City of Berkeley
Department of Health and Human Services
Public Health Division

Influenza-Related Emergency Room Visits, Berkeley, 2005-2007

Prepared by

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SUMMARY

Background

Why is this Topic Important?

Influenza is a respiratory viral illness that annually impacts between 5% and 20% of Americans, causing 36,000 deaths and 200,000 hospitalizations annually. Adults aged 65 years and older, children under 2 years of age, and persons with chronic medical conditions are at the greatest risk of serious illness and death. Vaccines can prevent or reduce the severity of influenza. Emergency room data first became available to the Berkeley Health Department from a state agency in 2005. Tracking emergency room visits for influenza is a useful surveillance tool in the event of an influenza pandemic.

Purpose of this Report

This report statistically describes who in Berkeley was treated in an emergency room (ER) for a diagnosis of influenza or pneumonia from 2005 to 2007. A diagnosis of influenza or pneumonia was considered potentially "influenza-related."

FINDINGS

- Each year about 200 Berkeley residents have an influenza-related emergency room visit.
- Females have higher rates of influenza-related ER visits than males.
- The rate of influenza-related ER visits is greatest in residents under 5 years of age and residents 65 years and older.
- Compared to other race/ethnicities, African Americans have the highest rates.
- Berkeley residents living in zip codes of South and West Berkeley (94702, 94703, 94710) have high rates compared to other zip codes.

These findings are consistent with previously documented patterns of health inequities in Berkeley and national data that show that African Americans and Latinos are less likely than other race/ethnic groups to get preventive interventions such as vaccinations. This in turn may be related to barriers to accessing health care: lack of health insurance, not having a regular medical home/primary care provider, linguistic isolation, cultural beliefs and practices, difficulties in transportation, or scheduling difficulties (after work shifts).

Recommendations/Follow-up

The following recommendations encompass the spectrum of primary to tertiary prevention and also aims to influence upstream determinants of health, which contribute to health inequities.

A. Improved Surveillance

1. Data on hospitalization and visits to emergency rooms represent only the most severe cases of influenza-related morbidity. The Public Health Division should continue discussions with Medi-Cal and Kaiser Permanente-North for sharing data on primary care visits in which influenza-related morbidity was diagnosed. These data will help more fully estimate the magnitude and distribution of the problem.

2. Surveillance should be extended to vaccine coverage. The same data sets for primary care mentioned above may include data to estimate vaccination coverage. These data can be used to identify population groups that may merit more intensive follow-up to achieve higher rates of vaccination and monitor the impact of interventions to improve vaccination coverage.

3. The Public Health Preparedness Program should consult with surrounding health jurisdictions to identify any best practices, especially those for identifying subgroups of vulnerable populations and for conducting real-time influenza surveillance.

4. Kaiser Permanente-North is already participating in a California Influenza Surveillance Project. The PHD should explore whether a subset of data on Berkeley residents might be available for reporting and statistical analyses.

5. The California Immunization Registry (CAIR) and the Bay Area Regional Registry (BARR) can provide flu vaccination rates for residents whose physicians are participating. The Public Health Division should continue its efforts to recruit providers to the registry.

B. Improved Vaccination Coverage

1. The Public Health Division should evaluate its strategies for providing seasonal flu vaccine. In October 2008, a mass dispensing exercise demonstrated the capability of vaccinating a large number of people of all ages in a few hours on a single day. In previous years, flu clinics involved several days of activities at numerous locations. The mass dispensing boosted the total annual number of vaccines dispensed by the Division to the highest level ever recorded in Berkeley (2,971). There is an opportunity to examine cost-benefit, impact, and resources to select and/or expand a given dispensing model.

2. The Public Health Preparedness Program and Immunization Program should consult with surrounding health jurisdictions to identify any best practices, especially those for identifying and reaching out to subgroups of vulnerable populations.

C. Improved Public Health Preparedness Infrastructure to respond to Pandemic Influenza

1. Continue training of Public Health Division staff in the use of the incident command system (ICS) to manage public health emergencies and the training of public health nurses in the natural history, diagnosis, treatment, and public health follow-up of specific communicable diseases with the potential to cause public health emergencies.

2. Continue developing automated tools (such as the rapid epidemiologic assessment) for rapid assessment of needs in a public health emergencies, and tools for case management public health nurses (Berkeley Outbreak Management System) involved in outbreak and contact investigations.

3. Continue to participate in local, regional, and statewide exercises to develop and test capabilities for emergency public health response.

D. Dissemination of this Report (and lay summary)

1. Share this report with Alta Bates Medical Center, local providers and community-based organizations such as Lifelong Medical Care clinics and UC Berkeley's Tang Student Health Center that play a role in improving vaccination coverage.

2. Share this report with local pharmacies that offer flu shots to 1) acknowledge their efforts (albeit for a fee) and 2) inform them of the large public health issues involved in preventing adverse effects of influenza.

3. Share a lay summary of this report with the Berkeley Unified School District, School-Linked Health Services, and child care providers, and emphasize CDC's new focus on childcare and school age children as important sources of community flu transmission.

4. Utilize a fuller array of City resources and avenues for communicating the importance of flu vaccination; make sure messages are distributed in other languages and in a manner that is culturally appropriate for all of Berkeley's diverse communities. Evaluate and address barriers to flu vaccination, including specific sub-populations or neighborhoods with low flu vaccination rates.

