A Guide to the Use of National Healthcare Utilization Databases For Health Professions Education

Amy J. Baker[1], Mark R. Raymond[1], John R. Boulet[2], Steven A. Haist[1]
[1]National Board of Medical Examiners
[2]Educational Commission for Foreign Medical Graduates

May 1, 2013
San Francisco, CA
American Educational Research Association Annual Meeting

Abstract

This paper illustrates the utility of practice analysis for informing curriculum and assessment design in professions education. The paper accomplishes three objectives: (1) Introduces four healthcare utilization surveys administered by the National Center for Health Statistics (NCHS); (2) Summarizes selected results for the survey, the National Hospital Ambulatory Medical Care Survey – Emergency Department (NHAMCS-ED); and (3) Illustrates how the data can inform decisions regarding the design of curricula and assessments in professions education. The survey tracks over 129 million patient visits to various healthcare facilities, documenting the health problems prompting those visits, the diagnostic studies performed, and the types of services provided. While the specific examples are relevant to nursing, medicine, and other healthcare fields, the general principles apply to other professions.

Introduction

The curricula of most US medical schools transformed significantly over the past two decades. Perhaps the most notable change is the move from being organized according to traditional scientific disciplines (e.g., anatomy, biochemistry, pathology) to those that integrate these scientific disciplines into a framework, typically by teaching the discipline within the context of human organ systems (e.g. cardiovascular; gastrointestinal). Many integrated curricula are structured on principles of problem-based learning with student-centered approaches to instruction. Students are presented with actual problems (e.g., shortness of breath, back pain) which they will encounter in their later professional life (Barrows & Tamblyn, 1980; Schmidt, Machiels-Bongaerts, Hermans, ten Cate, Venekamp, & Boshuizen, 1996). Likewise during patient evaluation, students will learn the pathology of the primary disease, as well other diseases in the differential diagnosis. They will also be exposed to the pharmacology used to treat the patient, in addition to learning normal anatomy, normal physiology, etc. While problem-based learning has many important strengths, it is not without its challenges, as meta-analyses support the effectiveness of problem-based education in terms of most clinical skills (Albanese & Mitchell, 1993; Vernon & Blake, 1993), findings also suggest that it has a negative effect on the acquisition of basic science knowledge. In addition, educators face many implementation challenges, including the task of identifying which specific problems or cases to include in their curricula.

The role of practice analysis in developing assessments for credentialing examinations (American Educational Research Association, American Psychological Association, & National Council on Measurement in Education, 1999; Boulet, Gimpel, Errichetti, & Meoli, 2003; Clauser, Margolis, & Case, 2006; Kane, 1997; Raymond M. R., 2001), and for identifying the

competencies expected of medical students and residents (Edwards, Currie, Wade, & Kaminski, 1993; Patterson, Ferguson, & Thomas, 2008) are well documented in the literature. In other fields, such as business and industry, job analysis is regarded as an essential tool for designing employee educational programs (Ash, 1988; Gael, 1983; Harvey, 1991). However, using job analysis for curriculum design of health professions is not well-articulated. Traditional methods of practice analysis may be a concern, as they focus on discreet observable tasks, which are not always well-suited for professional education (LaDuca, 1994). Thus, *problem-based practice analysis* is a proposed alternative method: it focuses on the types of problems professionals will address, the context of those problems, as well as the methods and tools (e.g., instrumentation, treatment modalities, and cognitive models) that professionals exercise on those problems (Raymond M. R., 2001). This proposed approach to practice analysis dovetails nicely with the needs and goals of the problem-based based curriculum.

This paper illustrates the utility of practice analysis for informing decisions about the content of curricula and assessments in professional education. More specifically, we demonstrate how healthcare utilization data, available from the National Center for Health Statistics (NCHS), can be used to identify the medical problems physicians are likely to encounter in clinical practice. These data can be one source of information to advise curriculum decisions in medical education.[1] Using NHCS data, students can be presented with realistic cases they are most likely to encounter at the next stage in their career (graduate medical education or residency). For instance, medical school curricula emphasize ambulatory care, even though medical students will be expected to care mostly for hospitalized patients when they leave medical school and enter residency (Lypson, Frohna, Gruppen, & Woolliscroft, 2004; Raymond, Mee, King, Haist, &

[1] Decisions about which medical cases/problems to present should include other factors, such as the impact or criticality of a case (even though low incidence) for teaching certain scientific principles.

