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RESEARCH REPORT

FACTORS ASSOCIATED WITH CAREGIVER DECISION NOT TO TRANSPORT PEDIATRIC PATIENTS ASSESSED BY EMERGENCY MEDICAL SERVICES

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ABSTRACT

Objectives: Almost one third of pediatric 9-1-1 calls result in non-transport by Emergency Medical Services (EMS). It is unknown to what extent these decisions are driven by caregivers' decisions to decline transport versus EMS advice that transport is unnecessary. Further, it is unknown whether demographic, economic, encounter, or agency factors are associated with caregivers declining transport.

Methods: We conducted a retrospective cross-sectional study with data from the national 2019 ESO Data Collaborative. We included 9-1-1 responses for children <18 years. The primary outcome was caregiver decision not to transport patient (per EMS documentation) compared to EMS-initiated non-transport. Bivariable and multivariable logistic regression identified factors associated with caregiver decision not to transport.

Results: Of 313,903 pediatric 9-1-1 activations, 37.2% resulted in non-transport, with 80.0% of pediatric non-transports attributable to caregiver decision. Specific reasons for caregiver refusal included plans to seek care by private vehicle and not feeling the injury/illness required emergent transport. The patient and encounter characteristics for children not transported by EMS were similar, regardless of whether the caregiver or EMS clinician made the decision not to transport. There was wide inter-agency variation in both the rate of non-transport per EMS agency (median 0.37, interquartile range (IQR) 0.25-0.48) and the proportion of these encounters attributable to a caregiver decision (median 0.82, IQR 0.68-0.94).

Conclusions: In this large national dataset, pediatric non-transport by EMS was common, and in most cases was attributed to caregiver decision in documentation. The proportion of non-transport and caregiver decision varied significantly between EMS agencies. Further research is needed to understand pediatric patient outcomes after non-transport and to identify why the proportion of encounters resulting in caregiver refusal per EMS agency varies so widely. Developing standardized, evidence-based non-transport protocols for children may help reduce this potentially unwarranted clinical variation.

BACKGROUND

In 2021, there were 2.4 million pediatric 9-1-1 activations in the United States (US) (NEMSIS-End-of-Year-Report-2021.pdf n.d.). Almost one-third of these pediatric Emergency Medical Services

(EMS) encounters resulted in non-transport (Gerlacher, Sirbaugh, & Macias 2001; Kannikeswaran et al. 2007; Ramgopal, Owusu-Ansah, & Martin-Gill 2018; C. Ward et al. 2022). In some cases, EMS clinicians advise that transport to a healthcare facility is not indicated, also known as EMS-initiated non-transport (Jaslow et al. 1998; Knapp et al. 2009; Millin, Brown, & Schwartz 2011a). In others, caregivers may decline transport, in some cases against the medical advice of EMS clinicians (Seltzer et al. 2001).

Developing and disseminating alternative EMS disposition programs, including EMS-initiated non-transport for low-acuity patients, is a national priority (Munjal & Carr 2013). Almost one-third of children transported to the hospital by EMS have no urgent or emergent medical needs (C. E. Ward et al. 2023). This use of the EMS system for non-emergent complaints can be inefficient and unsafe, leading to delays in care for other patients with more acute needs (Alpert et al. 2013; Mell et al. 2017). Several initiatives have attempted to address this issue. The Emergency Triage, Treat, and Transport (ET3) program was a voluntary, five-year payment model funded by the Centers for Medicare and Medicaid Services (CMS) to try and realign these incentives (Goldman et al. 2020). The results of this program have not yet been shared publicly, though the program was ended two years ahead of schedule with CMS noting that the number of interventions was lower than expected (Centers for Medicare and Medicaid, 2021). Some EMS agencies have recently implemented protocols allowing EMS-initiated non-transport of children. While initial results appear promising, these protocols have not been widely disseminated or tested for safety (Coster et al. 2019; Oulasvirta et al. 2019a; Yeung et al. 2019).

Despite the significant rate of pediatric non-transport, little is known about what proportion of pediatric non-transport is currently due solely to caregiver decision to decline transport, EMS recommendation that transport is unnecessary, established protocols, or shared decision-making between EMS and caregiver. It is unknown how pediatric non-transport practices vary between EMS agencies. Furthermore, no pediatric studies have investigated demographic or clinical factors associated with caregiver decision to decline transport. The primary objective of this study was to determine the prevalence of and factors associated with caregiver decision to decline transport for children assessed by EMS. The secondary objective was to determine the variability of the per-EMS agency proportions of non-transport and caregiver refusals.

METHODS

Study Design and Data Source

We performed a retrospective study using the ESO Data Collaborative (Austin, TX) public release dataset for 2019 (C. Ward et al. 2022). ESO is an encounter-based EMS electronic health record that uses the National EMS Information System (NEMSIS) data standards (Kannikeswaran et al. 2007). Each record includes patient demographic information, agency-specific details, and information about clinical care, transportation, and disposition. The ESO Data Collaborative consists of EMS agencies that use the ESO software and have voluntarily agreed to share de-identified patient care records for research purposes. The 2019 data set includes data from 8,340,148 EMS encounters from 2,000 participating EMS agencies. The Institutional Review Board at Children's National Hospital approved this study.

