Evaluation of the Washington State HCA Proposed List of "Non-Emergency" Diagnoses

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What do we know about patients who are seen in Oregon EDs and whose primary discharge diagnosis is on the HCA list?

In order to understand the potential impact of the HCA list of "non-emergency" diagnoses in a real-world scenario, we used a dataset of 2,776,288 ED visits to 27 Oregon emergency departments (EDs) in 2001-2005. Further information about the dataset is reported elsewhere. (1)

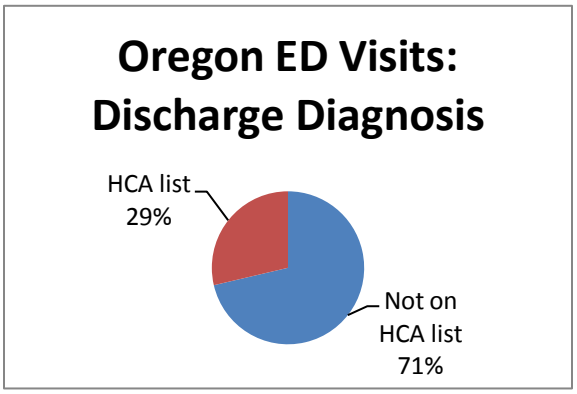

Figure 1: Proportion of Oregon ED Visits with HCA-List Diagnoses

Of these ED visits, 795,941 (29%) had discharge diagnoses on the HCA list (Figure 1).

Of those "non-emergency" visits, 18,579 (2.3%) resulted in hospitalization from the ED (Figure 2). We looked separately at an especially vulnerable group: OHP (Medicaid expansion) enrollees age 65 and older. Of 366 such patients, 81 (22%) required hospitalization (Figure 3). (See Appendix A for breakdowns by age and insurance status.)

Of course, there are many conditions that require ED care and do not lead to hospital admission. The next section of this report examines an alternative approach to identifying cases in need of emergency care.

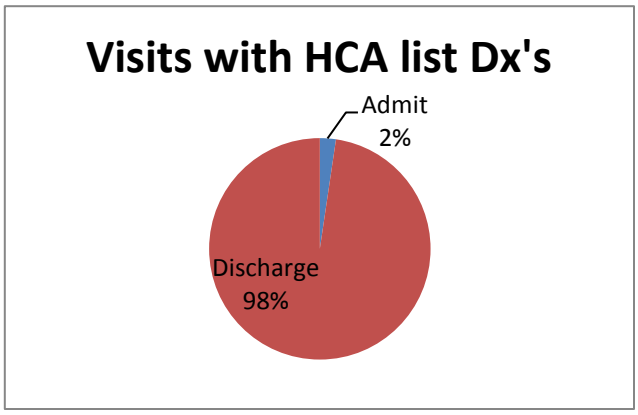

Figure 2: Proportion of HCA-List Diagnoses Admitted to Hospital

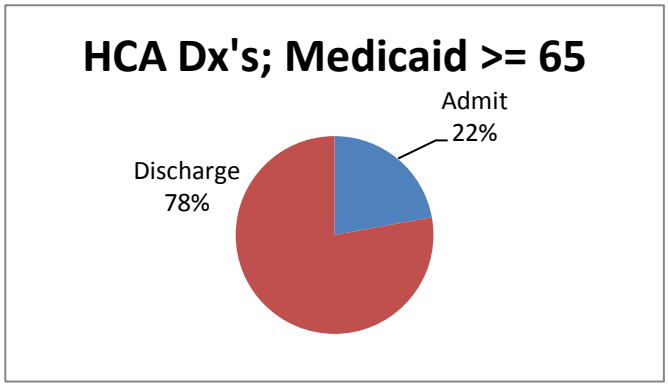

Figure 3: Proportion of Oregon Health Plan Enrollees Age >= 65 with HCA-List Diagnoses, Who Are Admitted to Hospital

Conclusion: Among patients seeking emergency department care who have diagnoses on the HCA "non-emergency" list, there is a non-trivial risk of requiring hospitalization.

How does the HCA list compare to the Emergency Department Algorithm developed by John Billings and colleagues?

Of the 527 diagnoses on the HCA list of "non-emergency" diagnoses, 57 (11%) were found by the EDA developers to have at least some probability (non-zero probability) of requiring the ED (either ED needed, potentially avoidable with better primary care, or ED needed, not avoidable).

In addition, the EDA excludes diagnoses in certain categories: injuries, drug-related, alcohol-related, and other psychiatric diagnoses, because the clinicians involved in developing the EDA could not agree on how to classify diagnoses in these categories. There are also diagnoses that were left unclassified because not enough cases existed in the medical records reviewed by the clinicians on the EDA research team. Of the HCA list, 260 (49%) were excluded by the EDA: 188 injury diagnoses, 1 alcohol-related diagnosis, and 71 unclassified diagnoses (Figure 5). Appendix B contains lists of these diagnoses.

