

Characteristics of Self-Triaged Emergency Department Visits by Adults With Cancer

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Adults with a new diagnosis of cancer frequently visit emergency departments (EDs) for disease- and treatment-related symptoms, and many of these visits may be preventable.¹⁻⁵ Despite receiving specialized treatment at one cancer treatment hospital, patients often visit other health systems.⁶ Because clinic telephone automated messages often advise that “if this is a medical emergency, please hang up and call 911,” a potential explanation is that patients who self-refer (go to the ED without calling their care team) are sicker and go to the nearest ED.

However, it is unclear whether clinical severity is associated with the proximity of the ED visited. A patient’s decision to go to the ED is rife with uncertainty,⁷ complicated by several factors. First, with little clinical training, patients and caregivers must determine the appropriate site of care by assessing illness severity. Further, appropriately selecting between an outpatient clinic, urgent care, specialized oncology urgent care,⁶ and the ED involves familiarity with the timing of the next available appointment and the clinical capabilities of each setting. Fear, current pain, and prior experiences with the ED or specific facilities^{8,9} add further complexity to ED decision-making. Finally, outpatient clinics and cancer treatment centers have 24/7 telephone lines for clinical advice, but these resources may be underutilized.⁶

Inherent limitations in more widely available data sets prevent insights into multiple ED visits by the same patient. Yet cancer diagnosis details and unbilled clinical encounter data, across insurance types, are important.¹⁰⁻¹² We analyzed a comprehensive set of ED visits for patients across insurance types and without insurance who were treated by 2 health systems by linking tumor registries to the respective electronic health record (EHR) and an all-payer regional health information exchange containing identifiably linked hospital visits. To investigate patterns of ED use, we analyzed whether patients (1) traveled to the closest ED, (2) self-referred to the ED, or (3) visited on the weekend when they were most sick.

ABSTRACT

OBJECTIVES: Adults with a new diagnosis of cancer frequently visit emergency departments (EDs) for disease- and treatment-related issues, although not exclusively. Many cancer care providers have 24/7 clinician phone triage available, but initial recorded phone messages tend to advise patients to go to the nearest ED if they are “experiencing a medical emergency.” It is unclear how well patients triage themselves to the optimal site of care.

STUDY DESIGN: Cross-sectional study of tumor registry records (university patients diagnosed 2008-2018 and safety-net patients diagnosed 2012-2018) identifiably linked to electronic health records and a regional health information exchange.

METHODS: We geoprocesed addresses to calculate driving time distance from the patient’s home to the ED. We used mixed-effects regression to predict the diagnosis code-based severity for ED visits within 6 months of diagnosis, clustering visits within patients and hospitals.

RESULTS: A total of 39,498 adults made 38,944 ED visits to 67 different hospitals. Patients self-referred for 85.5% of visits and bypassed a median (IQR) of 13 (4-33) closer EDs. Visits closer to home were not significantly more clinically severe; visits were significantly less severe if the patient self-referred [adjusted odds ratio [AOR], 0.89; 95% CI, 0.81-0.97] or they were on weekends [AOR, 0.93; 95% CI, 0.87-0.99]. Reanalyzing within each individual health system also showed similar findings.

CONCLUSIONS: Adults with cancer infrequently use available clinician advice before visiting the ED and may use factors other than clinical severity to determine their need for emergency care. Future work should explore the challenges that patients face navigating unplanned acute care, including reasons for underusing existing resources.

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TAKEAWAY POINTS

- ▶ Despite available 24/7 nurse triage phone lines and oncology-specific urgent care clinics, a diverse group of patients with cancer frequently did not call for help before an emergency department visit (85.5% of visits).
- ▶ Patient self-referred visits, visits to hospitals closer to a patient's home, and visits on weekends were not for more severe clinical conditions.
- ▶ Findings suggest potential targets to help patients manage acute care needs during cancer treatment and are especially relevant to providers who will be participating in the Medicare Enhancing Oncology Model alternative payment pilot.

METHODS

Patient Cohort

Using the tumor registries of the 2 health systems comprising our regional comprehensive cancer center, we assembled a cohort of adults 18 years and older who received a cancer diagnosis between January 1, 2008, and June 30, 2018, at The University of Texas Southwestern Medical Center (hereafter, University) and between January 1, 2012, and December 31, 2018, at Parkland Health (public safety-net health system for the uninsured in Dallas County; hereafter, Safety Net). For patients with synchronous diagnoses, we selected the highest-stage cancer. For patients with metachronous cancer diagnoses, we selected the first diagnosis and excluded subsequent diagnoses. We excluded leukemias and nonmelanoma skin cancers, the former in line with other research¹³ that excluded acute leukemias because of inpatient treatment and hospitalizations due to disease relapse and differential acute care needs in early chronic leukemia.

During the study period, both health systems had 24/7 telephone triage with a clinician—either an oncologist or a nurse with triage protocols—who had access to the EHR and who logged calls into the record. Both health systems created oncology acute care clinics (University in mid-2012 and Safety Net in mid-2015) that had seen relatively little use compared with ED visits,⁶ but we included a variable to adjust for whether the ED visit occurred before or after acute care clinic creation.

The tumor registry provided demographic data including street address at the time of diagnosis, date of diagnosis, cancer type and stage, initial treatment modalities, comorbid diagnoses, and date of death. We dichotomized cancer stage into advanced (stages IIIB and higher for lung cancer, stages III and higher for pancreatic cancer, and stage IV for all others except brain cancer) vs nonadvanced stage.^{6,14} We used comorbid diagnoses to generate a Charlson Comorbidity Index score.¹⁵

Dallas–Fort Worth Hospital Council Foundation Linkage

We identifiably linked patients to a database of ED visits in an all-payer regional health information exchange, the Dallas–Fort Worth Hospital Council Foundation (DFWHC Foundation), using a combination of first, middle, and last names; date of birth; zip code;

medical record number; and sex. The DFWHC Foundation maintains a longitudinally linked record of approximately 12 million unique patients, including the uninsured, and their 65 million hospital encounters from more than 80 hospitals (98% of nonfederal hospitals, not including freestanding EDs or urgent care clinics) within a 100-mi radius of Dallas, Texas, where both health systems are based. The DFWHC Foundation provided claimlike data including hospital name and address, date of visit, disposition, and diagnosis codes.

Outcome: ED Visit Severity

We used principal diagnosis codes to generate a validated¹⁶ ED visit severity classification (patched¹⁷ and modified Billings severity^{18,19}: emergent, intermediate, nonemergent, alcohol/mental health/substance abuse, unclassified). We excluded alcohol/mental health/substance abuse and unclassified ED visits from the ordinal severity scale. Data from the DFWHC Foundation contained discharge diagnoses from the ED visit only if the patient was not hospitalized because hospitalizations reported only inpatient discharge diagnoses. Consequently, we added hospitalization as the highest severity in a 4-category ordinal severity outcome: hospitalized, emergent, intermediate, and nonemergent. See **eAppendix Table 1** (eAppendix available at ajmc.com) for details on distribution of severities before and after these exclusions.

