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The Found Down Patient: A Western Trauma Association Multicenter Study

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Structured Abstract

Background—Unconscious patients who present after being “found down” represent a unique triage challenge. These patients are selected for either trauma or medical evaluation based on

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limited information, and have been shown in a single-center study to have significant occult injuries and/or missed medical diagnoses. We sought to further characterize this population in a multicenter study, and to identify predictors of mistriage.

Methods—The Western Trauma Association Multicenter Trials Committee conducted a retrospective study of patients categorized as "found down" by ED triage diagnosis at 7 major trauma centers. Demographic, clinical and outcome data were collected. Mistriage was defined as patients being admitted to a non-triage-activated service. Logistic regression was used to assess predictors of specified outcomes.

Results—Of 661 patients, 33% were triaged to trauma evaluations, and 67% were triaged to medical evaluations; 56% of all patients had traumatic injuries. Trauma-triaged patients had significantly higher rates of combined injury and a medical diagnosis, and underwent more CT imaging; they had lower rates of intoxication and homelessness. Among the 432 admitted patients, 17% of them were initially mistriaged. Even among properly-triaged patients, 23% required cross-consultation from the non-triage-activated service after admission. Age was an independent predictor of mistriage, with a doubling of the rate for age groups over 70. Combined medical diagnosis and injury was also predictive of mistriage. Mistriaged patients had a trend toward increased late-identified injuries, but mistriage was not associated with increased length of stay or mortality.

Conclusions—Patients who are "found down" experience significant rates of mistriage and triage discordance requiring cross-consultation. Though the majority of "found down" patients are triaged to non-trauma evaluation, over half have traumatic injuries. Characteristics associated with increased rates of mistriage, including advanced age, may be used to improve resource utilization and minimize missed injury in this vulnerable patient population.

Study Type—Epidemiological study. Type III.

Keywords

Found down; triage; mistriage; trauma systems

Background

When a patient is discovered unresponsive with no clear etiology, they are often given the emergency department triage diagnosis of "found down." This scenario presents a set of unique challenges to the prehospital care provider, the emergency room physician, the surgical and medical consultants, and the health system as a whole. Utilizing resources effectively and efficiently to provide appropriate care for these patients, in the absence of a history of present illness or known mechanism, can be exceedingly difficult. Given the paucity of information available at time of triage, medical patients may be inappropriately triaged to trauma service activation, and injured patients may be triaged to medical services. Potential delays in diagnosis may lead to poor outcomes in this population.

In a previous study performed at a single urban trauma center, "found down" patients were shown to have increased rates of homelessness, prior emergency department (ED) visits, psychiatric diagnoses, and alcohol and substance abuse (1). Regardless of whether patients were initially triaged for a medical or trauma evaluation, nearly half the cohort had traumatic

injuries. Significant rates of triage discordance were noted, wherein patients initially triaged to a medical service required consultation from a trauma service, or vice versa; late-identified injuries and medical diagnoses also occurred at a significant rate. However, limited numbers and the single-center nature of the study precluded a more comprehensive assessment of triage practices, including any analysis of predictors of resource use and outcomes.

Following upon this initial demographic exploration of the “found-down” population, and in order to better describe this cohort across regional and demographic boundaries, the Western Trauma Association Multicenter Trials group conducted a study at major trauma centers across the United States. The goals of this study were to more rigorously describe this minimally characterized population, to assess trends in triage discordance and resource utilization, and to identify predictors of mistriage and clinical outcomes. A secondary goal was to assess the adequacy of current triage protocols for identifying traumatic injuries and urgent medical diagnoses. Our ultimate aim in undertaking this study was to identify potential improvements in triage, diagnosis, and care of this vulnerable patient population.