Study Population

The study included all ESO records from January 1, 2019 to December 31, 2019, for patients aged 0 - 17 years with a 9-1-1 EMS scene response, and a final patient disposition of non-transport. The study excluded ESO records for interfacility medical transports, community assistance calls, calls that did not result in any patient contact, encounters where the patient was deceased upon arrival, and activations for a patient in police custody.

Primary Outcome

Consistent with previous studies, to identify non-transported patients, we utilized the EMS clinician documentation for "disposition" (NEMSIS v3.4 element eDisposition.12) coded as a dichotomous variable of "transport" versus "non-transport" (Gerlacher, Sirbaugh, & Macias 2001; Ramgopal, Owusu-Ansah, & Martin-Gill 2018). Disposition values for non-transported patients included: 1) No treatment, no transport; 2) Patient evaluated, no treatment/transport required; 3) Patient refused evaluation/care (without transport); 4) Patient treated, released (AMA); 5) Patient treated, released (per protocol); and 6) Treatment, no transport. For pediatric patients, #3 and #4 refer to the caregiver decision to refuse treatment.

The primary outcome was the entity who made the decision not to transport a child. We coded this as a dichotomous variable with values of "Caregiver Decision" versus "EMS Decision." This outcome variable was classified based on the EMS clinician response to "Disposition" (NEMSIS v3.4 element eDisposition.12) and the recorded "Reason for Refusal." The "Reason for Refusal" variable is specific to ESO and is not an element of the NEMSIS v3.4 data standards, with categories: 1) Against medical advice, 2) Patient does not feel injury/illness requires ambulance, 3) Patient to seek further care in POV, and 4) Other. "Disposition" and "Reason for Refusal" responses were used to determine whether the non-transport decision was attributable to "Caregiver Decision" or "EMS Decision" (Supplemental Figure 1). Records where the classification of entity making the non-transport decision was unclear, including those where the "Disposition" and "Reason for Refusal" appeared inconsistent, were excluded from the analysis (Supplemental Figure 1).

Secondary Outcomes

The secondary outcomes were the interquartile ranges (IQR) of the per-EMS agency proportions of 1) encounters that resulted in pediatric non-transport and 2) non-transport that was attributed to caregiver refusal.

Covariates

Covariates of interest were selected based on biologic and sociologic plausibility and have been identified as relevant to EMS transport decision-making in previous studies (Gerlacher, Sirbaugh, & Macias 2001; Jaslow et al. 1998; Knapp et al. 2009; Millin, Brown, & Schwartz 2011b; Ramgopal, Owusu-Ansah, & Martin-Gill 2018; C. E. Ward et al. 2023). Covariates included age, sex, race/ethnicity, U.S. Census geographic region (Midwest, Northeast, South, West), urbanicity per the Centers for Medicare and Medicaid Services (CMS) definitions (urban defined as areas with a population of 50,000 or more or clusters with at least 2,500 but fewer than 50,000 people; rural defined as the top three quartiles of non-urban areas; or super-rural defined as the lowest quartile of non-urban areas); pri-

ority level of EMS call (emergent versus non-emergent), originator of EMS call (patient, family, bystander, or health care provider/first responder), EMS unit level of care (ALS versus BLS), whether call occurred during standard medical office hours (8:00 a.m.-5:00 p.m., Monday-Friday), documentation of complete vital signs recorded (pulse, respiratory rate, and oxygen saturation), whether the patient was injured, whether the call was classified as medical, trauma or both, if the patient was pregnant, and if language barrier was present.

The race/ethnicity variable was constructed based upon the NEMSIS variable for race and the ESO variable for ethnicity. NEMSIS records patient or family's self-report of race as defined by the U.S. Office of Management and Budget (OMB), which includes the following categories: American Indian or Alaskan Native, Asian, Black or African American, Hispanic or Latino, Native Hawaiian or Other Pacific Islander, and White. Ethnicity is an ESO-specific dichotomous variable of whether patient self-reports as Hispanic or Latino, versus not Hispanic or Latino. We created a combined race/ethnicity variable (see Supplemental Table 1 for details).

