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# Telemedicine Facilitation of Transfer Coordination From Emergency Departments



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**Study objective:** Interhospital transfers are costly to patients and to the health care system. The use of telemedicine may enable more efficient systems by decreasing transfers or diverting transfers from crowded referral emergency departments (EDs) to alternative appropriate facilities. Our primary objective is to describe the prevalence of telemedicine for transfer coordination among US EDs, the ways in which it is used, and characteristics of EDs that use telemedicine for transfer coordination.

**Methods:** We used the 2016 National Emergency Department Inventory–USA survey to identify telemedicine-using EDs. We then surveyed all EDs using telemedicine for transfer coordination and a sample of EDs using telemedicine for other clinical applications. We used a multivariable logistic regression model to identify characteristics independently associated with use of telemedicine for transfer coordination.

**Results:** Of the 5,375 EDs open in 2016, 4,507 responded to National Emergency Department Inventory–USA (84%). Only 146 EDs used telemedicine for transfer coordination; of these, 79 (54%) used telemedicine to assist with clinical care for local admission, 117 (80%) to assist with care before transfer, and 92 (63%) for arranging transfer to a different hospital. Among telemedicine-using EDs, lower ED annual visit volume (odds ratio 5.87, 95% CI 2.79 to 12.36) was independently associated with use of telemedicine for transfer coordination.

**Conclusion:** Although telemedicine has potential to improve efficiency of regional emergency care systems, it is infrequently used for coordination of transfer between EDs. When used, it is most often to assist with clinical care before transfer. [Ann Emerg Med. 2020;76:602-608.]

Please see page 603 for the Editor's Capsule Summary of this article.

A **podcast** for this article is available at [www.annemergmed.com](http://www.annemergmed.com).

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## INTRODUCTION

Every year, greater than 2 million emergency department (ED) visits result in a transfer to another hospital.<sup>1</sup> Transfers typically occur to move patients to a higher level of resources or expertise than available at the original hospital. However, interhospital transfers have also been associated with increased morbidity and mortality for patients<sup>2,3</sup> and increased health care costs for the system,<sup>4</sup> and often move patients farther from their homes and local support systems.

There is some evidence that a subset of transfers may be avoidable,<sup>4,5</sup> and many of these potentially avoidable transfers could be a target for emergency telemedicine services to help guide that decision. Telemedicine may also be used to coordinate interhospital transfers and improve the quality of care delivered during the transfer process. For example, a patient requiring evaluation by a specialist could have that evaluation by telemedicine from the original ED,

and potentially avoid the transfer. Alternatively, telemedicine could be used for triage of interhospital transfers. For example, rather than an emergency medicine provider's needing to call multiple hospitals for a potential transfer, a transfer coordination telemedicine service can better assess where in the system the patient should be transferred and can relieve the in-person emergency medicine provider from the time-consuming task of searching for an accepting hospital. During the COVID-19 crisis, the use of telemedicine for assistance with patient management may prove to be helpful for hospitals no longer able to transfer their patients owing to the overwhelmed health care system.

Because studies increasingly describe applications of telemedicine for clinical emergency medicine and in the transfer process between EDs,<sup>4,6,7</sup> our aim was to characterize the use of telemedicine in the interhospital transfer process among EDs nationally. Our primary

**Editor's Capsule Summary***What is already known on this topic*

Telemedicine may be a helpful adjunct to clinical care, but its optimal role is not defined.

*What question this study addressed*

Is telemedicine being used to facilitate interhospital transfer coordination?

*What this study adds to our knowledge*

Few hospitals use telemedicine for transfer coordination. Hospitals with <10,000 visits per year are more likely to use it for this purpose.

*How this is relevant to clinical practice*

The role of telemedicine in the management of interfacility transfer needs further exploration and evaluation.

objective was to describe the prevalence of telemedicine for transfer coordination among US EDs, the ways in which it is used, and characteristics of EDs that use telemedicine for transfer coordination.

