also be attributable to the decrease in the mean length of stay.

Rates of hospitalizations and ED visits are a reflection of the numbers of adults with COPD or bronchiectasis and, once someone has the condition, utilization of health-care services. Therefore, declines in the rates can be accomplished by reducing the numbers of adults who have COPD, by reducing the need for hospitalizations once an adult has developed COPD, or a combination of the two. Favorable trends in the prevalence of smoking and in air pollution should eventually reduce the prevalence of COPD.[11,12] Although limited evidence points to a possible decline in the prevalence of COPD since 1999, the prevalence of self-reported COPD remains stubbornly high.[1] Among patients with COPD or obstructive lung function, the prevalence of smoking has remained very high.[13,14] Therefore, increased

efforts to promote smoking cessation in these patients may reduce their hospitalizations and visits to the emergency room. In addition, annual vaccinations for influenza, vaccinations for pneumococcal disease, and optimal management of their condition including pulmonary rehabilitation should also reduce this need.

Reducing readmissions has become an important objective of medical care in recent times.[15] Only 4 years of NIS data about the readmission rate in patients hospitalized for COPD or bronchiectasis were available, and these results showed mostly little change in the 30-day readmission rate during that time, with about 7% of patients with COPD or bronchiectasis being readmitted within 30 days with COPD or bronchiectasis as the principal diagnoses although the results for 2012 hinted at some improvement. Previous studies have reported 30-day read-mission rates among Medicare beneficiaries with COPD of 22.6% from 2003 to 2004 and of 7.1% for COPD as the principal diagnosis, 17.3% for any diagnosis of COPD, and 20.5% for any diagnosis in 2008.[16,17] A host of patient, clinical, provider, and system factors have been found to predict readmissions among patients with COPD.[18-28] Interventions to reduce readmissions have met with mixed success, but some that may reduce readmissions include continuity with patient's primary care provider or pulmonologist,[29] coordination of discharges,[30] and pulmonary rehabilitation.[31] However, the time frame for examining the rate of readmissions following these interventions was as long as 1 year rather than 30 days.

Several limitations warrant consideration. Because data for the present study were obtained by using an online research tool, stratification by other factors such as demographic factors was not feasible. Second, severity of the condition that led a patient to access medical care was not available, and, therefore, the possible contribution of changes in disease severity to changes in length of stay and case-fatality rate could not be examined. Third, the validity of the ICD-9-CM codes used to identify hospitalizations and ED visits for COPD and bronchiectasis in the NIS and NEDS has not been specifically tested. Limited studies of hospitalizations in other settings have shown sensitivities of 55% to 65%, specificities of 67% to 90%, and a positive predictive value of 50.4%.[32,33] In addition, a study of ED records showed positive predictive values ranging from 60% to 100% depending on the ICD-9 code.[34]

In conclusion, data from the NIS show that rates of hospital discharges from 2001 to 2012, ED visits from 2006 to 2011, and 30-day readmission rate from 2009 to 2012 among patients with COPD or bronchiectasis changed nonsignificantly. In contrast, significant reductions in length of stay and case-fatality rate occurred in the hospital. These results should serve to inform efforts to optimize medical care for patients with COPD or bronchiectasis in the United States.

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ABBREVIATIONS

CCS	Clinical Classifications Software
ICD-9-CM	International Classification of Diseases 9th Revision-Clinical Modification
NEDS	Nationwide Emergency Department Sample
NHDS	National Hospital Discharge Survey
NIS	Nationwide Inpatient Sample