Geoprocessing

Patient address at the time of diagnosis was cleaned and processed in R version 4.0.2 (R Project for Statistical Computing). Treatment hospital (University or Safety Net), ED, and patient addresses were geocoded, and the distance between residential location and medical home and between residential location and ED was calculated using StreetMap Premium and Network Analyst in ArcGIS Pro version 2.6.1 (Esri). For each ED visit, we counted the number of EDs that were closer to the patient's residential address by driving time. For our analyses, we categorized distance into quintiles. Visits with patient addresses that geocoded with low precision or to addresses outside Texas were excluded (10.4% of patients) (see **eAppendix Table 2** for patient demographic comparison between high- and low-precision address matches).

EHR Linkage

We included ED visits within 180 days (6 months) of diagnosis to create a sample from patients with similar acute cancer care needs and excluded hospital visits overlapping with the diagnosis date. We extracted EHR (Epic) clinical interactions (telephone notes, secure messages, and outpatient visits for all specialties) from the day before an ED visit. ED visits without a preceding clinical contact were defined as self-referred.

Analysis of Primary Predictors

The prespecified primary predictors were patient ED self-referral vs prior clinician contact, distance traveled to the ED (number of closer EDs bypassed), and weekend/holiday vs weekday ED visits.

We used multivariable mixed-effects regression clustering ED visits within patient, and patient within hospital visited, to account for expected correlation between ED visits. Covariates included cancer type, stage, initial treatment modalities, death within 180 days after diagnosis, and Charlson Comorbidity Index score, plus demographic and geocoded variables as described earlier. Finally, we used marginal effects methods to convert adjusted odds ratios (AORs) into adjusted percentages for improved interpretability.

We used SAS 9.4 (SAS Institute) for data management and Stata/MP 15.1 (StataCorp) for statistical analyses. The University of Texas Southwestern Institutional Review Board approved this study (STU 112017-026; 122017-042).

Sensitivity Analyses

We assessed the robustness of our findings by reanalyzing with absolute distance traveled in miles and the number of closer EDs passed using distance in miles and by stratifying analyses by treatment home hospital (University and Safety Net) because these subgroups may have real and perceived differences in ED choice based on insurance status.

RESULTS

Cohort Characteristics

We identified 39,498 adults with a new diagnosis of cancer across both health systems. Half were women (50.0%), half were non-White (53.2%), and one-third (32.3%) were 65 years or older at time of diagnosis. Major cancer types included gastrointestinal cancers, including colorectal, at 16.7%; breast cancer at 14.6%; and lung cancer at 10.5%. One-third (35.1%) of patients were covered by Medicaid or uninsured at the time of diagnosis (18.7% at University and 77.0% at Safety Net).

We excluded ED visits from patients whose address was unable to be geocoded or out of state (5187 visits); when the patient was transferred to another facility (to avoid double counting because the transferred visit was also in the data set) or left without being seen/against medical advice (1644 visits); that had unclassified severity (7429 visits); or that were for alcohol, mental health, or injury (5777 visits). Finally, we excluded ED visits overlapping with the cancer diagnosis date (2551 visits). See [eAppendix Table 2](#) for complete details on exclusions.

Of this cohort ($n = 39,498$), 40.8% of patients did not make any ED visits in the 180 days after their cancer diagnosis. Half (49.5%) made 1 to 3 ED visits, and 9.8% made 4 or more ED visits, accruing 38,944 total ED visits after the exclusions above. Of the patients who made 1 or more ED visits, 81.1% always self-referred to the ED, 6.5% at least once did not self-refer, and 12.4% did not self-refer at all. See [Table 1](#) for demographics of the final study cohort of patients/visits.

Half of all ED visits were to the cancer treatment hospital (51.2%), but this comprised 29.0% of University patient visits to the University hospital and 74.4% of Safety Net patient visits to the SafetyNet hospital. This reflects wider hospital choice available to University patients (80.6% commercial or Medicare coverage) compared with Safety Net patients (23.0% with more flexible commercial or Medicare coverage; uninsured charity care limits payment for services only at the Safety Net health system).

ED Visit-Level Characteristics

Patients self-referred for 85.5% of ED visits. One-quarter (25.6%) of ED visits occurred on weekends/holidays. Patients lived a median (IQR) of 21.0 (14.1-29.6) minutes from the ED visited, corresponding to a median (IQR) of 13 (4-33) closer EDs bypassed in any direction. More than half (53.7%) of ED visits resulted in hospitalization, and one-quarter of ED visits (25.4%) were classified emergent but not hospitalized. See [Table 2](#)¹⁷⁻¹⁹ for complete ED visit-level characteristics and [eAppendix Table 3](#) for the top 5 diagnosis groups across severity.

The [Figure](#) displays the mean distance traveled to EDs by patients in each Census tract separately for the 2 subcohorts, as well as a map of the distribution of regional ED facilities and the volume of visits to each ED.

Regression Analysis

Patient self-referral to the ED. Multivariate mixed-effects regression modeling of ED visit severity with hospitalization found significantly lower visit severity when patients self-referred to the ED (AOR, 0.89; 95% CI, 0.81-0.97).

Distance traveled to the ED. There were no significant differences in the distribution of clinical severity of ED visits across any quintile of driving time to the ED.

Weekend ED visits. Weekend/holiday ED visits had significantly lower severity compared with weekday ED visits (AOR, 0.93; 95% CI, 0.87-0.99). See [eAppendix Table 4](#) for complete modeling results and marginally adjusted proportions of ED visit clinical severity.

Sensitivity Analyses

Reanalyzing using alternate ED distance measures (distance in miles, number of EDs passed based on miles) did not substantively change the findings. Reanalyzing after separating the cohorts into their respective cancer treatment hospitals (University and Safety Net) generated no substantive differences in our findings. See [eAppendix Table 4](#) for sensitivity analysis details.

DISCUSSION

Our analysis of the comprehensive ED visits from population-based samples of adults with a new diagnosis of cancer suggests that despite high rates of patient ED self-referral (no clinician contact before ED visit), such visits were significantly less clinically severe. Patients visited an array of different EDs, but visits to EDs closer to home were not associated with higher clinical severity. On weekends

