Supplemental Digital Content for Geographic Disparities in Re-triage Destinations Among Seriously Injured Californians

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Supplementary Digital Content 8. Table 11. illustrates an annual summary on severely injured patients listed as transferred but not subsequently found in a second hospital.

Data management	Step	Processing logic	Total records
Pre-processing	1	Records from period 2009-2018 were collected	ED: 41224883
			IP: 7,439,260
	2	Unique records produced using all fields available	ED: 24,592,353
			IP: 4,036,917
Relevant ED record collection or starting point of the re-triage	3	ED records for patient of age 18-89 years old having valid record linkage number available AND RISS>15 AND presented to a non-trauma or level III/IV trauma centers with injury diagnosis defined by the ICD-9: 800-904.9, 910-939.0, and 950-959.9 or ICD-10: S00-T19, T33-T34, T79 codes AND discharge dispositions not 'Expired', 'Left against medical advice or discontinued care', or 'Discharged/Transferred to an Inpatient Rehabilitation Facility (IRF) including Rehabilitation Distinct Part Unit of a Hospital with a Planned Acute Care Hospital Inpatient Readmission'.	55,222
Denominator or universe of all relevant re- triages	4	Records after ED discharges where linked (using record linkage number) to inpatient admission record except for Emergency or Elective type inpatient admissions. Admissions up to 1 day after discharge were considered.	8,882
Numerator or sub-optimal re- triages	5	Records with inpatient destination being level III/IV trauma and non-trauma centers.	2,680

Supplemental Digital Content 1. Table 1. Data management is used to produce a universe of relevant re-triages and sub-optimal re-triages.

Supplemental Digital Content 2. Table 2. Annual counts of re-triages and under-triages in the California Department of Healthcare Access and Information (HCAI) ED and inpatient discharge datasets. Re-triages are identified according to the direction: from ED department of sending facility to the inpatient settings of receiving facility (ED-to-PDD) and between ED departments of different facilities (ED-to-ED).

Triago direction		Year												
Triage direction	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Total re-triages*:	226	487	518	653	698	640	896	838	1002	899	1003	1062	1307	1209
ED-to-PDD	218	464	486	618	669	609	856	804	959	830	935	954	1183	1083
ED-to-ED	8	23	32	35	29	31	40	34	43	69	68	108	124	126
Total under-	2474	2540	2924	2795	3025	2990	2853	3027	3243	3264	3509	5257	3373	3643
triages**														
Total triages	2692	3004	3410	3413	3694	3599	3709	3831	4202	4094	4444	6211	4556	4726

*Re-triage was defined as a patient with a RISS>15 who first visited a non-trauma or Level I/II trauma center, but was subsequently taken to another center.

**Under-triage was defined as any patient with an ISS>15 who was never taken to a Level I/II trauma center.

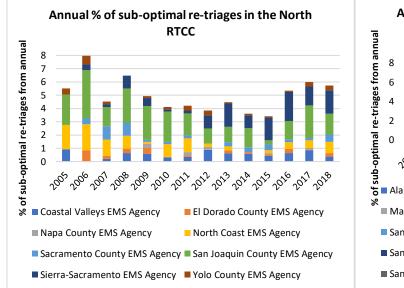
The under-triaged patients are patients that were never re-triaged from the original non-trauma or level III/IV trauma center.

	Re-triages	Sub-optimal	Optimal
Sending center location by LEMSA	N=8,882 (%)	re-triages N=2,680 (%)	re-triages N=6,202 (%)
	North Reg	ion	
Coastal Valleys	385 (4.3)	51 (1.9)	334 (5.4)
El Dorado County	40 (0.5)	15 (0.6)	25 (0.4)
Japa County	63 (0.7)	8 (0.3)	55 (0.9)
forCal	30 (0.3)	0 (0)	30 (0.5)
orth Coast	292 (3.3)	44 (1.6)	248 (4)
acramento County	113 (1.3)	24 (0.9)	89 (1.4)
an Joaquin County	352 (4)	139 (5.2)	213 (3.4)
ierra-Sacramento	570 (6.4)	113 (4.2)	457 (7.4)
Tolo County	37 (0.4)	20 (0.7)	17 (0.3)
	Bay Area Re	egion	
lameda County	471 (5.3)	201 (7.5)	270 (4.4)
ontra Costa County	475 (5.3)	89 (3.3)	386 (6.2)
Iarin County	59 (0.7)	55 (2.1)	4 (0.1)
lonterey County	47 (0.5)	15 (0.6)	32 (0.5)
an Benito County	36 (0.4)	6 (0.2)	30 (0.5)
inta Clara County	127 (1.4)	63 (2.4)	64 (1)
anta Cruz County	33 (0.4)	9 (0.3)	24 (0.4)
an Francisco County	108 (1.2)	65 (2.4)	43 (0.7)
an Mateo County	51 (0.6)	44 (1.6)	7 (0.1)
olano County	192 (2.2)	53 (2)	139 (2.2)
	Central Reg	gion	
entral California	1006 (11.3)	31 (1.2)	975 (15.7)
ern County	199 (2.2)	113 (4.2)	86 (1.4)
lerced County	175 (2)	2 (0.1)	173 (2.8)
ountain Valley	273 (3.1)	36 (1.3)	237 (3.8)
uolumne County	161 (1.8)	6 (0.2)	155 (2.5)
	South-East R	Region	
land Counties	525 (5.9)	108 (4)	417 (6.7)
nperial County	293 (3.3)	8 (0.3)	285 (4.6)
	2 98 (8.8)	0 (0.2)	200 (110

