



MONTANA EMS

ANNUAL REPORT 2022

A SUMMARY OF 2021 EMS DATA



MONTANA
EMS, TRAUMA SYSTEMS &
INJURY PREVENTION PROGRAM



CONTENTS

Executive Summary	2
Montana EMS Agencies	3
Report Background	6
Methods	6
Overview of EMS Incident Dataset	7
Important Definitions.....	7
Ground Transporting Agencies.....	11
Non-Transporting Agencies	26
Air Medical Agencies	32
Time Sensitive Illness and Injury	44
Alcohol/Drug Exposure	45
Mental and Behavioral Health.....	48
Trauma	50
Traumatic Brain Injury (TBI).....	56
Suspected Stroke	58
Suspected Cardiac Chest Pain and STEMI	60
Out-of-Hospital Cardiac Arrest (OHCA)	64
Medication Administration Table (Top 50)	67
Appendix 1. Montana Population Characteristics	68
Acronyms	69
List of Tables	70
List of Figures.....	71
References	73
Montana Field Trauma Decision Scheme/ Trauma Team Activation Criteria.....	76

EXECUTIVE SUMMARY

We are pleased to present the Montana EMS Annual Report 2022 made possible by the hard work of more than 5,000 emergency care providers across the state. The report analyzes 2021 EMS data by agency-type (non-transporting, ground transport, air transport) and by time-sensitive illnesses and injuries, including alcohol/drug exposure, trauma, traumatic brain injury, stroke, heart attack and cardiac arrest.

The intent of this report is to provide EMS agencies, public health professionals and policy makers with information that can be used to enhance performance, identify education opportunities, and describe prehospital emergency care in Montana.

EMS agencies that wish to replicate the measures presented in this report are encouraged to contact the EMS and Trauma System Section for more information.

Key findings of this report include the following:

- 127 ground ambulance agencies responded to 132,910 requests for service, up from 122,551 last year
- 11 air medical providers responded to 5,325 requests for service, up from 5,102 last year
- Injury-related complaints accounted for 1 in 5 ground 911 transports and 2 in 5 air 911 transports
- Among pediatric patients (aged 0-17 years), mental and behavioral health-related complaints accounted for 1 in 3 interfacility transports, and over 10% of 911 transports
- One third of all self-harm related inter-facility transports were for pediatric patients aged 0-17
- Volunteer agencies transported 911 patients roughly three times farther than paid agencies, with most calls lasting 30 to 90 minutes longer than paid agencies
- Volunteer agencies typically transport interfacility patients further than 60 miles, and most of these calls last from 3 to 6 hours
- There were more than 2,600 fixed and rotor wing interfacility transports originating from rural hospitals across the state

Opportunities:

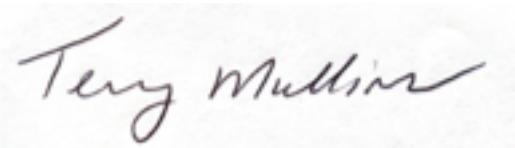
To support EMS agencies, we will be undertaking some important initiatives over the next year. Later this spring, we will publish the third EMS Quality Improvement report, previous versions can be viewed on the Section's website. Additionally, with support from the Montana Department of Transportation, we will begin providing every EMS agency in the state with assistance to improve the quality and accuracy of their EMS records. Finally, to ensure that the Montana EMS Registry stays up to date with changes in data reporting nationwide, we will work with EMS agencies to adopt version 3.5 of the National EMS Information System.



Shari Graham
EMS System Manager

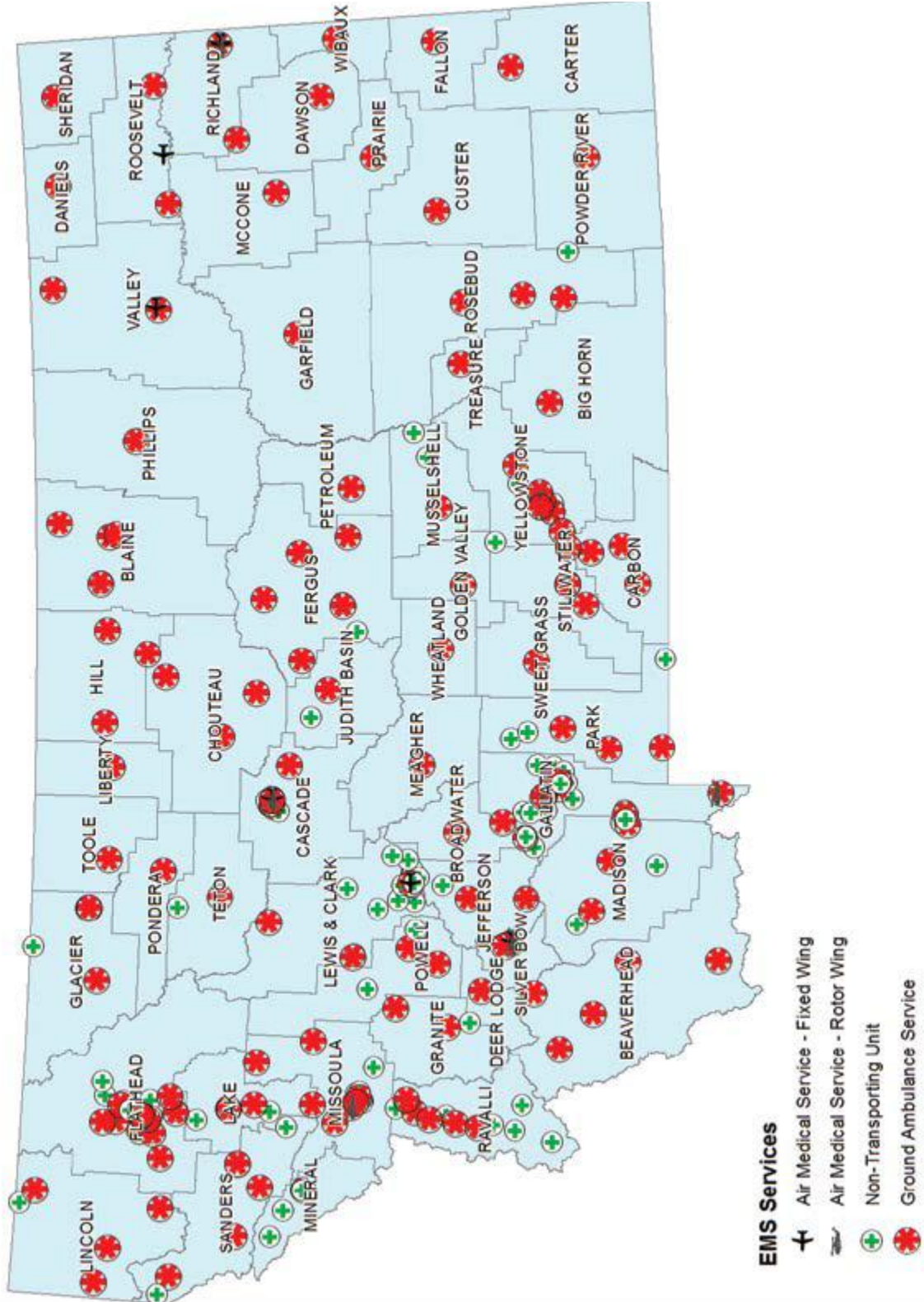


Hannah Yang
EMS, Trauma, and Injury Prevention Epidemiologist



Terry Mullins
Section Supervisor

MONTANA EMS AGENCIES



SPECIAL THANKS TO THE FOLLOWING EMS AGENCIES THAT CONTRIBUTED TO THIS REPORT:

GROUND TRANSPORTING AGENCIES

A-1 Ambulance
 Absarokee Rural Fire District*
 Alert III - Ground
 American Medical Response (Billings)
 American Medical Response (Bozeman)
 Anaconda Fire
 Arlee Ambulance Service*
 Augusta Volunteer Ambulance Service*
 Avon Volunteer Fire Department & QRU*
 Babb-St Mary EMS* (Inactive)
 Beartooth EMS & Rescue
 Beaverhead EMS*
 Belt Volunteer Ambulance*
 Big Mountain Fire & Rescue
 Big Sandy Volunteer Ambulance Service*
 Big Sky Fire Department
 Bigfork Fire District
 Billings Clinic Broadwater
 Bitterroot Health Ambulance
 Blackfeet Tribal EMS
 Blaine County Ambulance I*
 Boulder Ambulance Service*
 Big Horn County Ambulance
 Central Montana Medical Center Ambulance Service
 Central Valley Fire District / Belgrade City Fire Department
 City of Bozeman Fire Dept
 City of Havre Ambulance/Fire Department
 City of Whitefish Fire Department
 Clarks Fork Valley Ambulance*
 Clarkston Fire Service Area*
 Coast2Coast Public Safety
 Colstrip Ambulance Service*
 Columbus Rural Fire District 3
 Community Ambulance Service of Western Sanders County*
 Condon/Swan Valley QRU*
 Dahl Memorial Healthcare Ambulance*
 Daniels County Ambulance Service*
 Denton Ambulance*
 Eagle Ambulance Service, Inc.
 Eureka Volunteer Ambulance Service*
 Evergreen Fire Rescue
 Fallon County Ambulance*
 Fisher River Valley Fire/Rescue*
 Fort Belknap EMS
 Frenchtown Rural Fire District
 Garfield Ambulance*
 Geraldine Community Ambulance Service*
 Glendive Ambulance Service*
 Golden Valley Quick Response Ambulance*
 Grass Range Ambulance Service*
 Grasshopper Valley Ambulance*

Great Falls Emergency Services
 Great Falls Fire Rescue
 Hebgen Basin Fire District
 Help Flight St Vincent Healthcare - Ground
 Hill County Ambulance Service of Rudyard*
 Hot Springs Community Ambulance Service Inc.*
 Hot Springs Fire Department Ambulance*
 Joliet EMS Inc.*
 Judith Basin County EMS*
 Kalispell Fire/Ambulance Department
 Lakeside QRU, Inc*
 Laurel Volunteer Ambulance Service*
 Libby Volunteer Ambulance*
 Liberty County Ambulance and QRU*
 Lima Rural Fire Department and Ambulance*
 Lincoln Volunteer Ambulance Service*
 Livingston Fire Rescue
 Lockwood Rural Fire District Ambulance
 Madison Valley Ambulance Service
 Marion Fire District*
 Meagher County Ambulance*
 Memorial Ambulance of Fort Benton*
 Miles City Fire Rescue
 Missoula Emergency Services Inc.
 Montana Medical Transport Ambulance
 Musselshell County Ambulance*
 North Valley EMS Inc.*
 Northeast Montana Health Services
 Northern Cheyenne Ambulance Service
 Northern Rockies EMS
 Paradise Valley Fire Service Area*
 Park City Volunteer Ambulance Service*
 Petroleum County Ambulance Service*
 Philipsburg Ambulance Service*
 Phillips County Ambulance*
 Plains Community Ambulance*
 Polson Ambulance Inc.
 Pondera Logan Health Ambulance
 Powder River County EMS*
 Powell EMS*
 Prairie County Ambulance Service*
 Pulse Dba Jefferson Valley EMS and Rescue*
 Red Lodge Fire/Rescue*
 Redwater Valley Ambulance Service*
 Richey Ambulance Service*
 Richland County Ambulance*
 Rocky Boy Health Board Ambulance
 Roosevelt Memorial Medical Center Ambulance*
 Rosebud County*
 Roy Ambulance Service*
 Ruby Valley EMS*
 Seeley Lake QRU/Rural Fire Department*
 Sheridan Memorial Hospital EMS*
 Smith Valley Volunteer Fire Department Ambulance*

Spectrum
St Peters Hospital Ambulance
Stat Ambulance Service*
Stevensville City & Rural Fire Dept.*
Superior Area Ambulance Service*
Sweet Grass County Ambulance Service*
Teton County Ambulance Service*
Thompson Falls Ambulance*
Three Forks Area Ambulance Service*
Three Rivers EMS*
Toole County Ambulance*
Treasure County Ambulance Service*
Troy Volunteer Ambulance Service*
Victor Volunteer Rural Fire Department QRU*
Vitalogy EMS
West Valley Volunteer Fire Department*
Wheatland County Ambulance Service*
Wibaux County Ambulance Service*
Winifred Community Ambulance*
Wise River Volunteer Fire Company*
Worden Fire Department & Ambulance*

NON-TRANSPORTING AGENCIES

Billings Fire Department
Cascade County QRT*
Chief Cliff Fire Service QRU*
Elliston EMS*
Florence Volunteer Fire & QRU*
Gore Hill Fire Rescue*
Helena Fire Department
Lincoln Volunteer Fire & Rescue*
Manhattan Volunteer Fire Department*
Montana City Volunteer Fire Department*
Polson Fire Department*
Pulse Dba Jefferson Valley EMS & Rescue, NTU*
Sheridan Memorial Hospital Rapid Response System*
Teton County EMS- Pendroy QRU*
Wilderness Medics, Inc.

AIR MEDICAL AGENCIES

Rotor Wing
Alert I - Rotor
Help Flight St Vincent Healthcare - Rotor
Life Flight Network Butte
Mercy Flight Benefis Healthcare - Rotor

FIXED WING

Alert II - Fixed
Billings Clinic Medflight - Fixed
Help Flight St Vincent Healthcare - Fixed
Life Flight Network Fixed Wing Butte
Mercy Flight - Benefis Healthcare - Fixed
Montana Medical Transport - Fixed
Stat Air Ambulance Service - Fixed

** denotes volunteer agency*

REPORT BACKGROUND

The purpose of this report is to describe Emergency Medical Services (EMS) system utilization and performance in Montana during 2021 through analysis of the state’s EMS incident dataset.

Montana’s EMS incident dataset consists of patient care documentation collected by emergency care providers. Montana statute requires all ground transporting agencies (GTAs) and air medical agencies (AMAs) licensed in the state to submit a patient care report (PCR) for each patient encountered during an EMS activation. Non-transporting agencies (NTAs) are not required to report data, however, some NTAs voluntarily report. The EMS incident dataset captures agency information, patient demographics, response times, incident location, prehospital interventions, and treatments provided to the patient. In general, PCRs are uploaded to the state data repository within 24 hours of the patient encounter. Montana has been collecting NEMSIS v3.4.0 data since January 2017.

This report includes:

- system utilization volumes and demand analysis
- descriptive analysis of who is utilizing EMS (age-sex pyramids, pie charts showing race)
- descriptive analysis of why EMS is activated (primary impressions)
- focused reports on time sensitive illnesses and injuries: drug overdose, trauma, traumatic brain injury (TBI), suspected stroke, suspected cardiac chest pain and STEMI, non-traumatic out-of-hospital cardiac arrests (OHCA)

The report is divided into separate sections for ground transporting agencies, non-transporting agencies, and air medical agencies including rotor wing agencies (RWAs) and fixed wing agencies (FWAs). Within each section, data is divided by response type and patient disposition.

METHODS

This report includes EMS incidents that occurred in Montana between Jan 1, 2021- Dec 31, 2021. Records for out-of-state incidents and records missing values for incident state, response type, or patient disposition were excluded from the analysis. 2020 US Census bridged race population estimates were used to calculate age adjusted rates per 100,000 residents.¹

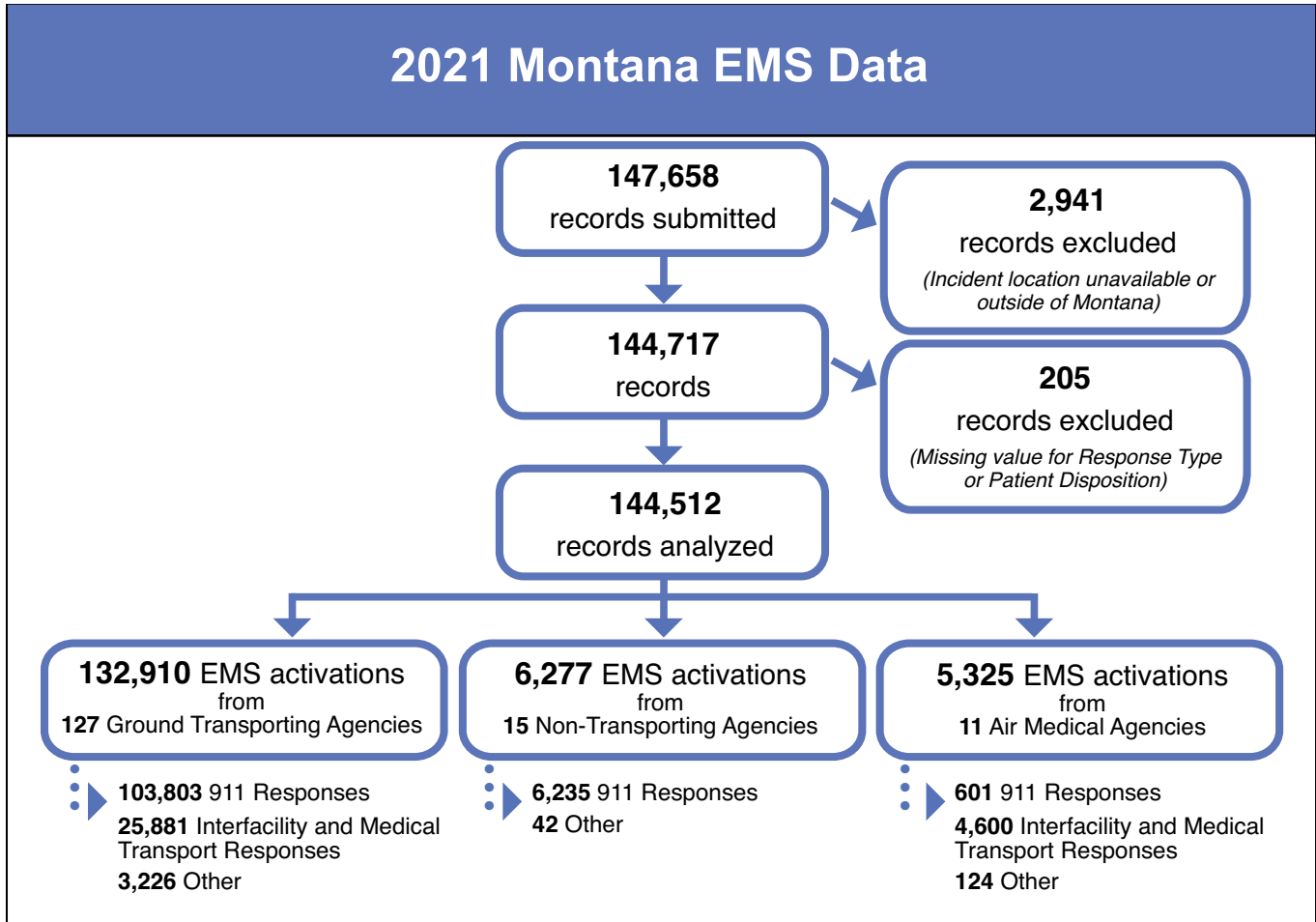
The EMS dataset is a registry of EMS activations; it is not a “patient-based” dataset. A single patient or a single event may be represented in more than one record for a variety of reasons. For example, if several agencies responded to the same incident, they would each submit a PCR. No attempt was made to link records from different EMS agencies that pertained to the same incident.

Extreme outliers were excluded when calculating response times and distances traveled. Within each agency type and response type category, any value greater than the third quartile plus the interquartile range multiplied by ten ($Q3+10 \times IQR$) was excluded.

Response times were defined as follows:

- Chute time: “Unit notified by dispatch” to “Unit en route”. Measures the time it takes the ambulance crew start moving toward the scene, from the time they are notified
- On-scene time: “Unit on scene” to “Unit left scene”. Measures the time spent by the EMS crew on scene.
- Time at sending facility: “Unit on scene” to “Unit left scene”. Measures the time spent by EMS at the sending/first facility while picking up the patient during an interfacility or medical transport.
- EMS transport time: “Unit left scene” to “Unit arrived at destination”. Measures patient-loaded travel time
- Turnaround time: “Unit arrived at destination” to “Unit back in service”. Measures the time from when the ambulance arrives at the ED with a patient until the EMS unit is back in service
- Total call time: “Unit notified by dispatch” to “Unit back in service”. Measures the time from when the ambulance was notified by dispatch until the EMS unit is back in service.

OVERVIEW OF EMS INCIDENT DATASET



IMPORTANT DEFINITIONS

EMS Activation is an occurrence which initiates an EMS response with the potential of patient medical care.

Response Type describes the circumstances under which a particular EMS Agency was requested to respond.

- 911 Response: EMS activation where the response is emergent or immediate to an incident location (scene), regardless of method of notification (e.g., 9-1-1, direct dial, walk-in, flagging down, air ambulance scene flight)
- Interfacility Transport Response: Emergent response for transport from one healthcare facility to another for the purpose of continuation of acute care
- Medical Transport Response: Non-emergent response for transport that is not between hospitals or that does not require an immediate response, i.e.- to/from an appointment, for a scheduled procedure
- Other includes intercept, standby, mutual aid, and public assistance.

Patient Disposition describes whether care and/or transport were provided to the patient by the responding EMS personnel.

- **911 Transport:** A 911 response that resulted in patient transport by the responding EMS unit
- **IFM Transport:** An interfacility or medical transport (IFMT) response that resulted in patient transport by the responding EMS unit

Table 1 shows the patient disposition categories in detail.²

Table 1. EMS activations by patient disposition and agency type, 2021

Patient Disposition	Ground Transporting Agencies	Non-Transporting Agencies	Air Medical Agencies	All
Patient Transported by this EMS Unit	91,917	106	4,987	97,010
Patient Treated, Transported by this EMS Unit	91,787	100	4,987	96,874
Patient Dead at Scene-No Resuscitation Attempted (With Transport)	42	0	0	42
Patient Dead at Scene-Resuscitation Attempted (With Transport)	37	5	0	42
Patient Refused Evaluation/Care (With Transport)	51	1	0	52
Patient Treated, No Transport (per protocol)	6,450	2,540	10	9,000
Patient Treated, Transferred Care to Another EMS Unit	4,242	2,450	8	6,700
Patient Treated, Released (per protocol)	1,769	54	2	1,825
Patient Treated, Transported by Law Enforcement	188	8	0	196
Patient Treated, Transported by Private Vehicle	251	28	0	279
Patient Evaluated, No Treatment/Transport Required	3,856	115	1	3,972
Patient Refusal, No Transport	12,333	299	9	12,641
Patient Refused Evaluation/Care (Without Transport)	7,607	208	9	7,824
Patient Treated, Released (Against Medical Advice)	4,726	91	0	4,817
Patient Dead at Scene, No Transport	1,605	115	39	1,759
Patient Dead at Scene-No Resuscitation Attempted (Without Transport)	940	79	1	1,020
Patient Dead at Scene-Resuscitation Attempted (Without Transport)	665	36	38	739
Other (No Patient Contact)	16,749	3,102	279	20,130
Assist/Standby/Non-Patient	5,150	3,097	5	8,252
Assist, Agency	1,932	3,053	0	4,985
Assist, Public	1,815	34	0	1,849
Assist, Unit	182	4	0	186
Standby-No Services or Support Provided	24	0	5	29
Standby-Public Safety, Fire, or EMS Operational Support Provided	1,025	6	0	1,031
Transport Non-Patient, Organs, etc.	172	0	0	172
Canceled	11,599	5	274	11,878
Canceled (Prior to Arrival At Scene)	4,987	1	237	5,225
Canceled on Scene (No Patient Contact)	5,931	4	16	5,951
Canceled on Scene (No Patient Found)	681	0	21	702
All Patient Transports	91,917	106	4,987	97,010
All Patient Contacts	116,161	3,175	5,046	124,382
All EMS Activations	132,910	6,277	5,325	144,512

Figure 1. Map of all 911 responses by county (age-adjusted rate per 100,000 population), Montana, 2021

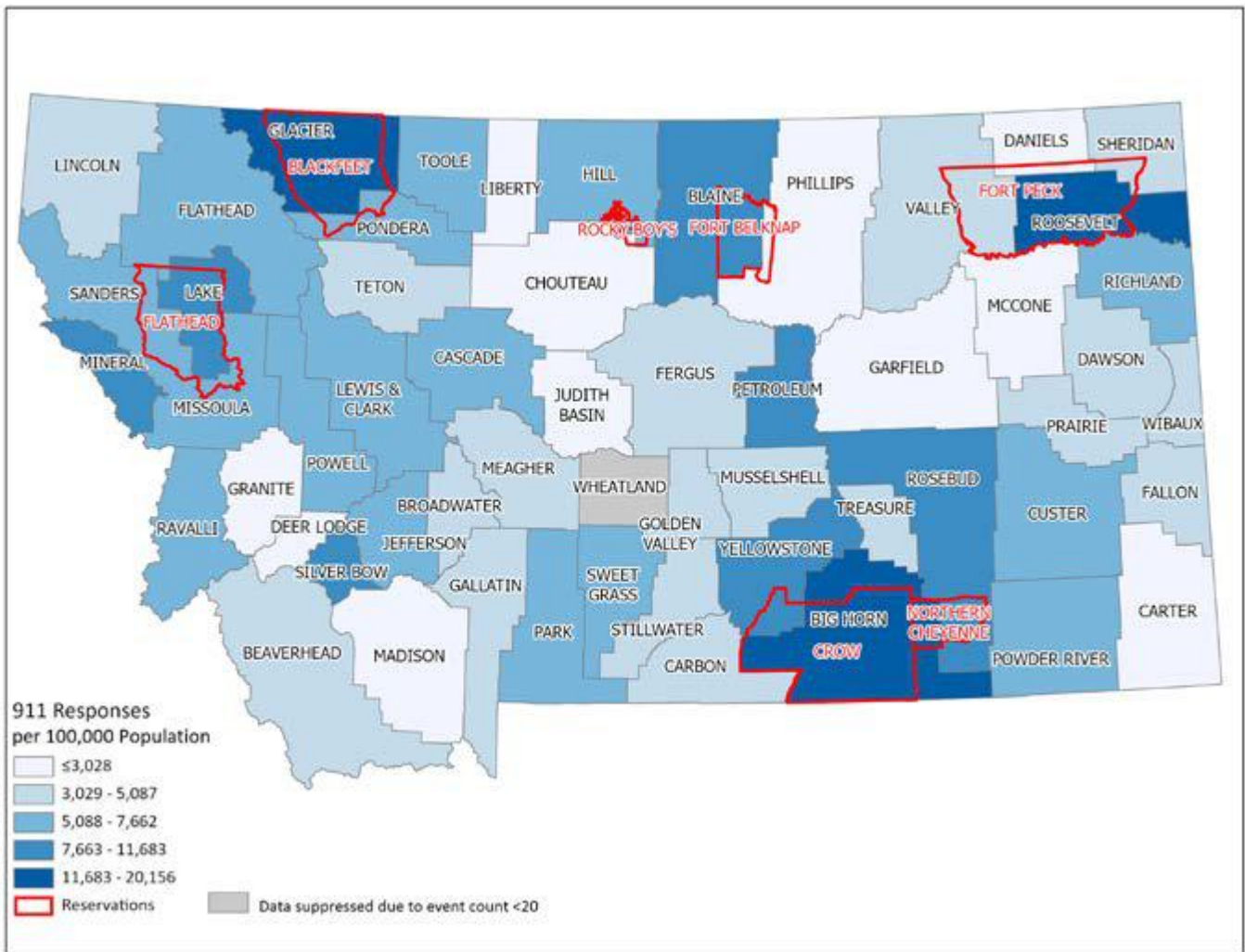


Figure 2. Weekly count of all 911 responses, 2021

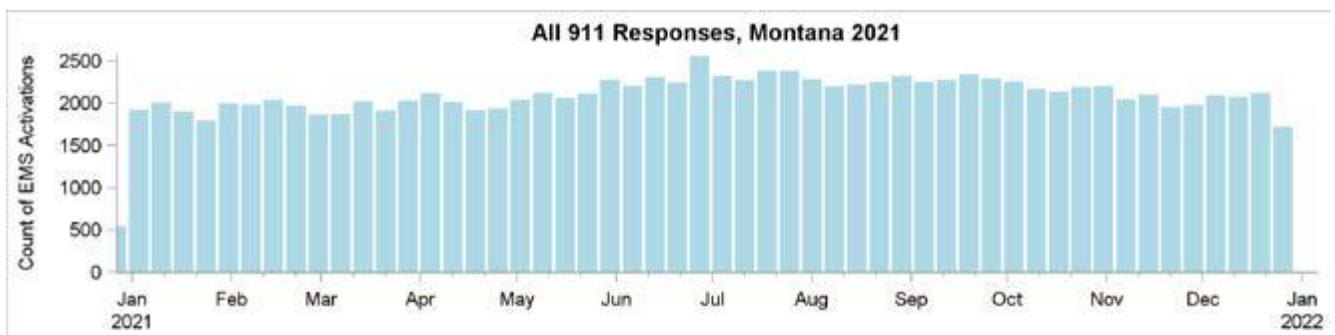


Figure 3. Map of all IFMT responses by county (age-adjusted rate per 100,000 population), Montana, 2021

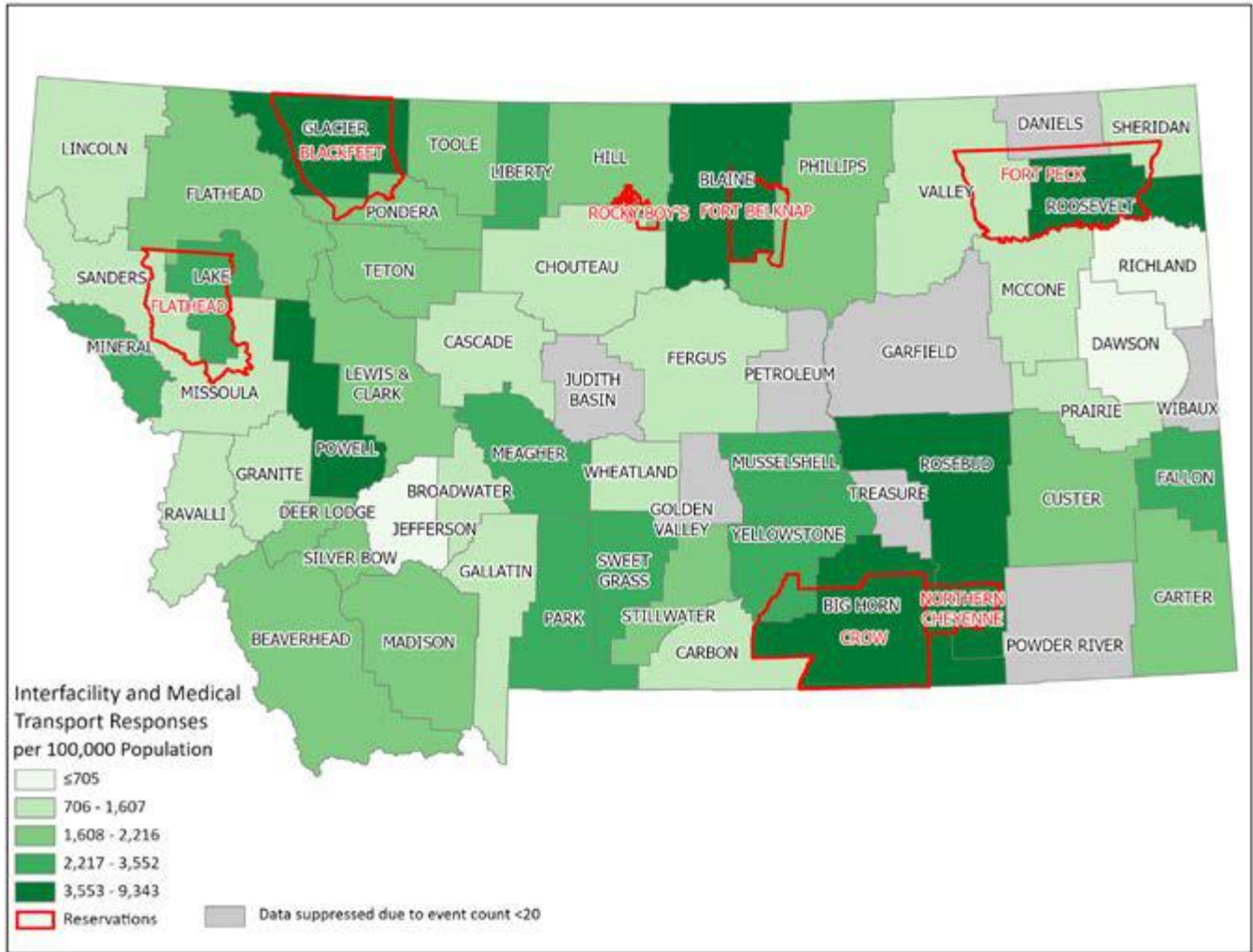
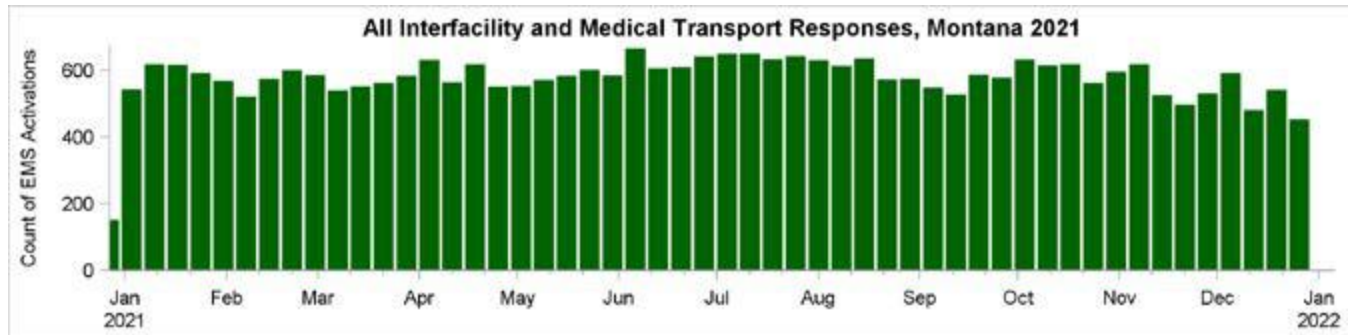


Figure 4. Weekly count of all IFMT responses, 2021



GROUND TRANSPORTING AGENCIES

A total of 127 Ground Transporting Agencies (GTA) submitted data for this report, documenting 132,910 EMS activations during 2021. 85% (N=112,522) of the records were submitted by paid GTAs and 15% (N=20,388) by volunteer GTAs.