TABLE 1. Characteristics of Patients With Cancer in 2 Regional Health Systems

Characteristic	Cohort (N = 39,498)	University subcohort (n = 26,502)	Safety Net subcohort (n = 12,996)
Female, n (%)	19,764 (50.0%)	12,610 (47.6%)	7154 (55.0%)
Age in years at diagnosis, n (%)			
18-24	589 (1.5%)	347 (1.3%)	242 (1.9%)
25-34	1599 (4.0%)	1109 (4.2%)	790 (6.1%)
35-44	3947 (10.0%)	2301 (8.7%)	1646 (12.7%)
45-54	8139 (20.6%)	4938 (18.6%)	3201 (24.6%)
55-64	12,166 (30.8%)	7641 (28.8%)	4525 (34.8%)
≥ 65	12,757 (32.3%)	10,165 (38.4%)	2592 (19.9%)
Race/ethnicity, n (%)			
White	18,494 (46.8%)	15,689 (59.2%)	2805 (21.6%)
Black	9476 (24.0%)	5137 (19.4%)	4339 (33.4%)
Hispanic	9201 (23.3%)	4054 (15.3%)	5147 (39.6%)
Other	2327 (5.9%)	1622 (6.1%)	705 (5.4%)
Non-English language preference, n (%)	8139 (20.6%)	3554 (13.4%)	4585 (35.3%)
Insurance type, n (%)			
Commercial	13,911 (35.2%)	12,648 (47.7%)	1263 (9.7%)
Medicare	10,920 (27.6%)	9662 (36.5%)	1258 (9.7%)
Medicaid and uninsured/county charity care/self-pay	13,881 (35.1%)	4060 (15.2%)	9821 (75.6%)
Unknown	786 (2.0%)	132 (0.5%)	654 (5.0%)
Advanced stage ^a at diagnosis, n (%)	9524 (24.1%)	6247 (23.6%)	3277 (25.2%)
Died within 180 days, n (%)	2685 (6.8%)	1066 (4.0%)	1619 (12.5%)
Disease type, n (%)			
Lung	4164 (10.5%)	3018 (11.4%)	1146 (8.8%)
Colorectal cancer	2318 (5.9%)	1583 (6.0%)	735 (5.7%)
Pancreas and other gastrointestinal	4265 (10.8%)	2566 (9.7%)	1699 (13.1%)
Breast	5759 (14.6%)	3616 (13.6%)	2143 (16.5%)
Head and neck	2537 (6.4%)	1928 (7.3%)	609 (4.7%)
Lymphoma	3223 (8.2%)	2206 (8.3%)	1017 (7.8%)
Prostate	3906 (9.9%)	3024 (11.4%)	882 (6.8%)
Ovarian, vaginal, and uterine	3133 (7.9%)	1612 (6.1%)	1521 (11.7%)
Unknown	536 (1.4%)	355 (1.3%)	181 (1.4%)
Other	9657 (24.4%)	6594 (24.9%)	3063 (23.6%)
Charlson Comorbidity Index score at diagnosis, mean (SD)	1.60 (2.70)	1.72 (2.96)	1.36 (2.07)
Initial cancer treatment modality, n (%)			
Surgery	20,493 (51.9%)	14,439 (54.5%)	6054 (46.6%)
Radiation therapy	12,691 (32.1%)	9463 (35.7%)	3228 (24.8%)
Chemotherapy	16,326 (41.3%)	11,024 (41.6%)	5302 (40.8%)
Immunotherapy	2389 (6.0%)	1541 (5.8%)	848 (6.5%)
Emergency department visit ^b frequency, n (%)			
0	16,103 (40.8%)	11,386 (43.0%)	4717 (36.3%)
1-3	19,540 (49.5%)	12,952 (48.9%)	6588 (50.7%)
≥ 4	3855 (9.8%)	2164 (8.2%)	1691 (13.0%)

Safety Net, Parkland Health; University, The University of Texas Southwestern Medical Center.

^aStages IIIB and higher for lung cancer, stages III and higher for pancreatic cancer, and stage IV for all others except brain cancer.

^bEmergency department visits within 180 days of cancer diagnosis.

when outpatient clinics were closed, ED visits were also significantly less severe. Despite available 24/7 telephone access to a clinician, only 1 in 7 ED visits were preceded by clinician contact. An overarching explanation of our findings is that patients may use other criteria rather than clinical severity to determine their need for ED care.

A smaller analysis of patients with ED visits made to only a single cancer treatment hospital analyzed the details of phone triage advice they received, and it found that less than half of visits to the cancer treatment hospital were preceded by a call and that many clinician recommendations (60%) were to go to the ED.²⁰ The overall high hospitalization rate here is in line with the literature.^{3,21} We are not aware of other geospatial investigations of comprehensive ED visits and visit severities among adults with cancer.

Our findings underscore an underrecognized barrier to patient-centered care: Patients and caregivers have little clinical training yet must determine when and where to present for new or worsening symptoms. Given this, many potential nonclinical influences drive ED use. For one, clinical severity does not distinguish the experienced severity of a patient's pain and does not account for pain exceeding the available home medications.²² Symptoms may begin earlier in the week but unexpectedly escalate over the weekend before outpatient sites reopen. The burden of driving further to a cancer-treating hospital (Figure) rather than to hospitals closer to home also deserves further investigation. Our data do not directly capture patient decisions, but the inherent uncertainty of uninvestigated or worsening symptoms also complicates decision-making.

On the other hand, half of ED visits were made to other hospitals that may have less personalized cancer care information and may be less familiar managing cancer- and treatment-related complications. Because our analysis excluded ED visits for alcohol, mental health, or injury, cancer care details are likely to be relevant to shaping the evaluation and management of these acute presentations. Although we did not exclude other ED visits unrelated to cancer or treatment, the literature finds that only approximately 5% of ED visits made at any time since the cancer diagnosis

were clearly unrelated.¹ Differences in the pattern of hospital choice and ED self-referral between the University and Safety Net patients suggest that although the type of insurance strongly influences hospital choice, especially for the uninsured, other unmeasured facility characteristics may also be influential, such as prior good or bad experiences.

Our findings also highlight that without widespread linked EHRs,²³ cancer care teams may not be aware of many of their patients' ED visits and unplanned acute care needs. Because patients wish to avoid the ED and have more triage support from their clinical team,²² more work should be done to understand why so few patients use existing 24/7 clinician assistance. This finding—consistent across health systems serving disparate populations—underlines broader issues related to navigating care during a complicated time in a patient's life. Indeed, these findings point to opportunities for care delivery improvement that may be more amenable to change than immutable patient characteristics traditionally noted as risk factors for avoidable emergency care. For both health systems, initial patient calls are routed to clinicians who call patients back with direct triage follow-ups. We did not have data on time to a returned call or number of calls to reconnect, although these may be potential explanations for underuse and important avenues for future research.

Implications for Practice and Policy

Nearly all participants in the Center for Medicare and Medicaid Innovation's Oncology Care Model (OCM), the first cancer-specific alternative payment model, aimed to reduce ED use,²⁴ but there was no significant reduction in ED visit rates by the end of the 5-year pilot program.²⁵ Both health systems studied here participated in the OCM. Because existing tools for care coordination such as 24/7 telephone triage (a requirement of OCM participation) and promising oncology acute care clinics⁶ may be underutilized, providers should better understand the uncertainties that patients and caregivers face navigating the health system, especially as they move forward to the next iteration of the program, the Enhancing Oncology Model.

Limitations

ED visit severity was based on a validated diagnosis code–based algorithm,^{16,17} and although validation included patients with cancer, it is unclear how accurate this multicondition algorithm is in distinguishing severity for this specific population. Classifying

clinical severity using a primary diagnosis code has inherent limitations.²⁶ Future work should explore more sophisticated claims-based algorithms, perhaps incorporating procedure codes. Additionally, there is substantial clinician discretion in hospitalization decisions that often incorporates important nonclinical factors.^{27,28} However, to maximize the breadth and comprehensiveness of our unique integrated data set, classification using the primary diagnosis code was the strongest available measure of clinical severity.