References

1. Ford ES, Croft JB, Mannino DM, Wheaton AG, Zhang X, Giles WH. COPD surveillance—United States, 1999-2011. Chest. 2013; 144(1):284–305. [PubMed: 23619732]
2. Ford ES, Murphy LB, Khavjou O, Giles WH, Holt JB, Croft JB. Total and state-specific medical and absenteeism costs of COPD among adults aged ≥ 18 years in the United States for 2010 and projections through 2020. Chest. 2015. 147(1):31–45.
3. Agency for Healthcare Research and Quality. [August 8, 2014] Overview of HCUP.. Healthcare Cost and Utilization Project(HCUP) website. http://www.hcup-us.ahrq.gov/overview.jsp.
4. Agency for Healthcare Research and Quality. [August 8, 2014] Introduction to the HCUP Nationwide Inpatient Sample(NIS) 2011.. Healthcare Cost and Utilization Project(HCUP) website. http://www.hcup-us.ahrq.gov/db/nation/nis/NIS_Introduction_2011.pdf.
5. Agency for Healthcare Research and Quality. [August 8, 2014] Introduction to the HCUP Nation wide Inpatient Sample(NIS) 2012.. Healthcare Cost and Utilization Project(HCUP) website. http://www.hcup-us.ahrq.gov/db/nation/nis/NISIntroduction2012.pdf.
6. Agency for Healthcare Research and Quality. [August 8, 2014] Overview of the Nationwide Emergency Department Sample(NEDS).. Healthcare Cost and Utilization Project(HCUP) website. http://www.hcup-us.ahrq.gov/nedsoverview.jsp.
7. Agency for Healthcare Research and Quality. [August 8, 2014] Introduction to the HCUP Nationwide Emergency Department Sample(NEDS) 2011.. Healthcare Cost and Utilization Project(HCUP) website. http://www.hcup-us.ahrq.gov/db/nation/neds/NEDS2011Introduction01142014.pdf.
8. Agency for Healthcare Research and Quality. [August 7, 2014] Welcome to HCUPnet.. Healthcare Cost and Utilization Project(HCUP) website. http://hcupnet.ahrq.gov/.
9. Baker DW, Einstadter D, Thomas CL, Husak SS, Gordon NH, Cebul RD. Mortality trends during a program that publicly reported hospital performance. Med Care. 2002; 40(10):879–890. [PubMed: 12395022]
10. Tager IB, Segal MR. Temporal trends in chronic obstructive lung disease case fatality in hospitalized US veterans: 1970-1987. Chest. 1991; 99(5):1126–1133. [PubMed: 2019167]
11. Trends in current cigarette smoking among high school students and adults, United States, 1965-2007. Centers for Disease Control and Prevention website; http://www.cdc.gov/tobacco/data_statistics/tables/trends/cig_smoking/index.htm. [May 3, 2012]
12. US Environmental Protection Agency, Office of Air Quality Planning and Standards. [January 5, 2012] Our nation's air-status and trends through 2008.. US Environmental Protection Agency website. http://www.epa.gov/airtrends/2010/.
13. Ford ES, Mannino DM, Wheaton AG, Giles WH, Presley-Cantrell L, Croft JB. Trends in the prevalence of obstructive and restrictive lung function among adults in the United States: findings from the National Health and Nutrition Examination surveys from 1988-1994 to 2007-2010. Chest. 2013; 143(5):1395–1406. [PubMed: 23715520]
14. Centers for Disease Control and Prevention(CDC). Chronic obstructive pulmonary disease among adults—United States, 2011. MMWR Morb Mortal Wkly Rep. 2012; 61(46):938–943. [PubMed: 23169314]