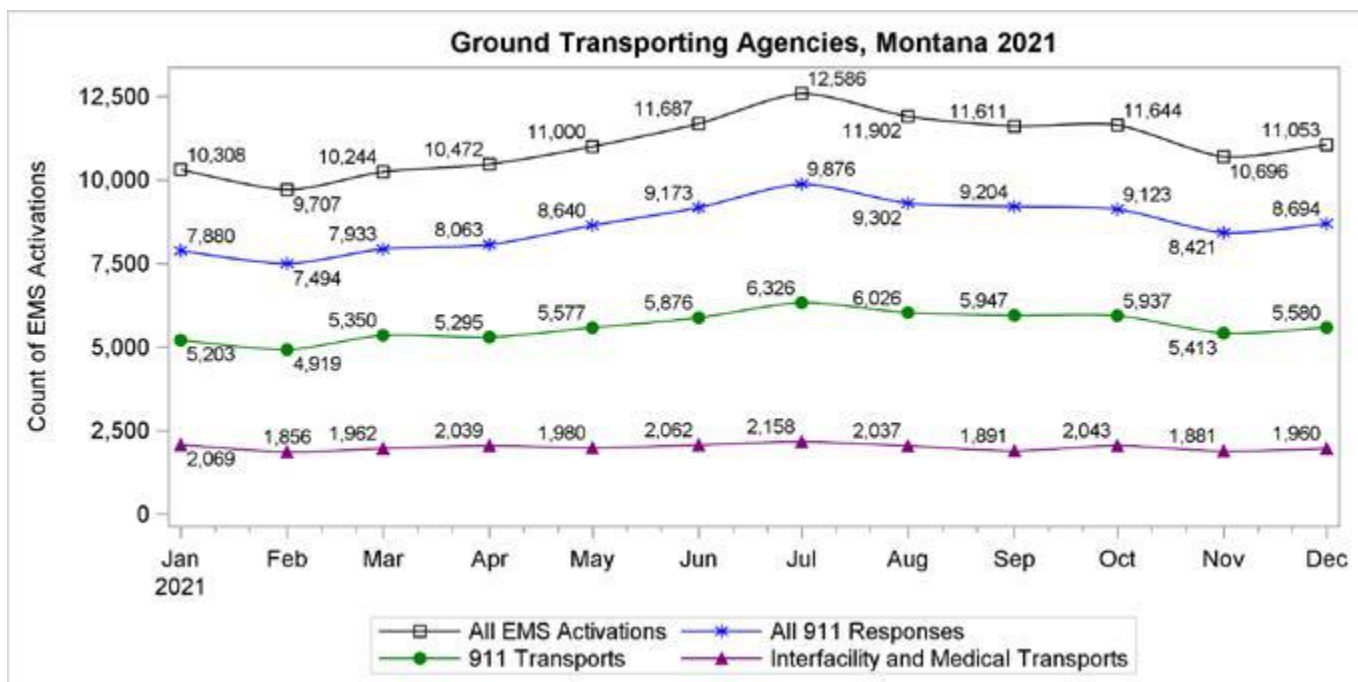
SYSTEM UTILIZATION

Table 2. EMS activations by patient disposition and response type, GTAs, 2021

Patient Disposition	Response Type			All (N)	All (Col %)
	911 Response	Interfacility and Medical Transport (IFMT) Response	Other		
Patient Transported by this EMS Unit	67,449	23,938	530	91,917	69%
Patient Treated, No Transport (per protocol)	6,143	150	157	6,450	5%
Patient Evaluated, No Treatment/Transport Required	3,615	81	160	3,856	3%
Patient Refusal/AMA, No Transport	11,971	42	320	12,333	9%
Patient Dead at Scene, No Transport	1,582	5	18	1,605	1%
Assist, Standby, or Non-patient Transport	2,023	1,394	1,733	5,150	4%
Canceled Call	11,020	271	308	11,599	9%
All (N)	103,803	25,881	3,226	132,910	100%
All (Row %)	78%	20%	2%	100%	

911 responses accounted for 78% of the activations (N=103,803), while IFMT responses comprised 20% (N=25,881). Of the 911 responses, 65% (N=67,449) resulted in patient transport by the responding EMS unit (Table 2). Table 4 details why the remaining 36,354 patients were not transported following a 911 response. 93% (N=23,938) of the IFMT responses resulted in patient transport.

Figure 5. System utilization volumes by month, GTAs, 2021



On average there were 11,076 EMS activations per month (an 8.5% increase from 2020 average of 10,212 per month), 8,650 monthly 911 responses, 5,621 monthly 911 transports, and 1,995 monthly IFM transports. July had the highest EMS utilization in all categories during 2021

DEMAND ANALYSIS, 911 RESPONSES

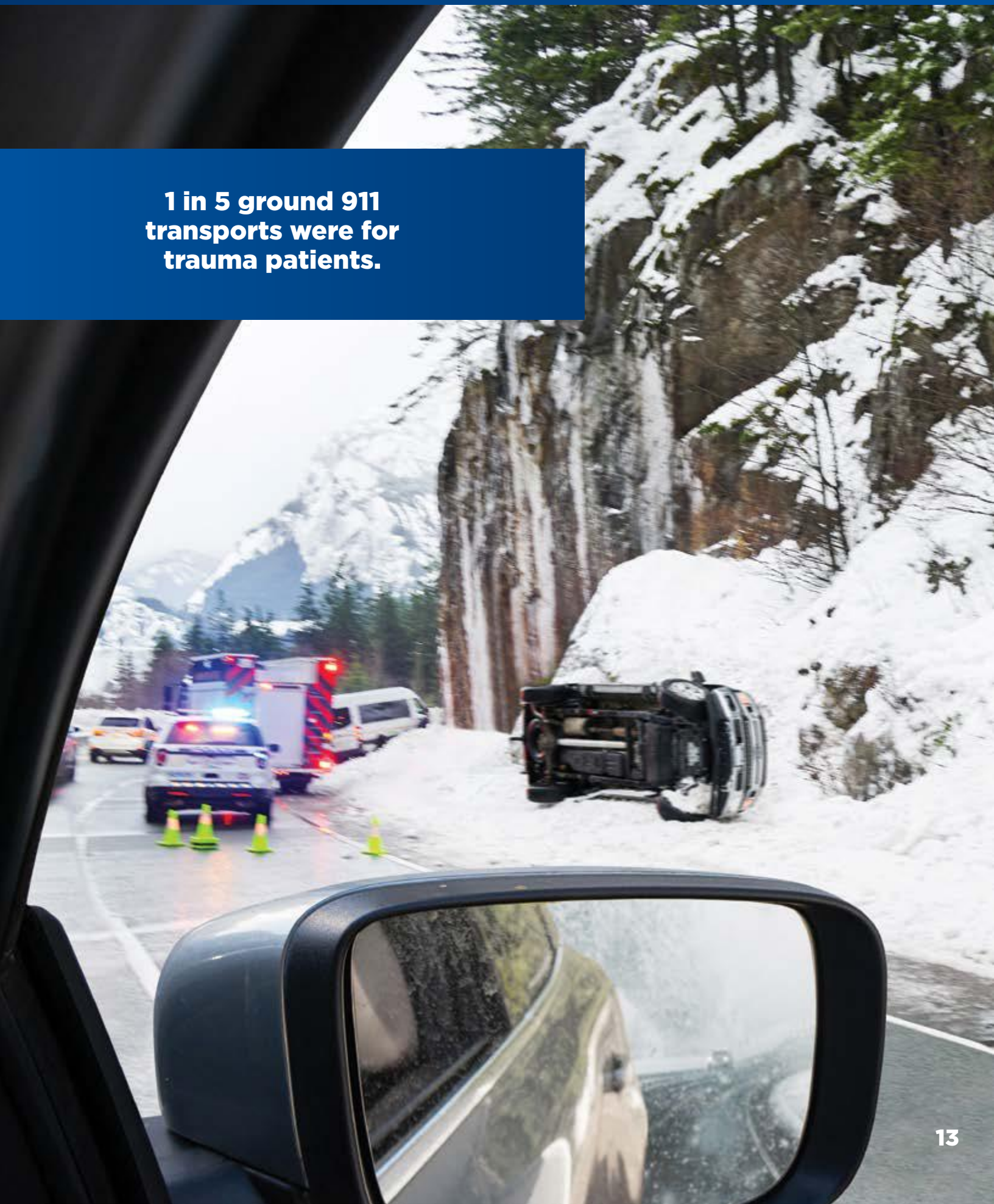
Table 3. 911 response demand analysis showing percentage of total N=103,803, GTAs, 2021

Hour of Day	Day of Week							Total
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	
0	0.53	0.39	0.37	0.43	0.40	0.45	0.51	3.07
1	0.42	0.36	0.33	0.33	0.37	0.42	0.48	2.70
2	0.39	0.30	0.27	0.28	0.27	0.32	0.44	2.28
3	0.31	0.33	0.27	0.26	0.28	0.27	0.31	2.03
4	0.30	0.25	0.27	0.24	0.26	0.28	0.29	1.89
5	0.30	0.29	0.30	0.27	0.26	0.27	0.30	1.99
6	0.35	0.35	0.38	0.34	0.34	0.37	0.34	2.47
7	0.39	0.50	0.53	0.49	0.47	0.51	0.39	3.28
8	0.50	0.63	0.63	0.66	0.61	0.60	0.52	4.16
9	0.55	0.72	0.76	0.71	0.74	0.75	0.61	4.83
10	0.63	0.77	0.74	0.82	0.79	0.79	0.74	5.27
11	0.68	0.82	0.79	0.81	0.76	0.80	0.74	5.42
12	0.74	0.83	0.80	0.81	0.84	0.87	0.72	5.61
13	0.75	0.79	0.80	0.82	0.83	0.83	0.78	5.60
14	0.76	0.79	0.81	0.89	0.80	0.83	0.79	5.67
15	0.74	0.85	0.81	0.83	0.83	0.90	0.73	5.68
16	0.74	0.81	0.83	0.87	0.82	0.87	0.78	5.72
17	0.75	0.78	0.82	0.85	0.80	0.85	0.82	5.67
18	0.73	0.75	0.72	0.78	0.79	0.80	0.80	5.37
19	0.74	0.68	0.72	0.70	0.76	0.74	0.72	5.06
20	0.71	0.64	0.70	0.64	0.68	0.75	0.71	4.84
21	0.57	0.57	0.65	0.60	0.62	0.72	0.69	4.42
22	0.51	0.52	0.52	0.54	0.52	0.59	0.58	3.76
23	0.43	0.42	0.42	0.42	0.45	0.50	0.56	3.20
Total	13.52	14.13	14.25	14.37	14.31	15.09	14.33	100.00

Table 3 presents the temporal pattern of demand for 911 GTA service. Each cell represents the percentage of 911 responses that occurred during that day of week and hour of day, with red colors representing higher demand. Demand analysis can inform needs for staffing, scheduling, and resource allocation.

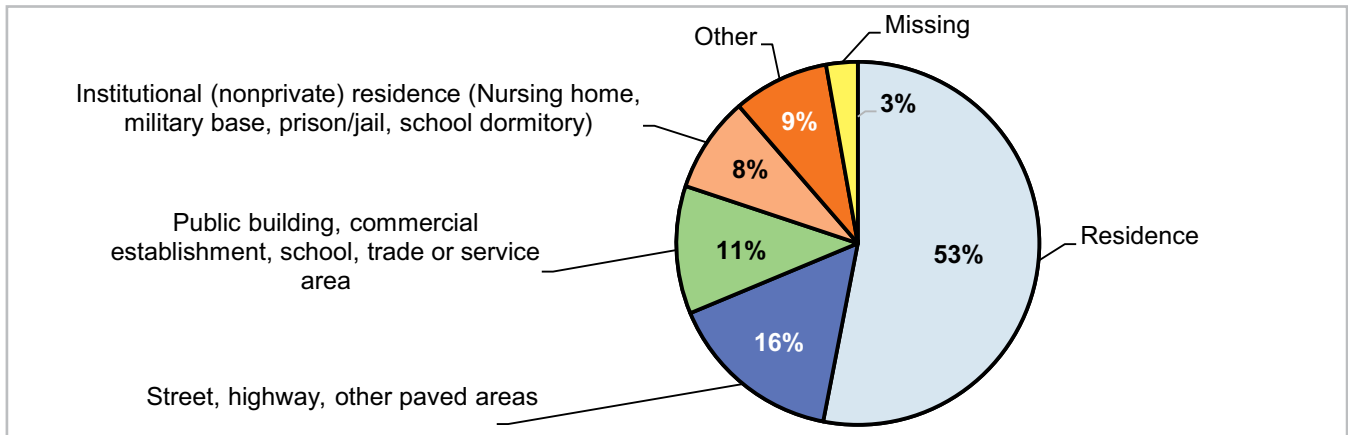
15% of GTA 911 responses occurred on Fridays, which was the busiest day of the week. 60% of GTA 911 responses occurred between the hours of 10AM-8PM.

1 in 5 ground 911 transports were for trauma patients.



SCENE LOCATION, 911 RESPONSES

Figure 6. Scene location, All 911 responses (N=103,803), GTAs, 2021



911 RESPONSES, NO TRANSPORT

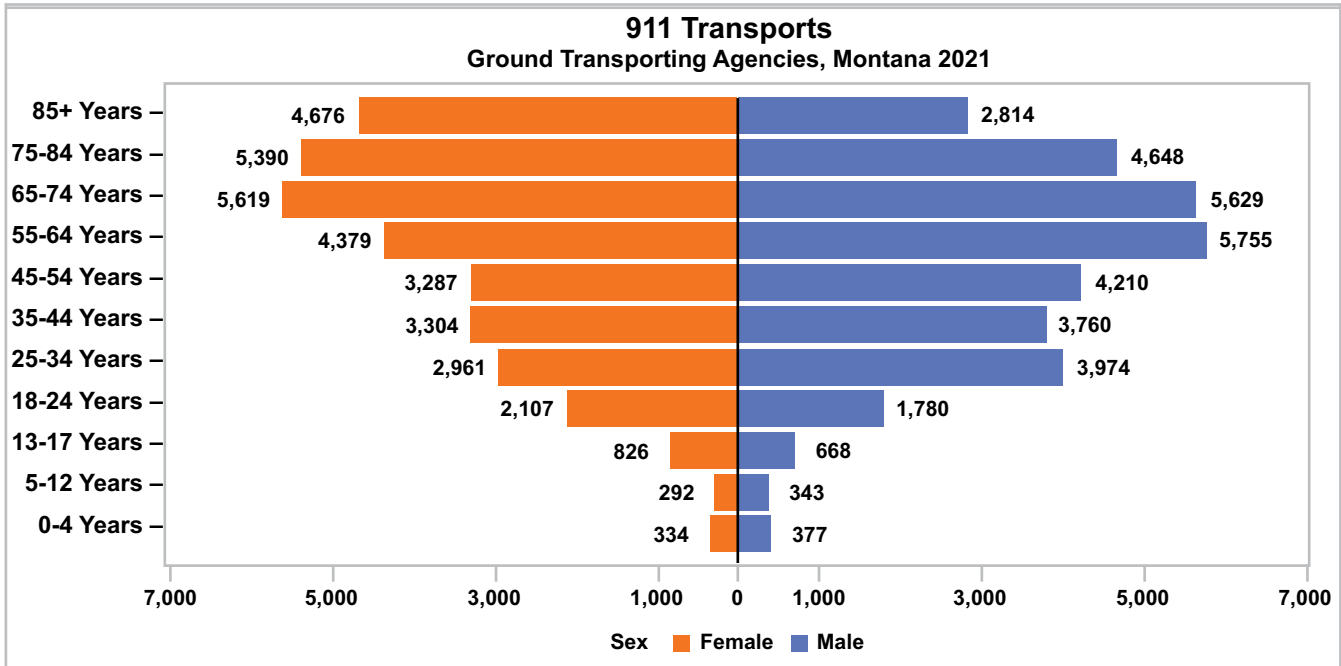
Table 4. Reason for 911 responses with no patient transport, GTAs, 2021

Reason for no patient transport	N	%
Patient refusal	11,971	33%
Canceled call	11,020	30%
Patient evaluated/treated, released (per protocol)	5,687	16%
Patient treated, transferred care to another EMS unit	4,071	11%
Assist/Standby/Non-Patient Transport (ie- organs)	2,023	6%
Patient dead at scene	1,582	4%
All	36,354	100%

36,354 GTA 911 responses did not result in patient transport. Canceled calls and patient refusals accounted for 63% of 911 responses with no patient transport (Table 4).

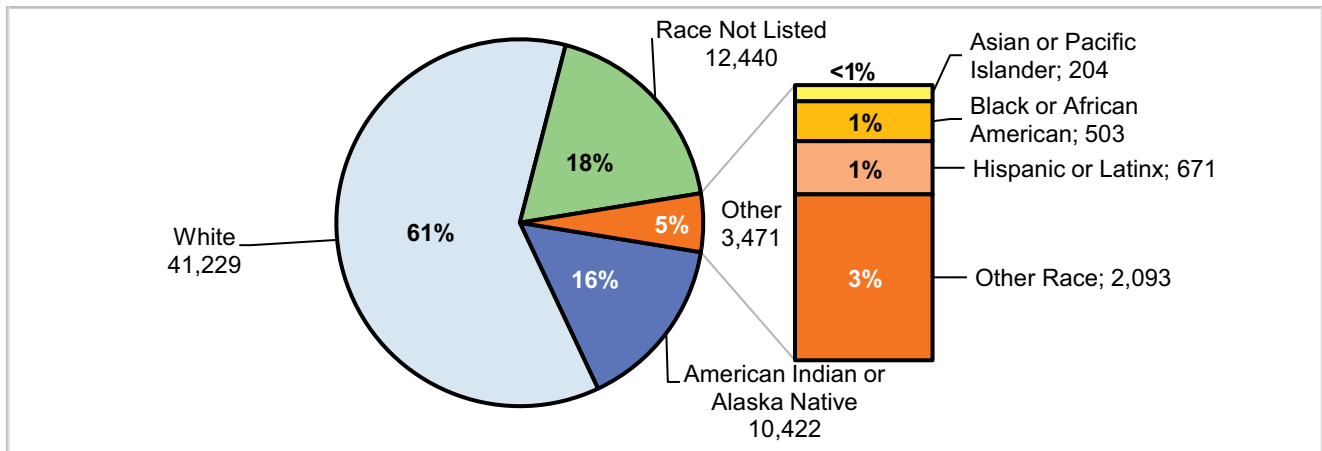
PATIENT DEMOGRAPHICS, 911 TRANSPORTS

Figure 7. Age-sex pyramid*, 911 transports, GTAs, 2021



*See Appendix 1. Montana Population Characteristics.

Figure 8. Patient race/ethnicity distribution, 911 transports (N=67,449), GTAs, 2021



*The data field "Patient Race" allows for multiple selections, therefore the sum may be greater than 100%.

PRIMARY IMPRESSION, 911 TRANSPORTS

Table 5. Top 10 primary impressions, 911 transports (N=67,449)*, GTAs, 2021

#	Primary Impression Pediatrics (Age 0-17)	N	%	Primary Impression Adults (Age 18 and Over)	N	%
1	Injury/Trauma	856	30%	Injury/Trauma	11,224	17%
2	Mental Health/Behavioral	363	13%	Cardiovascular/Circulatory	5,792	9%
3	Neurological	357	13%	Pain	5,316	8%
4	Alcohol, Drug, or Other Substance Exposure	174	6%	Respiratory	5,272	8%
5	Level of Consciousness	159	6%	Level of Consciousness	5,115	8%
6	Pain	137	5%	Neurological	4,806	7%
7	Respiratory	133	5%	Alcohol, Drug, or Other Substance Exposure	4,658	7%
8	Abdominal	81	3%	Malaise	4,542	7%
9	Illness and Infectious Disease	51	2%	Mental Health/Behavioral	4,125	6%
10	Digestive/Gastrointestinal (GI)	42	1%	Abdominal	3,559	6%
	All Top 10	2,353	83%	All Top 10	54,409	84%
	Other	232	8%	Other	9,660	15%
	Missing Impression	264	9%	Missing Impression	418	1%
	Total (Patient Age 0-17)	2,849	100%	Total (Patient Age 18+)	64,487	100%

*Of 67,449 GTA 911 transports, 113 were missing age and were excluded from Table 5.

Trauma was the top primary impression for both pediatric (30%) and adult (17%) 911 transports. Among pediatrics aged 0-17 years, Mental Health/Behavioral accounted for 13% of 911 transports, followed by Neurological (13%). Among adults aged 18 and over, Cardiovascular/Circulatory (9%) and Respiratory (8%) were the second and third most common primary impressions.

LIGHTS AND SIRENS, 911 TRANSPORTS

Figure 9. Lights and sirens during patient transport, 911 transports (N=67,449) GTAs, 2021

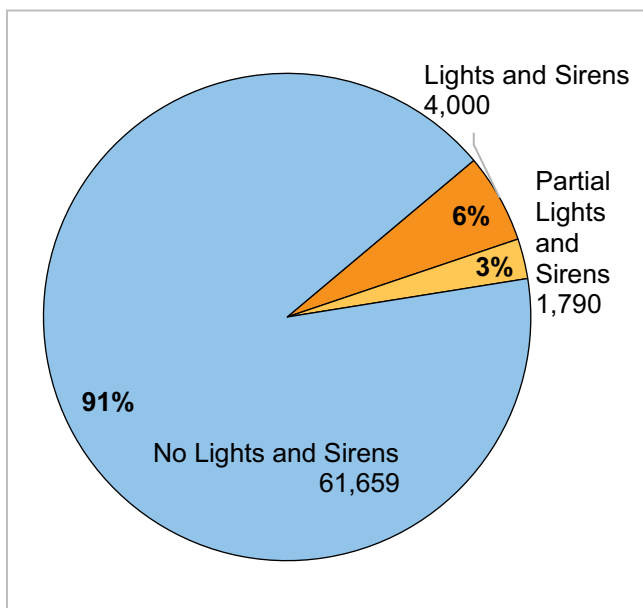


Table 6. Primary Impression for 911 Transports with Lights and Sirens during patient transport, GTAs, 2021

Primary Impression category	N	%
Injury/Trauma	797	20%
Cardiovascular/Circulatory	750	19%
Neurological	589	15%
Respiratory	448	11%
Level of Consciousness	425	11%
Other	991	25%
Lights and Sirens Total	4,000	100%

4,000 GTA 911 transports (6%) used lights and sirens during patient transport. The majority of these were Trauma patients (20%), followed by Cardiovascular/Circulatory (19%).

RESPONSE TIMES FOR PAID AND VOLUNTEER AGENCIES, 911 TRANSPORTS

Figure 10. Median and 90th percentile response times, 911 transports (N=57,139), Paid GTAs, 2021

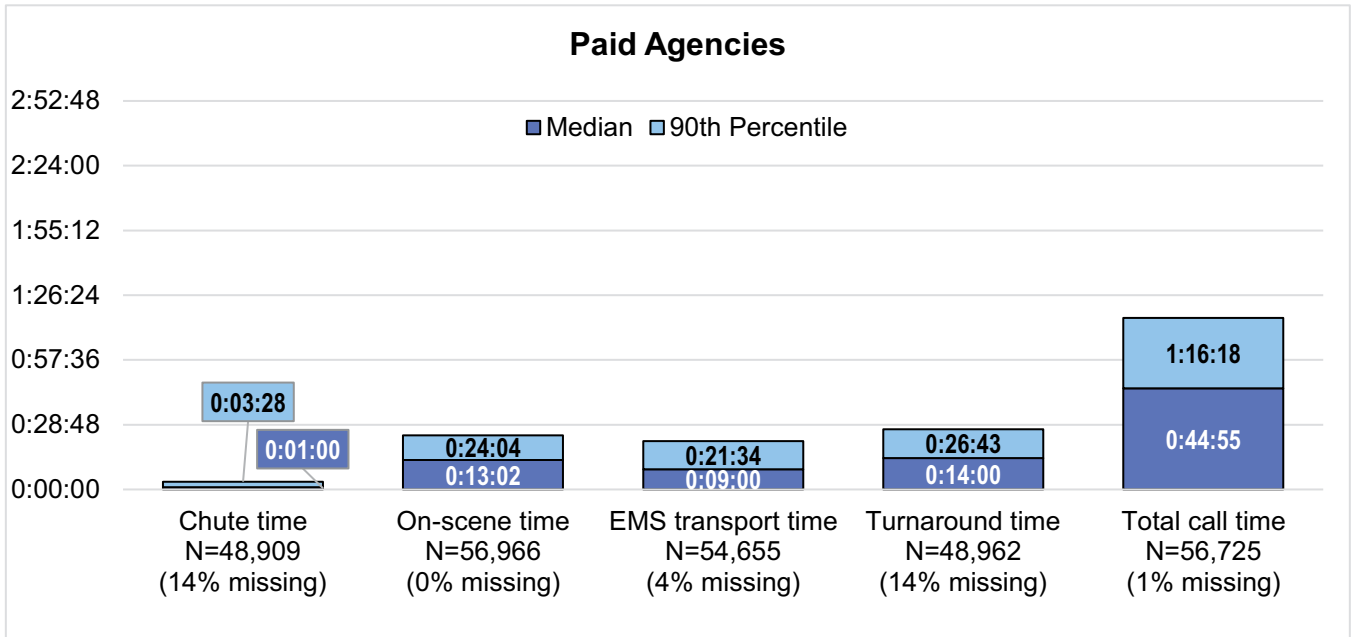
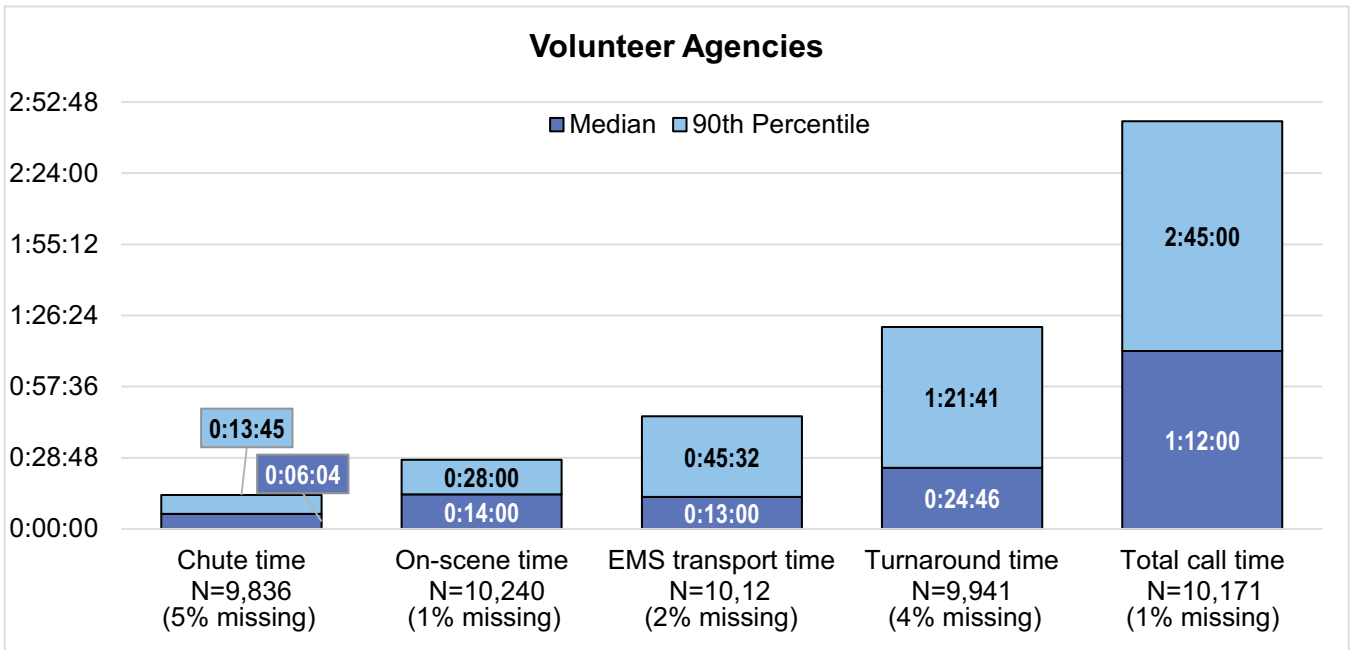


Figure 11. Median and 90th percentile response times, 911 transports (N=10,310), Volunteer GTAs, 2021



Of 67,449 GTA 911 transports, 85% (N=57,139) were by paid GTAs and 15% (N=10,310) by volunteer GTAs. Similar to findings from 2020, the 90th percentile chute time was four times longer for volunteer (13m 45s) compared to paid GTAs (3m 28s). 90th percentile on-scene time was comparable for both, around 24-28 minutes. 90th percentile EMS transport time was over twice as long for volunteer agencies (45m) versus paid (21m). Turnaround time was over three times as long for volunteer agencies (1h 22m) versus paid (27m). Total call time was 2.2 times longer for volunteer agencies (2h 45m) than paid (1h16m).