It is possible that patients had clinical interactions not captured in the EHRs—for instance, if the patient's primary care provider was outside the health system (especially in subgroups who were insured and lived far from the cancer treatment hospital). However, we expect this undercounting would be minor because patients likely prefer to call their cancer care team in this early phase of care. A prior study detailing the nature of triage advice given has documented regular logging of these unbilled encounters.²⁰

TABLE 2. Characteristics of Comprehensive ED Visits^{17-19,a}

ED visit characteristics	Combined n = 38,944	University n = 19,906 (%)	Safety Net n = 19,038 (%)
Self-referred (no call before ED visit), n (%)	33,280 (85.5%)	16,068 (80.7%)	17,212 (90.4%)
Visits to cancer treatment home hospital, n (%)	19,949 (51.2%)	5780 (29.0%)	14,169 (74.4%)
Weekend/holiday ^b visit, n (%)	9972 (25.6%)	5251 (26.4%)	4721 (24.8%)
Severity of visit, ^c n (%)			
Hospitalized	20,930 (53.7%)	11,402 (57.3%)	9528 (50.1%)
Emergent	9873 (25.4%)	4749 (23.9%)	5124 (26.9%)
Intermediate	5934 (15.2%)	2748 (13.8%)	3186 (16.7%)
Nonemergent	2207 (5.7%)	1007 (5.1%)	1200 (6.3%)
Miles driven to ED, median (IQR)	10.9 (6.3-16.3)	11.2 (6.1-17.8)	10.5 (6.4-15.2)
Minutes driven to ED, median (IQR)	21.0 (14.1-29.6)	22.2 (13.9-32.4)	19.9 (14.2-27.5)
Number of EDs bypassed, by driving distance, median (IQR)	16 (4-27)	15 (3-29)	16 (5-25)
Number of EDs bypassed, by driving time, median (IQR)	13 (4-33)	14 (4-35)	12 (4-28)
Miles to cancer treatment hospital, median (IQR)	13.1 (8.7-18.8)	15.4 (9.9-24.9)	11.9 (7.8-15.3)
Minutes to cancer treatment hospital, median (IQR)	25.9 (18.6-34.3)	30.2 (20.9-41.4)	22.9 (17.3-28.9)
Quintiles, number of EDs bypassed, by driving time			
Minimum	0.0	0.0	0.0
20th percentile	22.0	22.0	23.0
40th percentile	45.0	44.0	48.0
60th percentile	68.0	67.0	71.0
80th percentile	92.0	90.0	97.0
Maximum	118.0	111.0	118.0

ED, emergency department; Safety Net, Parkland Health; University, The University of Texas Southwestern Medical Center.

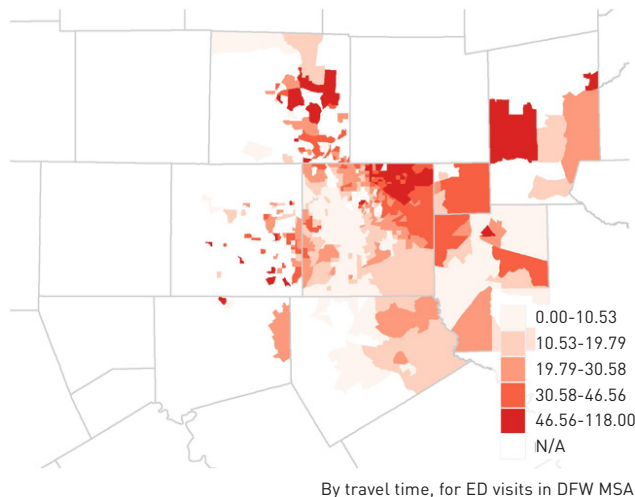
^aED visits within 180 days of new cancer diagnosis.

^bNew Year's Day, Memorial Day, Labor Day, Thanksgiving Day and day after, and Christmas Day.

^cBased on validated New York University Billings algorithm of ED visit severity, with Ballard et al modification and Johnston et al patch.¹⁷⁻¹⁹

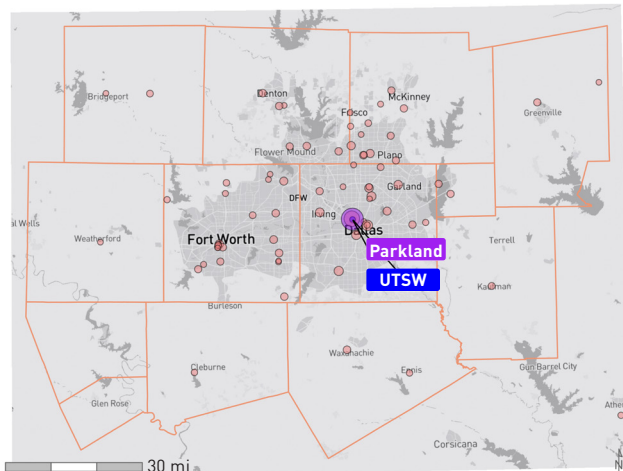
FIGURE. Distribution of EDs Visited by Adults With Cancer in the DFW Region, Alongside the Mean Number of Nonvisited EDs Closer to the Patient’s Home^a

A. Mean number of closer EDs for Safety Net patients^b



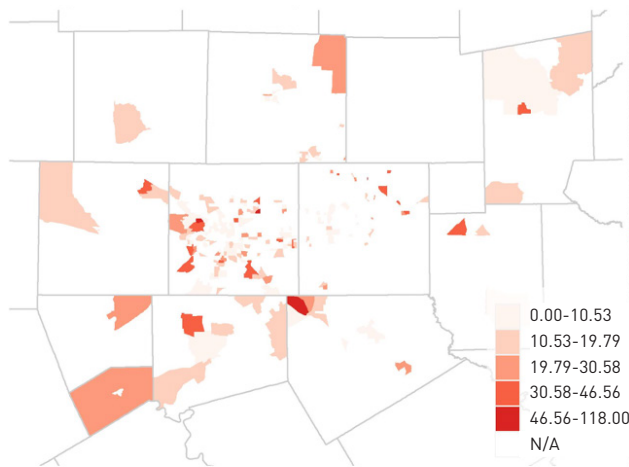
By travel time, for ED visits in DFW MSA

B. EDs in DFW MSA^c



Source: DFW Hospital Council

C. Mean number of closer EDs for University patients^d



By travel time, for ED visits in DFW MSA

DFW, Dallas–Fort Worth; ED, emergency department; MSA, metropolitan statistical area; N/A, not applicable; Safety Net, Parkland Health; University, The University of Texas Southwestern Medical Center.

^aED visits within 180 days of cancer diagnosis, from 2008–2018. More than 75% of Safety Net patients are covered by Medicaid or the county safety net charity care program, the latter of which limits reimbursed care to Parkland Hospital. In contrast, approximately 9% of University patients are covered by Medicaid or the county safety net charity care program, broadening the range of facilities that are payer accessible.