Winward, 2011). While the specific examples presented here have direct relevance to medicine, nursing, and other health professions, the general principles may apply to other fields, such as law and engineering (Jacobs, Rosenfeld, & Haber, 2003).

Methods

Data Sources. The NCHS routinely monitors the use of health care resources in the United States through surveys tracking the following information: patient visits to various types of healthcare facilities, the medical conditions that lead to those visits, the providers seen, the diagnostic studies performed, and the types of interventions provided. The analyses presented are based on the most recent survey information available, which is the 2010 calendar year. Detailed documentation regarding the surveys can be found at http://www.cdc.gov/nchs/. Among the surveys available from the CDC are the:

- National Ambulatory Medical Care Survey (NAMCS)
- National Hospital Ambulatory Medical Care Survey, Emergency Department (NHAMCS-ED)
- National Hospital Ambulatory Medical Care Survey, Outpatient Department (NHAMCS-OPD)
- National Hospital Discharge Survey (NHDS)

These surveys represent the three major clinical settings in which most healthcare is delivered: inpatient, outpatient, and emergency department. Although we completed analyses for all of the above surveys, for the purposes of this paper, only the results of the NHAMCS-ED data in 2010 will be discussed.

The NHAMCS-ED data is comprised of surveys from 373 Emergency Departments totaling 34,936 records. The basic sampling unit for the Emergency Department (ED) survey is the patient visit. The sampling method and weight applied to each record produces estimates for the total number of patient encounters (i.e., visits or admissions) for the entire U.S. population (National Center for Health Statistics, 2012). The weight applied to each record produces an estimated 129,843,377 ED encounters. Each survey record contains patient demographics, reason for visiting the ED, existing conditions, diagnostic service provided, the diagnosis, medications prescribed, other interventions, complications, and other data.

Analyses. Our goal is to identify patient conditions within the ED, that are most likely to be encountered, and then to follow each condition from initial presentation through treatment. We also seek to account for certain dependencies or patterns of covariance in a meaningful way. The following tables and figures summarize the results of three levels of analysis:

1. **High-level.** Diagnoses, procedures, and medications have a hierarchical structure. For example, there are approximately 13,000 ICD-9-CM diagnoses designated by a 5-digit code. These diagnoses are also classified into several hundred mid-level classifications (3-digit codes), and ultimately into 20 major categories. Frequency distributions were obtained at the highest level of a diagnosis (e.g., the 20 major categories). For example, the results indicate that "*During ED visits, approximately 5% of patients are diagnosed with a disease of the circulatory system.*"

2. **Detailed**. While high-level analyses provide an overview of the data, problem-based curricula require information about specific cases. Thus, more detailed analyses can explore

the 5-digit codes (i.e. specific diagnoses) embedded within the 3-digit ICD-9-CM diagnostic categories. For example, "*Of all circulatory conditions in the ED, "cardiac dysrhythmias" is the second most common set of circulatory diagnoses, accounting for 16% of these diagnoses. Within cardiac dysrhythmias, "atrial fibrillation*" *accounts for nearly one-third (35%) of the specific diagnoses in this 3-digit category.*"

3. **Case drill-downs.** These databases provide the ability to follow a specific diagnosis or reason for visit through the system. Using patient examples in each of the settings to be discussed, it's possible to determine which lab tests and imaging studies were ordered, the diagnoses assigned, and procedures performed. Our example uses patients reporting to the ED with a fever.

