FITCH

& ASSOCIATES

CONSULTANT REPORT

Knox County, TN

PO Box 170, 2901 Williamsburg Terrace, Suite G, Platte City, Missouri 64079

(816) 431-2600 (816) 431-2653 www.fitchassoc.com

Table of Contents

EXECUTIVE SUMMARY

In January 2023, Fitch & Associates (*FITCH*) participated in a Request for Proposal process initiated by Knox County, Tennessee. After being selected, we were tasked with evaluating the existing Emergency Medical Services (EMS) system and providing recommendations for its enhancement as part of the future EMS system contract. The primary tasks were to review the current contractor's performance in accordance with the existing contract, recommend areas of improvement, identify best practices for future monitoring of the contractor, identify areas to optimize the deployment of the EMS system and provide transparent findings to the purchasing staff and other County officials.

A structured process was employed, beginning with interviews of system participants, including County officials and key personnel from Fire, EMS, and Law Enforcement. *FITCH* provided the County and local departments with an extensive Information Data Request (IDR) tool. This tool provided the baseline data utilized as a major component of the study.

This document includes an executive summary that entails critical findings and recommendations as well as a quantitative data report. Overall, the firm's strategy is to provide the administration and elected policy group with sufficient objective data to establish a clear policy and direction for the future of emergency medical services in Knox County. All of the alternatives and recommendations presented are grounded in data analysis and best practices.

Critical Findings

FITCH believes that in order for a system to provide top-notch emergency services that are effective and efficient, it is crucial to address the Critical Findings outlined below in a thorough and robust manner. The report offers additional recommendations, which are outlined throughout its various sections and summarized in the conclusion.

1. **Participation in an RFP is financially infeasible for an EMS agency under the current contract design.**

Contract performance expectations require a contractor to staff significant unit hours which adds cost. Since 2019 expenses have risen while revenues have decreased. The payor mix of the population served includes a high percentage of self-pay patients. These factors culminate in the existing contract being financially non-viable. In addition, the hospitals and emergency departments experience long wait times

(wall times), equivalent to six 12-hour shifts per day. This costs the EMS contractor roughly $4,060,653 every year. There are three primary concerns: extended wall times at hospitals, reduced revenue per transport due to a high percentage of self-pay patients, and a significant rise in expenses since the start of the COVID-19 pandemic. The result is that the current system is financially unsustainable without subsidies or adjustments to performance expectations.

2. **Response times are not equitable for the community.**

Currently, Knox County is configured as one response zone. This does not take into consideration the population density of urban, suburban, and rural areas. The consequence of this is a contractor only needs to staff the high population density areas, which results in suburban and rural communities having extended response times. In reviewing response time statistics and data, we recommend realigning response zones to provide equitable response across all areas of the County. This recommendation is derived from the standards for response time set by the International Commission on Fire Accreditation.

3. **Current hospital wall times are excessive and will prevent any EMS contractor from being successful.**

During our on-site interviews with the current contractor (AMR) and hospital staff, it was reported that hospital wall times are increasing. After analyzing the data, we found that the current wall times are comparable to having 6.662 12-hour shift ambulances waiting idly and unable to respond to any 911 calls. The corresponding revenue loss will make it impossible for any EMS contractor to succeed in Knox County. If the issue is not addressed before awarding the RFP, Knox County should be aware that no agency will be able to meet the desired performance standards.

4. **There is a lack of effective and transparent controls in the EMS system for monitoring operational and clinical performance.**

Currently, the contractor relies on a manual process to collect performance and clinical data, which requires them to provide the information themselves. The County depends on compliance reports that are compiled directly by the EMS contractor. These reports are reviewed jointly. However, there is currently no provision for real-time reporting to assess the system's health. The county should require a software program that automates the process of measuring both clinical and operational performance. This will eliminate the reliance on the EMS contractor to provide the necessary data for performance evaluation.

5. The Mission District area requires significant resourcing with little to no additional funding.

The Mission District is a portion of the City of Knoxville that causes a significant demand for EMS service. Even though resources are limited in this district, it's advisable to assess the area for supplementary resources like alternative response units, mobile clinics, or other healthcare programs to help reduce the demand and burden on the healthcare system as a whole. It will take a multi-faceted and multi-disciplinary approach to reduce the EMS contractor burden. Furthermore, this will require the EMS Contractor, County and City officials, with many other healthcare and non-for-profit partners to support.

METHODOLOGY

Data was gathered by the Fitch team from the Knox County and American Medical Response (AMR) and other stakeholders utilizing their Information Data Request (IDR) tool. The team also requested Computer Aided Dispatch (CAD) reports as part of their data collection process. The collected information revealed that the system's response time starts from the initial 911 emergency medical dispatch (EMD) coding and extends all the way to the advanced life support (ALS) response provided to the patient. These data cover a period of five years.

To gauge the amount of work and volume of calls, we employed two distinct methods. The initial approach involved counting the number of service requests, which comprised both the dispatches and the calls themselves. The second method entailed tabulating the total number of resources that responded to these requests. By utilizing these two methods, we were able to obtain a comprehensive understanding of the workload and call volume. Analyses of drive times were conducted for both the existing and potential system designs.

Additional data related to the revenue cycle review for projected current and future gross/net income, 911 current staffing levels, EMS resource deployment, and Knox County's first response was gathered. These elements were analyzed in association with the CAD data to evaluate EMS performance and identify areas to enhance the current service delivery model.

Upon obtaining and thoroughly analyzing the completed information data request tool, FITCH proceeded with a comprehensive onsite qualitative assessment. Throughout this assessment, we had the opportunity to meet with the fundamental stakeholders responsible for the delivery of EMS services, wherein we engaged with County personnel, Hospital leadership, fire departments, AMR, and Knox County Communication Center. Upon the completion of both the quantitative and qualitative review, FITCH presented our initial findings and recommendations to the same key stakeholders in Knox County.

Current System Overview

Service Area Description

Knox County in Tennessee spans an area of 526 square miles and is home to around 486,000 people. The county is primarily urban and suburban, with some rural areas. According to the 2022 US Census, Knox County has an annual population growth of 1.58%.[1]

AMR attempts to deploy four (4) 24-hour ALS ambulances and up to 14 additional ALS units out of posts and locations throughout Knox County. This deployment plan covers operations 24/7, seven days a week. AMR also has two Advanced Life Support (ALS) SUV first response vehicles that it can deploy.

AMR employs a dynamic posting strategy around the clock to ensure that EMS units are always close to areas with insufficient coverage. For an effective posting plan, units are deployed to designated locations based on call volume and historical data. AMR uses the locations listed in Figure 1 as posts for deployment within the county.

Figure 1: AMR Posting Locations

American Medical Response (AMR) Post Locations			
275/Woodland	Clinton Hwy/Merchants	Papermill/Northshore	75/Merchants
Western/ED Shore	Emory/Dry Gap	AOC	RM Station34
640/Broadway	Maynardville Hwy/Brown Gap	RM Station 28	RM Station 16
West Hills	Washington Pike/Murphy Rd	Ut Hospital	Middlebrook Pike/Cedar Bluff
Rescue Squad East	Rutledge Pike/Old Rutledge Pine	Chapman/Young High	RM Station 27
Chapman/Lindy	Karns Red Light	Kingston Pike/Cedar Bluff	RM Station 31
Broadway/Woodland	Kingston Pike/Papermill	RM Station 41	John Sevier/Chapman

[1] US Census, Quick Facts, population estimates as of July 1, 2022

EMS Deployment Model

In Knox County, the current EMS deployment model involves an ALS transport ambulance and an ALS/BLS first response from local fire departments. The ALS response and patient transport services within the contracted service area are provided exclusively by an EMS-contracted provider, AMR. The following agencies provide Medical First Response in Knox County:

- Rural Metro Fire - BLS/ALS first response
- Knoxville Fire Department – BLS/ALS first response
- Karns Fire Department – BLS/ALS first response
- Seymour Fire Department – BLS/ALS first response
- Knox County Sheriffs – Deputy's carry Narcan and tourniquets

Prior to the study beginning, Knox County adjusted the minimum response time requirements from 10 minutes to 17 minutes. Prior to this, if a Fire Medical First Response company stated they were in service with an ALS Fire Unit, the EMS contractor was allowed an elongated response time. A common standard operating procedure was not instituted for the Fire Departments, requiring them to inform the county of their ALS first response status. The Rural Metro Fire units would notify Knox County Dispatch and inform them when they were staffed with a paramedic, but Knoxville Fire Department units did not. This resulted in creating both response time expectation inequities between the rural and urban areas and response time reporting challenges.

Before our study, Knox County authorized AMR to utilize BLS units and an ALS quick response vehicle (QRV) for handling emergency responses. AMR deployed two (2) BLS units for each ALS QRV. In cases where the patient's condition was of low acuity, AMR would transport them using a BLS unit, freeing up the ALS QRV and other ALS ambulances for future emergency responses.

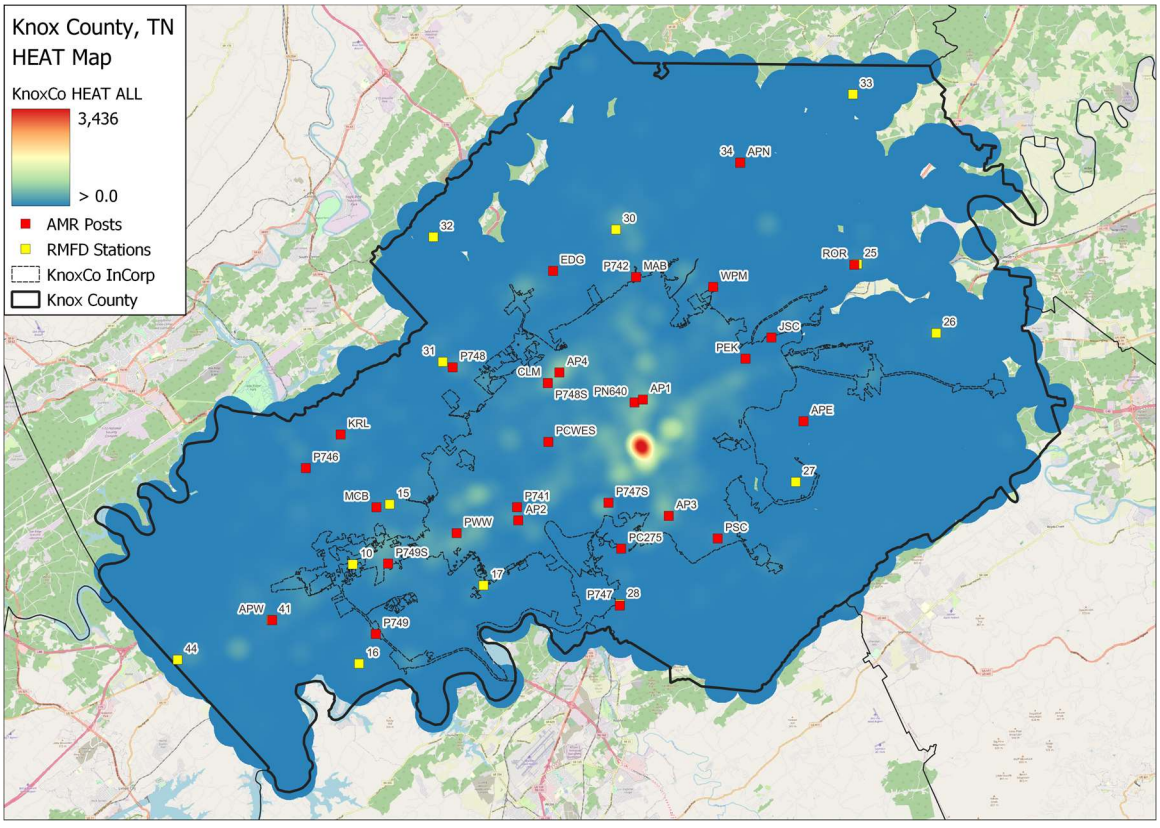
EMS-Related Distribution of Risk

Density Mapping

FITCH used heat mapping to assess the current density levels of responses for Priority 1 and Priority 2 call activity. Please refer to Figure 2 for visual representation. In order to deploy units effectively, it is important to identify areas with the highest level of risk or volume. By using this model, informed decisions can be made regarding response performance levels.

The color coding represents different levels of responses: red areas indicate a "hot spot" with over 3,436 responses in that year, while blue areas suggest a mostly rural response with over one call in that year. Areas with no color indicate that no calls were made that year. AMR posts and Rural Metro Fire Department stations are also represented for reference.

Figure 2. Knox County Heat Map

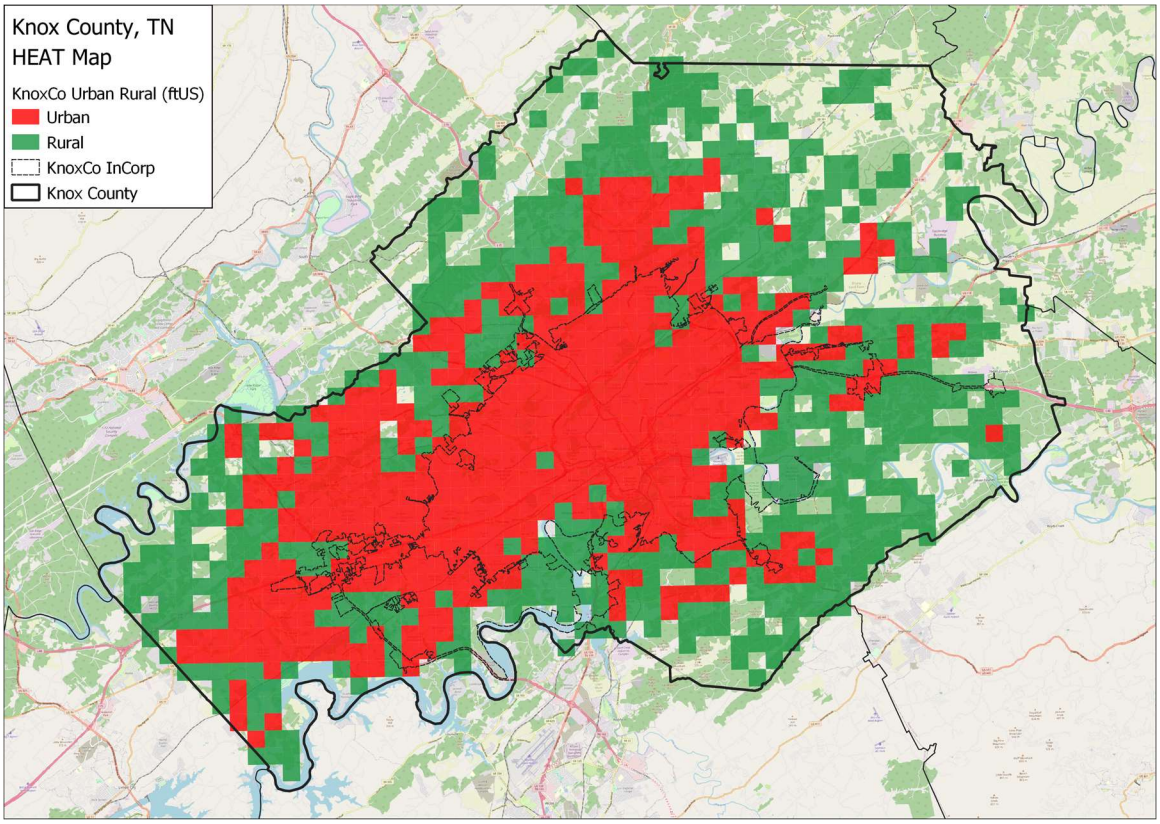


Commensurate Risk Mapping

To evaluate Urban/Rural density levels for response zones, *FITCH* utilized a commensurate risk map to evaluate call activity, which is shown in Figure 3 below. This model allows for informed decisions to be made on performance levels of response.