^bMean distance from patient’s home address to ED visited by Safety Net patients within a Census tract; distance as measured by the number of other hospitals closer to patient’s home by driving time. Darker color indicates further distance traveled for the average ED visit. White spaces indicate Census tracts with no patients with cancer who visited the ED within 180 days of cancer diagnosis.

^cDensity of ED visits to EDs in the DFW region, as visited by patients with cancer from the University and Safety Net health systems. Larger circles indicate higher number of visits to an ED facility.

^dMean distance from patient’s home address to ED visited by University patients within a Census tract; distance as measured by the number of other hospitals closer to patient’s home by driving time. Darker color indicates further distance traveled for the average ED visit. White spaces indicate Census tracts with no patients with cancer who visited the ED within 180 days of cancer diagnosis.

In computing distance to the ED, we used the patient's home address. However, patients may visit an ED further from their home for several reasons. For example, a further ED might be closer to work or their primary care office or is in network with their health insurance. Patients may also rely on public transportation, presenting different travel times. Alternatively, ambulances may transport patients to a closer ED without much patient input. We were unable to distinguish these factors, which might bias our results, although in an unclear summative direction.

Although we present these findings from the combined population-based sample of an academic referral center and integrated safety-net health system in a large metropolitan area spanning urban, suburban, and rural areas, it is unclear how generalizable these findings are to community cancer providers and other health care markets. However, our findings are from a large, diverse population over many years and across a broad range of insurance types, including the uninsured.

CONCLUSIONS

Despite additional available clinical resources, patients with cancer and their caregivers face challenges navigating the complexity of care, especially when it comes to identifying the appropriate setting for new or worsening symptoms. Although common prerecorded phone messaging advises patients to seek emergency care for emergent conditions, this may be especially unhelpful for patients with cancer who may have a heightened awareness and fear of their symptoms. When patients make less urgent visits to the ED despite facing unpredictable wait times and potential disruptions to cancer treatment, providers should take this as a signal to better address unmet patient needs. Our findings suggest that upstream patient decisions leading to an ED visit may be influenced by nonclinical factors and that there are opportunities to maximize existing clinical resources to optimize acute care coordination. ■

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Appendix Table 1: ED Visit Severities for Multivariate Modeling, Before and After Excluding Non-Ordinal Severities

ED visit characteristics	Combined after exclusion n = 38,944 (%)	UTSW before exclusion n = 25,615 (%)	PHHS before exclusion n = 26,410 (%)
Severity of visit [§]			
Hospitalized	20,930 (53.7)	11,402 (44.5)	9,528 (36.1)
Severe	9,873 (25.4)	4,749 (18.5)	5,124 (19.4)
Intermediate	5,934 (15.2)	2,748 (10.7)	3,186 (12.1)
Non-Severe	2,207 (5.7)	1,007 (3.9)	1,200 (4.5)
Alcohol, mental health, injury	[excluded]	1,739 (6.8)	4,038 (15.3)
Missing (unclassified) ^{§§}	[excluded]	3,970 (15.5)	3,334 (12.6)

[§]Based on validated NYU Billings algorithm of ED visit severity, with Ballard et al modification

^{§§}Unclassified diagnosis codes patched with Johnston et al

Billings J, Parikh N, Mijanovich T. Issue Brief: Emergency Department Use in New York City: A Substitute for Primary Care? . The Commonwealth Fund 2000:1-6.

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Appendix Table 2: Cohort comparison of patients matched and unmatched to a geocoded address, among patients who had any ED visits						
Characteristics	University of Texas Southwestern Medical Center sub cohort (86.1% matched)			Parkland Health and Hospital System safety-net sub cohort (96.0% matched)		
	Unmatched (n = 2,125)	Matched (n = 13,176)		Unmatched (n = 330)	Matched (n = 7,949)	
	Female	50.9	49.3	p = 0.169	47.6	53.8
Age at diagnosis						
18-24	1.8	1.3	p < 0.001	2.7	2.0	p < 0.001
25-34	6.6	3.7		10.9	6.2	
35-44	9.8	8.9		13.3	12.5	
45-54	22.9	19.0		29.1	24.7	
55-64	25.8	29.2		32.7	35.7	
65+	33.1	37.9		11.2	19.0	
Race/Ethn						
White	61.0	54.1	p < 0.001	25.2	21.7	p < 0.040
Black	20.1	22.2		35.8	33.7	
Hispanic	14.0	18.0		35.2	39.8	
Other	4.9	5.7		3.9	4.8	
Non-English language preference	12.5	16.1	p < 0.001	27.3	34.6	p < 0.006
Insurance type at diagnosis						
Commercial	47.6	43.9	p = 0.005	10.9	7.7	p = 0.013
Medicare	34.4	36.7		11.2	15.3	
Medicaid, Uninsured/charity care/self-pay	9.0	8.7		75.8	75.9	
Unknown	9.0	10.8		2.1	1.1	
Advanced stage at diagnosis	27.5	30.8	p = 0.002	24.9	31.6	p = 0.010
Died within 180 days of diagnosis	4.0	5.9	p < 0.001	86.7	82.6	p = 0.054
Disease type						
Lung	11.7	14.7	p < 0.001	10.0	10.3	p = 0.859
Colorectal cancer	7.2	6.8	p = 0.474	5.2	6.0	p = 0.518
Pancreas and other gastrointestinal	9.4	12.0	p < 0.001	12.7	15.3	p = 0.201
Breast	14.0	13.1	p = 0.277	7.9	13.3	p = 0.004
Head and neck	10.3	8.3	p = 0.054	4.9	5.1	p = 0.826
Lymphoma	9.2	8.8	p = 0.591	7.3	8.7	p = 0.360
Prostate	7.3	7.5	p = 0.808	5.5	4.8	p = 0.583
Ovarian, vaginal, uterine	7.6	7.3	p = 0.661	17.3	12.6	p = 0.013
Unknown	1.5	1.6	p = 0.802	1.5	1.6	p = 0.893
Other	2.7	3.0	p = 0.447	27.9	22.2	p = 0.016
Mean (SD) Charlson comorbidity index at diagnosis	1.79 (3.14)	1.96 (3.23)	p = 0.028	0.28 (1.08)	0.41 (1.15)	p = 0.039
Initial cancer treatment modality						
Surgery	52.7	49.3	p = 0.003	1.9	98.1	p < 0.001
Radiation therapy	43.1	42.6	p = 0.697	15.8	26.0	p < 0.001
Chemotherapy	52.1	52.6	p = 0.668	27.9	49.0	p < 0.001
Immunotherapy	6.5	6.7	p = 0.764	2.7	7.6	p = 0.001
Emergency Department visits within 6 months after diagnosis [§]						
0						
1-3	86.8	85.7	p = 0.157	82.7	79.4	p = 0.147
4+	13.2	14.3		17.3	20.6	

[§]Compiled through May 31, 2019

Appendix Table 3: Top 5 condition categories within each category of ED visit severity