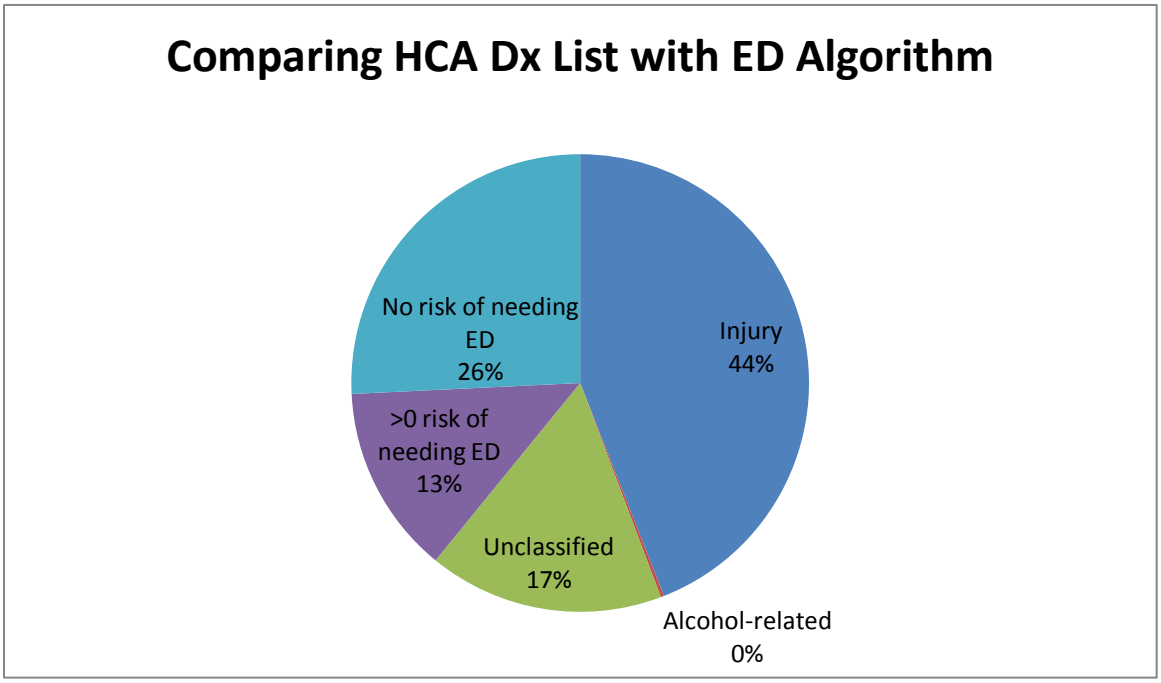

Figure 4: Comparing Diagnoses on HCA List with the Emergency Department Algorithm

Of the 2,776,288 visits to Oregon EDs, 795,941 (29%) had primary diagnoses on the HCA list. However, 329,500 (41%) of these HCA list diagnoses were injuries, alcohol-related, or unclassified by the EDA and are considered of indeterminate probability of requiring the ED. Another 15,416 visits led to hospital admission; the EDA excludes these cases as well. Of the remaining 451,025 ED visits, 372,218 (82%) had primary diagnoses which, according to the EDA, have some probability of requiring the ED. Of the 795,941 ED visits that would be deemed "non-emergency" by the HCA list, only 78,807 (10%) would be classified by the EDA as not needing ED care (i.e., zero probability of needing ED care). (See Figure 6)

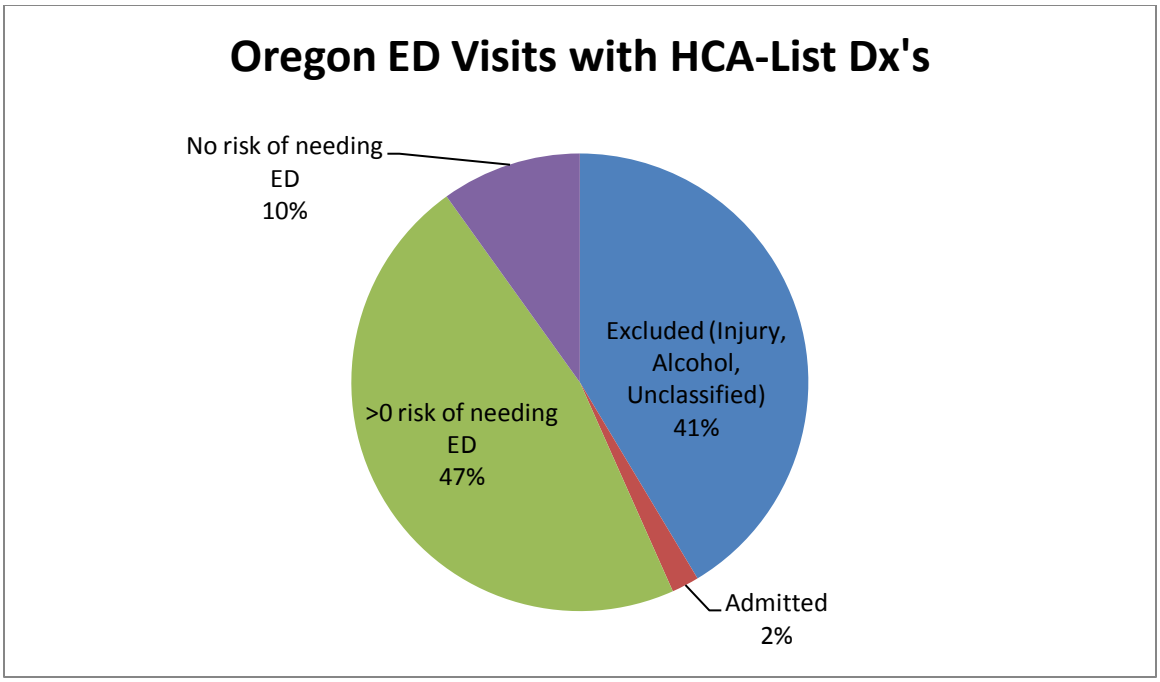

Figure 5: EDA Classification of Oregon ED Visits by Patients with Dx on HCA List

Appendix C contains additional methodological details, and Appendix D compares need for ED among patients with diagnoses on the HCA list, by age and insurance status.

Conclusion: The HCA list of "non-emergency" diagnoses is not consistent with the EDA.

What would happen were the HCA list to be utilized?

We now consider the potential impact of denying ED care to patients with diagnoses on the HCA list. This analysis involves three assumptions. These assumptions, though problematic, are commonly made by those who attempt to employ the EDA for triage purposes.