Methods

The Western Trauma Association Multicenter Trials Group performed a retrospective cohort study of patients who presented as “found down” at seven U.S. trauma centers. Institutional review board approval was obtained from the University of California San Francisco and at all contributing sites. Patients with an ED triage diagnosis of “found down” were identified at each site, as were patients with potentially related diagnoses, including altered mental status, intoxication, unresponsive, fall, syncope, cardiac arrest, and post arrest. Study coordinators at the respective sites then confirmed the “found down” diagnosis by reviewing the medical record, based on the physician's initial and final assessments. Patients were included in the study if they were clearly identified as initially found unconscious, with no clear mechanism of injury nor reliably witnessed account of precipitating events at the time of ED arrival. At all centers, triage decisions for medical versus trauma activation were made by triage nursing staff using available information, with no predetermined protocol. For these selected patients, prehospital and hospital paper charts were reviewed, as were electronic medical record documents, in order to collect demographic, clinical, and outcomes data. Late-identified diagnoses were defined as medical diagnoses made following admission from the ED; late-identified injuries were defined as traumatic injuries identified following admission from the ED. Patients younger than 18 years of age and incarcerated patients were excluded.

All data are presented as mean (SD), median (interquartile range [IQR]), or percentage. Percentages are calculated out of subgroup total (N) for each subgroup analysis. Univariate comparisons were made using Student's t test for normally distributed data, Wilcoxon rank-sum testing for skewed data, and Fisher's exact test for proportions. Regression analysis was performed to assess predictors of specified outcomes, including mistriage, late-identified injuries, late medical diagnoses, and mortality. In assessing triage as a screening test for identifying injury, trauma activation with true injury was defined as true positive, medical activation with true injury was defined as false negative, trauma activation with no injury

was defined as false positive, and medical activation with no injury was defined as true negative. For triage as a screening test for identifying medical diagnosis, medical activation with true medical diagnosis was defined as true positive, trauma activation with true medical diagnosis was defined as false negative, medical activation with no medical diagnosis was defined as false positive, and trauma activation with no medical diagnosis was defined as true negative. An [alpha] of 0.05 was considered significant. All data analysis was conducted by the authors using Stata version 12 (StataCorp, College Station, TX).

Results

A total of 661 “found down” patients were identified across 7 trauma centers during the study period. Mean age was 53.8 years, and the majority of these patients were men (458 patients, 69.3%). Prior ED visits (313 patients, 47.4%) and homelessness (140 patients, 21.2%) were common, as were prior psychiatric history (26%) and alcohol and substance intoxication (33% and 18.9%, respectively). A significant proportion of patients were uninsured (28%). Though 35.4% of patients had signs of injury identified in the field by EMS personnel, over half (56.1%) of the cohort actually had traumatic injuries identified in the ED. 28 patients (2.7%) were taken from the ED immediately to the operating room for emergent interventions. Nearly three-fourths of the patients had computed tomography (CT) scan performed in the ED (Table 1).

Of note, nearly half of these “found down” patients had both a medical diagnosis and a traumatic injury. The rate of cross-consultation, defined as non-triage-activated service being consulted during the index admission (eg medicine consulted for a trauma-triaged patient, or surgical services consulted for a medical-triaged patient) was 13.1% (87 patients). Of note, this consultation occurred following patient admission from the ED. Mistriage, defined as admission to a non-triage-activated service (eg, trauma-activated patient admitted to medicine), was found in 75 patients (11.4%). Thus, one-quarter of patients (162 patients, 24.5%) experienced some form of triage discordance, be it cross-consultation or mistriage.

The majority of patients in the cohort required hospital admission, with a median hospital stay of 3 days. Median ICU stay was 2 days among those admitted. Late-identified medical diagnoses were identified in 65 patients (9.8%), and late-identified injuries were identified in 40 patients (6.1%). Overall, 117 patients died in the cohort, for a mortality rate of 17.7%.

Analyzing the cohort by activation type, 218 patients (33%) were triaged to a trauma activation, while the other 443 patients (67%) were triaged to a medical activation. These two groups did not differ significantly with respect to age or gender, but the trauma-activated group had significantly lower rates of homelessness, prior ED visits, and intoxication (Table 2). Interestingly, trauma-activated patients had much higher rates of combined medical diagnosis and injury (70.6%, vs. 37.7% in medical-activated patients, $p<0.001$). A higher percentage of trauma-activated patients had CT scan performed in the ED (95.9%, vs. 63.4% in medical-activated patients, $p<0.001$).

