



Syndromic Surveillance Using Chief Complaints from Urgent Care Facilities during the Salt Lake 2002 Olympic and Paralympic Winter Games

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BACKGROUND

- Bioterrorism awareness: Olympic/Paralympic Games follows recent 09/11 terrorist attacks and Postal Service anthrax mailings
- Significant international travel by Olympics participants and media: potential for naturally occurring outbreaks from non-native organisms
- Live television coverage worldwide: opportunity for both organizers and terrorists to gain publicity/notoriety
- Chemical agents not monitored: the “CNN factor”
- Focus on biological agents and epidemiology
- Biological exposure at large confined indoor venues and winter-weather mitigants (including injury) at outdoor venues a concern
- Syndrome mapping mandated by International Olympic Committee health data systems
- Concurrent on-site monitoring of all hospital Emergency Departments within service areas of Olympic/Paralympic venues
- IHC the only urgent care provider with capacity (infrastructure, coverage area) or willingness to provide and analyze data
- Collaboration with University of Pittsburgh RODS Laboratory on logistics and data streaming

OBJECTIVES

- Develop urgent care syndromic surveillance system to complement hospital emergency department surveillance
- Minimize on-site intrusion at urgent care facilities by health department personnel and additional urgent care staffing to accommodate their possible presence
- Use existing data sources; no more forms to fill out
- Protect confidential patient medical information appropriately
- Identify individual patient encounters as required by statutory health department authority
- Provide timely analysis and reporting for identifying trends and sentinel events
- Correlate with subsequent billing data for validation and future system development

Table 1. Syndromic Categories

Flag	Syndrome	Example Signs and Symptoms (keyword basis)	Sample Keywords
1	Respiratory infection with fever	cough shortness of breath, difficulty breathing congestion bronchitis, bronchiolitis, pneumonia, pneumonitis chest pain (not trauma or cardiac) chest tightness Note: initial absence of strep and RSV not tracked (hospital ED-based)	COUGH, CGH SOB PNEUMON CHEST-PAIN, CP STREP, RSV
2	Bloody diarrhea	diarrhea not tracked (hospital ED-based)	DIAR
3	Gastroenteritis (includes diarrhea with and without blood)	vomiting combinations (e.g., "N/V/D") rash (not diaper rash)	VOM, THROW+UP N/V/D, N&V RASH
4	Rash illness (febrile illness with rash)	spots on arms or abdomen measles, rubella, fifth's disease, chicken pox, varicella dermatitis, exanthem pustules or vesicles	POX
5	CNS Syndrome (meningitis/encephalitis or unexplained acute encephalopathy/delirium)	headache with fever confusion delirium disorientation	HEADACHE+FEVER
6	Suspected viral hepatitis (acute)	jaundice, yellow skin/looks yellow hepatitis icterus	JAUNDICE HEPATI
7	Sexually Transmitted Diseases	not tracked (NPC)	
8	Sepsis or unexplained shock	not tracked (hospital ED-based)	
9	Unexplained death with history of fever	not tracked (hospital ED-based)	
10	Botulism-like syndrome (cranial nerve impairment and weakness)	double vision (diplopia), blurred vision difficulty swallowing or speaking paralysis weakness (not with cough or fever)	VISION DIFF+SWAL
11	Lymphadenitis with fever	adenopathy, lymphadenopathy swollen glands or nodes	SWOLL+GLAND
F	Fever	fever, chills, temp (tracked as a comorbidity)	FEVER, FVR