INTRODUCTION

Influenza is a respiratory viral illness that annually impacts between 5% and 20% of Americans, primarily during the months of September to May.[1] Although children have high rates of infection, adults aged 65 years and older, children under 2 years of age, and persons with chronic medical conditions are at the greatest risk of serious illness and death.[2] In the United States, influenza causes 36,000 deaths and 200,000 hospitalizations annually, and costs an estimated $10 billion of lost productivity per year.[3]

Pandemic influenza has received increased attention due to the current H1N1 ("swine") flu outbreak and the continuing spread of avian H5N1 influenza strain in Asia and Europe.[4] There are concerns that one of these viruses may eventually mutate and increase the chance of a severe pandemic. In the event of a pandemic, cases treated at local health care facilities such as emergency rooms (ERs) and hospitals will represent an important source of information for the early detection and surveillance of novel influenza infections, and for evaluation of the impact of countermeasures. Real-time surveillance similarly will enable us to track the course of the disease in our community and better manage anticipated waves of illness.

Since 2005, the Office of Statewide Health Planning & Development (OSHPD) has required all short stay civilian hospitals in California to report information on specific emergency department visits. In 2004, local health departments received authority (AB2876) to access individually identifiable patient records from OSHPD, thus expanding the possibilities to conduct epidemiologic surveillance of hospital- and emergency room-based conditions. This is especially important for distinguishing individual patients who may have multiple visits or admissions during the course of a year. The City of Berkeley Public Health Division requested and received an electronic dataset[5] from OSHPD that included all emergency department visits between 2005 and 2007 for patients with Berkeley ZIP codes (94702-94710).

The purpose of this report is to document the number and rate of influenza-related emergency room visits among Berkeley residents between 2005 and 2007. This information will be used as pre-pandemic baseline data for influenza surveillance. In addition, demographic characteristics (age, sex, ethnicity, zip code, payer, and hospital) were analyzed to examine health inequities and to identify high-risk groups.

METHODS

Data Sources

Emergency Department Visits

Computerized data files provided by OSHPD included a personal identifier of patients (encrypted Social Security Number, SSN), age at the ER visit, gender, race/ethnicity, residential ZIP code, primary and up to 24 secondary diagnoses (coded to the International Classification of Diseases, 9th revision, ICD-9CM), expected source of payment, and identifiers of the hospital. In the electronic data files, each row was a distinct visit.

Population

Berkeley population denominators used in rates were estimated by linear extrapolation (2005-2007) from the 1990 and 2000 censuses of the U.S. Bureau of Census.[6] Census data were

aggregated into cells of age (6 categories: 0-4 years, 5-14, 15-24, 25-44, 45-64, 65+), sex, race/ethnicity (5 categories: African American, Asian/PI, Latino, White, and Other), and 5-digit zip code (94702-94710).

Definitions

Influenza-Related Diagnoses

Based on the first three digits of the ICD-9 code, ER visits with a diagnosis of influenza (ICD, 487) or pneumonia (480-486) were considered influenza-related.[3] Narrow and broad case definitions were based on whether any of these ICD-9 codes appeared as the 1) primary diagnosis, or as 2) the primary or any of the up to 24 listed secondary diagnoses ("any-listed") for each visit.[3]

Influenza Strain Identified Cases

Based on national estimates, laboratory confirmation of specific strains of influenza virus was reported for 8.6% of primary and 8.0% of any-listed influenza-related hospitalizations.[3] We applied these percentages to the crude number of emergency room visits based on primary and any-listed diagnosis.

Person

The encrypted SSN was basis for defining a unique person. For approximately 20% of ER visits without a SSN, a person identifier was constructed from the estimated year of birth (year of admission – age at ER visit), sex, race/ethnicity, and zip code.

Rates

Rates for ER visits were defined as the number of ER visits divided by the population counts and expressed on a basis of 100,000 residents. Rates of persons with an ER visit used the annual number of de-duplicated persons using the unique SSN or person identifier.

Geographic Analysis

Residential zip code was available for geospatial analysis.

Statistical Analysis

The number and the crude rate of influenza-related ER visits were calculated for population subgroups by age, sex, race/ethnicity and zip code using STATA, Version 10 (Stata Corp, College Station, TX). Confidence intervals (95%) of rates were calculated using the exact Poisson distribution. Non-overlapping confidence intervals ($p < 0.05$) were used to assess the statistical significance of the differences in the rates. Age-adjusted rates (Berkeley population 2005 to 2007) in analyses of sex, race/ethnicity, and zip code were nearly the same as crude rates. To streamline the presentation, only crude rates are presented. ArcGIS 9.3 was used to visualize rates by zip code.

RESULTS

Based on the primary diagnosis alone, from 2005 to 2007, an annual average of 192 persons had 205 influenza-related ER visits (Table 1, Figure 1). Based on any-listed influenza-related diagnosis, an average of 239 persons had 261 visits. Between 2005 and 2007, there were no significant time trends for either primary or any-listed ER visit rates (annual average of 159 per and 202 per 100,000, respectively). From 18 to 21 laboratory-confirmed ER visits were estimated to occur annually (Table 1, Figure 2). On average, 6% to 7% of persons had multiple ER visits for influenza-related diagnoses in the same year (Table 2, Figure 3).