1. Discharge diagnosis is clear before the patient is seen, so that these patients could be denied treatment prospectively.
2. The EDA can be used for triage purposes. To the contrary, the original publication concerning the EDA stated, "The algorithm is not intended as a triage tool or as a mechanism to determine whether ED use is appropriate for required reimbursement by a managed care plan." (2)
3. The EDA approach correctly classifies need for ED care. The limitations of the EDA have been discussed elsewhere. (3, 4)

Notwithstanding the problematic nature of these assumptions, because the EDA is sometimes used to project the number of "avoidable" ED visits, it seems important to use the same approach to project the number of necessary ED visits that would be denied were the HCA list to be implemented. (This is the second approach described in Appendix C.)

Of the 451,025 patients whose primary ED discharge diagnosis was on the HCA list and whose diagnoses could be classified by the EDA, the probabilities assigned by the EDA suggest that, based on the diagnosis made after their visit, 53,213 (12%) needed ED care and an additional 149,362 (33%) needed care within 12 hours, which could be provided in a primary care setting if one were available. Of the 153,107 Oregon Health Plan (Medicaid expansion) patients whose primary ED discharge diagnosis was on the HCA list, the EDA suggests that 16,897 (11%) needed ED care and an additional 57,306 (37%) needed care within 12 hours, which could be provided in a primary care setting if one were available.

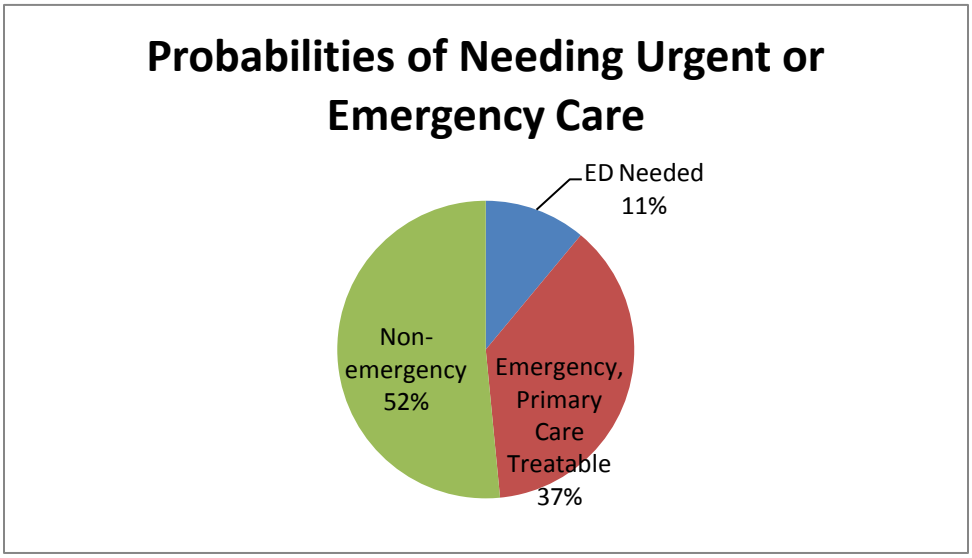

Figure 6: EDA-Assigned Probabilities of Requiring Urgent/Emergency Care for Oregon Health Plan Patients with HCA-List Diagnoses. (Analysis limited to the subset of visits for which the EDA can assign probabilities.)

Conclusion: Were the HCA list to be implemented, the EDA suggests that 11% of patients denied care would actually need ED care and an additional 37% would need primary care within 12 hours.

Among patients seen in the ED, what proportion have return ED visits?

Of 795,941 visits for diagnoses on the HCA list and for which admission status was known, 33,125 (4.2%) had a repeat visit within three days, and 134,380 (16.9%) had a repeat visit within 30 days.

Of the 777,362 patients who were *not* hospitalized on their first ED visit, 3,336 (0.4%) were hospitalized within three days; 9,646 (1.2%) were hospitalized within 30 days. Of patients aged ≥65, 2.2% were hospitalized within three days and 6.3% were hospitalized within 30 days.

Appendix E provides additional detail about return visits.

This third measure of severity is consistent with the other two: patients with diagnoses on the HCA list are at risk of having substantial medical problems, requiring ED care.

Appendices

Appendix A:

Hospitalization on Day of Emergency Department Visit for Patients whose Principal Diagnosis is on the HCA List

Appendix B:

Diagnoses on HCA List that are Inconsistent with the Emergency Department Algorithm

Appendix C:

Methodological Note on Applying the Emergency Department Algorithm

Appendix D:

Proportion of Patient Visits with HCA-list Diagnoses and with Non-Zero Need for the ED, Based on the ED Algorithm

Appendix E:

Return Visits after Discharge from the ED with an HCA List Diagnosis

Appendix F:

References Cited

Appendix A:
Hospitalization on Day of Emergency Department Visit for Patients whose Principal Diagnosis is on the HCA List

(Note: Totals may vary slightly because of missing data.)

Proportion admitted

Admission from ED	Freq.	Percent	Cum.
Discharge	777,362	97.67	97.67
Admit	18,579	2.33	100.00
Total	795,941	100.00	

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Admissions by age category

Key
frequency
row percentage

Age Category	Admission from ED: Discharge	Admit	Total
0-1	44,931	410	45,341
	99.10	0.90	100.00
2-9	65,767	297	66,064
	99.55	0.45	100.00
10-17	67,345	291	67,636
	99.57	0.43	100.00
18-39	342,814	2,827	345,641
	99.18	0.82	100.00
40-64	195,036	3,953	198,989
	98.01	1.99	100.00
>=65	61,435	10,800	72,235
	85.05	14.95	100.00
Total	777,328	18,578	795,906
	97.67	2.33	100.00

Admissions by Insurance Type

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+----------------+
| Key            |
|----------------|
|   frequency    |
| row percentage |
+----------------+
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insurance_category2	Admission from ED: Discharge	Admit	Total
Auto	53,927	799	54,726
	98.54	1.46	100.00
Commercial	236,948	2,935	239,883
	98.78	1.22	100.00
Medicaid - Other Stat	1,617	19	1,636
	98.84	1.16	100.00
Medicare	81,266	11,363	92,629
	87.73	12.27	100.00
OHP	216,952	2,252	219,204
	98.97	1.03	100.00
Other	59,428	501	59,929
	99.16	0.84	100.00
Uninsured	125,967	700	126,667
	99.45	0.55	100.00
Total	776,105	18,569	794,674
	97.66	2.34	100.00