Figure 1. Process Flow Diagram

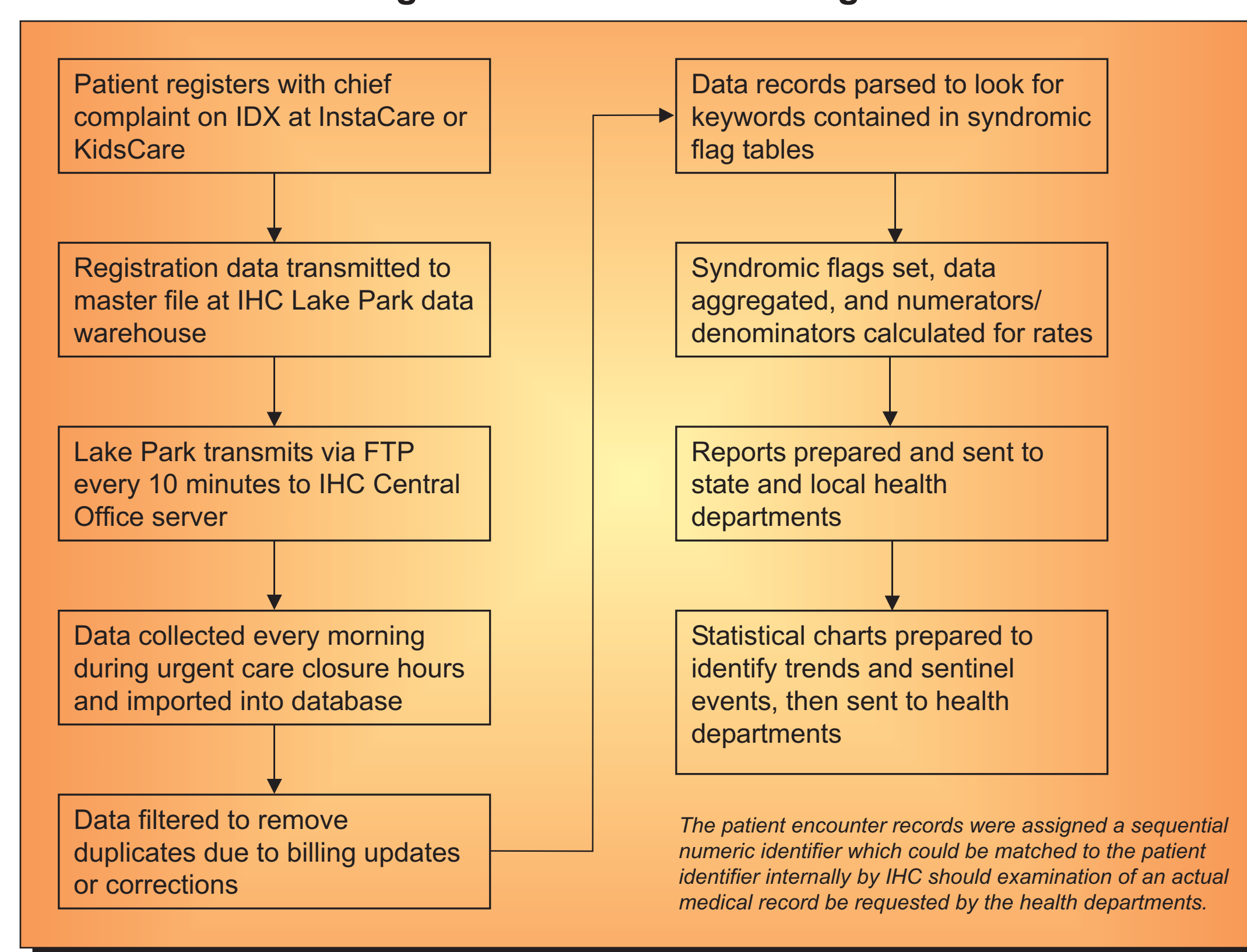


Figure 2. Control Charts Showing the Proportion of Visits with Respiratory or Gastrointestinal Syndrome