**MATERIALS AND METHODS****Study Design, Setting, and Selection of Participants**

This study involved 2 surveys. First, as part of the National Emergency Department Inventory (NEDI)-USA, we surveyed all 5,375 US EDs that were open in 2016 (Appendix E1 [survey 1], available online at <http://www.annemergmed.com>). The survey was coordinated by the Emergency Medicine Network, and methods previously have been reported.<sup>8</sup> The NEDI-USA survey collected EDs' basic characteristics, staffing, and telemedicine use (Appendix E1 [survey 1], available online at <http://www.annemergmed.com>). This survey was administered in 2017 to characterize US EDs in 2016. Using data from NEDI-USA, we identified all responding EDs that reported using telemedicine for transfer coordination as well as other clinical applications. We then sent tailored follow-up surveys to a sample of telemedicine-using US EDs in 2018 to further characterize telemedicine use in 2016; this subset included all EDs that reported using telemedicine for transfer coordination (Appendix E1 [survey 2], available online at <http://www.annemergmed.com>). Details of the follow-up survey and its administration have been previously described.<sup>9</sup>

EDs were classified by use of telemedicine for transfer coordination and other clinical applications. If EDs

reported different telemedicine use on follow-up, they were reclassified according to the updated data (Figure). This study was approved by the local institutional review board.

**Methods of Measurement**

The primary outcome was use of telemedicine for transfer coordination, according to the question, "Does your facility receive telemedicine services for patient evaluation?" followed by, "If your ED receives telemedicine services, does your ED use telemedicine for..." which included the option of transfer coordination. We then examined the characteristics of EDs that use telemedicine for transfer coordination in 2016 and the way in which it is used. This was based on the survey item, "In 2016, approximately what percentage of patients requiring admission for any reason were transferred to another facility?" This was followed by, "When arranging transfer to another hospital using telemedicine, does the receiving hospital ever assist with clinical care that enables the patient to be admitted locally, assist with pretransfer clinical care, and arrange or help facilitate transfer to a different hospital than the telemedicine provider's?"

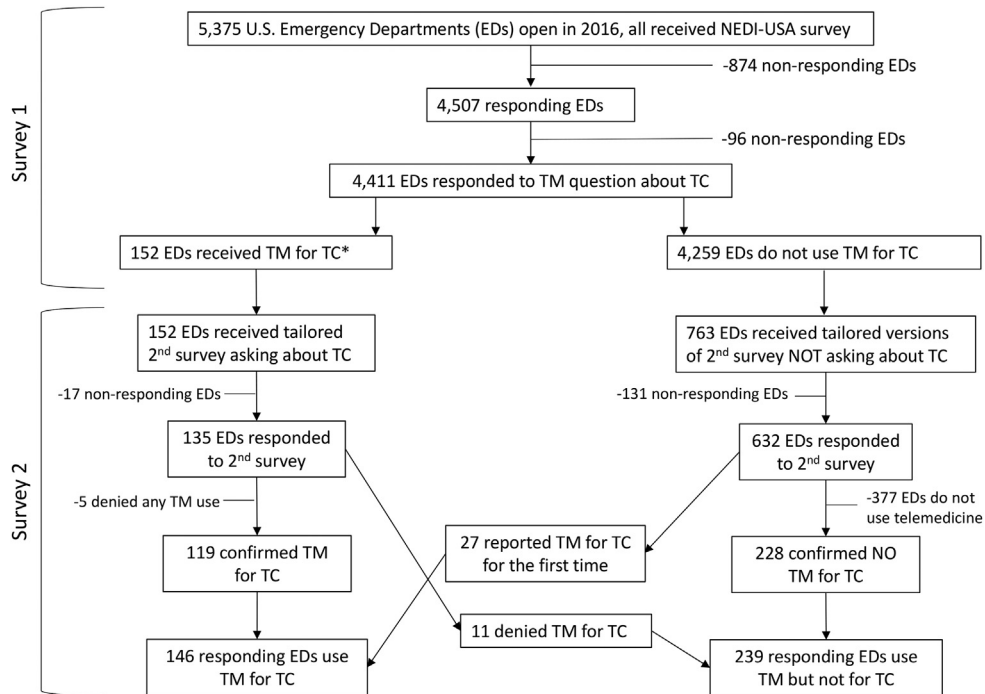
We also collected data on total number of ED beds; total number of full-time equivalents of staffing by attending physicians, physician assistants, and nurse practitioners; the presence of an attending physician in the ED 24 hours a day, 7 days a week; the availability of an attending physician when not immediately present in the ED; and the proportion of attending physicians board certified or board prepared in emergency medicine.