DISTANCES TRAVELED, 911 TRANSPORTS

Table 7. Distance traveled to the scene, 911 transports, GTAs, 2021

	Median Distance (Miles)	90 th Percentile Distance (Miles)	N	% Missing Data
Paid or Volunteer Agency				
Paid Agencies	3.0	17.4	8,854	85%
Volunteer Agencies	2.3	16.5	4,978	52%
Scene County				
Small Metro	4.0	30.0	269	99%
Micropolitan	3.0	10.0	3,960	77%
Non-core (Rural)	2.6	19.0	9,397	55%
Missing County	5.00	26.00	206	92%
All	2.8	17.0	13,832	80%

Table 8. Distance traveled from scene to destination, 911 transports, GTAs, 2021

	Median Distance (Miles)	90 th Percentile Distance (Miles)	N	% Missing Data
Paid or Volunteer Agency				
Paid Agencies	3.0	14.0	52,034	9%
Volunteer Agencies	8.2	36.9	9,264	10%
Scene County				
Small Metro	3.1	7.8	25,026	7%
Micropolitan	4.0	15.6	16,123	5%
Non-core (Rural)	2.6	28.6	17,908	14%
Missing County	10.0	26.0	2,241	13%
All	3.3	19.5	61,298	9%

Most 911 transports (80%) were missing data on distance traveled to the scene. In contrast, distance traveled from scene to destination- patient transport distance- was missing in 9% of 911 transports. Volunteer agencies transport 911 patients nearly 3 times as far as paid agencies. The 90th percentile distance for volunteer agencies was 36.9 miles, and for paid agencies it was 14.0 miles. In addition, the 90th percentile 911 patient transport distance is longer when the incident location (scene) is in a rural county (28.6 miles) versus small metro county (7.8 miles).

DEMAND ANALYSIS, INTERFACILITY AND MEDICAL TRANSPORT RESPONSES

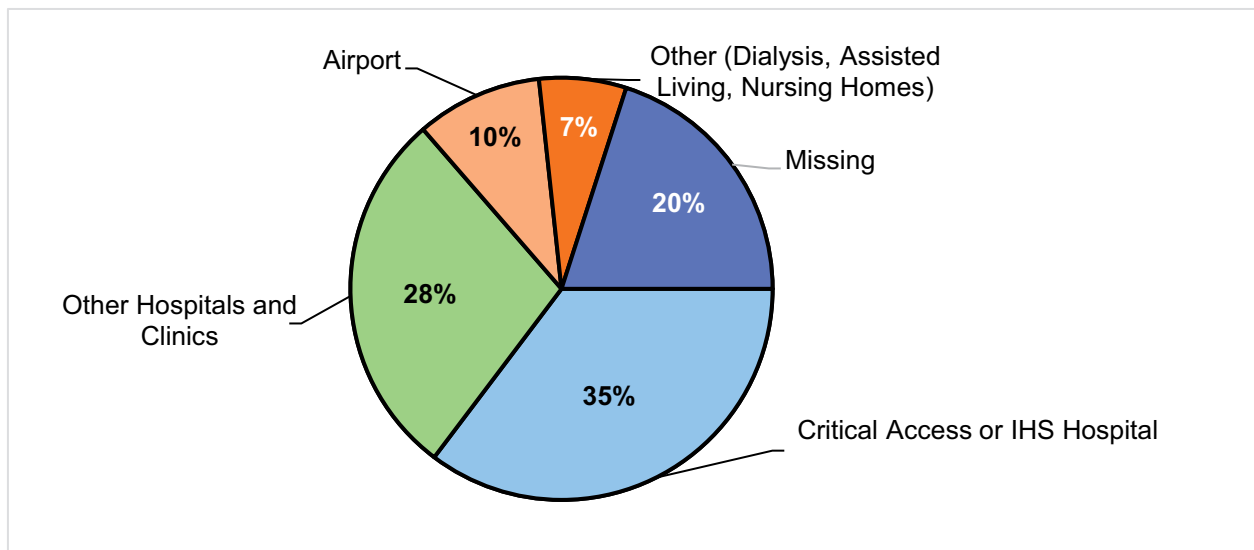
Table 9. IFMT response demand analysis showing percentage of total N=25,881, All IFMT responses, GTAs,

Hour of Day	Day of Week							Total
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	
0	0.42	0.40	0.48	0.43	0.39	0.41	0.41	2.94
1	0.35	0.31	0.33	0.40	0.37	0.29	0.38	2.44
2	0.25	0.29	0.22	0.25	0.27	0.28	0.29	1.84
3	0.23	0.18	0.20	0.26	0.20	0.21	0.21	1.50
4	0.19	0.12	0.20	0.26	0.15	0.25	0.19	1.36
5	0.21	0.18	0.29	0.16	0.30	0.19	0.31	1.65
6	0.19	0.19	0.21	0.24	0.21	0.28	0.21	1.53
7	0.30	0.27	0.30	0.34	0.32	0.31	0.22	2.06
8	0.32	0.56	0.60	0.64	0.70	0.58	0.39	3.79
9	0.34	0.72	1.00	0.89	0.95	0.85	0.51	5.25
10	0.54	0.98	1.16	1.05	1.22	1.22	0.56	6.72
11	0.65	1.02	1.11	1.12	1.00	1.15	0.58	6.63
12	0.65	0.99	1.22	1.19	1.26	1.20	0.64	7.14
13	0.61	1.11	1.28	1.06	1.00	1.13	0.61	6.79
14	0.52	1.16	1.16	1.10	1.13	1.14	0.74	6.95
15	0.56	1.02	1.16	0.99	0.99	1.00	0.72	6.43
16	0.63	0.91	0.87	0.89	0.92	0.88	0.68	5.79
17	0.59	0.72	0.78	0.85	0.78	0.75	0.63	5.10
18	0.53	0.71	0.80	0.76	0.77	0.84	0.69	5.09
19	0.60	0.66	0.62	0.72	0.68	0.68	0.60	4.56
20	0.52	0.63	0.71	0.55	0.60	0.58	0.64	4.23
21	0.54	0.56	0.56	0.55	0.59	0.58	0.48	3.85
22	0.46	0.46	0.50	0.55	0.44	0.53	0.50	3.44
23	0.41	0.41	0.36	0.44	0.51	0.44	0.36	2.92
Total	10.58	14.55	16.13	15.69	15.75	15.76	11.56	100.00

Table 9 presents the temporal pattern of demand for IFMT service among GTAs. Each cell represents the percentage of IFMT responses that occurred during that day of week and hour of day, with red colors representing higher demand. Most GTA interfacility and medical transport responses occurred on weekdays, with Friday as the busiest day (16%). 57% of IFMT responses occurred between the hours of 9AM to 5PM.

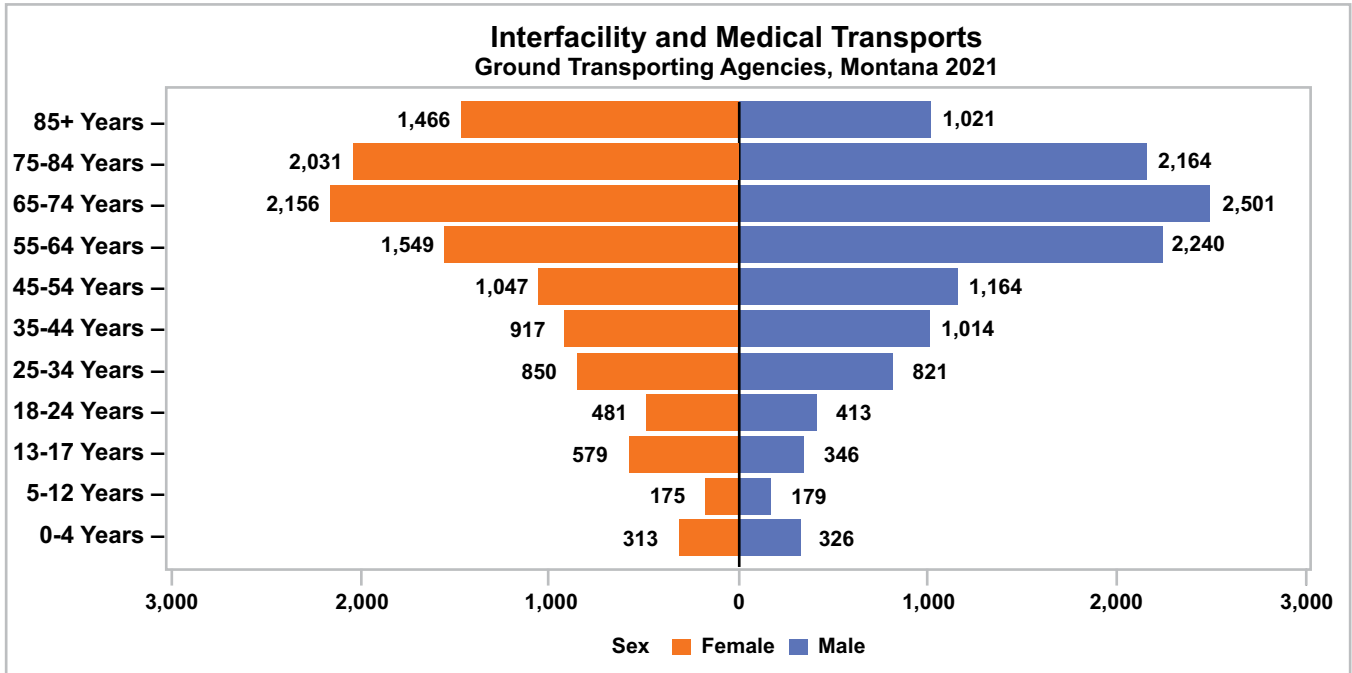
SENDING FACILITY, INTERFACILITY AND MEDICAL TRANSPORT RESPONSES

Figure 12. Sending facility, All IFMT responses (N=25,881), GTAs, 2021



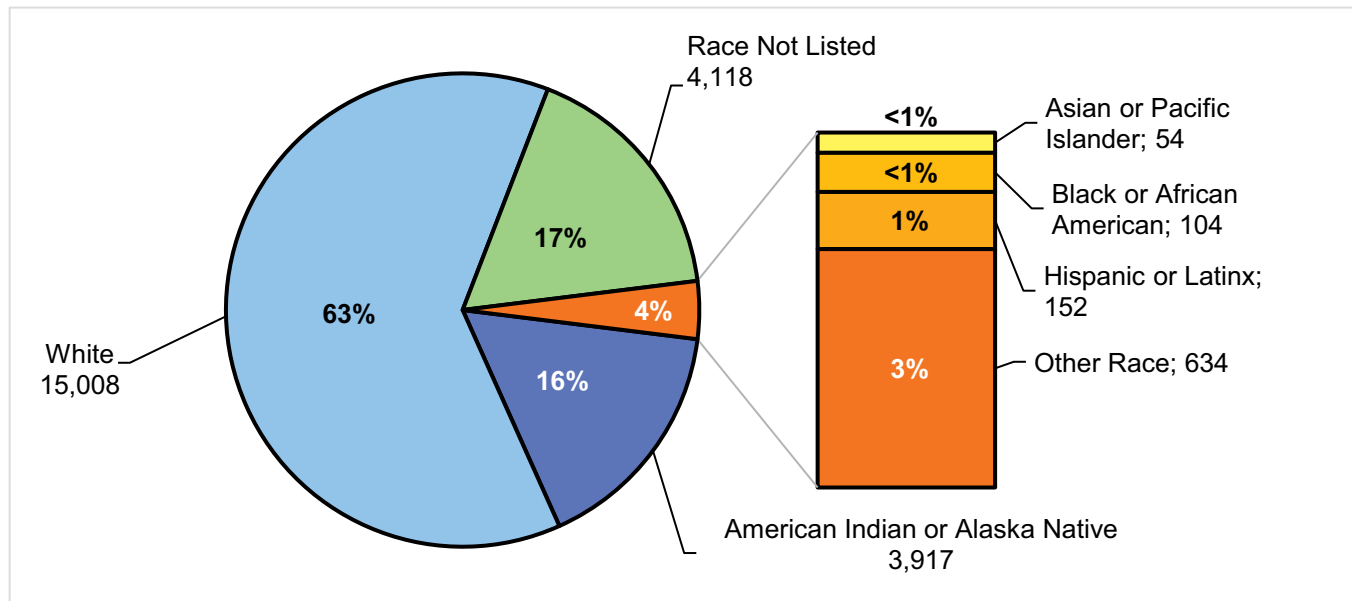
PATIENT DEMOGRAPHICS, INTERFACILITY AND MEDICAL TRANSPORTS

Figure 13. Age-sex pyramid*, IFM transports, GTAs, 2021



*See Appendix 1. Montana Population Characteristics

Figure 14. Patient race/ethnicity distribution, IFM transports (N=23,938), GTAs, 2021



*The data field "Patient Race" allows for multiple selections, therefore the sum may be greater than 100%.

PRIMARY IMPRESSION, INTERFACILITY AND MEDICAL TRANSPORTS

Table 10. Top 10 primary impressions, IFM transports where the sending facility was a critical access or Indian Health Service (CAH/IHS) hospital (N=8,249)*, GTAs, 2021

#	Primary Impression Pediatrics (Age 0-17)	N	%	Primary Impression Adults (Age 18 and Over)	N	%
1	Mental Health/Behavioral	148	24%	Cardiovascular/Circulatory	1,001	13%
2	Injury/Trauma	72	11%	Injury/Trauma	877	12%
3	Abdominal	51	8%	Abdominal	875	12%
4	Respiratory	46	7%	Illness and Infectious Disease	714	9%
5	Endocrine, Nutritional, and Metabolic	25	4%	Respiratory	565	7%
6	Digestive/Gastrointestinal (GI)	25	4%	Pain	497	7%
7	Illness and Infectious Disease	24	4%	Malaise	461	6%
8	Pain	22	4%	Digestive/Gastrointestinal (GI)	394	5%
9	Neurological	18	3%	Mental Health/Behavioral	381	5%
10	Level of Consciousness	13	2%	Neurological	344	5%
	All Top 10	444	71%	All Top 10	6,109	80%
	Other	49	8%	Other	1,329	17%
	Missing Impression	135	21%	Missing Impression	166	2%
	Total (Patient Age 0-17)	628	100%	Total (Patient Age 18+)	7,604	100%

*Of 8,249 IFM ground transports sent from CAH or IHS facilities, 17 were missing age and were excluded from Table 10.

Table 11. Top 10 primary impressions, IFM transports where the sending facility was a non-CAH/IHS hospital or clinic (N=7,157)*, GTAs, 2021

#	Primary Impression Pediatrics (Age 0-17)	N	%	Primary Impression Adults (Age 18 and Over)	N	%
1	Mental Health/Behavioral	260	44%	Malaise	1,027	16%
2	Observation/Exam (No Patient Complaint)	42	7%	Dependence/Mobility	888	14%
3	Respiratory	37	6%	Mental Health/Behavioral	680	10%
4	Injury/Trauma	23	4%	Unspecific	512	8%
5	Cardiovascular/Circulatory	18	3%	Respiratory	436	7%
6	Digestive/Gastrointestinal (GI)	15	3%	Observation/Exam (No Patient Complaint)	413	6%
7	Neurological	15	3%	Injury/Trauma	380	6%
8	Unspecific	15	3%	Pain	351	5%
9	Abdominal	11	2%	Cardiovascular/Circulatory	314	5%
10	Level of Consciousness	9	2%	Level of Consciousness	306	5%
	All Top 10	445	75%	All Top 10	5,307	81%
	Other	38	6%	Other	1,137	17%
	Missing Impression	113	19%	Missing Impression	94	1%
	Total (Patient Age 0-17)	596	100%	Total (Patient Age 18+)	6,538	100%

*Of 7,157 IFM ground transports sent from other hospitals or clinics, 23 were missing age and were excluded from Table 11

This analysis aims to compare why patients are transferred out from CAH or IHS hospitals, versus from other (typically larger) hospitals, by ground ambulance.

Of 23,938 IFM ground transports, 35% (N=8,249) were sent from CAH or IHS hospitals, and 30% (N=7,157) were sent from other hospitals. 19% (N=4,479) were missing the sending facility name, and 10% (N=2,384) listed airports as the sending facility. The remaining 1,699 were sent from facilities such as nursing homes, assisted living, and dialysis. Mental Health/Behavioral complaints were the most common primary impression for pediatric patients, accounting for 33% of all IFM Transports regardless of what type of facility was sending the patient. For adults, when the sending facility was a CAH or IHS hospital, the most common primary impression was Cardiovascular/Circulatory (13%), followed by Trauma (12%). When the sending facility was a non-CAH/IHS hospital, the most common primary impressions were Malaise (16%) and Dependence/Mobility (14%), which are likely non-acute medical transports.

RESPONSE TIMES FOR PAID AND VOLUNTEER AGENCIES, IFM TRANSPORTS

Figure 15. Median and 90th percentile response times, IFM transports (N=20,920), Paid GTAs, 2021

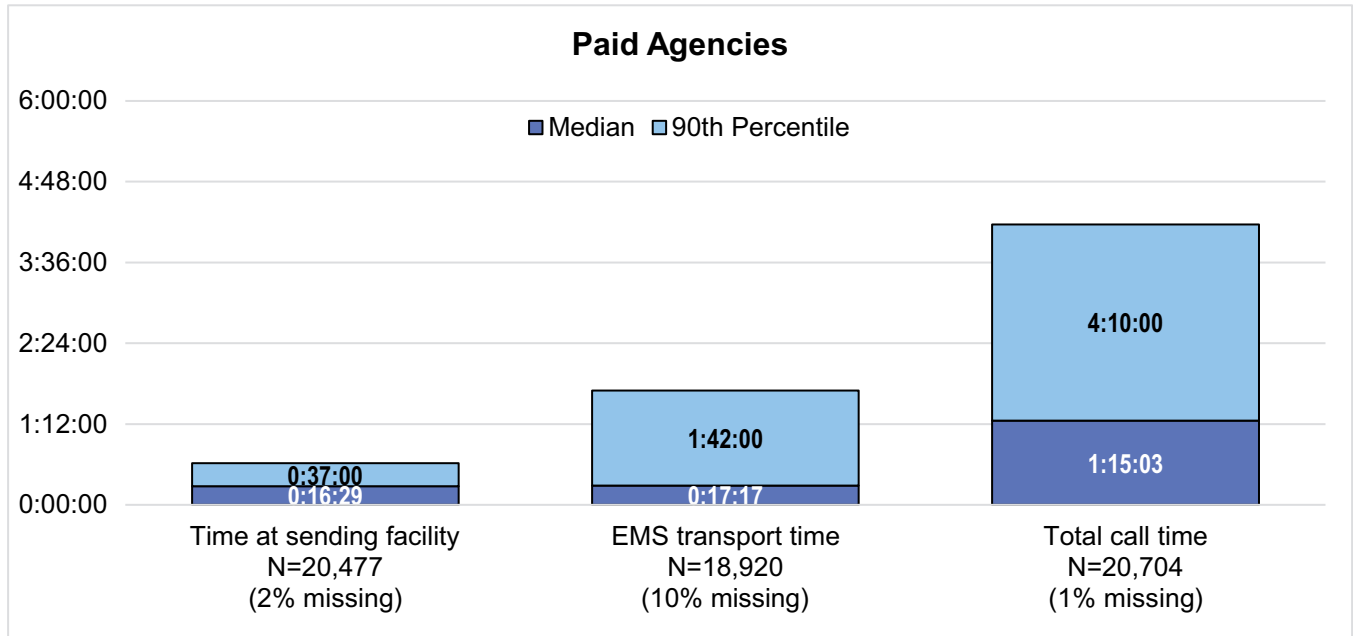
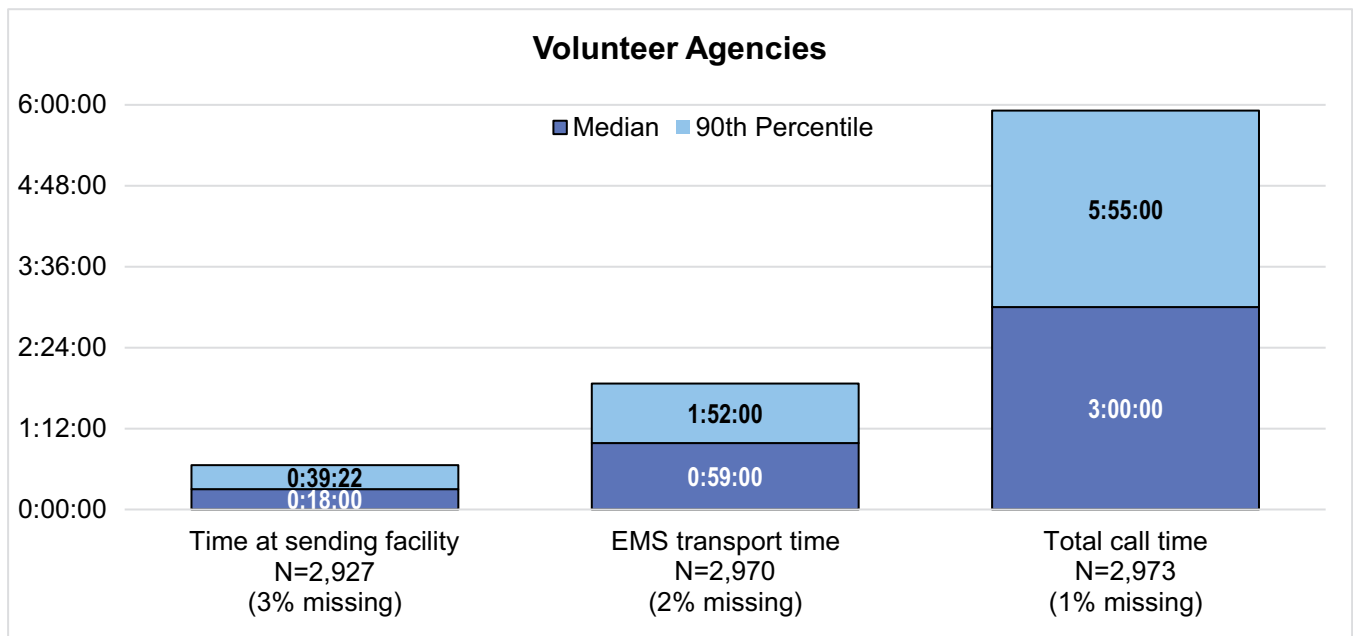


Figure 16. Median and 90th percentile response times, IFM transports (N=3,018), Volunteer GTAs, 2021



Of 23,938 IFM ground transports, 87% (N=20,920) were by paid GTAs and 13% (N=3,018) by volunteer GTAs. Similar to findings from 2020, the 90th percentile time spent at sending facility was comparable for both volunteer and paid GTAs, around 37-39 minutes. 90th percentile EMS transport time was also similar for both volunteer and paid GTAs, around 1h 40m- 1h 50m. However, the median EMS transport time was considerably longer for volunteer agencies (59m) versus paid (17m). This indicates that paid agencies skew towards shorter EMS transport times than volunteer agencies. 90th percentile total call time was 1.4 times longer for volunteer agencies and median total call time was 2.4 times longer for volunteer versus paid GTAs.

DISTANCES TRAVELED, INTERFACILITY AND MEDICAL TRANSPORTS

Table 12. Distance traveled to the sending facility, Interfacility and medical transports, GTAs, 2021

	Median Distance (Miles)	90 th Percentile Distance (Miles)	N	% Missing Data
Paid or Volunteer Agency				
Paid Agencies	1.0	47.0	2,441	88%
Volunteer Agencies	1.4	33.0	1,400	54%
Sending Facility County				
Small Metro	66.8	125.0	104	99%
Micropolitan	4.0	67.1	296	95%
Non-core (Rural)	1.0	33.5	3,407	61%
Missing County	13.1	67.8	34	89%
All	1.2	38.6	3,841	84%

Table 13. Distance traveled from sending facility to destination, Interfacility and medical transports, GTAs, 2021

	Median Distance (Miles)	90 th Percentile Distance (Miles)	N	% Missing Data
Paid or Volunteer Agency				
Paid Agencies	7.4	103.0	19,097	9%
Volunteer Agencies	59.3	115.6	2,589	14%
Sending Facility County				
Small Metro	4.2	45.0	8317	7%
Micropolitan	6.6	92.0	5449	8%
Non-core (Rural)	56.3	117.0	7,636	14%
Missing County	41.0	127.0	284	10%
All	8.0	103.0	21,686	9%

Most agencies are not documenting the distance traveled to the sending facility for interfacility and medical transports (84% missing overall). Most agencies are documenting patient-loaded travel distance from the sending facility to destination for interfacility and medical transports (9% missing overall). The median distance is 8 times higher for volunteer agencies (59.3 miles) compared to paid agencies (7.4 miles). Patient transport distance is 13 times longer when the sending facility is located in a rural county (56.3 miles) versus a small metro county (4.2 miles).



Volunteer EMS agencies spend a disproportionate amount of time transporting interfacility patients, compared with paid agencies.

NON-TRANSPORTING AGENCIES

A total of 15 Non-Transporting Agencies (NTA) submitted data for this report, documenting 6,277 EMS activations during 2021. Nearly all (96%, N=6,005) of the records were submitted by paid NTAs and 4% (N=272) by volunteer NTAs. There are over 100 licensed NTAs in the state, meaning that the majority of NTAs did not submit data. The NTAs that did not submit data are mostly small, rural volunteer agencies, therefore, data presented in this section is not representative and should be interpreted with caution.

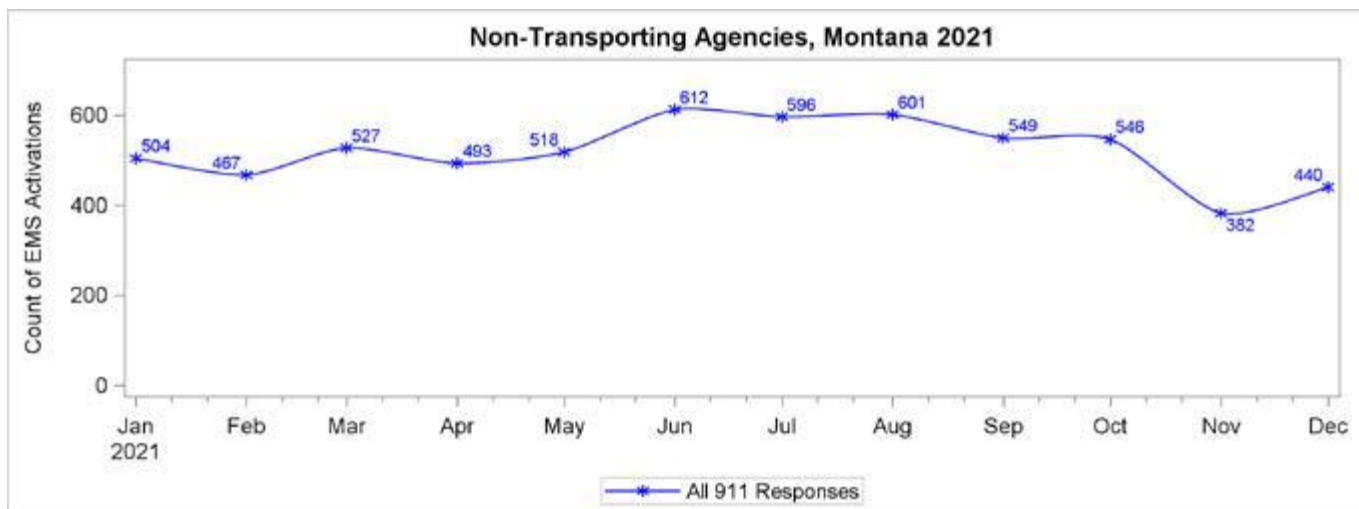
SYSTEM UTILIZATION

Table 14. EMS activations by patient disposition and response type, NTAs, 2021

Patient Disposition	Response Type		
	911 Response	Other	All
Patient Transported by this EMS Unit	105	1	106
Patient Treated, No Transport (per protocol)	2,522	18	2,540
Patient Evaluated, No Treatment/Transport Required	114	1	115
Patient Refusal/AMA, No Transport	298	1	299
Patient Dead at Scene, No Transport	115	0	115
Assist, Standby, or Non-patient Transport	3,076	21	3,097
Canceled Call	5	0	5
All	6,235	42	6,277

99% of NTA EMS activations (N=6,235) were 911 responses (Table 14). Approximately half (N=3,076) of the 911 responses had patient disposition of “Agency Assist”, which is defined as “This EMS unit only provided assistance (e.g., manpower, equipment) to another agency and did not provide treatment or primary patient care at any time during the incident.”²

Figure 17. System utilization volumes by month, NTAs, 2021



DEMAND ANALYSIS, 911 RESPONSES

Table 15. 911 Response demand analysis showing percentage of total N=6,235, NTAs, 2021

Hour of Day	Day of Week							Total
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	
0	0.42	0.26	0.13	0.32	0.19	0.27	0.35	1.94
1	0.26	0.21	0.22	0.11	0.26	0.18	0.26	1.49
2	0.37	0.18	0.11	0.27	0.18	0.18	0.27	1.56
3	0.29	0.30	0.11	0.29	0.27	0.16	0.19	1.62
4	0.32	0.24	0.16	0.14	0.16	0.19	0.24	1.46
5	0.24	0.16	0.27	0.24	0.29	0.19	0.27	1.67
6	0.47	0.43	0.34	0.43	0.29	0.19	0.27	2.42
7	0.38	0.59	0.59	0.85	0.74	0.53	0.35	4.04
8	0.50	0.61	0.66	0.93	0.80	0.66	0.59	4.75
9	0.64	0.83	0.87	0.85	0.72	0.90	0.72	5.53
10	0.79	0.71	0.77	0.80	0.93	0.75	0.79	5.53
11	0.77	0.95	0.90	0.93	0.82	0.80	0.99	6.16
12	0.80	1.22	0.85	0.88	1.11	0.95	0.91	6.72
13	0.95	0.98	0.72	0.90	0.91	0.80	0.72	5.98
14	0.64	1.03	0.80	0.90	1.03	0.91	0.88	6.19
15	0.71	0.96	0.80	0.74	0.71	0.95	0.69	5.55
16	0.59	0.80	0.93	0.98	0.83	0.82	0.72	5.68
17	0.80	0.72	0.75	0.91	0.91	0.99	0.88	5.98
18	0.67	0.90	0.71	0.98	0.80	0.69	0.64	5.39
19	0.66	0.87	0.99	0.64	0.83	0.85	0.80	5.65
20	0.83	0.87	0.69	0.69	0.69	0.79	0.66	5.21
21	0.58	0.55	0.55	0.59	0.50	0.71	0.64	4.11
22	0.45	0.42	0.48	0.58	0.26	0.47	0.42	3.06
23	0.35	0.29	0.48	0.37	0.22	0.30	0.29	2.31
Total	13.47	15.06	13.89	15.33	14.45	14.23	13.57	100.00

Table 15 presents the temporal pattern of demand for 911 service among NTAs. Each cell represents the percentage of 911 responses that occurred during that day of week and hour of day, with red colors representing higher demand. 15% of NTA 911 responses occurred on Wednesdays, which was the busiest day of the week. 64% of NTA 911 responses occurred between the hours of 10AM to 8PM.