The two activation groups differed significantly in hospital course and outcomes: trauma-activated patients were more frequently admitted to the hospital (77.5%, vs. 59.4% in

medical-activated patients, $p<0.001$). As shown in Table 2, 14.7% of trauma-activated patients required consultation from a medical service, and 12.4% of medical-activated patients required surgical consultation during the index admission. With regard to initial mistriage, 61 trauma-activated patients (28%) were ultimately admitted to a medical service, whereas only 14 medical-activated patients were admitted to surgical services (3.2%, $p<0.001$). Though a larger percentage of trauma-activated patients were admitted overall, median hospital and intensive care unit (ICU) days among admitted patients did not differ by initial activation type. Trauma-activated patients had a higher rate of mechanical ventilation (44.5% vs. 34.5% in medical-activated patients, $p=0.001$), but the medical-activated patients who required mechanical ventilation tended to remain on the ventilator longer, as shown by median ventilator-free days (17 days in medical-activated patients vs. 25 days in trauma-activated patients, $p=0.010$). Late-identified injuries were more frequent in the trauma-activated patients, late medical diagnoses were more frequent in the medical-activated patients, and rates of mortality in the ED and overall were similar (Table 2).

In order to characterize mistriage, or initial triage activation that resulted in admission to a different type of service (medical vs. surgical), we analyzed the subset of mistriaged patients as compared to “properly triaged” patients. As illustrated in Table 3, these patients tended to be older, with lower rates of prior ED visitation and intoxication. Signs of trauma identified by EMS were more common in mistriaged patients, as was the combination of injury and medical diagnosis. Every mistriaged patient received a CT scan. Mistriaged patients did not have significantly increased length of hospitalization or ICU stay, were less likely to be mechanically ventilated, and had no significant difference in length of mechanical ventilation. Though there was a trend toward increased late-identified injuries in mistriaged patients (14.7% vs. 7.9% in “properly triaged” patients, $p=0.076$), mortality was nearly identical.

In an effort to better understand the phenomenon of mistriage, this subset of patients was divided by mistriage “direction”, be it trauma activation admitted to a medical service, or medical activation admitted to a surgical service. As noted, substantially more patients were admitted to medical services after trauma activation (61 patients) than were admitted to surgical services following medical activation (14 patients). As demonstrated in Supplemental Digital Content Table 1, these two groups did not differ significantly with respect to age or gender, but the medical-activated patients subsequently admitted to surgical services did have higher rates of homelessness, prior ED visitation, and intoxication. No significant differences in outcomes were identified between the groups; mortality was numerically higher in the medical-activated patients admitted to surgical services (28.6% vs. 19.7%), but this did not reach statistical significance.

To assess predictors of mistriage in this cohort, logistic regression analyses were performed utilizing variables that were significantly different between mistriaged patients and “properly” triaged patients. Following univariate analysis, a multiple logistic regression model was developed to identify independent predictors of mistriage, as demonstrated in Table 4. Age was a significant independent predictor of mistriage, with odds increasing over 40% with every 10-year increase in age. EMS-identified signs of trauma was also an

independent predictor of mistriage, with combined injury and medical diagnosis the strongest predictor of mistriage (OR 3.42, 95% CI 1.51 - 7.73, $p<0.001$).

Given the strength of the association between age and mistriage, the cohort was divided into age groups by decade. As seen in Figure 1, the rate of mistriage was steadily under 15% for all decades up to 70 years old, at which point it more than doubled for older age groups.

Regression analysis was also performed to explore the relationship between mistriage and late-identified injuries and diagnoses; initial mistriage was not a significant predictor of either late-identified traumatic injury or medical diagnosis in both univariate and multiple logistic regression (data not shown). Mistriage was also not a significant predictor of mortality in logistic regression analysis.

As a final analysis, triage was treated as a screening test for traumatic injury and medical diagnosis, respectively. The results are depicted in Table 5, wherein trauma activation had a poor sensitivity (51%) but a high specificity (92%) for traumatic injury, with a positive predictive value (PPV) of 89% and a negative predictive value (NPV) of 58%. Medical activation had a moderate sensitivity (71%) and specificity (70%) for medical diagnosis, with higher PPV (95%) and considerably lower NPV (20%) than trauma activation.