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. * Look specifically at visits by patients with OHP who are >= 65 years old
. tab1 admit if Age>=65 & Age ~=. & OHP==1

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-> tabulation of admit if Age>=65 & Age ~=. & OHP==1
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Admission from ED	Freq.	Percent	Cum.
Discharge	285	77.87	77.87
Admit	81	22.13	100.00
Total	366	100.00	

Appendix B:
Diagnoses on HCA List that are Inconsistent with the Emergency Department Algorithm

*** What are the specific diagnoses with non-0 probabilities per the EDA?**

icd9	text_dx	Emergency_ED_Needed_Not_Avoid	Emergency_ED_Needed_Pot_Avoid	_Emergent_PC_Treatable	Non_Emergent
2761	Hyposmolality	0	.8947368	.1052632	0
7243	Sciatica	.6666667	0	.3333333	0
7241	Pain in thoracic spine	.6666667	0	.3333333	0
7213	Lumbosacral spondylosis	.6666667	0	.3333333	0
3310	Alzheimer's disease	.5	0	0	.5
68111	Onychia of toe	0	.3571429	.6428571	0
68102	Onychia of finger	0	.3571429	.6428571	0
684	Impetigo	0	.3380282	.6619718	0
6869	Local skin infection NOS	0	.3380282	.6619718	0
2189	Uterine leiomyoma NOS	.3333333	0	0	.6666667
72885	Spasm of muscle	.3333333	0	0	.6666667
V670	SURGERY FOLLOW-UP	.3333333	0	.3333333	.3333333
6806	Carbuncle of leg	.3333333	0	.6666667	0
6809	Carbuncle NOS	.3333333	0	.6666667	0
78052	Insomnia NOS	.25	0	.25	.5
78050	Sleep disturbance NOS	.25	0	.25	.5
5990	Urin tract infection NOS	0	.2417582	.2967033	.4615385
5950	Acute cystitis	0	.2417582	.2967033	.4615385
5959	Cystitis NOS	0	.2417582	.2967033	.4615385
6264	Irregular menstruation	.2	0	0	.8
78079	Malaise and fatigue NEC	.1818182	0	.1818182	.6363636
78071	Chronic fatigue syndrome	.1818182	0	.1818182	.6363636
460	Acute nasopharyngitis	0	.1774193	.8225806	0
4660	Acute bronchitis	0	.1774193	.8225806	0
4658	Acute uri mult sites NEC	0	.1774193	.8225806	0
4659	Acute uri NOS	0	.1774193	.8225806	0
30781	Tension headache	.1298701	0	.0909091	.7792208
34690	Migrne unsp wo ntrc mgrn	.1298701	0	.0909091	.7792208
7840	Headache	.1298701	0	.0909091	.7792208
7862	Cough	.1176471	0	.2352941	.6470588
72190	Spondylos NOS w/o myelop	.1111111	0	.1527778	.7361111
73399	Bone & cartilage dis NEC	.1111111	0	.6666667	.2222222
7329	Osteochondropathy NOS	.1111111	0	.6666667	.2222222
7248	Other back symptoms	.1111111	0	.1527778	.7361111
7245	Backache NOS	.1111111	0	.1527778	.7361111
7242	Lumbago	.1111111	0	.1527778	.7361111
4739	Chronic sinusitis NOS	.1	0	.15	.75

4730	Chr maxillary sinusitis	.1	0	.15	.75
37214	Chr allrg conjunctiv NEC	.0930233	0	.2325581	.6744186
37200	Acute conjunctivitis NOS	.0930233	0	.2325581	.6744186
37203	Mucopur conjunctivit NEC	.0930233	0	.2325581	.6744186
37230	Conjunctivitis NOS	.0930233	0	.2325581	.6744186
1100	Dermatophyt scalp/beard	.0769231	0	.2307692	.6923077
6268	Menstrual disorder NEC	.0769231	0	.3076923	.6153846
1108	Dermatophytosis site NEC	.0769231	0	.2307692	.6923077
6269	Menstrual disorder NOS	.0769231	0	.3076923	.6153846
1110	Pityriasis versicolor	.0769231	0	.2307692	.6923077
1109	Dermatophytosis site NOS	.0769231	0	.2307692	.6923077
1104	Dermatophytosis of foot	.0769231	0	.2307692	.6923077
V681	Issue repeat prescript	.0588235	0	.1176471	.8235294
462	Acute pharyngitis	0	.0578947	.2842105	.6578947
V655	Persn w feared complaint	.0434783	0	.6086956	.3478261
3829	Otitis media NOS	0	.0379747	.5907173	.371308
7821	Nonspecif skin erupt NEC	.0350877	0	.2105263	.7543859
6918	Other atopic dermatitis	.0350877	0	.2105263	.7543859
6926	Dermatitis due to plant	.0350877	0	.2105263	.7543859
6929	Dermatitis NOS	.0350877	0	.2105263	.7543859

. * What are the specific diagnoses excluded by the EDA?