ER visit rates had a J-shape age distribution with peaks at age extremes of 0-4 and 65+ years (Table 3, Figure 4). Compared to other race/ethnicities, African Americans had significantly higher rates. Zip codes in south and west Berkeley (94702, 94703, and 94710) had significantly higher rates than zip codes in central and north Berkeley (94704-94708) [Figure 5]. Women had higher rates than men, although this difference was not statistically significant ($p > 0.05$).

Medi-Cal was the expected source of payment in approximately 25% of ER visits and uninsured (self-pay) comprised approximately 10%. ER visits were seasonally distributed with a peak in January and February and trough in August (Table 4, Figure 6). Approximately 50% of ER visits occurred at Alta Bates Medical Center (Berkeley campus) and 20% occurred at Children's Hospital, Oakland (Table 5 and Figure 7).

DISCUSSION

This report describes the first-time analysis of individually identifiable data on emergency room visits for any health outcome in the City of Berkeley. From 2005 to 2007, the approximately 200 annual influenza-related ER visits clustered in the winter months and disproportionately impacted the very young, seniors, African Americans, and residents of south and west Berkeley. These findings are consistent with national data[7] and previously documented patterns of health inequities in Berkeley.[8]

The City of Berkeley participates in a CDC-sponsored national surveillance program for weekly mortality surveillance, including influenza mortality.[9] Based on these reports, there were 36 influenza-related deaths (all coded as pneumonia) of Berkeley residents in 2006. Using OSHPD hospitalization data for Berkeley residents and the same ICD-9 codes for primary diagnoses as those used in this study, there were 241 influenza-related hospitalizations in 2006. Many of these hospitalizations presumably were admitted through the emergency department. However, that there were more hospitalizations than ER visits in 2006 suggests that there is a subset of severe cases that are directly admitted to a hospital without being evaluated in the emergency department.

Vaccination is the primary prevention strategy to minimize seasonal influenza morbidity and mortality.[10] National data indicate that there are significant disparities in vaccination rates by race/ethnicity. In adults aged 50 years and older, African Americans and Latinos were less likely than Whites to have received an annual flu shot.[7] Barriers to flu shots include periodic shortages of vaccine, lack of health insurance, not having a regular medical home/primary care provider, linguistic isolation, cultural beliefs and practices, difficulties in transportation, or scheduling difficulties (after work shifts).

The Public Health Division has recognized many of these barriers and has offered free flu shots at Berkeley's senior centers, the Public Health Clinic (830 University Ave.), and other Berkeley locations since the 1980s. UC Berkeley's Tang Student Health Clinic also offers annual flu vaccinations, which primarily focus on the campus community but are open to the public for a fee.

In October 2008, the Public Health Division organized its seasonal influenza vaccination clinic ("iPOD: Immunization Point of Dispensing") as a rapid, mass dispensing exercise to enhance pandemic influenza/public health preparedness planning.[11] A single site (Berkeley Adult School) was chosen in west Berkeley, explicitly to provide improved geographic access to local populations with documented health inequities. In tandem, an outreach campaign was targeted to south and west Berkeley residents. Efforts to overcome barriers to flu vaccination included Spanish-language outreach and on-site Spanish-speaking staff; free vaccine; and late afternoon/early evening schedule to accommodate varying work and childcare schedules. On October 28, 2008, over 1373 individuals received flu vaccine as an injectable or nasally-administered dose in approximately 4 hours (3PM to 7 PM). Of the 881 Berkeley vaccine recipients with known Berkeley zip codes, 45% resided in south and west Berkeley areas (94702, 94703, 94710).

In 2008, the iPOD mass dispensing boosted the total annual number of vaccines dispensed by the PHD to the highest level ever recorded in Berkeley (Figure 8). This was the largest one-year increase (67%) in communitywide vaccine dispensing by the City of Berkeley. The increase was not merely a shift in time and location of the "usual" participants, but represents expanded population coverage.

Limitations

We have identified variations in the rates of influenza-related ER visits within the City of Berkeley, but have not provided comparative data for the region (Alameda County), the State of California, or the United States. To our knowledge, neither OSHPD nor county or state health authorities publish influenza-related ER visit rates – at all or using incompatible case definitions. We did not have the resources to acquire or analyze OSHPD data for Alameda County or the entire state in the time frame of this study, but may do so when resources permit. We were also not able to analyze Medi-Cal-specific ER visit rates. This requires detailed enrollment and beneficiary (denominator) data that, although requested, was not available from Medi-Cal's statistical division. A project sponsored by California Emergency Physicians monitors influenza-like illnesses from 58 California emergency departments based on illness codes in electronic billing data; however, these data are proprietary, and are only published for large regions (e.g., northern California), rather than small areas (e.g. Berkeley).

Our definition of influenza-related ER visits was adapted from a hospital-based study[3], and does not include a broader range of circulatory and respiratory disease diagnoses (ICDs 390 – 519) that some researchers considered influenza-related.