Results

Emergency Department Data. The information found in the NHAMCS-ED dataset collects information from ED visits. The data contains three reason for visit fields, three diagnosis fields, and eight medication fields, with the *primary* reason for visit, diagnosis, or medication found in the first field of each of these variable groups. The information in Table 1 illustrates the frequency of the episode of care at the Emergency Department. Although the vast majority of encounters are initial visits (92.5%), there is a sizeable portion of follow-up visits (7.5%) with patients returning to the ED, rather than following-up with a primary care physician. Table 2 illustrates the immediacy of the encounter during triage in the ED. Note that nearly 40% of ED visits were categorized as "semi-urgent" ("should be seen within 1-2 hours") or "non-urgent" ("should be seen within 2-24 hours"), in contrast to only 11% of the cases meeting the "immediate" or "emergent" criteria. Meanwhile, Table 3 shows the frequency of the 20 most

common reasons to visit the ED, with “stomach and abdominal pain” and “chest pain and related symptoms” being the most frequently encountered, and “cough” being the fifth most common. Additionally, complaints related to back problems appear in two different places in the top 20, as “back symptoms” and “low back symptoms” are the fifth and twentieth most encountered reasons for ED visits, respectively.

Table 4 provides an overview of the diagnostic services and procedures ordered during ED visits. The information tracked for each patient includes initial vital signs, blood tests, imaging studies, and procedures. Nearly half (47%) of patients in the ED undergo an imaging study (Table 4), usually an x-ray (35%). Other common studies ordered include CBCs (37%) and urinalyses (25%), and almost 50% of patients receive two or more diagnostic services during their ED visit. Additionally, IV fluids are provided to nearly one-third (27%) of patients and nearly half (47%) receive one or more procedures during their time in the ED.

The frequency of patient diagnoses, represented by the 19 major ICD-9 categories (Table 5), show that the most common ED diagnoses fall under the categories of: “Signs, Symptoms, Ill-defined conditions” (20%) and “Injury and Poisoning” (19%). Note also that “Circulatory” (5%) is the eighth most common major diagnostic category. A closer look at circulatory conditions shows that “essential hypertension” (30%), “cardiac dysrhythmias” (16%), and “heart failure” (12%) encompass the three most common sets of 3-digit diagnostic classifications for the circulatory system (Table 6). Further inspection shows that the vast majority of diagnoses under “essential hypertension” are coded to “unspecified essential hypertension” (95%) in the ED setting (Table 7).

Next, the data shows that more than three-quarters (79%) of ED diagnoses are treated with a form of medication. Table 8 presents the frequency of prescriptions for each major medication class, while Table 9 summarizes the frequency of specific drugs within the most commonly prescribed class of Central Nervous System (CNS) agents. The most prescribed ED medication is Zofran, used to treat severe nausea, while the remaining CNS agents in the top 10 are prescribed for pain; three of these are NSAIDs, while 5 are opioids.

As illustrated in Table 3, a substantial portion of ED visits are for fever. Figure 1 demonstrates a drill-down of fever cases in the ED. Approximately 4% of all ED visits presenting with fever, are diagnosed with "pneumonia, organism unspecified". For pneumonia cases in the ED, nearly 57% and 41% are ordered CBCs and blood cultures, respectively. Of all cases of pneumonia in the ED, 84% have one or more diagnostic imaging services. The figure also lists the 15 most commonly prescribed medications for pneumonia with anti-pyretics and antibiotics dominating the landscape, as they account for 11 of the top 15 listed. One caution when using the database is that medications may be listed more than once because of generic and multiple trade names (e.g., Azithromycin = Zithromax = Z-pak). Although Figure 1 presents a forward progression of case management of pneumonia, there may be instances where a backwards progression is useful (e.g., starting with the treatment and determining what ailments the treatment is commonly used for).

Discussion

In summary, the results suggest that with regards to the immediacy of the patient visit in the ED, when developing a curriculum for an Emergency Medicine rotation in medical school or for a residency program, considerable emphasis should be given to semi-urgent or non-urgent

conditions, such as chronic cough or back pain, in addition to underscoring immediate or urgent conditions such as myocardial infarction or a compound fracture. Furthermore, as almost 50% of the patients in the ED undergo an imaging study, an ED-based curriculum should include indications and contraindications, as well as interpretation of imaging studies.