. * Injury dx's

icd9	text_dx	BillingsInjury
8400	Sprain acromioclavicular	1
8401	Sprain coracoclavicular	1
8402	Sprain coracohumeral	1
8403	Sprain infraspinatus	1
8404	Sprain rotator cuff	1
8405	Sprain subscapularis	1
8406	Sprain supraspinatus	1
8408	Sprain shoulder/arm NEC	1
8409	Sprain shoulder/arm NOS	1
8410	Sprain radial collat lig	1
8411	Sprain ulnar collat lig	1
8412	Sprain radiohumeral	1
8413	Sprain ulnohumeral	1
8418	Sprain elbow/forearm NEC	1
8419	Sprain elbow/forearm NOS	1
84200	Sprain of wrist NOS	1
84201	Sprain carpal	1
84202	Sprain radiocarpal	1
84209	Sprain of wrist NEC	1
84210	Sprain of hand NOS	1
84211	Sprain carpometacarpal	1
84212	Sprain metacarpophalang	1
84213	Sprain interphalangeal	1
84219	Sprain of hand NEC	1
8430	Sprain iliofemoral	1
8431	Sprain ischiocapsular	1
8438	Sprain hip & thigh NEC	1
8439	Sprain hip & thigh NOS	1
8440	Sprain lateral coll lig	1
8441	Sprain medial collat lig	1
8442	Sprain cruciate lig knee	1
8443	Sprain super tibiofibula	1
8448	Sprain of knee & leg NEC	1
8449	Sprain of knee & leg NOS	1
84500	Sprain of ankle NOS	1
84501	Sprain of ankle deltoid	1
84502	Sprain calcaneofibular	1
84503	Sprain distal tibiofibul	1
84509	Sprain of ankle NEC	1
84510	Sprain of foot NOS	1
84511	Sprain tarsometatarsal	1
84512	Sprain metatarsophalang	1
84513	Sprain interphalang toe	1
84519	Sprain of foot NEC	1
8460	Sprain lumbosacral	1
8461	Sprain sacroiliac	1
8462	Sprain sacrospinatus	1
8468	Sprain sacroiliac NEC	1
8469	Sprain sacroiliac NOS	1
8470	Sprain of neck	1
8471	Sprain thoracic region	1
8472	Sprain lumbar region	1
8473	Sprain of sacrum	1
8474	Sprain of coccyx	1
8479	Sprain of back NOS	1
8480	Sprain of nasal septum	1
8481	Sprain of jaw	1

8482	Sprain of thyroid region	1
8483	Sprain of ribs	1
84840	Sprain of sternum NOS	1
84841	Sprain sternoclavicular	1
84842	Sprain chondrosternal	1
84849	Sprain of sternum NEC	1
8485	Sprain of pelvis	1
8488	Sprain NEC	1
8489	Sprain NOS	1
87200	Opn wound extern ear NOS	1
87201	Open wound of auricle	1
9100	Abrasion head	1
9102	Blister head	1
9104	Insect bite head	1
9106	Foreign body head	1
9108	Superfic inj head NEC	1
9110	Abrasion trunk	1
9112	Blister trunk	1
9114	Insect bite trunk	1
9116	Foreign body trunk	1
9118	Superfic inj trunk NEC	1
9120	Abrasion shoulder/arm	1
9122	Blister shoulder & arm	1
9124	Insect bite shoulder/arm	1
9126	Foreign body shouldr/arm	1
9128	Superf inj shldr/arm NEC	1
9130	Abrasion forearm	1
9132	Blister forearm	1
9134	Insect bite forearm	1
9136	Foreign body forearm	1
9138	Superf inj forearm NEC	1
9140	Abrasion hand	1
9142	Blister hand	1
9144	Insect bite hand	1
9146	Foreign body hand	1
9148	Superficial inj hand NEC	1
9150	Abrasion finger	1
9152	Blister finger	1
9154	Insect bite finger	1
9156	Foreign body finger	1
9158	Superfic inj finger-NEC	1
9160	Abrasion hip & leg	1
9162	Blister hip & leg	1
9164	Insect bite hip & leg	1
9166	Foreign body hip/leg	1
9168	Superfic inj hip/leg NEC	1
9170	Abrasion foot & toe	1
9172	Blister foot & toe	1
9174	Insect bite foot/toe	1
9176	Foreign body foot & toe	1
9178	Superf inj foot/toe NEC	1
9190	Abrasion NEC	1
9192	Blister NEC	1
9194	Insect bite NEC	1
9196	Superfic foreign bdy NEC	1
9198	Superficial injury NEC	1
920	Contusion face/scalp/nck	1
9210	Black eye NOS	1
9220	Contusion of breast	1
9221	Contusion of chest wall	1
9222	Contusion abdominal wall	1
92231	Back contusion	1
92232	Buttock contusion	1

92233	Interscplr reg contusion	1
9224	Contusion genital organs	1
9228	Multiple contusion trunk	1
9229	Contusion trunk NOS	1
92300	Contusion shoulder reg	1
92301	Contusion scapul region	1
92302	Contusion axillary reg	1
92303	Contusion of upper arm	1
92309	Contusion shoulder & arm	1
92310	Contusion of forearm	1
92311	Contusion of elbow	1
92320	Contusion of hand(s)	1
92321	Contusion of wrist	1
9233	Contusion of finger	1
9238	Multiple contusion arm	1
9239	Contusion upper limb NOS	1
92400	Contusion of thigh	1
92401	Contusion of hip	1
92410	Contusion of lower leg	1
92411	Contusion of knee	1
92420	Contusion of foot	1
92421	Contusion of ankle	1
9243	Contusion of toe	1
9244	Multiple contusion leg	1
9245	Contusion leg NOS	1
9248	Multiple contusions NEC	1
9249	Contusion NOS	1
94110	1st deg burn head NOS	1
94111	1st deg burn ear	1
94113	1st deg burn lip	1
94114	1st deg burn chin	1
94115	1st deg burn nose	1
94116	1st deg burn scalp	1
94117	1st deg burn face NEC	1
94118	1st deg burn neck	1
94119	1st deg burn head-mult	1
94210	1st deg burn trunk NOS	1
94211	1st deg burn breast	1
94212	1st deg burn chest wall	1
94213	1st deg burn abdomn wall	1
94214	1st deg burn back	1
94215	1st deg burn genitalia	1
94219	1st deg burn trunk NEC	1
94310	1st deg burn arm NOS	1
94311	1st deg burn forearm	1
94312	1st deg burn elbow	1
94313	1st deg burn upper arm	1
94315	1st deg burn shoulder	1
94319	1st deg burn arm-mult	1
94410	1st deg burn hand NOS	1
94411	1st deg burn finger	1
94412	1st deg burn thumb	1
94413	1st deg burn mult finger	1
94414	1 deg burn fingr w thumb	1
94415	1st deg burn palm	1
94416	1 deg burn back of hand	1
94417	1st deg burn wrist	1
94418	1st deg burn hand-mult	1
94510	1st deg burn leg NOS	1
94511	1st deg burn toe	1
94512	1st deg burn foot	1
94513	1st deg burn ankle	1
94514	1st deg burn lower leg	1
94515	1st deg burn knee	1