Alcohol, mental health, injury		Non-severe		Intermediate severity		Severe, not hospitalized		Hospitalized	
% of ED visits	Diagnoses	% of ED visits	Diagnoses	% of ED visits	Diagnoses	% of ED visits	Diagnoses	% of ED visits	Diagnoses
4.3	distal fracture, musculoskeletal injury	1.2	headache and neck pain	1.5	nausea, vomiting, diarrhea, presyncope	3.3	abdominal pain	4.2	sepsis, blood stream infection, postoperative/procedural infection
3.0	complication of procedure, device, or implant	0.8	joint pain (hip, knee, shoulder)	1.3	pain in limb	2.6	respiratory abnormality and shortness of breath	0.8	acute kidney failure
0.3	Adverse effect of medication, or allergy	0.6	menopausal and postmenopausal bleeding, other symptoms of female genital organs	1.0	urinary tract infection	1.3	chest pain, nonspecific	0.8	pulmonary embolism
0.3	anxiety, depression	0.5	rash, urticaria, dermatitis	0.9	back pain	0.9	neoplasm pain, postprocedural pain	0.7	pneumonia
0.3	open wound of distal extremities	0.2	breast symptoms	0.6	hypertension	0.7	syncope and collapse	0.6	neutropenia

Total ED visits after exclusions for non-geocoded address, discharge status, visit overlapping cancer diagnosis date = 52,150

eAppendix Table 4: Regression Modeling Full Results and Sensitivity Analyses

Characteristics	Main Regression Model		Sensitivity Analyses <small>Driving</small>			UTSW Only	PHHS Only
	Univariate (OR, 95% CI)	Multivariate (aOR, 95% CI)	# of closer EDs by Distance	Distance (cont miles)	Driving Time (cont time)	Multivariate (aOR, 95% CI)	Multivariate (aOR, 95% CI)
Female	0.72 (0.69-0.75)	0.75 (0.68-0.83)	0.75 (0.68-0.83)	0.75 (0.69-0.83)	0.75 (0.69-0.83)	0.80 (0.73-0.87)	0.79 (0.68-0.91)
Age at diagnosis							
18-24	REF	REF	REF	REF	REF	REF	REF
25-34	0.63 (0.53-0.76)	0.62 (0.43-0.90)	0.62 (0.43-0.90)	0.62 (0.43-0.90)	0.62 (0.43-0.90)	0.79 (0.54-1.14)	0.48 (0.29-0.80)
35-44	0.65 (0.55-0.77)	0.71 (0.50-1.01)	0.71 (0.50-1.01)	0.70 (0.50-1.00)	0.71 (0.50-1.00)	0.89 (0.63-1.27)	0.50 (0.31-0.81)
45-54	0.73 (0.62-0.86)	0.78 (0.55-1.10)	0.78 (0.56-1.10)	0.78 (0.55-1.10)	0.78 (0.55-1.10)	1.00 (0.71-1.41)	0.50 (0.31-0.80)
55-64	0.90 (0.76-1.06)	0.91 (0.65-1.28)	0.91 (0.65-1.28)	0.91 (0.65-1.28)	0.91 (0.65-1.28)	1.11 (0.79-1.55)	0.57 (0.35-0.91)
65+	1.14 (0.96-1.34)	1.10 (0.78-1.56)	1.10 (0.78-1.56)	1.10 (0.78-1.55)	1.10 (0.78-1.55)	1.21 (0.86-1.71)	0.57 (0.35-0.94)
Race/Ethn							
White	REF	REF	REF	REF	REF	REF	REF
Black	0.72 (0.68-0.75)	0.71 (0.64-0.79)	0.71 (0.64-0.79)	0.71 (0.64-0.79)	0.71 (0.64-0.79)	0.72 (0.66-0.80)	0.88 (0.75-1.04)
Hispanic	0.64 (0.61-0.67)	0.64 (0.57-0.72)	0.64 (0.57-0.72)	0.64 (0.57-0.73)	0.64 (0.57-0.73)	0.69 (0.61-0.78)	0.79 (0.65-0.95)
Other	1.02 (0.93-1.13)	0.90 (0.74-1.10)	0.90 (0.74-1.10)	0.90 (0.74-1.10)	0.90 (0.74-1.10)	0.94 (0.78-1.12)	0.92 (0.67-1.27)
English language preference	1.16 (1.11-1.21)	0.96 (0.85-1.08)	0.96 (0.85-1.08)	0.96 (0.85-1.08)	0.97 (0.85-1.08)	0.90 (0.80-1.02)	0.89 (0.75-1.05)
Insurance type							
Commercial	REF	REF	REF	REF	REF	REF	REF
Medicare	1.33 (1.20-1.47)	1.01 (0.82-1.23)	1.01 (0.82-1.23)	1.00 (0.82-1.23)	1.01 (0.82-1.23)	1.06 (0.95-1.19)	1.24 (0.94-1.64)
Medicaid	1.39 (1.26-1.54)	1.05 (0.85-1.29)	1.05 (0.85-1.29)	1.05 (0.85-1.29)	1.05 (0.85-1.29)	0.97 (0.85-1.11)	1.04 (0.81-1.32)
Uninsured/county charity care/self-pay	1.03 (0.91-1.16)	0.83 (0.69-1.01)	0.87 (0.69-1.10)	0.87 (0.69-1.10)	0.88 (0.70-1.10)	0.92 (0.81-1.04)	0.87 (0.70-1.08)
Unknown	1.53 (1.02-2.29)	0.99 (0.48-2.04)	1.00 (0.49-2.04)	0.98 (0.48-2.01)	0.99 (0.48-2.02)	1.02 (0.60-1.74)	1.91 (1.07-3.40)
Urban/Rural							
Urban	REF	REF	REF	REF	REF	REF	REF
Large Rural	1.94 (1.61-2.35)	1.40 (0.88-2.25)	1.40 (0.87-2.24)	1.40 (0.88-2.25)	1.40 (0.87-2.24)	1.27 (0.82-1.97)	2.45 (0.97-6.16)
Small Rural	1.29 (1.24-1.34)	0.84 (0.57-1.24)	0.84 (0.57-1.23)	0.84 (0.57-1.24)	0.84 (0.57-1.24)	0.92 (0.64-1.30)	0.47 (0.08-2.62)
Charlson comorbidity index at diagnosis	1.05 (1.04-1.06)	1.03 (1.01-1.04)	1.03 (1.01-1.04)	1.03 (1.01-1.04)	1.03 (1.01-1.04)	1.01 (1.00-1.03)	1.12 (1.06-1.18)
Advanced stage at diagnosis	1.85 (1.78-1.93)	1.73 (1.57-1.91)	1.73 (1.57-1.91)	1.73 (1.57-1.91)	1.73 (1.57-1.91)	1.52 (1.38-1.68)	1.81 (1.56-2.11)
Died within 180 days	3.64 (3.38-3.91)	3.97 (3.45-4.58)	3.98 (3.45-4.59)	3.98 (3.45-4.58)	3.97 (3.45-4.58)	2.44 (2.03-2.93)	6.34 (5.23-7.69)

