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Title
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Publication Date
2019

Characteristics and outcomes of geriatric patients who were screened through the Geriatric Emergency Nurse Initiative Expert (GENIE) risk screening and referral system

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Abstract. With a rapidly growing older adult population in the United States, the importance of age-appropriate care in the emergency department (ED) is becoming increasingly recognized. The University of California, San Diego (UCSD) La Jolla ED has adopted the use of a specialized health and welfare screening and referral system in its Senior Emergency Care Unit (SECU) to address the unique needs of older adult patients. Trained geriatric nurses screen patients and positive screens generate automatic referrals. Between December 1, 2016 and October 31, 2018 a total of 974 eligible patients were screened. Of these, 354 patients had one or more positive screens and received referrals. A retrospective chart review was used to examine clinical and demographic characteristics of patients to evaluate outcomes of the screening and referral system. Statistical analysis include: two sample t-tests to compare average age between groups; chi-square and likelihood ratio tests to compare demographic characteristics in patients who did and did not receive a referral, follow through with referrals, and return to the ED within 30-days; and logistic regression to asses if referral generation or follow-up predicted 30-day return to the ED. Patients receiving one or more referrals were older (M = 80, SD = 9.2) than those who did not receive any referrals [(M = 77, SD = 8.3), t(674) = 5.07, p<0.01] and patients who followed through with referrals were older (M = 81, SD = 9.2) than those who did not attend any referral follow-up [(M = 78, SD = 9.0), t(151) = 2.67, p<0.05]. Patients who were discharged received referrals at higher rates than expected compared to those who were admitted (χ^2 LR (13) 27.096, p=0.012) and patients reporting Black or African American race attended follow-up at lower than expected rates compared to patients reporting other races (χ^2 LR (6) =13.575, p= 0.035). Across all referrals, follow-up was less than 50% suggesting a need for quality improvement in the system.

1. Introduction

The population of older adults (over the age of 65) in the United States is growing rapidly and is projected to be greater than 70 million in 2030, up from 40 million in 2010. According to the CDC, in 2015, older adults accounted for 15% of Emergency Department (ED) visits. The proportion is projected to grow to 25% by 2020 (1,2). This rapid increase is likely to significant impact on the emergency care system. To prepare for these impacts it is necessary to consider special psychosocial and health needs of the population.

Relative to the general population, older adults use emergency services more frequently, their visits are more urgent, are longer, and patients are more likely to be admitted to the hospital. Furthermore, these patients are more likely to have adverse health outcomes after discharge and to have repeat ED visits (3). The American College of Emergency Physicians (ACEP), American Geriatrics Society (AGS), Emergency Nurses Association (ENA), and the Society for Academic Emergency Medicine (SAEM) collaborated to develop guidelines intended to improve ED geriatric care. These "Geriatric Emergency Department Guidelines" attempt to enhance expertise, education, quality improvement expectations; as well as ED equipment; policies; and protocols (4). One way this can be accomplished is through a separate geriatric area equipped to provide care for older adults. UCSD has adopted this model with plans to open a separate space for the SECU.

Given known risk factors associated with negative health outcomes for older adults (i.e. age, functional impairment, recent hospitalization or ED use, living alone, lack of social support), UCSD has developed the Geriatric Emergency Nurse Initiative Expert (GENIE) specialized risk screening tools and referral system to meet the unique needs of elderly patients. The GENIE screening and referral system aims to identify at-risk patients and, through referrals, implement interventions to address issues related to, and unrelated to, the acute issue that brought the patient to the ED. Screening for other health problems is particularly important given that frequent use of the ED by geriatric patients is associated with comorbid conditions (5).

An effective screening and referral system has the potential to decrease hospital visits and healthcare costs while improving quality of life and longevity of patients. Further studies are needed to determine the effectiveness of screening and intervention strategies for older patients (4). This study examines effectiveness of the GENIE screening and referral system in its initial implementation at the UCSD La Jolla ED and provides valuable information for quality improvement measures in the current screening and referral system. Statistical analysis is used to test the hypothesis that clinical characteristics/demographics including age, race, sex, financial coverage, arrival method, acuity level, and disposition are related to referral generation and referral follow-up. Further analysis is used to test the hypothesis that any referral or any follow-up predicts whether patients return to the hospital within 30-days (as a measure of outcome).

