Hospitalizations for Chronic Pancreatitis in Allegheny County, Pennsylvania, USA

Dhiraj Yadav Venkata Muddana Michael O'Connell

University of Pittsburgh Medical Center, Pittsburgh, Pa., USA

Key Words

Chronic pancreatitis · Hospitalizations · Alcohol · Alcoholism

Abstract

Background/Aims: Population-based estimates for chronic pancreatitis (CP) are scarce. We determined incident CP hospitalization rates and the risk of pancreatitis-related readmissions in Allegheny County, Pennsylvania, USA. **Methods:** We used Pennsylvania Health Care Cost Containment Council (PHC4) dataset to identify all unique White and Black Allegheny County residents with incident hospitalization for CP from years 1996–2005. We noted presence of alcoholism codes (from one year before index hospitalization until last contact) and pancreatitis-related readmissions until the third quarter of 2007. Age-, sex-, and race-adjusted (to US 2000 population) rates/100,000 were calculated. **Results:** 988 unique County residents with incident hospitalization for CP were identified. Of these, 37.6% also received alcoholism codes. Overall hospitalization rate was 7.75/100,000 (95% CI 7.26–8.24), which remained stable throughout the study period. Patients with alcoholism codes were significantly younger (47.2 vs. 58.0 years), more likely to be male (71.4 vs. 36.6%), and Black (38.5 vs. 17.7%). Hospitalization rates were significantly higher (2.4-fold) in Blacks (vs. Whites), particularly for those with alcoholism codes. During follow-up (median 45 months), pancreatitis-related readmissions were common, significantly more so for patients with alcoholism

codes. **Conclusions:** CP hospitalization rates over a one-decade period were stable. Readmissions were highest among patients with a diagnosis of alcoholism.

Copyright © 2011 S. Karger AG, Basel and IAP

Introduction

Pancreatitis accounts for significant healthcare utilization and costs. In the US, the economic burden from hospital admissions and charges for acute (AP) and chronic (CP) pancreatitis (USD 3.7 billion) was eighth, and the number of hospital admissions was seventh among all gastrointestinal disorders in 2004 [1].

In contrast to AP [2], few population-based data are available for CP [3–7]. Population-based US estimates for CP have been reported for the city of Rochester, Minn., USA (1940–1969) [8] and, Olmsted County, Minn., USA (1977–2006) [9] as well as the number of admissions to US

The Pennsylvania Health Care Cost Containment Council (PHC4) is an independent state agency responsible for addressing the problem of escalating health costs, ensuring the quality of health care, and increasing access to health care for all citizens. While PHC4 has provided data for this study, PHC4 specifically disclaims responsibility for any analyses, interpretations or conclusions.

These data were presented as a Poster at the Digestive Disease Week in Chicago, May 2011, and published in abstract form in *Gastroenterology* 2011;140(suppl 1):S-546.

non-federal acute care hospitals (1988–2004) [10]. The Olmsted County population is predominantly Caucasian, thereby limiting generalizability of the results. Population-based estimates for hospital admissions, based on non-unique patients [10, 11], do not accurately reflect disease distribution at a population level. Moreover, these reports did not stratify patients based on etiology [10] or diagnosis (AP or CP) [11], and did not consider concurrent diagnosis codes for AP or pseudocysts, which are often seen as the presenting diagnoses or complications of CP [10, 11]. There are no population-based estimates of pancreatitis related readmissions in patients with CP.

To address these knowledge gaps, we conducted a population-based study in Allegheny County, Pa., USA, to determine the hospitalization rate for CP from 1996 to 2005 and the risk of pancreatitis-related readmission following the index hospitalization.

Methods

This study was approved by the Institutional Review Board of the University of Pittsburgh Medical Center.

Data Source

The Pennsylvania Health Care Cost Containment Council (PHC4; www.phc4.org) is an independent state agency mandated by law to collect detailed information on all inpatient hospitalizations and ambulatory procedures at freestanding clinics in Pennsylvania (over 4 million records each year). The agency analyzes and reports data on the distribution of disease states and procedures, outcomes, and health care costs. PHC4 data are available for inpatient admissions from 1990 onward and for outpatient/ambulatory procedures from 1996 onward.