It is recognized that many influenza cases are diagnosed and treated in primary care settings and do not reach a severity threshold of an ER visit or hospitalization. The California Department of Public Health does employ a network of 200 sentinel physicians to report cases that meet a clinical case definition of influenza like illness.[12] These data provide a statewide picture, but do not lend themselves to local estimates. The Public Health Division is exploring the feasibility of using primary care encounter data of local health providers to fill in this data gap. Combined with managed care enrollment data, primary care data (e.g., Medi-Cal, Kaiser)

may also help better interpret the findings regarding the interplay between flu vaccination in primary care settings and subsequent ER use. At least one study has suggested that universal vaccination decreased subsequent ER use as well as hospitalizations and physician office visits.[13]

The California Department of Public Health has several influenza-related surveillance projects,[12] none of which links laboratory-confirmed ER cases to OSHPD data. Consequently we used a national estimate based on hospitalized cases to estimate the number of ER visits with laboratory-confirmed influenza strains.[14] The Center for Emerging Infections (CEI), a joint project of Bay Area health jurisdictions (including the Berkeley), state and federal health and agriculture agencies, and Kaiser Permanente-North, has conducted active, laboratory-based surveillance for all laboratory confirmed influenza cases hospitalized in a three-county catchment area since 2003.[15] The 2007-8 flu season was the first year that included all age groups (pediatric and adults) and all hospitals in the catchment area. CEI reported 11 hospitalized cases with laboratory confirmation for Berkeley residents in the 2007-8 flu season. When these data become more robust, it may be possible to provide Berkeley-specific estimates of laboratory-confirmed cases.

Other innovative approaches to influenza surveillance have been recently proposed, including the use of key words reflecting influenza symptoms or illness in Internet search engine queries.[16, 17] We were not able to examine how this might be used in a local setting.

Although we did not present the results of age-adjustment, only in the analysis of race/ethnicity did we find some confounding masking an even greater health disparity in African Americans (age-adjusted rate was 555 per 100,000 vs. crude rate of 380 per 100,000).

RECOMMENDATIONS/FOLLOW-UP

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Jose Ducos, Berkeley Vital Statistics, provided data on influenza-related mortality as part of the City of Berkeley's participation in CDC's 122 Cities surveillance program. Janet Cusick (Immunization Coordinator), Kathy Dervin and Tanya Bustamante (Public Health Preparedness Program), and Jose Ducos made many helpful comments and recommendations in their review of this report.

REFERENCES

1. Centers for Disease Control and Prevention. Key Factors About Influenza and Influenza Vaccine. Updated: August 30, 2006. Atlanta, GA: Centers for Disease Control and Prevention; 2006 (http://www.cdc.gov/flu/keyfacts.htm).

2. Centers for Disease Control and Prevention. Prevention and Control of Influenza Recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 2006;55(1-41).

3. Thompson WW, Shay DK, Weintraub E, Brammer L, Bridges CB, Cox NJ, et al. Influenza-Associated Hospitalizations in the United States JAMA 2004;292:1333-1340.

4. Homeland Security Council. National Strategy for Pandemic Influenza; 2005 (www.whitehouse.gov/homeland/pandemic-influenza.html, accessed 8/7/2008).

5. Office of Statewide Health Planning & Development. Patient Discharge Data File Documentation, January-December 2006 Sacramento: Office of Statewide Health Planning & Development; 2007 (www.oshpd.ca.gov/HID/Products/ PatDischargeData/PublicDataSet/Doc/PD06docwapp.pdf).

6. U.S. Bureau of Census. Summary Files 1-4. Detailed Tables (http://factfinder.census.gov/servlet/DatasetMainPageServlet?_program=DEC&_submenuId=datasets_1&_lang=en). Washington, DC: U.S. Bureau of Census; 2000.

7. Centers for Disease Control and Prevention. Public health and aging: influenza vaccination coverage among adults aged ≥50 years and pneumococcal vaccination coverage among adults aged ≥65 years – United States, 2002. MMWR 2003;52:987-992.

8. Breckwich-Vazquez V, Maizlish N, Ducos J, Rudolph L. City of Berkeley, Health Status Report, 2007. Berkeley: Public Health Division, Department of Health & Human Services, City of Berkeley; 2007.

9. Centers for Disease Control and Prevention. TABLE III. Deaths in 122 U.S. cities. Atlanta, GA: Centers for Disease Control and Prevention; 2009 (http://www.cdc.gov/mmwr).

10. Centers for Disease Control and Prevention. Questions & Answers: Flu Shot. Updated: July 24, 2006. Atlanta, GA: Centers for Disease Control and Prevention; 2006 (http://www.cdc.gov/flu/about/qa/flushot.htm, accessed 7/25/2007).

11. Public Health Division. After-Action Report of iPOD (Immunization Point of Dispensing), October 28, 2008. Berkeley: City of Berkeley; 2009.

12. Viral and Rickettsial Disease Laboratory Branch. The California Influenza Surveillance Project. 2007-2008 Influenza Season Summary. Sacramento: California Department of Public Health (www.cdph.ca.gov/PROGRAMS/VRDL/Pages/CaliforniaInfluenzaSurveillanceProject.aspx, accessed, 1/8/09); 2008.

13. Kwong JC, TA S, Lim J, et al. The effect of universal influenza immunization on mortality and health care use. PLoS Medicine 2008;28:1440-1451.

14. California Emergency Physicians. California Flu Watch. Emeryville, CA: CEP America/MedAmerica; 2008 (www.cep.com/fluWatch/CA_flu_watch_region_select.asp, accessed 1/8/09).

15. Center for Emerging Infections. Influenza Hospitalization Surveillance. Oakland, CA: Center for Emerging Infections; 2008 (www.ceip.us/influenza.htm, accessed 1/28/09).

16. Ginsberg J, Mohebbi MH, Patel RS, Brammer L, Smolinski MS, Brilliant L. Detecting influenza epidemics using search engine query data. Nature 2008 (letter published online 19 November 2008).

