ACCESS Telemedicine: An Alternative Healthcare Delivery Model for Rural Cerebral Emergencies (UNMHSC): Quantitative Analysis for the PTAC Preliminary Review Team

July 25, 2019

Summary

This analysis provides the Physician-Focused Payment Model Technical Advisory Committee (PTAC) with information on the context for the physician-focused payment model (PFPM), "ACCESS Telemedicine: An Alternative Healthcare Delivery Model for Rural Cerebral Emergencies," which was proposed by the University of New Mexico Health Sciences Center (UNMHSC) on February 13, 2019. Specifically, the analysis provides information on the volume of traditional Medicare (fee for service, or FFS) beneficiaries with neurological conditions presenting in rural emergency departments, the percentage of beneficiaries transferred from rural hospitals for neurology care, and the disposition of those transfers.

We used the Chronic Conditions Data Warehouse (CCW) Research Identifiable Medicare claims files (RIFs) from 2015-2017 to analyze the two proposed research questions:

1. What is the percentage of beneficiaries transferred from rural hospitals for neurology care?
2. How many referrals from rural facilities for neurology care could have been avoided if telemedicine services similar to ACCESS were available at the rural facility?

The first two columns of Exhibit 1 contain data provided by UNMHSC on patients with neuro-emergent conditions that presented in the emergency room and were served by the ACCESS program. ACCESS data may contain records for persons under age 65 who were not eligible for Medicare. The last two columns of Exhibit 1 summarize Medicare FFS claims based on principal or admitting diagnosis codes.

The distribution of neurologic conditions in the Medicare claims differed from those observed in the existing ACCESS program. For example, 52 percent of Medicare claims had a diagnosis of "dizziness" or "altered mental status," which accounts for 17 percent of the consultations reported for the existing ACCESS program. This difference in the distribution of conditions between the ACCESS data and Medicare FFS claims suggests that health care claims diagnosis codes are not sufficient to identify the subset of beneficiaries who are likely eligible for ACCESS.

For further analysis, Medicare claims were limited to the subset with a principal or admitting diagnosis associated with a condition identified by a Neurological Critical Care Fellow at the University of Chicago as likely being suitable for a program like ACCESS (rows marked with an asterisk in Exhibit 1). Less specific diagnoses such as altered mental status or dizziness were thus excluded. Exhibit 2 shows the percentage of beneficiaries who had claims that were transferred to an acute urban facility or rural referral center. Overall, 10 percent of FFS emergent claims were transferred from rural hospitals to a different facility. Claims with an intracerebral hemorrhage or aneurysm diagnosis were transferred at the highest percentage (47 percent and 43 percent, respectively). The percentage of transferred cases observed in the claims for these selected diagnoses (10 percent) was lower than reported in the ACCESS program data provided by UNMHSC for the full ACCESS program (90 percent). This difference may be in part due to all claims with the selected diagnoses being considered eligible for transfer, whereas a provider in the

emergency room would likely rely on additional clinical information not captured by claims to identify events that are not appropriate for transfer.

The remaining exhibits (Exhibits 3 – 6) present results from analysis on disposition of cases separately based on geographic location. Rural facilities in New Mexico (Exhibit 3) were considered separately because the ACCESS program was in operation in New Mexico during the period analyzed. The non-New Mexico rural facilities were further categorized by the level of rurality as determined by the Frontier and Remote (FAR) area codes created by the US Department of Agriculture Economic Research Service (see Appendix A for details). Exhibit 4 shows data for level one FAR facilities which are in the most rural areas of the country; Exhibit 5 shows data for all other non-New Mexico rural facilities. Discharge disposition was further categorized separately for transfers and non-transfers (i.e., kept at rural facility). Claims where the beneficiary was transferred from the rural facility and then discharged on the same day or kept for observation and discharged later may be a proxy for potentially avoidable transfers. Key points include:

- The rate of transfer across the three geographic areas did not vary substantially. Non-NM/non-FAR facilities had the highest rate of transfer (Exhibit 5, 10.7 percent), followed by NM rural facilities (Exhibit 3, 8.2 percent) and non-NM FAR facilities (Exhibit 4, 7.7 percent).

- Among patients transferred from a rural facility, the majority were admitted to the receiving inpatient facility (71 – 75 percent). Discharges same day or without inpatient admission, a proxy for potentially avoidable transfers, accounted for 19 – 25 percent of transfers.

- Claims at non-NM FAR facilities may pertain to areas where the ACCESS program would be most beneficial as these claims pertain to zip code areas where the majority of the population lives 60 minutes or more from an urban area with a population of at least 50,000, but not in NM where the ACCESS program has already been implemented. It is possible that claims for some diagnosis categories may better identify cases suitable for ACCESS services. Condition-specific transfer rates in Exhibit 6 were similar to those shown in Exhibit 2. For the majority of conditions, less than 7 percent of cases were transferred; only intracerebral hemorrhage and aneurysm diagnoses were transferred at a higher percentage (40.8 and 36.8 percent, respectively).

Overall, the analyses of claims data show a lower overall rate of transfers than reported for the ACCESS program in summary data provided by UNMHSC. Several factors may explain these differences. First, and most importantly, the two analyses rely on different sources of data: traditional Medicare claims available in the CCW for the analyses presented in this document and electronic health records (EHR) in the analysis done by UNMHSC (first two columns of Exhibit 1). Data on clinical presentation observed by the treating physician likely inform decisions on whether to seek a telemedicine consultation or to transfer beneficiaries; such information is not available in claims records. Therefore, the subset of Medicare beneficiaries who may benefit from ACCESS is not likely identifiable through claims data alone. Furthermore, the ACCESS program data were not limited to Medicare FFS beneficiaries. As such, the ACCESS experience may not reflect outcomes likely to be observed if the program were implemented in FFS Medicare.

