CLINICAL PRACTICE

Repeat Patients to the Emergency Department in a Statewide Database

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Abstract

Objectives: To describe the epidemiology of repeat users of the emergency department (ED) using a statewide database. **Methods:** Probabilistic linkage was used to convert three years of statewide ED visit data into a longitudinal, patient-based data set. Patients were classified as single, repeat (at least two visits within three years), or serial (four or more visits within a 365-day period) users of the ED. Serial patients were further stratified by the number of EDs attended. Descriptive statistics were used to assess differences between patient types. **Results:** There were 1,370,607 separate visits associated with 780,074 patients from 1996 to 1998. While repeat and serial patients represented 33% of the patients, they accounted for 62% of the ED visits during the study period. Repeat and serial patients were younger and had smaller median ED charges per visit than single-use patients. Serial patients attending five or more EDs were more likely to be coded as self-pay than other serial patients. Diagnosis codes relating to sprains, back problems, and headaches were prevalent among serial patients who visited five or more EDs. Approximately 30% of serial patients during the first year remained serial patients in the second year. **Conclusions:** Due to the high turnover in serial patients, control groups in future studies are necessary to evaluate interventions aimed at decreasing serial ED use. The likelihood of serial ED users to use multiple EDs indicates that those studying serial ED use should collect data from multiple EDs. **Key words:** emergency department; repeat use; database; data collection. ACADEMIC EMERGENCY MEDICINE 2004; 11:256–263.

More than 108 million emergency department (ED) visits occurred in the United States in 2000.[1] With an average charge of $292 per ED visit, expenditures for ED services alone have been estimated to be $26.6 billion per year.[2] Most studies of injury and illness focus on hospital discharge or mortality databases. This ignores an important part of the health care picture, as the majority of patients are treated and released from an ED without being admitted to the hospital.[3]

Recent data show that ED visits are on the rise. Between 1992 and 1999, there was an increase of 14% in the number of ED visits nationwide.[3] This poses challenges for the health care system since EDs across the country have reported problems with overcrowding, diverting, and loss of beds.[4–6] The causes as well as the prevention of overcrowding in EDs are complex problems.[4]

Perhaps one method of reducing ED overcrowding is to better identify and manage patients who frequently use the ED. Several studies have shown that patients who repeatedly seek ED care account for a large number of visits.[7–11] However, these studies have been conducted at one ED or within a single city.[7–9] Several other studies have focused on a subset of patients, such as those with asthma, injuries, or psychiatric problems, thus providing a less comprehensive description of repeat ED patients.[7,10,12]

The objective of this study was to describe the epidemiology of repeat patient visits coded as ''treated and released'' from the ED using a statewide database for the years 1996 through 1998. We used probabilistic record linkage methodology to identify patients who repeatedly visit EDs anywhere in the state. Also, we determined distinguishing characteristics of repeat patients compared with the general ED population. The use of a statewide database combined with probabilistic record linkage allowed us to longitudinally examine repeat ED use for an entire state, rather than a single locale.

METHODS

Study Design. This was a retrospective study of an ED database to assess repeat and chronic use of the

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ED. The institutional review board at our institution approved the use of the database for this study.

Data Source. Emergency department records from 1996 through 1998 were acquired from our state's Health Data Committee/Office of Healthcare Statistics, which mandates that all state-licensed hospitals report information on ED patient encounters. Hospitals may report data from their casemix file, uniform billing process, or other approved method. The ED database includes identifying information (i.e., name, gender, date of birth, admission date, and hospital identification number), up to nine International Classification of Disease 9th Revision Clinical Modification (ICD-9-CM) diagnosis codes and five procedure codes, external cause of injury codes (E codes), discharge status, and charges. Due to administrative rules governing the data, patients who are treated in the ED and subsequently admitted to the same facility are not included in the ED database. (Using our hospital discharge database, we estimated that there were a total of 138,586 patients admitted through an ED during the study period. Unfortunately, there are not enough identifiers in the inpatient database to include these patients in this analysis.) Additionally, patients treated at one ED and discharged or transferred to a different facility are included in the state ED database. For this reason, records were restricted to patients discharged to home from the ED (''treated and released''). Visits coded as a ''follow-up'' were also removed from the database (ICD-9-CM code of V53.7, V67.4, V54.8, V58.3, V54.0, V54.9, V67.0–V67.9, or V55.0–V55.9). While 35 hospitals currently provide data to the ED database, in 1996 there were four rural hospitals that did not submit ED data and two urban hospitals that submitted ED data for only the last six months of the year. Based on 1997 reporting, the underreporting of ED records is estimated to be approximately 50,000 cases, or 10% of the ED records for 1996 and fewer than 3% for the entire study period.