PRIMARY IMPRESSION, 911 RESPONSES

Table 16. Top 10 primary impressions, All 911 responses (N=6,235)*, NTAs, 2021

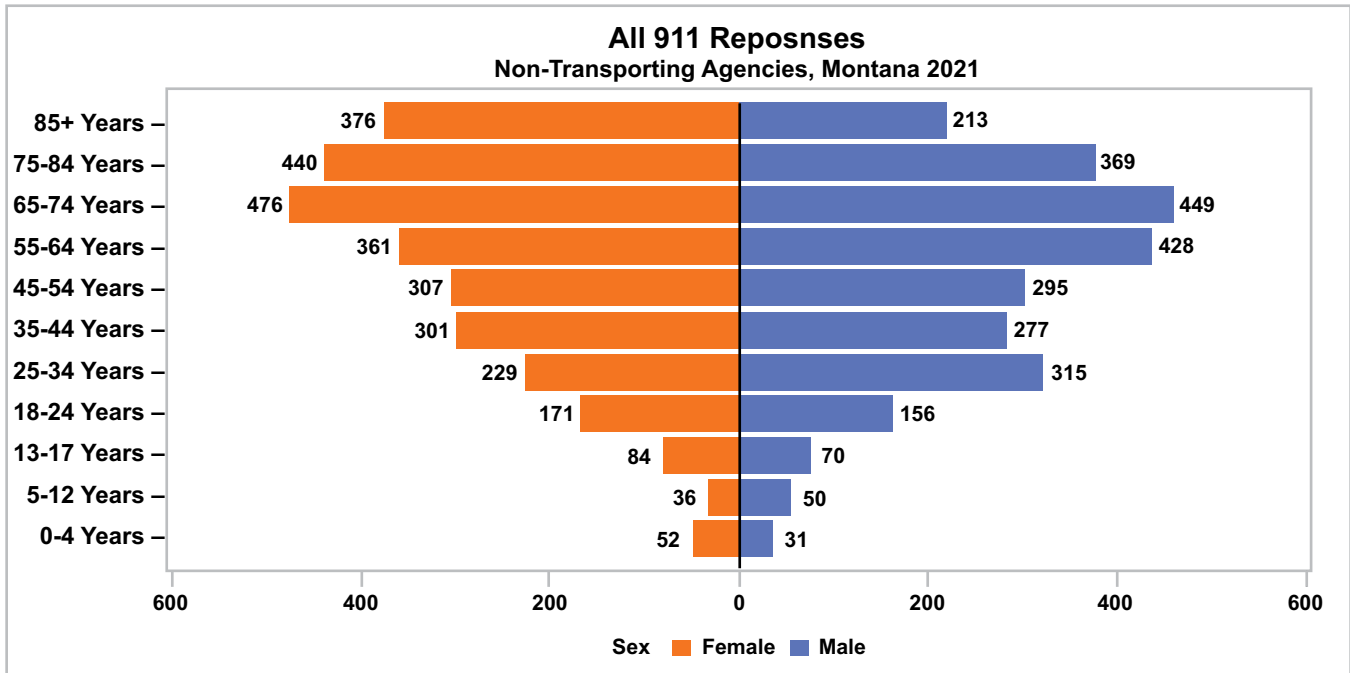
#	Primary Impression Pediatrics (Age 0-17)		Primary Impression Adults (Age 18 and Over)			
	N	%	N	%		
1	Injury/Trauma	55	16%	Injury/Trauma	513	9%
2	Neurological	38	11%	Cardiovascular/Circulatory	426	8%
3	Mental Health/Behavioral	17	5%	Respiratory	308	6%
4	Pain	10	3%	Neurological	307	6%
5	Respiratory	9	3%	Level of Consciousness	275	5%
6	Cardiovascular/Circulatory	8	2%	Malaise	254	5%
7	Level of Consciousness	8	2%	Mental Health/Behavioral	192	3%
8	Abdominal	7	2%	Pain	157	3%
9	Alcohol, Drug, or Other Substance Exposure	6	2%	Alcohol, Drug, or Other Substance Exposure	146	3%
10	Malaise	†	1%	Illness and Infectious Disease	134	2%
	All Top 10	161	46%	All Top 10	2,712	49%
	Other	15	4%	Other	480	9%
	Missing Impression	172	49%	Missing Impression	2,322	42%
	Total (Patient Age 0-17)	348	100%	Total (Patient Age 18+)	5,514	100%

†= Suppressed value, count is <5

*Of 6,235 NTA 911 responses, 373 were missing age and were excluded from Table 16

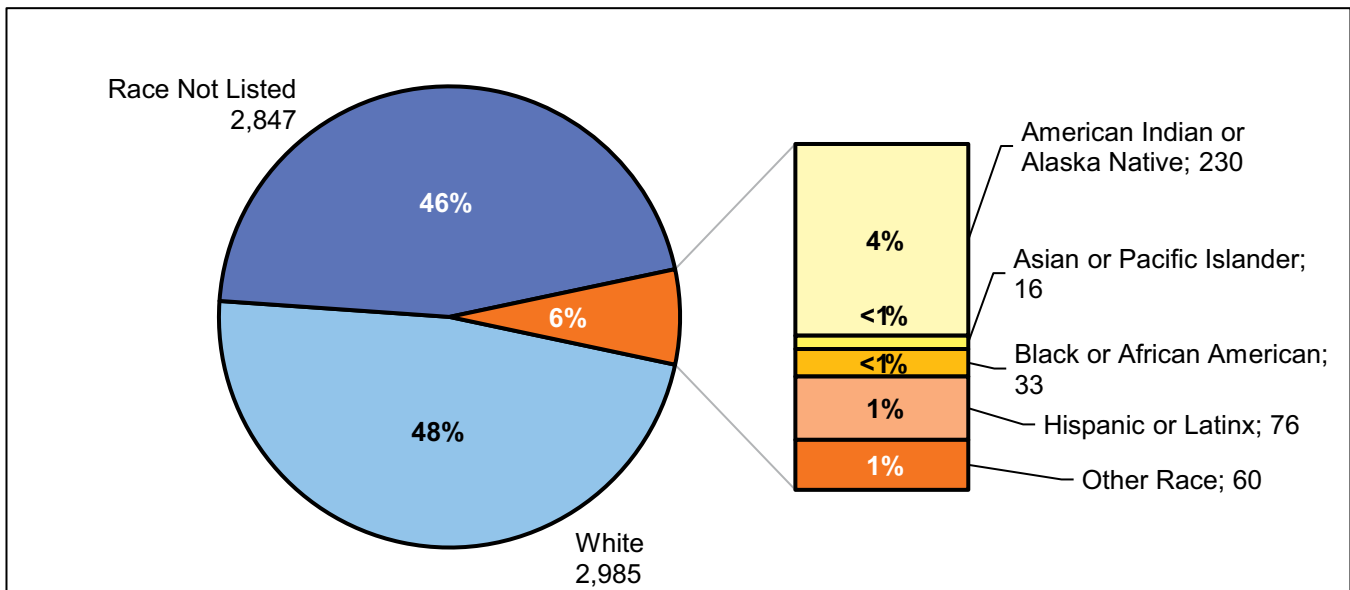
PATIENT DEMOGRAPHICS, 911 RESPONSES

Figure 18. Age-sex pyramid*, All 911 responses, NTAs, 2021



*See Appendix 1. Montana Population Characteristics

Figure 19. Patient race/ethnicity distribution, All 911 responses (N=6,235), NTAs, 2021



*The data field "Patient Race" allows for multiple selections, therefore the sum may be greater than 100%

RESPONSE TIMES FOR PAID AND VOLUNTEER AGENCIES, 911 RESPONSES

Figure 20. Median and 90th percentile response times, All 911 responses (N=5,981), Paid NTAs, 2021

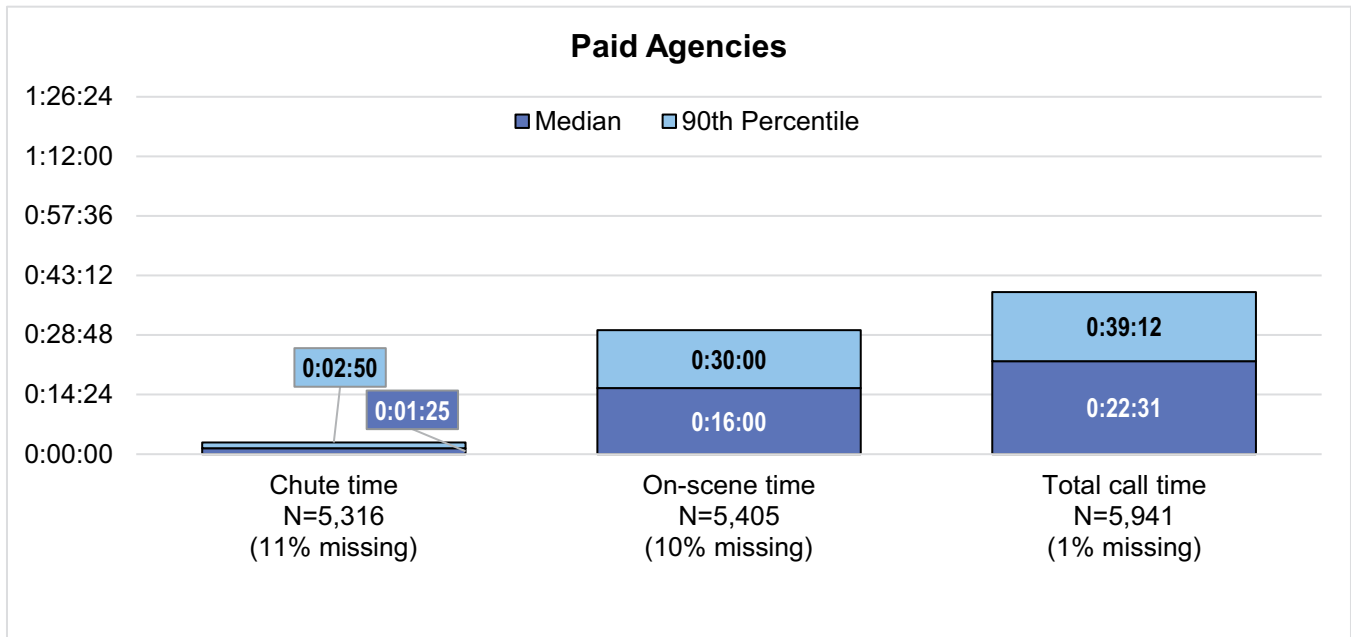
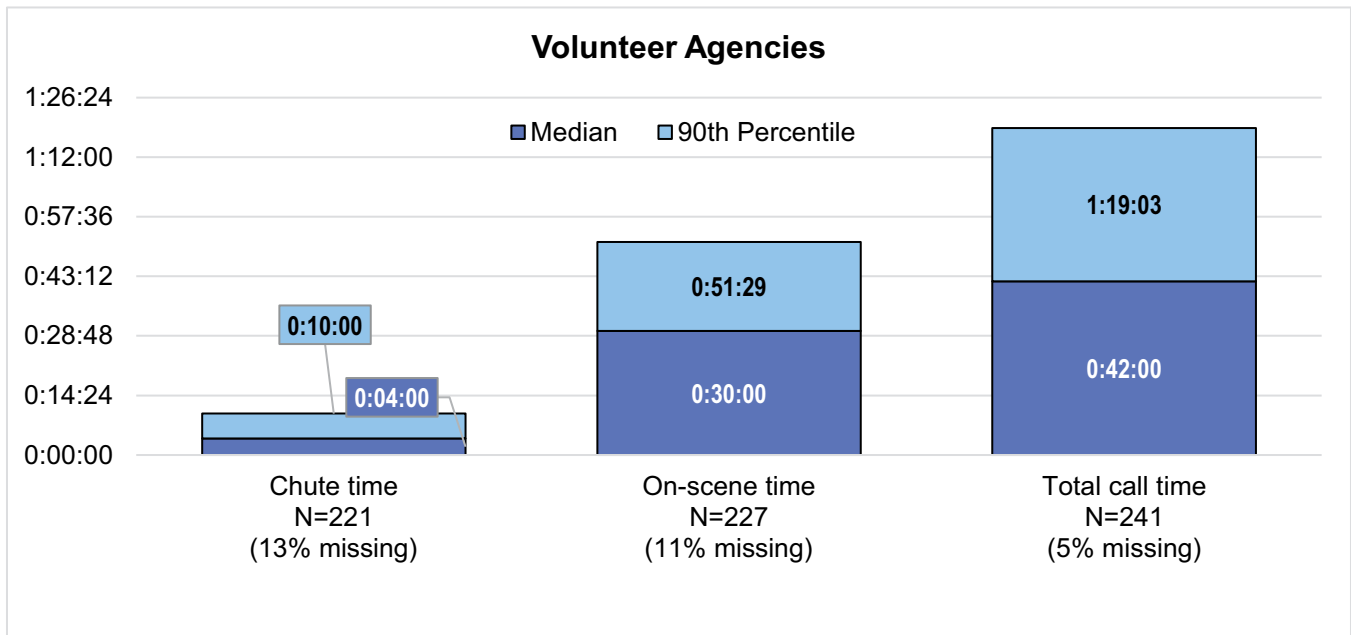


Figure 21. Median and 90th percentile response times, All 911 responses (N=254), Volunteer NTAs, 2021



Of 6,235 GTA 911 responses, 96% (N=5,981) were by paid agencies and 4% (N=254) by volunteer agencies. 90th percentile chute time was over three times longer for volunteer (10m) compared to paid NTAs (2m 50s). 90th percentile on-scene time was 1.7 times longer for volunteer NTAs (51m) compared with paid (30m). Total call time was 2 times longer for volunteer NTAs (1h 19m) than paid (39m).



40% of rotor wing 911 transports are for Trauma

AIR MEDICAL AGENCIES

A total of 11 Air Medical Agencies (AMAs) (4 rotor wing and 7 fixed wing) submitted data for this report, documenting 5,325 EMS activations during 2021. 49% (N=2,608) of the records were submitted by Rotor Wing Agencies (RWAs) and 51% (N=2,717) by Fixed Wing Agencies (FWAs).

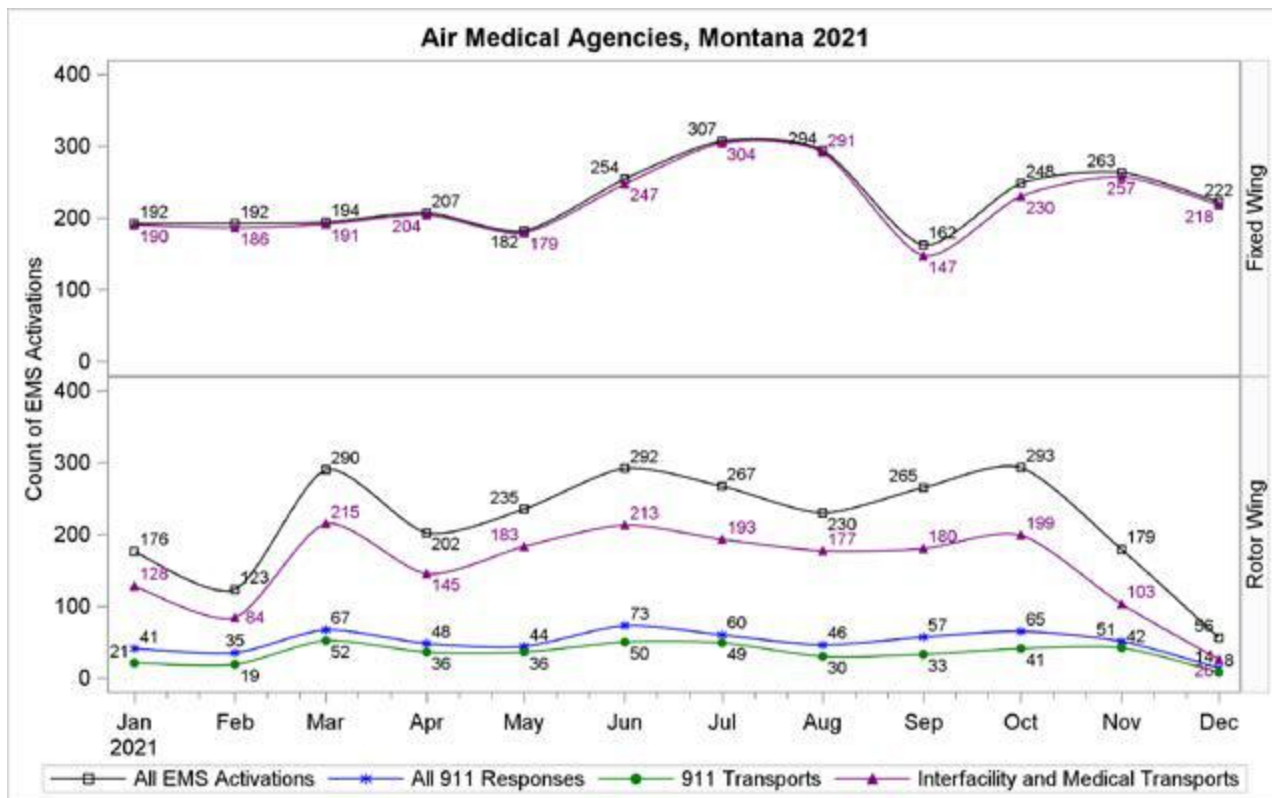
SYSTEM UTILIZATION

Table 17. EMS activations by patient disposition and response type, Fixed and rotor wing AMAs, 2021

Patient Disposition	Rotor Wing				Fixed Wing		
	911 Response	IFMT Response	Other	All RWA	IFMT Response	Other	All FWA
Patient Transported by this EMS Unit	417	1,846	55	2,318	2,644	25	2,669
Patient Treated, No Transport (per protocol)	6	1	0	7	3	0	3
Patient Evaluated, No Treatment/Transport Required	0	0	0	0	1	0	1
Patient Refusal/AMA, No Transport	8	0	1	9	2	0	0
Patient Dead at Scene, No Transport	29	7	1	37	0	0	2
Assist, Standby, or Non-patient Transport	0	0	5	5	0	0	0
Canceled Call	141	55	36	232	41	1	42
All	601	1,909	98	2,608	2,691	26	2,717

Nearly all (99.0%, N=2,691) FWA activations were IFM transports. Among RWA activations, 73% (N=1,909) were IFMT responses and 23% (N=601) were 911 responses. 69% (N=417) of RWA 911 responses resulted in patient transport (Table 17). Table 19 details why the remaining 184 patients were not transported following 911 responses.

Figure 22. System utilization volumes by month, Fixed and rotor wing AMAs, 2021



DEMAND ANALYSIS, ROTOR WING 911 RESPONSES

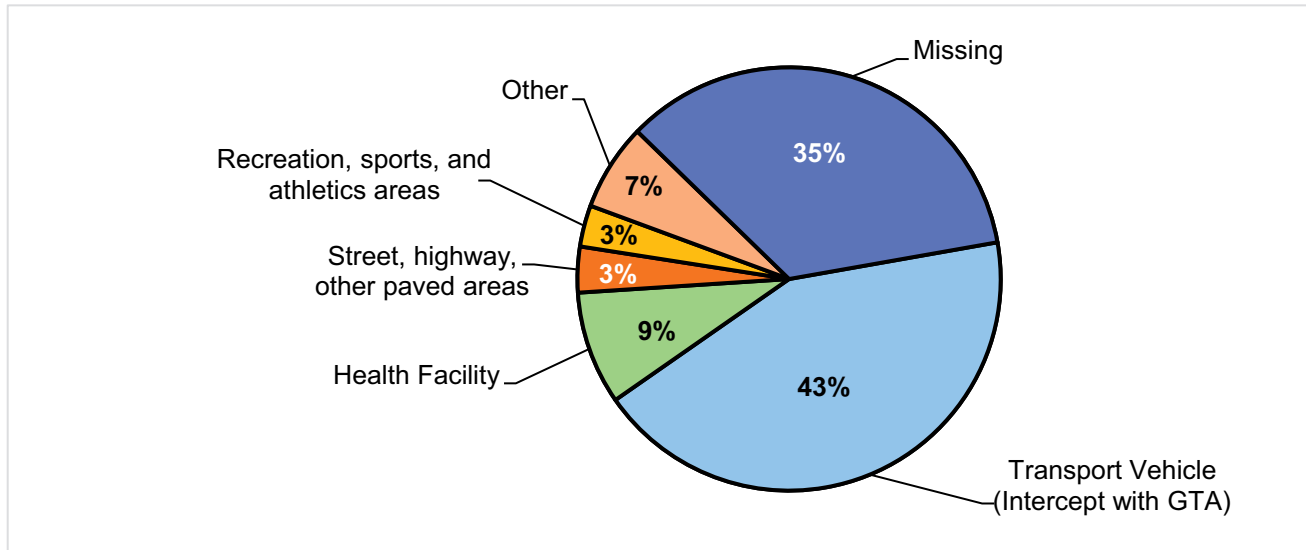
Table 18. 911 response demand analysis showing percentage of total N=601, RWAs, 2021

Hour of Day	Day of Week							Total
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	
0	0.17	0.33	0.83	0.50	0.33	0.33	0.67	3.16
1	0.50	0.17	0.17	0.33	0.17	0.33	0.67	2.33
2	0.17	0.17	0	0.17	0.33	0.17	0.17	1.16
3	0.17	0.33	0.17	0	0	0	0	0.67
4	0.17	0	0.17	0	0.17	0.17	0	0.67
5	0.17	0.50	0.17	0.33	0	0	0	1.16
6	0.17	0	0.17	0.33	0.17	0.33	0	1.16
7	0.17	0.33	0.50	0.33	0	0.67	0.17	2.16
8	0.83	0.50	0.67	0.33	0.17	1.50	0.17	4.16
9	0.33	0.33	1.33	0.50	0.50	0.67	0.67	4.33
10	0.83	1.16	1.00	1.00	0.17	0.50	0.67	5.32
11	1.33	0.83	1.83	0.83	0.33	1.66	1.16	7.99
12	1.16	0.50	1.00	0.50	0.67	1.50	1.33	6.66
13	0.83	1.16	0.33	0.50	2.00	0.67	0.67	6.16
14	0.33	0.83	0.33	0.67	1.00	1.00	1.66	5.82
15	1.16	1.16	1.00	0.67	1.50	1.50	1.16	8.15
16	1.83	0.67	0.50	0.83	1.00	1.33	1.16	7.32
17	1.50	0.33	0.83	0.83	0.33	0.83	1.16	5.82
18	1.33	0.50	0.83	0.17	1.00	1.33	2.00	7.15
19	0.50	1.00	0.83	1.00	0.17	0.50	0.67	4.66
20	0.67	0.50	0.17	0.50	0.33	0.67	1.16	3.99
21	0.33	0.33	0.33	1.00	0.33	1.00	0.33	3.66
22	0.50	0	1.00	0.17	0.33	0.67	0.83	3.49
23	0.50	0.33	0.50	0.50	0	0.50	0.50	2.83
Total	15.64	11.98	14.64	11.98	10.98	17.80	16.97	100.00

Table 18 presents the temporal pattern of demand for 911 service among RWAs. Each cell represents the percentage of 911 responses that occurred during that day of week and hour of day, with red colors representing higher demand. Fridays (18%), Saturdays (17%) and Sundays (16%) were the busiest days of the week for rotor wing 911 responses. 69% of rotor wing 911 responses occurred between the hours of 10AM-8PM.

SCENE LOCATION, ROTOR WING 911 RESPONSES

Figure 23. Scene location, All 911 responses (N=601), RWAs, 2021



ROTOR WING 911 RESPONSES WITH NO TRANSPORT

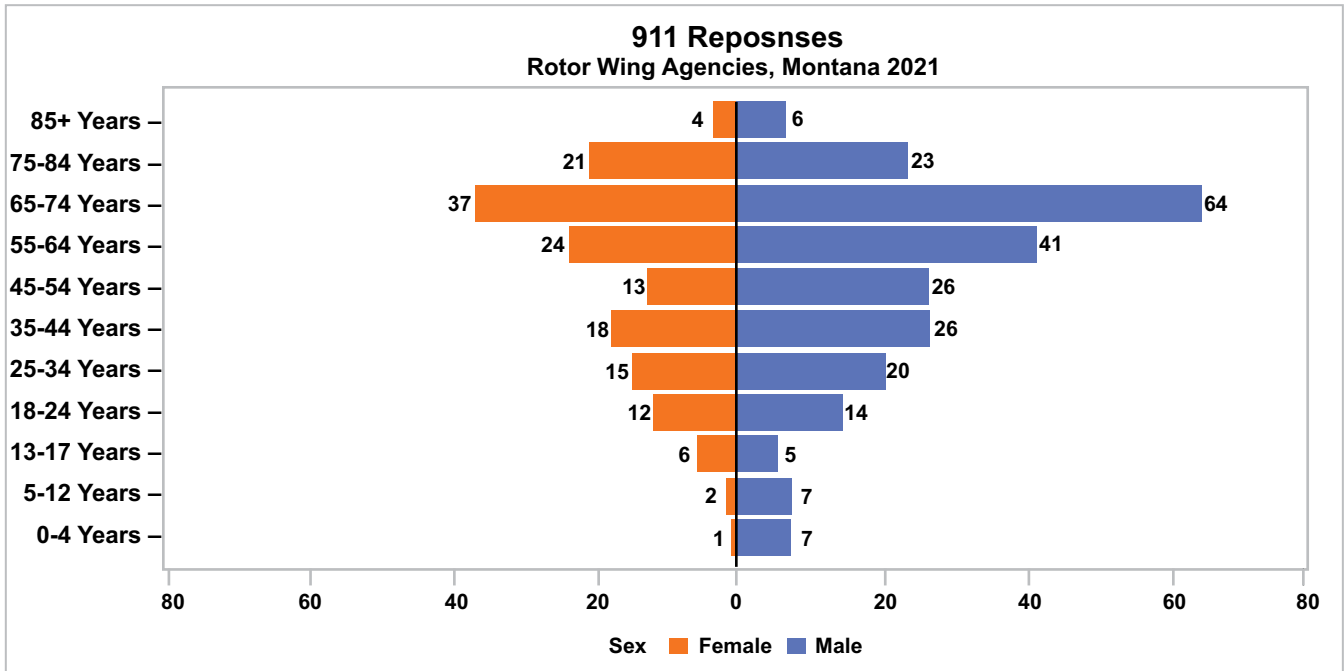
Table 19. Reason for 911 responses with no patient transport, RWAs, 2021

Reason for no patient transport	N	%
Canceled call	141	77%
Patient refusal	8	4%
Patient treated, no transport (per protocol)	6	3%
Patient dead at scene	29	16%
All	184	100%

There were 184 RWA 911 responses that did not result in patient transport. Canceled calls accounted for 77% (Table 19).

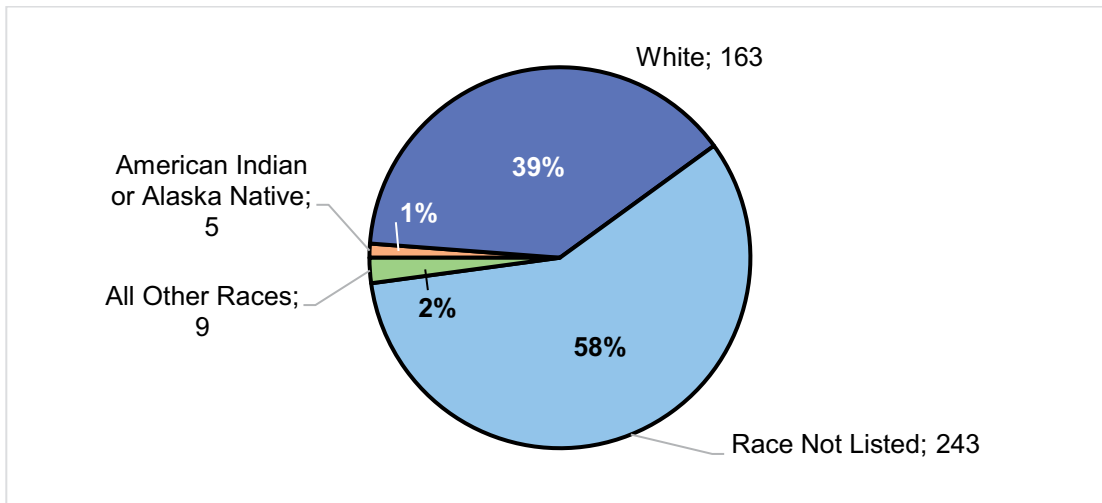
PATIENT DEMOGRAPHICS, ROTOR WING 911 TRANSPORTS

Figure 24. Age-sex pyramid*, 911 transports, RWAs, 2021



*See Appendix 1. Montana Population Characteristics

Figure 25. Patient race/ethnicity distribution, 911 transports (N=417), RWAs 2021



*The data field "Patient Race" allows for multiple selections, therefore the sum may be greater than 100%

PRIMARY IMPRESSIONS, ROTOR WING 911 TRANSPORTS

Table 20. Top 10 primary Impressions, 911 transports (N=417)*, RWAs, 2021

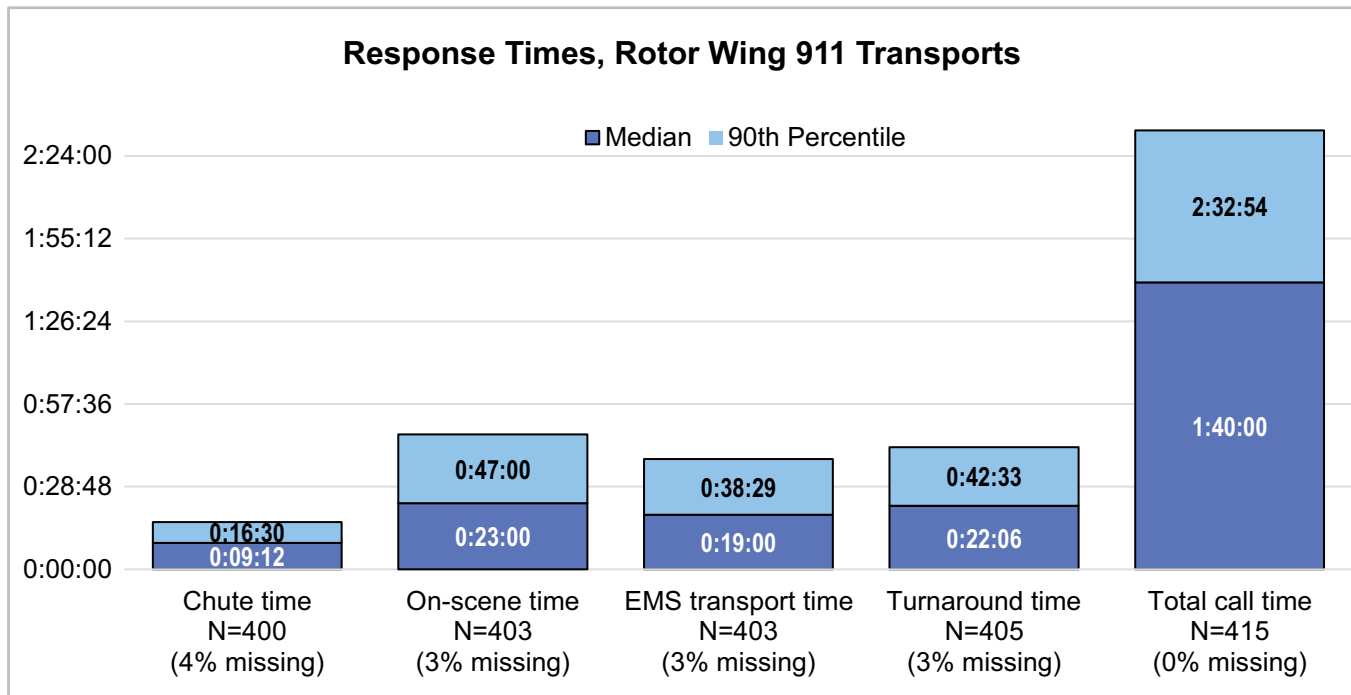
#	Primary Impression Pediatrics (Age 0-17)	N	%	Primary Impression Adults (Age 18 and Over)	N	%
1	Injury/Trauma	16	57%	Injury/Trauma	124	33%
2	Respiratory	†	7%	Cardiovascular/Circulatory	43	11%
3	Abdominal	†	7%	Level of Consciousness	34	9%
4	Level of Consciousness	†	4%	Neurological	30	8%
5	Neurological	†	4%	Respiratory	17	5%
6				Pain	10	3%
7				Abdominal	9	2%
8				Illness and Infectious Disease	5	1%
9				Mental Health/Behavioral	3	1%
10				Burn	3	1%
	All Top 10	22	79%	All Top 10	278	74%
	Other	0	0%	Other	14	4%
	Missing Impression	6	21%	Missing Impression	84	22%
	Total (Patient Age 0-17)	28	100%	Total (Patient Age 18+)	376	100%

† Suppressed value, count is <5

*Of 417 rotor wing 911 transports, 13 were missing age and were excluded from Table 20.