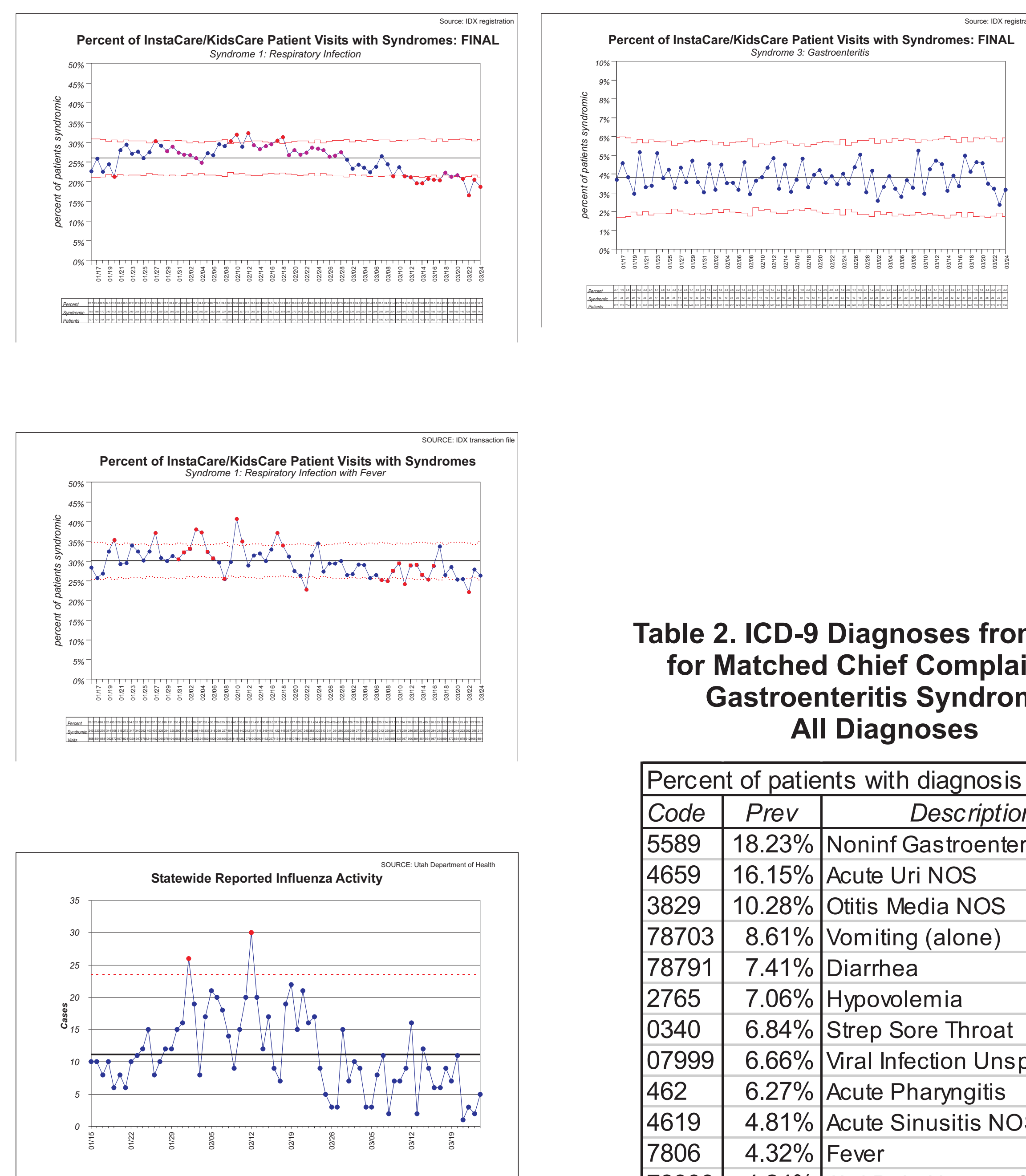


Table 2. ICD-9 Diagnoses from Billing for Matched Chief Complaints in Gastroenteritis Syndrome: All Diagnoses