Discussion

Patients found unresponsive with unknown mechanism of injury and unclear medical history represent a conundrum for effective triage and resource mobilization. Triage decisions are by necessity made with limited information, including the nature of the 911 emergency call, field location, patient appearance, and prehospital EMS evaluation and required treatment. These decisions are often made without a clear protocol in place, and may lead to critical delays in care for a complex mixed population of both trauma and medical patients. The basic demography of this population and the effectiveness of current triage practices remain largely uncharacterized.

Acute care surgeons are often involved in the evaluation and care of such “found down” patients, but little previous literature exists to guide them. To be sure, general triage strategies for identifying critically injured patients have been carefully developed and validated with the emergence of trauma systems in the United States (2, 3); in this context, effective triage has been shown to significantly impact patient outcomes (4). However, the optimal approach to a patient with unknown mechanism of injury remains undefined. In one prior study, among those with reportedly “insignificant” injuries including those “found down”, nearly one third of patients had significant injuries requiring surgical treatment (5). While prehospital emergency care research has indicated certain “field” predictors of the need for acute care interventions, these rely heavily on patient-provided history or witness accounts (6). Emergency medicine protocols exist for the evaluation of common presentations such as coma due to intoxication (7) and altered mental status (8, 9). Triage protocols have also been developed to identify specific high-risk patients, including those with a presentation of syncope of unknown etiology (10); similar protocols have been developed to identify patients at high risk of occult traumatic brain injury (11). Nonetheless,

prior to our initial single-center study of “found down” patients (1), no focused investigation of this population has been reported.

In this study, the first multicenter investigation focused on the “found down” patient population, we found that such patients represent a complex mix of both injured and medically ill patients. Though the majority (67%) of patients were triaged to a medical activation, over half (56.1%) of these patients experienced a traumatic injury. There were no differences in age, gender, or mortality based on triage-activation type; however, trauma-triaged patients had significantly higher rates of combined injury with medical diagnosis, and underwent more CT imaging. Trauma-triaged patients had lower rates of intoxication and homelessness. Nearly half (47.7%) of the patients had some combination of injury and medical diagnosis, underscoring the complexity of the cohort and the significant challenge for directing most appropriate triage activation. Accordingly, one in four patients experienced some form of triage discordance, be it mistriage requiring admission to the non-activated service (medical vs. surgical), or cross-consultation from the non-activated service. Resource utilization was thus high in terms of personnel and clinician involvement, but was also high in terms of diagnostic testing modalities – 74.1% of patients had a CT scan performed, and all mistriaged patients had CT. Late-identified injuries (6.1%) and late-identified medical diagnoses (9.8%) occurred at a significant rate.

The rate of triage discordance seen in this population is remarkable, but may be explained in several ways. Mistriage may well be related to the fact that triage decisions are often made on a case-by-case minimally-protocolled basis, utilizing limited information from prehospital providers. Perhaps just as importantly, nearly half of the patients in this cohort had some combination of injury and medical diagnosis; thus “mistriage” and triage “discordance” may be somewhat misnomers, in that a large proportion of this population actually has a complex presentation requiring evaluation and treatment by both medical and surgical providers.

Though mortality was not increased in the mistriaged patients, they did show a trend toward increased rate of late-identified injury. Our analysis did not demonstrate a significant association between mistriage and major adverse outcomes and mortality, but this must be understood in the context of a moderate-sized cohort with limited power with respect to less frequent outcomes; to interpret these negative findings as proof of no association between mistriage and adverse outcomes would likely represent a type 2 error. In this sense, the trends found in this study may be important despite not reaching statistical significance: increased late-identified injury rate in mistriaged patients represents a significant concern, as does the increased mortality in those mistriaged to medical activation but admitted to surgical services (28.6% vs. 19.7%, $p>0.05$).

Age, field signs of trauma, and combined injury and medical diagnosis were all independent predictors of mistriage. The latter two variables are likely related, in that patients with medical diagnoses who also have injuries (and signs thereof) may be triaged to trauma activation initially. The effect of age, and the alarming increase in mistriage rate at age 70, as represented in Figure 1, represents an area of possible intervention and future study: based on these findings we submit that in persons of advanced age “found down,” a

multidisciplinary approach is warranted. Prior trauma literature has indicated that triage protocols, even for patients with known mechanism of injury, have decreasing effectiveness in the elderly (12, 13), and that undertriage is correlated to worse outcomes in older patients (14). Given the high rate of mistriage seen in age groups over 70, activating both medical and trauma practitioners to provide the initial assessment of these patients could lead to decreased rates of missed injury and medical diagnoses, and thereby prevent potentially harmful delays in diagnosis and treatment. Indeed, such recommendations have been made in the past, in trauma studies that identified increased morbidity and mortality in patients over 70 (15, 16). These studies and our own findings lead us to recommend that the trauma service be activated for the evaluation and management of “found down” patients over 70 years of age upon arrival at the ED.