The map shows different areas with varying levels of risk. Urban areas marked in red have a high-risk level, with at least two emergency calls per month within a 1km cell and four or more calls in the eight surrounding cells. Rural areas marked in green have a lower risk level, with 0.25 emergency calls within the 1km cell and at least one call per month in the eight surrounding cells. Areas with no color indicate low density response zones, which do not meet the above criteria.

Figure 3. Commensurate Risk Map



Community Demand for Service

In the past five years, the total number of responses increased at a 2% compounded annual growth rate due to non-transport requests, whereas transport requests declined at a rate of -0.6%. A total of 63,927 requests were recorded in 2022, averaging 175 responses per day. Of those, 68% or 119 responses per day resulted in patient transports. All units spent a total of 78,587 call hours from the time of dispatch till the unit was clear and available. This averaged 215 hours per day of engagement. The City of Knoxville had the highest demand for service in 2022, accounting for 91% of the total, followed by Farragut (4%) and Powell (2%). See Figures 4-6.

The demand between midnight and 6 am was only 4.1 responses per day on average, which is less than half the demand for the rest of the day, which averaged 7.3 responses. For completed transports in 2022, the time on task per transport averaged 97.5 minutes. On average, the time spent on the task can be broken down into 12.6 minutes for turnout and travel, 17.9 minutes on scene, 15.9 minutes for travel to the destination, and 53.1 minutes for hospital turnaround. For non-transports, the total average time on task was 23.3 minutes in 2022.

Hospital turnaround time accounts for 54.5% of the total time spent on task. University of Tennessee Medical Center was the top transport destination, accounting for 32% of all transported trips, averaging 38.3 transports per day.

Figure 4. Number of Responses by Priority and Year 2018-2022

Priority	*Number of Responses*				
	2018	*2019*	*2020*	*2021*	*2022*
1	30,378	30,910	29,835	33,743	35,672
2	10,022	10,698	12,171	13,138	14,742
3	17,675	17,708	18,774	16,609	11,912
4-9	1,077	1,145	1,462	1,747	1,601
Total	59,152	60,461	62,242	65,237	63,927
Responses Per Day	162.1	165.6	170.1	178.7	175.1
YoY Growth		2.2%	2.7%	5.1%	-2.0%

Figure 5. Number of Transports by Priority and Year 2018-2022

Priority	*Number of Transports*				
	2018	*2019*	*2020*	*2021*	*2022*
1	23,100	22,905	20,814	22,423	24,558
2	7,199	7,337	8,226	8,630	9,567
3	12,885	12,385	12,761	11,132	7,555
4-9	1,064	1,124	1,436	1,747	1,601
Total	**44,248**	**43,751**	**43,237**	**43,932**	**43,281**
Responses Per Day	**121.2**	**119.9**	**118.1**	**120.4**	**118.6**
YoY Growth		**-1.1%**	**-1.4%**	**1.9%**	**-1.5%**

Figure 6. Number of Transports by Priority and Year 2018-2022

Transport/Non-Transport	*Number of Transports / Non-Transports*					
	*City***	*1*	*2*	*3*	*4-9*	*Total*
Transport	Knoxville	22,208	8,714	6,915	1,483	39,320
	Farragut	1,099	420	363	48	1,930
	Powell	682	288	182	51	1,203
	Corryton	197	77	49	6	329
	Other	177	22	15	4	218
	Mascot	121	23	22	8	174
	Strawberry Plains	74	23	9	1	107
	Total	**24,558**	**9,567**	**7,555**	**1,601**	**43,281**
	*City***	*1*	*2*	*3*	*4-9*	*Total*
Non-Transport	Knoxville	10,175	4,786	4,090	0	19,051
	Farragut	368	186	122	0	676
	Powell	202	119	74	0	395
	Corryton	66	42	31	0	139
	Other	215	9	19	0	243
	Mascot	58	20	13	0	91
	Strawberry Plains	30	13	8	0	51
	Total	**11,117**	**5,175**	**4,357**	**0**	**20,649**
All	Knoxville	32,383	13,500	11,005	1,483	58,371
	Farragut	1,467	606	485	48	2,606
	Powell	884	407	256	51	1,598
	Corryton	263	119	80	6	468
	Other	392	31	34	4	461
	Mascot	179	43	35	8	265
	Strawberry Plains	104	36	17	1	158
	Total	**35,672**	**14,742**	**11,912**	**1,601**	**63,927**

*****AMR Received Data Element Coding***

System Performance

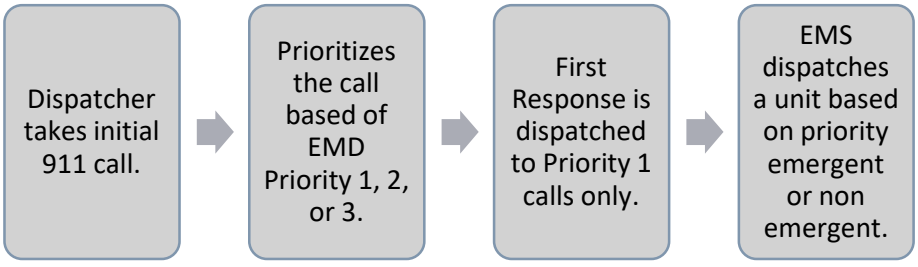
In 2022, Knox County received a total of 63,927 service requests. Out of these, 35,672 were deemed Priority 1 or emergent, which means that they were urgent in nature. This makes up 56.59% of the total calls that were dispatched as emergency calls. This high percentage is mainly due to calls being over-triaged at the dispatch level. According to FITCH's analysis of the data, the call volume decreased by 2.0% when compared to the previous year, 2021.

Dispatch Process

The Information Data Request indicated that EMS dispatch is currently being performed by AMR after the call is received by the 911 dispatch center. Knox County Dispatch has staffed call takers that will route all medical calls to AMR for call triaging using the Association of Public Safety Communication Officers (APCO) system.[2] AMR also does all the County Emergency Fire Dispatch (EFD) responses, except for Karns. AMR and Knox County 911 are located in the same facility, which means that AMR cannot be classified as a secondary dispatch center.

Triaging calls and dispatching responses should be a seamless process. Traditionally, the dispatch center would receive the call and prioritize the call based on Priority 1, 2, or 3. This is normally done using the Medical Priority Dispatch System (MPDS)[3], APCO, or other similar Emergency Medical Dispatch System. From the initial dispatch, the first response unit (Police or Fire Response) would be sent on Priority 1 calls only. The Emergency Medical Dispatcher remains on the line until emergency personnel arrive, providing potentially life-saving pre-arrival instructions to the requester. See Figure 7 below.

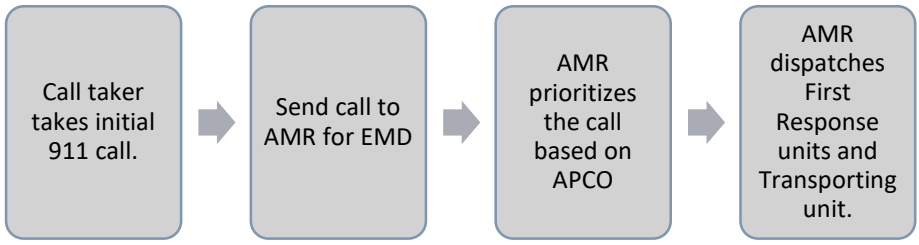
Figure 7. Traditional Dispatch Process



[2] https://www.apcointl.org/
[3] https://www.emergencydispatch.org/what-we-do/emergency-priority-dispatch-system/medical-protocol

Our on-site visit revealed that the 911 center receives the initial 911 call and then sends all calls to AMR for triaging. While this approach does work, we observed that AMR appears to be over-triaging. Currently, the process necessitates the caller to provide initial information twice prior to AMR triaging the caller. While this process can be effective, it also introduces an extra layer of redundancy and another failure point. Once AMR determines the level of response required, they then dispatch the required resources. The current Knox County Dispatch process is depicted in Figure 8.

Figure 8. Current Knox County Dispatch Process



Historic Performance

Total response time is defined within the contract as starting at "Call Transfer" and terminates with a First Response unit arriving "At Scene." In accordance with the contract's performance standards, FITCH conducted an independent review of the EMS contractor's performance over a five-year period. The evaluation was based on the actual experiences of the community and did not take into account any exemptions granted to the EMS Contractor for situations such as weather or road conditions. Additionally, throughout 2020 and parts of 2021, the EMS system was challenged with elongated response times and turnaround times at the hospital due to the COVID-19 pandemic. Amidst the COVID pandemic, the response times for Priority 1 and Priority 2 responses increased by nearly 2 minutes.

There are three commonly measured components of EMS response: dispatch time (911 center notified to agency notified), turnout time (agency notified to unit responding), and travel time (time from when the wheels begin rolling until the unit arrives on the scene). AMR's current EMS contract requires a 10-minute response time, which can be extended up to 7 minutes if ALS assets are available on the scene from Fire Medical First Response. As seen in Figure 9 below, the contractor did not meet the 90th percentile requirement for the years 2021 and 2022, even with the 7-minute allowance.

Figure 9. Performance by Priority and Year: 2018-2022

Year	Priority	# of Unit Responses	Annual Busy Hours	Unit Responses Per Day	Annual Busy Hours Per Day	Avg. Turn Around Time	80th Percentile Turnaround and Travel Time	90th Percentile Turnout and Travel Time
2018	1	30,695	30,608	84.1	83.9	7.6	10.4	12.8
	2	10,040	10,028	27.5	27.5	7.7	10.5	12.9
	3	17,758	18,157	48.7	49.7	11.5	15.7	19.4
	4	1,078	1,462	3	4	17.1	24.6	30.4
	Total	**59,571**	**60,256**	**163.2**	**165.1**	**9**	**12.3**	**15.6**
2019	1	31,220	33,293	85.5	91.2	7.9	10.7	13.2
	2	10,716	11,323	29.4	31	8	10.9	13.2
	3	17,753	19,236	48.6	52.7	12.3	16.9	21
	4	1,145	1,558	3.1	4.3	18.5	26.1	32.3
	Total	**60,834**	**65,409**	**166.7**	**179.2**	**9.4**	**12.8**	**16.4**
2020	1	30,128	30,615	82.3	83.6	8.3	11.4	14
	2	12,195	12,476	33.3	34.1	8.6	11.6	14.2
	3	18,813	19,220	51.4	52.5	12.3	16.8	21.1
	4	1,464	1,991	4	5.4	18.7	26.6	32.1
	Total	**62,600**	**64,302**	**171**	**175.7**	**9.8**	**13.5**	**17**
2021	1	34,077	37,741	93.4	103.4	9.3	12.9	15.9
	2	13,161	14,683	36.1	40.2	11.2	15.4	19.5
	3	16,673	18,531	45.7	50.8	14.2	19.3	24.2
	4	1,747	2,541	4.8	7	21	28.1	36.3
	Total	**65,658**	**73,496**	**179.9**	**201.4**	**11.3**	**15.5**	**19.6**
2022	1	36,057	44,570	98.8	122.1	10.1	14.1	17.5
	2	14,794	17,952	40.5	49.2	14.2	19.4	23.9
	3	11,986	13,702	32.8	37.5	14.5	19.2	24.6
	4	1,602	2,364	4.4	6.5	21.2	28	35.3
	Total	**64,439**	**78,587**	**176.5**	**215.3**	**12.2**	**16.8**	**21.2**

Hospital Wall Time

Hospitals have been dealing with a surge in admissions and significant staff shortages due to the impact of COVID-19. As a result, ambulance offload and turnaround times have increased. During our interviews with the EMS Contractor, the staff related that the longer wall times have caused a significant reduction in the number of available ambulances in the County. It is important to note that the delays in the hospital's waiting times are not the responsibility of the County or the EMS Contractor.

Figure 10 demonstrates that the hospital's current wall times make it impossible for an EMS contractor to be sustainable. Based on current data, the average wall time for AMR is 53 minutes. With a total of 43,507 transports, this means that AMR has accumulated 29,004-unit hours of unproductive wall time in the hospital. This is equivalent to six 12-hour ambulances per day providing supplementary staff to the hospital at no charge. Unless this situation is corrected it will hinder attracting competitive bids during the RFP process.

Figure 10. Hospital Wall Time & Wasted Hours

Values	Type
53	Average min at hospital
13	Reduce to 20 min. per transport
40	Waisted min. at the hospital
60	Minutes in an hour
43,507	Transport Volume
29004.6667	Wasted Unit Hours
4380	Annual Unit Hours for 12-hour shifts
6.662	Wasted 12-hour shifts per day

Transport of Deceased Persons

In Tennessee, the Coroner or Medical Examiner will only attend a scene if the death is deemed suspicious. In addition, EMS personnel cannot pronounce the time of death in the field and are required to transport deceased individuals to the morgue for an official declaration of death. This can overburden the EMS system and result in an ambulance being occupied for several hours.

Previously, the County attempted to procure transportation for deceased patients through a request for proposal (RFP) but was unsuccessful. Within the past year, the County has permitted the contractor to utilize a single person and a van to carry out the transportation. However, there is currently no specified response time for the EMS contractor, resulting in instances where deceased patients have remained at the scene for several hours without being transported.

In the future, it may be beneficial for the County to partner with an external agency, like a funeral home, to handle these transports. However, if this is not possible, the EMS contractor should have the option to: 1) provide one staff member and have police assistance to load the deceased patient into a van, 2) have a specific response time for the service, and 3) be aware that there may be a cost associated with the EMS contractor's completion of these services, which may be passed on to the County.

Comparative Analysis

Deployment Modeling and Options

Two primary factors influence the design of emergency response systems, the desired travel time performance, and the level of demand for services. Travel time performance is accomplished through the appropriate "distribution" of resources throughout the community. Once distribution has been determined, the level of demand is addressed with the appropriate concentration of resources at each distribution point. Demand is considered both geographically and temporally. Thus, the following system review was completed through a quantitative distribution and concentration of response resources.

A marginal utility analysis was also performed to determine the EMS Contractor's ability to cover the historical demand from their current strategic deployment locations within each specified travel time performance. AMR provided their current strategic deployment locations (posts), and FITCH compared them to our proprietary computer-based deployment modeling. Using the established targeted response time goals that are contractually set, FITCH utilized its proprietary software to determine the minimum number of resources required to geographically cover 90% of the historical volume at a defined response time. This allows for a better alignment of supply and demand within newly proposed models. Each model below utilizes 60 seconds for turnout time and the rest of the time for travel to the scene.

Analyses were performed to match staffing with demand strategically. The primary objective is to ensure that the geographical deployment is not negatively impacted by the demand. Demand-vs-Staffing charts were provided, showing the current AMR staffing against both the geographic and temporal demand.