Code	Prev	Description
5589	18.23%	Noninf Gastroenterit NEC
4659	16.15%	Acute Uri NOS
3829	10.28%	Otitis Media NOS
78703	8.61%	Vomiting (alone)
78791	7.41%	Diarrhea
2765	7.06%	Hypovolemia
0340	6.84%	Strep Sore Throat
07999	6.66%	Viral Infection Unspec
462	6.27%	Acute Pharyngitis
4619	4.81%	Acute Sinusitis NOS
7806	4.32%	Fever
78900	4.24%	Abd Pain Unspec Site
38200	4.06%	Ac Supp Otitis Media NOS
4871	3.75%	Flu W Resp Manifest NEC
4660	2.65%	Acute Bronchitis
490	2.65%	Bronchitis NOS
486	2.43%	Pneumonia, Organism NOS
7862	2.43%	Cough
78701	1.90%	Nausea and Vomiting

Figure 3. The Delphi Process for Creating the ICD-9 “Gold Standard”.

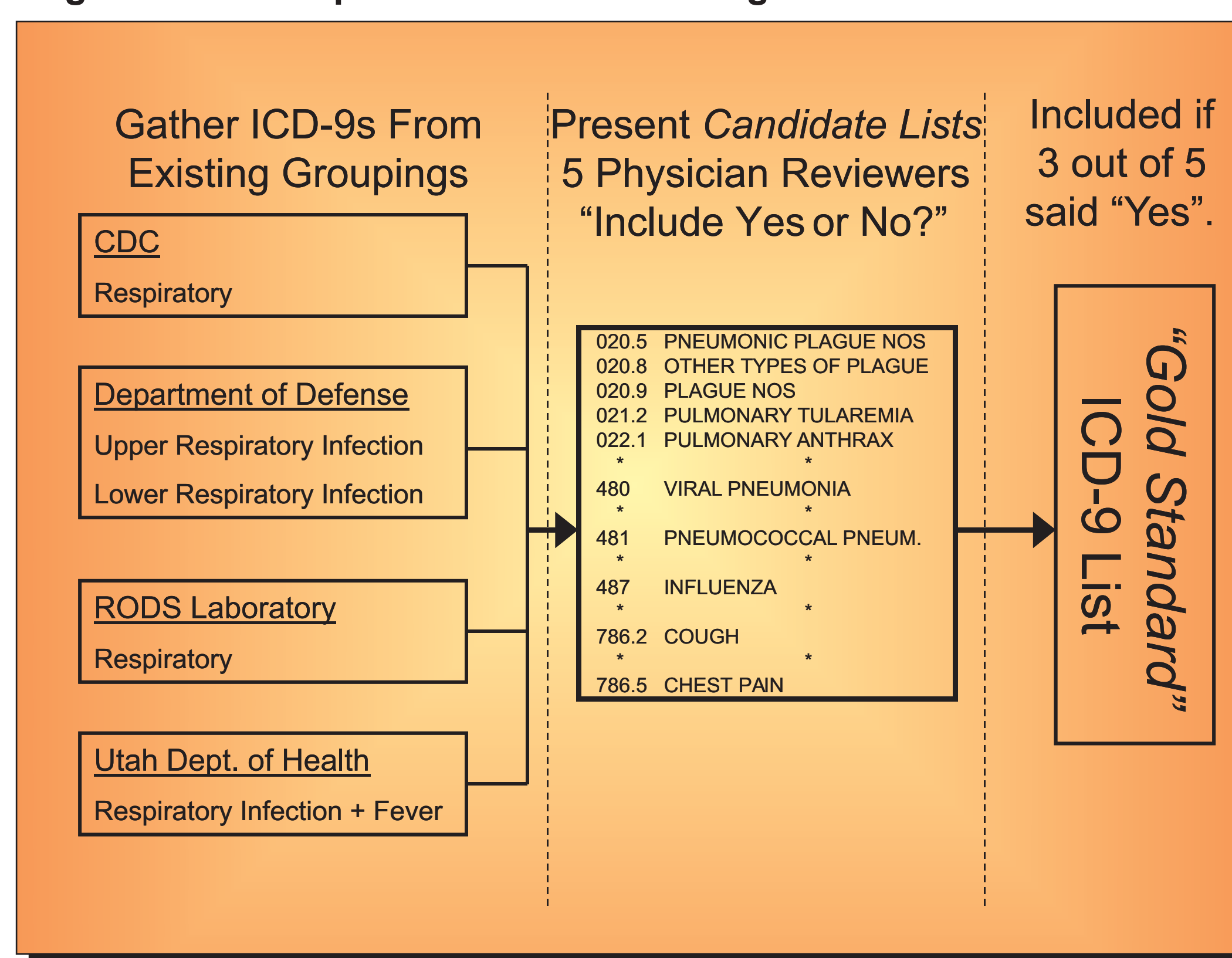


Figure 4. Matching Registration Records to ICD-9 Coded Discharge Diagnoses in the IDX Billing Records.