17. Google.Org. Flu Trends; 2008 (www.google.org/flutrends/, accessed 1/8/09).

Table 1. Rate of Influenza-Related* Emergency Department Visits, 2005-2007

	Primary Diagnosis						Any-Listed					
	Persons[#]			ER Visits			Persons[#]			ER Visits		
Item	N	Rate[†]	95% CI[‡]	N	Rate[†]	95% CI	N	Rate[†]	95% CI	N	Rate[†]	95% CI
2005	187	145	125 – 166	202	157	135 – 179	234	182	159 – 205	272	212	186 – 237
2006	194	150	129 – 172	203	157	136 – 179	241	187	163 – 210	254	197	173 – 221
2007	196	151	130 – 172	210	162	140 – 184	242	187	163 – 210	257	198	174 – 222
Total	577	149	137 – 161	615	159	146 – 171	717	185	172 – 199	783	202	188 – 216
Influenza strain identified[§]	17	13	7 – 16	18	14	7 – 20	19	16	9 – 23	21	17	10 – 25

* ICD-9-CM: Pneumonia (480-486), influenza (487)
# Persons with ≥1 ER visits
† Rate per 100,000
‡ CI, Confidence interval
§ Based on a national estimate[3]

Table 2. Distribution of Persons by the Number of Influenza-Related* Emergency Department Visits, Berkeley, 2005-2007

	Primary Diagnosis								Any-Listed							
Number of	2005		2006		2007		2005-7		2005		2006		2007		2005-7	
ER Visits	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	174	93	–		186	95	545	94	214	91	228	95	221	91	663	93
2+	13	7	–		10	6	32	6	20	9	13	5	21	9	54	7

* ICD-9-CM: Pneumonia (480-486), influenza (487)
– not available

Table 3. Influenza-Related* Emergency Room Average Annual Age-Adjusted Rates† of Visits by Demographic Characteristics, Berkeley, 2005-2007

	Primary Diagnosis				Any-Listed			
Item	N	%	Rate†	95% CI	N	%	Rate	95% CI
Total	615	100	159	146 – 171	783	100	202	188 – 216
Age								
0-4	77	13	496	385 – 606	127	16	815	674 – 957
5-14	47	8	137	98 – 176	66	8	1512	1176 – 1877
15-24	60	10	75	56 – 94	78	10	98	76 – 119
25-44	132	23	117	97 – 137	163	21	144	122 – 167
45-64	143	25	138	116 – 161	183	23	177	151 – 203
65+	118	20	287	235 – 338	166	21	403	342 – 464
Mean (SD)								
Sex, N (%)								
Female	330	54	165	147 – 183	405	52	203	183 – 223
Male	284	46	152	134 – 169	377	48	201	181 – 221
Ethnicity, N (%)								
African American	148	25	380	319 – 441	199	27	510	439 – 581
Asian/PI	82	14	117	91 – 142	100	14	142	114 – 170
Latino	53	9	159	116 – 202	68	9	97	74 – 120
White	243	42	244	181 – 307	298	40	321	248 – 394
Other Race	57	10	110	96 – 124	75	10	135	119 – 150
ZIP code, N (%)								
94702	132	22	275	228 – 322	167	22	348	295 – 401
94703	123	20	199	163 – 234	158	21	255	215 – 295
94704	62	10	104	78 – 130	81	11	136	106 – 165
94705	57	9	149	111 – 188	70	9	183	140 – 226
94706	64	11	141	106 – 175	81	11	178	139 – 217
94707	33	5	82	54 – 110	45	6	112	79 – 144
94708	28	5	78	49 – 107	42	5	117	82 – 153
94709	42	7	136	95 – 178	47	6	152	109 – 196
94710	63	10	236	178 – 294	79	10	295	230 – 361

* ICD-9-CM: Pneumonia (480-486), influenza (487)
† Rate per 100,000

Table 4. Characteristics of Influenza-Related* Emergency Room Visits, Berkeley, All Ages, 2005-2007

	Primary Diagnosis		Any-Listed	
Item	N	%	N	%
Total	615	100	783	100
Payer				
Medicare	125	20	160	20
Medi-Cal	154	25	205	26
Private Ins., incl. Pre-paid	235	38	296	38
Self-Pay	62	10	72	9
Other	39	7	50	7
Month of Year				
Jan.	97	16	121	15
Feb.	77	13	96	12
March	66	11	87	11
April	60	10	71	9
May	33	5	43	5
June	35	6	44	6
July	44	7	47	6
August	20	3	26	3
September	27	4	35	4
Oct.	31	5	43	5
Nov.	55	9	75	10
Dec.	70	11	95	12