As this dataset provides access to all medications prescribed in the ED setting, it is conceivable that medical schools would design their curriculum to teach students the 100 or 200 most commonly prescribed drugs. Prescribing medications is identified as a responsibility, as well as a source of fatal errors among new residents (Phillips & Barker, 2010). Such data can provide a useful guide for improving education and reducing medical errors, as it's reasonable to ensure that more common medications and procedures be included in all curricula, with the most common being introduced early. This is not to imply that curricula be limited to only the common medications and procedures; indeed, it is prudent to include tests which are particularly challenging, those that are key for certain critical or high-risk diseases, or those that illustrate an important basic science principle. For example, although molecular imaging is not common, it may be reasonable to teach, if it demonstrates an important point. Additionally, frequently prescribed medications used to treat critical diseases will need to be included in the curriculum as well as commonly used medications.

Furthermore, as the data highlight the prevalence of opioids prescribed in the ED, it seems evident that prescription drug abuse is one of the most significant medical issues to stress in curriculum development. With regards to medication instruction in problem-based case development, as evidenced in the drill down example of fever in the ED, instruction on the anti-pyretic and antibiotic classes of medications, as well as the specific medications commonly used, would be important points to address in curriculum development.

In summary, the proper training of professionals demands that educational programs be relevant to actual practice. Likewise, to support the content validity of any assessment scores, the context of the test questions and other stimuli should be realistic. While numerous strategies can be employed to develop curricula for the education and assessment of professionals, what is taught (or assessed) should ultimately be determined by the skills needed to practice effectively and the context in which those skills are executed. For physicians, nurses, and other health professionals, the use of national practice data can effectively delimit the reasons patients seek care and their common diagnoses; provided with this information, the typical management strategies, including procedures and medications, can be defined. The use of these data can help inform curricular design and serve as the basis for test development activities.

While credentialing organizations use national practice data to inform decisions regarding test content (Boulet, Gimpel, Errichetti, & Meoli, 2003; Raymond M. R., 2001) the value of patient data extends to curriculum development. For example, as more medical schools adopt problem-based curricula, where students learn about a subject in the context of complex, realistic problems, the choice of patient cases becomes paramount. By referencing national survey data sets, like those described here, educators can ensure their teaching materials are relevant. Although medicine can involve critical low-prevalence-high morbidity/mortality events, using educational materials based on common presentations and conventional treatments provides an effective milieu for students to understand medical concepts in the context of actual patient care. This strategy may also allow learners to better generalize their skills (or knowledge) from one educational setting (patient encounter) to another. For health professions such as medicine, using national healthcare data provides a framework for modeling curricular subject matter, and where applicable, developing content-valid assessments.

Table 1. Episode of Care at Emergency Department

Episode of Care	N	%
Initial visit	112,187,260	92.5
Follow-up visit	9,054,485	7.5
Total	121,241,745	100.0

Table 2. Immediacy with Which Patient Should Be Seen At Emergency Department

Immediacy	N	%
Immediate	1,485,622	1.1
Emergent	13,261,120	10.2
Urgent	56,346,717	43.4
Semi-urgent	42,433,030	32.7
Nonurgent	9,025,662	7.0
Visit occurred in ESA w/o nursing triage	7,291,226	5.6
Total	129,843,377	100.0

Table 3. Most Common Reasons for Visit to Emergency Department

Reason for Visit	N	%
Stomach and abdominal pain	13,498,085	6.1
Chest pain and related symptoms	9,329,409	4.2
Vomiting	8,321,437	3.8
Fever	8,002,635	3.6
Cough	7,031,429	3.2
Headache, pain in head	6,653,565	3.0
Nausea	5,945,439	2.7
Shortness of breath	5,613,428	2.5
Back symptoms	5,464,509	2.5
Pain, unspecified site	4,972,884	2.3
Accident, unspecified	4,854,024	2.2
Symptoms referable to throat	4,002,200	1.8
Leg symptoms	3,801,556	1.7
Vertigo – dizziness	3,728,948	1.7
Diarrhea	3,165,046	1.4
Earache, or ear infection	2,864,487	1.3
Skin rash	2,814,376	1.3
Neck symptoms	2,751,378	1.2
Nasal congestion	2,620,758	1.2
Low back symptoms	2,578,892	1.2