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Exhibit 1: Distribution of ED claims from rural facilities, by condition type

Condition (Conditions confirmed by neurologist consultant are marked with an asterisk)	ACCESS Consultations May 2015 – May 2018		Medicare FFS Claims Oct 2015 – Sept 2017	
	No. Consults	% Consults	No. Claims	% Claims
Ischemic Stroke*	850	29.73%	21,410	5.29%
Seizures*	498	17.42%	42,104	10.40%
Transient Ischemic Attack (TIA)*	364	12.73%	49,001	12.11%
Altered Mental Status	330	11.54%	106,604	26.34%
Migraine	202	7.07%	59,614	14.73%
Dizziness	157	5.49%	106,646	26.35%
Spine Injury*	75	2.62%	865	0.21%
Brain Tumor*	65	2.27%	371	0.09%
Traumatic Brain Injury	61	2.13%	54	0.01%
Bells Palsy	55	1.92%	4,919	1.22%
Intracerebral Hemorrhage*	49	1.71%	6,937	1.71%
Subdural Hematoma*	43	1.50%	1,816	0.45%
Conversion Disorder	39	1.36%	879	0.22%
Subarachnoid Hemorrhage*	35	1.22%	804	0.20%
Ataxia	20	0.70%	1,869	0.46%
Meningitis/Encephalitis	11	0.38%	475	0.12%
Aneurysm*	3	0.10%	296	0.07%
Cavernoma	2	0.07%	21	0.01%
Arteriovenous Malformation	0	0.00%	23	0.01%
Total	2,859	100.00%	404,708	100.00%

SOURCE: ACCESS consultations: taken from submitter's response to PRT questions and reflects primary consultations conducted through the HCIA-2 ACCESS program running from May 2015 through the end of May 2018.

Medicare FFS claims: taken from October, 2015 through September, 2017 Medicare Research Identifiable Files. See Appendix B for a list of diagnosis codes used to identify claims with a neurological condition as the principal or admitting diagnosis as well as the diagnosis to condition crosswalk. Claims are restricted as follows:

1. Inpatient and outpatient claims were isolated to those in the emergency department. See Appendix B for a list of revenue codes used to identify claims to the Emergency Department.
2. Rural facilities were defined by the CBSA Urban Rural Indicator (cbsa_urbn_rrl_ind='R') found in the Provider of services file
3. Beneficiary was enrolled in FFS A and B in the month of service, as determined by the 2015-2017 Master Beneficiary Summary File

Exhibit 2: Number of Medicare FFS transfers from rural facilities, selected conditions confirmed as relevant by neurologist review, Oct 2015- Sept 2017

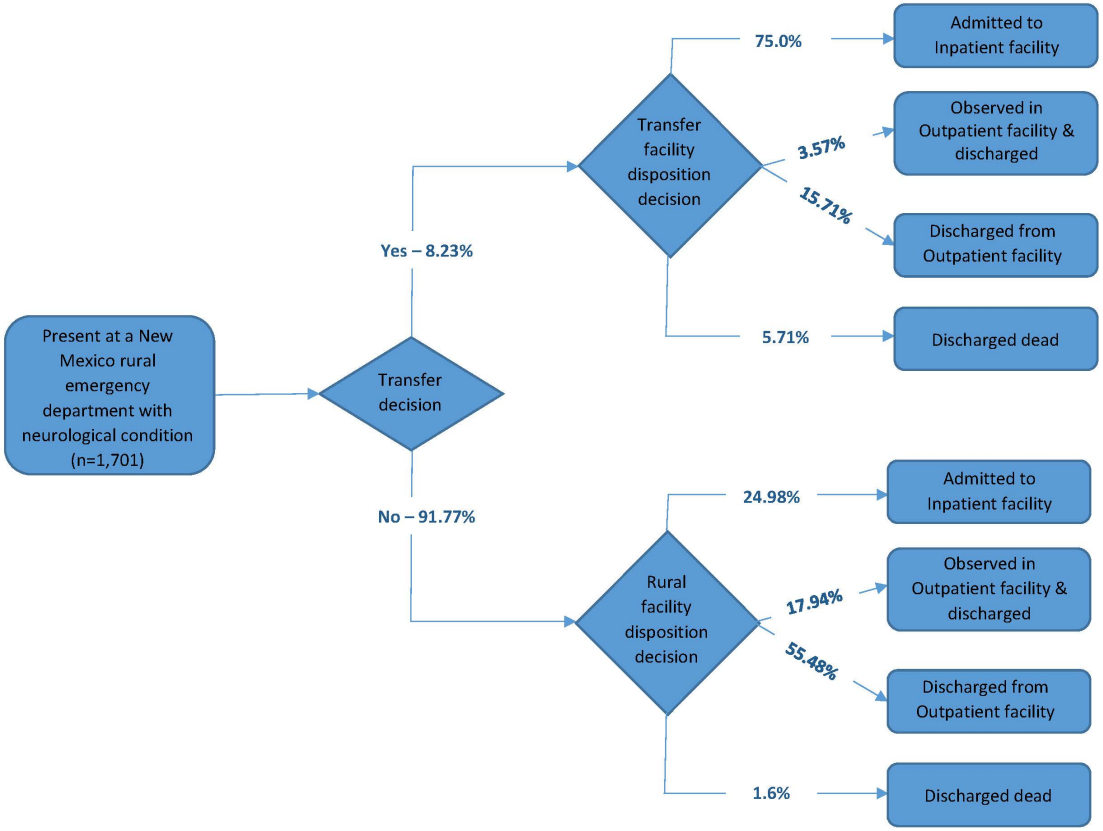
Condition (Order reflects frequency in the ACCESS Program)	No. Rural Claims	No. Transfers	% Transferred
Ischemic Stroke	21,410	404	1.89%
Seizures	42,104	3,300	7.84%
Transient Ischemic Attack (TIA)	49,001	5,151	10.51%
Spine Injury	865	20	2.31%
Brain Tumor	371	11	2.96%
Intracerebral Hemorrhage	6,937	3,258	46.97%
Subdural hematoma	1,816	31	1.71%
Subarachnoid hemorrhage	804	16	1.99%
Aneurysm	296	127	42.91%
Total	123,604	12,318	9.97%

SOURCE: October, 2015 through September, 2017 Medicare Research Identifiable Files. See Appendix B for a list of diagnosis codes used to identify claims with a neurological condition as the principal or admitting diagnosis as well as the diagnosis to condition crosswalk. Diagnoses were subset to those that were recommended by a Neurocritical Care Fellow at the University of Chicago and presented in the same order as Exhibit 1 from most to least common in ACCESS program data.