Response Evaluation

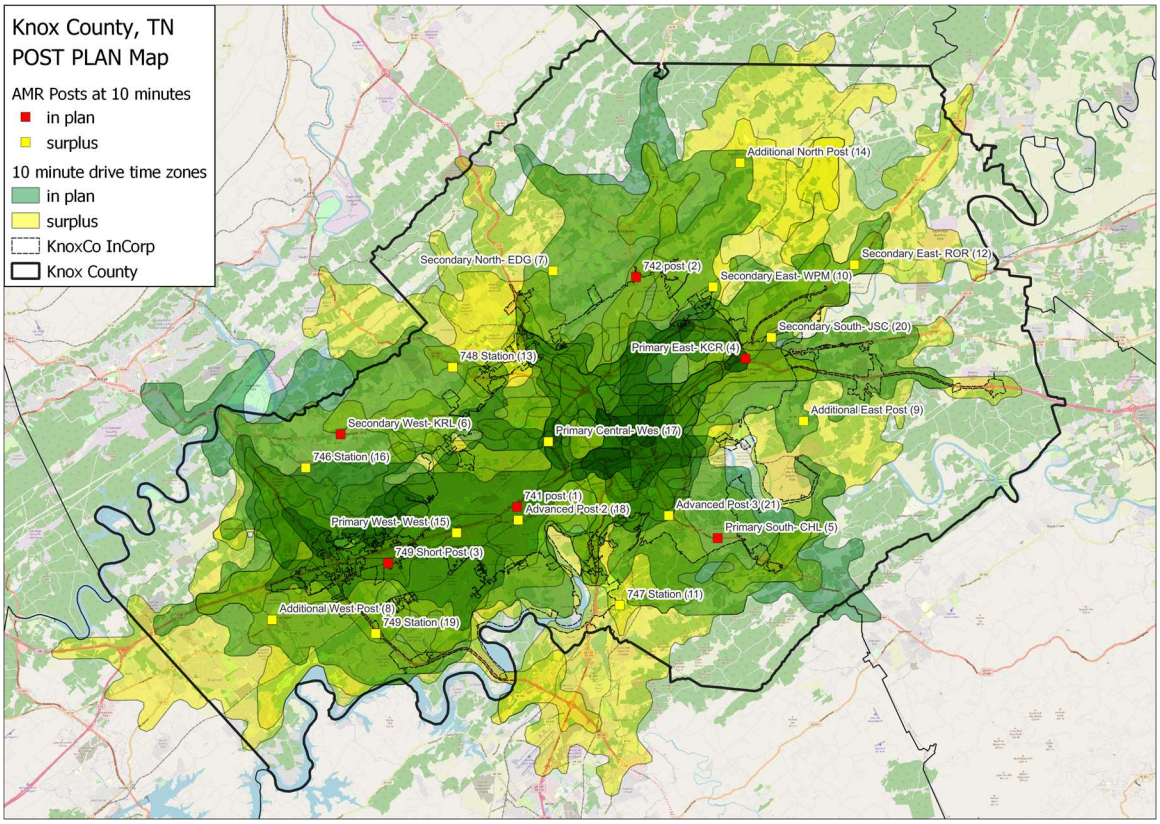
This study considers distribution models for 10-minute, 13-minute, and 15-minute travel times for all 911 calls. We also analyzed the impact on the system of the current 17-minute response model. Once distribution has been determined, the level of demand is addressed with the appropriate concentration of resources at each distribution point. Demand is considered both geographically and temporally. Thus, the following system designs were established through a quantitative distribution and concentration of response resources. In addition, FITCH used a computer-based model using an optimized 10, 13, 15, 20, and 30-minute deployment capture.

To understand the ranking, one should consider both the post-capture and the total capture. For example, in Figure 11, Papermill/Northshore captures 40,248 of the historical calls or 62.54% of the total system requests. The next post, Maynardville Hwy/Brown Gap, captures an additional 7,121 to increase total system capture to 73.6%. The value add of the second post is 11.06%. System capture continues to increase by adding more posts until you are able to capture 90% or above to achieve a 10-minute response time.

10-Minute Travel Time - AMR Posting Plan

FITCH reviewed the current AMR posting plan to determine their ability to capture 90% of the historical volume within 10 minutes. AMR could achieve a 10-minute response at the 90th percentile for historic volume with the designated six ambulances shown in Figure 11 below. According to the current deployment model, they are able to capture 92.67% of calls from 6 different locations within 11 minutes.

Figure 11. AMR Post Deployment at 10-Minutes

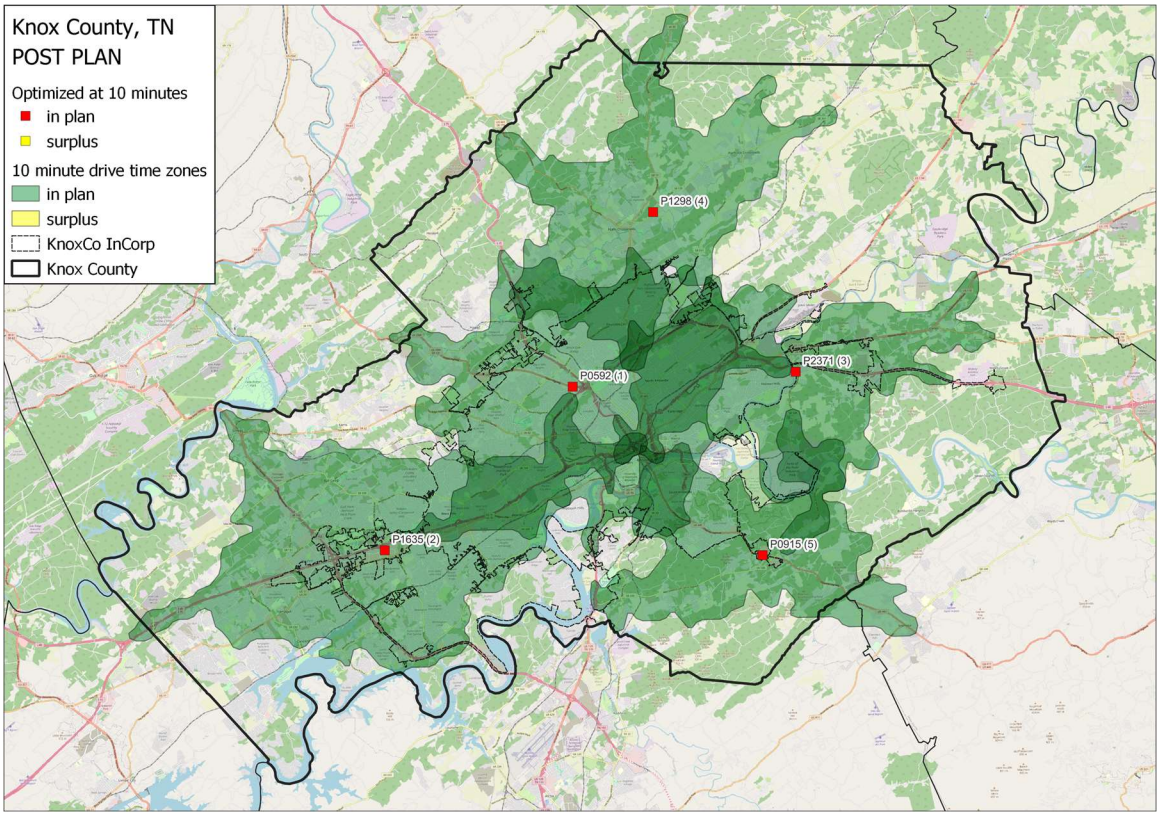


Rank	Post Number	Drive Time	Latitude	Longitude	Post Capture	Total Capture	Percent
1	*Papermill/ Northshore*	10	35.9397	-84.0034	40248	40248	62.54%
2	*Maynardville Hwy/Brown Gap*	10	36.0581	-83.9241	7121	47369	73.6%
3	*Kingston Pike/Cedar Bluff*	10	35.9117	-84.0866	4275	51644	80.24%
4	*RM Station 27*	10	35.9812	-83.8188	3608	55252	85.85%
5	*Karns Red Light*	10	35.9793	-841154	2360	57612	89.52%
6	*Chapman/Lindy*	10	35.9212	-83.8754	2028	59640	92.67%

10-Minute Travel Time - FITCH Optimized Posting

The *FITCH*-optimized computer-based models achieved 91.56% total historical volume capture with five ambulance locations, as shown in Figure 12 below. The *FITCH* model does not consider traditional posting areas such as gas stations and parking lots.

Figure 12. FITCH Optimized Post Deployment at 10-Minutes

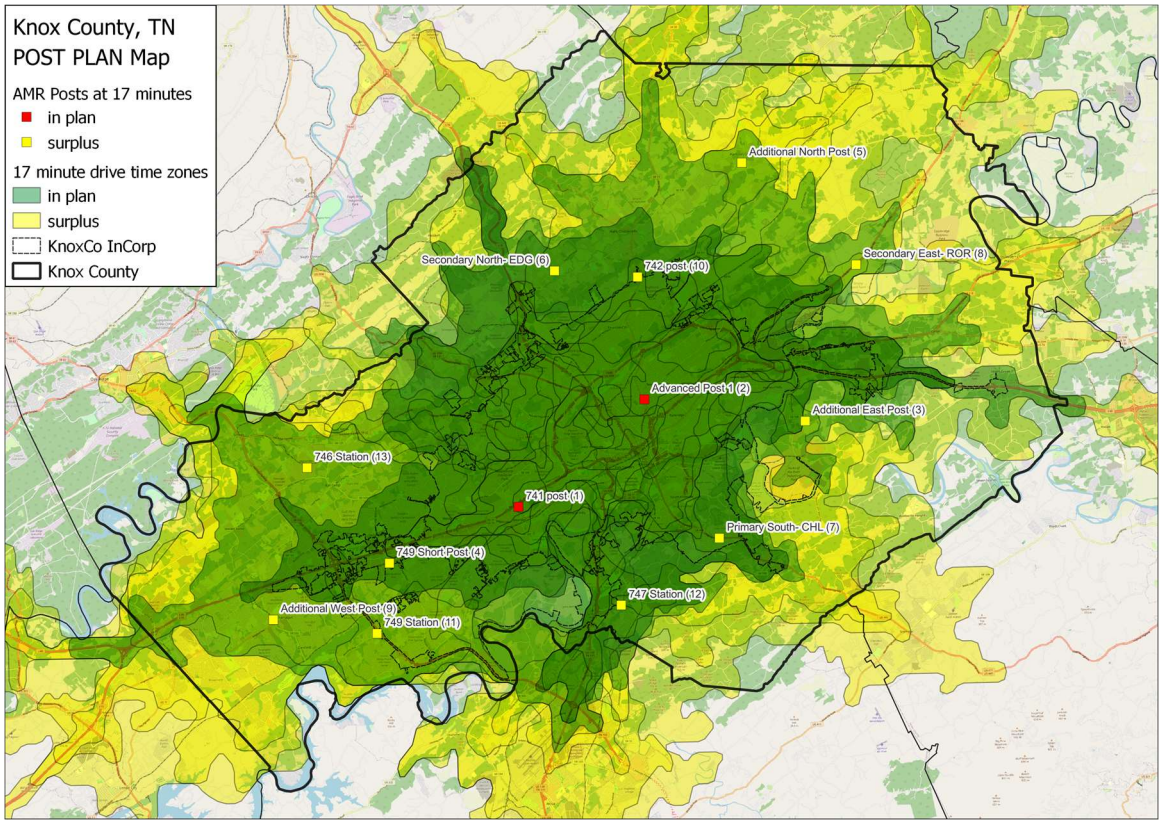


Rank	Post Number	Drive Time	Latitude	Longitude	Post Capture	Total Capture	Percent
1	P0592	10	35.999757	-83.966268	40788	40788	63.38%
2	P0569	10	35.907041	-84.107794	9978	50766	78.88%
3	P2823	10	35.974265	-83.826616	3402	54168	84.17%
4	P2091	10	36.087952	-83.899311	2845	57013	88.59%
5	P0070	10	35.912101	-83.85533	1914	58297	91.56%

17-Minute Travel Time - AMR Posting Plan

According to Figure 10, to maintain a travel time performance of 10 minutes for 90% of historic volume, AMR needs to use six ambulances located in the designated areas. Figure 13 shows that achieving a compliance rate of 94.45% with a response time of 17 minutes requires two units. When the County allowed AMR to increase its response time from 10 to 17 minutes, it effectively gave AMR four extra ambulances to operate within the County.

Figure 13. AMR Post Deployment at 17-Minutes



Rank	Post Number	Drive Time	Latitude	Longitude	Post Capture	Total Capture	Percent
1	Papermill/ Northshore	17	35.9397	-84.0034	57662	57662	89.60%
2	Broadway/Woodland	17	35.9943	-83.9214	3127	60789	94.45%

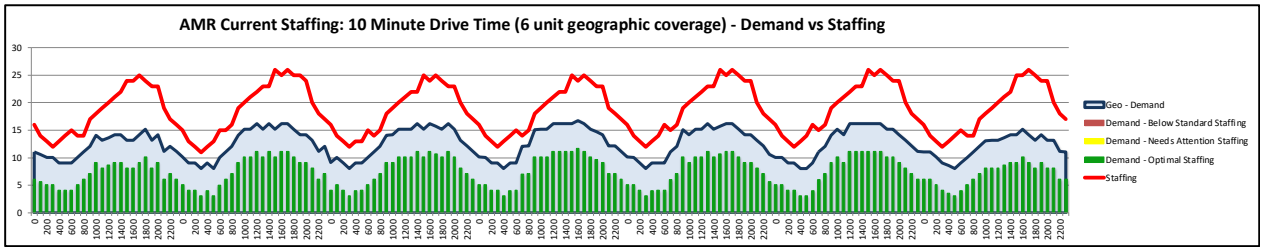
Staffing vs. Demand

To service 911 emergency volume, geographic coverage plus normalized hourly demand[4] provides the total number of staffed ambulances required per hour. The following figures indicate staffing to demand both for the current station deployment and FITCH-optimized deployment modeling. The figures read left to right, Sunday to Saturday, reviewing each hour's average demand and then normalized for the estimated time on task for the areas mentioned. Volume was determined using the most recent 52 weeks. The light blue area indicates how many units are required per the marginal resources required to capture the prescribed geographic response time. The bar lines indicate the average hourly demand and change colors depending on whether the red staffing line is above or below the dark blue geographic line and the average demand line. If the staffing line is above the dark blue line and there is "space" between the lines, that indicates there is capacity within the system, and the bars will be green. If the staffing line falls below the geographic plus demand line (dark blue), this indicates that there are not enough resources during that hour, and the bar lines will change colors to Yellow if between the dark blue line and the demand or will change red if below the demand.

Analysis of Current System

In Figure 14, AMR's current staffing plan is shown assuming there are no vacancies to cover geographical demand. This is the best-case scenario demonstrating if AMR was to reach 100% staffing, they would be able to cover the Knox County EMS contract.

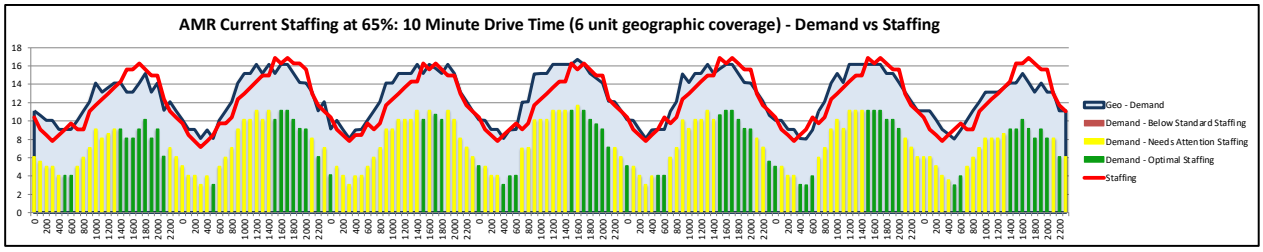
Figure 14. AMR Current Staffing to Demand



[4] Normalized demand equals demand per hour plus time on task to calculate the overall time consumed during a response.

During the discussions with AMR, it was disclosed that their current staffing level is at 65%. *FITCH* conducted a staffing-to-demand analysis to determine the impact on the system of only covering 65% of the total hours. Figure 15 shows that AMR is unable to meet the expected level of performance for the 10-minute response standard at the reduced staffing level.