**Primary Data Analysis**

Descriptive statistics were used to compare ED characteristics between those that did and did not use telemedicine for transfer coordination, with results presented as proportions with 95% confidence intervals and medians with interquartile ranges. We then used multivariable logistic regression to identify characteristics independently associated with ED use of telemedicine for transfer coordination. Model covariates were selected a priori and included rural location (defined as ED location outside of a core-based statistical area), US region, ED visit volume, number of full-time equivalent attending physicians, and proportion of adult patients requiring admission who were transferred to another facility. Analyses were performed with Stata (version 14.2; StataCorp, College Station, TX).

**RESULTS**

The NEDI-USA survey had an 84% response rate, with 4,507 of the 5,375 EDs open in 2016 responding. Of



**Figure.** EDs included in the study and responding to surveys. *TM*, Telemedicine; *TC*, transfer coordination. \*First reported telemedicine for transfer coordination in the NEDI-USA survey by either December 2017 or May 2018. †This includes EDs that received telemedicine but did not use it for transfer coordination, and includes EDs that did not receive any telemedicine.

responding EDs, 4,411 (98%) indicated whether they use telemedicine. There were 163 EDs using telemedicine for transfer coordination, and 146 (90%) responded to survey 2 (Figure).

Among the 146 EDs using telemedicine for transfer coordination, telemedicine was most frequently used to assist with clinical care before transfer (n=117, 80%), and was also used for arranging transfer to a different hospital (n=92, 63%) and for assisting with clinical care for local admission (n=79, 54%).

We compared characteristics of EDs using telemedicine for transfer coordination with those of EDs that use telemedicine for other applications (Table 1). In bivariate analyses, relative to EDs that used telemedicine for other applications, EDs using it for transfer coordination were more likely to have a lower annual ED visit volume (<10,000 visits; 61% versus 39%) and lower annual pediatric visit volume (median 385 versus 3,150), were less likely to have at least one attending physician on duty continuously (23% versus 77%), and were less likely to have the majority of physicians board certified or board prepared in emergency medicine (24% versus 76%). Among telemedicine-using EDs, lower annual ED visit volume (<10,000 visits per year) (adjusted odds ratio 5.87; 95% confidence interval 2.79 to 12.36) was independently

associated with use of telemedicine for transfer coordination (Table 2).

### LIMITATIONS

This study has potential limitations. Although NEDI-USA had an 84% response rate, there may have been differences between responders and nonresponders that could have influenced our results; however, responding EDs were similar to nonresponding ones.<sup>9</sup> There is a possibility for misclassification in type of telemedicine received, given the check-box nature of this survey question. However, we mitigated this by reading each response option to the greater than 60% of EDs that completed the surveys by telephone interview, and by calling EDs that reported discrepant responses in type of telemedicine received between the 2 surveys. Sampling bias may have been introduced with respondents' assumptions of the definition of telemedicine. Debates exist in the field of telemedicine about whether to include nonvideo-assisted telephone calls in the definition of telemedicine. We did not list a definition of telemedicine in the written survey, and on the telephone survey, the respondents were told that telemedicine was "The use of technology for remote clinical diagnostic and treatment services. This service can be audio, visual, or both." Some of

**Table 1.** Characteristics of telemedicine-using EDs that do and do not use telemedicine for transfer coordination, n=385.