	Caregiver Decision (N=81,176)	EMS Decision (N=20,309)	Total Non-Transported Patients (N=101,485)
Age (Years)			
Mean (SD)	8.69 (5.92)	8.42 (5.87)	8.64 (5.91)
Median [Min, Max]	9.00 [0, 17.0]	8.00 [0, 17.0]	9.00 [0, 17.0]
Sex			
Female	39,474 (48.6%)	9,360 (46.1%)	48,834 (48.1%)
Male	40,699 (50.1%)	10,222 (50.3%)	50,921 (50.2%)
Missing	1,003 (1.2%)	727 (3.6%)	1,730 (1.7%)
Race/Ethnicity			
American Indian or Alaskan Native	110 (0.1%)	33 (0.2%)	143 (0.1%)
Asian, Non-Hispanic	875 (1.1%)	244 (1.2%)	1,119 (1.1%)
Black, Non-Hispanic	18,298 (22.5%)	4,224 (20.8%)	22,522 (22.2%)
Hispanic or Latino	12,863 (15.8%)	2,488 (12.3%)	15,351 (15.1%)
Native Hawaiian or Other Pacific Islander	84 (0.1%)	29 (0.1%)	113 (0.1%)
Other or Unknown	1,425 (1.8%)	381 (1.9%)	1,806 (1.8%)
White, Non-Hispanic	36,119 (44.5%)	7,928 (39.0%)	44,047 (43.4%)
Missing	11,402 (14.0%)	4,982 (24.5%)	16,384 (16.1%)
EMS Requested By			
Patient	9,853 (12.1%)	2,036 (10.0%)	11,889 (11.7%)
Bystander	18,070 (22.3%)	3,866 (19.0%)	21,936 (21.6%)
Family	38,101 (46.9%)	9,699 (47.8%)	47,800 (47.1%)
First Responder or Health Professional	8,429 (10.4%)	2,154 (10.6%)	10,583 (10.4%)
Missing	6,723 (8.3%)	2,554 (12.6%)	9,277 (9.1%)

Table 1. Patient demographic and EMS agency characteristics for pediatric encounters resulting in non-transport, sorted by entity making non-transport decision.

	Caregiver Decision (N=81,176)	EMS Decision (N=20,309)	Total Non-Transported Patients (N=101,485)
Urbanicity			
Rural	13,395 (16.5%)	2,631 (13.0%)	16,026 (15.8%)
Urban	65,343 (80.5%)	17,192 (84.7%)	82,535 (81.3%)
Super Rural	2,397 (3.0%)	480 (2.4%)	2,877 (2.8%)
Missing	41 (0.1%)	6 (0.0%)	47 (0.0%)
Geographic Region			
Midwest	15,465 (19.1%)	4,708 (23.2%)	20,173 (19.9%)
Northeast	1,957 (2.4%)	663 (3.3%)	2,620 (2.6%)
South	54,423 (67.0%)	9,246 (45.5%)	63,669 (62.7%)
West	8,899 (11.0%)	5,613 (27.6%)	14,512 (14.3%)
Missing	432 (0.5%)	79 (0.4%)	511 (0.5%)
Priority			
Emergent	69,517 (85.6%)	17,091 (84.2%)	86,608 (85.3%)
Non-emergent	11,659 (14.4%)	3,218 (15.8%)	14,877 (14.7%)
Unit Level			
ALS	69,746 (85.9%)	14,428 (71.0%)	84,174 (82.9%)
BLS	6,201 (7.6%)	3,131 (15.4%)	9,332 (9.2%)
Missing	5,229 (6.4%)	2,750 (13.5%)	7,979 (7.9%)
Injury			
No injury	55,716 (68.6%)	12,947 (63.8%)	68,663 (67.7%)
Injury	23,075 (28.4%)	5,560 (27.4%)	28,635 (28.2%)
Missing	2,385 (2.9%)	1,802 (8.9%)	4,187 (4.1%)
Medical v. Trauma			
Medical	45,081 (55.5%)	11,813 (58.2%)	56,894 (56.1%)
Trauma	32,565 (40.1%)	7,058 (34.8%)	39,623 (39.0%)
Medical and Trauma	1,132 (1.4%)	308 (1.5%)	1,440 (1.4%)
Missing	2,398 (3.0%)	1,130 (5.6%)	3,528 (3.5%)
Pregnancy			
Not pregnant	81,038 (99.8%)	20,280 (99.9%)	101,318 (99.8%)
Pregnant	138 (0.2%)	29 (0.1%)	167 (0.2%)
Time of Day			
During office hours	32,671 (40.2%)	8,987 (44.3%)	41,658 (41.0%)
Outside office hours	48,505 (59.8%)	11,322 (55.7%)	59,827 (59.0%)
Vital Signs Obtained			
Incomplete	38,358 (47.3%)	10,698 (52.7%)	49,056 (48.3%)
Complete	42,818 (52.7%)	9,611 (47.3%)	52,429 (51.7%)
Language Barrier Present			
No language barrier	77,651 (95.7%)	18,045 (88.9%)	95,696 (94.3%)
Language barrier	690 (0.9%)	171 (0.8%)	861 (0.8%)
Missing	2,835 (3.5%)	2,093 (10.3%)	4,928 (4.9%)

Table 1 (continued). Patient demographic and EMS agency characteristics for pediatric encounters resulting in non-transport, sorted by entity making non-transport decision.