15. Kangovi S, Grande D. Transitional care management reimbursement to reduce COPD readmission. Chest. 2014; 145(1):149–155. [PubMed: 24394826]
16. Jencks SF, Williams MV, Coleman EA. Rehospitalizations among patients in the Medicare fee-for-service program. N Engl J Med. 2009; 360(14):1418–1428. [PubMed: 19339721]
17. Elixhauser, A.; Au, DH.; Podulka, J. HCUP Statistical Brief. Agency for Healthcare Research and Quality; Rockville, MD: 2011. Readmissions for Chronic Obstructive Pulmonary Disease, 2008: Statistical Brief #121..
18. Chan FW, Wong FY, Yam CH, et al. Risk factors of hospitalization and readmission of patients with COPD in Hong Kong population: analysis of hospital admission records. BMC Health Serv Res. 2011; 11:186. [PubMed: 21831287]
19. Coventry PA, Gemmell I, Todd CJ. Psychosocial risk factors for hospital readmission in COPD patients on early discharge services: a cohort study. BMC Pulm Med. 2011; 11:49. [PubMed: 22054636]
20. Steer J, Norman EM, Afolabi OA, Gibson GJ, Bourke SC. Dyspnoea severity and pneumonia as predictors of in-hospital mortality and early readmission in acute exacerbations of COPD. Thorax. 2012; 67(2):117–121. [PubMed: 21896712]
21. de Batlle J, Mendez M, Romieu I, et al. PAC-COPD Study Group. Cured meat consumption increases risk of readmis sion in COPD patients. Eur Respir J. 2012; 40(3):555–560. [PubMed: 22408205]
22. Barba R, de Casasola GG, Marco J, et al. Anemia in chronic obstructive pulmonary disease: a readmission prognosis factor. Curr Med Res Opin. 2012; 28(4):617–622. [PubMed: 22409165]
23. Wark PA, Tooze M, Powell H, Parsons K. Viral and bacterial infection in acute asthma and chronic obstructive pulmonary disease increases the risk of readmission. Respirology. 2013; 18(6): 996–1002. [PubMed: 23600594]
24. Zapatero A, Barba R, Ruiz J, et al. Malnutrition and obesity: influence in mortality and readmissions in chronic obstructive pulmonary disease patients. J Hum Nutr Diet. 2013; 26(suppl 1):16–22. [PubMed: 23656492]
25. Lin J, Xu Y, Wu X, et al. Risk factors associated with chronic obstructive pulmonary disease early readmission. Curr Med Res Opin. 2014; 30(2):315–320. [PubMed: 24156615]
26. Prieto-Centurion V, Gussin HA, Rolle AJ, Krishnan JA. Chronic obstructive pulmonary disease readmissions at minority-serving institutions. Ann Am Thorac Soc. 2013; 10(6):680–684. [PubMed: 24364772]
27. Nguyen HQ, Chu L, Amy Liu IL, et al. Associations between physical activity and 30-day readmission risk in chronic obstructive pulmonary disease. Ann Am Thorac Soc. 2014; 11(5):695–705. [PubMed: 24713094]
28. Sharif R, Parekh TM, Pierson KS, Kuo YF, Sharma G. Predictors of early readmission among patients 40 to 64 years of age hospitalized for chronic obstructive pulmonary disease. Ann Am Thorac Soc. 2014; 11(5):685–694. [PubMed: 24784958]
29. Sharma G, Kuo YF, Freeman JL, Zhang DD, Goodwin JS. Outpatient follow-up visit and 30-day emergency department visit and readmission in patients hospitalized for chronic obstructive pulmonary disease. Arch Intern Med. 2010; 170(18):1664–1670. [PubMed: 20937926]
30. Lainscak M, Kadivec S, Kosnik M, et al. Discharge coordinator intervention prevents hospitalizations in patients with COPD: a randomized controlled trial. J Am Med Dir Assoc. 2013; 14(6):e1–e6. [PubMed: 23623520]
31. Revitt O, Sewell L, Morgan MD, Steiner M, Singh S. Short outpatient pulmonary rehabilitation programme reduces readmission following a hospitalization for an exacerbation of chronic obstructive pulmonary disease. Respirology. 2013; 18(7):1063–1068. [PubMed: 23734624]
32. Cooke CR, Joo MJ, Anderson SM, et al. The validity of using ICD-9 codes and pharmacy records to identify patients with chronic obstructive pulmonary disease. BMC Health Serv Res. 2011; 11:37. [PubMed: 21324188]
33. Lacasse Y, Daigle JM, Martin S, Maltais F. Validity of chronic obstructive pulmonary disease diagnoses in a large administrative database. Can Respir J. 2012; 19(2):e5–e9. [PubMed: 22536584]

34. Ginde AA, Tsai CL, Blanc PG, Camargo CA Jr. Positive predictive value of ICD-9-CM codes to detect acute exacerbation of COPD in the emergency department. Jt Comm J Qual Patient Saf. 2008; 34(11):678–680. [PubMed: 19025089]