Characteristics	EDs That Use Telemedicine for Transfer Coordination, n=146		EDs That Use Telemedicine but Do Not Use It for Transfer Coordination, n=239	
	No.	% (95% CI)	No.	% (95% CI)
<b>Telemedicine services</b>				
ED is in a hospital that provides telemedicine	12	39 (23–57)	19	61 (43–77)
ED receives telemedicine	143	38 (33–43)	231	62 (57–67)
ED receives telemedicine services and is in a hospital that provides telemedicine	12	43 (26–62)	16	57 (38–74)
Rural location	106	58 (51–65)	77	42 (35–49)
<b>Region</b>				
Northeast	11	22 (12–35)	40	78 (65–88)
Midwest	90	62 (53–69)	56	38 (31–47)
South	24	23 (16–32)	82	77 (68–84)
West	21	26 (17–36)	61	74 (64–83)
ED volume in 2016, median (IQR)	146	2,076 (892–7,076)	239	18,576 (7,520–37,595)
<b>ED visits in 2016</b>				
<10,000	118	61 (54–68)	74	39 (32–46)
≥10,000	28	15 (10–20)	165	85 (80–90)
ED visits by children in 2016, median (IQR)	133	385 (144–1,506)	221	3,150 (1,095–6,077)
Total no. of ED beds, median (IQR)	144	4 (2–8)	237	12 (7–24)
<b>Total no. of staff, median (IQR)</b>				
FTE attending physicians	139	2 (1–4)	231	5 (4–11)
FTE PAs	136	1 (0–2)	232	1 (0–4)
FTE NPs	141	0 (0–2)	230	0.1 (0–2)
≥1 attending physician on duty in the ED continuously	63	23 (19–29)	209	77 (71–81)
<b>If no attending physician continuously, when physician is unavailable is any physician available by 2-way voice communication continuously</b>				
Within the hospital	44	71 (58–81)	18	29 (19–42)
Outside the hospital	2	50 (9–91)	2	50 (9–91)
<b>Attending physicians board-certified or -prepared by ABEM, AOBEM, %</b>				
<20	54	51 (42–61)	51	49 (39–58)
20–49	11	33 (19–51)	22	67 (49–81)
50–79	9	26 (14–44)	25	74 (56–86)
80–100	38	24 (18–31)	120	76 (69–82)
<b>Approximate percentage of adult patients requiring admission for any reason who were transferred to another facility in 2016, %</b>				
0–4	26	31 (22–41)	59	69 (59–78)
5–19	63	39 (31–46)	100	61 (54–69)
20–49	29	48 (35–60)	32	52 (40–65)
50–79	14	50 (32–68)	14	50 (32–68)
80–100	7	28 (14–49)	18	72 (51–86)

**Table 1.** Continued.

Characteristics	EDs That Use Telemedicine for Transfer Coordination, n = 146		EDs That Use Telemedicine but Do Not Use It for Transfer Coordination, n = 239	
	No.	% (95% CI)	No.	% (95% CI)
<b>Other clinical applications for which telemedicine is used</b>				
Pediatrics	115	44 (38–50)	148	56 (50–62)
Stroke/neurology	132	42 (37–48)	180	58 (52–63)
Psychiatry	93	53 (45–60)	83	47 (40–55)
Trauma	121	74 (66–80)	43	26 (20–34)
Dermatology	43	80 (67–88)	11	20 (12–33)
Radiology	45	75 (62–84)	15	25 (16–38)
<b>Video connection</b>				
No, telephone only	4	57 (21–87)	3	43 (13–79)
Yes, 1-way	0	n/a	3	100 (n/a)
Yes, 2-way	137	38 (33–43)	226	62 (57–67)
<b>Telemedicine other uses</b>				
Oversee PAs/NPs	47	84 (72–91)	9	16 (9–28)
Access consultant services	125	38 (33–44)	200	62 (56–67)
Offset crowding by remote management	11	55 (33–75)	9	45 (25–67)
Facilitate transfers between hospitals	131	48 (42–54)	140	52 (46–58)
Access distance education	71	67 (57–75)	35	33 (25–43)

CI, Confidence interval; IQR, interquartile range; FTE, full-time equivalents; PA, physician assistant; NP, nurse practitioner; ABEM, American Board of Emergency Medicine; AOBEM, American Osteopathic Board of Emergency Medicine; n/a, not applicable.

the respondents to the written survey may have assumed telephone-only did not count as telemedicine and thus decreased the number of EDs reporting telemedicine use. Finally, limiting the study to emergency medicine-only telemedicine potentially missed a necessary component of inpatient clinician support.

**DISCUSSION**

To our knowledge, this is the first national description of ED use of telemedicine for transfer coordination. Given the increasing focus on ensuring efficient, high-value delivery of health care, the use of telemedicine for coordination of interhospital transfer processes may be increasingly important. By characterizing EDs that use telemedicine for transfer coordination and understanding the ways in which it is currently used, our study sets the stage for important future work.