Data from individual institutions and ambulatory clinics are de-identified by PHC4, and each patient is assigned with a unique identification number. Inpatient and outpatient data files can be linked at the level of a unique patient to allow longitudinal evaluation of desired variables or outcomes of interest (e.g. readmissions, diagnoses, etc.). The inpatient and outpatient data files are available as standardized datasets comprising more than 70 data fields, including demographics (age, sex, race), admission details (year, quarter, type: emergency, urgent or elective, source), discharge (length of stay, discharge disposition, inpatient mortality), discharge diagnoses (primary and up to 8 secondary), procedure codes (primary and up to 5 secondary), diagnoses-related groups, severity of illness, provider and facility, county and region of residence, payment source, and charges. The datasets can also be queried to create additional data fields specific to a research project.

Case Ascertainment

We queried the PHC4 dataset to identify all unique Allegheny County residents (2000 census population, 1,281,666) who received a primary or secondary inpatient discharge diagnosis of CP (ICD-9 CM 577.1) from 1996 to 2005. From these, we excluded

patients who were not White or Black, who had received a prior diagnosis (primary or secondary) of CP at anytime from 1990–1995, who had a pancreatic cancer diagnosis (157.x) concurrently or within 6 months before or after the index admission during 1996–2005, and who received CP as a secondary diagnosis during the index admission if AP (ICD9-CM 577.0) or pancreatic pseudocyst (ICD9-CM 577.2) was not the primary discharge diagnosis. We excluded patients with any prior diagnosis of CP in the preceding 6 years as we sought to capture incident hospital admissions related to CP. We did not exclude patients with a prior diagnosis or concurrent diagnosis (i.e. during the index admission) of AP and/or pseudocyst since CP often develops after an attack of AP, and AP or pseudocyst can be the initial manifestation of CP.

Associated Diagnosis Codes

Because no unique ICD-9 CM codes characterize the etiology of CP, we used presence of any associated codes for alcoholism (ICD9-CM 291, 303, 305.0, 357.5, 425.5, 571.0, 571.2, 571.3, 980.0, V11.3) within one year prior to or during the index hospitalization or during the follow-up period as a surrogate for alcohol etiology of CP. We divided patients according to whether they did and did not have associated alcoholism codes. We recorded when a patient received an alcoholism code (during or within one year prior to index admission, or during the follow-up period) and the type of code (e.g. alcohol-related liver disease, ICD9-CM 571.1, 571.2, 571.3; delirium tremens, ICD9-CM 291.0). As a measure of validity, we evaluated the prevalence of diagnosis codes for high-risk behaviors associated with alcoholism (tobacco abuse, hepatitis C).

Follow-Up

We determined whether patients had any subsequent hospitalization or outpatient/ambulatory procedure reportable to the PHC4 until the third quarter of 2007. The time between discharge from the index hospitalization and the final PHC4 data entry was defined as that patient's follow-up period. For patients with readmission(s), we determined whether AP or CP was the primary or any discharge diagnosis.

Data Analysis

Descriptive information is presented as proportions for categorical data and mean $\pm$ standard deviation or median and interquartile range (IQR) for continuous data. Bivariate comparisons for categorical data were performed using χ^2 test and for continuous data using Student's *t* or Mann-Whitney *U* test as applicable.

To calculate incident hospitalization rates for CP, the entire non-Hispanic White and Black population of Allegheny County from years 1996–2005 was considered to be at risk. Crude hospitalization rates were calculated per 100,000 population for each year as well as the entire study period using denominators derived from US Census figures. The rates were age, sex, and race adjusted to the 2000 US White and Black population using direct standardization, and 95% confidence intervals (CI) of rates were calculated using the Poisson distribution. Hospitalization rates were calculated for all cases and following stratification for sex, race, and the presence of associated codes for alcoholism. The rates were considered significant if the CI for the comparison groups did not overlap.

The rate of readmission during follow-up (overall and by sex, race, and the presence of alcoholism codes) was estimated using

Table 1. Demographics and selected characteristics of CP patients in Allegheny County, Pa., USA, who had incident hospitalization (1996–2005)