By treating triage as a screening test for both injury and medical diagnosis, we were able to assess the sensitivity and specificity of our current triage practices, as well as the predictive value of “positive” tests, or activations to a particular service (medical vs. trauma). The results are likely representative of the fact that many patients had *both* medical diagnoses and injuries, and thus positive predictive values are high in both analyses. The limited sensitivity and negative predictive values should be taken as cautionary regarding our current ability to appropriately differentiate between medical and surgical diagnoses in the “found down” patient. That limitation may well be inherent to the difficult nature of triage in this particular population, and thus may not change significantly with changes in pre-hospital triage protocols; this further underscores the importance of sufficient mobilization of resources and personnel when such patients do arrive at the hospital, e.g. trauma activation for elderly patients found down from unknown etiology.

The main strength of this study is its multicenter design, and the fact that it incorporates patients from both urban and suburban populations. Also, it represents the most extensive evidence to date for this under-characterized population. It is limited by its retrospective approach, and by the fact that comprehensive injury and outcomes data (including ISS, transfusions, longitudinal labs, etc) were not collected, thus limiting the ability to derive certain predictive models, including for overall mortality. Also, the premise of this study is that these centers had a system wherein prehospital data led to triage of “found down” patients to either a medical or trauma evaluation; this is not a universal practice, and thus results may not be as useful in settings where, for instance, every single “found down” patient is evaluated by the trauma service. However, most major trauma centers face a limitation on personnel and resources, and thus a better understanding of triage protocols and their effectiveness is essential. With regard to next steps, our findings support the adoption of routine multidisciplinary evaluation of the elderly “found down” patient; implementing and testing such a practice represents an area for ongoing investigation.

To conclude, in this study we demonstrated that the “found down” population represents a complex cohort of injured and medically ill patients, who in many ways confound our triage protocols and require significant resource utilization. Patients with combined injury and medical diagnosis are most likely to be mistriaged, and advanced age is a strong predictor of mistriage. We posit that early trauma activation for “found down” patients over 70 years old should be considered in order to prevent unfavorable outcomes that result from mistriage.

Our findings may be incorporated into future studies, with the goal of developing protocols that mitigate the impacts of late-identified diagnoses, delayed care, and adverse outcomes in this vulnerable population.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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References