We found that transfer coordination was reported as an infrequent application of telemedicine in US EDs in 2016. Given this low use of telemedicine for transfer

coordination, we are far from realizing telemedicine’s potential to have systemwide influence. When used, transfer coordination telemedicine was most frequently for assistance with clinical care before transfer. Greater than half of the respondents who used telemedicine for transfer coordination used it to help the patient remain at the referring hospital. Many respondents who used telemedicine for transfer coordination reported that the telemedicine service assisted with transfer of the patient to a hospital different than the telemedicine-providing hospital. We speculate that several of these responding EDs subscribed to one of the larger telemedicine providers that offer such a service. Enabling patients to remain at local hospitals and enabling them to be transferred to hospitals other than the telemedicine-providing hospital are applications with substantial potential for improved efficiency of the health care system. EDs at referral centers could benefit as well because decreased transfers could reduce adverse effects of ED crowding.<sup>10</sup>

The use of telemedicine for decreasing either the need for transfer or assisting with care at the local hospital may



**Table 2.** Factors associated with telemedicine use for transfer coordination in multivariable model among telemedicine-using EDs, n=385.

Variable	Odds Ratio	95% CI
Rural location	1.42	0.72-2.79
<b>Region</b>		
Northeast	1.00	[Reference]
Midwest	1.86	0.76-4.50
South	0.64	0.26-1.59
West	0.56	0.22-1.46
<b>ED volume (dichotomous)</b>		
<10,000	5.87	2.79-12.36
≥10,000	1.00	[Reference]
No. FTE attending physicians present	1.00	0.97-1.03
<b>Proportion of adult patients requiring admission who were transferred to another facility, %</b>		
0-4	1.00	[Reference]
5-19	0.73	0.37-1.44
20-49	0.78	0.34-1.79
50-79	1.14	0.38-3.45
80-100	0.33	0.10-1.06

Hosmer-Lemeshow goodness-of-fit test  $P=.97$ .

also be an important patient-centered application. Patients may increasingly be able to stay near their loved ones and support network, avoiding the hassle and costs of transportation to and from the referral hospital during an acute stay, as well as for follow-up care. If local community hospitals are increasingly able to retain patients, increased reimbursement may also help to reduce hospital closures, avoid worsening disparities in access, and support the local economy.

EDs appear to be using telemedicine for transfer coordination to augment staffing. EDs that use telemedicine for transfer coordination were less likely to have board-certified or -prepared emergency physicians or at least 1 attending physician on duty 24 hours a day, 7 days a week. To our knowledge, there is no evidence that having a board-certified or -prepared emergency physician overseeing a nonemergency medicine board-certified or -prepared provider through telemedicine is equivalent to in-person oversight. However, having the ability to interview and examine patients by live video may augment such oversight.

We also found that the EDs that used telemedicine for transfer coordination more frequently used telemedicine for

other applications as well (eg, pediatrics, stroke, trauma, psychiatry, dermatology, radiology). We did not explore whether there were particular subsets of patients or conditions for which transfer coordination was more frequently used. This warrants further study.

Our study did not explore the typical structure of a telemedicine consultation for transfer coordination (eg, academic hub-and-spoke model versus large commercial provider). However, in the setting of a referral ED providing telemedicine services to a remote referring ED, an additional source of value for a telemedicine encounter used for transfer coordination may be in knowledge transmission that occurs between emergency physicians at a referral and referring ED. Ideally, telemedicine connections would enable single-coverage providers to experience benefits similar to those of collaboration with colleagues, potentially improving the care of other patients at the referring ED.

Past work demonstrated that EDs that do not use telemedicine frequently cite costs as a barrier.<sup>8</sup> With the increasing use of telemedicine by other specialties—namely, stroke telemedicine—there will be a larger telemedicine infrastructure in place in EDs and hospitals. Referral EDs could share video hardware and software with their stroke telemedicine programs for emergency telemedicine to assist in transfer coordination.

For telemedicine to reach its potential, several important barriers must be overcome. For example, reimbursement for transfer coordination does not currently exist. Provider acceptance of telemedicine is also a potential barrier, whether it is acceptance by a provider at the originating site or potentially from the provider telemedicine program site. Thoughtful application of telemedicine, including respect given to the providers at the originating sites and efficient work flows for providers at the telemedicine-providing and receiving sites, is critical to a program's success. Finally, barriers can exist in rural facility inpatient clinicians' comfort in keeping patients for whom teleconsultation recommends no need to transfer. An emergency telemedicine program for transfer coordination cannot be successful if there is no support for the inpatient teams.

Telemedicine is infrequently used for transfer coordination between EDs. When used, it is most often used to assist with clinical care before transfer. The use of telemedicine for transfer coordination may be increasingly valuable for ensuring effective systems of emergency care. We encourage future studies to better understand

emergency medicine telemedicine services that facilitate the transfer request process.

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