Variable	All CP patients (n = 988)	Alcoholism codes (n = 371)	No alcoholism codes (n = 617)	p value
Age, years	53.9 ± 18.1	47.2 ± 11.5	58.0 ± 20.1	<0.001
Males	491 (49.7)	265 (71.4)	226 (36.6)	<0.001
Whites	736 (74.5)	228 (61.5)	508 (82.3)	<0.001
Median length of stay, days	4 (3–7)	4 (3–7)	5 (3–7)	0.03
Death (index admission)	5 (0.5)	2 (0.5)	3 (0.5)	0.62
Tobacco abuse ^a	319 (32.3)	222 (59.8)	97 (15.7)	<0.001
Hepatitis C ^a	81 (8.2)	69 (18.6)	12 (1.9)	<0.001
Follow-up				
Available ^b	868 (87.9)	331 (89.7)	537 (87.5)	0.37
Median duration, months	45 (23–75)	45 (22–75)	45 (23–75)	0.84
AP or CP (any diagnosis) ^b	503 (57.9)	250 (75.5)	253 (47.1)	<0.001
AP or CP (primary diagnosis) ^b	390 (44.9)	214 (64.7)	176 (32.8)	<0.001

Values for age are expressed as mean ± standard deviation. Figures in parentheses indicate percentage or IQR.

^a Diagnosis codes received during index admission or during follow-up.

^b Proportion based on patients who survived index admission.

the Kaplan-Meier methodology. Multivariable Cox regression analysis was used to determine predictors of pancreatitis-related readmission during the follow-up period using age, sex, race, and the presence of associated alcoholism codes as covariates.

A p value of <0.05 was considered significant for all analyses. Data were analyzed using SPSS v17 (SPSS Inc., Chicago, Ill., USA).

Results

Study Cohort

We identified 988 incident hospitalizations for CP in unique White or Black Allegheny County residents from 1996 to 2005. Of these, 668 (67.6%) received a primary inpatient discharge diagnosis of CP during the index hospitalization; in the remainder, CP was a secondary diagnosis with AP (295 patients, 29.9%) or pancreatic pseudocyst (25 patients, 2.5%) as a primary diagnosis. Table 1 summarizes the study cohort characteristics during the index hospitalization. Compared with patients without associated alcoholism codes, those who received alcoholism codes were younger and more likely to be male and Black. Figure 1 presents the age distribution of CP patients at the time of index hospitalization. CP patients with alcoholism codes were mostly young or middle aged (80% between ages 35–65 years), while those without alcoholism codes had a wider age distribution, with the proportion increasing with age (over 40% were 65 years or older). The preva-

Fig. 1. Distribution of patients with incident hospitalization for CP in Allegheny County, Pa., USA, from 1996–2005, by age and presence of associated alcoholism.

lence of concurrent AP or pseudocyst (primary or any diagnosis) was significantly higher in patients with alcoholism codes (57.1 vs. 26.4%, $p < 0.001$). The length of stay was slightly but significantly higher in patients without alcoholism codes, and the overall mortality during the index hospitalization was low. Diagnosis codes for alcoholic liver disease were present in 112 patients (11.3% overall, 30.2% among those with CP with alcoholism codes).

Table 2. CP hospitalization rates in Allegheny County, Pa., USA (1996–2005)

Group	All	CP with alcoholism codes	CP without alcoholism codes
All patients	7.75 (7.26–8.24)	3.18 (2.86–3.51)	4.57 (4.20–4.93)
Males	8.28 (7.53–9.03)	4.74 (4.16–5.31)	3.55 (3.08–4.02)
Females	7.24 (6.59–7.89)	1.71 (1.38–2.04)	5.53 (4.98–6.09)
Whites	6.41 (5.94–6.88)	2.14 (1.86–2.42)	4.27 (3.90–4.65)
Blacks	15.26 (13.34–17.18)	9.06 (7.56–10.55)	6.20 (5.02–7.39)

Rates are per 100,000 population (95% CI).

Fig. 2. Hospitalization rate for CP in Allegheny County, Pa., USA, from 1996 to 2005 for all cases and based on presence of associated codes for alcoholism.

Hospitalization Rates

Although some fluctuations were seen in the yearly hospitalization rates for CP during the study period, no significant differences were observed overall or after stratification based on the presence of alcoholism codes (fig. 2), gender and race (data not shown). Data are therefore presented for the entire study duration. Table 2 summarizes the age-, sex-, and race-standardized incident hospitalization rate for CP per 100,000 population during the study period. The overall hospitalization rates were similar for males and females but showed significant differences based on whether an associated diagnosis code for alcoholism was present. Among patients with alcoholism codes, the CP hospitalization rate was 2.8-fold higher among males compared with females, whereas hospital-

Fig. 3. Risk of readmission after incident hospitalization for CP in Allegheny County, Pa., USA, from 1996–2005, based on presence of associated codes for alcoholism.

ization rates were 1.6 times higher in females compared with males among those without alcoholism codes. The hospitalization rates were significantly higher in Blacks compared with Whites: 2.4-fold higher among all patients, 4.2-fold higher with alcoholism codes, and 1.5-fold higher without alcoholism codes.