Characteristics	Main Regression Model		Sensitivity Analyses			UTSW Only	PHHS Only
	Univariate (OR, 95% CI)	Multivariate (aOR, 95% CI)	# of closer EDs by Distance	Distance (cont miles)	Driving Time (cont time)	Multivariate (aOR, 95% CI)	Multivariate (aOR, 95% CI)
Disease type							
Lung	1.73 (1.63-1.83)	1.33 (1.12-1.58)	1.33 (1.12-1.57)	1.33 (1.12-1.58)	1.33 (1.12-1.58)	1.27 (1.06-1.51)	1.20 (0.93-1.55)
Breast	0.50 (0.47-0.53)	0.60 (0.51-0.71)	0.60 (0.51-0.71)	0.60 (0.51-0.71)	0.60 (0.51-0.71)	0.73 (0.61-0.87)	0.58 (0.46-0.73)
Colorectal cancer	1.10 (1.01-1.19)	1.16 (0.98-1.38)	1.16 (0.98-1.38)	1.16 (0.98-1.38)	1.16 (0.98-1.38)	1.27 (1.05-1.54)	1.15 (0.86-1.54)
Melanoma	0.69 (0.60-0.81)	0.72 (0.52-0.99)	0.72 (0.52-0.99)	0.72 (0.52-1.00)	0.72 (0.52-0.99)	0.74 (0.55-0.99)	1.07 (0.56-2.08)
Head and neck	0.95 (0.88-1.02)	0.68 (0.56-0.82)	0.68 (0.56-0.82)	0.68 (0.56-0.82)	0.68 (0.56-0.82)	0.75 (0.62-0.91)	0.71 (0.53-0.96)
Brain	0.92 (0.82-1.04)	0.96 (0.75-1.25)	0.96 (0.75-1.25)	0.96 (0.74-1.25)	0.96 (0.74-1.25)	1.01 (0.80-1.28)	1.16 (0.69-1.95)
Kidney	0.87 (0.79-0.96)	0.92 (0.74-1.14)	0.92 (0.74-1.14)	0.92 (0.74-1.15)	0.92 (0.74-1.14)	1.05 (0.84-1.31)	0.78 (0.57-1.08)
Lymphoma	1.39 (1.30-1.48)	1.35 (1.12-1.63)	1.35 (1.12-1.62)	1.35 (1.12-1.62)	1.35 (1.12-1.62)	1.26 (1.04-1.54)	1.37 (1.05-1.79)
Prostate	0.52 (0.47-0.57)	0.37 (0.30-0.45)	0.37 (0.30-0.45)	0.37 (0.30-0.45)	0.37 (0.30-0.45)	0.46 (0.37-0.56)	0.31 (0.22-0.44)
Ovarian, vaginal, uterine	0.64 (0.60-0.68)	0.73 (0.61-0.88)	0.73 (0.61-0.88)	0.74 (0.61-0.88)	0.73 (0.61-0.88)	0.82 (0.67-1.01)	0.65 (0.51-0.83)
Pancreas	1.66 (1.50-1.85)	1.34 (1.05-1.71)	1.34 (1.05-1.71)	1.34 (1.05-1.71)	1.34 (1.05-1.71)	1.32 (1.04-1.69)	1.02 (0.71-1.48)
Other Gastrointestinal	1.69 (1.59-1.80)	1.55 (1.30-1.85)	1.55 (1.30-1.84)	1.55 (1.31-1.85)	1.55 (1.31-1.85)	1.47 (1.21-1.78)	1.30 (1.02-1.65)
Unknown	2.48 (2.08-2.97)	2.69 (1.89-3.82)	2.68 (1.89-3.82)	2.69 (1.89-3.82)	2.69 (1.89-3.82)	2.61 (1.80-3.78)	2.00 (1.16-3.45)
Other	REF	REF	REF	REF	REF	REF	REF
Initial cancer treatment modality							
Surgery	0.55 (0.53-0.57)	0.70 (0.64-0.77)	0.70 (0.64-0.77)	0.70 (0.64-0.77)	0.70 (0.64-0.77)	0.73 (0.67-0.80)	0.68 (0.59-0.79)
Radiation therapy	0.89 (0.86-0.93)	0.84 (0.77-0.91)	0.84 (0.77-0.92)	0.84 (0.77-0.91)	0.84 (0.77-0.91)	0.83 (0.76-0.91)	0.89 (0.77-1.03)
Chemotherapy	1.21 (1.17-1.26)	1.20 (1.10-1.31)	1.20 (1.10-1.31)	1.20 (1.10-1.31)	1.20 (1.10-1.31)	1.07 (0.98-1.17)	1.35 (1.18-1.54)
Immunotherapy	1.01 (0.94-1.08)	0.85 (0.73-0.99)	0.85 (0.73-0.99)	0.84 (0.77-0.91)	0.85 (0.73-0.99)	0.84 (0.72-0.97)	1.01 (0.80-1.27)
After OUCC established	1.00 (0.97-1.04)	0.89 (0.83-0.96)	0.89 (0.83-0.96)	0.89 (0.83-0.96)	0.89 (0.83-0.96)	0.81 (0.74-0.88)	1.13 (1.00-1.28)
Weekend ED visit	0.93 (0.89-0.97)	0.93 (0.87-0.99)	0.93 (0.87-0.99)	0.93 (0.87-0.99)	0.93 (0.87-0.99)	0.89 (0.82-0.95)	0.99 (0.90-1.09)
Phone contact within 1 day before ED visit	0.69 (0.65-0.73)	0.89 (0.81-0.97)	0.89 (0.81-0.97)	0.89 (0.81-0.97)	0.89 (0.81-0.97)	0.97 (0.88-1.08)	0.99 (0.85-1.14)
Visited ED at cancer-treating facility	1.06 (1.02-1.10)	1.31 (1.21-1.43)	1.31 (1.21-1.42)	1.31 (1.21-1.43)	1.31 (1.21-1.43)	1.87 (1.70-2.05)	0.74 (0.65-0.85)
UTSW patient (ref = safety-net patient)		0.51 (0.34-0.76)	0.51 (0.33-0.76)	0.51 (0.34-0.76)	0.51 (0.34-0.76)	-	-
Pre-Diagnosis ED Visits	0.97 (0.97-0.98)	0.95 (0.94-0.96)	0.95 (0.94-0.96)	0.95 (0.94-0.96)	0.95 (0.94-0.96)	0.96 (0.94-0.97)	0.95 (0.93-0.97)