Statistical Analysis

We calculated the proportion of EMS activations resulting in non-transport and the proportion of these non-transport encounters attributable to "Caregiver Decision" versus "EMS Decision." We generated descriptive statistics to measure variability between EMS agencies. Data for covariates were missing for 0-32% (Supplemental Table 2). Data for pregnancy status was missing in 32% of records. It was assumed that these non-responses indicated a patient was not pregnant (due, in many cases, to the patient's age), so missing values for this variable were categorized as "not pregnant." As described above, data points were discarded when there was a discrepancy between the documented "Disposition" and "Reason for Refusal," i.e., when one variable indicated that non-transport was due to caregiver decision while another indicated that non-transport was per EMS decision (Supplemental Figure 1). After this transformation, only 0.3% of Decision for Non-transport was missing. Complete case analysis was used when measuring bivariable associations and constructing logistic regression model.

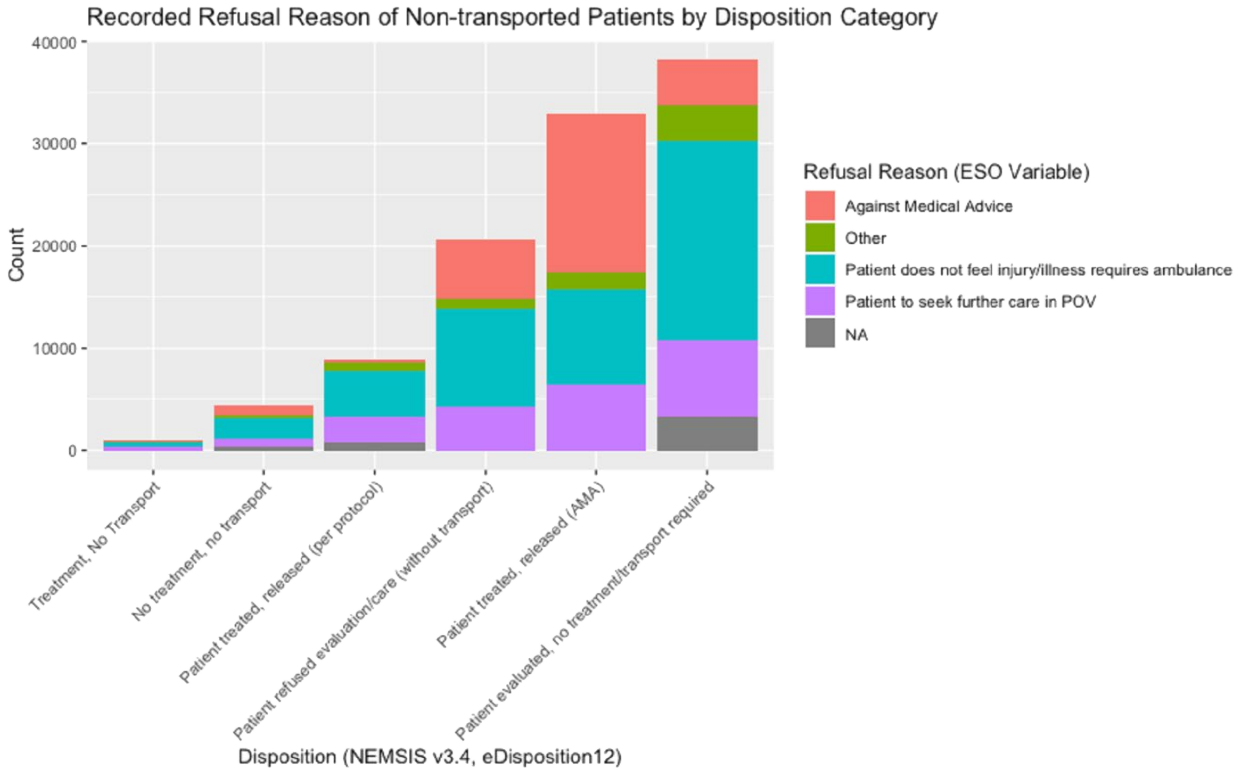

Figure 1. Reason for refusal (ESO specific variable) sorted by encounter disposition (NEMSIS variable) category.

We evaluated bivariable associations with the outcome of non-transport due to "Caregiver Decision" versus "EMS Decision," using odds ratios (OR) with 95% confidence intervals (95% CI). We constructed a multivariable logistic regression model to evaluate associations of covariates with this outcome, expressing results as adjusted odds ratios (aOR) with 95% CIs. Diagnostic plots of the logistic regression model plotted deviance versus

fitted values of the model. We assessed for multicollinearity by calculating variance inflation factors (VIF). All data analysis was performed using R (Studio Version 2022) (R Core Team (2021). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/. n.d.).