Follow-Up

Of the 983 (99.5%) patients who survived their incident hospitalization for CP, 868 (88.3%) had at least one

contact (either hospitalization or ambulatory procedure) by the end of the follow-up period. Median follow-up was 45 months (IQR 23, 75; range 1–136), and was similar regardless of the presence of alcoholism codes. Of these, 503 (57.9%) were readmitted with AP or CP as the primary or any diagnosis; pancreatitis-related readmissions were significantly more likely in patients who also received alcoholism diagnosis (table 1). On Cox regression analyses, significant predictors of pancreatitis-related readmission as the primary diagnosis were presence of alcoholism codes (HR 2.1, 95% CI 1.7–2.7, $p < 0.001$; fig. 3) and age (for each year increase in age HR 0.97, 95% CI 0.97–0.98, $p < 0.001$); data were similar for any pancreatitis-related readmission.

Discussion

In this population-based study of unique patients, we found the incident hospitalization rates for CP in Allegheny County, PA to be 7.75 per 100,000 population and that these did not fluctuate significantly over a 10-year period (1996–2005). Approximately 40% CP patients had associated codes for alcoholism, and these had the highest rate of pancreatitis-related readmissions following the index hospitalization. Our study confirms previous observations of high susceptibility in Blacks compared with Whites, especially for alcohol-related CP.

A unique advantage of the PHC4 dataset we used is that, unlike other publicly available datasets (e.g. National Hospital Discharge Survey, National Hospital Ambulatory Medical Care Survey, Nationwide Inpatient Sample), the outpatient and inpatient files can be linked longitudinally at the level of unique patients, and data files can be linked to study readmissions or the desired outcomes over time. Thus, our estimates likely represent the true incident CP hospitalization rates at a population level. Although the hospitalization rate in our study appears to be similar to an earlier US study by Yang et al. [10] based on the Nationwide Inpatient Sample, the results of these two studies are not directly comparable. While Yang et al. [10] only used primary diagnosis of CP as the inclusion criteria, we also included patients in whom CP was a secondary diagnosis in conjunction with a primary diagnosis of AP or pseudocyst. A similar approach by Yang et al. [10] would have increased the hospitalization rate in their study by at least a similar fraction.

We did not find a significant increase in the rate of hospitalizations for CP during the study period. Our incident hospitalization rates are similar to those of Yang et

al. [10], who evaluated CP hospitalizations in non-unique patients at non-federal US hospitals, but different than those reported by Tinto et al. [12] in England as well as our findings in Olmsted County, Minn., USA [9]. Interestingly, the period for study and the rate of hospitalizations for CP is mostly similar in these studies. The observed differences in the UK cohort could be related to the distribution of risk factors; for example, the increase in hospitalization rates seen in England was attributed to a rise in the rates of alcohol consumption during the study period, while per capita alcohol sales in the US during this period remained relatively stable [13]. Difference in incidence between Allegheny and Olmsted Counties could be due to shorter duration of the Pennsylvania study (10 vs. 30 years), an increase in the utilization of cross-sectional imaging studies beginning in the late 1980s (thereby increasing the sensitivity to detect the presence of CP), and inclusion in the Olmsted study of all CP patients rather than only those who were hospitalized.

The above data suggest that in contrast to the rapidly rising incidence of AP [14, 15], the incidence of CP in the US is either stable or has increased only modestly over the past 20–25 years. These observations have important epidemiologic implications. The major contributors to the rising incidence rates for AP are believed to be gallstones (related to the rising rates of obesity, a risk factor for gallstones) [2], detection bias (diagnosis of milder cases) and overdiagnosis (false positives) due to increasing routine serum enzyme testing [16]. Other possibilities include alcohol, though this has increased only modestly in the US when compared with other countries [12, 15, 17], increasing use of ERCP, and availability of new medications that can cause AP [2]. Empiric evidence suggests that a subset of patients with AP progress to CP, more often in patients with alcoholic AP [18, 19]. The disproportionate rise in the incidence of AP therefore can be explained by the contribution from etiologies not associated with progression from AP to CP (e.g. gallstones) or by other factors (e.g. detection bias).