Characteristics	Main Regression Model		Sensitivity Analyses			UTSW Only	PHHS Only
	Univariate (OR, 95% CI)	Multivariate (aOR, 95% CI)	# of closer EDs by Distance	Distance (cont miles)	Driving Time (cont time)	Multivariate (aOR, 95% CI)	Multivariate (aOR, 95% CI)
Quintile of Travel drive time (minutes)							
0-20	0.94 (0.88-0.99)	-	-	-	0.95 (0.85-1.05)	-	-
21-40	0.83 (0.78-0.89)	-	-	-	0.92 (0.82-1.03)	-	-
41-60	0.88 (0.83-0.94)	-	-	-	0.91 (0.81-1.01)	-	-
61-80	0.99 (0.93-1.05)	-	-	-	0.95 (0.85-1.06)	-	-
81-100	REF	-	-	-	REF	-	-
Quintile of Travel by driving distance (miles)							
0-20	0.93 (0.88-0.98)	-	-	0.96 (0.86-1.06)	-	-	-
21-40	0.85 (0.80-0.91)	-	-	0.97 (0.86-1.08)	-	-	-
41-60	0.87 (0.82-0.93)	-	-	0.90 (0.80-1.00)	-	-	-
61-80	0.92 (0.87-0.99)	-	-	0.96 (0.85-1.07)	-	-	-
81-100	REF	-	-	REF	-	-	-
Quintile of # of closer EDs by drive time							
0-20	1.00 (0.94-1.06)	1.01 (0.91-1.12)	-	-	-	1.02 (0.91-1.14)	0.94 (0.79-1.13)
21-40	0.89 (0.83-0.94)	0.97 (0.87-1.09)	-	-	-	1.02 (0.91-1.15)	0.86 (0.71-1.05)
41-60	0.95 (0.89-1.01)	0.98 (0.87-1.09)	-	-	-	1.04 (0.93-1.18)	0.86 (0.71-1.05)
61-80	0.99 (0.93-1.05)	1.02 (0.91-1.14)	-	-	-	1.04 (0.92-1.17)	0.99 (0.81-1.20)
81-100	REF	REF	-	-	-	REF	REF
Quintile of # closer EDs by drive distance							
0-20	0.99 (0.93-1.05)	-	1.01 (0.91-1.12)	-	-	-	-
21-40	0.92 (0.86-0.98)	-	0.97 (0.87-1.09)	-	-	-	-
41-60	0.93 (0.87-0.99)	-	0.99 (0.88-1.11)	-	-	-	-
61-80	1.04 (0.97-1.11)	-	1.05 (0.94-1.18)	-	-	-	-
81-100	REF	-	REF	-	-	-	-
Var(_cons)							
Patient	-	1.20 (0.97-1.47)	1.20 (0.97-1.47)	1.19 (0.97-1.47)	1.19 (0.97-1.46)	0.94 (0.77-1.14)	1.04 (0.74-1.48)
Patient within Hospital	-	2.25 (1.99-2.55)	2.25 (1.99-2.55)	2.25 (1.99-2.54)	2.26 (2.00-2.56)	0.12 (0.03-0.55)	2.32 (1.94-2.77)

Characteristics	Main Regression Model		Sensitivity Analyses			UTSW Only	PHHS Only
	Univariate (OR, 95% CI)	Multivariate (aOR, 95% CI)	# of closer EDs by Distance	Distance (cont miles)	Driving Time (cont time)	Multivariate (aOR, 95% CI)	Multivariate (aOR, 95% CI)
<u>Marginal Effects</u>							
Phone contact before ED visit (Severity 2)-NON-EMERGENT	5.5 (5.1-5.9)	5.5 (5.1-6.0)	5.5 (5.1-5.9)	5.5 (5.1-5.9)	5.5 (5.1-5.9)	5.1 (4.6-5.6)	6.8 (6.0-7.7)
No contact before ED visit (Severity 2)-NON-EMERGENT	6.0 (5.7-6.3)	6.0 (5.7-6.3)	6.0 (5.7-6.3)	6.0 (5.7-6.3)	6.0 (5.7-6.3)	5.2 (4.9-5.5)	6.9 (6.4-7.3)
Phone contact before ED visit (Severity 3)-INTERMED	14.5 (13.9-15.1)	14.5 (13.8-15.1)	14.5 (13.8-15.1)	14.5 (13.8-15.1)	14.5 (13.9-15.1)	13.4 (12.5-14.2)	17.0 (16.0-18.1)
No contact before ED visit (Severity 3)-INTERMED	15.2 (14.8-15.6)	15.2 (14.8-15.6)	15.2 (14.8-15.6)	15.2 (14.8-15.6)	15.2 (14.8-15.6)	13.6 (13.1-14.1)	17.1 (16.5-17.7)
Phone contact before ED visit (Severity 4)-EMERGENT	24.8 (24.3-25.4)	24.8 (24.3-25.4)	24.8 (24.3-25.4)	24.8 (24.3-25.4)	24.8 (24.3-25.4)	23.5 (22.7-24.3)	27.5 (26.6-28.3)
No contact before ED visit (Severity 4)-EMERGENT	25.3 (24.9-25.8)	25.3 (24.9-25.8)	25.3 (24.9-25.8)	25.3 (24.9-25.8)	25.3 (24.9-25.8)	23.7 (23.1-24.3)	27.5 (26.8-28.2)
Phone contact before ED visit (Severity 5)-HOSP	55.2 (53.9-56.4)	55.2 (53.9-56.5)	55.2 (53.9-56.5)	55.2 (53.9-56.5)	55.2 (53.9-56.5)	58.0 (56.3-60.0)	48.7 (46.6-50.8)
No contact before ED visit (Severity 5)-HOSP	53.4 (52.8-54.1)	53.4 (52.8-54.1)	53.4 (52.8-54.1)	53.4 (52.8-54.1)	53.4 (52.8-54.1)	57.5 (56.7-58.3)	48.5 (47.6-49.5)
NON-EMERGENT, quintile 0-20 (ED, distance)	5.9 (5.5-6.3)						
NON-EMERGENT, quintile 21-40	6.0 (5.6-6.5)						
NON-EMERGENT, quintile 41-60	6.0 (5.6-6.4)						
NON-EMERGENT, quintile 61-80	5.9 (5.4-6.3)						
NON-EMERGENT, quintile 81-100	5.9 (5.5-6.4)						
INTERMED, quintile 0-20	14.0 (14.5-15.6)						
INTERMED, quintile 21-40	15.3 (14.7-15.9)						
INTERMED, quintile 41-60	15.3 (14.7-15.9)						
INTERMED, quintile 61-80	15.0 (14.4-15.6)						
INTERMED, quintile 81-100	15.1 (14.5-15.7)						
EMERGENT, quintile 0-20	25.2 (24.7-25.7)						
EMERGENT, quintile 21-40	25.4 (24.8-25.9)						
EMERGENT, quintile 41-60	25.3 (24.8-25.9)						
EMERGENT, quintile 61-80	25.2 (24.6-25.7)						
EMERGENT, quintile 81-100	25.3 (24.7-25.8)						
HOSP, quintile 0-20	53.9 (52.8-54.9)						
HOSP, quintile 21-40	53.3 (52.1-54.5)						
HOSP, quintile 41-60	53.4 (52.1-54.6)						
HOSP, quintile 61-80	54.0 (52.8-55.2)						
HOSP, quintile 81-100	53.7 (52.5-55.0)						