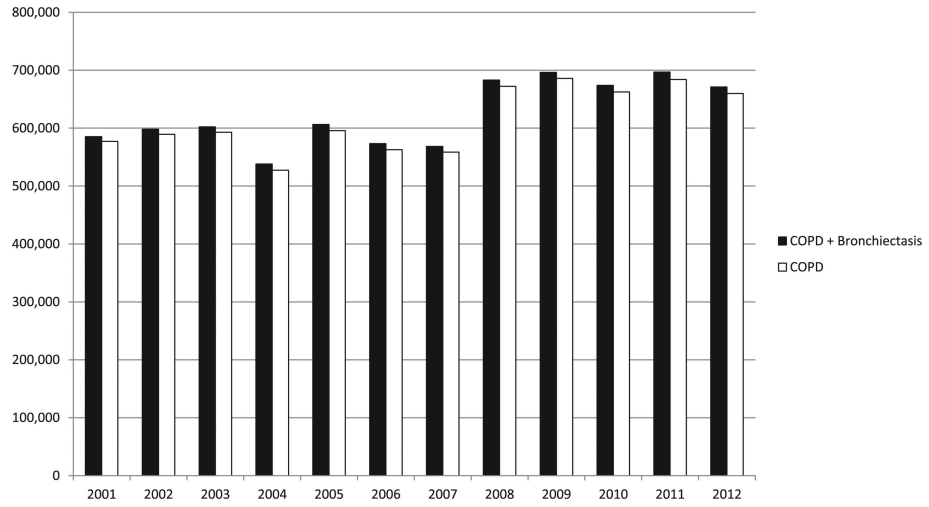

Figure 1.

Numbers of hospital discharges for COPD or bronchiectasis among patients aged ≥ 18 y, Nationwide Inpatient Sample 2001-2012.

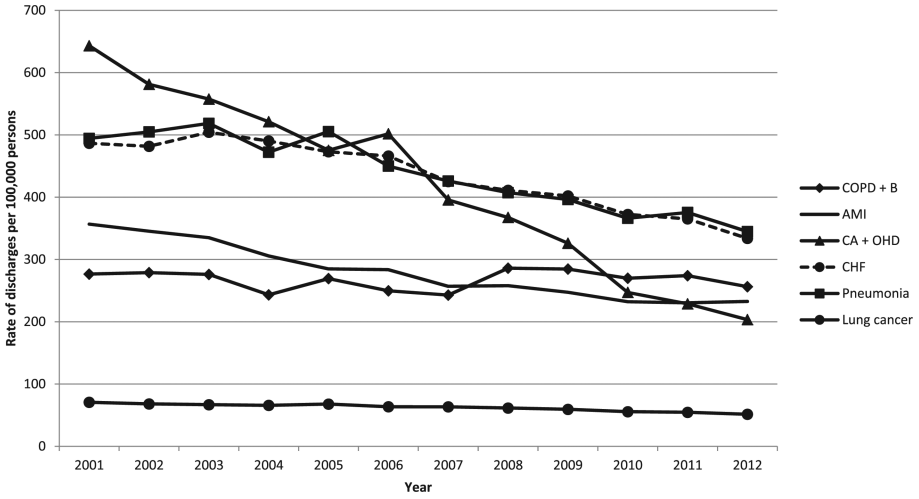

Figure 2.

Age-adjusted rate of hospitalizations for selected chronic conditions among patients aged ≥ 18 y, Nationwide Inpatient Sample 2001-2012. AMI = acute myocardial infarction; B = bronchiectasis; CA = coronary atherosclerosis; CHF = congestive heart failure; OHD = other heart disease.