2. Methods

The first step in geriatric screening in the ED involves identifying patients. Eligible patients are 65+ years with an acuity of "urgent" who were seen in the SECU at the UCSD La Jolla ED from December 1, 2016 through October 31 2018. These patients are identified by the following criteria:

1. General identification of patients for geriatric screening = the ER Triage Nurse
   - All patients >/= 65 years old are eligible.
   - Emergency Severity Index (ESI) = 3.
   - At the discretion of the GENIE, primary RN or treating physician

2. More specific geriatric screening done by the Primary Care Nurse.
- Identification of Senior's at Risk, (ISAR). A screening tool to identify seniors with increased risk of adverse health outcomes or disabilities arriving in the ER. (Score of >/= 2 is positive.)
- Get up and Go, (GUG). Assesses mobility, balance, risk for fall. (Score of >/= 3 is at risk for falling.)
- If either one of the above geriatric screens are positive, the geriatric emergency nurse initiative expert (GENIE) is notified in EPIC to perform additional geriatric screens.

The geriatric screens used by geriatric emergency nurses at the UCSD La Jolla ED along with the automatic referrals generated are listed in table 1:

Table 1: Geriatric screens and referrals

Screen	Positive score and referral
Delirium = Ultra Brief 2, if positive then the CAM ICU	Delirium = positive score/ notify attending, primary care RN, and the rest of the geriatric team. Investigate for cause.
Depression = Patient Health Questionnaire (PHQ9)	Depression = Score of "10-19" possible referral outpatient senior behavioral health clinic, "20-27", psychiatry consult for major depression, S.I. or H.I. in the ER.
Dementia = Mini Cog, but for the sight impaired or seniors unable to draw the Blind Montreal Cognitive Assessment would be used.	Dementia = positive score/ referral to UCSD Memory Aging and Resilience Clinic (MARC) or Alzheimer's Clinic, or seniors primary care physician.
Medication Safety = UCSD Abbreviated Beers Criteria and the BEERS Criteria.	Medication Safety = Suspicion of polypharmacy or inappropriate medication/ referral UCSD pharmacist.
Activities of Daily Living = Katz Index	ADL's = Katz Index score >/=3. Inpatient or home health occupational therapy or physical therapy.
Agitation = Richmond Agitation and Sedation Scale (RASS)	Get Up and Go = Risk for Fall, referral to Physical Therapy consult in the ER and provide home health PT as needed.
Nutrition = Mini Nutritional Assessment (MNA)	Nutrition = MNA score 8-11 = Outpatient nutrition clinic. MNA score 0-7 = Inpatient nutrition consult. This is a STAT standing order for the GENIE to initiate.
Elder Abuse = Elder Abuse Suspicion Index (EASI)	Elder Abuse = positive -> referral to Social Work/Case Management
Caregiver Strain Evaluation = Modified Caregiver Strain Index (CSI)	Caregiver Strain = positive score 17 to 26 or if caregiver expresses need for help = referral for additional care/respite Case Manager or Social Work.
GENIE follow up calls to all screened seniors within 24-48 hours	No primary care physician = Referral to Medicine for Seniors UCSD Geriatrics / Provide a pathway for primary care.

Patient-level data for seniors 65+ who visited the UCSD La Jolla ED was obtained through the EPIC electronic medical records by a Structured Query Language (SQL) query or by chart review and included demographics, clinical data and return visits within 30 days. Demographics included age, gender, ethnicity/nationality, expected payer (self-pay, Medi-Cal/Medicare, commercial). Clinical variables collected include flow measures (arrival, treatment, leave ED dates and times), chief complaint, mode of arrival, acuity, risk and welfare screening results, and clinical care data (disposition). Referral data includes referrals made by the GENIE, if the patient completed the referral and if they returned to the ED within 30 days.

3. Data Analysis
Patients who received a GENIE consults were then grouped into those who got a referral versus those who did not, patients who completed their referrals versus those who did not, and patients who returned to the hospital in 30-days versus those who did not (30-day return to the ED is used as one indicator of patient outcome). Clinical and demographic differences are compared between groups.

