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Original Research

Establishing Transport Statistics: Results From the Medevac Transport Statistics Survey

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A B S T R A C T

Objective: The purpose of this article was to report the results of a national survey of medical transport programs to establish national estimates of critical care transports and use those results combined with other data sources to generate annual transport volume estimates.
Methods: An online survey was administered to collect transport statistics from medical transport programs registered in the Association of Air Medical Services Atlas and Database of Air Medical services in 2015.
Results: Roughly 20% of all registered programs participated. An estimated 640,000 critical care transports are conducted annually; an additional breakdown by mode of transfer is presented.
Conclusion: Low participation rates preclude establishing precise critical care transport statistics. Future participation is encouraged to enable more accurate data reporting to establish resources that can support research and policy initiatives.

Although there are robust resources that report statistics for many medical conditions and diseases provided by the Centers for Disease Control and Prevention and other agencies, there are no publically available resources that comprehensively report medical transport statistics completed by critical care transport programs. Currently, there are only several available statistics addressing medical transport. The first is that approximately 1.6 million patients are transferred between hospitals annually,[1] not accounting for prehospital patient transports or discerning the mode of transport. The second and most often citied statistic is 400,000 rotor wing (RW) transports annually with another 100,000+ transports via fixed wing (FW), provided by the Association of Air Medical Services (AAMS) via their News Room website.[2] The third source is the annual HEMS Accidents and Risk Reports that estimates about 300,000 patients being flown by RW annually.[3] Another more recent source is the Air Medical Services Cost Study[4] that reports 13,519 FW and 76,870 RW Medicare claims in 2014. Each of these sources only provides either the total trip volume or transport mode–specific data, with each not accounting for all aspects of critical care transport. The purpose of this article was to report the results of a national survey of medical transport programs to establish national estimates of critical care transports and use those results combined with other data sources to generate annual transport volume estimates for comparison.

Methods

Primary data were collected via an online survey entitled Medevac Transport Statistics. The survey consisted of 5 questions to identify 1) which AAMS region the transport program was located in (question 1), 2) how many patient transports were conducted in 2015 (question 2), and questions 3-5) how many transports were completed by each mode of transport (RW, FW, or critical care ground [CCG] [questions 3-5]). To ensure reliability in identifying how many patients are transported annually, we only accounted for transports in which patients were actually transported; any other mission profiles that included a response without a corresponding patient transport were not included. CCG was defined as ground transports above the level of advanced life support.

The survey was administered via Qualtrics online survey platform (Qualtrics, Provo, UT). Participation was invited by e-mail to all 300 medical transport programs registered on the AAMS Atlas and Database of Air Medical Services.[5] The survey was deemed nonhuman subjects research and, therefore, was exempt from institutional review board oversight.

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Secondary Data Sources

The following secondary data sources were used to compare with the estimates generated from our survey results. Secondarily, the other data were used in combination with our survey results to generate additional annual transport volume estimates.

Atlas and Database of Air Medical Services

The atlas[5] (ADAMS) is produced annually by the Association for Air Medical Services and contains the total number of transport programs and geospatial location of every RW and FW base that responds to medical and trauma scenes in the 50 United States. For this study, we used the 2015 atlas that coincides with the year of data collected from the transport programs in our survey.

Air Medical Services Cost Study Report

The Air Medical Services Cost Study Report[4] was completed in 2017 to quantify the current costs associated with providing emergent air medical transport services, with the goal of providing data to inform current policy efforts related to Medicare reform. Data were collected from 191 of the 300 programs in service in 2017 and reported the average cost per transport across all transport programs. The payer mix, percentage of total volume completed by payer mix, and Centers for Medicare and Medicaid claims data from 2014 were used from the Air Medical Services Cost Study to generate annual transport statistics for our survey.

A Statistical Analysis of HEMS Accidents and Risk

The Analysis of HEMS Accidents[3] is presented annually at the Air Medical Transport Conference. In addition to providing in-depth analysis of the previous year's accidents, it also provides updated statistics on the number of transport programs, the number of helicopters, and the average number of patients and hours flown per helicopter. The number of helicopters and the average number of patients flown per helicopter were used to generate annual transport statistics.

Critical Care Transport Workplace and Salary Survey

The Workplace Salary Survey[6] was published for several years ranging from 2010 to the most recent published in 2014. The survey reports many aspects of transport program characteristics including team configurations, transport services provided, and categoric ranges of annual transport volume for each participating program. For our study, we used the number of programs and associated annual transport volume ranges to generate annual transport statistics.