RESPONSE TIMES, ROTOR WING 911 TRANSPORTS

Figure 26. Median and 90th percentile response times, 911 transports (N=417), RWAs, 2021



DEMAND ANALYSIS, AIR MEDICAL INTERFACILITY AND MEDICAL TRANSPORT RESPONSES

Table 21. IFMT response demand analysis showing percentage of total N=4,600, Fixed and rotor wing AMAs, 2021

Hour of Day	Day of Week							Total
	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	
0	0.35	0.35	0.37	0.46	0.67	0.24	0.54	2.98
1	0.41	0.37	0.22	0.50	0.26	0.43	0.72	2.91
2	0.30	0.24	0.13	0.28	0.17	0.33	0.33	1.78
3	0.28	0.22	0.15	0.22	0.13	0.37	0.22	1.59
4	0.17	0.17	0.30	0.20	0.22	0.30	0.24	1.61
5	0.20	0.20	0.22	0.17	0.20	0.13	0.17	1.28
6	0.15	0.20	0.09	0.20	0.33	0.26	0.30	1.52
7	0.33	0.39	0.39	0.24	0.37	0.24	0.33	2.28
8	0.37	0.41	0.61	0.57	0.46	0.63	0.28	3.33
9	0.59	0.59	0.76	0.59	0.57	0.83	0.57	4.48
10	0.78	0.76	0.96	0.67	0.87	0.93	0.41	5.39
11	0.61	0.87	0.96	0.83	1.04	0.98	0.63	5.91
12	0.87	0.83	0.91	0.70	1.09	0.76	0.74	5.89
13	0.83	0.98	0.87	0.85	1.04	0.96	0.37	5.89
14	0.78	1.04	0.91	0.67	1.17	0.67	0.87	6.13
15	0.52	0.96	1.11	0.72	0.70	0.85	0.76	5.61
16	0.83	0.96	0.76	0.74	0.91	0.85	0.78	5.83
17	1.00	0.76	0.83	0.93	1.17	0.78	0.91	6.39
18	0.65	0.72	0.63	0.83	0.80	0.96	0.72	5.30
19	0.85	0.80	0.80	0.96	0.91	1.04	0.85	6.22
20	0.91	0.65	0.93	0.78	0.78	0.93	0.67	5.67
21	0.54	0.54	0.63	0.78	0.70	0.74	0.67	4.61
22	0.52	0.57	0.67	0.50	0.54	0.48	0.57	3.85
23	0.46	0.39	0.57	0.41	0.67	0.59	0.46	3.54
Total	13.30	13.96	14.78	13.78	15.78	15.28	13.11	100.00

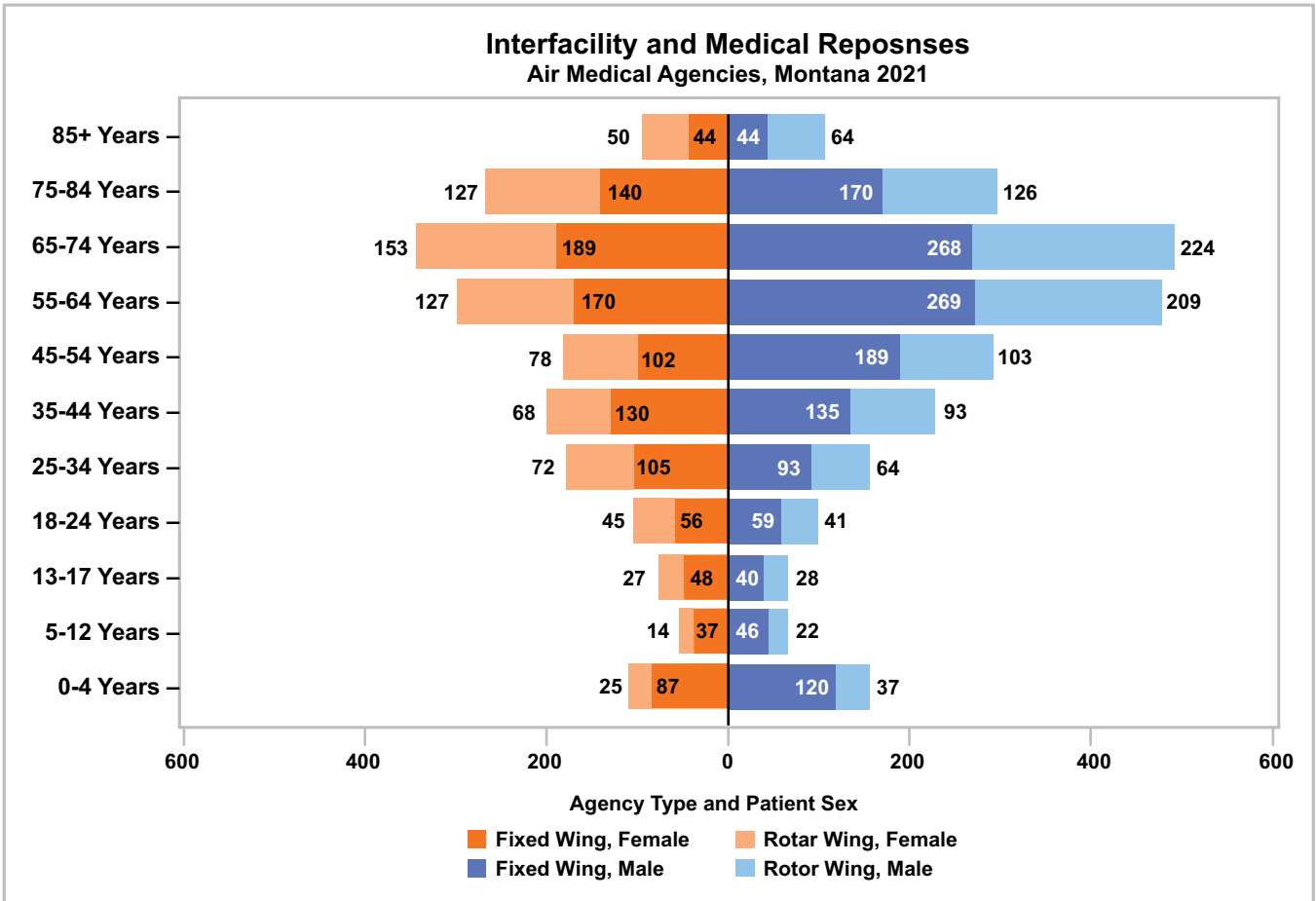
Table 21 presents the temporal pattern of demand for IFM service among AMAs. Each cell represents the percentage of IFMT responses that occurred during that day of week and hour of day, with red colors representing higher demand. Thursdays (16%) were the busiest day of the week for air medical interfacility and medical transports. 52% of air medical interfacility and medical transports occurred between the hours of 9AM to 5PM.

Over 60% of air medical interfacility transports originated from rural hospitals or nearby airports.



PATIENT DEMOGRAPHICS, AIR MEDICAL INTERFACILITY AND MEDICAL TRANSPORTS

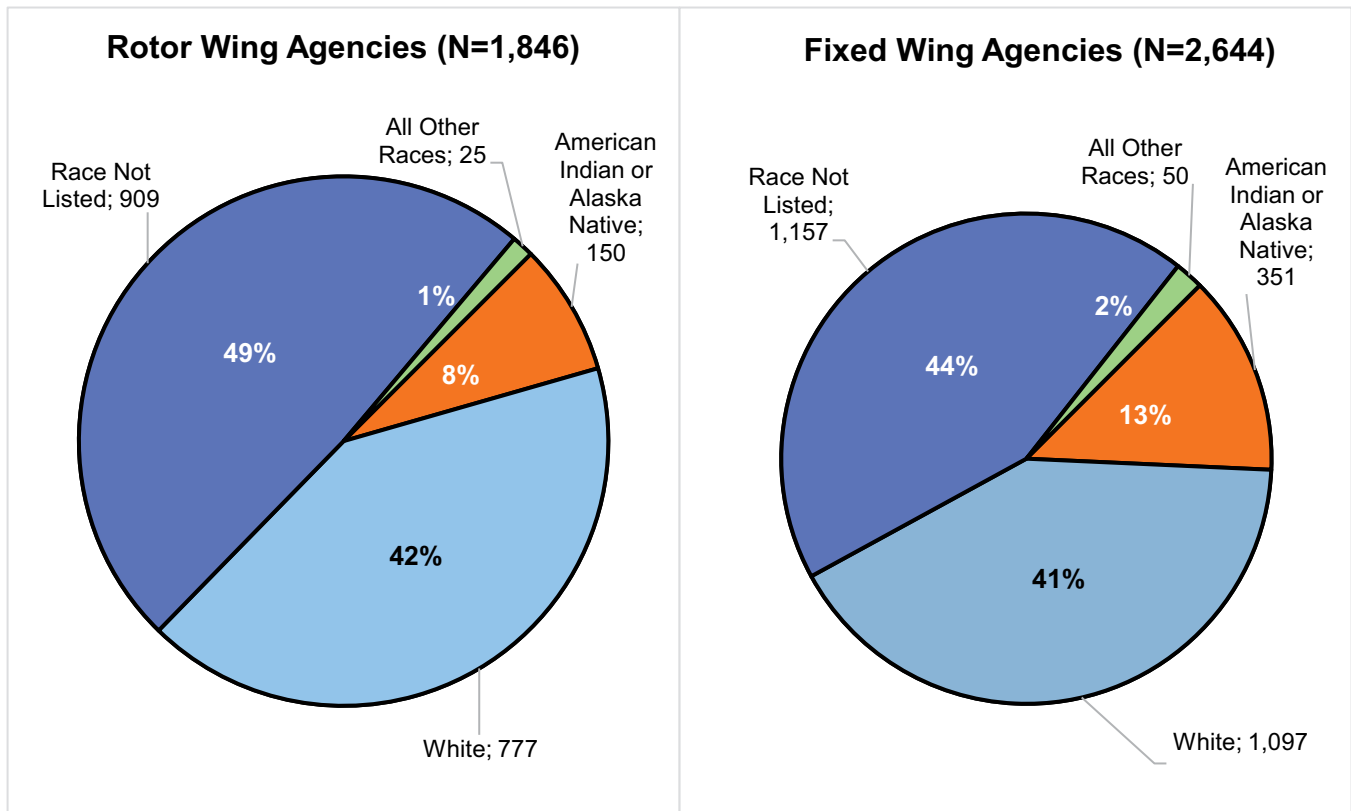
Figure 27. Age-sex pyramid*, IFM transports, Fixed and rotor wing AMAs, 2021



*See Appendix 1. Montana Population Characteristics

PATIENT DEMOGRAPHICS, AIR MEDICAL INTERFACILITY AND MEDICAL

Figure 28. Patient race/ethnicity distribution, IFM transports (N=4,490), Fixed and rotor wing AMAs, 2021



*The data field "Patient Race" allows for multiple selections, therefore the sum may be greater than 100%

PRIMARY IMPRESSION, AIR MEDICAL INTERFACILITY AND MEDICAL TRANSPORTS

Table 22. Top 10 primary impressions, IFM transports (N=1,846)*, RWAs, 2021

#	Primary Impression Pediatrics (Age 0-17)	N	%	Primary Impression Adults (Age 18 and Over)	N	%
1	Injury/Trauma	28	18%	Cardiovascular/Circulatory	269	16%
2	Respiratory	14	9%	Injury/Trauma	184	11%
3	Neurological	12	8%	Neurological	174	10%
4	Level of Consciousness	10	6%	Respiratory	139	8%
5	Mental Health/Behavioral	9	6%	Abdominal	95	6%
6	Illness and Infectious Disease	7	4%	Illness and Infectious Disease	85	5%
7	Observation/Exam (No Patient Complaint)	6	4%	Level of Consciousness	84	5%
8	Pain	5	3%	Pain	37	2%
9	Cardiovascular/Circulatory	†	2%	Endocrine, Nutritional, and Metabolic	36	2%
10	Endocrine, Nutritional, and Metabolic	†	2%	Obstetric/Gynecological (OB/GYN)	36	2%
	All Top 10	97	61%	All Top 10	1,139	68%
	Other	10	6%	Other	78	5%
	Missing Impression	51	32%	Missing Impression	462	28%
	Total (Patient Age 0-17)	158	100%	Total (Patient Age 18+)	1,679	100%

†= Suppressed value, count is <5

*Of 1,846 rotor wing IFM transports, 9 patients were missing age and was excluded from Table 22.

Table 23. Top 10 primary impressions, IFM transports (N=2,644)*, FWAs, 2021

#	Primary Impression Pediatrics (Age 0-17)	N	%	Primary Impression Adults (Age 18 and Over)	N	%
1	Injury/Trauma	42	11%	Cardiovascular/Circulatory	298	13%
2	Abdominal	26	7%	Injury/Trauma	247	11%
3	Neurological	21	5%	Neurological	205	9%
4	Respiratory	21	5%	Respiratory	202	9%
5	Illness and Infectious Disease	18	5%	Illness and Infectious Disease	141	6%
6	Level of Consciousness	12	3%	Abdominal	140	6%
7	Mental Health/Behavioral	10	3%	Level of Consciousness	104	5%
8	Observation/Exam (No Patient Complaint)	10	3%	Pain	66	3%
9	Digestive/Gastrointestinal (GI)	8	2%	Digestive/Gastrointestinal (GI)	51	2%
10	Cardiovascular/Circulatory	7	2%	Obstetric/Gynecological (OB/GYN)	45	2%
	All Top 10	175	45%	All Top 10	1,499	67%
	Other	26	7%	Other	225	10%
	Missing Impression	186	48%	Missing Impression	521	23%
	Total (Patient Age 0-17)	387	100%	Total (Patient Age 18+)	2,245	100%

*Of 2,644 fixed wing IFM transports, 12 were missing age and were excluded from Table 23.

Of 4,490 air medical IFM transports, 41% (N=1,846) were rotor wing and 59% (N=2,644) were fixed wing. Trauma was the most common primary impression for pediatric patients for both rotor and fixed wing, accounting for 13% (N=70) of pediatric air medical IFM transports overall. Among adult patients, Cardiovascular/Circulatory was the most common type of primary impression, accounting for 14% of adult IFM air transports (N=567), followed by Trauma (11%, N=431).

RESPONSE TIMES, AIR MEDICAL INTERFACILITY AND MEDICAL TRANSPORTS

Figure 29. Median and 90th percentile response times, IFM transports, Sending facility= CAH and IHS hospitals (N=2,675), Fixed and rotor wing AMAs, 2021

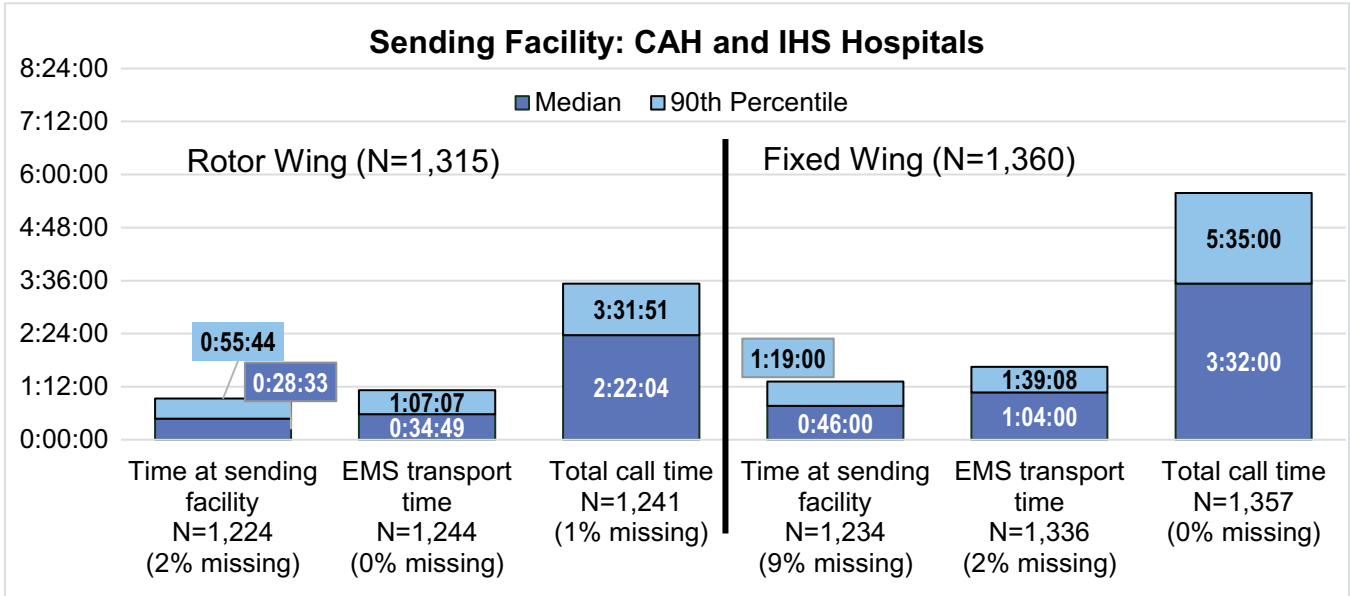
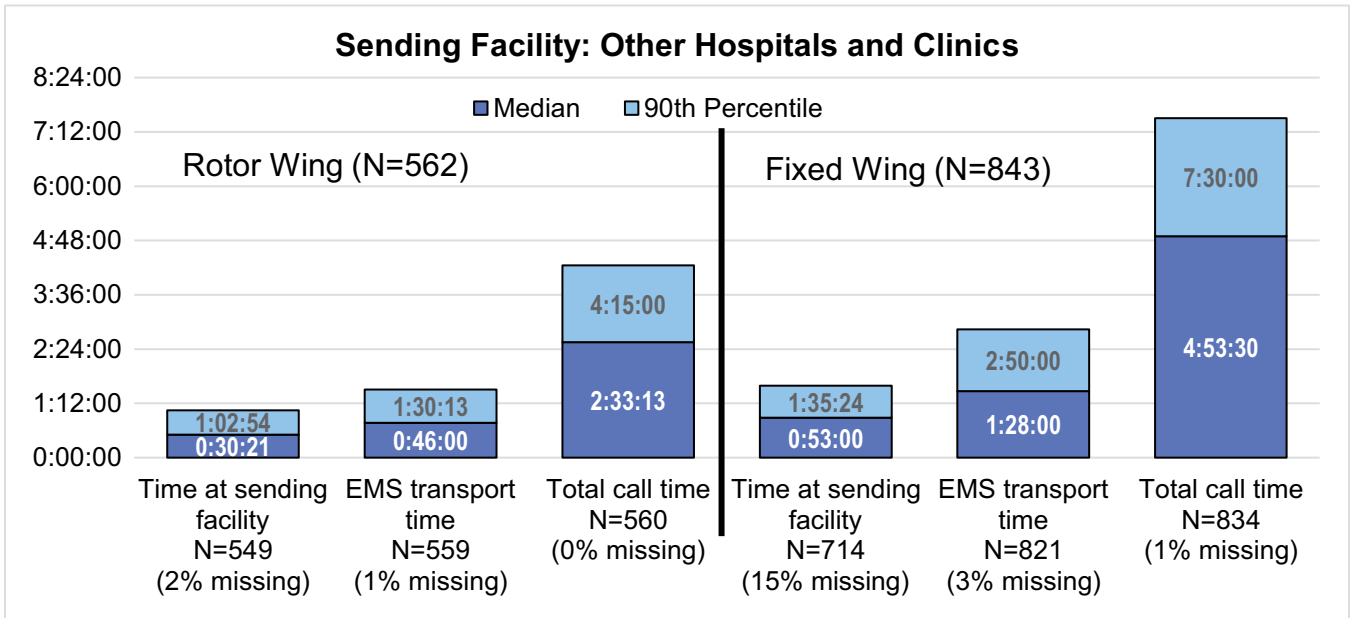


Figure 30. Median and 90th percentile response times, IFM transports, Sending facility= Other Hospitals and Clinics (N=1,405), Fixed and rotor wing AMAs, 2021



Of 1,846 rotor wing IFM transports, 68% originated from CAH or IHS hospitals (N=1,248) and 30% were sent from other hospitals or clinics (N=562). 32 were missing a valid sending facility name, and 4 listed airports as the sending facility. Among RWAs, 90th percentile time spent at sending facility was comparable for all facility types (56-63 min). RWA EMS transport time was also similar for different facility types, around 1h 7m to 1h 30 min.

Of 2,644 fixed wing IFM transports, 51% were sent from CAH or IHS hospitals (N=1,360), and 32% from other hospitals or clinics (N=843). 33 were missing a valid sending facility name, and 408 listed airports as the sending facility. Among FWAs, the 90th percentile EMS transport time and total call time were longer when the sending facility was a non-CAH/IHS hospital. This reflects transports going out-of-state originating from larger hospitals.



TIME SENSITIVE ILLNESS AND INJURY

To assist EMS agencies with the development and improvement of their quality improvement activities, this section of the Annual Report focuses on time sensitive illnesses and injuries (TSII). Research shows that care provided by EMS can dramatically improve the outcomes for TSII patients.³⁻⁸ This section of the report covers alcohol and drug exposure, naloxone administration, mental and behavioral health crisis, severe injury, traumatic brain injury, stroke, chest pain/ST-segment myocardial infarction (STEMI), and out-of-hospital cardiac arrest.



ALCOHOL/DRUG EXPOSURE ¹

In 2020, nearly 100,000 people died of alcohol-related causes in the United States, and over 90,000 died of drug overdoses.⁹ Alcohol and/or drug intoxication calls comprise a significant proportion of EMS responses, and also contribute to motor vehicle crashes, homicide, suicide, domestic violence, and other unintentional injuries like drowning. During 2021, Montana GTAs responded to a total of 8,799 alcohol or drug exposure related 911 calls – equating to 9 alcohol/drug related calls for every 1 cardiac arrest call. 88% of GTA 911 responses (N=7,714) resulted in patient transport.

Traditionally, the EMS response model involves stabilizing these patients, giving naloxone if the patient is in respiratory distress, and transporting them to the emergency department- from which they are usually released within hours. However, intoxicated patients often become repeat users of EMS. A different, more cohesive, approach is needed for responding to patients who may have substance use disorders, linking them to effective treatment, and stopping the cycle of repeated EMS utilization

Figure 31. Alcohol or drug exposure-related system utilization volumes by month, GTAs, 2021

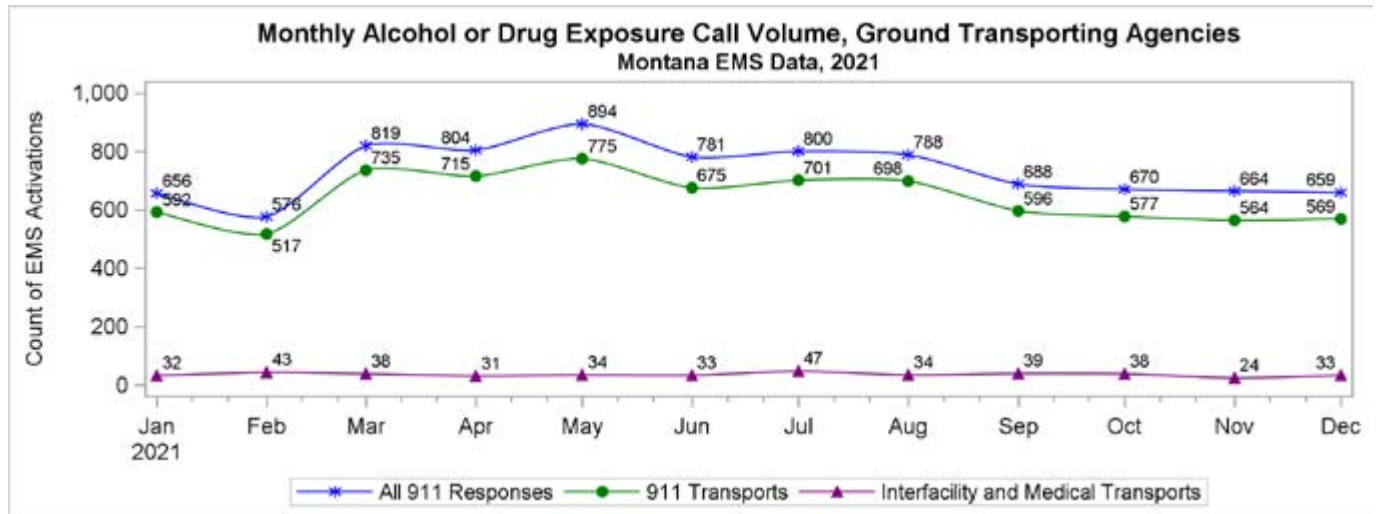
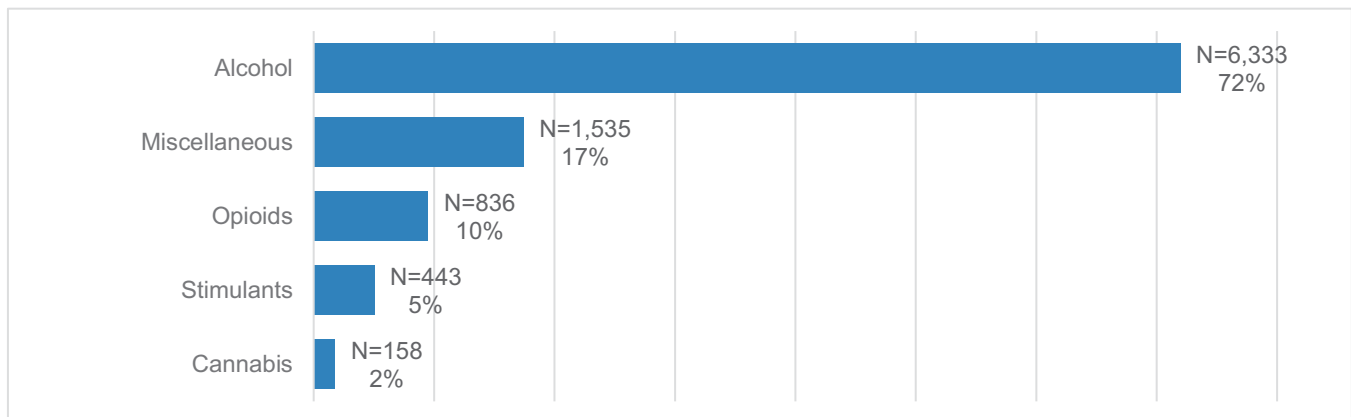


Figure 32. Relative frequency of substances involved, alcohol/drug exposure-related 911 responses (N=8,799), GTAs, 2021



*One record/call may contain multiple qualifying substance related codes. Therefore, the sum of the indicator totals may be greater than the total number of substance exposure related calls (N=8,597).

¹ Any Mention of alcohol/drug exposure ICD-10-CM code -subcodes included- (T36-T50, F10-F16, F19, T65.2, T65.9, F55, O35.5, O99.32) in provider primary of secondary impression; or, meets opioid OD syndrome definition

Alcohol was involved in 72% (N=6,333) of all substance-related 911 responses. The “Miscellaneous” category includes cases where no specific substance was noted; it also includes sedative/hypnotic/ anxiolytics and hallucinogens. Opioids were involved in 10% (N=836) of substance exposure-related 911 responses, and stimulants were involved in 5% (N=443).

For more information on opioid overdose related 911 responses please visit the [EMS Data on Opioid Overdose 2021 report](#) on the EMSTS webpage.