RESULTS

Of the 8,340,148 EMS encounters in the ESO dataset, 313,903 were 9-1-1 activations for patients aged <18 years, of which 106,173 (37.2%) resulted in non-transport. For 4,688 (4.4%) of these non-transports, the entity responsible for the non-transport decision could not be determined from the EMS documentation due to an inconsistency between the classification of the "Disposition" and "Reason for Refusal " variables. Of the remaining 101,485 encounters, 81,176 (80.0%) were attributable to caregiver decision, and 20,309 (20.0%) were EMS-initiated. The median age of non-transported patients was 9 years, and 50,921 (51.9%) were male. Most activations (82,535, 80.5%) originated in urban areas. Complete patient demographic and EMS agency characteristics for pediatric encounters resulting in non-transport are summarized in Table 1.

Figure 1 depicts the ESO-specific refusal reason by NEMSIS disposition category. Each disposition category contained the full range of refusal reasons, but "Patient does not feel injury/illness requires ambulance" was the most common refusal reason, representing 44-49% of refusal reasons in all disposition categories except Patient treated, released (AMA)." For "Patient treated, released (AMA)," the most common refusal reason was "Against Medical Advice" (47%). Notably, "Against Medical Advice" was a refusal reason in all disposition categories, including "Patient evaluated, no treatment/transport required," where it represented 12% of refusal reasons.

Unadjusted and adjusted odds ratios of the covariate association with the outcome of caregiver decision are summarized in Table 2. Based upon multivariable logistic regression, demographic factors associated with a modestly increased likelihood of caregiver decision for non-transport were patient female sex and Hispanic/Latino race/ethnicity identification. Black, Non-Hispanic, Asian, Non-Hispanic, and other or unknown race/ethnicity were associated with modest decreased likelihood of caregiver decision. Other demographic covariates, including age, were not significant. Community factors of rural or super-rural community, compared with urban community, and regions of Northeast, Midwest, and South compared to the West, were associated with increased likelihood of caregiver decision. Encounter factors associated with increased likelihood of caregiver decision included Advanced Life Support (ALS) designation of EMS unit, the absence of an injury, and the designation of trauma. 9-1-1 activations resulting from a caregiver or bystander call were associated with increased caregiver decision likelihood compared to healthcare workers placing the call. In addition, having complete vital signs recorded by EMS was associated with increased likelihood of caregiver decision, as was activation occurring outside of regular office hours. We did not find evidence of multicollinearity.

Among the 1,209 agencies for which data were available, the mean and median non-transport proportions for pediatric 9-1-1 encounters per agency were 0.38 and 0.37, respectively, with an interquartile range of 0.25-0.48 (Figure 2a). Across the 1140 agencies

for which refusal reason was available, the mean and median proportions of caregiver decision were 0.78 and 0.82, respectively, with an interquartile range of 0.68 - 0.94 (Figure 2b).

	Caregiver Decision (%)	EMS Decision (%)	OR (95% CI)	aOR (95% CI)
Sex				
Male	79.9	20.1	Reference	
Female	80.8	19.2	1.06 (1.03, 1.09)	1.05 (1.01, 1.10)
Race/Ethnicity				
White	82.0	18.0	Reference	
American Indian or Alaskan Native	76.9	23.1	0.73 (0.50, 1.08)	0.83 (0.54, 1.32)
Asian, Non-Hispanic	78.2	21.9	0.79 (0.68, 0.91)	0.83 (0.71, 0.98)
Black, Non-Hispanic	81.2	18.8	0.95 (0.91, 0.99)	0.83 (0.79, 0.87)
Hispanic or Latino	83.8	16.2	1.13 (1.08, 1.19)	1.09 (1.03, 1.15)
Native Hawaiian or Other Pacific Islander	74.3	25.7	0.64 (0.42, 0.97)	0.87 (0.54, 1.45)
Other or Unknown	78.9	21.1	0.82 (0.73, 0.92)	0.86 (0.75, 0.99)
Urbanicity				
Urban	79.2	20.8	Reference	
Rural	83.6	16.4	1.34 (1.28, 1.40)	1.09 (1.03, 1.16)
Super-rural	83.3	16.7	1.31 (1.19, 1.45)	1.35 (1.20, 1.53)
Region				
West	61.3	38.7	Reference	
Northeast	74.7	25.3	1.86 (1.69, 2.05)	1.99 (1.67, 2.38)
Midwest	76.7	23.3	2.07 (1.98, 2.17)	1.27 (1.18, 1.37)
South	85.5	14.5	3.71 (3.57, 3.86)	2.12 (1.99, 2.26)
Priority				
Non-emergency	78.4	21.6	Reference	
Emergency	80.3	19.7	1.12 (1.08, 1.17)	0.91 (0.86, 0.96)
Requested By				
Health Professional	79.6	20.4	Reference	
Family	79.7	20.3	1.00 (0.95, 1.06)	1.05 (0.98, 1.12)
Bystander	82.4	17.6	1.19 (1.13, 1.27)	1.11 (1.03, 1.19)
Patient	82.9	17.1	1.24 (1.16, 1.32)	1.24 (1.14, 1.35)
EMS Unit				
BLS	66.4	33.6	Reference	
ALS	82.9	17.1	2.44 (2.33, 2.56)	1.25 (1.16, 1.35)
Time of Dispatch				
During office hours	78.4	21.6	Reference	
Outside of office hours	81.1	18.9	1.18 (1.14, 1.22)	1.17 (1.12, 1.21)
Vital Signs				
Incomplete	78.2	21.8	Reference	
Complete	81.7	18.3	1.24 (1.20, 1.28)	1.24 (1.19, 1.29)

Table 2. Factors associated with caregiver decision for pediatric patients not transported by EMS.