Probabilistic Linkage. The database for this study was created by probabilistically identifying unique patients in the ED database. Probabilistic record linkage was performed using CODES 2000 (Strategic Matching, Inc., Morrisonville, NY). Probabilistic record linkage is a method that uses variables common to independent databases to determine the probability that two records refer to the same person and/or event.[13,14] In this case, we used probabilistic linkage on a single file to find multiple occurrences of the same patient. Thus, we were able to transform the visit-based ED database into a longitudinal patient-based database. Variables used for the linkage process included first and last name, date of birth, hospital code, county of residence, zip code of residence, gender, and age. The match cutoff weight was set so that each match would have a minimum probability of being correct of 90%.[14]

Definitions. The earliest ED visit in the three-year time period for each patient was considered the patient's first visit. Any record that matched to the patient's first visit was defined to be a repeat visit. Patients were categorized into three groups: single users, serial users (four or more visits within a 365-day period), or repeat users (at least two visits within three years but not a serial user). The ''year'' that a patient became serial was defined based upon the day of the first of his or her four visits. To determine if a serial user from one year was also a serial user in a subsequent year, 365 days were added to the date of the first visit in a serial use sequence. It was then determined whether the patient had four or more visits within the next 365-day span. This definition is consistent with a previously published study.[9] Visits were coded based on ICD-9-CM as injury (ICD-9-CM 800–959, 990–999), illness (ICD-9-CM 001–289, 320–799), psychiatric (ICD-9-CM 290, 293–302, 306–319), drug/alcohol-related (ICD-9-CM 303–305, 291–292, 980.0), or poisoning (ICD-9-CM 960–979, 980.1–989). All ICD-9-CM codes associated with a visit were used for this classification; therefore, it is possible for a single visit to be classified in more than one group. For a finer categorization of the types of diagnoses that were associated with different patient types, ICD-9-CM codes were clustered into diagnostic categories.[15] As above, all ICD-9-CM codes for each patient and visit were analyzed, so it is possible for a patient or visit to be counted in multiple categories. Age was defined to be the age of the patient at the time of the first ED visit. Primary payer was categorized for each visit as follows: government (Medicare, Medicaid, other government), private (Blue Cross/Blue Shield, other commercial, managed care), self-pay, other (industrial and worker's compensation, unclassified), and unknown. Weekend ED visits were defined as occurring on Friday, Saturday, or Sunday.

Data Analysis. We used a descriptive analytic strategy. Data are presented for the complete database, and then stratified by the type of patient (single, repeat, or serial). Charges, ages, and numbers of visits are presented as median (first quartile [Q1], third quartile [Q3]). Percentages, stratified by patient type and number of hospitals, are used to compare visit types, leading diagnoses, and insurance types. All statistical analyses were conducted using SAS version 8.2 (SAS Institute, Inc., Cary, NC).

RESULTS

During the three-year study period, there were 1,459,385 reported ED visits in Utah hospitals that did not result in inpatient admissions. Additionally,

there were a total of 138,586 ED patients directly admitted to the hospital who were not included in the database, resulting in 1,597,971 ED patients. A total of 1,348,803 (84% of all ED visits statewide) visits were coded as ''discharged to home'' and were not follow-up visits. Approximately half of the patients were male (49%) and the median age at first visit was 30 years (range 0 to 106 years). The majority (59%) of visits had an illness-related diagnosis reported, and less than half (41%) included injury-related diagnoses, followed by drugs and alcohol (4%), psychological problems (3%), and poisonings (2%). Nearly $500 million in ED charges were reported during the study period.