Table 24. Alcohol/drug exposure-related 911 responses, GTAs, 2021

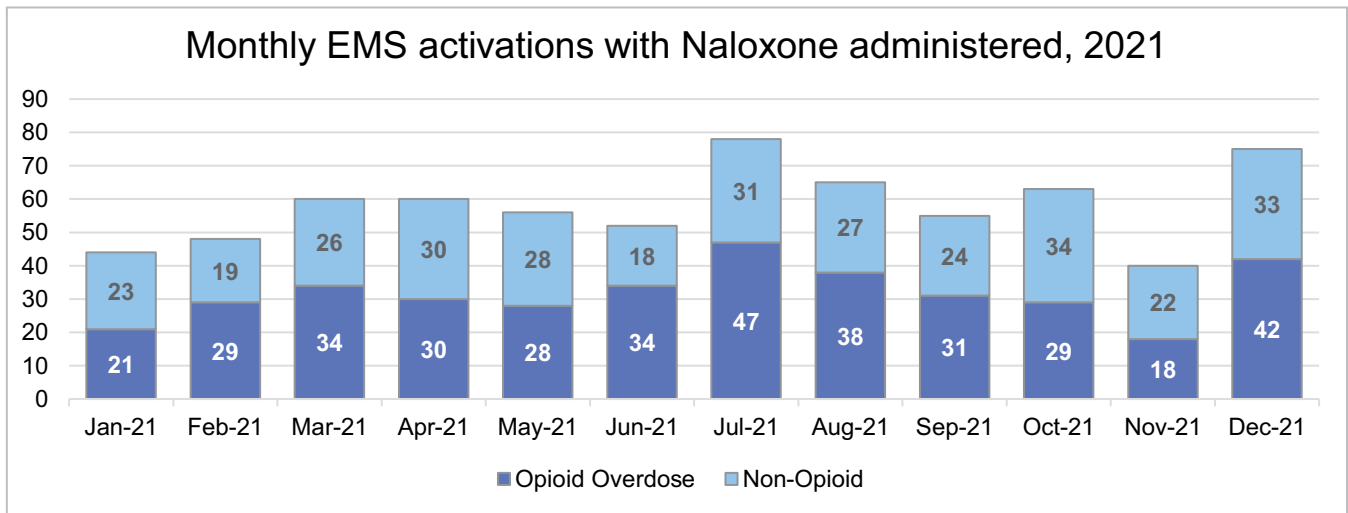
Patient Disposition	N	%
Patient Transported by this EMS Unit	7,714	87.7%
Patient Treated/Evaluated, No Transport (per protocol)	532	6.0%
Patient Refusal/AMA, No Transport	504	5.7%
Patient Dead at Scene, No Transport	30	0.3%
Other (No Patient Contact)	19	0.2%
Patient Sex		
Female	3,180	36.1%
Male	5,588	63.5%
Not Reported	31	0.4%
Patient Age		
0-17 Years	366	4.2%
18-44 Years	4,575	52.0%
45-64 Years	3,054	34.7%
65+ Years	755	8.6%
Not Reported	49	0.6%
Incident County NCHS Urban-Rural Classification		
Small Metro	4,509	51.2%
Micropolitan	1,613	18.3%
Non-core (Rural)	2,246	25.5%
Not Reported	431	4.9%
Self-Harm Indicated		
Self-harm code	843	9.6%
No self-harm code	7,956	90.4%
Total	8,799	100.0%

NALOXONE REPORT

Naloxone is an opioid antagonist medication used for the emergency treatment of a known or suspected opioid overdose. It has limited negative side effects if given to a patient who has not taken opioids, so it is sometimes given to rule out opioid overdose. There was a total of 865 naloxone administrations documented during 696 EMS activations in 2021 – nearly half of the activations were not classified as opioid related. The most common non-opioid patients who were given naloxone were cardiac, altered level of consciousness, and unspecified overdose.

For more information, please visit the Naloxone Administration by [EMS 2021 report](#) on the EMSTS webpage.

Figure 33. Opioid overdose-related versus non-opioid EMS activations with naloxone administered, by month, All EMS agencies, 2021



MENTAL AND BEHAVIORAL HEALTH²

Like other states, Montana has a shortage of behavioral health facilities and licensed mental healthcare providers. Efforts to train first responders, including EMS providers, on recognizing and de-escalating a behavioral health crisis will help to reduce the severity of an event and help the patient to have a better recovery,

There was a total of 8,499 EMS activations due to mental and behavioral health. 71% were 911 responses (N=6,058), while 28% were interfacility or medical transport responses (N=2,369).

Among 911 responses, 42% had an anxiety-related primary impression (N=2,550), while 27% were self-harm or suicide related (N=1,622). Among IFMT responses, 46% were unspecified/miscellaneous mental problems³ (N=1,084) while 37% were self-harm or suicide related (N=875).

Table 25. Provider Primary Impressions for mental and behavioral health related EMS activations, all EMS agencies, 2021

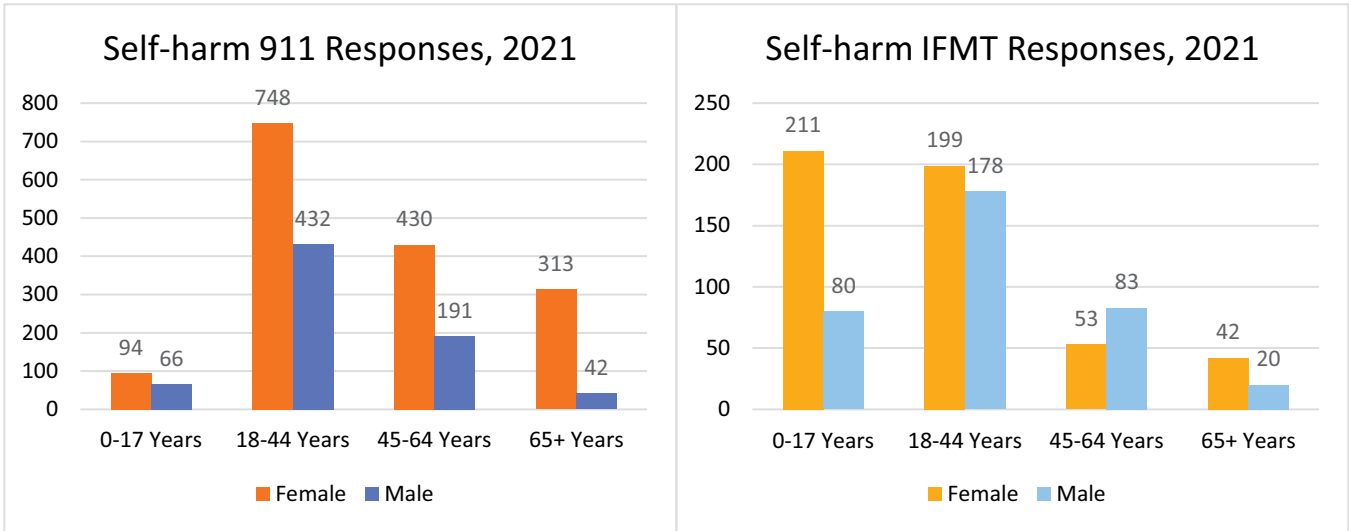
Primary Impression	911 Responses		Interfacility and Medical Transport Responses	
Anxiety	2,550	42%	177	7%
Self-harm	1,622	27%	875	37%
Unspecified/Miscellaneous²	1,194	20%	1,084	46%
Mood disorder	249	4%	159	7%
Assault	240	4%	56	2%
Psychotic	171	3%	1	0%
Personality Disorders	31	1%	17	1%
Disruptive, impulse control, and conduct disorders	1	0%	0	0%
All	6,058	100%	2,369	100%

Self-harm related EMS activations showed variation by age and sex. There were over twice as many 911 responses for females than males (1,589 for females versus 738 for males), and 1.4 times as many IFMT responses for females than males (505 for females versus 364 for males). Females incurred more self-harm related 911 responses than males in every age group with the largest discrepancy in the 65+ age group (Figure 34). 1 in 3 interfacility transports for self-harm were patients aged 0-17 years.

² Provider primary impression is a mental or behavioral health code

³ Unspecified/miscellaneous includes "Mental disorder NOS", "Homicidal and suicidal ideations", "Other symptoms and signs involving emotional state", "Strange and inexplicable behavior", "Visual or Auditory hallucinations"

Figure 34. Self-harm related EMS Activations by age group and sex, 2021

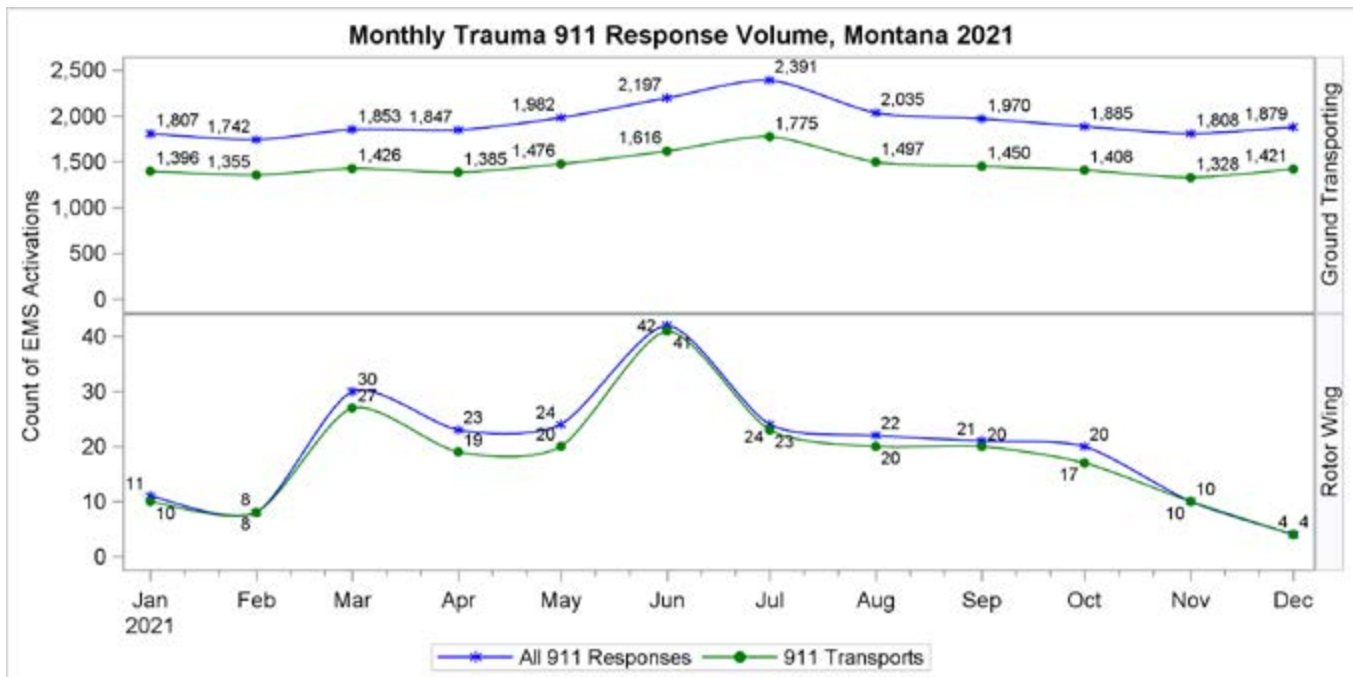


TRAUMA⁴

TRAUMA-RELATED 911 TRANSPORTS

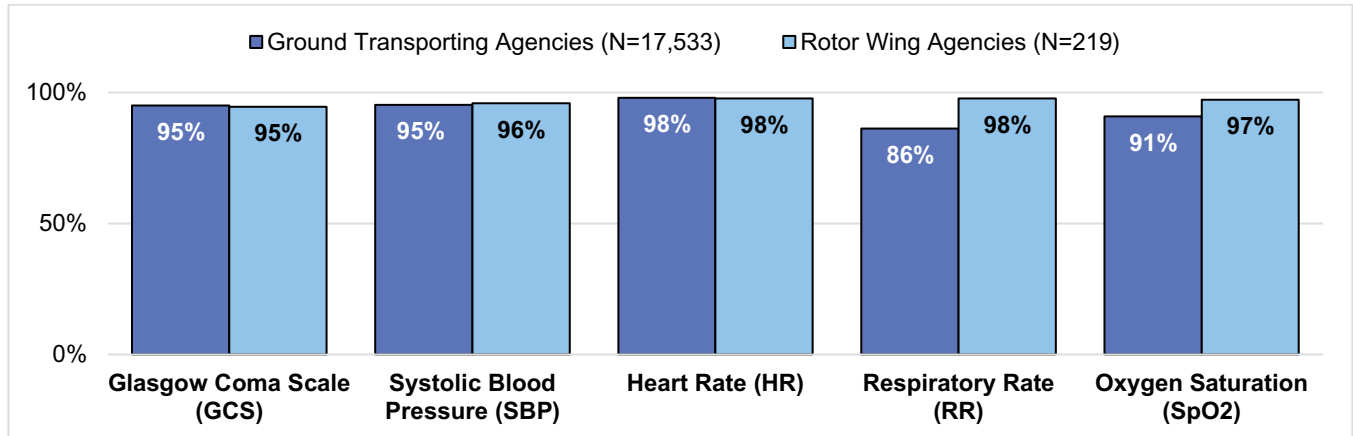
Trauma (injury) is the main reason for 911 transport, accounting for approximately 1 in 5 ground 911 transports and 2 in 5 air medical 911 transports. During 2021, there were 23,396 GTA 911 responses related to Trauma and 75% (N=17,533) resulted in transport of the patient. There were 239 rotor wing 911 responses for trauma and 92% (N=219) resulted in transport of the patient.

Figure 35. Trauma-related 911 response volumes by month, GTAs/RWAs, 2021



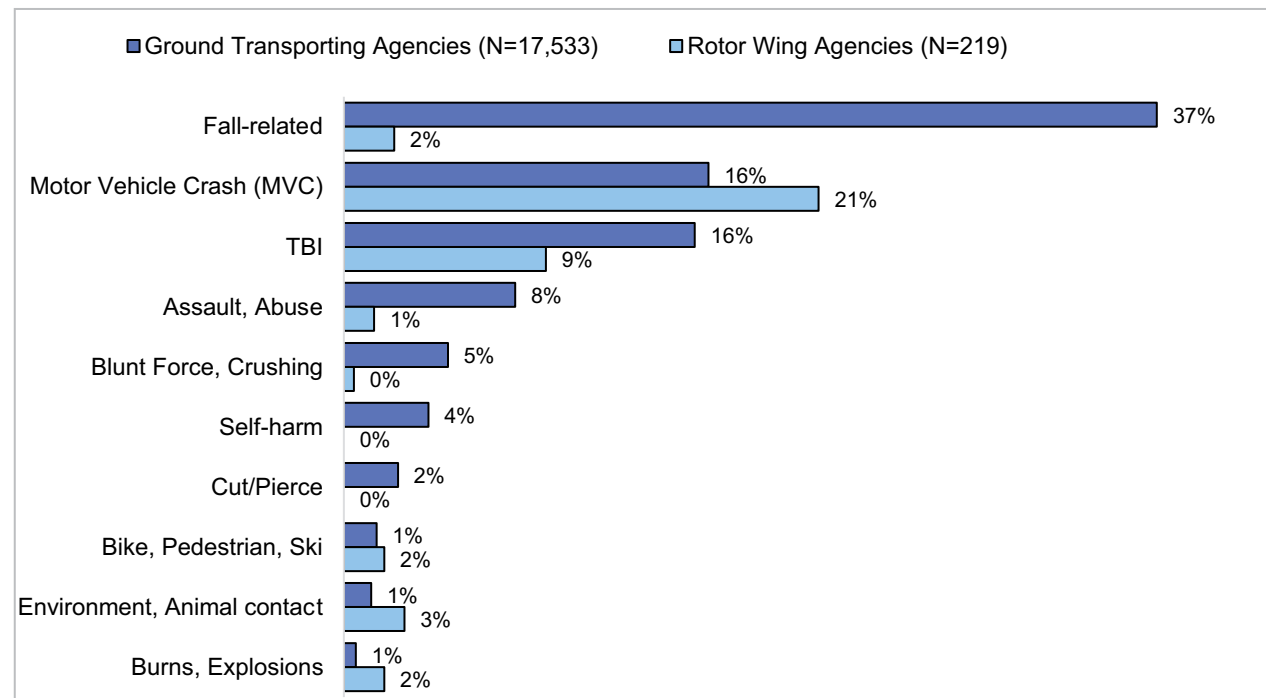
⁴ Trauma case definition: Possible Injury (eSituation.02) = "Yes"; OR Cause of Injury (eInjury.01) is not blank; OR Provider primary or secondary impression (eSituation.11/eSituation.12) of Any S Code, R58, T07, G89.11, T14.90, T79.4, L55.0-L55.2, T30.0, O71.9, T14, T30.0, T79.9 OR Dispatch complaint (eDispatch.01) = "automated crash notification, OR Vehicular Injury Risk Factors (eInjury.04) is one of the following values: 2904001: Auto v. Pedestrian/Bicyclist Thrown, Run Over, or > 20 MPH Impact, 2904007: Crash Death in Same Passenger Compartment, 2904009: Crash Ejection (partial or complete) from automobile, 2904011: Crash Intrusion, including roof: > 12 in. occupant site; > 18 in. any site, 2904013: Crash Vehicle Telemetry Data (AACN) Consistent with High Risk of Injury, 2904015: Motorcycle Crash > 20 MPH

Figure 36. Completion rate of initial vital sign documentation, Trauma-related 911 transports, GTAs/RWAs, 2021



Vital sign measurement is of paramount importance for trauma patients, in order to keep the patient stable and provide life-saving interventions. RWAs have above a 95% completion rate (at least one measurement) for all the vital signs. GTAs have above a 90% completion rate for all the vital signs except respiratory rate, which was completed in 86% of patient care records.

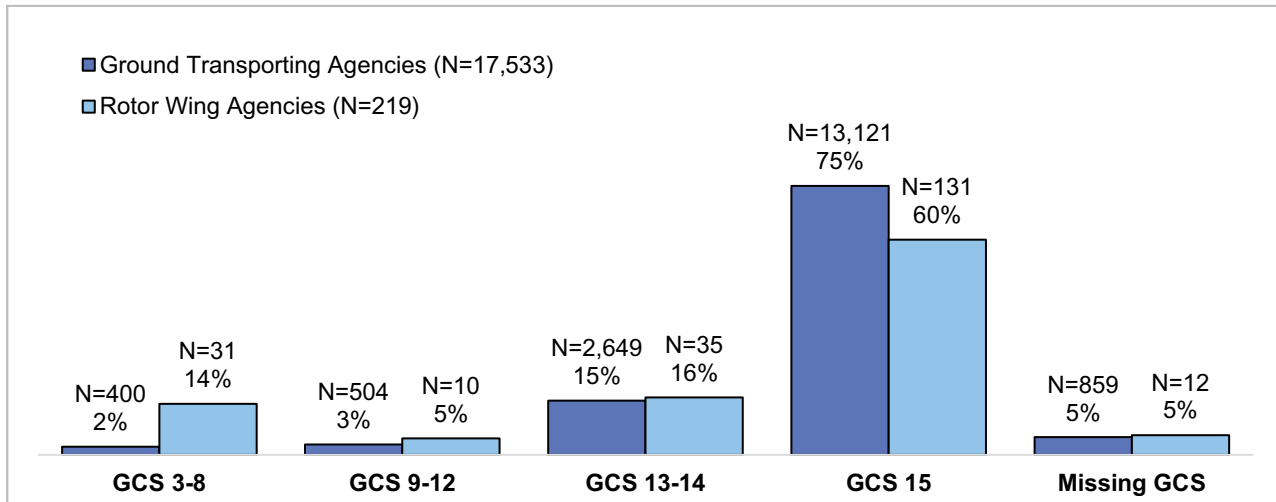
Figure 37. Relative frequency of top 10 causes of injury*, Trauma-related 911 transports, GTAs/RWAs, 2021



*Cause-of-injury is a multi-select field. The categories presented here are NOT mutually exclusive.

Falls were the most commonly documented cause of injury for GTA trauma-related 911 transports (37%), followed by MVCs (16%) and TBI's (16%). Among RWA trauma 911 transports, 21% were MVC-related followed by TBI's (9%).

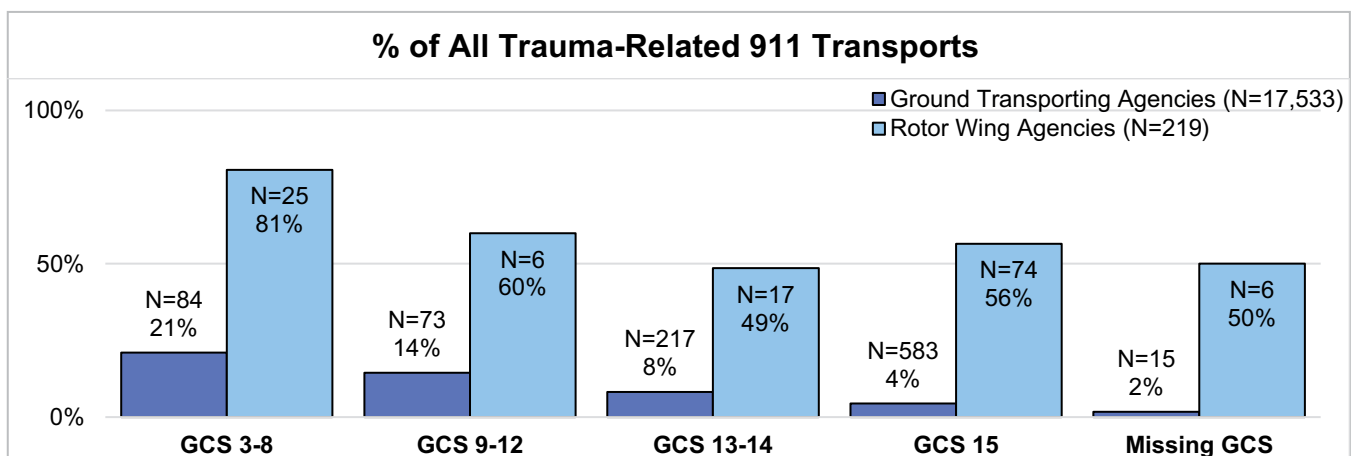
Figure 38. Number and percentage of trauma-related 911 transports by GCS category, GTAs/RWAs, 2021



The Glasgow Coma Scale (GCS) is used to objectively describe the extent of a patient’s impaired consciousness according to three aspects of responsiveness: eye-opening, motor, and verbal responses. Scores range from 3 (completely unconscious) to 15 (fully conscious). Figure 38 compares the distribution of patient GCS scores for GTAs versus RWAs. 1 in 5 (19%, N=41) RWA trauma patients had a GCS score of 12 or lower, versus 1 in 20 (5%, N=904) for GTA trauma patients. 75% of GTA trauma 911 transports were for fully conscious patients (GCS 15), versus 60% for RWAs.

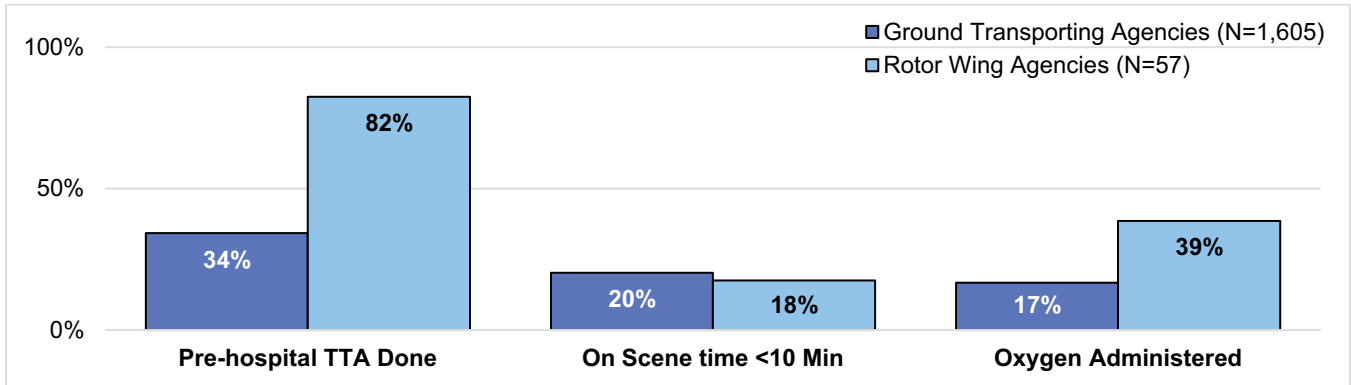
Trauma team activation (TTA) involves paging specific hospital staff to report to the emergency department as quickly as possible, including a surgeon, anesthesiologist, respiratory therapist, critical care nurse, operating room nurse, x-ray and lab technicians, chaplain, and others depending on the level of the activation (partial or full). As the first line of medical providers assessing a trauma patient, EMS plays a crucial role in ensuring that the patient receives appropriate and efficient care. [The Montana Field Trauma Decision Scheme/Trauma Team Activation Criteria](#) outlines how EMS providers should decide whether to activate or alert the trauma team of a receiving facility. Activation criteria fall into four areas: physiologic, anatomic, mechanism of injury, and special considerations.¹⁰

Figure 39. Rate of pre-hospital trauma team activation by GCS category, Trauma-related 911 transports, GTAs/RWAs, 2021



Pre-hospital TTA is indicated for trauma patients with a GCS score ≤ 13 . Among 911 transports with GCS 3-8, GTAs documented pre-hospital alert in 21% and RWAs did so in 81%. Documentation of pre-hospital alert was missing for 70% of GTA trauma related 911 transports, and 3% for rotor wing.

Figure 40. EMS performance improvement indicators, Trauma-related 911 transports meeting activation criteria, GTAs/RWAs, 2021



Montana’s State Trauma Care Committee (STCC) regularly reviews EMS and hospital-based performance improvement (PI) indicators to assess how the trauma system impacts patient care, morbidity, and mortality. The EMS-specific PI indicators shown in Figure 40 are measured only among the injured patients that met pre-hospital TTA criteria in any of the four areas (physiologic, anatomic, mechanism of injury, and special considerations). 9% (N=1,605) of trauma-related 911-transports by GTAs and 26% (N=57) by RWAs met pre-hospital activation criteria.

1. **Pre-hospital TTA Done:** Pre-hospital TTA was documented in 34% of trauma 911 ground transports that met activation criteria, and 82% for rotor wing. Trauma team activation has been shown to fundamentally improve trauma patients’ outcomes.
2. **On-scene time <10 minutes:** Patients with serious trauma require rapid assessment, treatment, and transportation to a designated trauma center; the goal is EMS scene time under 10 minutes. 20% of GTA and 18% of RWA 911 transports met this goal.
3. **Oxygen administered:** 17% of GTA and 39% of RWA trauma 911 transports that met activation criteria received oxygen.

TRAUMA-RELATED INTERFACILITY AND MEDICAL TRANSPORTS

Interfacility transport plays an important role in a rural trauma system. Ground transporting agencies completed 3,309 interfacility and medical transports for Trauma and air medical completed 926 interfacility and medical transports for trauma. 55% (N=433) were rotor wing and 45% (N=493) were fixed wing.

Figure 41. Trauma-related IFM transport volumes by month, GTAs and AMAs, 2021

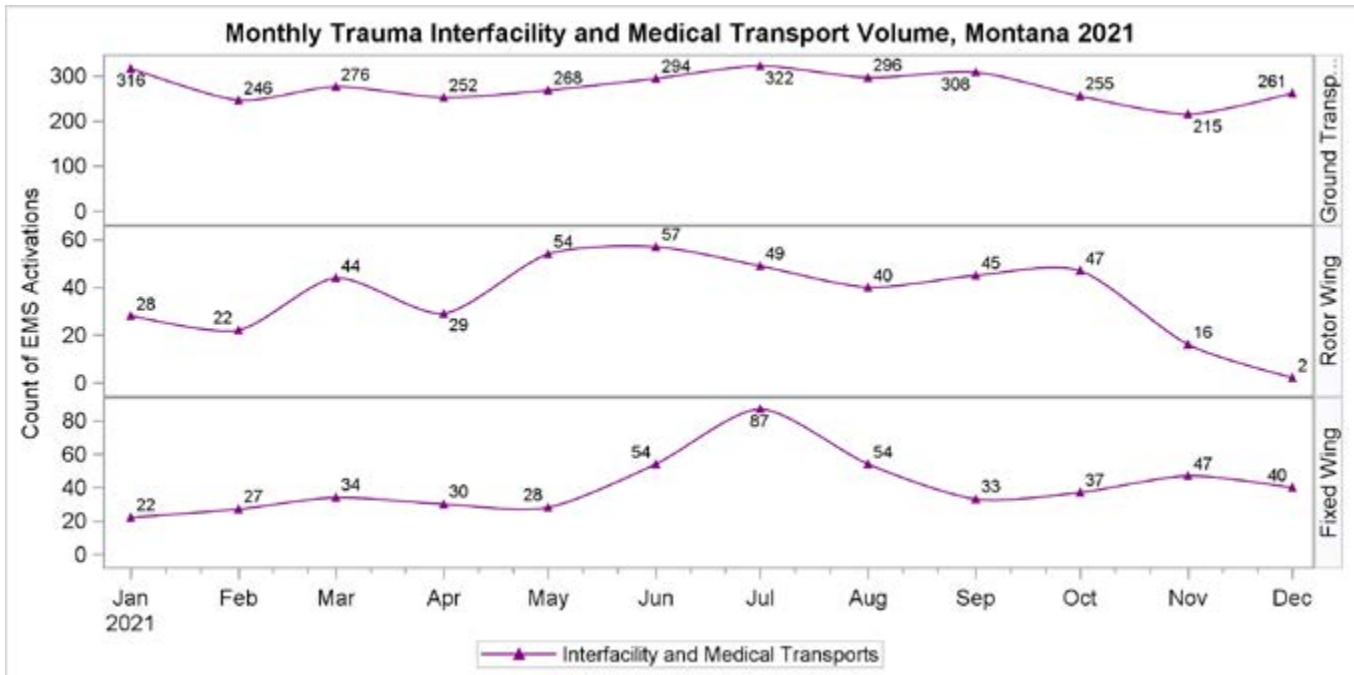
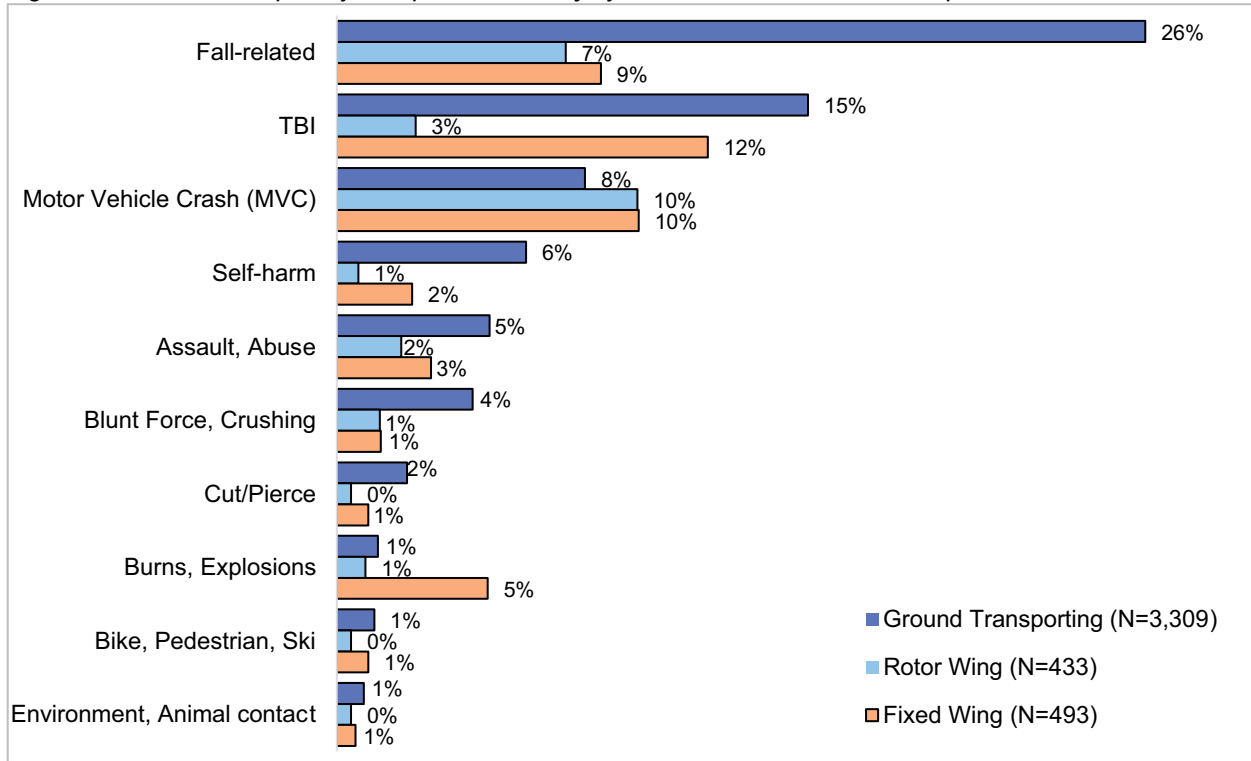


Figure 42. Relative frequency of top causes of injury, Trauma-related IMF Transports, GTAs and AMAs, 2021



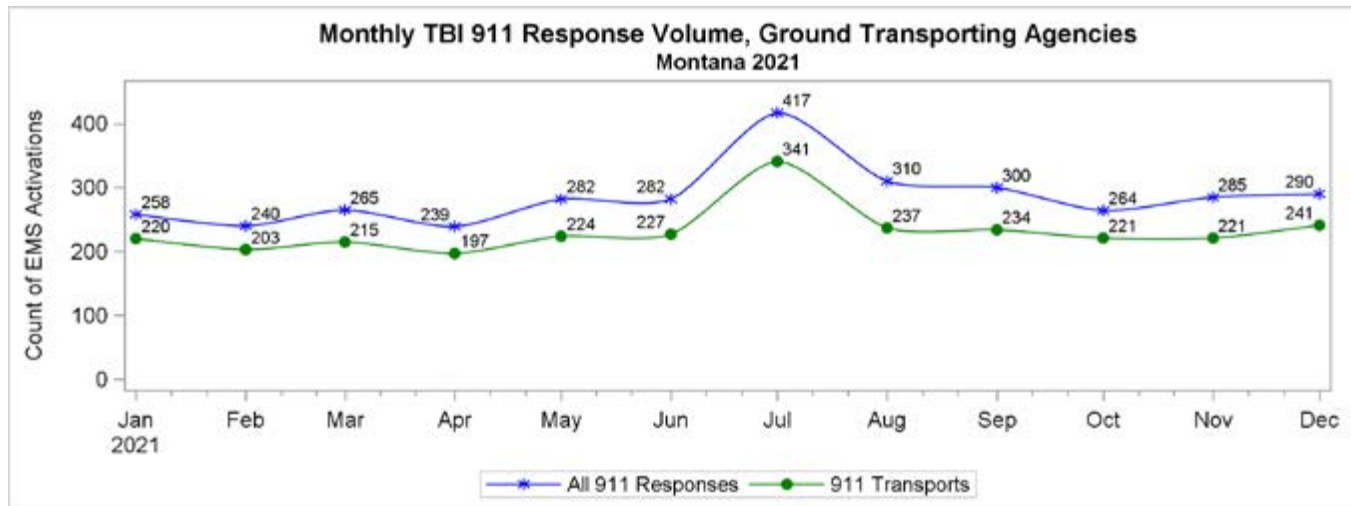
*Cause-of-injury is a multi-select field. The categories presented here are NOT mutually exclusive.