	Caregiver Decision (%)	EMS Decision (%)	OR (95% CI)	aOR (95% CI)
Presence of Trauma				
Medical	78.6	21.4	Reference	
Trauma	79.2	20.8	1.21 (1.17, 1.25)	1.52 (1.44, 1.62)
Medical and Trauma	82.2	17.8	0.96 (0.85, 1.09)	1.17 (0.99, 1.38)
Presence of injury				
Injury	80.6	19.4	Reference	
No injury	81.1	18.9	1.04 (1.00, 1.07)	1.41 (1.33, 1.50)
Pregnancy				
No pregnancy	80.0	20.0	Reference	
Pregnancy	82.6	17.4	1.19 (0.80, 1.78)	0.85 (0.56, 1.37)
Language Barrier				
Language barrier	80.1	19.9	Reference	
No language barrier	81.1	18.9	0.94 (0.79, 1.10)	0.90 (0.73, 1.13)

Table 2 (continued). Factors associated with caregiver decision for pediatric patients not transported by EMS.

DISCUSSION

In this study, 38% of pediatric patients assessed by EMS were not transported, and in 80% of cases, documentation implied the caregiver was the entity determining non-transport. Several factors were significantly associated with caregiver versus EMS decision for non-transport. The magnitude of these effects was modest, with adjusted odds ratios ranging from 0.83-2.12. For important demographic and encounter factors such as age, sex, and race, the groups of non-transported children were similar regardless of whether EMS or caregivers made the decision not to transport. Finally, there was large variability in per-EMS agency proportions of encounters resulting in non-transport and non-transport attributable to caregiver decision. The interquartile range for the per-agency proportion of patients not transported was 0.25-0.48, and the interquartile range for proportion of per-agency caregiver decision as the recorded reason for non-transport was 0.68-0.94.

This analysis of a large national dataset of EMS encounters validates previous observations regarding pediatric non-transport and provides additional insights into the patient, clinical, and regional factors associated with non-transport decision making. The rate of non-transport of patients in this dataset is comparable to published literature on the topic, where pediatric non-transport rates range from 16-46% (Gerlacher, Sirbaugh, & Macias 2001; Hartka & Vaca 2020; Kannikeswaran et al. 2007; Lowery et al. 2023; Oulasvirta et al. 2019a; Ramgopal, Owusu-Ansah, & Martin-Gill 2018; Richard et al. 2006). The broad range of reported per-agency non-transport rates likely reflects heterogeneity in study settings, as urban EMS agencies have lower rates of non-transport than rural regions (C. Ward et al. 2022).

The rate of caregivers making non-transport decisions in our study (80%) is slightly higher than in the previously published literature. Two studies using the National EMS Information System (NEMSIS) dataset reported caregiver refusal rates of 66-67% for pediatric non-transport cases (Hartka & Vaca 2020; C. Ward et al. 2022). This difference may be explained by how we defined this variable. Our study used the NEMSIS "Dispo-

sition" variable and the ESO "Reason for Refusal" variable, providing additional important context. For a sizeable proportion of non-transported patients in the ESO database, the refusal reason was recorded as "Patient does not feel injury/illness requires transport," a descriptor that by itself does not indicate disagreement between the caregiver and EMS team about the disposition of the patient and cannot be reasonably categorized as a refusal of transport. In this dataset, for 19,450 non-transport encounters (20%), the combination of recorded disposition and refusal reason was "Patient evaluated, no treatment/transport required" and "Patient does not feel injury/illness requires transport." For this reason, the current study focused on whether EMS documentation indicated that the caregiver's perception and preferences were the primary reason for non-transport rather than a narrower definition of refusal, in contrast to an EMS-initiated decision.