Probabilistic linkage found that there were 771,527 unique patients in the database. The median number of visits per patient was 1, with a range of 1 visit to a maximum of 153 visits in the three-year period. Probabilistic linkage identified 517,114 one-time users of the ED, 219,571 repeat patients, and 34,842 serial patients. One-time users of the ED accounted for 67% of all patients but only 38% of visits. While repeat patients accounted for less than a third (28%) of all patients, they represented more than 40% of all visits. Similarly, serial patients accounted for 5% of patients but represented more than one in five (21%) ED visits.

Patient and visit demographics stratified by type of ED patient are displayed in Table 1. The average charges per visit decreased as ED repeat usage increased. However, the median cumulative charge per patient increased from $259 (Q1 = $148, Q3 = $439) for single-use patients to $1,880 ($1,115, $3,152) for serial patients. No difference between the patient groups for ED usage by day of the week was found; all three categories were more likely to use the ED on the weekends as opposed to weekdays. The primary payer for the charges changed as the number of visits increased. Single and repeat patients of the ED were more likely to use commercial insurance, while serial patients were more likely to use government insurance. The percentage of visits with more than one diagnosis increased as the number of ED visits increased. The top five diagnostic categories for single and repeat ED patients were the same (superficial injuries, sprains, open wounds of extremities, other upper respiratory infections, and open head wounds). For serial patients, however, abdominal pain and otitis media replaced open wounds of the head and extremities in the top five diagnostic categories.

The majority (61%) of repeat patients attended the same ED. However, the same was not true of serial patients, of whom 62% were seen at more than one ED. The median number of hospitals attended by a serial patient was 2, with a range of 1 to 30 hospitals. Due to the large proportion of serial patients using more than one ED, serial patient visit characteristics were stratified by number of EDs attended (Table 2). The majority (70%) of serial patients visited only one or two EDs, 24% visited three to four EDs, and 6% visited five or more EDs. Patients visiting more than one hospital were more likely to be younger and male compared with other serial patients.

Table 2 also shows that as the number of EDs visited increased, the median charge per visit stayed fairly consistent, from $209 (Q1 = $114, Q3 = $391) for serial patients who visited one or two EDs to $203 ($112, $366) for serial patients who visited five or more EDs. However, there was an increasing trend for cumulative charges per patient, where serial patients visiting five or more hospitals had the highest cumulative median charges of $4,414 ($2,701, $7,520). We also found that patients visiting five or more EDs had a median number of days between visits of 30 days, nearly twice as frequent as serial users of only one or two EDs. As the number of EDs that a patient visited increased, there was a decline in the use of government insurance, and the proportion of visits that were coded as self-pay more than doubled, from 7% for one or two EDs to 18% for patients seen at five or more different EDs. Serial patients seen at five or more EDs were more likely to have only one diagnosis for their visit compared with other serial patients. In addition, serial patients seen at five or more EDs had a higher percentage of injury-related visits than serial patients seen at only one or two EDs. As the number of hospitals visited by serial users increased, so did the number of visits related to sprains, headaches/migraines, and back problems. In fact, these three diagnoses accounted for 23% of all diagnoses for serial patients that attended five or more hospitals.

To determine the proportion of serial patients who continue to be serial users of the ED from year to year, we analyzed serial patients from 1996 who subsequently had four or more ED visits in 1997 and 1998. Of the 17,645 serial ED patients from 1996, 5,846 (33%) were also serial in 1997 and 5,463 (31%) were serial in 1998. Only 1,601 (5%) of serial patients were serial patients of the ED in all three years. We also found that the number of EDs attended was related to the number of years a person was a serial patient. More specifically, more than 75% of patients who were serial patients in only one of the study years were seen at one or two EDs, compared with 59% of two-year serial patients and 38% of three-year serial patients. Conversely, less than 5% of one-year serial patients were seen at five or more EDs. About one in ten (11%) two-year serial patients and nearly one third (32%) of three-year serial patients were seen at five or more EDs.