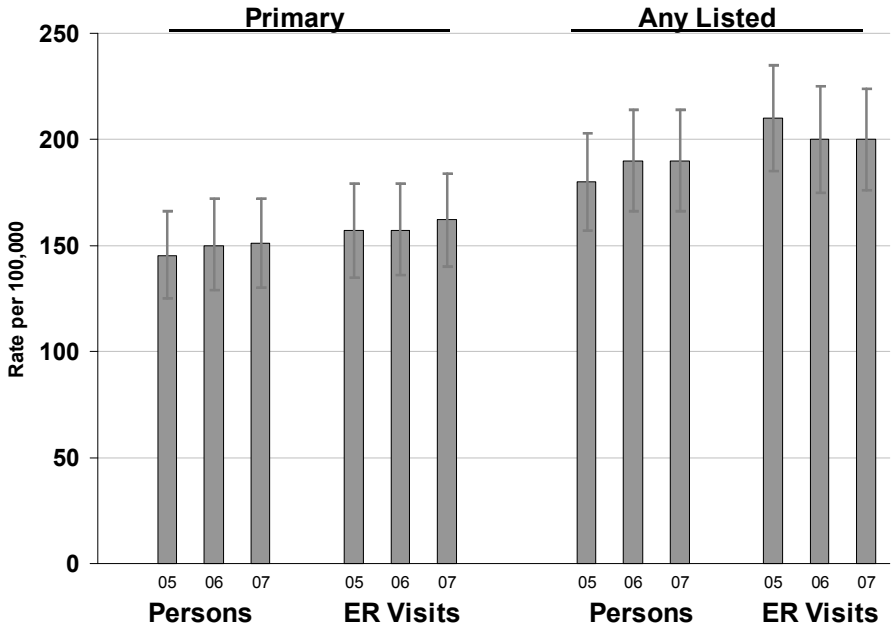
* ICD-9-CM: Pneumonia (480-486), influenza (487)

Table 5. Characteristics of Influenza-Related* Emergency Room Visits, Berkeley, All Ages, 2005-2007

	Primary Diagnosis		Any-Listed	
Item	N	%	N	%
Total	615	100	783	100
Hospital				
Alta Bates Medical Center	310	50	363	46
Children's Hospital	117	19	164	21
Kaiser-Oakland	31	5	42	5
Alameda Co. Medical Center	60	10	81	10
Summit Medical Center	26	4	36	5
All Others	71	12	97	12
Residents of Zip Codes:				
94702				
Alta Bates Medical Center	69	52	70	44
Children's Hospital	25	19	39	25
Alameda Co. Medical Center	14	11	20	13
All Others	24	18	29	19
94703				
Alta Bates Medical Center	55	45	47	58
Children's Hospital	30	24	<10	<10
Alameda Co. Medical Center	18	15	<10	<10
All Others	20	17	19	24
94710				
Alta Bates Medical Center	20	32	23	29
Children's Hospital	25	40	32	41
All Others	18	29	24	30

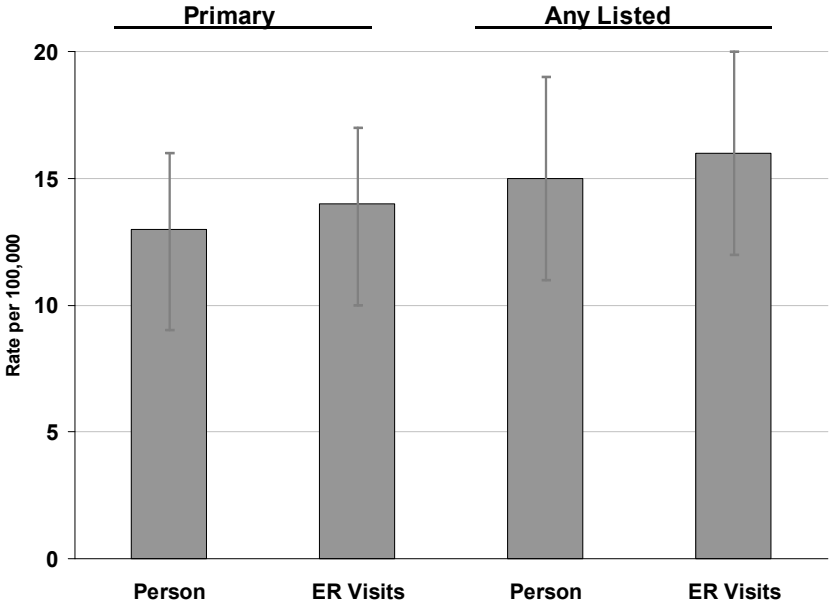
* ICD-9-CM: Pneumonia (480-486), influenza (487)

Figure 1. Rate and 95% Confidence Interval of Unique Persons and Emergency Room Visits for Influenza-Related Morbidity, Primary or Any-Listed Diagnosis (ICD9 480-487), Berkeley, 2005-2007



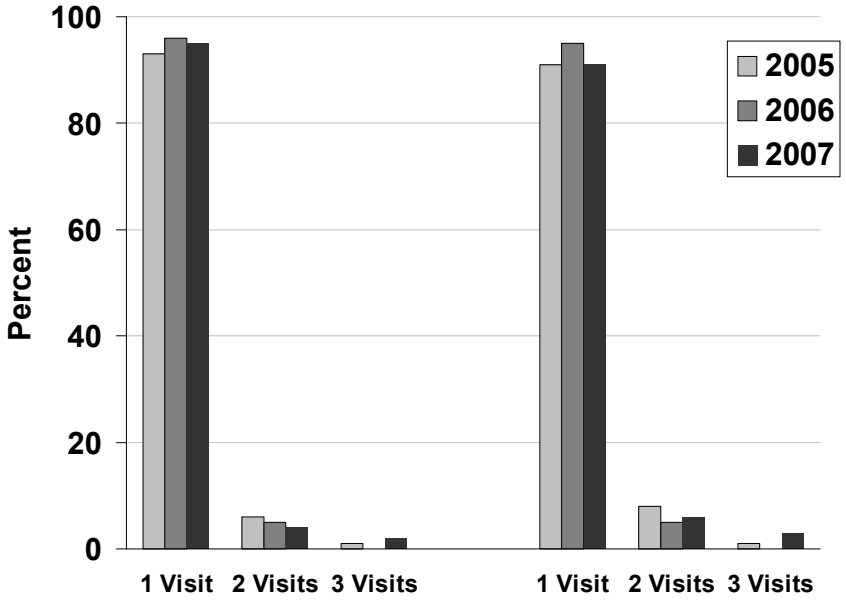
Source: Office of Statewide Health Planning and Development, U.S.Census, 1990, 2000