Claims are restricted as follows:

1. Inpatient and outpatient claims were isolated to those in the emergency department. See Appendix C for a list of revenue codes used to identify claims to the Emergency Department.
2. Rural facilities were defined by the CBSA Urban Rural Indicator (cbsa_urbn_rrl_ind='R') found in the Provider of services file
3. Beneficiary was enrolled in FFS A and B in the month of service, as determined by the 2015-2017 Master Beneficiary Summary File
4. Transfers were isolated to acute facilities in urban areas and acute Rural Referral Centers

Exhibit 3. Disposition of Medicare FFS beneficiaries with selected neurological conditions who present to a New Mexico rural facility

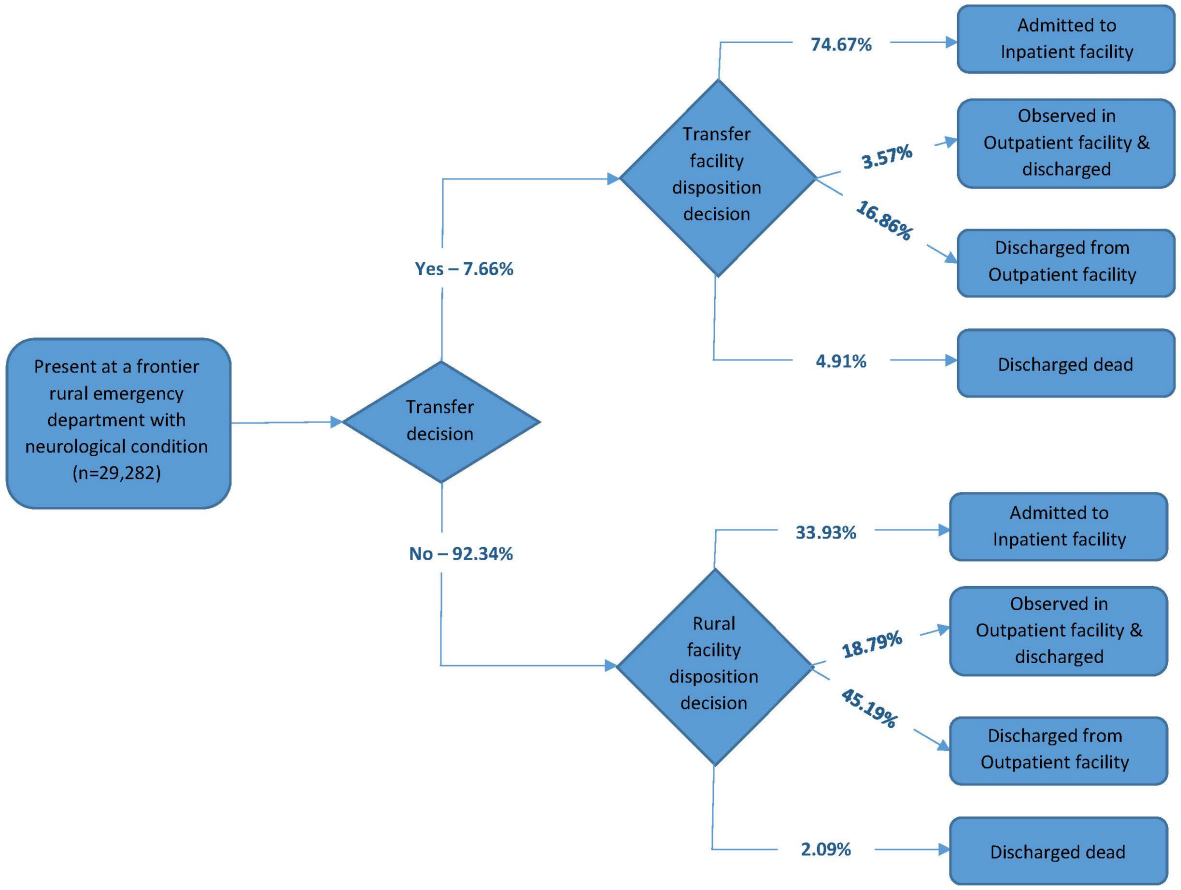


SOURCE: October, 2015 through September, 2017 Medicare Research Identifiable Files. See Appendix B for a list of diagnosis codes used to identify claims with a neurological condition as the principal or admitting diagnosis as well as the diagnosis-to-condition crosswalk. Diagnoses were subset to those that were recommended by a Neurocritical Care Fellow at the University of Chicago.