Table 4. Diagnostic Services and Procedures Ordered during ED Visits

Type of Study	N	%
Initial Vital Signs		
Temperature	123,888,134	95.4
Heart rate	122,776,250	94.6
Patient's respiratory rate	124,625,510	96.0
Blood pressure - Systolic	115,085,864	88.6
Blood pressure - Diastolic	114,852,711	88.5
Pulse oximetry (percent)	114,394,919	88.1
On oxygen	104,065,470	80.1
Glasgow coma scale	44,937,018	34.6
Blood Tests		
CBC	48,613,865	37.4
Blood urea nitrogen	34,856,298	26.8
Cardiac Enzymes	17,770,536	13.7
Electrolytes	30,417,970	23.4
Glucose	32,011,687	24.7
Liver Function Tests	13,503,490	10.4
Arterial Blood Gases	3,661,886	2.8
Prothrombin time/INR	10,903,467	8.4
Blood culture	5,352,396	4.1
Blood alcohol	2,927,268	2.3
Other blood test	25,371,100	19.5
Other Tests		
Cardiac monitor	11,918,911	9.2
EKG/ECG	24,171,843	18.6
HIV test	461,588	0.4
Rapid flu/Influenza test	1,883,658	1.5
Pregnancy test	8,908,249	6.9
Toxicology screen	4,995,841	3.8
Urinalysis	32,114,922	24.7
Wound culture	1,438,235	1.1
Other test/service	19,991,562	15.4
Total # of Services		
0 diagnostic services	37,723,701	29.4
1 diagnostic service	27,583,056	21.5
2 or more	63,000,255	49.1
Total	*128,307,012*	*100*

Type of Study	N	%
Imaging		
Any Image	61,285,752	47.2
X-ray	45,383,605	35.0
CAT scan	21,287,052	16.4
CT Scan (all types)	23,480,018	18.2
MRI scan	704,482	0.5
Ultrasound	4,856,691	3.7
Other imaging	1,328,499	1.0
Procedures		
IV fluids	35,200,581	27.1
Cast	373,865	0.3
Splint or wrap	7,506,344	5.8
Suturing/Staples	4,038,972	3.1
Incision and drainage	1,477,317	1.1
Foreign body removal	551,191	0.4
Nebulizer therapy	4,013,055	3.1
Bladder catheter	2,866,792	2.2
Pelvic exam	2,333,032	1.8
Central line	161,459	0.1
CPR	132,603	0.1
Endotracheal intubation	277,148	0.2
Other procedure	11,369,422	8.8
Total # of Procedures		
0 procedures	66,044,477	52.7
1 procedure	50,011,765	39.8
2 procedures	8,096,105	6.5
3 procedures	1,103,128	0.9
4 procedures	142,423	0.1
5 procedures	22,692	0.0
6 procedures	17,545	0.0
Total	*125,438,135*	*100*

Table 5. Major Diagnostic Categories for ED Visits

Major Diagnostic Categories	N	%
Signs, Symptoms, Ill-defined conditions	43,279,854	20.4
Injury and Poisoning	40,624,192	19.1
Respiratory	19,443,225	9.1
External Causes of Injury and Supplemental Classification	14,741,808	6.9
Musculoskeletal/Connective	12,503,366	5.9
Digestive	12,383,316	5.8
Genitourinary	12,087,644	5.7
Circulatory	10,008,037	4.7
Mental	9,177,417	4.3
Skin/Subcutaneous	7,298,033	3.4
Nervous	6,962,344	3.3
Sense Organs	6,386,748	3.0
Endocrine, Nutritional, Metabolic, Immunity	6,259,981	2.9
Infection/Parasitic	5,837,788	2.7
Pregnancy, Childbirth, Puerperium	2,522,768	1.2
Blood/Blood-Forming	1,802,330	0.8
Neoplasms	855,540	0.4
Congenital Anomalies	181,300	0.1
Perinatal Conditions	176,233	0.1
Total	212,531,924	100.0