94516	1st deg burn thigh	1
94519	1st deg burn leg-mult	1
9461	1st deg burn mult site	1
9491	1st degree burn NOS	1

*** Unclassified dx's**

icd9	text_dx	BillingsUnclassified
112	CANDIDIASIS	1
1122	Candidias urogenital NEC	1
1123	Cutaneous candidiasis	1
1125	Disseminated candidiasis	1
11281	Candidal endocarditis	1
11282	Candidal otitis externa	1
11284	Candidal esophagitis	1
11285	Candidal enteritis	1
11289	Candidiasis site NEC	1
133	ACARIASIS	1
1338	Acariasis NEC	1
372	DISORDERS OF CONJUNCTIVA	1
37201	Serous conjunctivitis	1
37202	Ac follic conjunctivitis	1
37204	Pseudomemb conjunctivit	1
37205	Ac atopic conjunctivitis	1
3721	CHRONIC CONJUNCTIVITIS	1
37210	Chr conjunctivitis NOS	1
37213	Vernal conjunctivitis	1
37220	Blepharoconjunctivit NOS	1
37222	Contact blepharoconjunct	1
3723	CONJUNCTIVITIS NEC/NOS	1
37239	Conjunctivitis NEC	1
382	SUPPURATIVE/UNSPEC OTITIS MEDIA	1
38201	Ac supp OM w drum rupt	1
3821	Chr tubotympan suppur OM	1
3822	Chr atticoantral sup OM	1
3823	Chr sup otitis media NOS	1
3824	Suppur otitis media NOS	1
38302	Ac mastoiditis-compl NEC	1
4650	Acute laryngopharyngitis	1
466	AC BRONCHITIS/BRONCHIOL	1
472	CHR PHARYNG/NASOPHARYNG	1
4721	Chronic pharyngitis	1
473	CHRONIC SINUSITIS	1
4731	Chr frontal sinusitis	1
4732	Chr ethmoidal sinusitis	1
4733	Chr sphenoidal sinusitis	1
4738	Chronic sinusitis NEC	1
47400	Chronic tonsillitis	1
47410	Hypertrophy T and A	1
47411	Hypertrophy tonsils	1
47412	Hypertrophy adenoids	1
4748	Chr T & A dis NEC	1
4749	Chr T & A dis NOS	1
595	CYSTITIS	1
5951	Chr interstit cystitis	1
5952	Chronic cystitis NEC	1
5953	Trigonitis	1
59581	Cystitis cystica	1
59582	Irradiation cystitis	1
59589	Cystitis NEC	1
616	INFLAM DISEASE OF CERVIX, VAGINA, VULVA	1

6161	VAGINITIS AND VULVOVAGINITIS	1
V6700	Follow-up surgery NOS	1
V6709	Follow-up surgery NEC	1
V672	Chemotherapy follow-up	1
V674	FU exam treatd healed fx	1
V6751	High-risk rx NEC exam	1
V676	Comb treatment follow-up	1
V680	ISSUE MEDICAL CERTIFICAT	1
V682	Request expert evidence	1
V6889	Administrtve encount NEC	1
V689	Administrtve encount NOS	1
V700	Routine medical exam	1
V701	Psych exam-authority req	1
V702	Gen psychiatric exam NEC	1
V703	Med exam NEC-admin purp	1
V705	Health exam-group survey	1
V706	Health exam-pop survey	1
V707	Exam-clincal trial	1

. *** Alcohol-related dx's**

icd9	text_dx	BillingsAlcohol
V704	Exam-medicolegal reasons	1

Appendix C:
Methodological Note on Applying the Emergency Department Algorithm

The Emergency Department Algorithm (EDA) was developed by John Billings and colleagues as a tool to monitor access to care. As described in the original report by Billings et al.:

> If uninsured patients who cannot pay for treatment out-of-pocket are turned away by neighborhood clinics facing cost pressures, they will be forced to rely more on emergency departments for routine care. This would likely alter the diagnostic mix of uninsured patients in EDs, with less serious, nonemergent cases representing a greater share of the care provided. With an accurate gauge of this shift in ED utilization patterns, researchers would have a powerful tool to understand how changes in the health care delivery system are affecting low-income, uninsured patients. (2)

Several authors have pointed out limitations of the EDA when used for monitoring the safety net. (3, 4) However, application of the EDA becomes both conceptually and methodologically even more challenging when one attempts to use it for other purposes. Conceptually, the authors of the EDA point out:

> The algorithm is not intended as a triage tool or as a mechanism to determine whether ED use is appropriate for required reimbursement by a managed care plan. (2)

Methodologically, applying the algorithm to identify patients as not needing ED care is problematic because, as one author put it, "The algorithm categorizes populations, not visits." (4)

> Often, the studies that use the NYU model present it as a method of categorizing ED visits: visits are determined to be non-emergent or an emergent type, and a category's percentage is based on the number of visits assigned to it. But this is a misleading simplification of the methodology.
>
> The NYU algorithm actually assigns a set of four probabilities to each visit, one value for each emergent/non-emergent category, based on the primary diagnosis code. So, all visits with the same diagnosis code are assigned the same set of probabilities. The majority of visits are characterized by more than one non-zero probability. (4)