1. Kornblith LZ, Kutcher ME, Evans AE, Redick BJ, Privette A, Schecter WP, Cohen MJ. The “found down” patient: a diagnostic dilemma. The journal of trauma and acute care surgery. 2013; 74(6): 1548–52. [PubMed: 23694886]
2. West JG, Trunkey DD, Lim RC. Systems of trauma care. A study of two counties. Archives of surgery. 1979; 114(4):455–60. [PubMed: 435058]
3. Salomone JP. Prehospital triage of trauma patients: a trauma surgeon's perspective. Prehospital emergency care : official journal of the National Association of EMS Physicians and the National Association of State EMS Directors. 2006; 10(3):311–3.
4. Shackford SR, Mackersie RC, Hoyt DB, Baxt WG, Eastman AB, Hammill FN, Knotts FB, Virgilio RW. Impact of a trauma system on outcome of severely injured patients. Archives of surgery. 1987; 122(5):523–7. [PubMed: 3579561]
5. Velmahos GC, Jindal A, Chan LS, Murray JA, Vassiliu P, Berne TV, Asensio J, Demetriades D. “Insignificant” mechanism of injury: not to be taken lightly. Journal of the American College of Surgeons. 2001; 192(2):147–52. [PubMed: 11220713]
6. Sporer KA, Youngblood GM, Rodriguez RM. The ability of emergency medical dispatch codes of medical complaints to predict ALS prehospital interventions. Prehospital emergency care : official journal of the National Association of EMS Physicians and the National Association of State EMS Directors. 2007; 11(2):192–8.
7. Buylaert WA. Coma induced by intoxication. Acta neurologica Belgica. 2000; 100(4):221–4. [PubMed: 11233676]
8. Kanich W, Brady WJ, Huff JS, Perron AD, Holstege C, Lindbeck G, Carter CT. Altered mental status: evaluation and etiology in the ED. The American journal of emergency medicine. 2002; 20(7):613–7. [PubMed: 12442240]
9. Xiao HY, Wang YX, Xu TD, Zhu HD, Guo SB, Wang Z, Yu XZ. Evaluation and treatment of altered mental status patients in the emergency department: Life in the fast lane. World journal of emergency medicine. 2012; 3(4):270–7. [PubMed: 25215076]
10. Colivicchi F, Ammirati F, Melina D, Guido V, Imperoli G, Santini M, Investigators OS. Development and prospective validation of a risk stratification system for patients with syncope in the emergency department: the OESIL risk score. European heart journal. 2003; 24(9):811–9. [PubMed: 12727148]
11. Wasserman EB, Shah MN, Jones CM, Cushman JT, Caterino JM, Bazarian JJ, Gillespie SM, Cheng JD, Dozier A. Identification of a Neurologic Scale That Optimizes EMS Detection of Older Adult Traumatic Brain Injury Patients Who Require Transport to a Trauma Center. Prehospital emergency care : official journal of the National Association of EMS Physicians and the National Association of State EMS Directors. 2014
12. Newgard CD, Zive D, Holmes JF, Bulger EM, Staudenmayer K, Liao M, Rea T, Hsia RY, Wang NE, Fleischman R, et al. A multisite assessment of the American College of Surgeons Committee

on Trauma field triage decision scheme for identifying seriously injured children and adults. Journal of the American College of Surgeons. 2011; 213(6):709–21. [PubMed: 22107917]

13. MacKenzie EJ, Rivara FP, Jurkovich GJ, Nathens AB, Frey KP, Egleston BL, Salkever DS, Scharfstein DO. A national evaluation of the effect of trauma-center care on mortality. The New England journal of medicine. 2006; 354(4):366–78. [PubMed: 16436768]
14. Rogers A, Rogers F, Bradburn E, Krasne M, Lee J, Wu D, Edavettal M, Horst M. Old and undertriaged: a lethal combination. The American surgeon. 2012; 78(6):711–5. [PubMed: 22643270]
15. Demetriades D, Sava J, Alo K, Newton E, Velmahos GC, Murray JA, Belzberg H, Asensio JA, Berne TV. Old age as a criterion for trauma team activation. The Journal of trauma. 2001; 51(4): 754–6. discussion 6-7. [PubMed: 11586171]
16. Parker S, Afsharpad A. Ground-level geriatric falls: a not-so-minor mechanism of injury. Case reports in orthopedics. 2014; 2014:164632. [PubMed: 25431716]