TRAUMATIC BRAIN INJURY (TBI)⁵

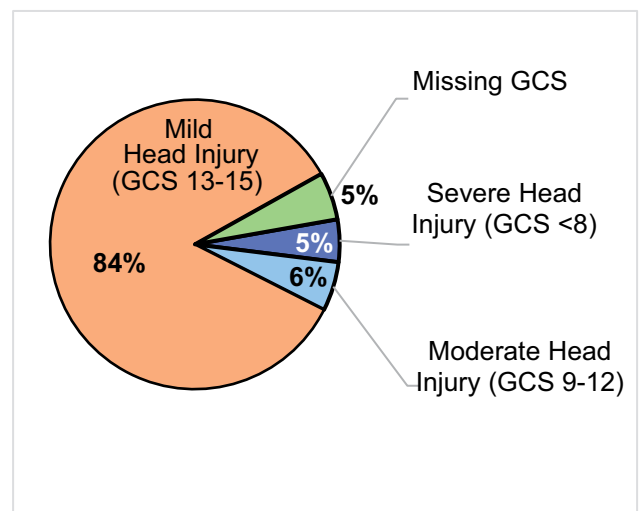
Recent peer-reviewed studies demonstrate that EMS providers and emergency department staff can significantly improve the survival and recovery of individuals with severe traumatic brain injury (TBI) by implementing three simple interventions: avoiding hypoxia, hypotension, and hyper-ventilation.⁵ Montana GTAs responded to 3,432 911 calls for TBI in 2021. 81% (N=2,781) resulted in transport of the patient.

Figure 43. TBI-related 911 response volume by month, GTAs, 2021



84% of TBI 911 transports were mild head injuries (GCS 13-15), while 6% were moderate (GCS 9-12) and 5% were severe (GCS ≤8), and 148 were missing GCS (Figure 44).

Figure 44. TBI-related 911 transports (N=2,781) by GCS category, GTAs, 2021



EPIC-TBI teaches avoidance of the 3 H's (hypotension, hypoxia, and hyperventilation). Among TBI 911 transports, 3% experienced hypotension and 9% experienced hypoxia, with variation by GCS (Figure 45). Among 48 TBI 911 transports with positive pressure ventilation documented, 38% had end-tidal CO₂ (ETCO₂) levels below 35mmHg indicating hyperventilation, with variation by GCS (Figure 46).

⁵ TBI case definition: Provider primary or secondary impression (eSituation.11/eSituation.12) of S09.90, S02.0, S02.1, S02.8, S02.91, S04.02, S04.03, S04.04, S06, S07.1, T74.4

Figure 45. Percent of TBI-related 911 transports with at least 1 instance of hypotension or hypoxia, GTAs, 2021

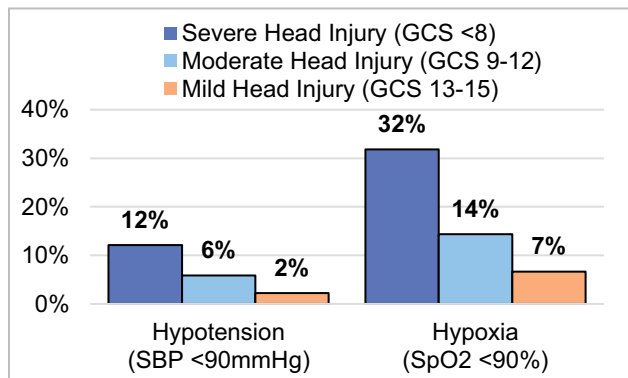
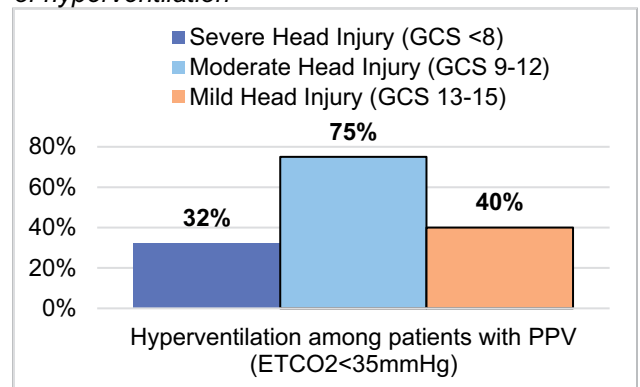
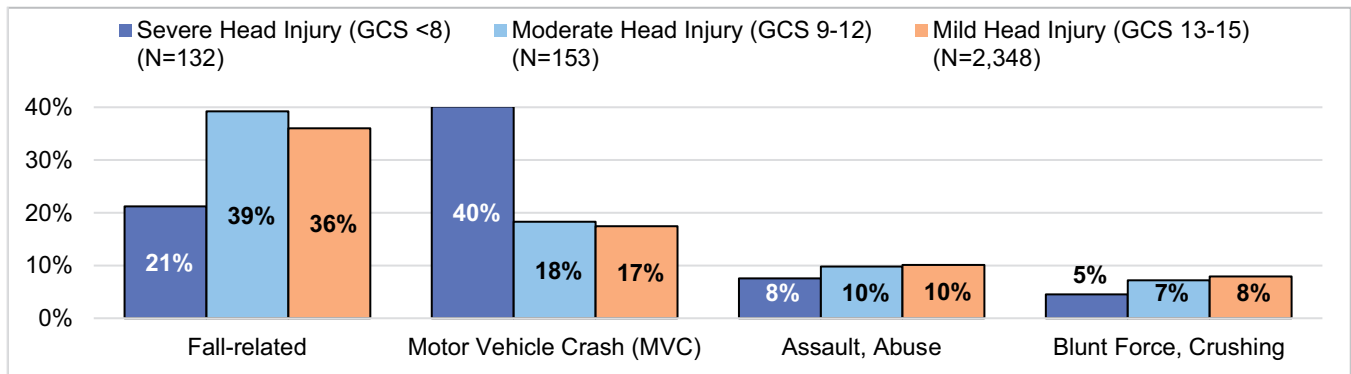


Figure 46. Percent of TBI-related 911 transports with Positive Pressure Ventilation and at least 1 instance of hyperventilation, GTAs, 2021



40% of severe head injuries were related to MVC's while 21% were fall-related. Among moderate and mild head injuries, the reverse pattern was seen: around 40% were fall-related and around 20% were MVC-related

Figure 47. Relative frequency of top causes of injury, TBI-related 911 transports, 2021



SUSPECTED STROKE⁶

As Montana's stroke system of care has grown, the importance of early stroke recognition, documenting time of symptom onset, evaluating the severity of the stroke and pre-notifying a stroke center that a patient is on their way all serve to improve the outcome of this illness. There were 1,798 GTA 911 responses for suspected stroke in 2021. 91% (N=1,634) resulted in transport of the patient. There were 849 IFM transports for stroke, 63% (N=538) were by GTAs and 37% (N=311) by air medical.

Figure 48. Suspected stroke-related 911 response volume by month, GTAs, 2021

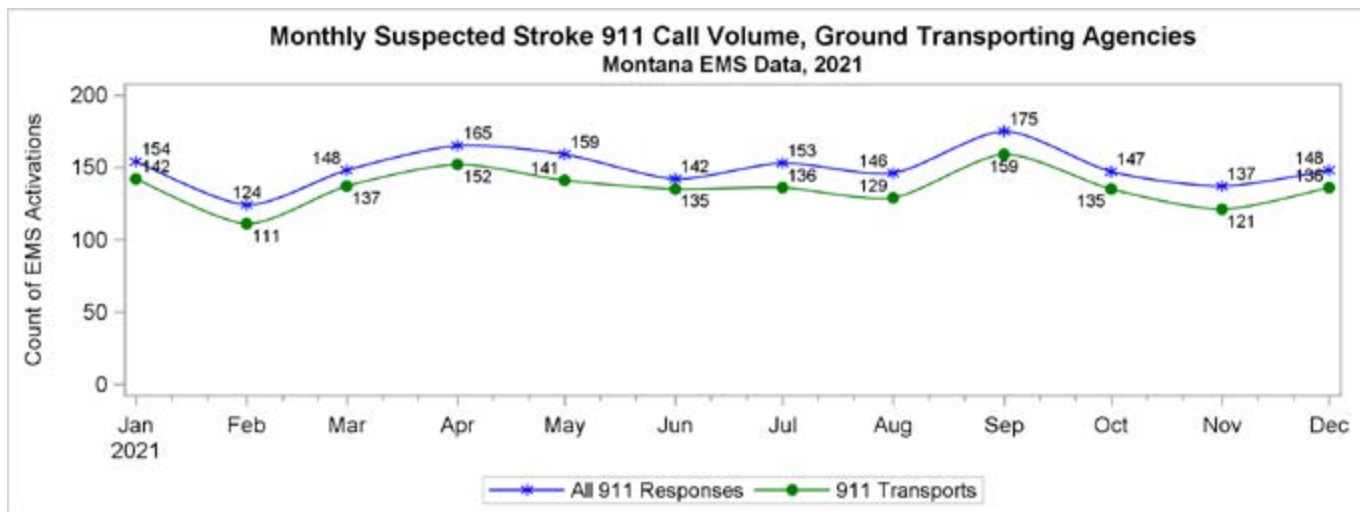
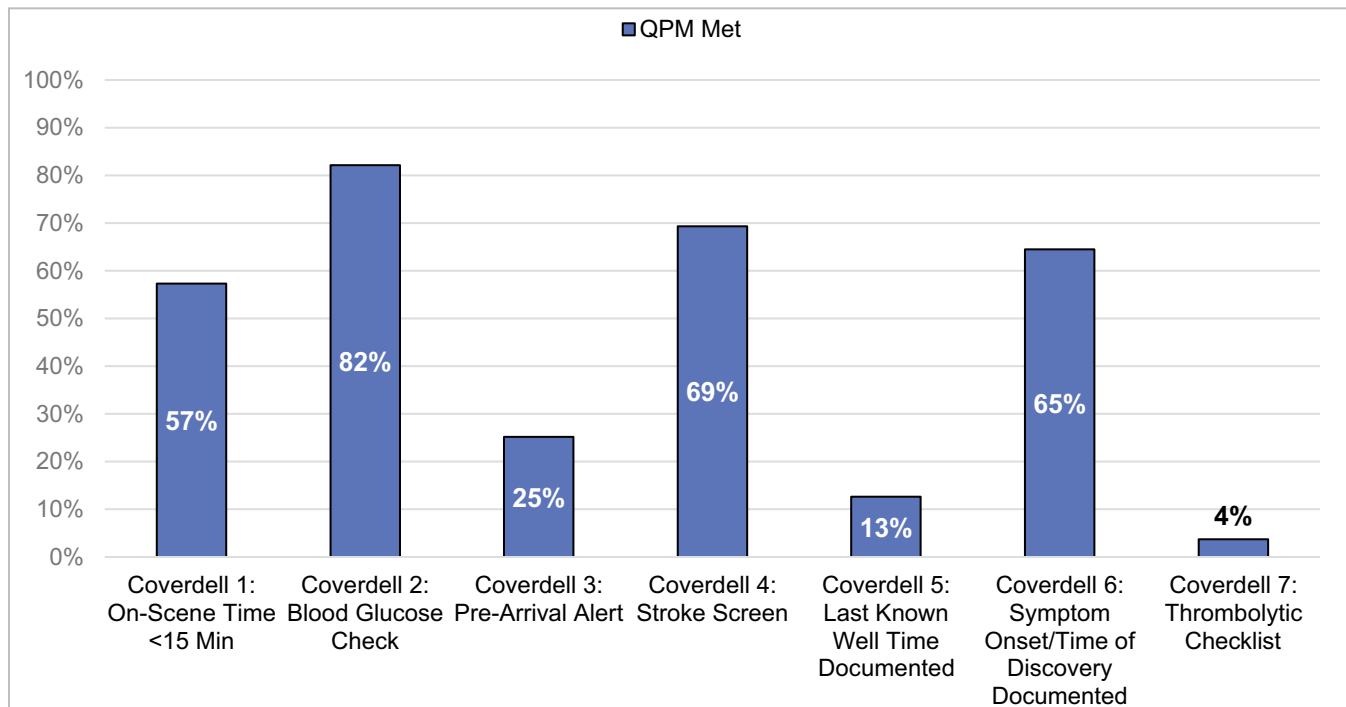


Figure 49. Paul Coverdell National Acute Stroke Program EMS quality performance measures, Suspected stroke 911 transports (N=1,634), GTAs, 2021



⁶ Suspected stroke case definition: Provider primary or secondary impression (eSituation.11/eSituation.12) of I60, I61, I63, G45, G46.3, G46.4; OR Stroke scale score (eVitals.19) = "Positive"

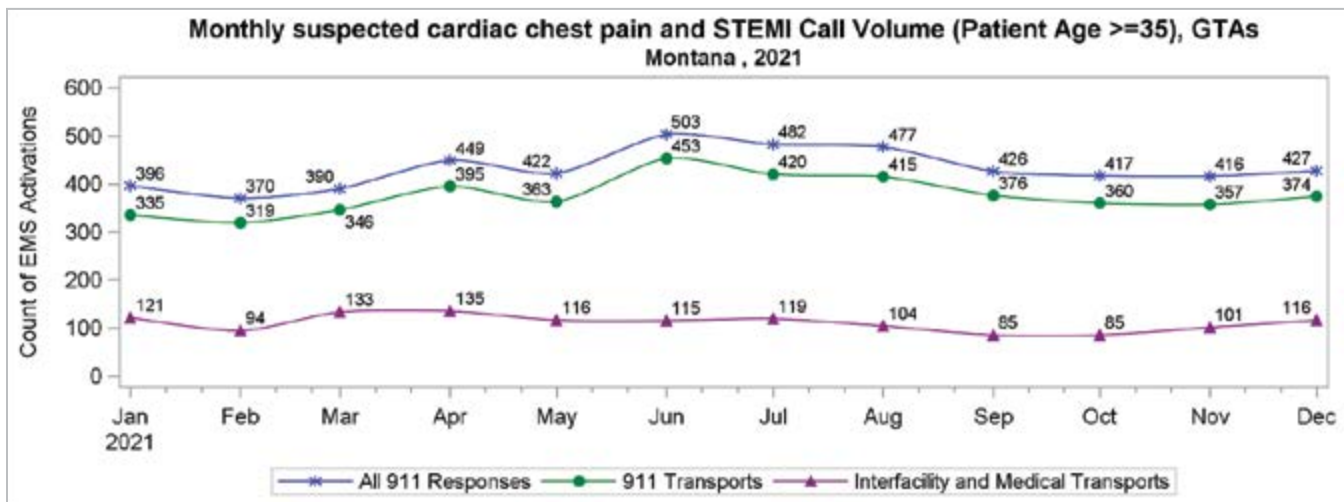
- 1. On-Scene Time <15 Min:** 57% of suspected-stroke 911 transports had an on-scene time less than 15 minutes. The median on-scene time for stroke 911 transports was 13:38 (mm:ss) and the 90th percentile was 23:06. American Heart Association/American Stroke Association recommends an on-scene time of less than 15 minutes because timeliness of pre-hospital care is an important link in the stroke chain of survival.
- 2. Blood Glucose Check:** 82% of suspected-stroke 911 transports had at least one blood glucose level checked and recorded. Assessment of blood glucose as an important pre-hospital intervention in the stroke chain of survival. Hypoglycemia is frequently found in patients with stroke-like symptoms; administering glucose may resolve neurological deficits.
- 3. Pre-Arrival Alert:** 25% of suspected-stroke 911 transports had documentation of EMS calling in a stroke pre-arrival alert to the receiving facility. In 11% of stroke 911 transport records, the EMS provider documented that no pre-arrival alert was provided. Documentation was missing in 62% of records. Stroke pre-notification is an important factor in reducing elapsed time before treatment and ensuring appropriate hospital resources are mobilized before patient arrival to the hospital.
- 4. Stroke Screen:** 69% of suspected-stroke 911 transports had a stroke identification screen or severity scale completed and recorded. Use of stroke screening tools in the pre-hospital is important to ensure priority triage of suspected stroke patients.
- 5. Last Known Well Time Documented:** LKW is the date and time at which the patient was last known to be without the signs and symptoms of the current stroke. This information, along with symptom onset time, is critical to determining eligibility for time-dependent treatments such as thrombolytic therapy or mechanical intervention. 13% of suspected-stroke 911 transports had a documented last known well time that was prior to the documented incident date and time.
- 6. Symptom Onset/Time of Discovery Documented:** Symptom onset is the date/time of the start of the patients' symptoms, or the earliest time that the patient was known to have symptoms. If the event was witnessed, then LKW and Symptom Onset time will be identical. Both should be recorded, even if identical. 65% of suspected-stroke 911 transports had a documented time of discovery (symptom onset) that was prior to the documented incident date and time.
- 7. Thrombolytic Checklist Used:** 3% of suspected-stroke 911 transports had a thrombolytic stroke checklist completed. Currently, Montana's state ePCR form does not have a thrombolytic checklist/worksheet available. This type of checklist identifies possible contraindications to thrombolytic therapy such as current anticoagulant use, recent surgery or trauma, active internal bleeding, and more. Use of thrombolytic stroke checklist tools in the pre-hospital setting may help determine next treatment steps, if communicated effectively to the receiving hospital.

SUSPECTED CARDIAC CHEST PAIN AND STEMI⁷

Many EMS agencies have implemented STEMI systems of care in their communities. This involves training on the recognition of STEMI, early acquisition, interpretation, and hospital notification of the findings from a field 12-lead ECG. In addition, ensuring that patients have supplemental oxygen administration and, when appropriate, the administration of an aspirin all work to improve the care and outcome of STEMI.

There were 4,513 911 transports by GTAs for suspected cardiac chest pain and STEMI (CP/STEMI) among patients aged 35 and older in 2021. 64% of CP/STEMI 911 transports had documentation that a 12-Lead was obtained. 7.3% (N=330) met the STEMI syndrome definition. Additionally, there were 1,324 IFM transports related to CP/STEMI, and 9.8% (N=130) met the STEMI syndrome definition.

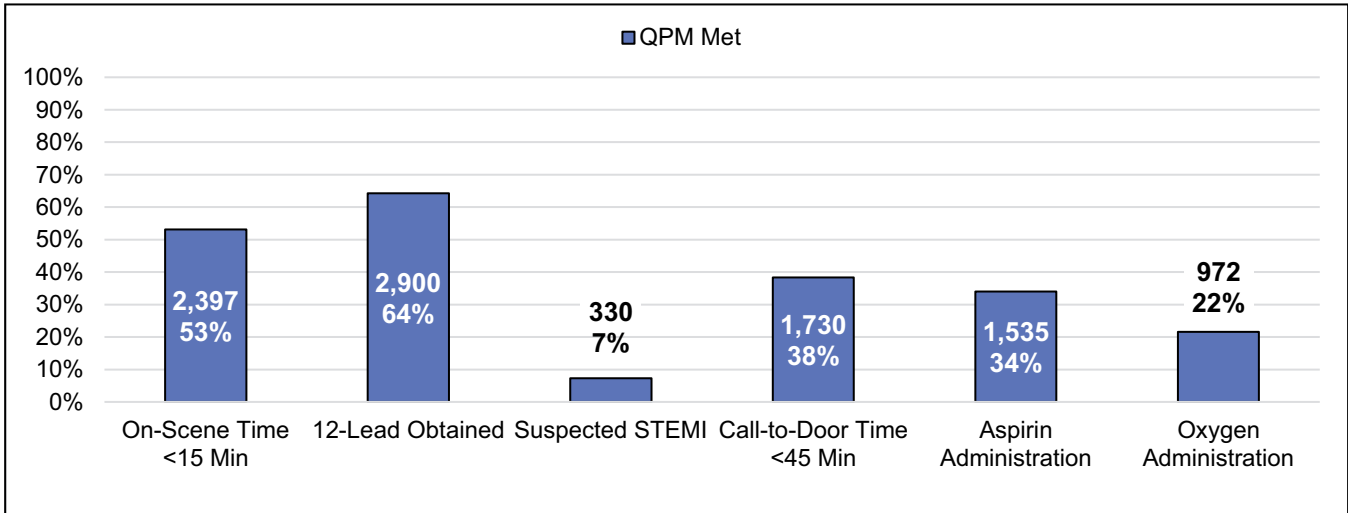
Figure 50. Suspected cardiac chest pain or STEMI system utilization volumes by month (Patients aged 35 and older), GTAs, 2021



⁷ Suspected cardiac chest pain case definition: Provider impression (eSituation.11/eSituation.12) or Symptom (eSituation.09/eSituation.10) of I20-I25, R07.9, R07.89

Suspected STEMI case definition: Provider impression (eSituation.11/eSituation.12) of I21.0-I21.3; OR ECG finding (eVitals.03) = "9901051", "9901053", "9901055", "9901057", or pre-arrival alert (eDisposition.24) - "STEMI"

Figure 51. EMS PI indicators, Suspected cardiac chest pain and STEMI 911 transports (N=4,513), GTAs, 2021



- 1. On-Scene Time <15 Min:** 53% of CP/STEMI 911 transports had an on-scene time less than 15 minutes. The median on-scene time was 14:03 (mm:ss) and the 90th percentile was 24:23. 46% of suspected STEMI 911 transports had an on-scene time less than 15 minutes. AHA recommends an on-scene time of less than 15 minutes because timeliness of pre-hospital care is an important link in the cardiac chain of survival.
- 2. 12-Lead Obtained:** 64% of CP/STEMI 911 transports had documentation that a 12-Lead was obtained.
- 3. Suspected STEMI:** 7% (N=330) of suspected cardiac chest pain and STEMI 911 transports were classified as suspected STEMI based on ECG results or provider primary/secondary impression of STEMI.
- 4. Call-to-Door Time:** Call-to-door time measures the time from when 911 was called until patient arrival at the destination facility- it does not capture care given in the hospital setting. AHA recommends less than 90 minutes from first medical contact to STEMI intervention by the hospital. 38% of CP/STEMI 911 transports had a call-to-door time less than 45 minutes. 50% (N=2,284) records were missing or had excluded call-to-door time values. The median call-to-door time was 34:00 and the 90th percentile was 1:00:05.
- 5. Aspirin Administration:** 34% of CP/STEMI 911 transports received aspirin. Aspirin inhibits platelet aggregation and can slow damage to the heart muscle and has a Class I indication for use in STEMI patients by the AHA meaning there is strong evidence and /or agreement that it helpful and good for the patient.
- 6. Oxygen Administration:** 22% of CP/STEMI 911 transports received oxygen.

STEMI

There were 330 suspected STEMI 911 transports for patients aged 35 or older by GTAS during 2021.

Figure 52. Suspected STEMI system utilization volumes by month (Patients aged 35 and older), GTAs, 2021

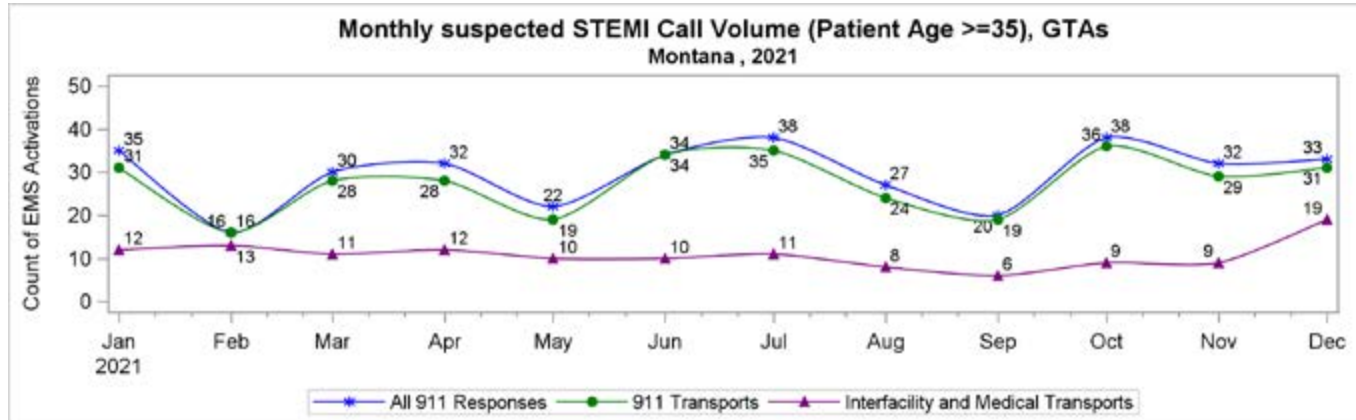
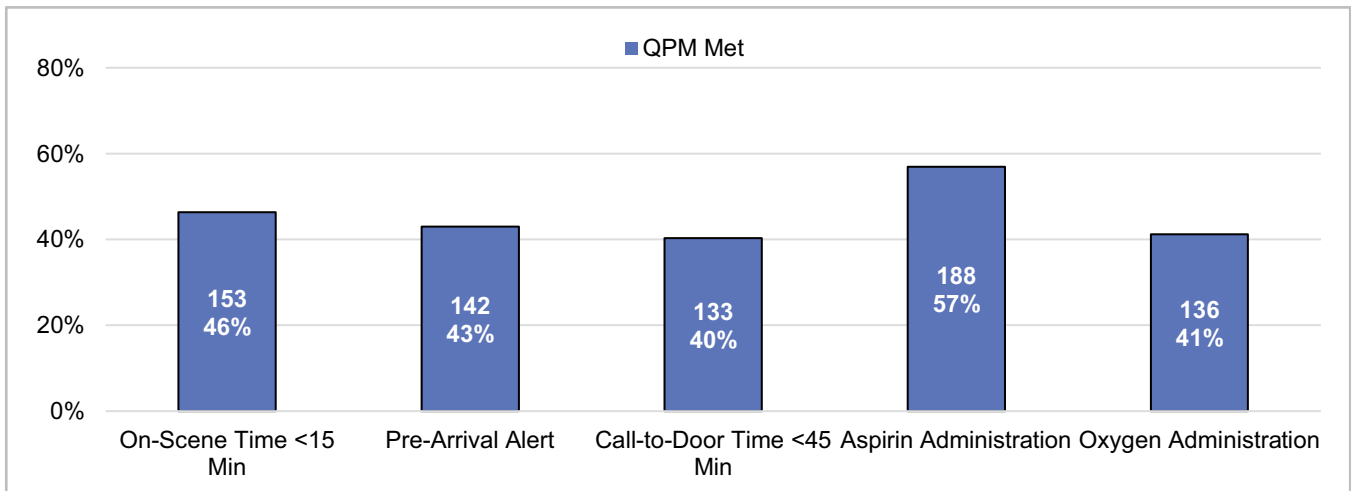


Figure 53. EMS PI indicators, Suspected STEMI 911 transports (N=330), GTAs, 2021



- 1. On-Scene Time <15 Min:** 46% of suspected STEMI 911 transports had an on-scene time less than 15 minutes.
- 2. Pre-Arrival Alert for STEMI:** 43% of suspected STEMI 911 transports had documentation of EMS calling in a STEMI pre-arrival alert to the receiving facility. 4% had documentation that no pre-arrival alert was provided. Documentation was missing in 49% of records. Pre-notification is an important factor in reducing elapsed time before treatment and ensuring appropriate hospital resources are mobilized before patient arrival to the hospital.
- 3. Call-to-Door Time:** 40% of suspected STEMI 911 transports had a call-to-door time less than 45 minutes.
- 4. Aspirin Administration:** 57% of suspected STEMI patients received aspirin.
- 5. Oxygen Administration:** 41% of suspected STEMI 911 transports received oxygen.

OUT-OF-HOSPITAL CARDIAC ARREST (OHCA)⁸

Agencies that adopt hands-only CPR with minimally interrupted chest compressions along with educating the community on the importance of citizen CPR and community AED use dramatically improve the outcomes from individuals that suffer out-of-hospital cardiac arrest.

There were 1,015 GTA 911 responses for OHCA with presumed cardiac etiology in 2021. Overall, 39% (N=395) of OHCA 911 responses resulted in transport of the patient. 633 (62%) had patient disposition of “dead at scene” (Table 26). Resuscitation was attempted for 64% (N=406) of the patients who were dead at scene. 34% of OHCA 911 transports had documentation of EMS calling in a cardiac arrest or STEMI pre-arrival alert to the receiving facility. 2% had documentation that no pre-arrival alert was provided. Documentation was missing in 64% of records.