For example, the EDA may assign a given diagnoses (ICD-9 code) a 5% probability of being non-emergent, a 20% probability of requiring care within 12 hours but only requiring care that could be administered in a primary care office ("emergency, primary care treatable,"), a 30% probability of requiring an ED for a condition that might have been avoidable with

better primary care access, and a 20% probability of requiring an ED but not being preventable or avoidable. In our analyses, we have addressed the probabilistic approach of the EDA in two ways: (1) by considering all visits with non-zero probability of requiring the ED; and (2) by modeling the expected number of patients who would require the ED. To illustrate this second approach, if there were 1,000 patients with a given ICD-9 diagnosis and the EDA assigned this diagnosis a 30% probability of requiring ED care (either preventable with primary care or not), we would calculate that 1,000 x 30% = 300 patients would have required the ED.

An additional consideration with the EDA is the precision of its probability estimates. The SAS code used to assign probabilities contains 659 different diagnoses. In developing the EDA, 5,700 ED charts were reviewed. Therefore, the average number of clinical scenarios per diagnosis was 8.6. If, for instance, nine cases were reviewed for a given diagnosis, and four (44%) fell into the nonemergency category, the 95% confidence interval would range from 14% to 79%. (3) Because of this lack of precision in estimating probabilities for individual diagnoses, we do not report risk of needing the ED by individual diagnosis but only in the aggregate.

Finally, the EDA is sometimes applied incorrectly. The SAS lookup table includes probabilities that injury diagnoses fall into the four categories. However, the SAS programming code that accompanies this lookup table overrides those probabilities, classifying all injuries into a separate category. The programming code reflects that the clinicians who were involved in the EDA development were unable to agree on probabilities for injuries and mental health conditions. However, some programmers have simply used the lookup table – thereby assigning probabilities to diagnoses that the EDA developers intended to exclude.

Appendix D:
Proportion of Patient Visits with HCA-list Diagnoses and with Non-Zero Need for the ED, Based on the ED Algorithm

(Note: the denominator of 451,025 visits excludes HCA list diagnoses that were injuries, alcohol-related, or unclassified by the EDA and are considered by the EDA to be of indeterminate probability of requiring the ED. Another 15,416 visits led to hospital admission; the EDA excludes these cases as well.)

```
 Non-0 prob |
      of ED |
 needed per |
        EDA |      Freq.     Percent        Cum.
------------+-----------------------------------
         No |     78,807       17.47       17.47
        Yes |    372,218       82.53      100.00
------------+-----------------------------------
      Total |    451,025      100.00

.

-> tabulation of NeedED by age_cat

+--------------------+
| Key                |
|--------------------|
|     frequency      |
| column percentage  |
+--------------------+

Non-0 prob |
     of ED |
needed per |                           Age Category
       EDA |       0-1        2-9      10-17      18-39      40-64       >=65 |     Total
-----------+-------------------------------------------------------------------+----------
        No |     3,482      3,680      4,924     42,957     17,706      6,047 |    78,796
           |      8.74       7.70      17.47      22.53      16.30      16.83 |     17.47
-----------+-------------------------------------------------------------------+----------
       Yes |    36,352     44,104     23,261    147,675     90,928     29,891 |   372,211
           |     91.26      92.30      82.53      77.47      83.70      83.17 |     82.53
-----------+-------------------------------------------------------------------+----------
     Total |    39,834     47,784     28,185    190,632    108,634     35,938 |   451,007
           |    100.00     100.00     100.00     100.00     100.00     100.00 |    100.00
```

-> tabulation of NeedED by insurance_category2

```
+-------------------+
| Key               |
|-------------------|
|     frequency     |
| column percentage |
+-------------------+
```

Non-0 prob of ED needed per EDA	Auto	Commercia	Medicaid	Medicare	OHP	Other	Uninsured	Total
No	1,564	22,193	208	8,037	25,609	6,017	15,056	78,684
	30.36	15.40	16.75	15.62	16.73	33.69	19.46	17.47
Yes	3,587	121,916	1,034	43,414	127,498	11,841	62,302	371,592
	69.64	84.60	83.25	84.38	83.27	66.31	80.54	82.53
Total	5,151	144,109	1,242	51,451	153,107	17,858	77,358	450,276
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

.

. * Look specifically at visits by patients with OHP who are >= 65 years old

Non-0 prob of ED needed per EDA	Freq.	Percent	Cum.
No	33	14.86	14.86
Yes	189	85.14	100.00
Total	222	100.00	

Appendix E:
Return Visits after Discharge from the ED with an HCA List Diagnosis

% of patient visits with HCA diagnoses, who have another visit within 3 days

Visit within 3 days of index visit	Freq.	Percent	Cum.
No	762,816	95.84	95.84
Yes	33,125	4.16	100.00
Total	795,941	100.00	

By age

Key
frequency
row percentage

Age Category	Visit within 3 days of index visit: No	Yes	Total
0-1	43,686	1,655	45,341
	96.35	3.65	100.00
2-9	64,697	1,367	66,064
	97.93	2.07	100.00
10-17	66,239	1,397	67,636
	97.93	2.07	100.00
18-39	329,775	15,866	345,641
	95.41	4.59	100.00
40-64	189,544	9,445	198,989
	95.25	4.75	100.00
>=65	68,840	3,395	72,235
	95.30	4.70	100.00
Total	762,781	33,125	795,906
	95.84	4.16	100.00

By insurance type

Key
frequency
row percentage

insurance_category2	Visit within 3 days of index visit: No	Yes	Total
Auto	53,240	1,486	54,726
	97.28	2.72	100.00
Commercial	232,638	7,245	239,883
	96.98	3.02	100.00
Medicaid - Other Stat	1,531	105	1,636
	93.58	6.42	100.00
Medicare	87,248	5,381	92,629
	94.19	5.81	100.00
OHP	208,655	10,549	219,204
	95.19	4.81	100.00
Other	56,926	3,003	59,929
	94.99	5.01	100.00
Uninsured	121,363	5,304	126,667
	95.81	4.19	100.00
Total	761,601	33,073	794,674
	95.84	4.16	100.00