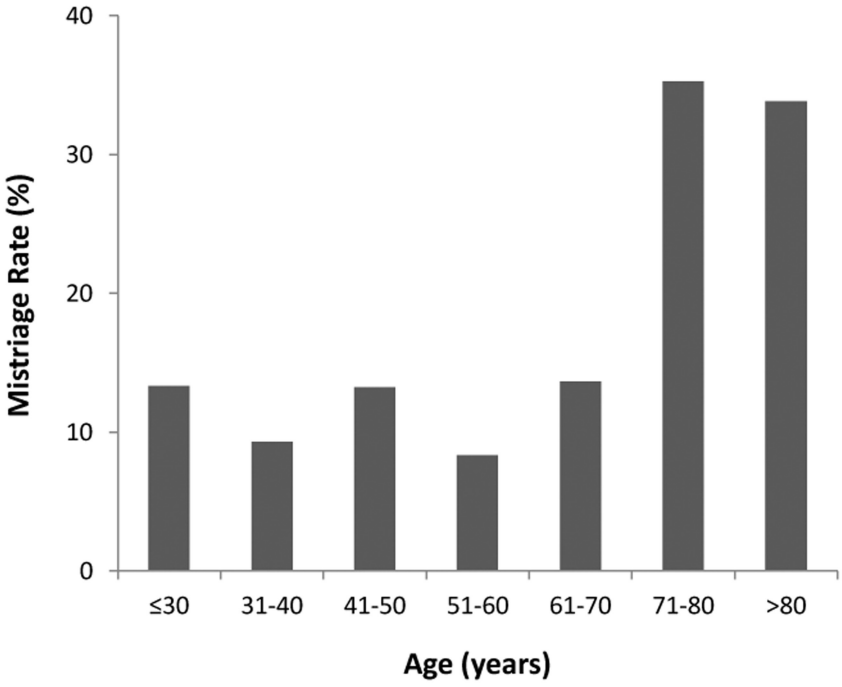

Figure 1. Mistriage rate by age group

Table 1
Demographics/Outcomes of 'found down' patients

Characteristic	Total (n = 661)
Age (years)	53.8±19.1
Male	69.3% (458)
Prior ED visit	47.4% (313)
Homeless	21.2% (140)
Psychiatric history	26.0% (172)
Uninsured	28% (185)
Alcohol intoxication	33.0% (218)
Substance intoxication	18.9% (125)
Signs of trauma per EMS	35.4% (234)
Traumatic injury	56.1% (371)
Immediately to OR	2.7% (18)
Medical diagnoses	89.7% (593)
Combined injury + medical diagnosis	47.7% (315)
Any CT scan obtained	74.1% (490)
Cardiac arrest EMS	8.2% (54)
Respiratory arrest EMS	13.8% (91)
Cardiac arrest ED	6.2% (41)
Respiratory arrest ED	26.5% (175)
Death in ED	3.48% (23)
Admitted to hospital	65.4% (432)
Cross-consultation	13.1% (87)
Mistriage	11.4% (75)
Admitted to hospital	65.4% (432)
Hospital days (among admitted pts)	5 (3 - 10)
ICU days (among admitted pts)	2 (0 - 5)
Mechanically ventilated	37.8% (250)
Ventilator days (among ventilated pts)	2 (1 - 5)
Ventilator-free days (among ventilated pts)	19.5 (0 - 26)
Late-identified injury	6.1% (40)
Late-identified medical diagnosis	9.8% (65)
Mortality	17.7% (117)

Data presented as %, mean ± SD, median (IQR)

Ventilator-free days is number of unassisted breathing days to day 28

Table 2
Demographics/Outcomes of 'found down' patients by triage type

Characteristic	Trauma (n=218)	Medical (n=443)	*p*
Age (years)	54.8±20.9	53.2±18.2	0.34
Male	70.2% (153)	68.9% (305)	0.79
Prior ED visits	27.1% (59)	57.3% (254)	<0.01
Homeless	9.6% (21)	26.9% (119)	<0.01
Psychiatric history	20.2% (44)	28.9% (128)	0.02
Uninsured	26.2% (57)	28.9% (128)	0.41
Alcohol intoxication	29.8% (65)	34.5% (153)	0.71
Substance intoxication	10.6% (23)	23.0% (102)	<0.01
Signs of trauma	65.6% (143)	20.5% (91)	<0.01
Traumatic injury	89.5% (195)	41.5% (184)	<0.01
Immediately to OR	7.3% (16)	0.5% (2)	<0.01
Medical diagnoses	79.8% (174)	95.3% (422)	<0.01
Combined injury + medical diagnosis	70.6% (154)	37.7% (167)	<0.01
Any CT scan obtained	95.9% (209)	63.4% (281)	<0.01
Cardiac arrest EMS	2.8% (6)	10.8% (48)	<0.01
Respiratory arrest EMS	14.2% (31)	13.5% (60)	0.72
Cardiac arrest ED	2.3% (5)	8.1% (36)	<0.01
Respiratory arrest ED	32.6% (71)	23.5% (104)	0.01
Deceased in ED	2.8% (6)	3.8% (17)	0.65
Admitted to hospital	77.5% (169)	59.4% (263)	<0.01
Admitted to surgical service	49.5% (108)	3.2% (14)	<0.01
Admitted to medical service	28.0% (61)	56.2% (249)	<0.01
Surgical consults	17.9% (39)	12.4% (55)	<0.01
Medical consults	14.7% (32)	1.4% (6)	0.11
Cross-consultation	14.7% (32)	12.4% (55)	0.46
Mistriage	28% (61)	3.2% (14)	<0.01
Hospital days (among admitted patients)	5 (2 - 11)	5 (3 - 9)	0.78
ICU days (among admitted patients)	2 (1 - 4)	2 (0 - 5)	0.94
Mechanically ventilated	44.5% (97)	34.5% (153)	<0.01
Ventilator days (among ventilated patients)	2 (1 - 4)	3 (2 - 5)	0.06
Ventilator-free days (among ventilated patients)	25 (0 - 26)	17 (0 -26)	0.01
Late-identified injury	10.6% (23)	3.8% (17)	0.01
Late-identified medical diagnosis	6.9% (15)	11.3% (50)	0.09
Mortality	19.3% (42)	16.9% (75)	0.45