Data Analysis

Measures of central tendency were tabulated for our survey results. We then used those measures of central tendency to extrapolate the following: 1) national estimates based on our survey data and 2) national estimates based on using data from the secondary sources (as described in Table 2). To ensure anonymity of the responding programs, all results are reported in aggregate by AAMS regions used in the Workplace and Salary Survey.[6]

Results

In total, 61 of 300 programs registered with AAMS responded, representing a 20% response rate. They reported 130,000 total transports: 47,300 RW, 46,400 CCG, and 7,100 FW. Of the 61 programs responding, 11 provided RW/CCG/FW services, 17 provided only RW and CCG services, 4 provided only RW/FW services, 8 provided only FW services, 18 provided only RW services, and 3 did not specify. Table 2 presents a complete listing of the 300 transport programs by AAMS region and their associated modes of transport provided, the number of programs that responded to this survey (n = 61), and the associated mean transport statistics. Nationally, medical transport programs individually transport an average of 2,135 patients annually. The percentage of transports completed by mode of transport in each AAMS region is reported in Figure 1. Based on the study sample, approximately 32% of transports are completed by RW, 57% by CCG, and 11% by FW.

Annual Total National Transport Estimates

In order to estimate the total number of transports in the United States, with 20% of programs responding to our Web survey, we applied the central limit theorem to estimate total transports provided annually. The central limit theorem posits that as multiple samples (transport programs) are drawn from the population (all transport programs), the means of those samples tend to be normally distributed. Additionally, if the average of the sample means is calculated, that average is very close to the actual mean of the population.[7] Therefore, we can use means from within programs (eg, mean RW and FW transports per program) and across programs (eg, mean transports for all 61 respondents) to generate national estimates of transport volumes.

For example, the average number of transports completed by program (2,135) multiplied by the number of programs in 2015 (N = 300) yields an average annual transport volume of 640,500, or approximately 640,000 transports. Additional annual transport volume statistics calculated using the secondary data sources described in the

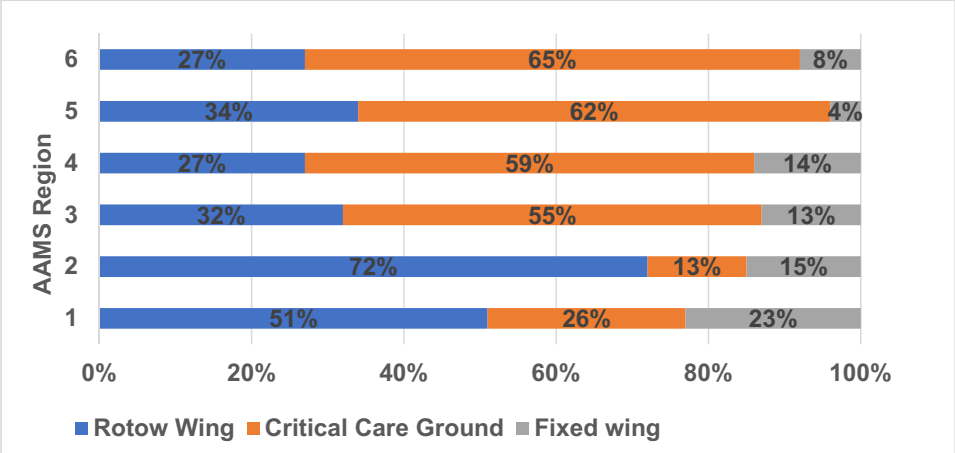

Figure 1. Percentage of Total Trips by Mode

Table 1
Estimated Annual Transport Volume Statistics

Data Source	Total Trips	Rotor Wing	Critical Care Ground	Fixed Wing
Medevac Statistics Survey[a]	640,000			
Medevac Statistics Survey[b] (adjusted by service lines)	414,000	228,000	159,000	27,000
Medevac Statistics Survey[c] (generalized study sample)	651,000	237,000	232,000	36,000
Air Medical Services Cost Study Report[d]		208,000		37,000
Air Medical Services Cost Study Report[e]		255,000		
A Statistical Analysis of HEMS Accidents and Risk		300,000		
Critical Care Transport Workplace and Salary Survey[f]	784,000			
CAMTS[g]		245,000	199,000	45,000