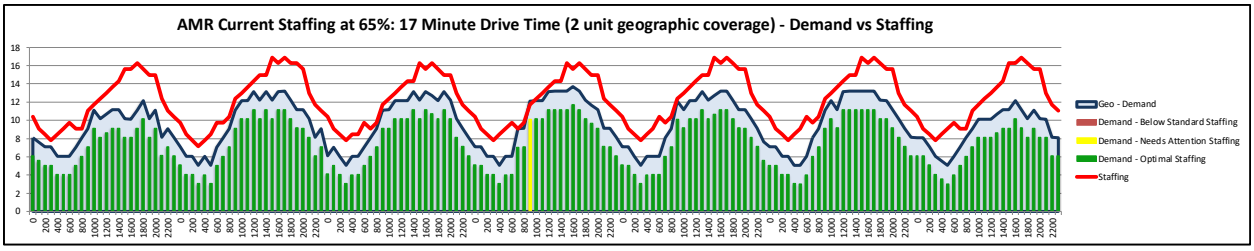
Figure 15. AMR Current Staffing at 65%



FITCH evaluated the response time change from 10 minute to 17 minute that Knox County made to help offset the staffing and wall time challenges. In our review, AMR would be able to meet the new performance standards with their 65% staffing. This change financially offset the hospital wall times and AMRs need to staff four (4) more geographic units to meet the 10-minute performance expectation.

Figure 16. *FITCH* Optimized 17-minute Staffing to Demand (ALS)

2 Geographic Units



FITCH Optimized Staffing to Demand Models

FITCH has developed 7 optimized models that incorporate both ALS and BLS response units. The optimized staffing to demand for BLS ambulances is consistent across all seven models, with a recommended response time of 30 minutes per geographical unit. All potential future models can be found in the financial attachment.

Pathway Forward

After years of debate, evidence-based literature has finally provided EMS with a clear and essential path forward. For years the profession has had a foot in two worlds. It has never been clearly determined if it had more commonality with emergency responders, such as police or fire, or with health care. As EMS has evolved, the need has clearly directed EMS towards a medical model that also responds to emergencies rather than the other way around. Below are two excerpts from the EMS Agenda for the Future. The first is a statement of where EMS is currently, and the second is a statement of where EMS needs to be.

Future State and the EMS 2050 Agenda

As a component of the health care delivery system, EMS addresses all possible injuries and illnesses, and treats all ages. It is a component of, and is also comprised by, systems intended to provide care for specific diseases and population segments. Contemporary EMS systems were created to meet the immediate needs of the acutely ill and injured; to provide “stabilization” and transportation. EMS, in general, meets these objectives in relative isolation from other health care and community resources. Reports have been published regarding public health surveillance by EMS personnel and referral to social services agencies. However, most EMS systems are disconnected from other community resources, except perhaps other public safety agencies, and are not involved in the business of ensuring follow-up by social service agencies or other community agencies/resources potentially able to intervene when patients need support. Thus, the potential positive effects of EMS, in terms of improved health for individual patients and the community, remain unrealized.

Emergency medical services (EMS) of the future will be community-based health management that is fully integrated with the overall healthcare system. It will have the ability to identify and modify illness and injury risks, provide acute illness and injury care and follow-up, and contribute to treatment of chronic conditions and community health monitoring. This new entity will be developed from redistribution of existing healthcare resources and will be integrated with other healthcare providers and public health and public safety agencies. It will improve community health and result in more appropriate use of acute health care resources. EMS will remain the public’s emergency medical safety net.

Future State

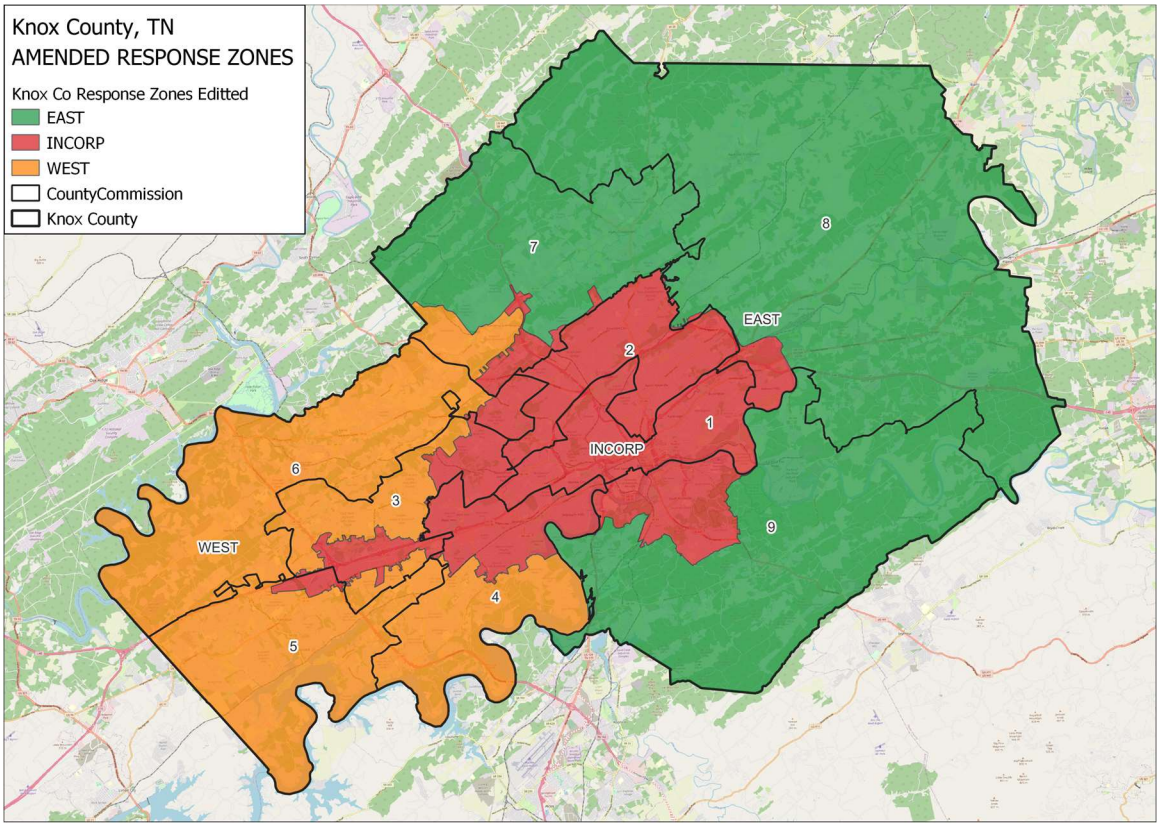
The current EMS contract is between Knox County and AMR. The county has an EMS Response Manager who oversees the EMS contract, monitors performance and response times, and assesses penalties if necessary. Through experience, the county has learned the current contract could be expanded to improve service delivery and improve oversight and controls. Under a new contract, the County can also work together to pilot programs with the EMS contractor to assess new response models, alternative medical care delivery, and analyze performance data to evolve the system during the contract period.

FITCH presented 6 different deployment options, and 37 different models that included contracting performance model, purchased unit hour models and fire department deployed models. Ultimately, in working with the county and stakeholders, the future state model was determined to be the potential best fit. All other models are presented in Attachment C which shows unit hours required, workload, performance, costing, profitability, and subsidy.

Upon analyzing the current EMS contract in Knox County, Fitch observed that there is only one response zone that covers the entire county. FITCH recommends the county be divided into three response zones as shown in Figure 17. The Incorporated zone is colored in red. This zone is inclusive of the city of Knoxville, which is considered a suburban/urban area. The rural zones are colored green and orange and are divided into East and West zones respectively. Using the 2022 data to determine volume by these new zones, FTICH evaluated and determined the following response for each zone:

- Urban zone had 41,174 responses.
- East zone had 11,828 responses.
- West zone had 11,261 responses.
- Out-of-county responses total 95.

Figure 17. *Amended Response Zone*



Response Time Recommendations:

To create response time performance standards that will better serve Knox County, FITCH recommends a community baseline response for which the EMS System should be held accountable. The recommended response times are based on the standards from the 9th addition of the Commission on Fire Accreditation International (CFAI) and incorporate the review of historical risk.

The Commission on Fire Accreditation International (CFAI) standards help guide emergency service agencies with performance measurements. The standards establish a baseline and benchmark for the purpose of evaluating response times. The standards for response times are determined in two parts: first, by identifying the population density zones of the service area, and second, by determining the appropriate level of response time for each area. The first unit arriving would be the medical first response unit and the second unit responding would be the EMS transport unit.

Figure 18. CFAI Response Time Baselines and Benchmarks

Metropolitan – an incorporated or unincorporated area with a population of over 200,000 people and/or a population density over 3,000 people per square mile.

Metropolitan	1st Unit	2nd Unit	Effective Response Force
Benchmark	4 minutes	8 minutes	8 minutes
Baseline	5:12 minutes	10:24 minutes	10:24 minutes

Urban – an incorporated or unincorporated area with a population of over 30,000 people and/or a population density over 2,000 people per square mile.

Urban	1st Unit	2nd Unit	Effective Response Force
Benchmark	4 minutes	8 minutes	8 minutes
Baseline	5:12 minutes	10:24 minutes	10:24 minutes

Suburban – an incorporated or unincorporated area with a population of 10,000 to 29,999 and/or any area with a population density of 1,000 to 2,000 people per square mile.

Suburban	1st Unit	2nd Unit	Effective Response Force
Benchmark	4 minutes	8 minutes	10 minutes
Baseline	5:12 minutes	10:24 minutes	13 minutes

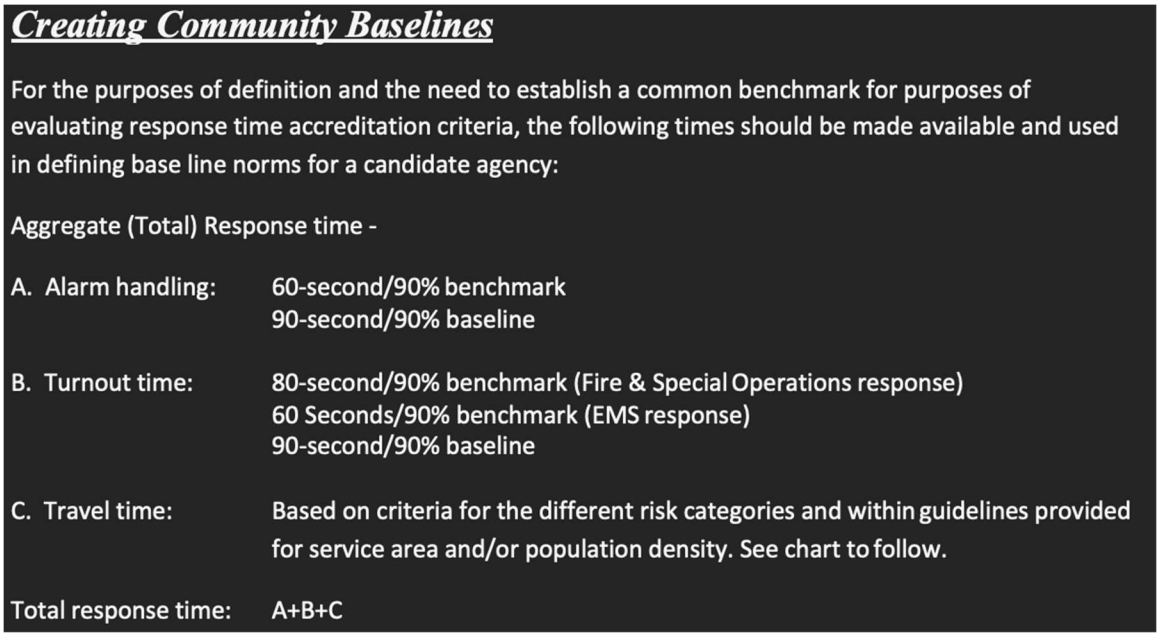
Rural – an incorporated or unincorporated area with total population less than 10,000 people, or with a population density of less than 1,000 people per square mile.

Rural	1st Unit	2nd Unit	Effective Response Force
Benchmark	10 minutes	14 minutes	14 minutes
Baseline	13 minutes	18:12 minutes	18:12 minutes

Wilderness – any rural area not readily accessible by public or private maintained road. Due to the large disparity between communities that protect wilderness areas, recommended travel times are not provided for this level of service.

The countdown for the emergency unit's response time starts when it receives a dispatch from the Dispatch Center, which includes the full address and type of call. This is when the EMS team goes into action. The clock stops when the unit reaches the scene of the incident or when it is in a staging area waiting for other emergency personnel to arrive due to unsafe conditions. Figure 19 shows the CFAI definitions and associated benchmarks for specific intervals of a response.

Figure 19. CFAI Response Time Baselines



Creating Community Baselines

For the purposes of definition and the need to establish a common benchmark for purposes of evaluating response time accreditation criteria, the following times should be made available and used in defining base line norms for a candidate agency:

Aggregate (Total) Response time -

A. Alarm handling:	60-second/90% benchmark 90-second/90% baseline
B. Turnout time:	80-second/90% benchmark (Fire & Special Operations response) 60 Seconds/90% benchmark (EMS response) 90-second/90% baseline
C. Travel time:	Based on criteria for the different risk categories and within guidelines provided for service area and/or population density. See chart to follow.
Total response time:	A+B+C

The components of response that are typically measured and monitored include:

- **Dispatch Time** — The time interval from when the initial call is received from the requestor until the first dispatch notification for a unit to respond.
- **Turnout Time** — The time interval from when response personnel receive the dispatch notification until there is a staffed ambulance responding.
- **Travel Time** — The time interval from when the staffed ambulance initiates response until it arrives at the scene of the incident.
- **Dispatch to First Unit Arrival** – This is the cumulative duration for Turnout and Travel times. It only includes the time controlled by responding resources, not the Dispatch Center.
- **Hello-to-Hello time** — This is the cumulative time for the components of a request that represents the time from when a call is received in the Dispatch Center until response personnel arrive on the scene with the patient. From the caller/patient's perspective, this is the most important time interval.
- **Time-on-Task** – This is the time interval from the initial dispatch of a response to the time the unit becomes available for another response. A unit may become available following a transport to the hospital, treatment, and release on on-scene, canceled, etc.

Response Time Performance Goals and Recommendations

Knox County has a population density of 942 people per square mile. This is calculated using the published 2022 population of 494,574, according to the US Census. The total population is divided by the total square mileage to determine which category Knox County is classified under. Based on the above information Knox County should aim for a baseline of a 9-minute travel time plus a 59-second turnout time totaling 10 minutes for Urban areas, a 19-minute travel time plus a 59-second turnout time for the Rural areas totaling 20 minutes. These meet the baseline performance standards of the CFAI.

To ensure the most critical response receive the highest level of performance, all urgent and low-acuity requests have separate response times. This allows for proper triaging and resource allocation.

Figure 20 delineates the FITCH recommended response time standards based on priority level and the three recommended response zones.