For patients age >= 65 on OHP:

Visit within 3 days of index visit	Freq.	Percent	Cum.
No	353	96.45	96.45
Yes	13	3.55	100.00
Total	366	100.00	

% of patient visits with HCA diagnoses, who have another visit within 30 days

Visit within 30 days of index visit	Freq.	Percent	Cum.
No	661,561	83.12	83.12
Yes	134,380	16.88	100.00
Total	795,941	100.00	

By age

Key
frequency
row percentage

Age Category	Visit within 30 days of index visit: No	Yes	Total
0-1	39,052	6,289	45,341
	86.13	13.87	100.00
2-9	61,095	4,969	66,064
	92.48	7.52	100.00
10-17	62,351	5,285	67,636
	92.19	7.81	100.00
18-39	279,176	66,465	345,641
	80.77	19.23	100.00
40-64	160,231	38,758	198,989
	80.52	19.48	100.00
>=65	59,621	12,614	72,235
	82.54	17.46	100.00
Total	661,526	134,380	795,906
	83.12	16.88	100.00

By insurance type

Key
frequency
row percentage

insurance_category2	Visit within 30 days of index visit: No	Yes	Total
Auto	48,774	5,952	54,726
	89.12	10.88	100.00
Commercial	214,553	25,330	239,883
	89.44	10.56	100.00
Medicaid - Other Stat	1,267	369	1,636
	77.44	22.56	100.00
Medicare	71,678	20,951	92,629
	77.38	22.62	100.00
OHP	169,980	49,224	219,204
	77.54	22.46	100.00
Other	49,331	10,598	59,929
	82.32	17.68	100.00
Uninsured	104,903	21,764	126,667
	82.82	17.18	100.00
Total	660,486	134,188	794,674
	83.11	16.89	100.00

For patients age >= 65 on OHP:

Visit within 30 days of index visit	Freq.	Percent	Cum.
No	315	86.07	86.07
Yes	51	13.93	100.00
Total	366	100.00	

Return visits requiring hospital admission

% of patient visits with HCA diagnoses, who are admitted on their next visit within 3 days

Visit within 3 days of index visit, with admission	Freq.	Percent	Cum.
No	774,026	99.57	99.57
Yes	3,336	0.43	100.00
Total	777,362	100.00	

By age

Key
frequency
row percentage

Age Category	Visit within 3 days of index visit, with admission: No	Yes	Total
0-1	44,810	121	44,931
	99.73	0.27	100.00
2-9	65,697	70	65,767
	99.89	0.11	100.00
10-17	67,269	76	67,345
	99.89	0.11	100.00
18-39	342,029	785	342,814
	99.77	0.23	100.00
40-64	194,094	942	195,036
	99.52	0.48	100.00
>=65	60,093	1,342	61,435
	97.82	2.18	100.00
Total	773,992	3,336	777,328
	99.57	0.43	100.00

By insurance type

Key
frequency
row percentage

insurance_category2	Visit within 3 days of index visit, with admission: No	Yes	Total
Auto	53,866	61	53,927
	99.89	0.11	100.00
Commercial	236,269	679	236,948
	99.71	0.29	100.00
Medicaid - Other Stat	1,608	9	1,617
	99.44	0.56	100.00
Medicare	79,690	1,576	81,266
	98.06	1.94	100.00
OHP	216,316	636	216,952
	99.71	0.29	100.00
Other	59,339	89	59,428
	99.85	0.15	100.00
Uninsured	125,693	274	125,967
	99.78	0.22	100.00
Total	772,781	3,324	776,105
	99.57	0.43	100.00

For patients age >= 65 on OHP:

Visit within 3 days of index visit, with admission	Freq.	Percent	Cum.
No	281	98.60	98.60
Yes	4	1.40	100.00
Total	285	100.00	

% of patient visits with HCA diagnoses, who are admitted on their next visit within 30 days

Visit within 30 days of index visit, with admission	Freq.	Percent	Cum.
No	767,716	98.76	98.76
Yes	9,646	1.24	100.00
Total	777,362	100.00	

By age

Key
frequency
row percentage

Age Category	Visit within 30 days of index visit, with admission: No	Yes	Total
0-1	44,645	286	44,931
	99.36	0.64	100.00
2-9	65,631	136	65,767
	99.79	0.21	100.00
10-17	67,154	191	67,345
	99.72	0.28	100.00
18-39	340,569	2,245	342,814
	99.35	0.65	100.00
40-64	192,114	2,922	195,036
	98.50	1.50	100.00
>=65	57,569	3,866	61,435
	93.71	6.29	100.00
Total	767,682	9,646	777,328
	98.76	1.24	100.00

By insurance type

Key
frequency
row percentage

insurance_category2	Visit within 30 days of index visit, with admission: No	Yes	Total
Auto	53,737	190	53,927
	99.65	0.35	100.00
Commercial	235,316	1,632	236,948
	99.31	0.69	100.00
Medicaid - Other Stat	1,603	14	1,617
	99.13	0.87	100.00
Medicare	76,615	4,651	81,266
	94.28	5.72	100.00
OHP	214,834	2,118	216,952
	99.02	0.98	100.00
Other	59,177	251	59,428
	99.58	0.42	100.00
Uninsured	125,207	760	125,967
	99.40	0.60	100.00
Total	766,489	9,616	776,105
	98.76	1.24	100.00

For patients age >= 65 on OHP:

Visit within 30 days of index visit, with admission	Freq.	Percent	Cum.
No	274	96.14	96.14
Yes	11	3.86	100.00
Total	285	100.00	

Appendix F:
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