CAMTS, Commission on Accreditation of Medical Transport Systems.
All calculations were completed using data from the Atlas and database of Air Medical Services 2015 and rounded to the nearest thousand.
[a] Calculated by taking the average number of trips per program and multiplied by the total number of programs (300).
[b] The total trips calculated by taking the average number of trips by mode and multiplying by the number of programs that provide that service according to the 2015 ADAMS database of service providers.
[c] Totals calculated via multiplying the total transport of the study sample × 5 to generate a national total.
[d] Calculated via the proportion of Medicare trips (37% of total trips) of trips billed to Medicare in 2014 and generalized to total trips.
[e] The used average number of trips per base (295) multiplied by the number of bases in the United States (864).
[f] We took the proportion of programs that selected each transport volume category and generalized that proportion to the total number of transport services nationally (300); we then multiplied the number of programs by the maximum number of transport in each category (500, 1,000, etc) to calculate a total number of transports.
[g] Calculated by taking the proportion of transport teams accredited by CAMTS that provide each mode listed (161) multiplied by the average number of transports for that mode and generalized to the overall number of transport programs.

Methods section and a description of the associated calculation approach used are provided in Table 1.

Annual Transports by Mode

We used several data sources to aid in generating estimates of total annual transports by transport mode. Using the ADAMS database list of medical transport services from 2015, the only comprehensive list of providers and their associated modes of transport available, 82% provide RW (245/300), 32% provide CCG (96/300), and 28% provide FW (85/300) services (Table 2). Annually, programs in our survey reported providing on average 929 RW transports, 1,659 CCG transports, and 313 FW transports. To establish annual transport volume by mode, we used several approaches as presented and described in Table 1. For example, to establish CCG volume, we took the average number of transports reported in the responses to this survey and projected that percentage (32% of programs) to the national number of transport programs, estimating 159,000 CCG transports conducted annually. Alternatively, using the list of Commission on Accreditation of Medical Transport Systems (CAMTS)-accredited programs that differentiates between CCG and lower levels of ground transport,[8] 40% of programs provide CCG, resulting in the estimation of approximately 199,000 transports annually.

Discussion

The goal of this project was to establish national estimates of transports completed by medical transport programs in the United States. This is the first report of critical care transport statistics on a national level that accounted for all 3 modes of transport, providing insight into the percentage of transports conducted between air and ground and the associated regional variation. Although only 20% of registered transport programs participated, the results from this survey do align with other reports of medical transport statistics. Although the range of annual transport volume is between 414,000 and 784,000 transports, the most accurate number probably resides around 640,000 because this represents the average number of

Table 2
Association of Air Medical Services (AAMS) Regions and Transport Program Statistics

		Services Provided[a]					Average Annual Trip Volume			
AAMS Region	States Included	Total # of Programs	RW	CCG	FW	# of Programs Reporting in Study	Trips per Program(range)	RW	CCG	FW
1	Alaska, California, Guam, Hawaii, Nevada, Oregon, Washington	56	42	17	10	9	1,398 (105-3,143)	752	381	355
2	Arizona, Colorado, Idaho, Montana, New Mexico, Utah, Wyoming	31	27	9	22	5	628 (36–1,077)	772	136	162
3	Illinois, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota, Wisconsin	51	34	14	14	10	1,474 (358–5,600)	994	1,685	401
4	Alabama, Arkansas, Kentucky, Louisiana, Mississippi, Oklahoma, Tennessee, Texas	41	34	10	15	8	1,368 (295–4,466)	458	1,007	250
5	Connecticut, Delaware, District of Columbia, Indiana, Maine, Maryland, Massachusetts, Michigan, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont	63	60	29	12	15	2,918 (115–11,689)	1,099	1,977	126
6	Florida, Georgia, North Carolina, Puerto Rico, South Carolina, Virginia, West Virginia	58	48	17	12	14	2,858 (200-15,280)	1,068	2,595	324
	Column totals	300	245	96	85	61				

CCG = critical care ground; FW = fixed wing; RW = rotor wing.
[a] According to ADAMS database 2015.

transports per program regardless of mode. Given that this survey provided a 20% sample and considering the tenets of the central limit theorem, adding additional data from other programs would only minimally skew the mean left or right. Additionally, the 784,000 statistic likely represents the high end of annual trip volume because this calculation method heavily overcounts transports.