Claims were restricted as follows:

1. Inpatient and outpatient claims were isolated to those in the emergency department (ED). See Appendix C for a list of revenue codes used to identify claims to the ED.
2. Rural facilities were defined by the CBSA Urban Rural Indicator (cbsa_urbn_rrl_ind='R') found in the provider of services file
3. New Mexico facilities were defined by the state abbreviation (state_cd='NM') found in the provider of services file
4. Beneficiary was enrolled in FFS A and B in the month of service, as determined by the 2015-2017 Master Beneficiary Summary File
5. Transfers were isolated to acute facilities in urban areas and acute Rural Referral Centers

Exhibit 4. Disposition of Medicare FFS beneficiaries with selected neurological conditions who present to a non-NM frontier rural facility

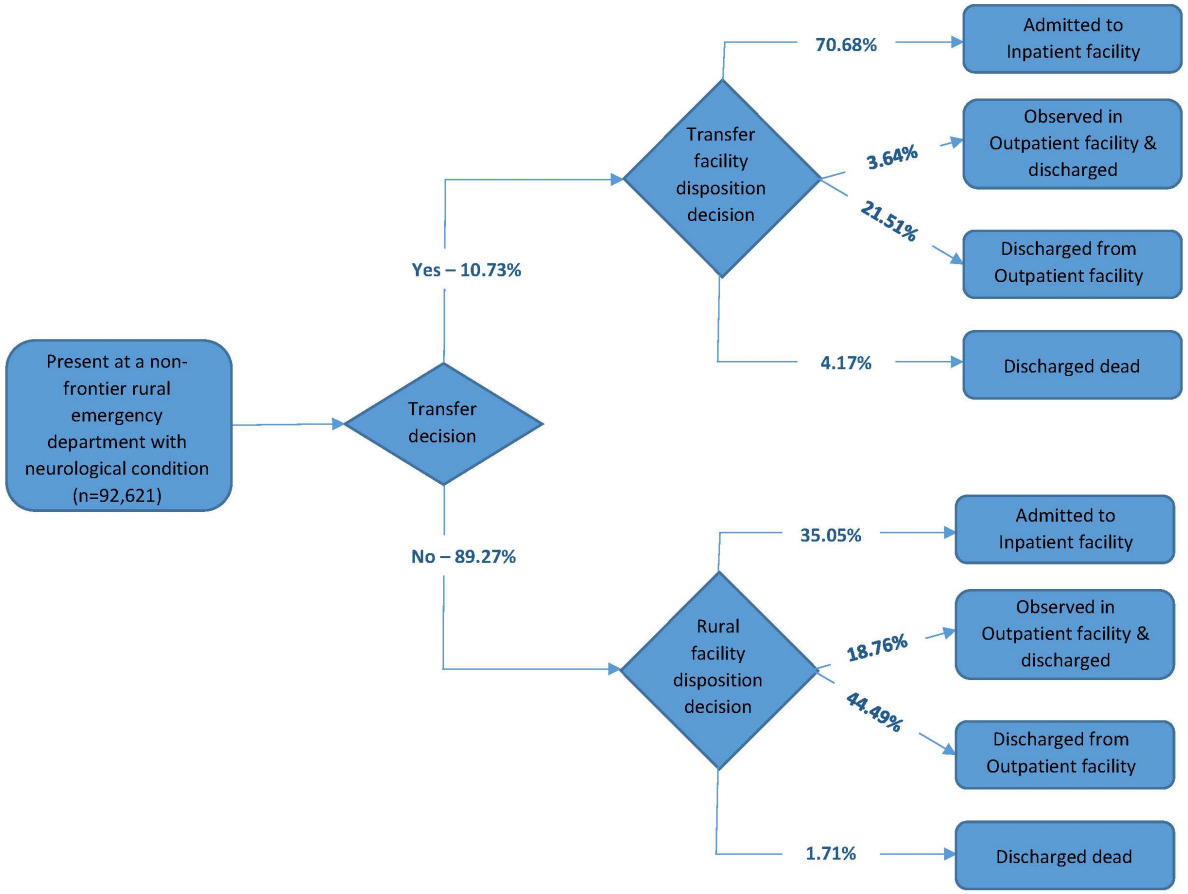


SOURCE: October, 2015 through September, 2017 Medicare Research Identifiable Files. See Appendix B for a list of diagnosis codes used to identify claims with a neurological condition as the principal or admitting diagnosis as well as the diagnosis-to-condition crosswalk. Diagnoses were subset to those that were recommended by a Neurocritical Care Fellow at the University of Chicago.

Claims were restricted as follows:

1. Inpatient and outpatient claims were isolated to those in the emergency department (ED). See Appendix C for a list of revenue codes used to identify claims to the ED.
2. Rural facilities were defined by the CBSA Urban Rural Indicator (cbsa_urbn_rrl_ind='R') found in the Provider of services file
3. Frontier facilities were defined by the zip code found in the provider of services file and zip code level one FAR codes (far1='1') created by the USDA ERS.
4. Beneficiary was enrolled in FFS A and B in the month of service, as determined by the 2015-2017 Master Beneficiary Summary File
5. Transfers were isolated to acute facilities in urban areas and acute Rural Referral Centers

Exhibit 5. Disposition of Medicare FFS beneficiaries with selected neurological conditions who present to a non-NM non-frontier rural facility



SOURCE: October, 2015 through September, 2017 Medicare Research Identifiable Files. See Appendix B for a list of diagnosis codes used to identify claims with a neurological condition as the principal or admitting diagnosis as well as the diagnosis-to-condition crosswalk. Diagnoses were subset to those that were recommended by a Neurocritical Care fellow at the University of Chicago.