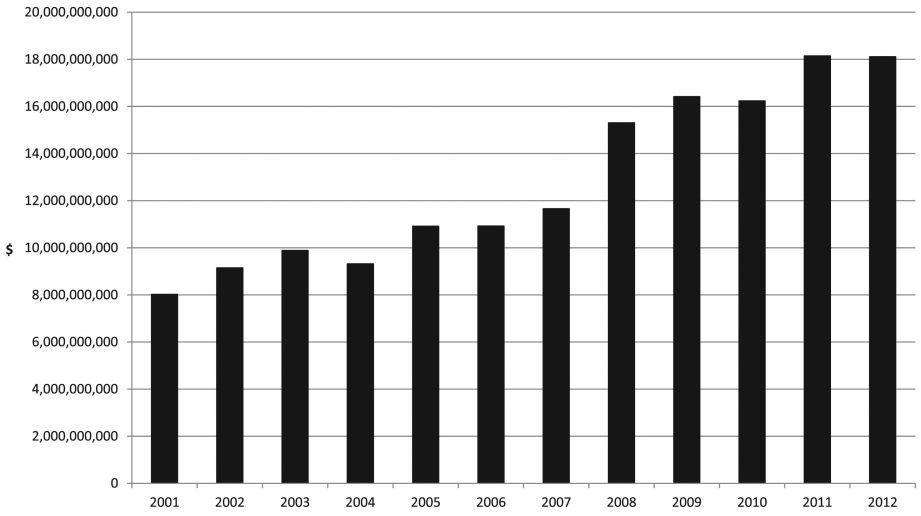

Figure 3.

Aggregate charges for inpatient stays for COPD or bronchi-ectasis among patients aged ≥ 18 y, Nationwide Inpatient Sample 2001-2012.

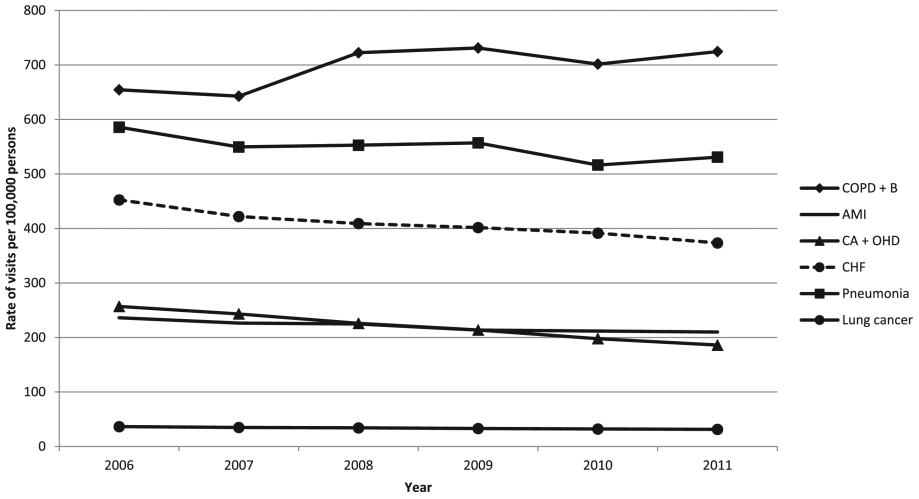

Figure 4.

Age-adjusted rate of ED visits for selected chronic conditions among patients aged ≥ 18 y, Nationwide Emergency Department Sample 2006-2011. See Figure 2 legend for expansion of abbreviations.

Table 1

Age-Adjusted and Age-Specific Discharge Rates (SE), Lengths of Stay (SE), Case-Fatality Rates (SE), Charges (SE), and Costs (SE) for Patients With COPD or Bronchiectasis Among Patients Aged ≥ 18 y, Nationwide Inpatient Sample 2001-2012