Data collected as noted above were compared between groups using appropriate statistical analyses. T-tests and chi squared were used to test the hypothesis that clinical or demographic characteristics were related to patients being given referrals or attending follow-up. Logistic regression was used to test the hypothesis that any referrals or any follow-up predicted 30-day return. All data were collected from the medical record during the course of clinical care. There was no attempt to contact patients who received care at UCSD and no contact information was queried. Data analyses were performed in Microsoft Excel and SPSS.

4. Results
4.1. Overall patient population demographics and clinical characteristics
The study population (mean age = 78 (8.7), 71% white, 10% Asian, 13% other race or mixed race, <1 percent Black or African American, 44% male, 56% female) included 974 individuals. The clinical characteristics considered in the analyses are as follows: financial coverage (66% Medicare, 33% commercial insurance), means of arrival (71% automobile, 19% paramedic unit), acuity level (80% level 3, 15% level 2, 5% level 4), and disposition (66% discharged 33% admitted). The most common chief complaints were: 9.2% Falls, 9% weakness, 8% chest pain, 8% shortness of breath, and 8% abdominal pain. In 648 of the patients 30-day return could be assessed and 23% returned while 77% did not return. Values that occur in low frequencies and are of insignificant proportion of total are included in statistical analyses but are not reported in this section (additional values listed in Appendix 1).

4.2. Demographics and clinical characteristics by referral versus no-referral
Of the 974 patients who received a consult, 354 received 1 or more referrals (36%) and 620 received no referrals (64%). See tables 2 and 3 for demographic and clinical characteristics between groups (referral and no referral).

Table 2: Referral demographic characteristics

	Average Age	Race	Sex
Referral	80 (9.2)	251 white (71%), 31 Asian (9%), 48 other race or mixed race (13%)	150 male (42%), 204 female (58%)
No Referral	77 (8.3)	439 white (71%), 69 Asian (11%), 83 other race or mixed race (13%)	280 male (45%), 340 female (55%)

Table 3: Referral clinical characteristics

	Financial coverage	Arrival Method	Acuity level	Disposition
Referral	248 Medicare (70%), 102 commercial (29%)	237 automobile (67%), 79 paramedic unit (22%)	294 level 3 (83%), 50 level 2 (14%), 10 level 4 (3%)	230 discharged (65%), 95 admitted (27%)
No Referral	394 Medicare (64%), 219 commercial (35%)	461 automobile (74%), 106 paramedic unit (17%)	483 level 3 (78%), 98 level 2 (16%), 35 level 4 (6%)	364 discharged (59%), 230 admitted (37%)

Patients who were discharged received referrals at higher rates than expected compared to those who were admitted (χ^2 LR (13) 27.096, p=0.012). There was no significant correlations found between receiving a referral and: race (χ^2 LR (6) = 8.47, p = 0.206), sex (χ^2 (1, N = 974) = 0.711, p= 0.399), financial coverage (χ^2 LR (5) = 9.988, p= 0.076), arrival method (χ^2 LR (9) = 11.194, p= 0.263.), or acuity level (χ^2 LR (3) =6.254, p= 0.100). Patients receiving one or more referrals were older (M = 80, SD = 9.2) than those who did not receive any referrals [(M = 77, SD = 8.3), t(674) = 5.07, p<0.05]. A logistic regression test suggested that any referral was not predictive of 30-day return [B = 0.252, p = 0.181, OR = 1.29 (95% CI: 0.89, 1.86)].

4.3. Demographics and clinical characteristics by any follow-up versus no follow-up
Of 361 patients who had one or more referrals, 151 attended at least one follow-up (42%) and 200 patients attended no follow-up (58%). See tables 4 and 5 for demographic and clinical characteristics between the groups (follow-up and no follow-up).

Table 4: Follow-up demographic characteristics

	Average Age	Race	Sex
Follow-up	81 (9.2)	109 white (72%), 15 Asian (10%), 26 other race or mixed race (17%), 1 Black or African American (1%)	65 male (43%), 86 female (57%)
No Follow-up	78 (9.0)	146 white (69%), 17 Asian (8%), 25 other race or mixed race (12%), 19 Black or African American (10%)	89 male (42%), 122 female (58%)