Figure 2. Isolate-Confirmed Estimated Rate of Unique Persons and Emergency Room Visits for Influenza-Related Morbidity, Primary or Any-Listed Diagnosis (ICD9 480-487) Berkeley, 2005-2007



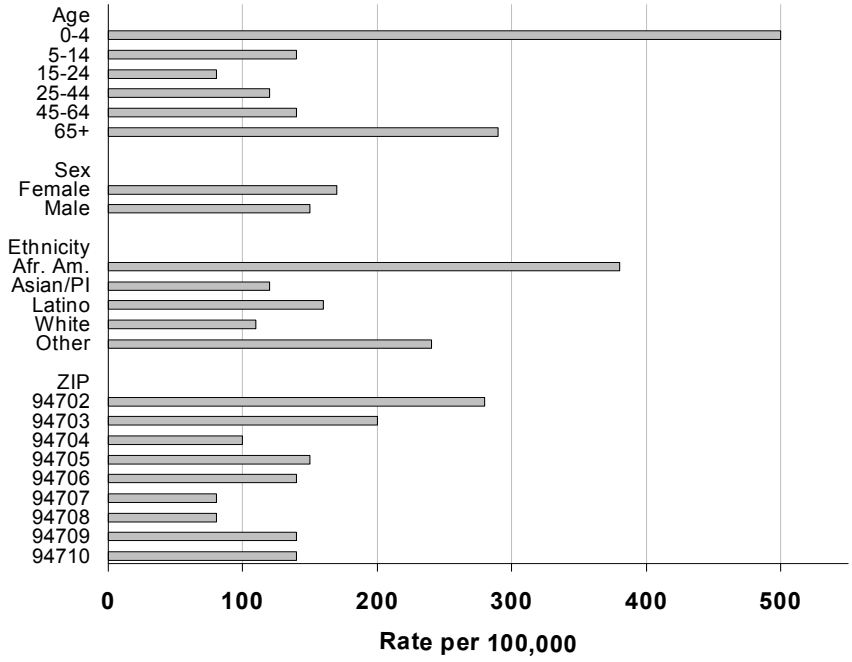
Source: Office of Statewide Health Planning and Development, U.S.Census, 1990, 2000

Figure 3. Distribution of Persons by Percent of Emergency Room Visits, 2005-2007



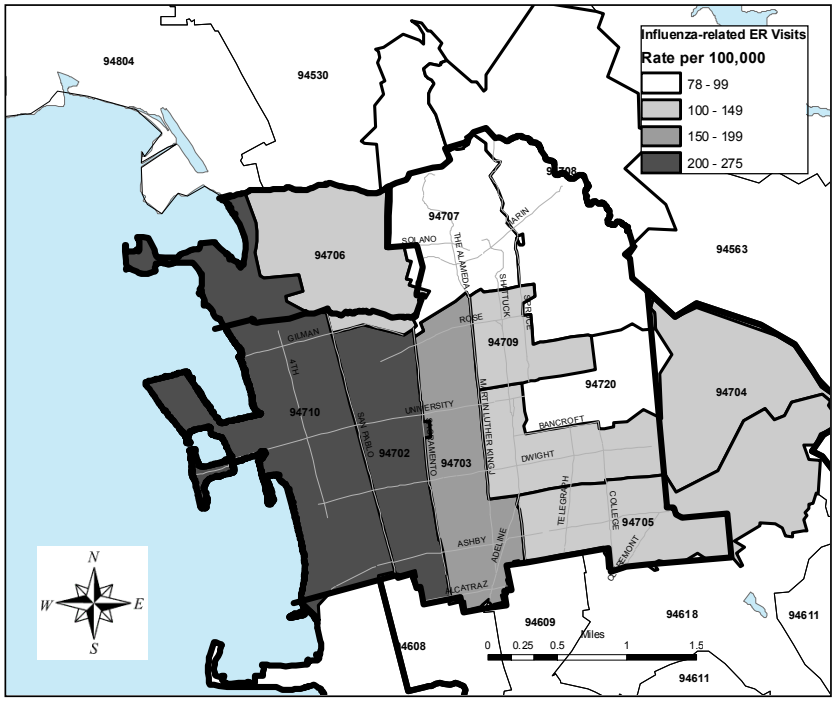
Source: Office of Statewide Health Planning and Development, U.S.Census, 1990, 2000

Figure 4. Emergency Room Visit Rates by Demographic Characteristics, Berkeley, 2005 - 2007