Parameter	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	*P* Trend
Rate per 100,000													
All discharges[a]	276.5 (3.9)	278.8 (4.4)	275.9 (4.0)	243.2 (3.5)	269.2 (4.4)	249.7 (3.9)	242.7 (3.8)	286.0 (4.9)	284.5 (5.1)	269.8 (4.7)	274.0 (4.3)	256.3 (2.2)	.554
Age group, y													
18-44	19.6 (0-7)	20.1 (0-8)	19.6 (0-9)	17.2 (1-0)	17.5 (0-8)	16.8 (0-7)	16.9 (0-8)	18.3 (0-8)	18.4 (0-9)	17.5 (0-9)	17.1 (1-1)	16.4 (0-5)	.003
45-64	252.9 (6.1)	257.4 (6.4)	261.3 (6.3)	227.4 (5.4)	248.5 (7.1)	236.1 (6.4)	233.9 (6.7)	266.7 (7.8)	286.7 (9.2)	276.2 (8.7)	277.8 (7.5)	276.9 (4.0)	.029
65-84	1,103.7 (22.6)	1,109.7 (26.0)	1,088.7 (23.0)	965.6 (20.4)	1,073.2 (25.5)	979.6 (22.5)	945.4 (21.3)	1,123.9 (28.5)	1,089.9 (27.8)	1,018.7 (25.5)	1,037.1 (23.7)	939.4 (11-6)	.037
≥85+	1,237.1 (32.9)	1,230.2 (33.8)	1,197.4 (34.2)	1,057.1 (29.0)	1,224.5 (33.2)	1,151.7 (32.6)	1,094.0 (30.5)	1,384.2 (42.6)	1,269.2 (37.1)	1,243.8 (38.0)	1,299.6 (35.9)	1,181.2 (18.4)	.660
Length of stay, d													
All discharges[a]	4.5 (<0.1)	4.5 (0.1)	4.3 (0.1)	4.4 (0.1)	4.3 (0.1)	4.3 (0.1)	4.1 (0.1)	4.3 (0.1)	4.2 (0.1)	3.9 (0.1)	4.2 (0.1)	4.0 (0.1)	.003
Age group, y													
18-44	4.0 (0.1)	4.2 (0.1)	3.9 (0.1)	4.1 (0.2)	3.9 (0.2)	4.1 (0.2)	3.8 (0.1)	4.1 (0.2)	4.0 (0.2)	3.6 (0.1)	4.2 (0.3)	3.9 (0.1)	.147
45-64	4.9 (0.1)	4.7 (<0-l)	4.6 (<0-l)	4.6 (<0-l)	4.5 (<0-l)	4.4 (<0-l)	4.3 (<0-l)	4.3 (<0-l)	4.3 (<0-l)	4.1 (<0-l)	4.1 (<0-l)	4.0 (<0-l)	<.0001
65-84	5.4 (0.1)	5.3 (<0.1)	5.1 (<0.1)	5.1 (<0.1)	5.0 (<0.1)	4.9 (<0.1)	4.8 (<0.1)	4.9 (<0.1)	4.7 (<0.1)	4.6 (<0.1)	4.5 (<0.1)	4.4 (<0.1)	<.0001
≥85+	5.6 (0.1)	5.4 (0.1)	5.3 (0.1)	5.2 (0.1)	5.1 (0.1)	5.0 (0.1)	4.9 (0.1)	5.0 (0.1)	4.9 (0.1)	4.7 (0.1)	4.6 (<0-l)	4.6 (<0-l)	<.0001
Case-fatality rate (%)													
All discharges[b]	2.5 (0.1)	2.3 (0.1)	2.2 (0.1)	2.0 (0.1)	1.8 (<0-l)	1.8 (<0-l)	1.6 (<0-l)	1.5 (<0-l)	1.4 (<0-l)	1.2 (<0-l)	1.2 (<0-l)	1.1 (<0-l)	.008
Age group, y													
18-44	...	...	...	...	...	...	...	...	...	...	...	...	...
45-64	1.4 (0.1)	1.2 (0.1)	1.2 (0.1)	1.1 (0.1)	0.9 (0.1)	1.0 (0.1)	0.9 (0.1)	0.8 (0.1)	0.8 (0.1)	0.6 (<0.1)	0.6 (<0.1)	0.6 (<0.1)	<.001
65-84	3.4 (0.1)	3.2 (0.1)	2.8 (0.1)	2.8 (0.1)	2.5 (0.1)	2.4 (0.1)	2.1 (0.1)	2.1 (0.1)	1.7 (0.1)	1.6 (0.1)	1.6 (0.1)	1.6 (0.1)	<.001
≥85+	4.8 (0.2)	4.6 (0.2)	4.5 (0.2)	3.7 (0.2)	3.4 (0.2)	3.3 (0.2)	3.2 (0.2)	3.0 (0.2)	2.7 (0.2)	2.4 (0.1)	2.4 (0.2)	1.9 (0.1)	<.001
Mean charge ($)													
All discharges[a]	12,521 (263)	14,531 (495)	15,193 (456)	16,644 (827)	16,716 (521)	18,368 (653)	19,577 (578)	21,414 (574)	22,766 (592)	22,900 (618)	25,933 (757)	26,647 (527)	<.001
Age group, y													
18-44	11,440 (437)	14,007 (890)	14,132 (780)	16,258 (1,529)	15,736 (938)	17,965 (1,199)	18,779 (1,038)	20,761 (1,005)	22,070 (958)	22,074 (1,095)	25,962 (1,353)	26,651 (966)	<.001
45-64	13,578 (379)	14,792 (430)	16,158 (596)	16,637 (467)	17,403 (456)	18,354 (419)	20,219 (524)	21,688 (649)	23,313 (960)	23,272 (629)	25,558 (726)	26,050 (366)	<.001