Table 5: Follow-up clinical characteristics

	Financial coverage	Arrival Method	Acuity level	Disposition
Follow-up	109 Medicare (72%), 42 commercial (28%)	101 automobile (67%), 35 paramedic unit (17%)	133 level 3 (88%), 17 level 2 (11%), 1 level 4 (1%)	97 discharged (64%), 44 admitted (29%)
No Follow-up	142 Medicare (67%), 65 commercial (31%)	143 automobile (68%), 45 paramedic unit (21%)	167 level 3 (79%), 35 level 2 (17%), 9 level 4 (4%).	138 discharged (65%), 55 admitted (26%)

Patients reporting White, Asian, Other Race or Mixed Race followed up at or above the expected rate while patients reporting Black or African American race followed up at lower rates (χ^2 LR (6) = 13.575, p= 0.035). Patients of acuity level 3 were more likely to follow-up than patients with any other acuity level (χ^2 LR (3) = 12.78, p= 0.005). There was no significant correlations found between any follow-up and: sex (χ^2 (1, N = 974) = 0.088, p= 0.767), financial coverage (χ^2

LR (5) = 6.246, p= 0.283), means of arrival (χ^2 LR (9) = 7.044, p= 0.633), or disposition (χ^2 LR (13) = 13.287, p=0.426). Patients attending any follow-up were older (M = 81, SD = 9.2) than those who did not attend any follow-up (M = 78, SD = 9.0), t (151) = 2.67, p<0.01. A logistic regression test suggested that any follow-up was not predictive of 30-day return [*B* = 0.313, *p* = 0.191, OR = 1.37 (95% CI: 0.85, 2.18)].

4.4. Demographics and clinical characteristics by referral outcome (seen versus not seen)
Below, characteristics are compared between patients who were seen and patients who were not seen after being referred in the six separate referrals: MARC, nutrition, physical therapy, senior medicine, and senior behavioral health. Statistical analysis between groups in each referral is limited by small sample sizes.

4.4.1. Memory Aging and Resilience Clinic (MARC) Referrals
Of 106 patients referred to the MARC, 5 were seen (5%) and 101 were not seen (95%). For the 5 patients that were seen, the average number of days to follow-up appointment was 155 days. See tables 6 and 7 for demographic and clinical characteristics between the groups (seen and not seen). The relationship between MARC follow-up and 30-day return was found to be insignificant (χ^2 LR (1) = 0.163, p= 0.686).

Table 6: MARC referral demographic characteristics

	Average Age	**Race**	**Sex**
Seen	80 (SD=7.2)	4 white (80%), 0 Asian (0%), 1other race or mixed race (20%)	2 male (40%), 3 female (60%)
Not Seen	80 (SD=8.8)	64 white (63%), 12 Asian (12%), 13 other race or mixed race (13%)	46 male (46%), 55 female (54%)

Table 7: MARC referral clinical characteristics

	Financial coverage	**Arrival Method**	**Acuity level**	**Disposition**
Seen	3 Medicare (60%), 2 commercial (40%)	3 patients automobile (60%), 2 patients paramedic unit (40%)	5 level 3 (100%), 0 level 2 (0%), 0 level 4 (0%)	5 discharged (0%), 0 admitted (0%)
Not Seen	69 Medicare (68%), 32 commercial (32%)	73 automobile (62%), 17 patients paramedic unit (14%)	81 level 3, (80%), 18 level 2 (18%), 35 level 4 (2%)	68 discharged (67%), 24 admitted (24%)

4.4.2. Nutrition Referrals
Of 40 patients referred to the UCSD nutrition clinic, 5 were seen (12.5%) and 35 were not seen (87.5%). For the 5 patients that were seen, the average number of days to follow-up appointment was 28 days. See tables 8 and 9 for demographic and clinical characteristics between the groups (seen and not seen). The relationship between nutrition follow-up and 30-day return was found to be insignificant (χ^2 LR (1) = 0.688, p= 0.407).

Table 8: Nutrition referral demographic characteristics

	Average Age	**Race**	**Sex**
Seen	79.4 (12.6)	1 white (20%), 1 Asian (20%), 3 other race or mixed race (60%).	1 male (20%), 4 female (80%)

Not Seen	76 (8.3)	26 white (74%), 4 Asian (11%), 3 other race or mixed race (9%).	19 male (54%), 16 female (46%)