Claims were restricted as follows:

1. Inpatient and outpatient claims were isolated to those in the emergency department. See Appendix C for a list of revenue codes used to identify claims to the Emergency Department.
2. Rural facilities were defined by the CBSA Urban Rural Indicator (cbsa_urbn_rrl_ind='R') found in the Provider of services file
3. Non-frontier facilities were defined by the zip code found in the provider of services file and zip code level one FAR codes (far1='0') created by the USDA ERS.
4. Beneficiary was enrolled in FFS A and B in the month of service, as determined by the 2015-2017 Master Beneficiary Summary File
5. Transfers were isolated to acute facilities in urban areas and acute Rural Referral Centers

Exhibit 6. Disposition of Medicare FFS beneficiaries with selected neurological conditions who present to a non-New Mexico frontier rural facility, by condition

Condition (Order reflects frequency in the ACCESS Program)		Kept at Rural Facility					Transferred from Rural Facility				
	Number of Rural Claims	Overall (%)	Admitted to IP facility (%)	Died (%)	Discharged (%)	Observed (%)	Overall (%)	Admitted to IP facility (%)	Died (%)	Discharged (%)	Observed (%)
Ischemic Stroke	4,958	98.55	95.01	4.44	0.55		1.45	86.11	6.94	2.78	4.17
Seizures	9,646	93.80	19.45	0.42	68.59	11.54	6.20	77.59	1.51	17.73	3.18
Transient Ischemic Attack (TIA)	11,686	92.94	12.25	0.09	51.38	36.29	7.06	69.82	0.48	24.85	4.85
Spine Injury	256	97.27	96.79	3.21			2.73	85.71	14.29		
Brain Tumor	87	96.55	89.29	9.52	1.19		3.45	100.00			
Intracerebral Hemorrhage	1,700	59.18	37.08	18.49	34.89	9.54	40.82	76.95	12.54	8.50	2.02
Subdural hematoma	635	98.74	87.24	11.48	1.28		1.26	62.50	25.00		12.50
Subarachnoid hemorrhage	238	97.06	88.31	11.26	0.43		2.94	85.71	14.29		
Aneurysm	76	63.16	6.25		93.75		36.84	64.29	3.57	21.43	10.71
Total	29,282	92.34	33.93	2.09	45.19	18.79	7.66	74.67	4.91	16.86	3.57

SOURCE: October, 2015 through September, 2017 Medicare Research Identifiable Files. See Appendix B for a list of diagnosis codes used to identify claims with a neurological condition as the principal or admitting diagnosis as well as the diagnosis-to-condition crosswalk. Diagnoses were subset to those that were recommended by a Neurocritical Care fellow at the University of Chicago and presented in the same order as Exhibit 1 from most to least common in ACCESS program data.

Claims were restricted as follows:

1. Inpatient and outpatient claims were isolated to those in the emergency department. See Appendix C for a list of revenue codes used to identify claims to the Emergency Department.
2. Rural facilities were defined by the CBSA Urban Rural Indicator (cbsa_urbn_rrl_ind='R') found in the Provider of services file
3. Frontier facilities were defined by the zip code found in the provider of services file and zip code level one FAR codes (far1='1') created by the USDA ERS.
4. Beneficiary was enrolled in FFS A and B in the month of service, as determined by the 2015-2017 Master Beneficiary Summary File
5. Transfers were isolated to acute facilities in urban areas and acute Rural Referral Centers

Appendix A. Data and definitions

This analysis is based on CCW Medicare RIFs for October 2015 through September 2017. Neurology related claims were defined using the inpatient admitting or outpatient principal ICD-10 diagnosis code. Neurological conditions included in analysis are based on the submitter's responses to PRT questions; Appendix B contains a list of these conditions and the diagnosis codes associated with each. Exhibit 1 includes all neurological conditions noted in the submitter's responses to PRT questions, while analysis for Exhibits 2 – 6 are limited to a subset identified by an external neurologist as being most likely to be potentially appropriate for ACCESS Telemedicine based on claims information only.

The analysis was restricted to events that began in a rural facility. Rural facilities were defined by the CBSA Urban Rural Indicator (cbsa_urbn_rrl_ind='R') found in the public use Provider of Services (POS) file.

Beneficiaries were included in this analysis if they were enrolled in Medicare Parts A and B and if they were not a member of an HMO at the time of the event and the 60 days following. This inclusion was based on information contained in the Medicare Beneficiary Summary File.

Initiating emergent events were drawn from inpatient (IP) and outpatient (OP) claims. Events that begin in an emergency department (ED) and result in subsequent admission to the hospital are found among IP claims; those that result in transfer to another facility or some other kind of discharge are found in OP claims. In both cases, ED claims were identified by the presence of an ED revenue center in the claim (see Appendix C for a list of these revenue centers). Rural claims were further categorized into New Mexico, frontier excluding New Mexico, and non-frontier excluding New Mexico using the public use POS file to find facility zip codes and zip code level one FAR codes created by the US Department of Agriculture Economic Research Service.

Transfers were determined by comparing the service dates for the rural originating ED claims with other IP and OP acute-facility RIF claims. Acute facilities were defined by the last four digits of the facility's CMS Certification Number (CCN) (see Appendix D for a list of these four digits). Rural acute IP facilities were further limited to Rural Referral Centers identified in the FY2016-FY2018 Acute Inpatient Prospective Payment System Final Rules (see Appendix E for list of provider types). A transfer was considered to have taken place if the originating ED discharge date matched an admission date on one of the acute-facility claims described above.[1]

Length of stay was calculated for transfer claims and non-transfer claims and then all claims were categorized into three separate dispositions: "admitted to IP facility", "observed in OP facility and discharged", and "discharged from OP facility". These categories were used to align with data the submitter provided on disposition of cases under the current ACCESS program and in response to PRT questions. "Admitted to IP facility" claims were defined as claims to an IP facility regardless of length of stay. "Observed in OP facility and discharged" claims were defined as OP facility claims where the length of stay was greater than zero days. "Discharged from OP facility" claims were defined as OP facility claims where the patient was admitted and discharged on the same day (thus, the length of stay was zero). Rural originating ED claims were tabulated by disposition category for transfer and non-transfer claims separately.

[1] For OP claims, "discharge date" means the claim through-date and "admission date" means claim from-date.