Table 6. Most Common 3-Digit, Circulatory Diagnoses for ED Visits

3-digit Diagnostic Categories	N	%
Essential hypertension	2,960,964	29.6
Cardiac dysrhythmias	1,552,288	15.5
Heart failure	1,243,149	12.4
Acute myocardial infarction	549,069	5.5
Other acute and subacute form of ischemic heart disease	496,474	5.0
Occlusion of cerebral arteries	401,424	4.0
Transcient cerebral ischemia	334,733	3.3
Hypotension	316,717	3.2
Other venous embolism and thrombosis	244,168	2.4
Other forms of chronic ischemic heart disease	179,503	1.8
Hemorrhoids	162,966	1.6
Acute pulmonary heart disease	153,328	1.5
Other disorders of circulatory system	147,419	1.5
Angina pectoris	129,034	1.3
Other diseases of endocardium	99,483	1.0
Hypertensive renal disease	91,964	0.9
Phlebitis and thrombophlebitis	91,217	0.9
Ill-defined descriptions and complications of heart disease	83,916	0.8
Other and unspecified intracranial hemorrhage	80,850	0.8
Conduction disorders	79,860	0.8

Table 7. Most Common Specific Diagnoses within 3-digit Circulatory Category for ED Visits

Specific (5-digit) Diagnoses within 3-digit Circulatory Categories	N	%
401 Essential hypertension	**2,960,964**	**100.0**
4019- Unspecified essential hypertension	2,824,449	95.4
4011- Benign essential hypertension	77,150	2.6
4010- Malignant essential hypertension	59,365	2.0
427 Cardiac dysrhythmias	**1,552,288**	**100.0**
42731 Atrial fibrillation	549,135	35.4
42789 Other cardiac dysrhythmias	343,821	22.1
4275- Cardiac arrest	250,029	16.1
4271- Paroxysmal ventricular tachycardia	111,324	7.2
4279- Cardiac dysrhythmia, unspecified	105,649	6.8
42769 Other premature beats	58,602	3.8
42732 Atrial flutter	47,624	3.1
4270- Paroxysmal supraventricular tachycardia	40,245	2.6
42741 Ventricular fibrillation	35,542	2.3
42761 Supraventricular premature beats	6,280	0.4
42781 Sinoatrial node dysfunction	4,037	0.3
428 Heart failure	**1,243,149**	**100.0**
4280- Congestive heart failure	1,153,128	92.8
4289- Heart failure, unspecified	25,914	2.1
42823 Systolic heart failure, acute on chronic	15,647	1.3
42832 Diastolic heart failure, chronic	12,145	1.0
42833 Acute on chronic diastolic heart failure	11,086	0.9
42821 Acute systolic heart failure	9,914	0.8
42830 Diastolic heart failure, unspecified	4,445	0.4
42843 Acute on chronic combined systolic an...	3,938	0.3
42822 Systolic heart failure, chronic	3,291	0.3
42831 Acute diastolic heart failure	2,805	0.2
42820 Systolic heart failure, unspecified	836	0.1