Figure 54. Presumed cardiac OHCA 911 response volume by month, GTAs, 2021

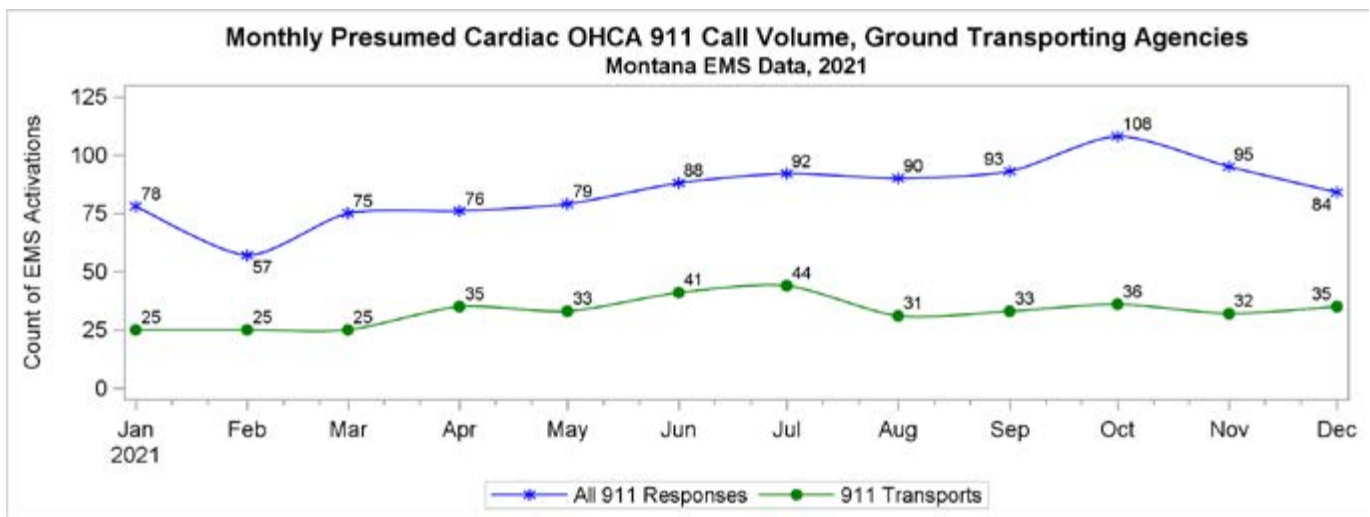
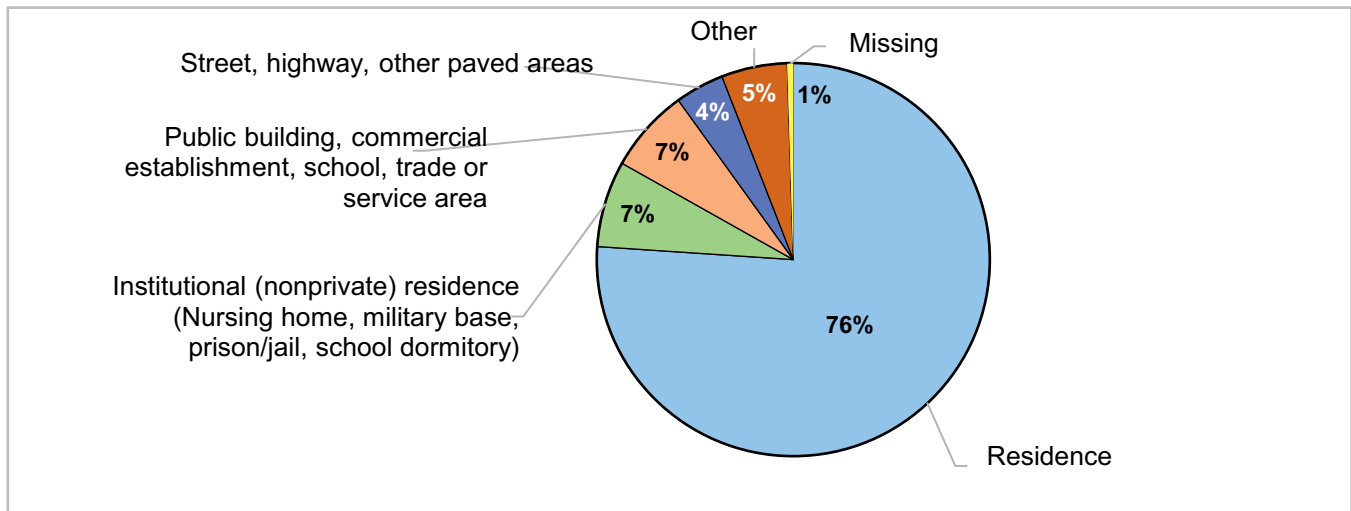


Table 26. Patient dead at scene, Presumed Cardiac OHCA 911 Responses by Patient Disposition, GTAs, 2021

Patient Dead at Scene	Patient Not Transported	Patient Transported	All
Resuscitation attempted by Responding EMS Unit	384	22	406
No resuscitation attempted by Responding EMS Unit	211	16	227
All	595	38	633

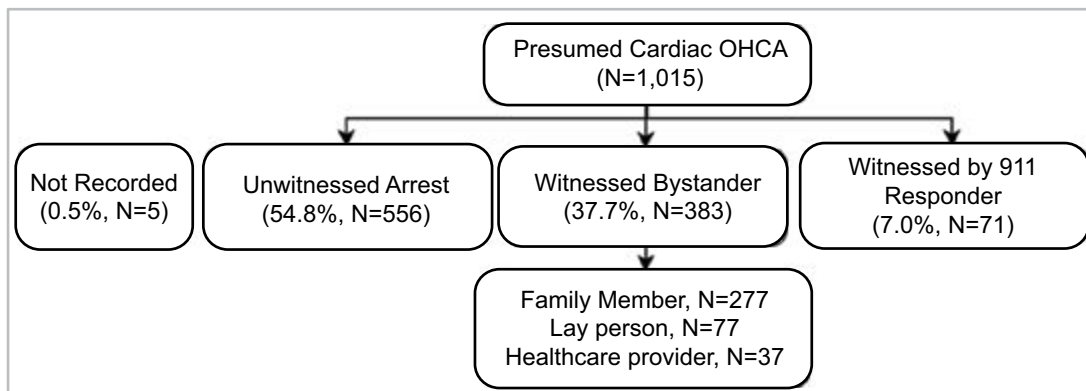
⁸ Presumed cardiac OHCA case definition: Cardiac Arrest (eArrest.01) = “Yes, Prior to EMS Arrival” or “Yes, After EMS Arrival” AND Cardiac arrest etiology (eArrest.02) = “Cardiac (Presumed)”

Figure 55. Location of the arrest, Presumed cardiac OHCA 911 responses (N=1,015), GTAs, 2021



The majority of OHCA occurred in residences (76%), followed by institutional residences, and public places.

Figure 56. Arrest witnessed by, Presumed cardiac OHCA 911 responses, GTAs, 2021



*The data field "Arrest witnessed by" allows multiple selections, therefore the sum may be greater than the total number of OHCA (N=1,015).

Of 1,015 GTA 911 responses for presumed cardiac etiology OHCA, 55% were unwitnessed or not recorded, 38% were witnessed by a bystander, and 7% were witnessed by EMS personnel (Figure 56). Table 27 reports unwitnessed, bystander witnessed, and 911 responder witnessed OHCA by initial arrest rhythm as well as bystander intervention, which forms the basis for the Utstein style OHCA reporting framework.¹¹

Table 27. Presumed cardiac OHCA 911 responses by initial rhythm and bystander intervention, GTAs, 2021

	Cardiac Arrest Unwitnessed/ Not Recorded		Cardiac Arrest Witnessed by Bystander		Cardiac Arrest Witnessed by 911 Responder		All	
	N	%	N	%	N	%	N	%
Initial Arrest Rhythm								
Asystole	380	68%	169	44%	13	18%	562	55%
Shockable Initial Rhythm*	58	10%	99	26%	22	31%	179	18%
Other Initial Rhythm^	92	16%	107	28%	36	51%	235	23%
Not Recorded/Not Applicable	31	6%	8	2%	0	0%	39	4%
CPR provided prior to EMS arrival?								
Yes	241	43%	224	58%	5	7%	470	46%
No	260	46%	116	30%	57	80%	433	43%
Not Recorded	60	11%	43	11%	9	13%	112	11%
AED used prior to EMS arrival?								
Yes, with defibrillation	23	4%	49	13%	2	3%	74	7%
Yes, Applied without defibrillation	89	16%	58	15%	2	3%	149	15%
No	445	79%	271	71%	66	93%	782	77%
Not Recorded	4	1%	5	1%	1	1%	10	1%
Total	561	100%	383	100%	71	100%	1015	100%

*VF, TF, Unknown shockable rhythm; ^PEA, Unknown Non-Shockable rhythm

The Utstein framework allows for identification of the following important subgroups that highlight the contribution of cardiac rhythm and bystander actions as key determinants of resuscitation outcome:

- 1. Overall:** All presumed cardiac OHCA
- 2. Unwitnessed:** Unwitnessed presumed cardiac OHCA
- 3. Bystander Witnessed:** Presumed cardiac OHCA witnessed by a bystander (anyone, including healthcare providers, who was not part of the dispatched response)
- 4. Utstein:** Bystander witnessed and found in shockable rhythm (Shockable rhythms include: Ventricular tachycardia, Ventricular fibrillation, Supraventricular tachycardia, AED-advised unknown shockable rhythm)
- 5. Utstein Bystander:** Bystander witnessed, found in shockable rhythm, and received some bystander intervention prior to EMS arrival (CPR and/or AED)
- 6. 911 responder witnessed:** Presumed cardiac OHCA witnessed by EMS personnel who were part of the dispatched response. This refers to cardiac arrests that occurred after EMS arrival.
- 7. 911 responder witnessed and found in shockable rhythm:** Witnessed by EMS personnel, found in shockable rhythm

A successful resuscitation outcome is defined by return of spontaneous circulation (ROSC), signs of which may include breathing (more than an occasional gasp), coughing, movement, a palpable pulse or a measurable blood pressure. “Any ROSC” refers to a brief (approximately >30 seconds) restoration of spontaneous circulation that provides evidence of more than an occasional gasp, occasional fleeting palpable pulse, or arterial waveform. “Sustained ROSC” is deemed to have occurred when chest compressions are not required for 20 consecutive minutes and signs of circulation persist. Table 28 shows the rate of “Any ROSC” as well as “Sustained ROSC” by subgroup.

Table 28. Rates of Any ROSC and Sustained ROSC of presumed cardiac OHCA 911 responses, GTAs, 2021

Utstein Subgroup	Any ROSC		Sustained ROSC >20 Min		Total Denominator
	N	%	N	%	
Overall:	216	21%	41	4%	1015
Unwitnessed	63	11%	12	2%	556
Bystander Witnessed	120	31%	19	5%	383
Utstein	50	51%	13	13%	99
Utstein Bystander	40	50%	13	16%	80
911 responder witnessed	31	44%	10	14%	71
911 responder witnessed and found in shockable rhythm	15	68%	7	32%	22

When an OHCA was witnessed by EMS personnel and the patient's initial cardiac rhythm was shockable, 32% of presumed cardiac OHCA 911 responses resulted in sustained ROSC, and 68% resulted in any ROSC. In comparison, under less ideal conditions with an unwitnessed arrest, 2% resulted in sustained ROSC and 11% any ROSC.

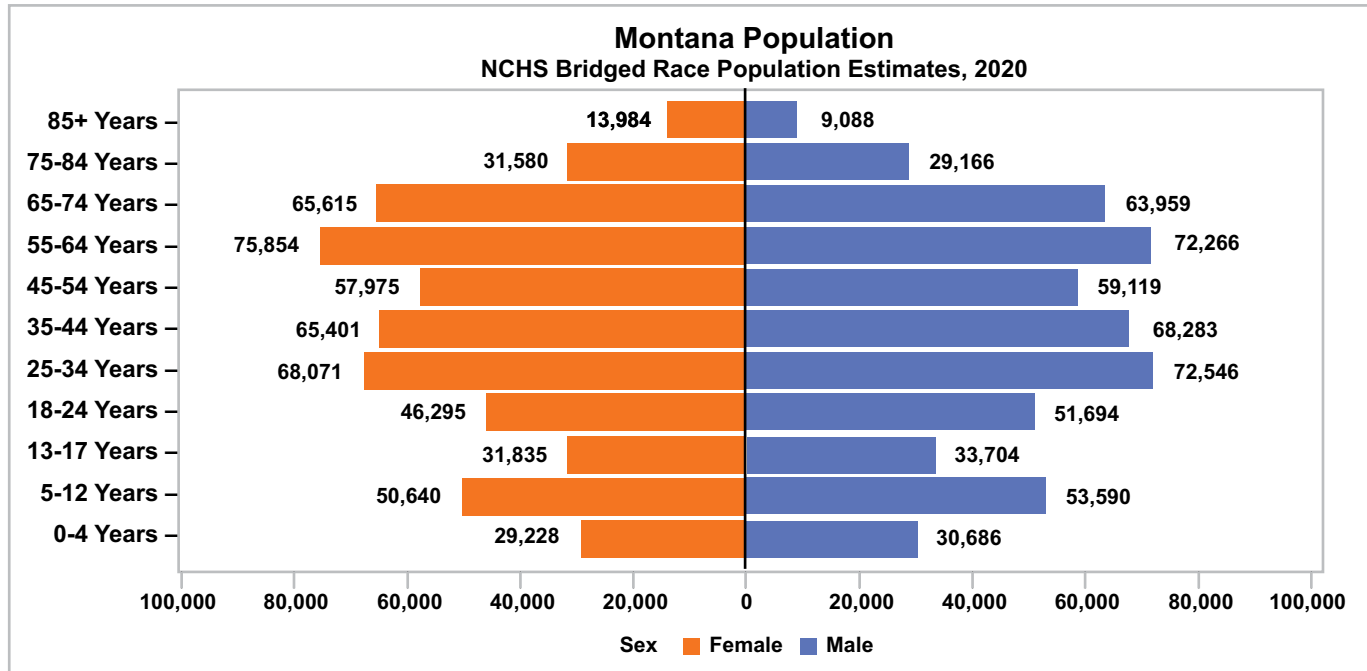


MEDICATION ADMINISTRATION TABLE (TOP 50)

	Medication Name with Rx NORM Code		Count of EMS Activations	Count of Doses
1	7806	Oxygen	12,472	13,227
2	26225/66981	Ondansetron (Zofran)	4,054	4,283
3	4337	Fentanyl	3,922	6,840
4	125464	Normal saline	3,467	3,571
5	1191	Aspirin	1,863	1,865
6	4917	Nitroglycerin	1,158	1,530
7	285059/ 214199/ 542137	Albuterol/Ipratropium (DuoNeb)	1,086	1,144
8	35629/ 1008377	Lactated Ringer's Solution	1,022	1,039
9	435	Albuterol (Proventil)	995	1,209
10	6960/11177	Midazolam (Versed)	970	1,412
11	7052	Morphine	797	1,195
12	6470/202479	Lorazepam (Ativan)	764	1,027
13	317361	Epinephrine 1:10,000 (0.1 mg/mL)	714	2,202
14	7242	Naloxone (Narcan)	672	817
15	6130	Ketamine (Ketalar)	568	1,068
16	237653	Dextrose 50% Injectable Solution	374	391
17	4850/377980	Glucose (Oral Forms)	342	390
18	373902	Sodium Chloride Irrigation Solution	313	341
19	7512/227559	Norepinephrine (Levophed)	251	320
20	5224	Heparin	244	253
21	224913/ 3423	Hydromorphone (Dilaudid)	237	442
22	328316/727374/566760	Epinephrine 1:1000 (1 mg/mL)	218	433
23	6902/ 203856	Methylprednisolone (Solu-MEDROL)	208	209
24	3498	Diphenhydramine (Benadryl)	207	213
25	8782	Propofol (Diprivan)	195	263
26	237648/1795480	Dextrose 10% Injectable Solution	185	194
27	703	Amiodarone (Cordarone)	163	220
28	36676	Sodium Bicarbonate	152	158
29	9863	Sodium Chloride	132	135
30	68139	Rocuronium (Zemuron)	102	122
31	4832	Glucagon (Glucagen)	101	103
32	7213	Ipratropium (Atrovent)	92	98
33	7486	Nitrous Oxide	88	89
34	296	Adenosine (Adenocard)	87	124
35	8745	Promethazine (Phenergan)	85	89
36	1223/ 370624	Atropine	83	95
37	7396/ 151490	Nicardipine (Cardene)	77	95
38	3322	Diazepam (Valium)	75	103
39	5093	Haloperidol (Haldol)	72	78
40	6585	Magnesium Sulfate	62	69
41	71535	Vecuronium (Norcuron)	62	87
42	11124	Vancomycin	57	62
43	8163	Phenylephrine (Neo-Synephrine)	53	65
44	10691	Tranexamic Acid	52	57
45	309778	Dextrose 5% Injectable Solution	51	51
46	5856	Insulin	47	51
47	3992	Epinephrine Auto-Injector	44	82
48	3443	Diltiazem (Cardizem)	42	51
49	8591	Potassium Chloride	38	39
50	6915	Metaclopramide	37	41

APPENDIX 1.

MONTANA POPULATION CHARACTERISTICS¹



ACRONYMS

Acronym	Meaning
AED	Automatic External Defibrillator
AMA	Air Medical Agency
CAH	Critical Access Hospital
CPR	Cardio-pulmonary Resuscitation
EMS	Emergency Medical Services
EPIC	Excellence in Pre-hospital Injury Care
ePCR	Electronic Patient Care Report
FWA	Fixed Wing Agency
GCS	Glasgow Coma Scale
GTA	Ground Transporting Agency
HR	Heart Rate
IFMT	Interfacility and Medical Transport
IHS	Indian Health Service
MVC	Motor Vehicle Crash
NEMSIS	National Emergency Medical Services Information System
NTA	Non-Transporting Agency
OHCA	Out-of-Hospital Cardiac Arrest
PCR	Patient Care Report
ROSC	Return of Spontaneous Circulation
RR	Respiratory Rate
RWA	Rotor Wing Agency
SBP	Systolic Blood Pressure
SpO2	Oxygen Saturation
STCC	State Trauma Care Committee
STEMI	ST-segment Elevated Myocardial Infarction
TBI	Traumatic Brain Injury
TTA	Trauma Team Activation

LIST OF TABLES

Table 1. EMS activations by patient disposition and agency type, 2021.....	7
Table 2. EMS activations by patient disposition and response type, GTAs, 2021	10
Table 3. 911 response demand analysis showing percentage of total N=103,803, GTAs, 2021	11
Table 4. Reason for 911 responses with no patient transport, GTAs, 2021	12
Table 5. Top 10 primary impressions, 911 transports (N=67,449)*, GTAs, 2021	13
Table 6. Primary Impression for 911 Transports with Lights and Sirens during patient transport, GTAs, 2021.....	13
Table 7. Distance traveled to the scene, 911 transports, GTAs, 2021	15
Table 8. Distance traveled from scene to destination, 911 transports, GTAs, 2021.....	15
Table 9. IFMT response demand analysis showing percentage of total N=25,881, All IFMT responses, GTAs, 2021.....	16
Table 10. Top 10 primary impressions, IFM transports where the sending facility was a critical access or Indian Health Service (CAH/IHS) hospital (N=8,249)*, GTAs, 2021	18
Table 11. Top 10 primary impressions, IFM transports where the sending facility was a non-CAH/IHS hospital or clinic (N=7,157)*, GTAs, 2021.....	18
Table 12. Distance traveled to the sending facility, Interfacility and medical transports, GTAs, 2021.....	20
Table 13. Distance traveled from sending facility to destination, Interfacility and medical transports, GTAs, 2021.....	20
Table 14. EMS activations by patient disposition and response type, NTAs, 2021	21
Table 15. 911 Response demand analysis showing percentage of total N=6,235, NTAs, 2021.....	22
Table 16. Top 10 primary impressions, All 911 responses (N=6,235)*, NTAs, 2021.....	22
Table 17. EMS activations by patient disposition and response type, Fixed and rotor wing AMAs, 2021.....	25
Table 18. 911 response demand analysis showing percentage of total N=601, RWAs, 2021.....	26
Table 19. Reason for 911 responses with no patient transport, RWAs, 2021.....	27
Table 20. Top 10 primary Impressions, 911 transports (N=417)*, RWAs, 2021.....	28
Table 21. IFMT response demand analysis showing percentage of total N=4,600, Fixed and rotor wing AMAs, 2021	29
Table 22. Top 10 primary impressions, IFM transports (N=1,846)*, RWAs, 2021.....	32
Table 23. Top 10 primary impressions, IFM transports (N=2,644)*, FWAs, 2021.....	32
Table 24. Alcohol/drug exposure-related 911 responses, GTAs, 2021	37
Table 25. Provider Primary Impressions for Mental and behavioral health related EMS activations, 2021	38
Table 26. Patient dead at scene, Presumed Cardiac OHCA 911 Responses by Patient Disposition, GTAs, 2021.....	51
Table 27. Presumed cardiac OHCA 911 responses by initial rhythm and bystander intervention, GTAs, 2021.....	53
Table 28. Rates of Any ROSC and Sustained ROSC of presumed cardiac OHCA 911 responses, GTAs, 2021.....	54

LIST OF FIGURES

Figure 1.	Map of all 911 responses by county (age-adjusted rate per 100,000 population), Montana, 2021.....	8
Figure 2.	Weekly count of all 911 responses, 2021	8
Figure 3.	Map of all IFMT responses by county (age-adjusted rate per 100,000 population), Montana, 2021.....	9
Figure 4.	Weekly count of all IFMT responses, 2021.....	9
Figure 5.	System utilization volumes by month, GTAs, 2021	10
Figure 6.	Scene location, All 911 responses (N=103,803), GTAs, 2021.....	11
Figure 7.	Age-sex pyramid*, 911 transports, GTAs, 2021.....	12
Figure 8.	Patient race/ethnicity distribution, 911 transports (N=67,449), GTAs, 2021.....	12
Figure 9.	Lights and sirens during patient transport, 911 transports (N=67,449) GTAs, 2021.....	13
Figure 10.	Median and 90th percentile response times, 911 transports (N=57,139), Paid GTAs, 2021.....	14
Figure 11.	Median and 90th percentile response times, 911 transports (N=10,310), Volunteer GTAs, 2021	14
Figure 12.	Sending facility, All IFMT responses (N=25,881), GTAs, 2021	16
Figure 13.	Age-sex pyramid*, IFM transports, GTAs, 2021.....	17
Figure 14.	Patient race/ethnicity distribution, IFM transports (N=23,938), GTAs, 2021.....	17
Figure 15.	Median and 90th percentile response times, IFM transports (N=20,920), Paid GTAs, 2021.....	19
Figure 16.	Median and 90th percentile response times, IFM transports (N=3,018), Volunteer GTAs, 2021	19
Figure 17.	System utilization volumes by month, NTAs, 2021	21
Figure 18.	Age-sex pyramid*, All 911 responses, NTAs, 2021.....	23
Figure 19.	Patient race/ethnicity distribution, All 911 responses (N=6,235), NTAs, 2021.....	23
Figure 20.	Median and 90th percentile response times, All 911 responses (N=5,981), Paid NTAs, 2021.....	24
Figure 21.	Median and 90th percentile response times, All 911 responses (N=254), Volunteer NTAs, 2021.....	24
Figure 22.	System utilization volumes by month, Fixed and rotor wing AMAs, 2021	25
Figure 23.	Scene location, All 911 responses (N=601), RWAs, 2021.....	26
Figure 24.	Age-sex pyramid*, 911 transports, RWAs, 2021	27
Figure 25.	Patient race/ethnicity distribution, 911 transports (N=417), RWAs 2021	27
Figure 26.	Median and 90th percentile response times, 911 transports (N=417), RWAs, 2021.....	28
Figure 27.	Age-sex pyramid*, IFM transports, Fixed and rotor wing AMAs, 2021.....	30
Figure 28.	Patient race/ethnicity distribution, IFM transports (N=4,490), Fixed and rotor wing AMAs, 2021.....	30
Figure 29.	Median and 90th percentile response times, IFM transports, Sending facility= CAH and IHS hospitals (N=2,675), Fixed and rotor wing AMAs, 2021	32
Figure 30.	Median and 90th percentile response times, IFM transports, Sending facility= Other Hospitals and Clinics (N=1,405), Fixed and rotor wing AMAs, 2021.....	32
Figure 31.	Alcohol or drug exposure-related system utilization volumes by month, GTAs, 2021	34

LIST OF FIGURES

Figure 32. Relative frequency of substances involved, alcohol/drug exposure-related 911 responses (N=8,799), GTAs, 2021.....	34
Figure 33. Opioid overdose-related versus non-opioid EMS activations with naloxone administered, by month, All EMS agencies, 2021.....	36
Figure 34. Self-harm related EMS Activations by age group and sex, 2021.....	38
Figure 35. Trauma-related 911 response volumes by month, GTAs/RWAs, 2021.....	39
Figure 36. Completion rate of initial vital sign documentation, Trauma-related 911 transports, GTAs/RWAs, 2021.....	39
Figure 37. Relative frequency of top 10 causes of injury*, Trauma-related 911 transports, GTAs/RWAs, 2021.....	40
Figure 38. Number and percentage of trauma-related 911 transports by GCS category, GTAs/RWAs, 2021.....	40
Figure 39. Rate of pre-hospital trauma team activation by GCS category, Trauma-related 911 transports, GTAs/RWAs, 2021.....	41
Figure 40. EMS performance improvement indicators, Trauma-related 911 transports meeting activation criteria, GTAs/RWAs, 2021.....	41
Figure 41. Trauma-related IFM transport volumes by month, GTAs and AMAs, 2021.....	42
Figure 42. Relative frequency of top causes of injury, Trauma-related IMF Transports, GTAs and AMAs, 2021.....	42
Figure 43. TBI-related 911 response volume by month, GTAs, 2021.....	43
Figure 44. TBI-related 911 transports (N=2,781) by GCS category, GTAs, 2021.....	43
Figure 45. Percent of TBI-related 911 transports with at least 1 instance of hypotension or hypoxia, GTAs, 2021.....	44
Figure 46. Percent of TBI-related 911 transports with Positive Pressure Ventilation and at least 1 instance of hyperventilation, GTAs, 2021.....	44
Figure 47. Relative frequency of top causes of injury, TBI-related 911 transports, 2021.....	44
Figure 48. Suspected stroke-related 911 response volume by month, GTAs, 2021.....	45
Figure 49. Paul Coverdell National Acute Stroke Program EMS quality performance measures, Suspected stroke 911 transports (N=1,634), GTAs, 2021.....	45
Figure 50. Suspected cardiac chest pain or STEMI system utilization volumes by month (Patients aged 35 and older), GTAs, 2021.....	47
Figure 51. EMS PI indicators, Suspected cardiac chest pain and STEMI 911 transports (N=4,513), GTAs, 2021.....	47
Figure 52. Suspected STEMI system utilization volumes by month (Patients aged 35 and older), GTAs, 2021.....	48
Figure 53. EMS PI indicators, Suspected STEMI 911 transports (N=330), GTAs, 2021.....	48
Figure 54. Presumed cardiac OHCA 911 response volume by month, GTAs, 2021.....	50
Figure 55. Location of the arrest, Presumed cardiac OHCA 911 responses (N=1,015), GTAs, 2021.....	51
Figure 56. Arrest witnessed by, Presumed cardiac OHCA 911 responses, GTAs, 2021.....	51

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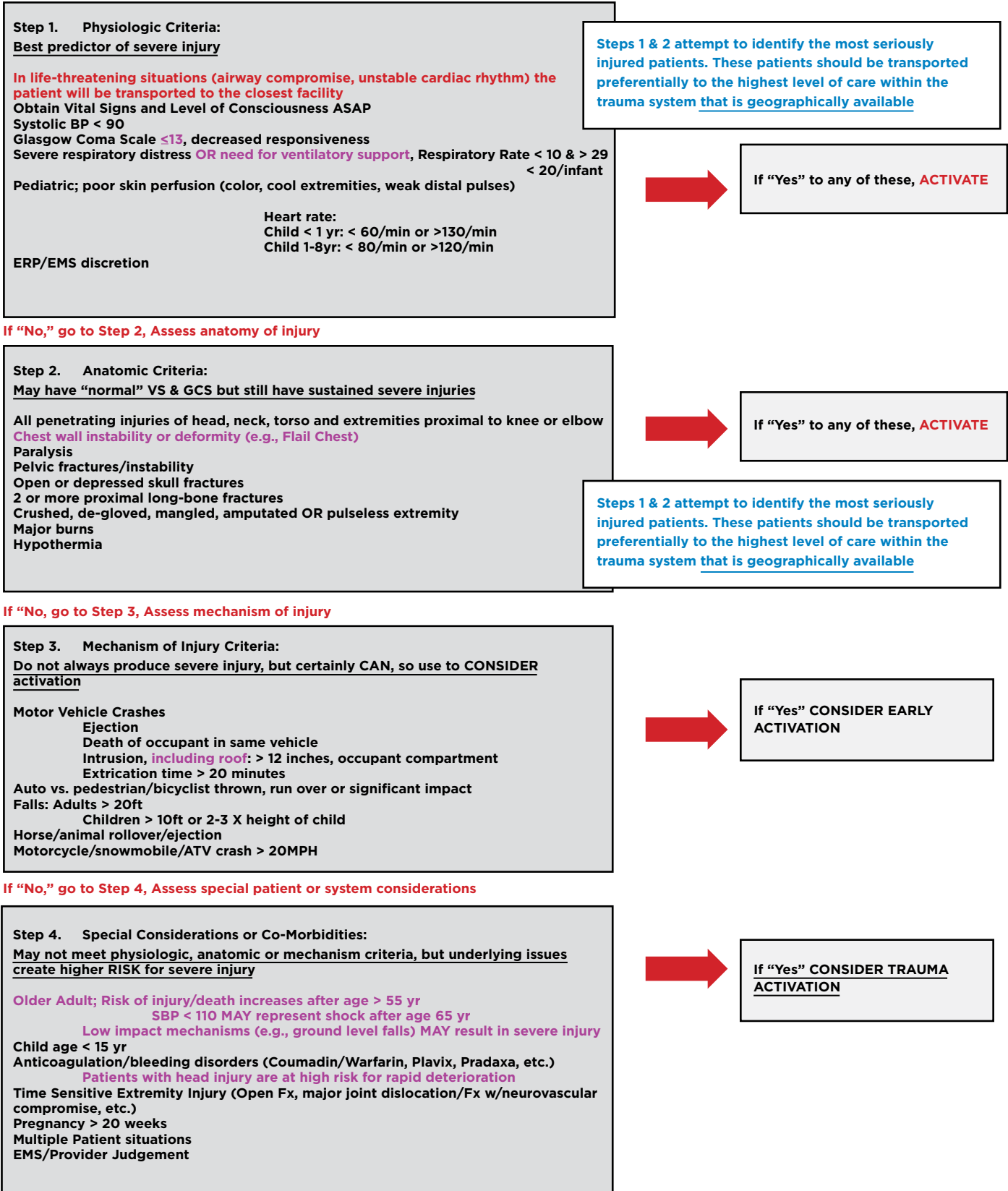
Montana Field Trauma Decision Scheme/Trauma Team Activation Criteria

EMS & Facilities should utilize these criteria to identify patients needing trauma team activation

Goals for all phases of care include early identification, communications with EMS/medical control/facilities and notification to enhance effectiveness

While these criteria are presented in sequential fashion, using all applicable criteria to identify significantly injured patients is advised

Trauma Patients with severe injuries should be transported preferentially to the highest level of care within the trauma system geographically available





MONTANA
EMS, TRAUMA SYSTEMS &
INJURY PREVENTION PROGRAM