Appendix B. Diagnoses used to identify neurological conditions

Condition	Associated ICD-10 Diagnosis codes
Altered Mental Status	R41.82
Aneurysm	I67.1
Arteriovenous Malformation	Q28.0, Q28.1, Q28.2, Q28.3
Ataxia	R27.0
Bells Palsy	G51.0
Brain Tumor	C71.0, C71.1, C71.2, C71.3, C71.4, C71.5, C71.6, C71.7, C71.8, C71.9, C72.0, C72.1, C72.20, C72.21, C72.22, C72.30, C72.31, C72.32, C72.40, C72.41, C72.42, C72.50, C72.59, C72.9, C79.31, C79.32, D33.3, D33.4, D33.7, D33.9
Cavernoma	Q28.3, D18.02
Conversion Disorder	F44.4, F44.6, F44.7, F44.8 F44.9
Dizziness	R42
Intracerebral Hemorrhage	S06.300A, S06.300D, S06.300S, S06.301A, S06.301D, S06.301S, S06.302A, S06.302D, S06.302S, S06.303A, S06.303D, S06.303S, S06.304A, S06.304D, S06.304S, S06.305A, S06.305D, S06.305S, S06.306A, S06.306D, S06.306S, S06.307A, S06.307D, S06.307S, S06.308A, S06.308D, S06.308S, S06.309A, S06.309D, S06.309S, S06.310A, S06.310D, S06.310S, S06.311A, S06.311D, S06.311S, S06.312A, S06.312D, S06.312S, S06.313A, S06.313D, S06.313S, S06.314A, S06.314D, S06.314S, S06.315A, S06.315D, S06.315S, S06.316A, S06.316D, S06.316S, S06.317A, S06.317D, S06.317S, S06.318A, S06.318D, S06.318S, S06.319A, S06.319D, S06.319S, S06.320A, S06.320D, S06.320S, S06.321A, S06.321D, S06.321S, S06.322A, S06.322D, S06.322S, S06.323A, S06.323D, S06.323S, S06.324A, S06.324D, S06.324S, S06.325A, S06.325D, S06.325S, S06.326A, S06.326D, S06.326S, S06.327A, S06.327D, S06.327S, S06.328A, S06.328D, S06.328S, S06.329A, S06.329D, S06.329S, S06.330A, S06.330D, S06.330S, S06.331A, S06.331D, S06.331S, S06.332A, S06.332D, S06.332S, S06.333A, S06.333D, S06.333S, S06.334A, S06.334D, S06.334S, S06.335A, S06.335D, S06.335S, S06.336A, S06.336D, S06.336S, S06.337A, S06.337D, S06.337S, S06.338A, S06.338D, S06.338S, S06.339A, S06.339D, S06.339S, S06.340A, S06.340D, S06.340S, S06.341A, S06.341D, S06.341S, S06.342A, S06.342D, S06.342S, S06.343A, S06.343D, S06.343S, S06.344A, S06.344D, S06.344S, S06.345A, S06.345D, S06.345S, S06.346A, S06.346D, S06.346S, S06.347A, S06.347D, S06.347S, S06.348A, S06.348D, S06.348S, S06.349A, S06.349D, S06.349S, S06.350A, S06.350D, S06.350S, S06.351A, S06.351D, S06.351S, S06.352A, S06.352D, S06.352S, S06.353A, S06.353D, S06.353S, S06.354A, S06.354D, S06.354S, S06.355A, S06.355D, S06.355S, S06.356A, S06.356D, S06.356S, S06.357A, S06.357D, S06.357S, S06.358A, S06.358D, S06.358S, S06.359A, S06.359D, S06.359S, S06.360A, S06.360D, S06.360S, S06.361A, S06.361D, S06.361S,

Condition	Associated ICD-10 Diagnosis codes
	S06.362A, S06.362D, S06.362S, S06.363A, S06.363D, S06.363S, S06.364A, S06.364D, S06.364S, S06.365A, S06.365D, S06.365S, S06.366A, S06.366D, S06.366S, S06.367A, S06.367D, S06.367S, S06.368A, S06.368D, S06.368S, S06.369A, S06.369D, S06.369S, S06.370A, S06.370D, S06.370S, S06.371A, S06.371D, S06.371S, S06.372A, S06.372D, S06.372S, S06.373A, S06.373D, S06.373S, S06.374A, S06.374D, S06.374S, S06.375A, S06.375D, S06.375S, S06.376A, S06.376D, S06.376S, S06.377A, S06.377D, S06.377S, S06.378A, S06.378D, S06.378S, S06.379A, S06.379D, S06.379S, S06.380A, S06.380D, S06.380S, S06.381A, S06.381D, S06.381S, S06.382A, S06.382D, S06.382S, S06.383A, S06.383D, S06.383S, S06.384A, S06.384D, S06.384S, S06.385A, S06.385D, S06.385S, S06.386A, S06.386D, S06.386S, S06.387A, S06.387D, S06.387S, S06.388A, S06.388D, S06.388S, S06.389A, S06.389D, S06.389S, I62.1, I62.9, I69.10, I69.11, I69.120, I69.121, I69.122, I69.123, I69.128, I69.131, I69.132, I69.133, I69.134, I69.139, I69.141, I69.142, I69.143, I69.144, I69.149, I69.151, I69.152, I69.153, I69.154, I69.159, I69.161, I69.162, I69.163, I69.164, I69.165, I69.169, I69.190, I69.191, I69.192, I69.193, I69.198, I69.110, I69.111, I69.112, I69.113, I69.114, I69.115, I69.118, I69.119, I61.0, I61.1, I61.2, I61.3, I61.4, I61.5, I61.6, I61.8, I61.9
Ischemic Stroke	I63.00, I63.011, I63.012, I63.013, I63.019, I63.02, I63.031, I63.032, I63.033, I63.039, I63.09, I63.10, I63.111, I63.112, I63.113, I63.119, I63.12, I63.131, I63.132, I63.133, I63.139, I63.19, I63.20, I63.211, I63.212, I63.213, I63.219, I63.22, I63.231, I63.232, I63.233, I63.239, I63.29, I63.30, I63.311, I63.312, I63.313, I63.319, I63.321, I63.322, I63.323, I63.329, I63.331, I63.332, I63.333, I63.339, I63.341, I63.342, I63.343, I63.349, I63.39, I63.40, I63.411, I63.412, I63.413, I63.419, I63.421, I63.422, I63.423, I63.429, I63.431, I63.432, I63.433, I63.439, I63.441, I63.442, I63.443, I63.449, I63.49, I63.50, I63.511, I63.512, I63.513, I63.519, I63.521, I63.522, I63.523, I63.529, I63.531, I63.532, I63.533, I63.539, I63.541, I63.542, I63.543, I63.549, I63.59, I63.6, I63.8, I63.9, I69.30, I69.31, I69.310, I69.311, I69.312, I69.313, I69.314, I69.315, I69.318, I69.319, I69.320, I69.321, I69.322, I69.323, I69.328, I69.331, I69.332, I69.333, I69.334, I69.339, I69.341, I69.342, I69.343, I69.344, I69.349, I69.351, I69.352, I69.353, I69.354, I69.359, I69.361, I69.362, I69.363, I69.364, I69.365, I69.369, I69.390, I69.391, I69.392, I69.393, I69.398
Meningitis/Encephalitis	G00.0, G00.1, G00.2, G00.3, G00.8, G00.9, G01, G02, G03.0, G03.1, G03.2, G03.8, G03.9, G04.00, G04.01, G04.02, G04.1, G04.2, G04.30, G04.31, G04.32, G04.39, G04.81, G04.89, G04.90, G04.91, G05.3, G05.4
Migraine	G43.001, G43.009, G43.011, G43.019, G43.101, G43.109, G43.111, G43.119, G43.401, G43.409, G43.411, G43.419, G43.501, G43.509, G43.511, G43.519, G43.601, G43.609, G43.611, G43.619, G43.701, G43.709, G43.711, G43.719, G43.A0, G43.A1, G43.B0, G43.B1, G43.C0,