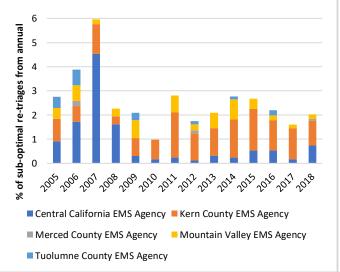
Supplemental Digital Content 3. Table 3. Re-triages by Sending Center LEMSA of Seriously Injured Patients in California from 2009-2018.

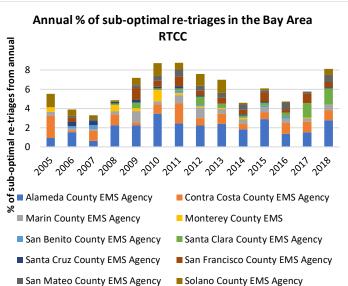
Riverside County	549 (6.2)	220 (8.2)	329 (5.3)
San Diego County	669 (7.5)	75 (2.8)	594 (9.6)
	South-West R	Region	
Los Angeles County	903 (10.2)	760 (28.4)	143 (2.3)
Orange County	326 (3.7)	107 (4)	219 (3.5)
San Luis Obispo County	165 (1.9)	145 (5.4)	20 (0.3)
Santa Barbara County	68 (0.8)	2 (0.1)	66 (1.1)
Ventura County	89 (1)	53 (2)	36 (0.6)

Supplemental Digital Content 4. Figure 1. Annual sub-optimal re-triages of Seriously Injured Patient in California from 2009-2019 in each local emergency medical services agencies (LEMSA)segregated by regional trauma coordination center (RTCC)

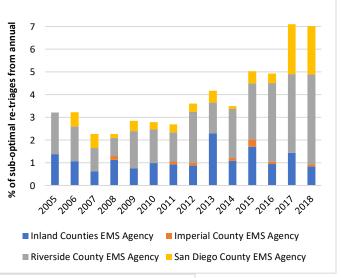


Annual % of sub-optimal re-triages in the Central RTCC

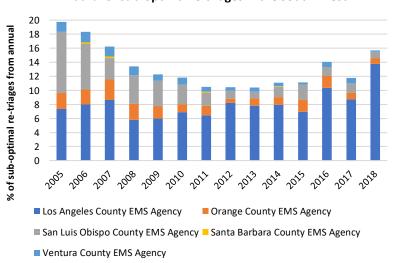




Annual % of sub-optimal re-triages in the South-East



Annual % of sub-optimal re-triages in the South-West



RTCC	The total population during 2009-2018, Average ± SD	The annual average number of Level I/II trauma centers	The annual average number of Level III/IV & non- trauma	Level I/II trauma centers per 1,000,000 residents	Level I/II trauma centers per 100 Level III/IV & non-trauma
North	$4,\!787,\!666 \pm 110,\!911$	6.0	85.5	1.25	7.0
Bay Area	$7,558,614 \pm 247,741$	6.4	85.3	0.85	7.5
Central	$3{,}541{,}876 \pm 93{,}750$	4.0	50.6	1.13	7.9
South-East	$7,\!793,\!012 \pm 241,\!303$	8.8	71.8	1.13	12.3
South-West	$14,\!708,\!537 \pm 290,\!637$	12.1	162.6	0.82	7.4

Supplemental Digital Content 5. Table 4. Capacity and demand of trauma care by RTCC.

Supplemental Digital Content 6. Table 5. The length of stay and discharge disposition in receiving center from sub-optimal versus optimal re-triaged seriously injured patients in California 2009-2018.

Do triogo	Total N	Length of stay, days				
Re-triage	Total N	Average ± Standard Deviation	Median (Interquartile Range)			
Sub-optimal	2677	11.2 ± 15.3	4 (1-13.5)			
Optimal	6205	16.2 ± 26.9	4 (1-15.5)			

Supplemental Digital Content 6. Table 6. Unadjusted rates of discharge disposition from sub-optimal versus optimal re-triaged seriously injured patients in California 2009-2018.