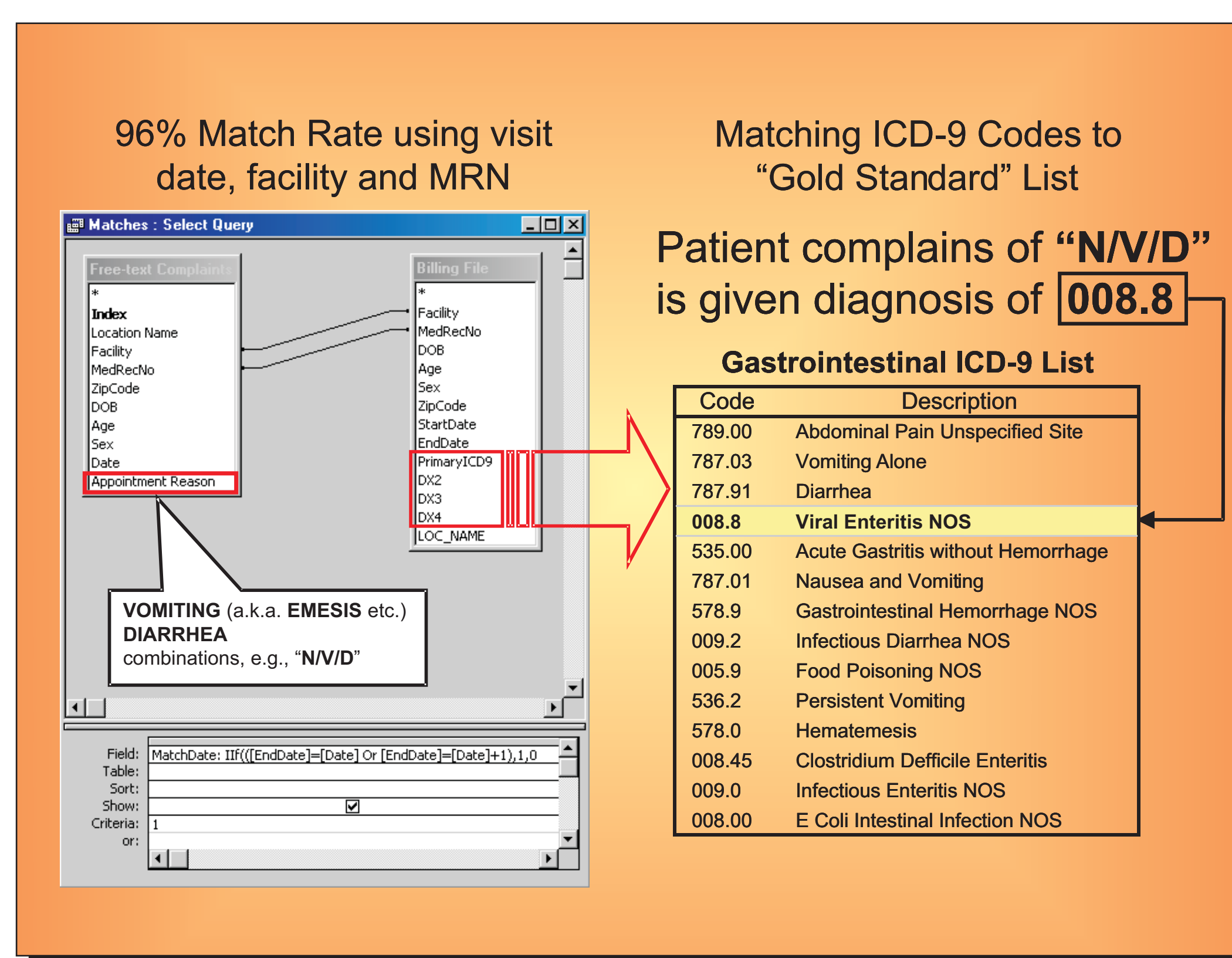