Parameter	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	*P* Trend
65-84	14,076 (320)	15,754 (487)	16,929 (459)	17,873 (457)	18,618 (470)	19,679 (476)	20,974 (488)	23,003 (551)	24,038 (659)	24,807 (618)	26,588 (649)	27,727 (352)	<.001
≥85+	13,771 (504)	15,398 (689)	15,953 (474)	17,775 (645)	18,211 (543)	19,462 (634)	20,683 (625)	22,744 (624)	23,566 (690)	24,982 (733)	25,883 (676)	27,376 (418)	<.001
Median charge ($)													
All discharges[a]	...	...	...	...	...	...	...	...	...	...	...	...	...
Age group, y													
18-44	7,041	7,877	8,361	9,286	9,442	10,692	11,675	12,623	13,964	13,776	16,028	16,148	...
45-64	8,253	8,840	9,574	10,228	10,771	11,959	12,866	14,084	14,859	15,304	16,629	17,490	...
65-84	8,968	9,719	10,407	11,301	11,876	12,753	13,726	15,361	16,012	16,640	17,813	18,708	...
≥85+	9,029	9,650	10,369	11,372	12,000	12,858	13,948	15,777	16,292	17,260	18,384	19,451	...
Mean cost ($)													
All discharges[a]	5,365 (98)	5,890 (192)	5,830 (165)	6,323 (285)	6,293 (234)	6,716 (306)	6,782 (247)	7,097 (178)	7,152 (188)	7,331 (175)	7,786 (258)	7,706 (153)	<.001
Age group, y													
18-44	4,948 (168)	5,692 (349)	5,417 (291)	6,142 (530)	6,029 (432)	6,635 (572)	6,584 (457)	6,913 (325)	7,062 (347)	7,094 (317)	7,931 (479)	7,682 (278)	<.001
45-64	5,796 (126)	6,027 (150)	6,244 (186)	6,427 (144)	6,500 (140)	6,654 (120)	6,916 (138)	7,185 (128)	7,142 (118)	7,444 (146)	7,517 (138)	7,567 (113)	<.001
65-84	5,942 (100)	6,299 (140)	6,440 (127)	6,722 (122)	6,800 (120)	7,095 (118)	7,187 (108)	7,548 (114)	7,481 (87)	7,904 (150)	7,844 (130)	8,068 (125)	<.001
≥85+	5,673 (150)	6,021 (198)	6,027 (137)	6,569 (197)	6,429 (133)	6,953 (161)	7,003 (145)	7,308 (131)	7,247 (108)	7,627 (161)	7,530 (137)	7,707 (78)	<.001
Median cost ($)													
All discharges[a]	...	...	...	...	...	...	...	...	...	...	...	...	...
Age group, y													
18-44	3,215	3,401	3,443	3,824	3,823	4,154	4,244	4,579	4,681	4,791	5,117	5,053	...
45-64	3,793	3,914	4,102	4,322	4,411	4,678	4,838	5,136	5,164	5,303	5,375	5,500	...
65-84	4,071	4,253	4,425	4,691	4,829	5,071	5,233	5,587	5,616	5,785	5,846	6,018	...
≥85+	4,036	4,233	4,428	4,673	4,815	5,135	5,296	5,676	5,702	5,854	5,913	6,165	...

[a] Age-adjusted estimates.

[b] Age-adjusted rate for adults aged ≥45 y.