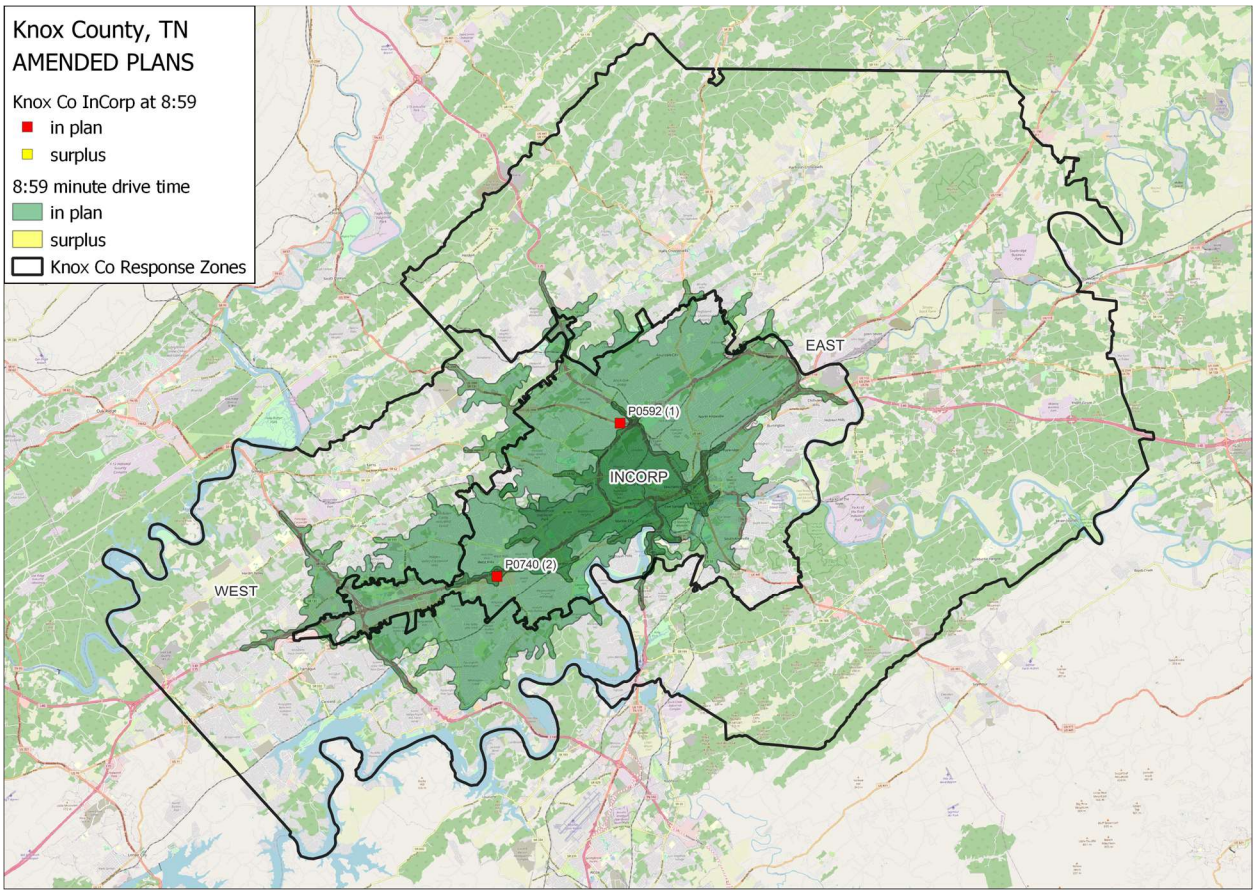
Figure 20. Response Plan and Response Capture

Response Zones	*Priority Level*	*Compliance*	*Performance Standard*
Incorp	Priority 1	90%	≤10:00
	Priority 2	90%	≤15:00
	Priority 3	90%	≤ 30:00
Region	*Priority Level*	*Compliance*	*Performance Standard*
East	Priority 1	90%	≤20:00
	Priority 2	90%	≤25:00
	Priority 3	90%	≤ 30:00
Region	*Priority Level*	*Compliance*	*Performance Standard*
West	Priority 1	90%	≤20:00
	Priority 2	90%	≤25:00
	Priority 3	90%	≤ 30:00

To ensure a clear understanding of the unit hours required and deployment to meet the above performance standards. FITCH evaluated each zone to ensure response time could be achieved by the EMS contractor as long as a minimum number of unit hours are deployed, and resources are deployed in a coordinated manner.

In evaluating the Urban Zone, an EMS contractor would be required to deploy 2 ambulances to meet the 10-minute performance times as they would capture 90.03% of the Urban Zones' historic volume.

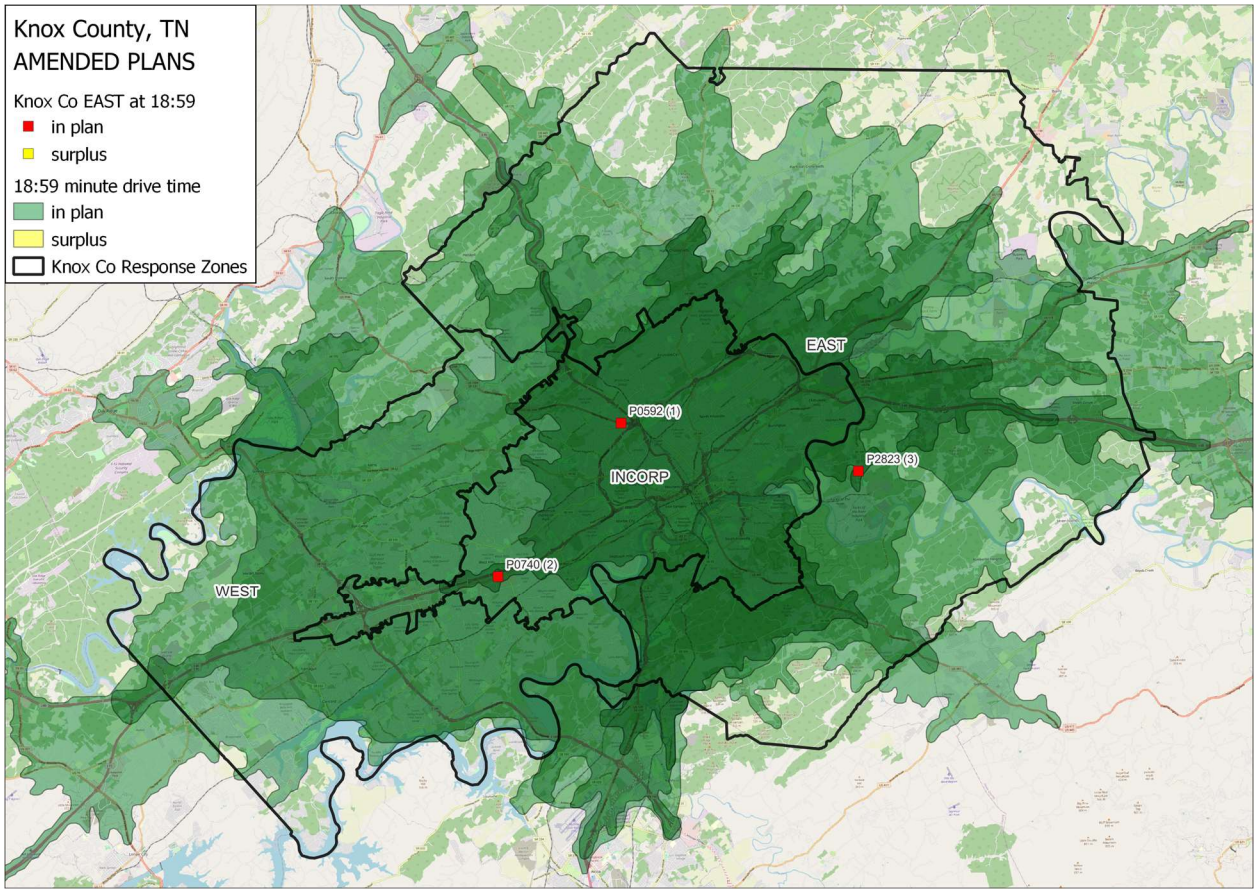
Figure 21. FITCH Optimized Post Deployment at 10-Minutes Urban



In evaluating both the Rural Zones, FITCH kept the Urban zones' posts and extended their response time to determine the volume capture in the specific region. FITCH evaluated the specific Zones volume to determine the number of geographic resources required.

The East Zone would require an additional deployed unit, above the Urban zone units to capture a total of 95.36% of this historic East Zones Volume. The West Zone would be able to capture 95.73% of the historical volume with the same three staged units.

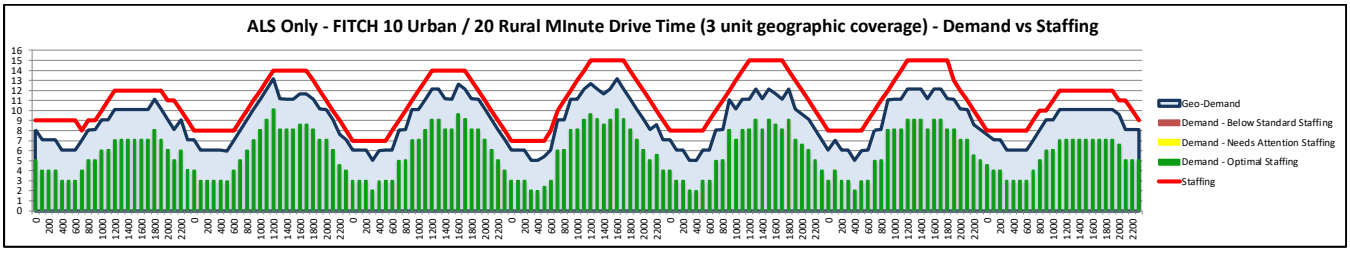
Figure 22. FITCH Optimized Post Deployment at 20-Minutes East & West Zones



FITCH's optimized model depicts a 10-minute urban response and a 20-minute rural response utilizing three geographical units.

Figure 23. *FITCH* Optimized 10-minute Urban / 20-minute Rural Staffing to Demand (ALS)

3 Geographic Units



FITCH' reviewed the ability to deploy a tiered response system that allows for BLS units to handle low acuity volume. Based on current deployment data and the understanding of both deployed and billable BLS volume, FITCH estimated that 4 24/7 units could be deployed in the system. To ensure a meaningful response time to the low acuity calls, FITCH evaluated that one geographically deployed unit, strategically located could capture 99.84% of the historical volume.

Figure 24. FITCH Optimized Post Deployment at 30-Minutes for BLS Tiered Response

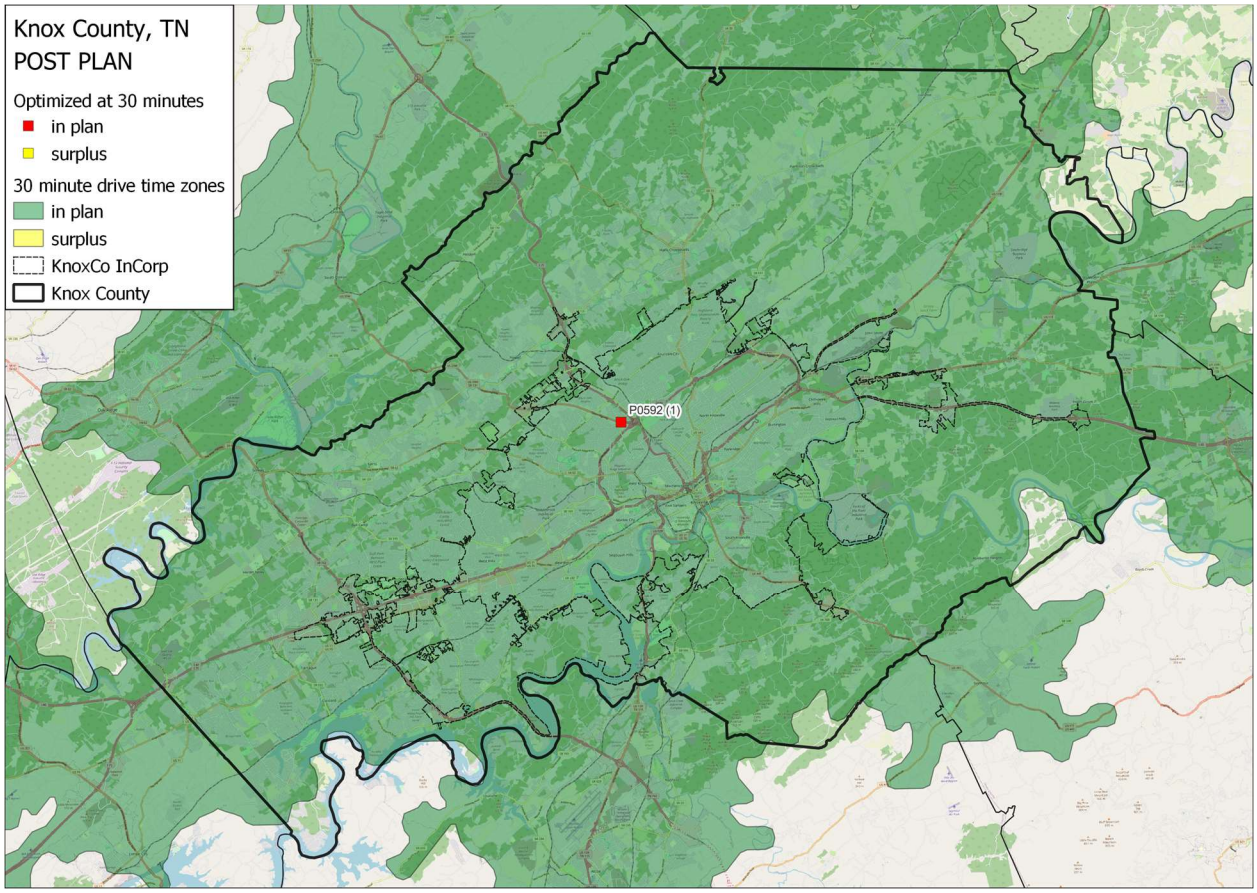
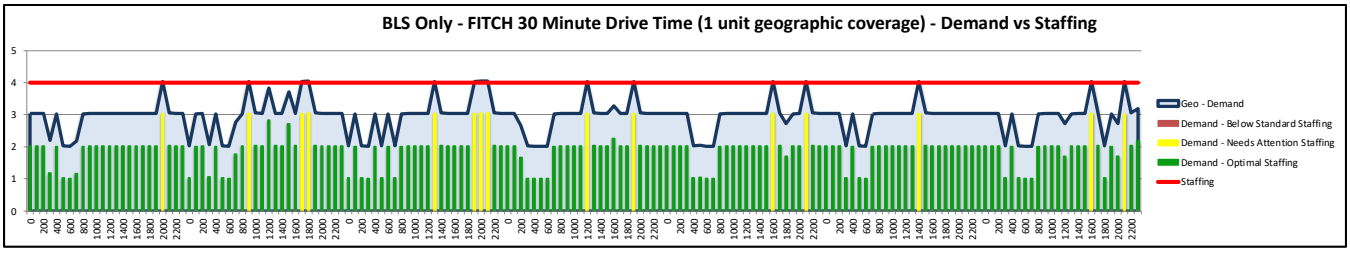


Figure 25. *FITCH* Optimized 30-minute BLS Tiered Response Staffing to Demand



Penalties Applied as Outlined in the EMS Contract

According to the current EMS contract, failure to meet the response time requirements will result in a penalty. A penalty letter will be sent to the contractor and must be paid within 15 days of the penalty letter. If the penalty is not paid within 15 days, the payment will double with further actions taken. In addition to these penalties, the contractor is also subject to response time and performance time for liquidated damages for a missed response, sometimes referred to as a level zero fine.

It is recommended by FITCH that the county implements liquid damage provisions to improve response time performance. In the event that the contractor does not meet the response time requirements, the county may impose liquid damages. If a priority one response exceeds twice the contracted response performance standard, the county should consider implementing a fine structure that is more than twice the standard fine. Furthermore, we suggest discontinuing the use of level zero fines.

Tiered Response

The current contract with AMR requires an ALS transporting unit to respond to all 911 calls. Based on APCO EMD, there is an opportunity to utilize both ALS and BLS units based on the Priority of the initial dispatch complaint.

A tiered response allows the EMS Contractor to utilize Medical First Response, BLS, and ALS in the 911 system. In a tiered response, the initial dispatch will dictate the type of response needed. For a Priority 1 and some Priority 2 calls Medical First Response and an ALS ambulance will be dispatched. Priority 3 calls and some Priority 2 calls will only require a BLS ambulance to respond. Once on scene, if the BLS unit needs additional manpower or an ALS unit based on the patient's condition, then an ALS upgrade can be initiated by dispatch.