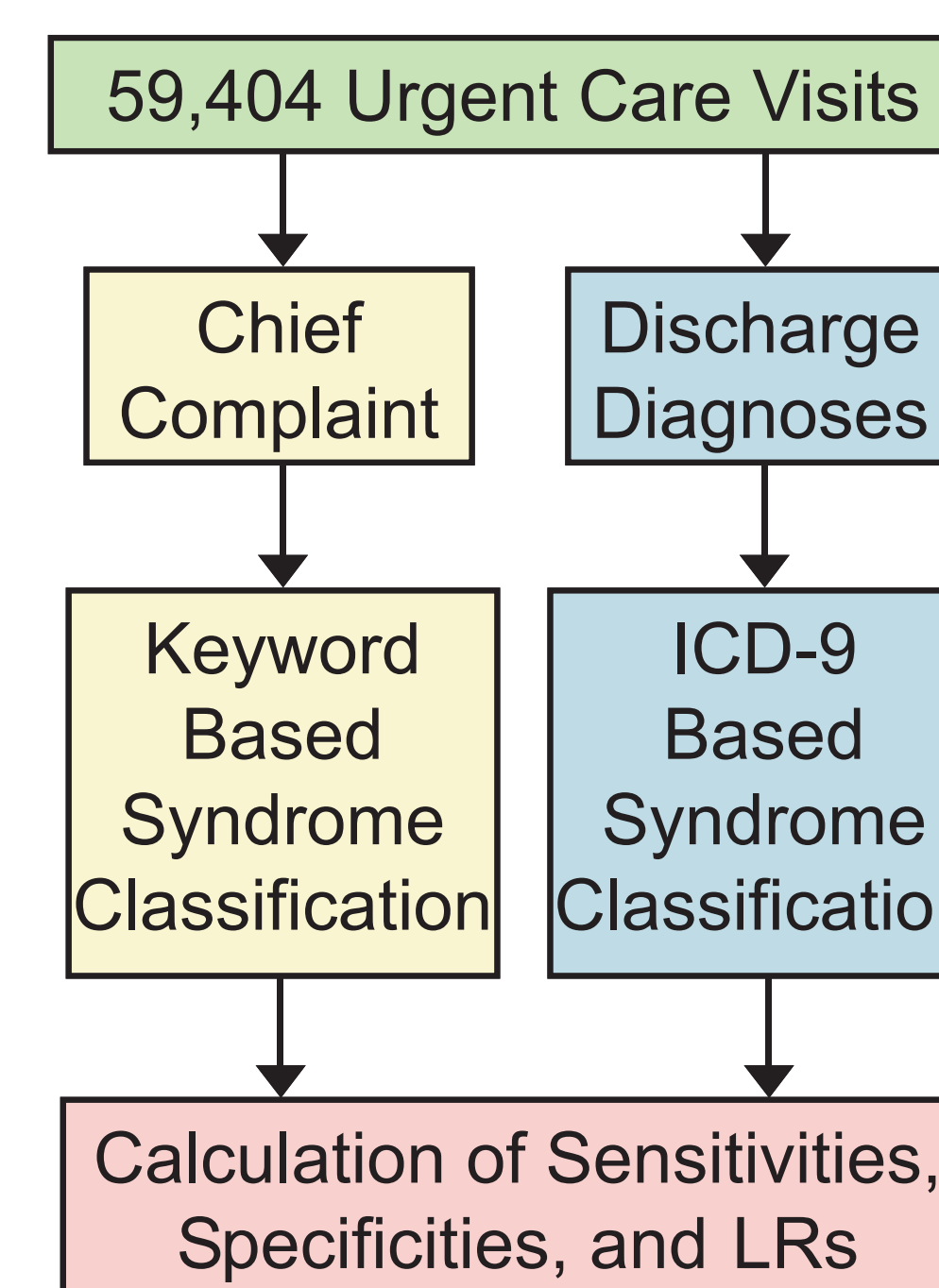