Table 9: Nutrition referral clinical characteristics

	Financial coverage	**Arrival Method**	**Acuity level**	**Disposition**
Seen	4 Medicare (80%), 1 commercial (20%)	4 automobile (80%), 1paramedic unit (20%)	4 level 3 (80%), 1 level 2 (20%), 0 level 4 (0%)	5 discharged (100%), 0 admitted (0%)
Not Seen	25 Medicare (71%), 9 commercial (26%).	23 automobile (66%), 8 paramedic unit (23%)	30 level 3 (86%), 5 level 2 (14%), 0 level 4 (0%)	16 discharged (84%), 3 admitted (16%)

4.4.3. Physical Therapy Referrals

Of 6 patients referred to physical therapy, 2 were seen (33%) and 4 were not seen (77%). For the 2 patients that were seen, the average number of days to follow-up appointment was 15 days. See tables 10 and 11 for demographic and clinical characteristics between the groups (seen and not seen). The relationship between physical therapy follow-up and 30-day return was found to be insignificant (χ^2 LR (1) = 0.505, p= 0.477).

Table 10: Physical therapy referral demographic characteristics

	Average Age	**Race**	**Sex**
Seen	79.4 (12.6)	1 was white (50%), 1 were Asian (50%), 0 reported other race or mixed race (0%).	1 was male (50%) and 1 was female (50%)
Not Seen	70 (7.1)	3 were white (74%), 1 was Asian (25%), 0 reported other race or mixed race (0%).	1 were male (25%) and 3 were female (75%)

Table 11: Physical therapy referral clinical characteristics

	Financial coverage	**Arrival Method**	**Acuity level**	**Disposition**
Seen	1 Medicare (50%), 1 commercial (50%).	42 automobile (100%), 0 paramedic unit (0%)	3 level 3 (75%), 0 level 2 (0%), 1 level 4 (25%)	1 discharged (50%), 1 was admitted (50%)
Not Seen	2 Medicare (50%), 2 commercial insurance (50%).	4 automobile (100%), 0 paramedic unit (0%)	2 level 3 (100%), 0 level 2 (0%), 0 level 4 (0%)	4 discharged (100%), 0 were admitted (0%)

4.4.4. Senior Medicine Referrals:

Of 11 patients referred to senior medicine, 4 were seen (36%) and 7 were not seen (64%). For the 4 patients that were seen, the average number of days to the follow-up appointment was 119 days. See tables 12 and 13 for demographic and clinical characteristics between the groups (seen and not seen). The relationship between senior medicine follow-up and 30-day return was found to be insignificant (χ^2 LR (1) = 1.243, p= 0.265).

Table 12: Senior medicine referral demographic characteristics

	Average Age	**Race**	**Sex**

Seen	80 (9.0)	3 white (75%), 0 Asian (20%), 0 other race or mixed race (0%), 1 Black or African American (25%)		2 male (50%) 2 female (50%)
Not Seen	77 (8.5)	3 white (43%), 0 Asian (0%), 0 other race or mixed race (0%) and 3 Black or African American (43%).		1 male (14%), 6 female (86%)

Table 13: Senior medicine referral clinical characteristics

	Financial coverage	Arrival Method	Acuity level	Disposition
Seen	2 Medicare (50%), 2 commercial (50%)	3 by automobile (75%), 1 paramedic unit (25%)	4 level 3 (100%), 0 level 2 (0%), 0 level 4 (0%)	3 discharged (75%), 1 admitted (25%)
Not Seen	4 Medicare (57%), 3 commercial (43%).	7 automobile (100%), 0 paramedic unit (0%)	6 level 3 (86%), 1 level 2 (14%), 0 level 4 (0%)	4 discharged (57%), 3 admitted (43%)

4.4.5. Home Health Referrals

Of 287 patients referred to the home health, 130 were seen (45%) and 5 were not seen (2%) and follow-up was unable to be assessed by chart review for 152 patients (53%). See tables 14 and 15 for demographic and clinical characteristics between the groups (seen and not seen). The relationship between home health follow-up and 30-day return was found to be insignificant (χ^2 LR (2) = 4.156, p= 0.105).