Table 2

Numbers and Age-Adjusted and Age-Specific Rates (SE) Per 100,000 Population of ED Visits for COPD or Bronchiectasis Among Patients Aged ≥ 18 y, Nationwide Emergency Department Sample 2006-2011

Numbers and Rates	2006	2007	2008	2009	2010	2011	*P* Value
Numbers							
All visits	1,480,363	1,478,903	1,693,782	1,741,138	1,702,431	1,787,612	...
Age group, y							
18-44	405,504	396,508	425,904	458,180	409,577	412,161	...
45-64	483,309	502,319	582,801	613,050	620,182	657,335	...
65-84	508,196	494,478	582,363	569,630	570,428	606,464	...
≥85+	83,354	85,598	102,714	100,278	102,244	111,652	...
Rate							
All visits[a]	654.4 (10.3)	642.7 (9.7)	722.4 (11.7)	731.2 (11.6)	701.7 (10.8)	724.6 (11.1)	.072
Age group, y							
18-44	361.3 (13.1)	353.0 (12.0)	378.3 (14.0)	406.4 (15.0)	362.7 (12.9)	363.2 (12.3)	.726
45-64	642.6 (17.1)	651.8 (16.9)	741.3 (20.7)	763.7 (20.8)	758.4 (19.8)	794.1 (21.1)	.005
65-84	1,573.5 (37.7)	1,508.2 (35.3)	1,734.2 (44.0)	1,662.9 (38.0)	1,634.2 (39.1)	1,700.8 (42.4)	.168
≥85+	1,713.0 (47.7)	1,698.5 (46.4)	1,976.9 (57.0)	1,868.3 (50.3)	1,848.0 (50.2)	1,946.1 (62.2)	.104
Percent admitted to same hospital							
All visits[a]	19.1 (0.2)	19.5 (0.2)	20.6 (0.2)	20.8 (0.2)	20.6 (0.2)	19.7 (0.2)	.280
Age group, y							
18-44	3.4 (0.1)	3.6 (0.1)	4.0 (0.2)	3.7 (0.2)	4.0 (0.2)	3.6 (0.2)	.384
45-64	29.1 (0.5)	29.5 (0.6)	31.1 (0.5)	31.6 (0.6)	31.5 (0.6)	30.2 (0.6)	.182
65-84	50.3 (0.7)	50.8 (0.7)	53.7 (0.6)	54.1 (0.6)	52.8 (0.7)	50.9 (0.7)	.487
≥85+	54.6 (0.8)	55.9 (0.8)	59.3 (0.8)	60.1 (0.8)	57.9 (0.8)	58.0 (0.9)	.200
Percent died in ED							
All visits	...	...	...	...	...	...	...
Age group, y							
18-44	...	...	...	...	...	...	...
45-64	...	...	...	...	...	...	...

Numbers and Rates	2006	2007	2008	2009	2010	2011	*P* Value
65-84	0.1 (<0.1)	0.1 (<0.1)	0.1 (<0.1)	0.1 (<0.1)	0.1 (<0.1)	0.2 (<0.1)	...
≥85+	0.3 (<0.1)	0.2 (<0.1)	...	0.2 (<0.1)	0.1 (<0.1)	0.2 (<0.1)	...

[a]Age-adjusted estimates.

Table 3

Unadjusted Percentage of Readmission Within 30 d Among Patients Aged ≥ 18 y With an Index Hospitalization for COPD or Bronchiectasis, Nationwide Inpatient Sample 2009-2012

Readmissions	2009	2010	2011	2012
Readmissions with the same ICD-9-CM codes as principal diagnosis				
Total	7.4	7.1	7.3	6.9
Age group, y				
18-44	5.8	5.2	5.2	4.8
45-64	8.4	8.0	8.2	7.9
65+	7.0	6.7	6.9	6.5
Readmissions with the same ICD-9-CM in any diagnosis				
Total	18.0	17.7	18.1	17.5
Age group, y				
18-44	10.9	10.6	10.9	10.8
45-64	17.5	17.2	17.7	17.1
65+	18.7	18.4	18.7	18.0
Readmissions for any cause				
Total	21.2	20.9	21.2	20.5
Age group, y				
18-44	16.4	16.5	17.1	16.6
45-64	21.0	20.7	21.1	20.5
65+	21.6	21.1	21.4	20.7

ICD-9-CM = *International Classification of Diseases 9th Revision-Clinical Modification.*