For RW volume, the individual sources and calculation methods are within a relatively close range of 220,000 to 300,000 transports and represent data from the most recent and comprehensive studies currently available including the Air Medical Services Cost Study[4] (2017) and the Statistical Analysis of HEMS Accidents Study[3] (2017). Additionally, the average transports per helicopter, which are easier to establish and reported by both the Air Medical Services Cost Study[4] and the HEMS Accidents Study[3] report, are nearly identical (295 and 325, respectively). This range of transports is at least 25% lower than the traditional 400,000 that have been historically reported by the AAMS.

Establishing CCG transports is confounded by the lack of a central monitoring agency that publically reports CCG operations as distinctly as AAMS does via the ADAMS database for air resources. Although the ADAMS database does report the number of transport programs and the associated modes of transport they provide, including CCG (1,358 total ambulances), there is no differentiation between the levels of ground service that are provided. CAMTS does differentiate the levels of ground service provided; thus, we included calculations for each mode based off of CAMTS providers as well. Additionally, varying definitions of what constitutes CCG transport diminish the ability to track and/or report the statistics accurately. The CCG statistics are less reliable because each calculation is based solely on data from the Medevac Statistics survey. As evidenced in our Medevac Statistics survey data, the difference between 32% and 40% of programs conducting CCG is 40,000 transports annually. Short of having a majority of programs participate in this or another similar data reporting system, establishing the incidence of CCG transports will continue to remain a challenge.

The FW statistics are estimated from only 2 data sources (Medevac Statistics and Air Medical Services Cost Study), yielding a narrow range between 27,000 and 45,000. The range of FW volume differs significantly from the 100,000+ statistic most commonly reported by the AAMS, likely representing a more accurate figure because the Air Medical Services Cost Study is based on Medicare claims data.

The percentage of transports completed by mode of transport varies significantly by region, as evidenced in Figure 1, thus reducing the accuracy of estimating an overall percentage of transports completed by mode nationally based on a small number of regional statistics. Although certain circumstances may require reporting a national percentage, studies conducted within certain geographic regions or in particular health systems situated within a region should reference the more specific regional percentages.

Interestingly, the annual volume statistics calculated via the Air Medical Services Cost Study Report,[4] the Statistical Analysis of HEMS Accidents and Risk[3] presentation, and this survey's results (adjusted for service lines) provide similar results for RW and FW transports. These sources, paired with the 2015 ADAMS database, specify the most recent data on the number of programs and service lines that are provided nationally, potentially yielding the most accurate statistics currently available. Given the consistent figures provided across the sources of data and calculations used in this study, general estimates of overall critical care transports on an annual basis are approximately 640,000 total transports, with around 300,000 RW, 230,000 CCG, and 35,000 FW.

Limitations

There are several limitations that warrant consideration. First, the response rate of 20% is low and can thus skew total transport volume statistics presented via the different estimation approaches. Second, all annual transport volume statistics are calculated relying on our survey data in combination with other data sources to produce representative values, potentially limiting overall accuracy. Third, the calculation using the Critical Care Transport Workplace and Salary Survey is biased because those programs that conduct > 10,000 transports annually are only accounted for the first 10,000 transports, thus potentially underreporting total transports completed by those programs while potentially overreporting transports for programs that are in the lower categories (eg, a program that completed 2,600 transports would indicate in the 2,501-5,000 category and would thus bias the total number of transports accounted for). Lastly, each of the calculation methods applied relied on using averages, which will yield differences in the total sums reported if attempting to add the modes of transport together to achieve annual estimates. Therefore, each estimate should be considered independently.

Conclusion

We attempted to establish national estimates of annual transport statistics. Although the current sample of participating programs was low, triangulating multiple sources of data has provided a more consistent picture of annual transport volumes. Establishing accurate national medical transport statistics is necessary to drive research and policy initiatives on local and national levels. This can only be accomplished through participation in this or other anonymous data collection projects. To continue this effort and to contribute your program's 2017 medical transport statistics, go to https://nursing.case.edu/medevac/ or copy and paste the following hyperlink: https://cwru.az1.qualtrics.com/jfe/form/SV_2hklBUgQwxLovWd.

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Supplementary materials

Supplementary material associated with this article can be found in the online version at https://doi.org/10.1016/j.amj.2019.03.008.

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