DISCUSSION

Our study has three main findings: 1) by generating statewide statistics at both the visit and patient level, we were able to compare repeat and serial users of the ED with single-use patients; 2) repeat and serial

TABLE 1. Patient and Emergency Department (ED) Visit Characteristics Stratified by Type of User

	All Patients	One Visit	Repeat Users (Not Serial)	Serial Users
Visit information				
Number of visits	1,348,803	517,114	548,743	282,946
Number of patients	771,527	517,114	219,571	34,842
Median visits per patient	1	1	2	6
Range of visits	1–153	1	2–9	4–153
Number of days between visits†	92 (21, 251)	NA	197 (29, 92)	57 (79, 366)
Percent of visits with >1 diagnosis	35%	33%	35%	37%
Percent of visits on weekends	46%	47%	46%	46%
Patient information				
Age at first visit (yr)†	25 (13, 42)	25 (14, 43)	24 (13, 41)	25 (12, 40)
% Male	49%	51%	50%	44%
ED charges				
Total ED charges	$472,991,941	$188,173,730	$194,043,427	$90,774,784
Charges per visit†	$246 ($134, $428)	$259 ($148, $439)	$249 ($135, $433)	$213 ($115, $394)
Charges per patient†	$356 ($185, $705)	$259 ($148, $439)	$673 ($411, $1,113)	$1,880 ($1,115, $3,152)
Visit type*				
% Injury visits	41%	49%	41%	27%
% Illness visits	59%	51%	59%	73%
% Poisoning	2%	2%	2%	1%
% Drugs and alcohol	4%	3%	3%	5%
% Psychological	3%	2%	3%	5%
Top five diagnosis clusters*				
1.	Superficial injuries 10%	Superficial injuries 11%	Superficial injuries 10%	Superficial injuries 6%
2.	Sprains 7%	Sprains 8%	Sprains 7%	Sprain 5%
3.	Open extremity wound 5%	Open extremity wound 6%	Open extremity wound 5%	Other upper respiratory infection 5%
4.	Other upper respiratory infection 4%	Other upper respiratory infection 6%	Other upper respiratory infection 4%	Abdominal pain 4%
5.	Open head wound 4%	Open head wound 4%	Open head wound 4%	Otitis media 4%
Payer information				
% Government	23%	16%	23%	36%
% Commercial	47%	54%	47%	32%
% Self-pay	9%	9%	8%	10%
% Other	5%	5%	5%	4%
% Unknown	17%	16%	17%	18%

*Every diagnosis for each visit was considered. Therefore, one patient visit can be assigned to multiple clusters.
†Data are presented as median (Q1, Q3).

TABLE 2. Serial Users of the Emergency Department (ED) Stratified by Number of Different Hospitals Visited

	All Serial Patients	1–2 Hospitals	3–4 Hospitals	5 or More Hospitals
Visit information				
Number of visits	282,946	166,082	73,968	42,896
Number of patients	34,842	24,446	8,267	2,129
Median visits per patient	6	6	7	14
Number of days between visits†	57 (79, 366)	59 (28, 93)	57 (32, 97)	30 (28, 93)
Percent of visits with >1 diagnosis	37%	37%	37%	34%
Percent of visits on weekends	46%	45%	45%	47%
Patient information				
Age at first visit (yr)†	25 (12, 40)	24 (6, 41)	26 (18, 37)	30 (22, 37)
% Male	44%	43%	44%	50%
ED charges				
Total ED charges	$90,774,784	$52,624,265	$25,029,214	$13,121,305
Charges per visit†	$213 ($115, $394)	$209 ($114, $391)	$227 ($122, $418)	$203 ($112, $366)
Charges per patient†	$1,880 ($1,115, $3,152)	$1,649 ($991, $2,718)	$2,291 ($1,431, $3,731)	$4,414 ($2,701, $7,520)
Visit type*				
% Injury visits	27%	24%	28%	33%
% Illness visits	73%	75%	71%	67%
% Poisoning	1%	1%	2%	1%
% Drugs and alcohol	5%	4%	7%	6%
% Psychological	5%	4%	6%	5%
Top five diagnosis clusters*				
1.	Superficial injuries 6%	Superficial injuries 6%	Superficial injuries 8%	Sprain 11%
2.	Sprain 5%	Other upper respiratory infection 5%	Sprain 7%	Superficial injuries 9%
3.	Other upper respiratory infection 5%	Sprain 4%	Abdominal pain 4%	Back problem 6%
4.	Abdominal pain 4%	Otitis media 4%	Headache/migraine 4%	Headache/migraine 6%
5.	Otitis media 4%	Abdominal pain 4%	Other upper respiratory infection 4%	Abdominal pain 4%
Payer information				
% Government	36%	41%	31%	25%
% Commercial	32%	32%	33%	32%
% Self-pay	10%	7%	12%	18%
% Other	4%	3%	4%	4%
% Unknown	18%	17%	20%	22%