Aligning the APCO EMD protocols with medical-trained dispatchers and the 911 Communication Center will allow for proper priority dispatching. Once this process is completed with the guidance of the system-wide Medical Director, lower acuity calls will be dispatched as a Priority 3, and BLS will be able to respond. A tiered response will allow ALS units to remain available for the more critical 911 calls.

Dispatch Center

In Knox County, the delivery of dispatch services is fragmented under the current model. The current contractor, AMR, tends to over-triage calls coming from the County. In the future, the county must decide which of the two dispatch operation models to adopt. FITCH recommends for each model; the EMS contractor dispatch center should remain co-located in the Knox County 911 Dispatch facility.

Model 1 - Both the county and the EMS contractor use the same computer-aided dispatch (CAD) program to improve efficiency and accuracy during call hand-offs. This creates greater transparency in the system and benefits both parties in real time.

Model 2 - In this model, the County handles all requests by triaging them first. They also use a common CAD system, which makes the call-taking process more efficient and reduces over triaging of responses. The EMS contractor remains responsible for managing field assets and ensuring that all response units are correctly posted.

Regardless of the chosen model, the county should anticipate and be willing to pay for its share of a CAD-to-CAD interface with the contract holder. This will enable data exchange and enhance transparency in ePCR. The choice of which dispatch model the county chooses is ultimately a policy decision that should involve key stakeholders.

Clinical Innovation

Over the last 40 years, EMS has undergone significant changes in the level of care provided by EMS providers. As communities grow and expand, a phenomenon known as Urban Sprawl, EMS contracts, which usually span 7-10 years, must be carefully considered to ensure that EMS is able to adapt and evolve with the changing times. This evolution could involve expanding units to cover greater volume, sometimes at a cost, or introducing new clinical programs.

EMS systems across North America are testing and implementing cutting-edge clinical innovations and pilot programs. With the rise of new concepts such as Community Paramedicine, Nurse Triage, and telehealth, EMS is evolving. The County should support piloting new ideas and promoting clinical innovation without any risk to the contractor.

If the pilot programs prove to be successful, the County should include the new program and strategies via contract addendums. It is important to remember that during the pilot phase, there is no fault in case the program does not work. It is not guaranteed that every program will work in every market.

Clinical Outcome Reporting

The present EMS agreement lacks details on clinical outcomes reporting, which prevents the County from effectively assessing the contractor's "Process Outcomes".[5] Although clinical standards were not specifically outlined, it is recommended that the County collaborates with the EMS provider to pilot and develop a clinical dashboard and scorecard that mirrors the performance standard stated in the new RFP. By conducting this pilot, the Contractor would still be responsible for meeting the performance expectations, but it would enable the introduction of incentives for clinical excellence, enhance the transparency of clinical performance, and establish a benchmark for future EMS contracts.

Real-Time System Performance Analytics and Reporting

FirstWatch is a reliable solution that transforms raw data into clear and understandable information for both the County and EMS Contractor. FirstWatch is an Online Compliance Utility (OCU) that captures real-time data from the CAD software, simplifying and managing contractual compliance for both parties. With the help of FirstWatch software, performance can be enhanced by monitoring KPIs and adherence to patient care protocols. At present, the Contractor is the license holder, which restricts the County's access to information shared by the Contractor with the Administrator.

Hands-Only CPR

The American Heart Association created Hands-Only CPR to encourage more individuals to perform CPR. Studies have shown that Hands-Only CPR is just as effective as conventional CPR during the first few minutes of a cardiac arrest that occurs at home, at work, or in a public setting. Unfortunately, only 40% of out-of-hospital cardiac arrests receive immediate assistance prior to EMS arrival. Promoting a campaign for Hands-Only CPR can help to increase survival rates for this deadly condition in Knox County.

Pulse Point Integration

Pulse Point is an application designed to help everyday citizens who are CPR trained and willing to assist during a cardiac arrest. The app is connected to the CAD in the 911 Dispatch Center and will notify users when a cardiac arrest is reported to the dispatch center. The location of the incident is tagged on the

[5] Process Outcomes-The link between EMS protocols and appropriate clinical treatment methods with measurable performance standards

app and users nearby will receive alerts. This enables trained laypersons to provide immediate help by administering Hands-Only CPR until the arrival of first responders.

Customer Surveys

Obtaining feedback from customers is crucial to improve the quality of care and overall customer experience. To become a successful EMS System, both the County and the Contractor must comprehend the expectations and experiences of patients. Conducting customer surveys will enable the Contractor to gather and analyze feedback from patients. There are numerous commercially available EMS-specific products to choose from.

Medical Direction

The Medical Director is a Physician who provides guidance and oversight to an EMS organization. EMS agencies operate using medical protocols written or approved by the Medical Director. The protocols will determine the medical treatments and procedures that an EMT or Paramedic can. Along with the protocols, the Medical Director will establish procedures for Online Medical Control. This feature enables a provider to contact and talk to a physician instantly regarding treatment. The current EMS Medical Director is employed directly by the EMS Contractor.

Hiring a part-time Medical Director to oversee all EMS services in Knox County could be highly advantageous. With this measure in place, the standard of medical care provided throughout the system would be ensured to be consistent and uniform. It would be beneficial for the County Medical Director to serve as the sole medical director for the entire system. This would establish a cohesive clinical care system that involves the dispatch center, medical first response agencies, and EMS Contractor for transportation services. The cost for this service could be shared with the contracted EMS agency by requiring them to utilize the County's, Medical Director.

System Medical Direction

A System Medical Director (SMD) with authority over the County, 911 Communication Center, EMS Contractor, and First Responding agencies are recommended to help ensure that all Knox County residents and visitors consistently receive the highest level of service. Knox County should designate one individual who, at a minimum, is board certified in Emergency Medicine. This individual would be responsible for the following:

- Developing system-wide protocols for ALS and BLS agencies.
- Setting up a clinical quality assurance review program.

- Developing a scorecard/matrix to report the clinical and operational performance of each agency.
- Working with the EMS Contractor to develop and implement Clinical Innovations and associated pilot programs.

This is an option if all participants in the delivery of pre-hospital care work with one System Medical Director. There is state EMS statue they would allow for all parties to work for one Medical Director if chosen.[6]

Quality Assurance and Improvement Oversight

To ensure consistent and effective service for the citizens of Knox County, it's important to establish a Quality Assurance and Improvement Program. FITCH recommends implementing a program that ensures accurate initial triaging of callers. The EMS contractor should have the ability to correct an inappropriate initial dispatch in real-time or retrospectively. It is considered a best practice for the Medical Director of the system to oversee and manage this program.

[6] 1200-12-01-.16(2) of Tennessee State EMS Rules and Regulations

Conclusion

When it comes to Emergency Medical Services (EMS), it's crucial to have a system that prioritizes the needs of patients. Across the globe, there are various EMS system designs in place. However, there is still ample room for improvement in terms of enhancing the overall customer experience, creating a sustainable EMS system, and promoting clinical innovation. By doing so, cities and EMS systems can better meet the expectations of patients and provide them with the care they need.

FITCH

& ASSOCIATES

DATA REPORT

KNOX COUNTY, TN

PO Box 170, 2901 Williamsburg Terrace, Suite G, Platte City, Missouri 64079

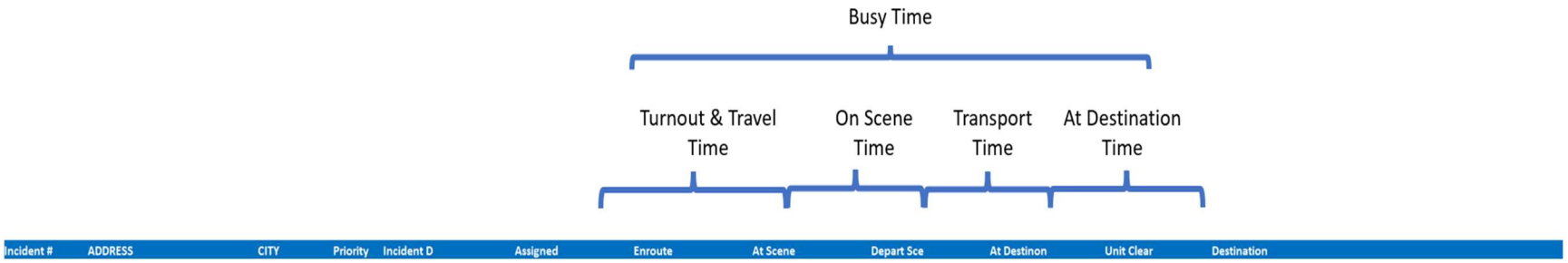
(816) 431-2600 (816) 431-2653 www.fitchassoc.com

TABLE OF CONTENTS

© Fitch & Associates, LLC

METHODOLOGY

This report analyzes 5 years of data from 2018 through 2022. It should be noted that CAD data elements captured are labeled by AMR and do not always describe or name areas and zones accurately. Turnout and travel time was calculated from the assigned time to unit arriving on scene time. This is different than the response time citizens experience since dispatch time is not included. On-scene time is the duration from the unit arriving on scene through the unit begin to transport. Transport time was calculated from the time a unit began to transport through the time a unit arrived at destination. Lastly, at destination time (or hospital turnaround time) was calculated as the duration from the unit arrived at destination time through call complete time. So, the deployed or busy time of a unit can be broken down into four components: turnout & travel time, on-scene time, transport time and at destination time. Below is a visual example of how each task component is calculated.



© Fitch & Associates, LLC
August 2023

EXECUTIVE SUMMARY

In the past five years, total number of calls increased at a 2% CAGR due to non-transport requests, while transport requests declined at a -0.6% CAGR.

A total of 63,927 requests was recorded in 2022, averaging 175 calls per day. Of those, 68% or 119 per day were transports. From dispatch to clear, all units spent a total of 78,587 call hours, averaging 215 hours per day. City of Knoxville accounted for 91% of the total demand in 2022, followed by Farragut (4%) and Powell (2%). Demand from midnight through 0600 averaged 4.1 per day, which is less than half of the demand for the rest of the day (7.3 per day on average). University Of Tennessee Medical Center was the top transport destination, accounting for 32% of all transported trips, averaging 38.3 transports per day. For completed transports in 2022, the busy time per trip averaged 97.5 minutes including 12.6 minutes turnout and travel time, 17.9 minutes on scene time, and 15.9 minutes average travel time to destination, and 53.1 minutes hospital turnaround time. For non-transports, total busy time was 23.3 minutes in 2022.

© Fitch & Associates, LLC
August 2023

Table 1: Number of Responses by Priority and Year: 2018 - 2022

Priority	Number of Calls				
	2018	2019	2020	2021	2022
1	30,378	30,910	29,835	33,743	35,672
2	10,022	10,698	12,171	13,138	14,742
3	17,675	17,708	18,774	16,609	11,912
4-9	1,077	1,145	1,462	1,747	1,601
Total	**59,152**	**60,461**	**62,242**	**65,237**	**63,927**
Responses per Day	**162.1**	**165.6**	**170.1**	**178.7**	**175.1**
YoY Growth		**2.2%**	**2.7%**	**5.1%**	**-2.0%**

Table 2: Number of Transports by Priority and Year: 2018 - 2022

Priority	Number of Transports				
	2018	2019	2020	2021	2022
1	23,100	22,905	20,814	22,423	24,558
2	7,199	7,337	8,226	8,630	9,567
3	12,885	12,385	12,761	11,132	7,555
4-9	1,064	1,124	1,436	1,747	1,601
Total	**44,248**	**43,751**	**43,237**	**43,932**	**43,281**
Transports per Day	**121.2**	**119.9**	**118.1**	**120.4**	**118.6**
YoY Growth		**-1.1%**	**-1.4%**	**1.9%**	**-1.5%**

© Fitch & Associates, LLC
August 2023

Table 3: Average Number of Calls/Transports per Day by Priority and Year: 2018 - 2022

Priority	Number of Calls per Day				
	2018	2019	2020	2021	2022
1	83.2	84.7	81.5	92.4	97.7
2	27.5	29.3	33.3	36.0	40.4
3	48.4	48.5	51.3	45.5	32.6
4-9	3.0	3.1	4.0	4.8	4.4
Total	**162.1**	**165.6**	**170.1**	**178.7**	**175.1**

Number of Calls per Day				
2019 vs 2018	2020 vs 2019	2021 vs 2020	2022 vs 2021	CAGR
1.8%	-3.7%	13.4%	5.7%	4.1%
6.7%	13.5%	8.2%	12.2%	10.1%
0.2%	5.7%	-11.3%	-28.3%	-9.4%
6.3%	27.3%	19.8%	-8.4%	10.4%
2.2%	**2.7%**	**5.1%**	**-2.0%**	**2.0%**

Priority	Number of Transports per Day				
	2018	2019	2020	2021	2022
1	63.3	62.8	56.9	61.4	67.3
2	19.7	20.1	22.5	23.6	26.2
3	35.3	33.9	34.9	30.5	20.7
4-9	2.9	3.1	3.9	4.8	4.4
Total	**121.2**	**119.9**	**118.1**	**120.4**	**118.6**
Transport %	**75%**	**72%**	**69%**	**67%**	**68%**

Number of Transports per Day				
2019 vs 2018	2020 vs 2019	2021 vs 2020	2022 vs 2021	CAGR
-0.8%	-9.4%	8.0%	9.5%	1.5%
1.9%	11.8%	5.2%	10.9%	7.4%
-3.9%	2.8%	-12.5%	-32.1%	-12.5%
5.6%	27.4%	22.0%	-8.4%	10.8%
-1.1%	**-1.4%**	**1.9%**	**-1.5%**	**-0.6%**

© Fitch & Associates, LLC
August 2023

Table 4: Performance by Priority and Year: 2018 – 2022

Year	Priority	# of Unit Reponses	Annual Busy Hours	Unit Responses per Day	Annual Busy Hours per Day	Avg. Turnout and Travel Time	80th Percentile Turnout and Travel Time	90th Percentile Turnout and Travel Time
2018	1	30,695	30,608	84.1	83.9	7.6	10.4	12.8
	2	10,040	10,028	27.5	27.5	7.7	10.5	12.9
	3	17,758	18,157	48.7	49.7	11.5	15.7	19.4
	4-9	1,078	1,462	3.0	4.0	17.1	24.6	30.4
	Total	**59,571**	**60,256**	**163.2**	**165.1**	**9.0**	**12.3**	**15.6**
2019	1	31,220	33,293	85.5	91.2	7.9	10.7	13.2
	2	10,716	11,323	29.4	31.0	8.0	10.9	13.2
	3	17,753	19,236	48.6	52.7	12.3	16.9	21.0
	4-9	1,145	1,558	3.1	4.3	18.5	26.1	32.3
	Total	**60,834**	**65,409**	**166.7**	**179.2**	**9.4**	**12.8**	**16.4**
2020	1	30,128	30,615	82.3	83.6	8.3	11.4	14.0
	2	12,195	12,476	33.3	34.1	8.6	11.6	14.2
	3	18,813	19,220	51.4	52.5	12.3	16.8	21.1
	4-9	1,464	1,991	4.0	5.4	18.7	26.6	32.1
	Total	**62,600**	**64,302**	**171.0**	**175.7**	**9.8**	**13.5**	**17.0**
2021	1	34,077	37,741	93.4	103.4	9.3	12.9	15.9
	2	13,161	14,683	36.1	40.2	11.2	15.4	19.5
	3	16,673	18,531	45.7	50.8	14.2	19.3	24.2
	4-9	1,747	2,541	4.8	7.0	21.0	28.1	36.3
	Total	**65,658**	**73,496**	**179.9**	**201.4**	**11.3**	**15.5**	**19.6**
2022	1	36,057	44,570	98.8	122.1	10.1	14.1	17.5
	2	14,794	17,952	40.5	49.2	14.2	19.4	23.9
	3	11,986	13,702	32.8	37.5	14.5	19.2	24.6
	4-9	1,602	2,364	4.4	6.5	21.2	28.0	35.3
	Total	**64,439**	**78,587**	**176.5**	**215.3**	**12.2**	**16.8**	**21.2**