Data presented as %, mean ± SD, median (IQR)

Table 3
Demographics/Outcomes of 'found down' patients by mistriage

Characteristic	Mistriage (n=75)	"Proper" Triage (n=357)	*p*
Age (years)	65.7±20.0	55.7±18.3	<0.01
Male	60.0% (45)	66.4% (237)	0.29
Prior ED visits	24.3% (18)	46.7% (166)	<0.01
Homeless	18.4% (66)	9.3% (7)	0.06
Psychiatric history	31.1% (23)	33.9% (108)	0.68
Uninsured	16.4% (12)	23.0% (82)	0.28
Intoxication (any)	29.8% (17)	45.6% (78)	0.04
Alcohol intoxication	14.3% (9)	23.3% (72)	0.13
Substance intoxication	17.5% (11)	26.5% (82)	0.15
Signs of trauma per EMS	75.9% (41)	41.5% (113)	<0.01
Traumatic injury dx in ED	88% (66)	57.1% (197)	<0.01
Medical diagnoses	89.3% (67)	86.6% (309)	0.58
Combined injury + medical diagnosis	79.7% (59)	45.5% (155)	<0.01
Any CT scan obtained	100% (75)	86.0% (307)	<0.01
Cross-consult required	2.7% (2)	23.3% (83)	<0.01
Hospital days (among admitted patients)	6 (3 - 9)	5 (3 - 10)	0.89
ICU days (among admitted patients)	2 (0 - 4)	2 (0 - 5)	0.16
Mechanically ventilated	45.3% (34)	54.9% (196)	<0.01
Ventilator days (among ventilated patients)	3 (2 - 4)	3 (2 - 6)	0.43
Ventilator-free days (among ventilated patients)	23.5 (1 - 26)	21 (0 -26)	0.76
Late-identified injury	14.7% (11)	7.9% (27)	0.08
Late-identified medical diagnosis	9.5% (7)	16.4% (58)	0.16
Mortality	21.3% (16)	21.9% (78)	1.00

Mistriage defined as patient admitted to non-activated service

Data presented as %, mean ± SD, median (IQR)

Table 4

Logistic Regression, Predictors of Mistriage

	Odds Ratio	95% CI	p-value
Age (by 10 years)	1.44	1.21 - 1.71	<0.01
Pre-hospital signs of trauma	2.64	1.25 - 5.60	0.01
Combined injury + medical diagnosis	3.42	1.51 - 7.73	<0.01

Logistic regression model includes the listed variables, with area under receiver operating curve 0.775.

Table 5

Triage as a Screening Test

Triage as a Screening Test for Traumatic Injury				
	Injury	No Injury		
Trauma Activation	195	23	PPV = 89%	(95 % CI 85 - 93)
Medical Activation	184	259	NPV = 58%	(95 % CI 54 - 63)
	Sensitivity = 51% (95% CI 46 - 57)	Specificity = 92% (95% CI 88 - 95)		
Triage as a Screening Test for Medical Diagnosis				
	Medical Diagnosis	No Med Diagnosis		
Medical Activation	422	21	PPV = 95%	(95% CI 93 - 97)
Trauma Activation	174	44	NPV = 20%	(95% CI 15 - 26)
	Sensitivity = 71% (95% CI 67 -74)	Specificity = 70% (95% CI 55 - 79)		