*Every diagnosis for each visit was considered. Therefore, one patient visit can be assigned to multiple clusters.
†Data are presented as median (Q1, Q3).

patients have distinctive ED use patterns; and 3) patients who are serial users of the ED over a long period of time are likely to be seen at multiple EDs.

Accounting for only one-third of all patients, repeat and serial ED patients accumulated more than 60% of all ED visits and ED charges. While we were unable to characterize the severity of the injury or illness in our database, the decreased average charges for repeat patients might be indicative of a decrease in severity. This assertion is supported by other studies suggesting that repeat patients tend to have lower severity or triage scores.[7,9] However, the fact that serial users were more likely to have more than one diagnosis compared with single- and repeat-user visits may indicate that serial patients have comorbidities necessitating their use of the ED.

We also found that as the number of ED visits increased, the percentage of patients using government insurance also increased. The use of government insurance or lack of health care insurance has long been associated with frequent ED use.[7,9,16,17] The lack of insurance or use of government insurance may be correlated with several other factors that have been associated with frequent ED use, including being unemployed or having a low monthly income,[10,18] being homeless or marginally housed,[9,10,18] and having a low-quality social network.[11] These studies suggest that sociodemographic factors may increase the need for periodic medical care among a segment of the population who has no traditional or routine source for health care other than the ED.

Our rate of continued ED use by serial patients from year to year is comparable to other studies.[9,11] However, we found that serial ED use across multiple years was strongly associated with visiting multiple EDs. In fact, almost two-thirds of patients who were serial patients in all three years of the study were seen at three or more EDs, suggesting that this group may constitute a unique subpopulation of serial ED users. Serial ED users visiting multiple EDs in our study presented most often with diagnoses of sprains, superficial injuries, back problems, headaches/migraines, and abdominal pain. While these diagnoses combined with visiting multiple hospitals and doctors have been associated with substance abuse,[19–23] we have no information to indicate such is true. A large portion of these patients could be undertreated or suffer from chronic pain. While we are unable to state a reason for these patients' visiting multiple EDs, it is probable that their continuum of care is broken, and this may impact overall medical care, hence necessitating frequent visits to an ED.

Few studies of interventions for lowering repeat ED usage have been published, and these have reported mixed or varied results.[24–28] For example, studies that have relied mostly on educational interventions have proved unsuccessful,[24,27] while more proactive interventions involving care plans, multidisciplinary teams, and follow-up visits with primary care physicians have shown results that vary from no difference in ED use to a reduction of more than 25% in the median number of ED visits.[25,26,28] Our results and those of others have shown that nearly 70% of the serial patients from one year will cease to be serial patients the next.[9,11] To account for this high turnover in serial ED patients, the use of a control group is necessary when evaluating the effectiveness of any interventions aimed at lowering serial ED use.[9] Furthermore, since nearly one-third of our serial ED users the first year were also serial users in year three but not year two, follow-up studies should be conducted to determine if patients have resumed their serial ED use. In addition, since many of the serial patients in our study attended different EDs, interventions should be implemented on a community-wide basis and not at a single hospital. At the very least, interventions implemented at a single ED should collect data from other EDs in the area to help ensure that serial usage is tracked accurately.