No billing codes designate a specific etiology for pancreatitis. As previously done to assess etiology for AP hospitalizations [15], we used associated codes for alcoholism as a surrogate for alcohol etiology of CP, though we recognize that some patients who use or abuse alcohol may not receive diagnosis codes for alcoholism. The proportion of CP cases with alcoholism codes in our study therefore represents the minimum contribution of alcohol to CP etiology at a population level. Nevertheless, it was reassuring that the demographic profile of patients with and without alcoholism codes was fairly similar to those

with alcoholic and nonalcoholic CP reported in the literature [5, 20–25]. Moreover, the prevalence of alcoholic liver disease among CP patients in our study was high as has been previously reported [26]. The prevalence of high-risk behaviors or diseases associated with alcohol abuse (tobacco use, hepatitis C) was also higher among patients with associated alcoholism codes validating our approach.

Natural history studies indicate high morbidity rates in patients with CP [20, 24, 25, 27], which we have confirmed at a population level. We found high rates of pancreatitis-related readmissions during a median follow up of 4 years, specifically among CP patients who also received a diagnosis of alcoholism.

Our study is subject to limitations inherent to the use of administrative data for research purposes. We evaluated incident hospitalizations rather than incident diagnosis of CP in unique patients, so we may have missed patients who were not hospitalized or did not have symptoms. There are limited data on the validation of CP diagnosis codes [28, 29]. Because we could not validate diagnostic codes, we may have overestimated true CP cases, which to some extent would offset the underestimation of cases managed as outpatients or who are asymptomatic. However, our aim was to determine the hospitalization rates for cases diagnosed with CP rather than to validate the diagnosis codes. We acknowledge that a lack of validation of CP diagnosis code could have affected the assessment of hospitalization rates for true cases of CP. We may not have detected incident admissions or pancre-

atitis-related readmissions not captured by the PHC4 (e.g. an Allegheny County resident with hospitalization for CP in another state). We evaluated hospitalization rates for CP in one Pennsylvania County, which may not be generalizable to the US population. Further, we included only Blacks and Whites, so our data may not be applicable to other racial or ethnic groups.

In conclusion, we calculated population-based estimates for incident hospitalization rates for CP in unique patients and the risk of readmission in a defined US population. Demographic characteristics of patients with CP hospitalization were generally similar to reported literature, particularly with regard to disparity due to race and alcohol abuse. CP patients, especially those with associated alcoholism had high rates of pancreatitis-related readmissions.

Disclosure Statement

None.

Acknowledgements

The authors thank Michelle L. Kienholz, Department of Medicine, University of Pittsburgh for critical review and editorial assistance. Dr. Yadav is supported in part through NIH (DK077906, PI: David C. Whitcomb, MD, PhD). Dr. Yadav has received support for this study from the Department of Medicine, University of Pittsburgh.

References

- 1 Everhart JE, Ruhl CE: Burden of digestive diseases in the United States part I: overall and upper gastrointestinal diseases. *Gastroenterology* 2009;136:376–386.
- 2 Yadav D, Lowenfels AB: Trends in the epidemiology of the first attack of acute pancreatitis: a systematic review. *Pancreas* 2006;33:323–330.
- 3 Dite P, Stary K, Novotny I, et al: Incidence of chronic pancreatitis in the Czech Republic. *Eur J Gastroenterol Hepatol* 2001;13:749–750.
- 4 Lankisch PG, Assmus C, Maisonneuve P, et al: Epidemiology of pancreatic diseases in Luneburg County. A study in a defined German population. *Pancreatol* 2002;2:469–477.
- 5 Lin Y, Tamakoshi A, Matsuno S, et al: Nationwide epidemiological survey of chronic pancreatitis in Japan. *J Gastroenterol* 2000;35:136–141.
- 6 Nojgaard C, Bendtsen F, Becker U, et al: Danish patients with chronic pancreatitis have a four-fold higher mortality rate than the Danish population. *Clin Gastroenterol Hepatol* 2010;8:384–390.
- 7 Levy P, Barthet M, Mollard BR, et al: Estimation of the prevalence and incidence of chronic pancreatitis and its complications. *Gastroenterol Clin Biol* 2006;30:838–844.
- 8 O'Sullivan JN, Nobrega FT, Morlock CG, et al: Acute and chronic pancreatitis in Rochester, Minnesota, 1940 to 1969. *Gastroenterology* 1972;62:373–379.
- 9 Yadav D, Lawrence T, Benson JT, et al: Incidence, prevalence and survival of chronic pancreatitis: a population-based study. *Gastroenterology* 2010;138(suppl 1):S-391.
- 10 Yang AL, Vadavkar S, Singh G, et al: Epidemiology of alcohol-related liver and pancreatic disease in the United States. *Arch Intern Med* 2008;168:649–656.
- 11 Everhart JE: Pancreatitis; in Everhart JE (ed): *The Burden of Digestive Diseases in the United States*. US Department of Health and Human Services, Public Health Service, National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, Washington; US Government Printing Office 2008; NIH Publication No. 09-6443, pp 119–122.
- 12 Tinto A, Lloyd DA, Kang JY, et al: Acute and chronic pancreatitis – diseases on the rise: a study of hospital admissions in England 1989/90–1999/2000. *Aliment Pharmacol Ther* 2002;16:2097–2105.
- 13 National Institute on Alcohol Abuse and Alcoholism: *Apparent per capita ethanol consumption for the United States, 1850–2007*. Volume 2010.