	Discharge disposition n(%)							
Re-triage	Total N	Home	Died	Short-term Acute Care Hospital	Post-acute care			
Sub-optimal	2680 (100)	1650 (61.6)	164 (6.1)	141 (5.3)	725 (27.1)			
Optimal	6202 (100)	3794 (61.2)	410 (6.6)	217 (3.5)	1781 (28.7)			

Supplemental Digital Content 6. Table 7. Odds ratio estimated (using logistic regression) for expected discharge disposition outcome after suboptimally re-triaged versus optimally re-triaged patients

Discharge Disposition of Re-triaged	Odds Ratio	Std Err	p-value	[95% Conf. Interval]
Home*	1.02	0.05	0.727	[0.93 - 1.12]
Died*	0.92	0.09	0.387	[0.76 - 1.11]
Short-term Acute Care Hospital*	1.53	0.17	<0.0001	[1.23 - 1.90]
Post-acute care*	0.92	0.05	0.110	[0.83- 1.02]

*See Supplemental Digital Content 6 Table 8 for the definition of the category.

Supplemental Digital Content 6. Table 8. Value sets used to group discharge disposition (disp) variable into categories.

Value sets for the period 2009-2014	Value sets for the period 2015-2018			
	Home			
12 = Home Health Service	01 = Discharged to home or self-care (routine discharge)			
01 = Routine (home)	06 = Discharged/transferred to home under the care of an organized home health service organization in anticipation of covered skilled care			
08 = Residential Care Facility	50 = Hospice - Home			
	51 = Hospice - Medical facility (certified) providing hospice level of care			
	81 = Discharged to home or self-care with a planned acute care hospital inpatient readmission 65 = Discharged/transferred to a psychiatric hospital or psychiatric distinct part unit of a hospital			

10 = Left Against Medical Advice	07 = Left against medical advice or discontinued care
09 = Prison/Jail	21 = Discharged/transferred to court/law enforcement
	43 = Discharged/transferred to a federal healthcare facility
	Died
11 = Died	20 = Expired
	Short-term Acue Hospital
02 = Acute Care within the admitting hospital	02 = Discharged/transferred to a short-term general hospital for inpatient care
05 = Acute Care at another hospital	82 = Discharged/transferred to a short-term general hospital for inpatient care with a planned acute care hospital inpatient readmission
	Post-acute care
06 = Other Care (not SN/IC) at another	90 = Discharged/transferred to an inpatient rehabilitation facility (IRF) including rehabilitation
hospital	distinct part unit of a hospital with a planned acute care hospital inpatient readmission
03 = Other Care within the admitting hospital	70 = Discharged/transferred to another type of health care institution not defined elsewhere in this code list
	04 = Discharged/transferred to a facility that provides custodial or supportive care (includes Intermediate Care Facility)
	05 = Discharged/transferred to a designated cancer center or children's hospital
	62 = Discharged/transferred to an inpatient rehabilitation facility (IRF) including a rehabilitation distinct part unit of a hospital
	63 = Discharged/transferred to a Medicare-certified long-term care hospital (LTCH)
	66 = Discharged/transferred to a Critical Access Hospital (CAH)
	61 = Discharged/transferred to a hospital-based Medicare-approved swing bed
07 = Skilled Nursing / Intermediate Care (SN/IC) at another facility	83 = Discharged/transferred to a skilled nursing facility (SNF) with Medicare certification with a planned acute care hospital inpatient readmission
04 = Skilled Nursing / Intermediate Care (SN/IC) within the admitting hospital	03 = Discharged/transferred to a skilled nursing facility (SNF) with Medicare certification in anticipation of skilled care
	64 = Discharged/transferred to a nursing facility certified under Medicaid (Medi-Cal), but not certified under Medicare

Supplementary Digital Content 7. Table 9. Re-admission after discharge from sub-optimal versus optimal re-triage destination among seriously injured patients in California 2009-2018.

		Re-admission, n (%)			
Survivor Re-admission	total N	<=10 days	<=30 days	<=60 days	
Sub-optimal	2584	168 (6.5)	273 (10.6)	326 (12.6)	
Optimal	5933	305 (5.1)	516 (8.7)	615 (10.4)	

Supplementary Digital Content 7. Table 10. Odds ratio estimated (using logistic regression) for re-admission after discharge from sub-optimal versus optimal re-triage destination among seriously injured patients in California 2009-2018.

Re-admission	Odds Ratio	Std Err	p-value	[95% Conf. Interval]
≤10 days	1.28	0.13	0.012	[1.06 - 1.56]
$\leq 30 \text{ days}$	1.24	0.10	0.006	[1.06 - 1.45]
≤60 days	1.25	0.09	0.002	[1.08 - 1.44]

Supplementary Digital Content 8. Table 11. Annual summary on severely injured patients listed as transferred but not subsequently found in a second hospital.

Year	Patients listed as transferred but not subsequently found in a second hospital
2009	202
2010	205
2011	233
2012	236
2013	236
2014	249
2015	216
2016	153
2017	390
2018	387