© Fitch & Associates, LLC
August 2023

Table 5: Performance by Jurisdiction and Year: 2018 – 2022

Year	Jurisdiction	# of Unit Reponses	# of Transports	Busy Hours	Unit Responses per Day	Transports per Day	Busy Hours per Day	Avg. Turnout and Travel Time	90th Percentile Turnout and Travel Time
2018	COUNTY	18,809	14,330	20,645	51.5	39.3	56.6	11.2	18.7
	INCORP	40,405	30,005	39,323	110.7	82.2	107.7	7.9	13.3
	OUT	181	124	167	0.5	0.3	0.5	9.0	15.8
	UNK	176	71	120	0.5	0.2	0.3	8.6	15.3
	Total	**59,571**	**44,530**	**60,256**	**163.2**	**122.0**	**165.1**	**9.0**	**15.6**
2019	COUNTY	19,587	14,430	22,440	53.7	39.5	61.5	11.7	19.7
	INCORP	40,910	29,384	42,688	112.1	80.5	117.0	8.3	14.2
	OUT	173	113	183	0.5	0.3	0.5	9.9	18.4
	UNK	164	56	98	0.4	0.2	0.3	8.7	14.5
	Total	**60,834**	**43,983**	**65,409**	**166.7**	**120.5**	**179.2**	**9.4**	**16.4**
2022	COUNTY	21,054	15,065	23,649	57.7	41.3	64.8	12.2	20.4
	INCORP	41,149	28,208	40,331	112.7	77.3	110.5	8.6	14.6
	OUT	204	120	195	0.6	0.3	0.5	11.6	22.1
	UNK	193	75	128	0.5	0.2	0.4	8.8	16.9
	Total	**62,600**	**43,468**	**64,302**	**171.5**	**119.1**	**176.2**	**9.8**	**17.0**
2021	COUNTY	21,969	15,360	27,079	60.2	42.1	74.2	13.9	23.2
	INCORP	43,285	28,584	46,069	118.6	78.3	126.2	9.9	17.2
	OUT	189	94	187	0.5	0.3	0.5	13.1	28.0
	UNK	215	84	161	0.6	0.2	0.4	10.4	18.2
	Total	**65,658**	**44,122**	**73,496**	**179.9**	**120.9**	**201.4**	**11.3**	**19.6**
2022	COUNTY	22,176	15,526	30,054	60.8	42.5	82.3	15.1	24.8
	INCORP	41,869	27,823	48,217	114.7	76.2	132.1	10.6	18.2
	OUT	130	69	128	0.4	0.2	0.4	13.4	24.2
	UNK	264	89	188	0.7	0.2	0.5	10.5	19.1
	Total	**64,439**	**43,507**	**78,587**	**176.5**	**119.2**	**215.3**	**12.2**	**21.2**

© Fitch & Associates, LLC
August 2023

Table 6: Average Busy Minutes by Task Component for Completed Calls: 2018 – 2022

Transport	Year	Turnout and Travel Time	On Scene Time	Transport Time	At Hospital Time	Total Busy Time	Sample Size
Transport	2018	9.2	15.2	15.0	35.8	74.5	44,530
	2019	9.6	15.9	15.9	40.6	81.3	43,983
	2020	10.2	16.5	15.6	38.3	79.4	43,468
	2021	11.7	17.5	15.7	45.9	89.3	44,122
	2022	12.6	17.9	15.9	53.1	97.5	43,507
Non-Transport	2018	8.1	15.7	NA	NA	19.9	15,041
	2019	8.5	16.9	NA	NA	21.3	16,851
	2020	8.8	16.8	NA	NA	21.5	19,132
	2021	10.1	16.5	NA	NA	21.8	21,536
	2022	11.2	18.2	NA	NA	23.3	20,932
All	2018	9.0	15.3	15.0	35.8	60.7	59,571
	2019	9.4	16.2	15.9	40.6	64.6	60,834
	2020	9.8	16.6	15.6	38.3	61.7	62,600
	2021	11.3	17.2	15.7	45.9	67.2	65,658
	2022	12.2	18.0	15.9	53.1	73.3	64,439

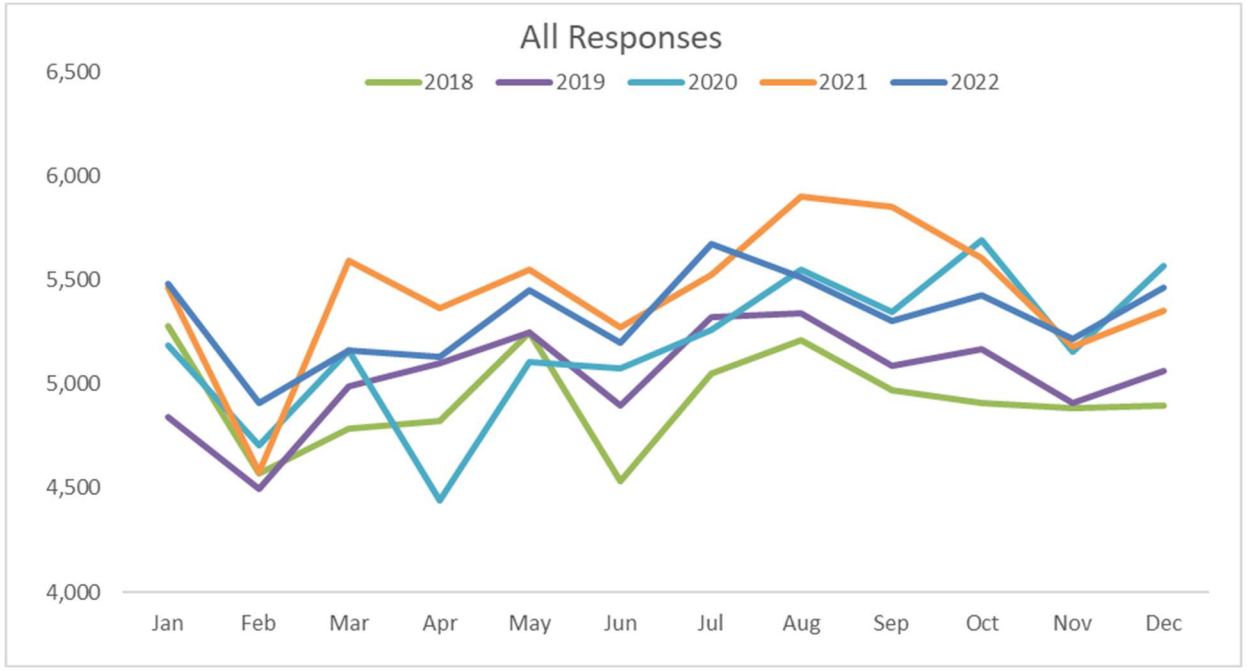
© Fitch & Associates, LLC
August 2023

Table 7: Number of Responses by Month and Year: 2018 – 2022

Month	Number of Calls					2019 vs 2018	2020 vs 2019	2021 vs 2020	2022 vs 2021	CAGR
	2018	2019	2020	2021	2022					
Jan	5,279	4,842	5,185	5,462	5,485	-8.3%	7.1%	5.3%	0.4%	1.0%
Feb	4,569	4,496	4,707	4,575	4,910	-1.6%	4.7%	-2.8%	7.3%	1.8%
Mar	4,787	4,989	5,159	5,591	5,163	4.2%	3.4%	8.4%	-7.7%	1.9%
Apr	4,822	5,103	4,443	5,365	5,130	5.8%	-12.9%	20.8%	-4.4%	1.6%
May	5,246	5,247	5,106	5,550	5,454	0.0%	-2.7%	8.7%	-1.7%	1.0%
Jun	4,534	4,898	5,074	5,275	5,197	8.0%	3.6%	4.0%	-1.5%	3.5%
Jul	5,048	5,322	5,258	5,525	5,671	5.4%	-1.2%	5.1%	2.6%	3.0%
Aug	5,209	5,340	5,549	5,904	5,510	2.5%	3.9%	6.4%	-6.7%	1.4%
Sep	4,968	5,085	5,345	5,849	5,305	2.4%	5.1%	9.4%	-9.3%	1.7%
Oct	4,910	5,165	5,694	5,606	5,424	5.2%	10.2%	-1.5%	-3.2%	2.5%
Nov	4,886	4,912	5,155	5,182	5,217	0.5%	4.9%	0.5%	0.7%	1.7%
Dec	4,894	5,062	5,567	5,353	5,461	3.4%	10.0%	-3.8%	2.0%	2.8%
Total	**59,152**	**60,461**	**62,242**	**65,237**	**63,927**	**2.2%**	**2.9%**	**4.8%**	**-2.0%**	**2.0%**

© Fitch & Associates, LLC
August 2023

Figure 1: Number of Responses by Month and Year



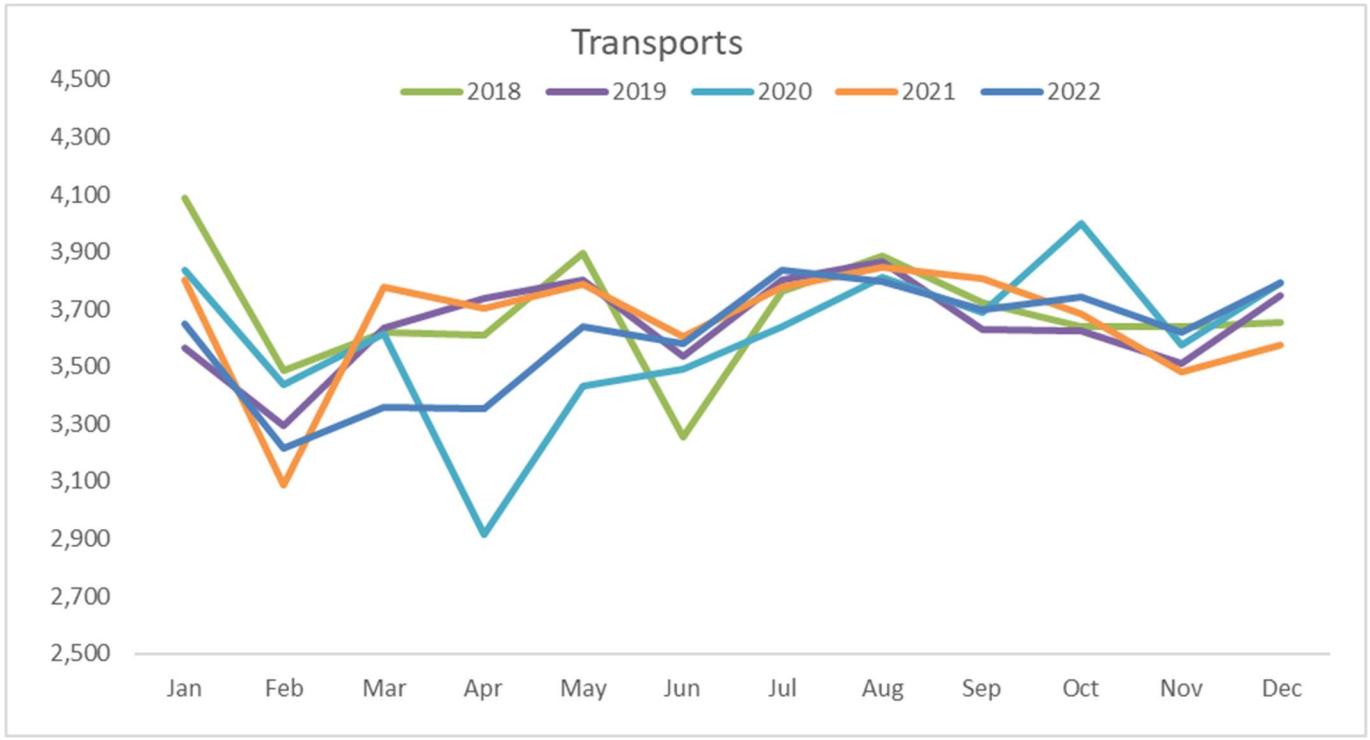
© Fitch & Associates, LLC
August 2023

Table 8: Number of Transports by Month and Year: 2018 – 2022

Month	Transports					2019 vs 2018	2020 vs 2019	2021 vs 2020	2022 vs 2021	CAGR
	2018	2019	2020	2021	2022					
Jan	4,086	3,564	3,838	3,803	3,648	-12.8%	7.7%	-0.9%	-4.1%	-2.8%
Feb	3,484	3,292	3,439	3,087	3,217	-5.5%	4.5%	-10.2%	4.2%	-2.0%
Mar	3,621	3,635	3,615	3,778	3,360	0.4%	-0.6%	4.5%	-11.1%	-1.9%
Apr	3,609	3,740	2,915	3,704	3,354	3.6%	-22.1%	27.1%	-9.4%	-1.8%
May	3,893	3,803	3,433	3,788	3,638	-2.3%	-9.7%	10.3%	-4.0%	-1.7%
Jun	3,253	3,538	3,489	3,603	3,581	8.8%	-1.4%	3.3%	-0.6%	2.4%
Jul	3,764	3,803	3,640	3,777	3,837	1.0%	-4.3%	3.8%	1.6%	0.5%
Aug	3,885	3,864	3,812	3,848	3,799	-0.5%	-1.3%	0.9%	-1.3%	-0.6%
Sep	3,725	3,628	3,689	3,806	3,696	-2.6%	1.7%	3.2%	-2.9%	-0.2%
Oct	3,638	3,626	3,998	3,684	3,742	-0.3%	10.3%	-7.9%	1.6%	0.7%
Nov	3,638	3,511	3,577	3,481	3,618	-3.5%	1.9%	-2.7%	3.9%	-0.1%
Dec	3,652	3,747	3,792	3,573	3,791	2.6%	1.2%	-5.8%	6.1%	0.9%
Total	**44,248**	**43,751**	**43,237**	**43,932**	**43,281**	**-1.1%**	**-1.2%**	**1.6%**	**-1.5%**	**-0.6%**

© Fitch & Associates, LLC
August 2023

Figure 2: Number of Transports by Month and Year



© Fitch & Associates, LLC
August 2023

Table 9: 2022: Number of Calls by City and Priority

Transport	Number of Calls					
	City**	1	2	3	4-9	Total
Transport	Knoxville	22,208	8,714	6,915	1,483	39,320
	Farragut	1,099	420	363	48	1,930
	Powell	682	288	182	51	1,203
	Corryton	197	77	49	6	329
	Other	177	22	15	4	218
	Mascot	121	23	22	8	174
	Strawberry Plains	74	23	9	1	107
	Total	**24,558**	**9,567**	**7,555**	**1,601**	**43,281**
Non-Transport	Knoxville	10,175	4,786	4,090	0	19,051
	Farragut	368	186	122	0	676
	Powell	202	119	74	0	395
	Corryton	66	42	31	0	139
	Other	215	9	19	0	243
	Mascot	58	20	13	0	91
	Strawberry Plains	30	13	8	0	51
	Total	**11,117**	**5,175**	**4,357**	**0**	**20,649**
All	Knoxville	32,383	13,500	11,005	1,483	58,371
	Farragut	1,467	606	485	48	2,606
	Powell	884	407	256	51	1,598
	Corryton	263	119	80	6	468
	Other	392	31	34	4	461
	Mascot	179	43	35	8	265
	Strawberry Plains	104	36	17	1	158
	Total	**35,672**	**14,742**	**11,912**	**1,601**	**63,927**