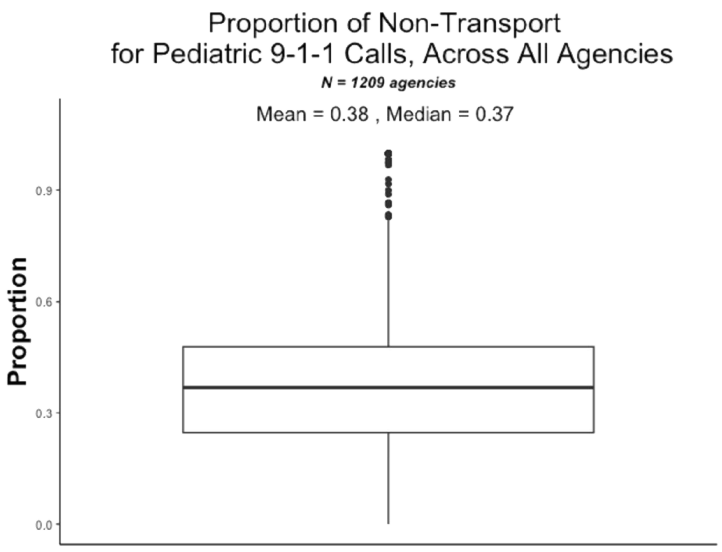

Figure 2a. Variation by EMS agency in the proportion of pediatric 9-1-1 calls that result in non-transport.

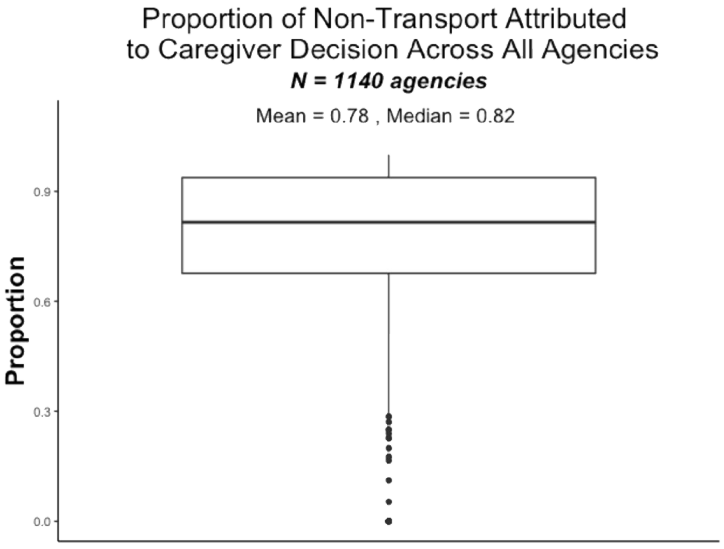

Figure 2b. Variation by EMS agency in the proportion of pediatric non-transport cases that are due to caregiver decision.

There are several important implications of our findings. This study adds to a growing body of literature showing that pediatric non-transport by EMS is common and occurs more often with children than adults, where non-transport rates are 10-20% (C. Ward et al. 2022). The reasons why non-transport rates differ significantly between adult and pediatric patients are not fully understood, although one may speculate that since an adult caregiver generally calls 9-1-1 on behalf of a child, there may be a lower threshold to seek a medical opinion on the severity of an acute illness for a child compared to an adult. This could result in 9-1-1 being called for lower severity illnesses for pediatric versus adult patients. However, while studies in Europe have assessed patient outcomes after non-transport, little is known about the patient outcomes for US children with non-transport after EMS evaluation (Coster et al. 2019; Oulasvirta et al. 2019b). Previous studies have been limited to small single-center analyses with

incomplete patient follow-up (Pringle et al. 2005; Seltzer et al. 2001). This is particularly concerning because EMS clinicians receive limited pediatric education and have documented deficiencies in pediatric assessment and management skills (Hansen et al. 2015; Jeruzal et al. 2019; Zaritsky et al. 1994). It is concerning that only half of patients with non-transport had complete vital signs recorded. Previous work has demonstrated that pediatric patients are less likely than adults to have vital signs documented by EMS, and the measurement and interpretation of pediatric vital signs may pose a challenge to EMS clinicians who do not regularly interact with pediatric patients (Hewes et al. 2016; Shinohara et al. 2022). The Pediatric Assessment Triangle (PAT) is a tool for rapid assessment of pediatric patients to identify critical illness and inform initial medical management, and its use may be especially important for pediatric patients for whom EMS is not able to obtain vital signs (Dieckmann, Brownstein, & Gausche-Hill 2010). There is a need for EMS agencies to develop initiatives to improve the rate of vital sign documentation for children not transported by EMS, or to use validated alternatives to assessing clinical status when vital signs cannot be obtained.