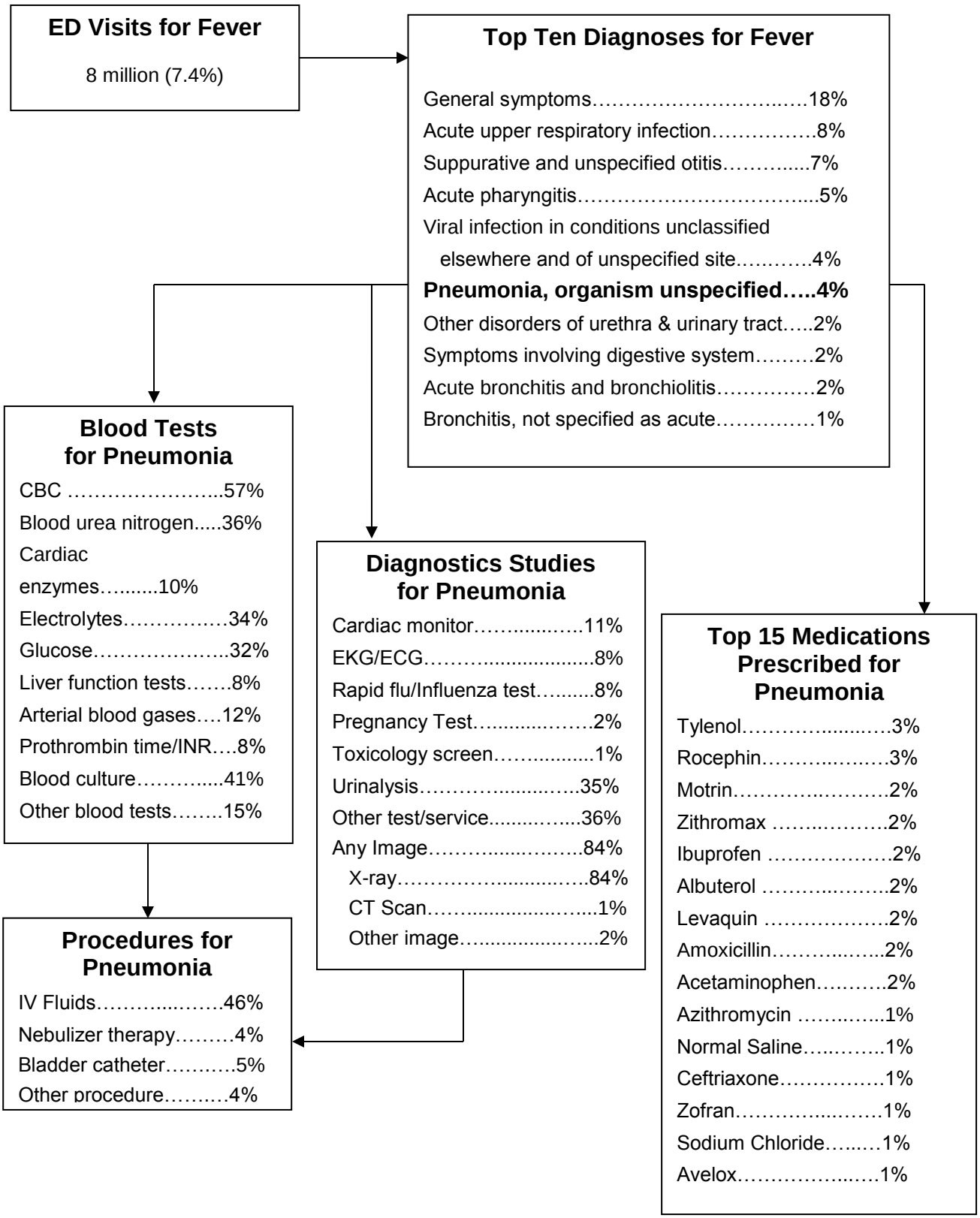
Table 8. Major Classes of Medications Prescribed during ED Visit

Major Medication Classes	N	%
Central nervous system agents	132,263,004	48.7
Anti-infectives	40,533,916	14.9
Respiratory agents	16,959,001	6.2
Nutritional products	16,054,936	5.9
Gastrointestinal agents	14,819,609	5.5
Cardiovascular agents	12,613,836	4.6
Topical agents	8,817,184	3.2
Hormones	8,534,453	3.1
Miscellaneous agents	5,753,444	2.1
Immunological agents	3,572,905	1.3
Metabolic agents	3,080,995	1.1
Coagulation modifiers	2,870,313	1.1
Psychotherapeutic agents	2,006,223	0.7
Medical gases	1,178,379	0.4
Radiologic agents	971,555	0.4
Genitourinary tract agents	918,757	0.3
Antineoplastics	181,567	0.1
Alternative medicines	117,770	0.0
Pharmaceutical aid	105,084	0.0
Biologicals	39,854	0.0
Plasma expanders	30,430	0.0
Total	271,423,215	100.0

Table 9. Most Common, Central Nervous System Agents, Prescribed during ED Visit

Central Nervous System Agents	N	%
Zofran	14,445,743	10.9
Motrin	9,706,824	7.3
Tylenol	9,273,130	7.0
Vicodin	7,914,154	6.0
Toradol	7,761,650	5.9
Morphine	7,239,483	5.5
Ibuprofen	7,007,490	5.3
Dilaudid	6,097,620	4.6
Percocet-5	5,968,562	4.5
Lortab	4,506,726	3.4

Figure 1. Drill-Down into Fever as Reason for Visit to Emergency Department



References

Albanese, M. A., & Mitchell, S. (1993). Problem-based learning: A review of literature on its outcomes and implementation issues. *Academic Medicine, 68*, 52-81.