*****AMR Received Data Element Coding***

© Fitch & Associates, LLC
August 2023

Table 10: 2022: Average Number of Calls per Day by City and Priority

Transport	Average Number of Calls per Day					
	City**	1	2	3	4-9	Total
Transport	Knoxville	60.8	23.9	18.9	4.1	107.7
	Farragut	3.0	1.2	1.0	0.1	5.3
	Powell	1.9	0.8	0.5	0.1	3.3
	Corryton	0.5	0.2	0.1	0.0	0.9
	Other	0.5	0.1	0.0	0.0	0.6
	Mascot	0.3	0.1	0.1	0.0	0.5
	Strawberry Plains	0.2	0.1	0.0	0.0	0.3
	Total	**67.3**	**26.2**	**20.7**	**4.4**	**118.6**
Non-Transport	Knoxville	27.9	13.1	11.2	0.0	52.2
	Farragut	1.0	0.5	0.3	0.0	1.9
	Powell	0.6	0.3	0.2	0.0	1.1
	Corryton	0.2	0.1	0.1	0.0	0.4
	Other	0.6	0.0	0.1	0.0	0.7
	Mascot	0.2	0.1	0.0	0.0	0.2
	Strawberry Plains	0.1	0.0	0.0	0.0	0.1
	Total	**30.5**	**14.2**	**11.9**	**0.0**	**56.6**
All	Knoxville	88.7	37.0	30.2	4.1	159.9
	Farragut	4.0	1.7	1.3	0.1	7.1
	Powell	2.4	1.1	0.7	0.1	4.4
	Corryton	0.7	0.3	0.2	0.0	1.3
	Other	1.1	0.1	0.1	0.0	1.3
	Mascot	0.5	0.1	0.1	0.0	0.7
	Strawberry Plains	0.3	0.1	0.0	0.0	0.4
	Total	**97.7**	**40.4**	**32.6**	**4.4**	**175.1**

*****AMR Received Data Element Coding***

© Fitch & Associates, LLC
August 2023

Table 11: 2022: Performance by City

City**	# of Unit Responses	# of Transports	Annual Busy Hours	# of Unit Responses per Day	# of Transports per Day	Annual Busy Hours per Day	Avg. Turnout and Travel Time	80th Percentile Turnout and Travel Time	90th Percentile Turnout and Travel Time
Knoxville	58,844	39,525	70,999	161.2	108.3	194.5	11.8	16.2	20.5
Farragut	2,620	1,934	3,515	7.2	5.3	9.6	15.7	21.8	26.7
Powell	1,605	1,209	2,232	4.4	3.3	6.1	13.8	18.7	22.9
Corryton	469	329	741	1.3	0.9	2.0	21.2	27.6	32.1
Mascot	265	174	379	0.7	0.5	1.0	19.2	24.3	30.1
Strawberry Plains	159	107	238	0.4	0.3	0.7	20.0	25.8	28.7
Other	477	229	482	1.3	0.6	1.3	14.2	20.0	24.0
Total	**64,439**	**43,507**	**78,587**	**176.5**	**119.2**	**215.3**	**9.0**	**12.4**	**16.4**

***AMR Received Data Element Coding*

© Fitch & Associates, LLC
August 2023

Table 12: 2022: Performance by City and Priority

City**	Priority	# of Calls	# of Transports	Avg. Turnout and Travel Time	80th Percentile Turnout and Travel Time	90th Percentile Turnout and Travel Time
Knoxville	1	32,734	22,401	9.8	13.7	16.9
	2	13,551	8,717	13.8	18.8	23.1
	3	11,075	6,923	13.9	18.5	23.4
	4-9	1,484	1,484	20.7	27.4	34.4
	Total	**58,844**	**39,525**	**11.8**	**16.2**	**20.5**
Farragut	1	1,477	1,103	11.4	16.4	20.3
	2	607	420	19.1	24.7	29.1
	3	488	363	22.7	27.0	34.2
	4-9	48	48	27.4	31.5	41.9
	Total	**2,620**	**1,934**	**15.7**	**21.8**	**26.7**
Powell	1	891	688	11.6	15.3	18.5
	2	407	288	15.3	21.5	24.4
	3	256	182	17.1	22.1	25.5
	4-9	51	51	24.8	30.0	33.2
	Total	**1,605**	**1,209**	**13.8**	**18.7**	**22.9**
Corryton	1	264	197	17.4	22.5	25.3
	2	119	77	24.6	30.7	33.8
	3	80	49	28.0	32.4	39.0
	4-9	6	6	33.5	36.5	46.1
	Total	**469**	**329**	**21.2**	**27.6**	**32.1**
Mascot	1	179	121	17.2	20.8	24.7
	2	43	23	22.8	31.2	36.3
	3	35	22	22.0	27.5	30.3
	4-9	8	8	32.1	39.8	39.9
	Total	**265**	**174**	**19.2**	**24.3**	**30.1**
Strawberry Plains	1	105	74	18.0	23.2	26.1
	2	36	23	23.1	29.6	33.4
	3	17	9	22.9	27.3	33.9
	4-9	1	1	46.9	46.9	46.9
	Total	**159**	**107**	**20.0**	**25.8**	**28.7**
Other	1	407	187	13.1	18.0	21.4
	2	31	22	21.2	26.6	29.6
	3	35	16	17.5	23.1	27.9
	4-9	4	4	30.1	46.0	46.0
	Total	**477**	**229**	**14.2**	**20.0**	**24.0**

*****AMR Received Data Element Coding***

© Fitch & Associates, LLC
August 2023

Table 13: 2022: Performance by Top Transport Destinations

Destination	Avg. Hospital Turnaround Time	90th Percentile Hospital Turnaround Time	Avg. Busy Minutes per Trip	Number of Trips	Total Busy Hours	# of Trips per Day	Busy Hours per Day	% of Total Trips	Cumulative % of Total Trips
UNIVERSITY OF TENNESSEE MEDICAL CENTER	55.6	88.5	99.4	14,024	23,233	38.3	63.5	32%	32%
FORT SANDERS REGIONAL MEDICAL CENTER	54.2	82.3	94.7	12,454	19,661	34.0	53.7	29%	61%
PARKWEST HOSPITAL	54.7	86.4	99.8	7,316	12,170	20.0	33.3	17%	78%
NORTH KNOXVILLE MEDICAL CENTER	57.9	91.9	102.7	3,817	6,530	10.4	17.8	9%	86%
TURKEY CREEK MEDICAL CENTER	45.0	72.0	91.2	2,466	3,747	6.7	10.2	6%	92%
FORENSICS CENTER	28.2	47.6	89.0	1,570	2,328	4.3	6.4	4%	96%
ETCH	38.6	61.3	81.2	1,273	1,723	3.5	4.7	3%	99%
TENNOVA HEALTHCARE POWELL, TN	60.6	103.3	102.2	112.0	191	0.3	0.5	0%	99%
MMC	58.6	90.6	111.5	102.0	190	0.3	0.5	0%	99%
BMH	52.3	80.7	109.4	97.0	177	0.3	0.5	0%	99%
Other	50.5	89.1	108.2	276.0	498	0.8	1.4	1%	100%

© Fitch & Associates, LLC
August 2023

Figure 3: 2022: Average Responses per Day by Month

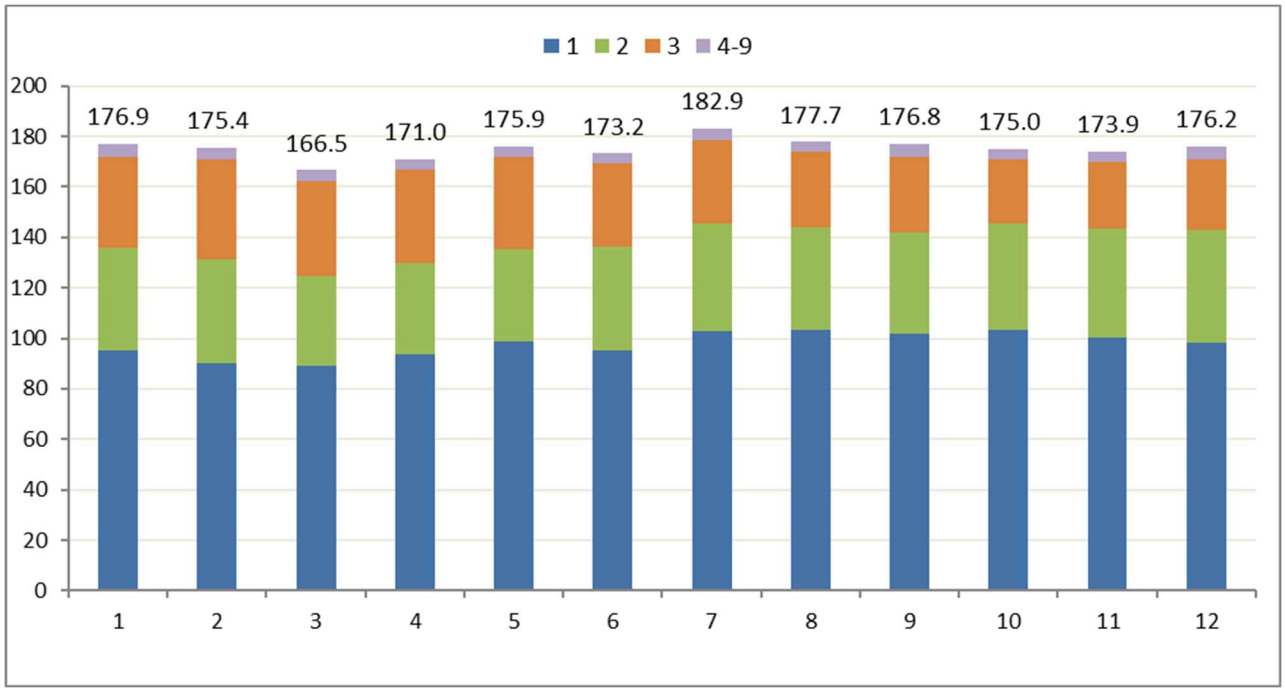
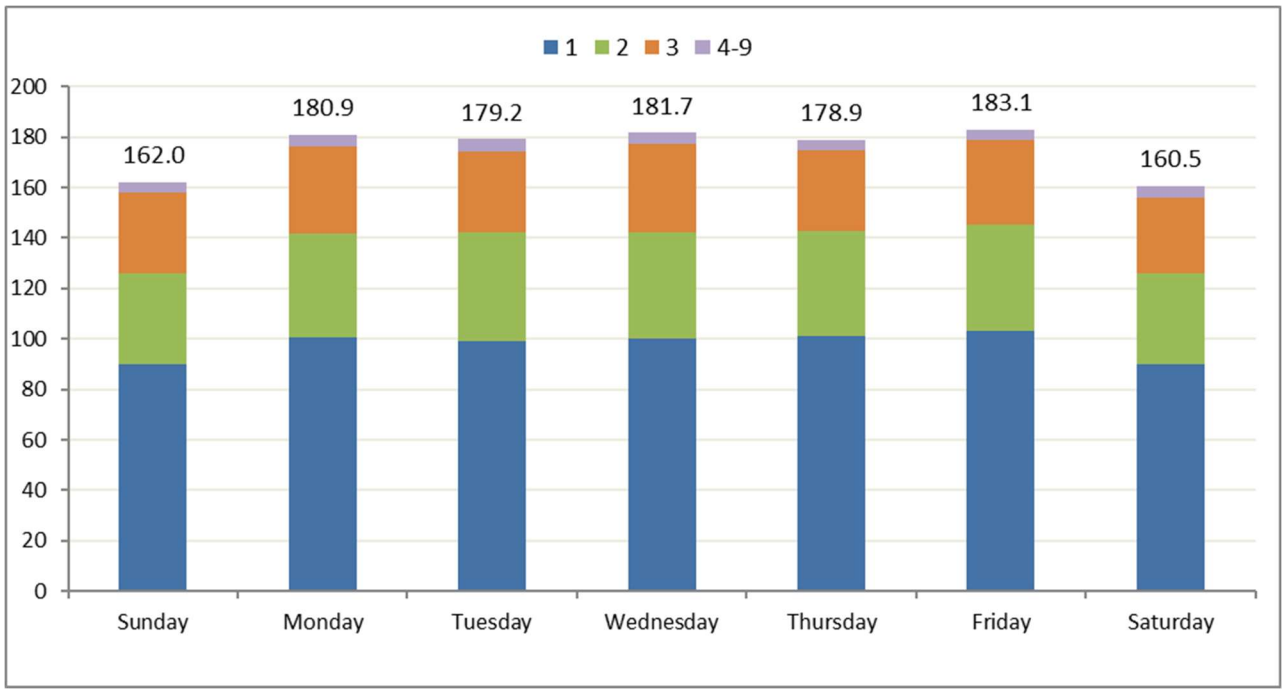
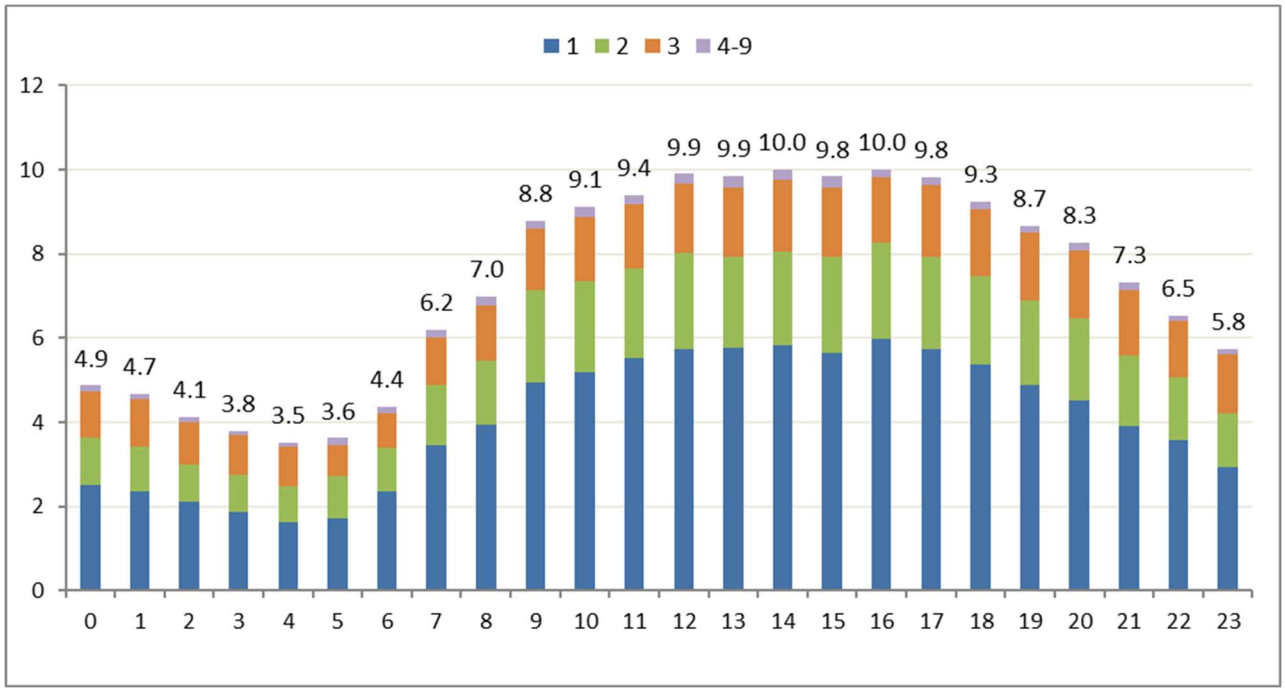


Figure 4: 2022: Average Responses per Day by Weekday



© Fitch & Associates, LLC
August 2023

Figure 5: 2022: Average Responses per Day by Hour



© Fitch & Associates, LLC
August 2023