Figure 5. Experimental Design Flowchart



RESULTS

- No evidence of outbreaks due to an external agent such as a bioterrorist introduction was found.
- An increase in respiratory syndrome incidence tracked closely the occurrence of influenza based on influenza surveillance (influenza-like illness, laboratory-confirmed influenza) (Figure 2).
- The rates of the other syndromes remained relatively constant over the tracking period.
- We obtained over a 95% match rate between encounter and billing records, evaluating 59,404 visits to compare the syndromes derived from the chief complaint with those derived using the ICD-9 diagnosis “Pyrite Standard” for the syndromes of interest and an overall “any syndrome” indicator (Figure 4).
- The sensitivity, specificity, and positive predictive values were, respectively, 0.40, 0.88, and 0.78 for the respiratory syndrome; 0.23, 0.96, and 0.23 for the gastrointestinal syndrome; 0.53, 0.98, and 0.33 for the rash syndrome; 0.02, 0.99, and 0.02 for the meningitis/encephalitis syndrome; and 0.10, 0.998, and 0.04 for the botulinic syndrome (Table 2).

Table 3. - Sensitivity, specificity and likelihood ratio positive (LR+) measurements comparing the keyword-based complaint syndromic classifier to the ICD-9 lists using up to 4 discharge diagnoses available for each urgent care encounter.

Syndrome	ICD-9 List	Sensitivity	Specificity	LR+
Respiratory	Respiratory / Influenza-like	0.42	0.90	4
Respiratory + Fever	Respiratory / Influenza-like	0.11	0.98	5
Rash	Rash	0.54	0.98	28
Rash + Fever	Rash	0.05	0.998	29
Gastroenteritis	Gastrointestinal	0.25	0.97	8
Gastroenteritis	Gastrointestinal without "Abdominal Pain" ICD-9 codes	0.42	0.97	13
Gastroenteritis	Gastrointestinal without "Abdominal Pain" and "Nausea alone" ICD-9 codes	0.46	0.97	14
CNS Syndrome	Encephalitic-Meningitic	0.02	0.99	2
CNS Syndrome	Encephalitic-Meningitic without "Headache" ICD-9 Code	0.14	0.99	12
Botulinic	Botulinic	0.10	0.998	42

CONCLUSIONS

- The accuracy of syndromic classification varied substantially among the syndromes.
- Complete evaluation of the suitability of this method would require consideration of the a priori probability of an outbreak of the diseases targeted by each syndrome as well as the relative costs of investigating increases in those syndromes.
- The system as it was operated during the Games required a fair amount of human intervention for data preparation and analysis.
- There is much promising research into automating the analytical processes, though clinical judgment needs to be applied in systems design.
- Effective acquisition of specific disease symptoms by searching free-text chief complaints requires knowledge of common disease manifestations, local information systems, and the abbreviations and linguistic conventions of the registration system operators.
- Opportunity for human error during data entry should be accounted for in a reasonably exhaustive manner and periodically reviewed based on new datasets.
- The most common complaints/syndromes might be more consistently identified if clinicians or registration clerks selected chief complaints from a pick list rather than by typing.
- In particular, reliable acquisition of the presence of fever would be helpful.
- For the three most common syndromes detected by this system—respiratory, gastrointestinal, and rash—the sensitivity appears likely to be sufficient for detecting large outbreaks of diseases that typically present with the symptoms captured by these syndrome categories.