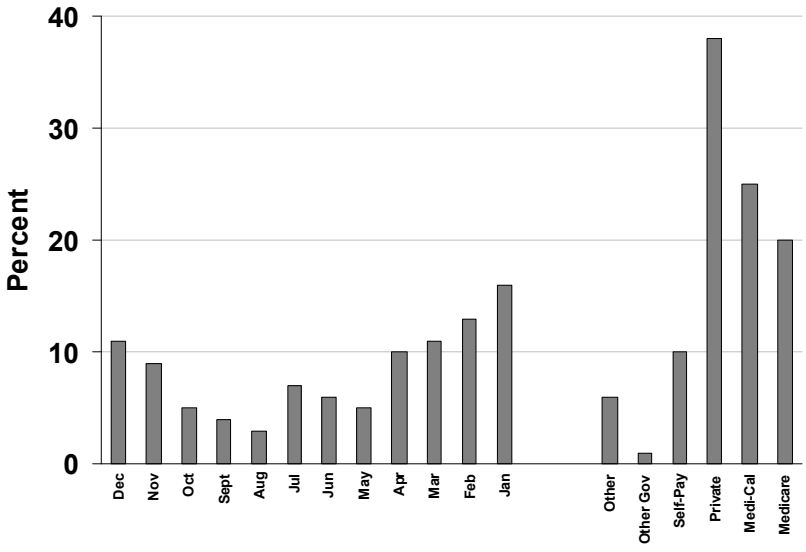
Source: Office of Statewide Health Planning and Development, U.S.Census, 1990, 2000

Figure 5. Average Annual Rate of Influenza-related ER Visits by Zip Code, Berkeley, 2005-2007



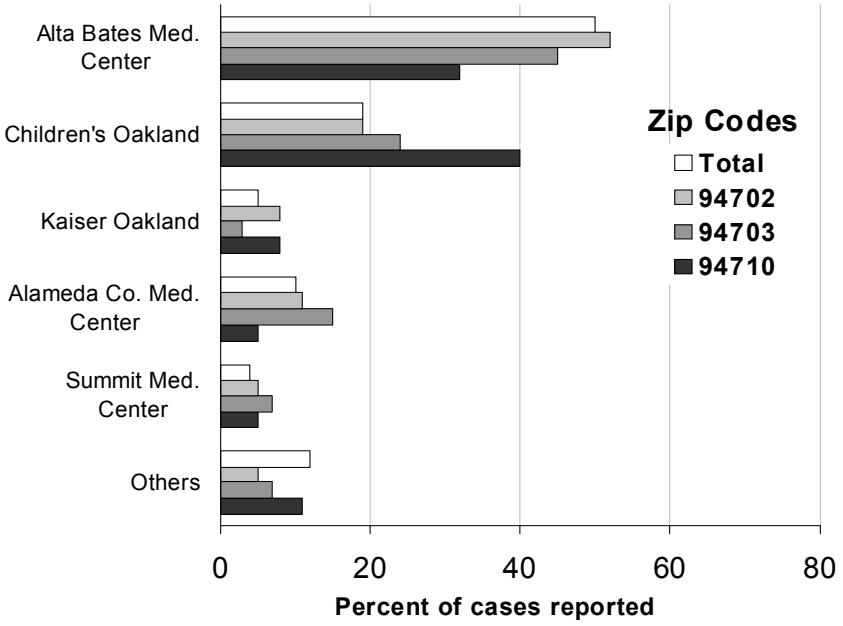
Source: Office of Statewide Health Planning and Development, U.S.Census, 1990, 2000

Figure 6. Percent of Emergency Room Visits by Months and Payer for Primary Diagnosis, Berkeley, 2005-2007



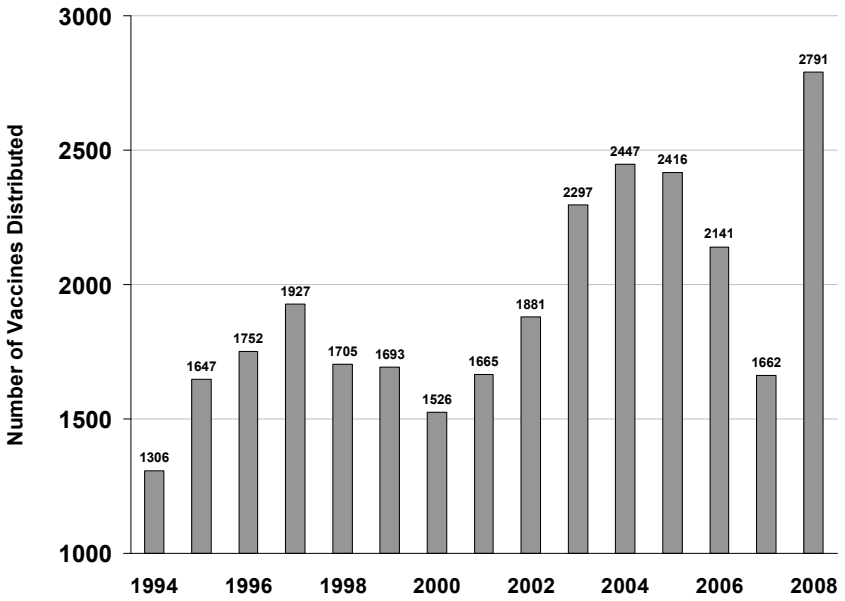
Source: Office of Statewide Health Planning and Development, U.S.Census, 1990, 2000

Figure 7. Distribution of ER Visits by Hospital Emergency Room and Selected Zip Codes, Berkeley, 2005-2007



Source: Office of Statewide Health Planning and Development, U.S.Census, 1990, 2000

Figure 8. Communitywide Distribution of Influenza Vaccine by the Public Health Division, Berkeley, 1994-2008



Source: Immunization Program, Berkeley Public Health Division