The discordance observed between the NEMSIS "Disposition" and ESO "Reason for Refusal" is both a limitation of our study and an important finding. This suggests that the current medical record documentation for non-transport cases may not adequately capture what clinical reasoning or decision-making transpired during an encounter. For example, the proportion of pediatric non-transports recorded as being "against medical advice" was 28% when looking at the ESO "Reason for Refusal" and 51% in the NEMSIS "Disposition" variable, with 36% of records having discordant responses. Furthermore, we found that while some NEMSIS disposition categories seem to clearly imply who made a non-transport decision, the ESO refusal reason provided further context and did not obviously align in some cases. For example, the NEMSIS disposition "Patient treated/released (per protocol)" is defined by the NEMSIS codebook to indicate that the patient met predefined EMS criteria for treat and release. However, in 3.2% of these cases, the ESO refusal reason was listed as AMA. This appears to be contradictory but may indicate that a caregiver advocated for non-transport, and the EMS clinicians used a non-transport protocol. Similarly, the disposition category "Patient evaluated, no treatment/transport required" was the most used NEMSIS disposition and does not provide enough information to determine how the non-transport decision was made. Our findings suggest that caution should be taken when using current disposition documentation to infer who has decided not to transport a child. This has implications for those engaged in medical oversight and research. In addition, current disposition categories do not explicitly account for instances of shared decision-making between caregivers and EMS teams. Revision to current disposition categories could address this issue by allowing EMS teams to be explicit when caregiver and EMS assessments of patients were aligned versus when they were at odds.

There are important economic implications of our findings. Current federal regulations categorize EMS services as a transportation benefit, meaning that transport to a qualifying destination (usually an ED) must occur for the agency to receive payment (Goldman et al. 2020; National EMS Advisory Council (NEMSAC) 2019). It is likely that these reimbursement regulations influence rates of non-transport. For example, private, non-hospital EMS agencies have lower rates of non-transport compared to government, non-fire and fire department-based agencies. This may be attributable to private agencies being

more reliant upon billable services (Déziel 2017; Eckstein 2013; C. Ward et al. 2022). It has also been shown that providing EMS flexibility in transporting low-acuity patients to alternative destinations, or to treat on scene, could save the federal government up to $560 million (Alpert et al. 2013). The National Association of EMS Physicians (NAEMSP) has advocated that EMS agencies be appropriately reimbursed for encounters resulting in non-transport (Millin, Brown, & Schwartz, 2011a). As initiatives to reimburse for alternative disposition and on-scene treatment develop, it will be increasingly vital to have more accurate documentation about how non-transport decisions are made, and by whom. At this time, many insurers will not provide reimbursement for care provided on scene when the patient refuses transport (National EMS Advisory Council (NEMSAC) 2019). Documentation suggesting that caregivers refused transport against medical advice has important financial ramifications for both patient families and EMS agencies.

Finally, we found that that the proportion of pediatric encounters resulting in non-transport and specifically caregiver refusals varied widely between EMS agencies. This may reflect variation between EMS agencies in how pediatric non-transport is managed and documented. This may be unwarranted clinical variation, with the practice being driven by local culture and norms rather than differences in the clinical needs of patients (Atsma, Elwyn, & Westert 2020). Further work is needed to understand why non-transport practices vary widely between EMS agencies. Understanding and developing initiatives to reduce unwarranted clinical variation, potentially with clinical decision support tools, has the potential to help improve patient safety and quality of care (Mitchell et al. 2014), healthcare efficiency (Lewkowicz, Wohlbrandt, & Boettinger 2020), and to address healthcare disparities (Vasey et al. 2021). A standardized, evidence-based clinical decision aid may help to reduce this clinical variability.

LIMITATIONS

There are several limitations to this study. First, while the ESO dataset captures a large volume of encounters from across the US, it is a convenience sample, and findings could be subject to a selection bias. Second, there are limitations related to medical record documentation. For some covariates, a proportion of records had missing data, including a sizeable number of the variable for pregnancy status. Imputation techniques were not used, and instead, complete case analysis was performed. A higher proportion of data were missing in the "EMS Decision" compared to "Caregiver Decision" group for all covariates with missing data except "Geographic Region." While we did not perform a statistical analysis of missing data, the fact that data may be missing not at random could introduce bias into this study. Additionally, this study had no way to verify with clinicians and caregivers who made a non-transport decision and whether both parties agreed with the EMS clinical documentation regarding this. There were also discrepancies in how the data used to construct our outcome variable (entity making the decision for non-transport) was recorded. In a subset of encounters, documentation describing the entity making the decision not to transport a child was ambiguous, and thus these records were excluded from the analysis. Finally, the study would be strengthened if there were the means to determine outcomes for non-transported patients, including subsequent 9-1-1 encounters, primary care follow-up, and hospitalizations.

CONCLUSION

In summary, consistent with previous research in other populations, this study demonstrated that in a large national dataset, 38% of pediatric patients for whom 9-1-1 was activated were not transported by EMS. Among these patients, caregiver decision was recorded to be the reason for non-transport 80% of the time. The patient and encounter characteristics for children not transported by EMS were broadly similar, regardless of whether EMS or the caregiver made the decision not to transport. However, there was wide inter-agency variation in both the rate of non-transport and the proportion of these encounters attributable to a caregiver decision. This suggests there may be unwarranted variation in pediatric non-transport practices between EMS agencies. Further research is needed to understand pediatric patient outcomes after non-transport and to identify the reasons for practice variability between EMS agencies. Developing standardized, evidence-based non-transport protocols for children may help reduce this potentially un-warranted clinical variation.

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