- 14 Fagenholz PJ, Castillo CF, Harris NS, et al: Increasing United States hospital admissions for acute pancreatitis, 1988–2003. *Ann Epidemiol* 2007;17:491–497.
- 15 Frey CF, Zhou H, Harvey DJ, et al: The incidence and case-fatality rates of acute biliary, alcoholic, and idiopathic pancreatitis in California, 1994–2001. *Pancreas* 2006;33:336–344.
- 16 Yadav D, Ng B, Saul M, et al: Relationship of serum pancreatic enzyme testing trends with the diagnosis of acute pancreatitis. *Pancreas* 2011;40:383–389.
- 17 O'Farrell A, Allwright S, Toomey D, et al: Hospital admission for acute pancreatitis in the Irish population, 1997–2004: could the increase be due to an increase in alcohol-related pancreatitis? *J Publ Health* 2007;29:398–404.
- 18 Lankisch PG, Breuer N, Bruns A, et al: Natural history of acute pancreatitis: a long-term population-based study. *Am J Gastroenterol* 2009;104:2797–2805, quiz 2806.
- 19 Takeyama Y: Long-term prognosis of acute pancreatitis in Japan. *Clin Gastroenterol Hepatol* 2009;7:S15–S17.
- 20 Ammann RW, Akovbiantz A, Largiader F, et al: Course and outcome of chronic pancreatitis. Longitudinal study of a mixed medical-surgical series of 245 patients. *Gastroenterology* 1984;86:820–828.
- 21 Cote GA, Yadav D, Slivka A, et al: Alcohol and smoking as risk factors in an epidemiology study of patients with chronic pancreatitis. *Clin Gastroenterol Hepatol* 2011;9:266–273, quiz e27.
- 22 Dani R, Mott CB, Guarita DR, et al: Epidemiology and etiology of chronic pancreatitis in Brazil: a tale of two cities. *Pancreas* 1990;5:474–478.
- 23 Frulloni L, Gabbrielli A, Pezzilli R, et al: Chronic pancreatitis: report from a multicenter Italian survey (PanCroInfAISP) on 893 patients. *Dig Liver Dis* 2009;41:311–317.
- 24 Lankisch PG, Seidensticker F, Lohr-Happe A, et al: The course of pain is the same in alcohol- and nonalcohol-induced chronic pancreatitis. *Pancreas* 1995;10:338–341.
- 25 Layer P, Yamamoto H, Kalthoff L, et al: The different courses of early- and late-onset idiopathic and alcoholic chronic pancreatitis. *Gastroenterology* 1994;107:1481–1487.
- 26 Pace A, de Weerth A, Berna M, et al: Pancreas and liver injury are associated in individuals with increased alcohol consumption. *Clin Gastroenterol Hepatol* 2009;7:1241–1246.
- 27 Cavallini G, Frulloni L, Pederzoli P, et al: Long-term follow-up of patients with chronic pancreatitis in Italy. *Scand J Gastroenterol* 1998;33:880–889.
- 28 Spanier BW, Schreuder D, Dijkgraaf MG, et al: Source validation of pancreatitis-related hospital discharge diagnoses notified to a national registry in the Netherlands. *Pancreatology* 2008;8:498–503.
- 29 Yadav D, Eigenbrodt ML, Briggs MJ, et al: Pancreatitis: prevalence and risk factors among male veterans in a detoxification program. *Pancreas* 2007;34:390–398.