Table 14: Home health referral demographic characteristics

	Average Age	Race	Sex
Seen	82 (9.0)	96 white (74%), 13 Asian (10%), 21other race or mixed race (16%), 0 black or African American (0%)	57 male (44%), 73 female (56%)
Not Seen	79 (8.3)	2 white (40%), 1 Asian (20%), 1 other race or mixed race (20%)	1 male (20%), 4 female (80%)
Unable to Assess	78 (9.2)	114 white (75%), 7 Asian (5%), 16 other race or mixed race (11%), 14 black or African American (9%)	64 male (42%), 88 female (58%)

Table 15: Home health referral clinical characteristics

	Financial coverage	Arrival Method	Acuity level	Disposition
Seen	98 Medicare (75%), 32 commercial (25%).	83 automobile (64%), 32 paramedic unit (25%)	114 level 3 (88%), 15 level 2 (11%), 1 level 4 (1%)	81 discharged (62%), 39 admitted (30%)
Not Seen	0 Medicare (0%), 5 commercial (100%)	3 automobile (60%), 0 paramedic unit (0%)	2 level 3 (40%), 2 level 2 (40%), 1 level 4 (20%)	4 discharged (80%), 1 admitted (20%)
Unable to Assess	106 Medicare (70%), 42 commercial (28%)	95 automobile (63%), 39 paramedic unit (26%)	119 level 3 (78%), 27 level 2 (18%), 6 level 4 (4%)	4 discharged (62%), 1 admitted (28%)

4.4.6. Senior Behavioral Health Referrals
One patient was referred to Senior Behavioral Health and was not seen (100%): the individual characteristics are as follows: age: 79; race: white; sex: female; financial coverage: Medicare; arrival method: automobile; acuity level: 3; disposition: discharged; 30-day return: no.

5. Discussion
With a growing older adult population in the United States that is more likely to have frequent healthcare contact and subsequent adverse health outcomes than the general population (3), it is of vital importance to find tools to mitigate risk and ensure that older adult patients have appropriate follow-up care when they leave the hospital. The ED is an ideal setting to take steps towards preventing return ED visits while ensuring that older adults are safe and healthy outside of the emergent issue that brought them to the ED. This study is able to provide important information about the initial implementation of the GENIE screening and referral system at the UCSD La Jolla ED. It provides information about the effectiveness of the system in different subsets of patients.

Through retrospective chart review, we found that across all referrals, follow-up was less than 50% suggesting a need for quality improvement in the system for all patients regardless of clinical or demographic characteristics. When clinical and demographic differences were considered between groups few correlations were found to be statistically significant and neither generation of a referral nor follow-up was predictive of return to the ED within 30-days. Significant correlations that were found in sub-groups include 1) older age and increased rates of both receiving a referral and following through with a referral 2) patients whose had a disposition of discharged and increased rates of receiving a referral and 3) reported race of Black or African American and decreased rates of follow-up. These results suggest that younger geriatric patients and Black and African American patients may benefit from additional support in ensuring completion of referrals.

The study has several limitations including: small sample sizes in each individual referral groups and unavailable data for 30-day follow-up in 326 patients. Additionally, because home health companies do not use the same electronic medical record as UCSD, we could not assess patient follow-up for home health referrals in 152 patients. Retrospective chart review has the potential for numerous sources of bias when information is transferred from the patient to the provider, from the provider to the medical record, and when it's abstracted from the medical record for its use in research.

Given low rates of follow-up in the GENIE screening and referral system, quality improvement measures are needed to ensure that more patients attend follow-up. Ways to improve referral follow-up in the future may include: better post-visit GENIE contact by telephone, email, or text reminders; clearer discharge instructions to patients; more thorough provider debriefing before leaving the ED; and easier and convenient access and transportation to speciality care. Pending improvements in the screening and referral system, extension to other EDs and to the general population may be considered. Other areas to be explored in the future include geriatric screening and its relationship to the medical system (i.e. costs, overcrowding, over-utilization), longevity and well-being of patients, and overall reduction of disease burden.

6. References:

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Appendix 1

Table 15: Low frequency values included in statistical analysis but listed above

Characteristics	Other values
Reported races	Unknown, American Indian or Alaska Native, Native Hawaiian or Other Pacific Islander
Financial coverage	Medicaid, other government, self-pay, workers compensation
Arrival methods	Basic/BLS ambulance, walk-in, other, private ambulance, critical care transport, taxi, public transportation, police custody
Dispositions	Send to trauma, transfer to acute rehab facility, transfer to SNF, discharge to home health, discharge home health to hospice, AMA, admit to psych, eloped with decisional making capacity, transfer to another facility, LWBS after triage, admit to OR
Acuity level	Level 1