The main strengths of our study are the availability of a statewide database and probabilistic linkage. The statewide ED database allowed us to follow a large number of patients over a wide geographic area, minimizing the loss to follow-up in our study. The use of probabilistic linkage also allowed us to group visits by individuals. We used a probability of 0.90 of being a correct match as a cutoff for choosing our matches. The selection of this cutoff point was determined prior to the study. A post analysis of the match probabilities suggests that either increasing or decreasing this cutoff point would not have had a significant impact on our study. In fact, the median probability that our matches are correct was 0.99999, with an interquartile range of 1.8×10^{-4}. In addition, 99% of all match probabilities were at least 0.95; therefore, lowering the match weight would have added relatively few new matches.

LIMITATIONS

The limitations of this study are primarily associated with the administrative nature of our database. Since the database is collected from hospitals only once a year, there is a lag time associated with our analysis. Thus, it is not possible to track and identify repeat or serial users at the time of their visits. Second, a measure of severity is not included in our database. While it is possible that visits for repeat and serial patients are less emergent or severe since they have lower average charges than visits of single-use patients, this cannot be confirmed with our data. Race and ethnicity are not captured in the database. Future analyses may find a relationship between these variables and ED use.

We were surprised that drugs and alcohol only accounted for 4% of all ED diagnoses. Perhaps there is

underreporting, since alcohol and drug use is often a secondary diagnosis and may not be listed on the patient's record. This bias could similarly impact the percentage of psychiatric visits we reported.

Another limitation is that we are unable to account for patients who moved out of state or died during the study period. Serial patients who leave the state may not actually cease their serial use but continue it elsewhere. We were unable to estimate the percentage of the population that moves out of state each year. Finally, in our state, patients who are treated in the ED and subsequently admitted to the same hospital are included in the hospital discharge database and are not included in our ED database. We have tried to minimize the impact of this administrative rule by restricting our analysis to patients who were treated at the ED and discharged to home under self-care. However, due to the absence of the admitted patients in the ED database, it is possible that we have incorrectly coded some repeat patients as single-use patients and some serial patients as repeat patients. Since we cannot estimate the rate at which single, repeat, or serial patients are admitted from the ED to the hospital, we do not know the impact of admissions on our analysis. Additionally, this has limited our analysis to approximately 84% of all ED visits during the study period. This may be the reason why our most frequent discharge diagnoses differ slightly from those published using the National Hospital Ambulatory Medical Care Survey (NHAMCS).[1] It is also important to point out that while NHAMCS reports primary diagnosis for each visit, our data are based on all diagnoses for each visit.

It is possible that the Health Insurance Portability and Accountability Act (HIPAA) guidelines may impact many types of analyses. Our databases are obtained under state law and are therefore not subject to HIPAA. Additionally, we have instituted several procedures to ensure the privacy of identifiable information. These include annually updated, detailed memoranda of understanding with the data owners, and gaining institutional review board approval for all proposed linkages. Additionally, once databases are linked, we create an analysis database that has the identifying information removed. Additional measures may be needed by organizations linking data for which the HIPAA guidelines apply.

When using probabilistic linkage, it is possible that some records fail to link records that should link if there are significant errors in the matching fields or if there are missing data in many of the fields used for the linking. When this occurs, record pairs with low match weights are produced, which are rejected as false matches. However, we believe that this was not the case in our study and linkage, because, as stated earlier, there were relatively few matches in the lower tail of our probability distribution.

CONCLUSIONS

In spite of these limitations, we have shown that by using probabilistic linkage to examine an ED statewide database, we can obtain a fairly complete and comprehensive picture of ED visits. We were able to assess the use patterns of repeat and serial ED patients on a statewide basis and show that patients who serially use the ED over a long period are likely to be seen at multiple EDs. Due to the high turnover in serial patients, control groups in future studies are necessary to evaluate interventions aimed at decreasing serial ED use. Furthermore, these studies should allow for more than a one-year follow-up period to determine whether patients have resumed their serial ED use.

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