American Educational Research Association, American Psychological Association, & National Council on Measurement in Education. (1999). Standards for Educational and Psychological Testing. Washington, DC: American Educational Research Association.

Ash, R. A. (1988). Job analysis in the world of work. In S. Gael (Ed.), *The job analysis handbook for business, industry, and government.* (Vols. I-II, pp. 1-13). New York, NY: Wiley & sons.

Barrows, H., & Tamblyn, R. (1980). *Problem-based Learning: An Approach to Medical Education.* New York, NY: Springer.

Boulet, J. R., Gimpel, J. R., Errichetti, A. M., & Meoli, F. G. (2003). Using national medical care survey data to validate examination content on a performance-based clinical skills examination. , 103,. *Journal of the American Osteopathic Association, 103*, 225-231.

Clauser, B. E., Margolis, M. J., & Case, S. M. (2006). Testing for licensure and certification in the professions. In R. L. Brennan (Ed.), *Educational Measurement* (4 ed.). Westport, CT: American Council on Education/Praeger.

Edwards, J. C., Currie, M. L., Wade, T. P., & Kaminski, D. L. (1993). Surgery resident selection and evaluation: A critical incident study. *Evaluation & the Health Professions, 16*, 73-86.

Gael, S. (1983). *Job analysis: A guide to assessing work activities* . San Francisco, CA: Jossey-Bass.

Harvey, R. J. (1991). Job analysis. In M. Dunnette, & L. Hough (Eds.), *Handbook of industrial and organizational psychology* (2nd ed., Vol. 2, pp. 71-163). Palo Alto, CA: Consulting Psychologists Press.

Jacobs, S. K., Rosenfeld, P., & Haber, J. (2003). Information Literacy as the Foundation for Evidence-Based Practice in Graduate Nursing Education: A Curriculum-Integrated Approach. *Journal of Professional Nursing, 19*(5), 320-328.

Kane, M. T. (1997). Model-based practice analysis and test specifications. *Applied Measurement in Education, 10*, 5-18.

LaDuca, A. (1994). Validation of professional licensure examinations: Professions theory, test design, and construct validity. *Evaluation & the Health Professions, 17*, 178-197.

Lypson, M. L., Frohna, J. G., Gruppen, L. D., & Woolliscroft, J. O. (2004). Assessing residents' competencies at baseline: Identifying the gaps. *Academic Medicine, 79*, 564-570.

National Center for Health Statistics. (2012, October 16). *Ambulatory Health Care Data.* Retrieved 2013, from Centers for Disease Control and Prevention: ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Dataset_Documentation/NHAMCS/doc2010.pdf

Patterson, F., Ferguson, E., & Thomas, S. (2008). Using job analysis to identify core and specific competencies: implications for selection and recruitment. *Medical Education, 42*, 1195-1204.

Phillips, D. P., & Barker, G. E. (2010). A July spike in fatal medication errors: A possible effect of new medical residents. *Journal of General Internal Medicine, 25*(8), 774-779.

Raymond, M. R. (2001). Job analysis and the specification of content for licensure and certification examinations. *Applied Measurement in Education, 14*, 369-415.

Raymond, M. R., Mee, J., King, A., Haist, S. A., & Winward, M. L. (2011). What new residents do during their initial months of training. *Academic Medicine, 86*(suppl), s59-s62.

Schmidt, H. G., Machiels-Bongaerts, M., Hermans, H., ten Cate, T. J., Venekamp, R., & Boshuizen, H. P. (1996). The Development of Diagnostic Competence:Comparison of a Problem-based, an Integrated, and a Conventional Medical Curriculum. *Academic Medicine, 71*(6), 658-664.

Vernon, D. T., & Blake, R. L. (1993). Does problem-based learning work? A meta-analysis of evaluative research. *Academic Medicine, 68*, 550-561.