Condition	Associated ICD-10 Diagnosis codes
	G43.C1, G43.D0, G43.D1, G43.801, G43.809, G43.811, G43.819, G43.821, G43.829, G43.831, G43.839, G43.901, G43.909, G43.911, G43.919
Seizures	G40.001, G40.009, G40.011, G40.019, G40.101, G40.109, G40.111, G40.119, G40.201, G40.209, G40.211, G40.219, G40.301, G40.309, G40.311, G40.319, G40.A01, G40.A09, G40.A11, G40.A19, G40.B01, G40.B09, G40.B11, G40.B19, G40.401, G40.409, G40.411, G40.419, G40.501, G40.509, G40.801, G40.802, G40.803, G40.804, G40.811, G40.812, G40.813, G40.814, G40.821, G40.822, G40.823, G40.824, G40.89, G40.901, G40.909, G40.911, G40.919, R56.00, R56.01, R56.1, R56.9, F44.5
Spine Injury	S14.0XXA, S14.0XXD, S14.0XXS, S14.101A, S14.101D, S14.101S, S14.102A, S14.102D, S14.102S, S14.103A, S14.103D, S14.103S, S14.104A, S14.104D, S14.104S, S14.105A, S14.105D, S14.105S, S14.106A, S14.106D, S14.106S, S14.107A, S14.107D, S14.107S, S14.108A, S14.108D, S14.108S, S14.109A, S14.109D, S14.109S, S14.111A, S14.111D, S14.111S, S14.112A, S14.112D, S14.112S, S14.113A, S14.113D, S14.113S, S14.114A, S14.114D, S14.114S, S14.115A, S14.115D, S14.115S, S14.116A, S14.116D, S14.116S, S14.117A, S14.117D, S14.117S, S14.118A, S14.118D, S14.118S, S14.119A, S14.119D, S14.119S, S14.121A, S14.121D, S14.121S, S14.122A, S14.122D, S14.122S, S14.123A, S14.123D, S14.123S, S14.124A, S14.124D, S14.124S, S14.125A, S14.125D, S14.125S, S14.126A, S14.126D, S14.126S, S14.127A, S14.127D, S14.127S, S14.128A, S14.128D, S14.128S, S14.129A, S14.129D, S14.129S, S14.131A, S14.131D, S14.131S, S14.132A, S14.132D, S14.132S, S14.133A, S14.133D, S14.133S, S14.134A, S14.134D, S14.134S, S14.135A, S14.135D, S14.135S, S14.136A, S14.136D, S14.136S, S14.137A, S14.137D, S14.137S, S14.138A, S14.138D, S14.138S, S14.139A, S14.139D, S14.139S, S14.141A, S14.141D, S14.141S, S14.142A, S14.142D, S14.142S, S14.143A, S14.143D, S14.143S, S14.144A, S14.144D, S14.144S, S14.145A, S14.145D, S14.145S, S14.146A, S14.146D, S14.146S, S14.147A, S14.147D, S14.147S, S14.148A, S14.148D, S14.148S, S14.149A, S14.149D, S14.149S, S14.151A, S14.151D, S14.151S, S14.152A, S14.152D, S14.152S, S14.153A, S14.153D, S14.153S, S14.154A, S14.154D, S14.154S, S14.155A, S14.155D, S14.155S, S14.156A, S14.156D, S14.156S, S14.157A, S14.157D, S14.157S, S14.158A, S14.158D, S14.158S, S14.159A, S14.159D, S14.159S, S14.2XXA, S14.2XXD, S14.2XXS, S14.3XXA, S14.3XXD, S14.3XXS, S14.4XXA, S14.4XXD, S14.4XXS, S14.5XXA, S14.5XXD, S14.5XXS, S14.8XXA, S14.8XXD, S14.8XXS, S14.9XXA, 14.9XXD, 14.9XXS, S22.000A, S22.000B, S22.000D, S22.000G, S22.000K, S22.000S, S22.001A, S22.001B, S22.001D, S22.001G, S22.001K, S22.001S, S22.002A, S22.002B, S22.002D, S22.002G, S22.002K, S22.002S, S22.008A, S22.008B, S22.008D, S22.008G, S22.008K, S22.008S, S22.009A, S22.009B, S22.009D,

Condition	Associated ICD-10 Diagnosis codes
	S22.009G, S22.009K, S22.009S, S22.010A, S22.010B, S22.010D, S22.010G, S22.010K, S22.010S, S22.011A, S22.011B, S22.011D, S22.011G, S22.011K, S22.011S, S22.012A, S22.012B, S22.012D, S22.012G, S22.012K, S22.012S, S22.018A, S22.018B, S22.018D, S22.018G, S22.018K, S22.018S, S22.019A, S22.019B, S22.019D, S22.019G, S22.019K, S22.019S, S22.020A, S22.020B, S22.020D, S22.020G, S22.020K, S22.020S, S22.021A, S22.021B, S22.021D, S22.021G, S22.021K, S22.021S, S22.022A, S22.022B, S22.022D, S22.022G, S22.022K, S22.022S, S22.028A, S22.028B, S22.028D, S22.028G, S22.028K, S22.028S, S22.029A, S22.029B, S22.029D, S22.029G, S22.029K, S22.029S, S22.030A, S22.030B, S22.030D, S22.030G, S22.030K, S22.030S, S22.031A, S22.031B, S22.031D, S22.031G, S22.031K, S22.031S, S22.032A, S22.032B, S22.032D, S22.032G, S22.032K, S22.032S, S22.038A, S22.038B, S22.038D, S22.038G, S22.038K, S22.038S, S22.039A, S22.039B, S22.039D, S22.039G, S22.039K, S22.039S, S22.040A, S22.040B, S22.040D, S22.040G, S22.040K, S22.040S, S22.041A, S22.041B, S22.041D, S22.041G, S22.041K, S22.041S, S22.042A, S22.042B, S22.042D, S22.042G, S22.042K, S22.042S, S22.048A, S22.048B, S22.048D, S22.048G, S22.048K, S22.048S, S22.049A, S22.049B, S22.049D, S22.049G, S22.049K, S22.049S, S22.050A, S22.050B, S22.050D, S22.050G, S22.050K, S22.050S, S22.051A, S22.051B, S22.051D, S22.051G, S22.051K, S22.051S, S22.052A, S22.052B, S22.052D, S22.052G, S22.052K, S22.052S, S22.058A, S22.058B, S22.058D, S22.058G, S22.058K, S22.058S, S22.059A, S22.059B, S22.059D, S22.059G, S22.059K, S22.059S, S22.060A, S22.060B, S22.060D, S22.060G, S22.060K, S22.060S, S22.061A, S22.061B, S22.061D, S22.061G, S22.061K, S22.061S, S22.062A, S22.062B, S22.062D, S22.062G, S22.062K, S22.062S, S22.068A, S22.068B, S22.068D, S22.068G, S22.068K, S22.068S, S22.069A, S22.069B, S22.069D, S22.069G, S22.069K, S22.069S, S22.070A, S22.070B, S22.070D, S22.070G, S22.070K, S22.070S, S22.071A, S22.071B, S22.071D, S22.071G, S22.071K, S22.071S, S22.072A, S22.072B, S22.072D, S22.072G, S22.072K, S22.072S, S22.078A, S22.078B, S22.078D, S22.078G, S22.078K, S22.078S, S22.079A, S22.079B, S22.079D, S22.079G, S22.079K, S22.079S, S22.080A, S22.080B, S22.080D, S22.080G, S22.080K, S22.080S, S22.081A, S22.081B, S22.081D, S22.081G, S22.081K, S22.081S, S22.082A, S22.082B, S22.082D, S22.082G, S22.082K, S22.082S, S22.088A, S22.088B, S22.088D, S22.088G, S22.088K, S22.088S, S22.089A, S22.089B, S22.089D, S22.089G, S22.089K, S22.089S, S24.101A, S24.101D, S24.101S, S24.102A, S24.102D, S24.102S, S24.103A, S24.103D, S24.103S, S24.104A, S24.104D, S24.104S, S24.109A, S24.109D, S24.109S, S24.111A, S24.111D, S24.111S, S24.112A, S24.112D, S24.112S, S24.113A, S24.113D, S24.113S, S24.114A, S24.114D, S24.114S, S24.119A, S24.119D, S24.119S, S24.131A, S24.131D, S24.131S,

Condition	Associated ICD-10 Diagnosis codes
	S24.132A, S24.132D, S24.132S, S24.133A, S24.133D, S24.133S, S24.134A, S24.134D, S24.134S, S24.139A, S24.139D, S24.139S, S24.141A, S24.141D, S24.141S, S24.142A, S24.142D, S24.142S, S24.143A, S24.143D, S24.143S, S24.144A, S24.144D, S24.144S, S24.149A, S24.149D, S24.149S, S24.151A, S24.151D, S24.151S, S24.152A, S24.152D, S24.152S, S24.153A, S24.153D, S24.153S, S24.154A, S24.154D, S24.154S, S24.159A, S24.159D, S24.159S, S24.2XXA, S24.2XXD, S24.2XXS, S34.101A, S34.101D, S34.101S, S34.102A, S34.102D, S34.102S, S34.103A, S34.103D, S34.103S, S34.104A, S34.104D, S34.104S, S34.105A, S34.105D, S34.105S, S34.109A, S34.109D, S34.109S, S34.111A, S34.111D, S34.111S, S34.112A, S34.112D, S34.112S, S34.113A, S34.113D, S34.113S, S34.114A, S34.114D, S34.114S, S34.115A, S34.115D, S34.115S, S34.119A, S34.119D, S34.119S, S34.121A, S34.121D, S34.121S, S34.122A, S34.122D, S34.122S, S34.123A, S34.123D, S34.123S, S34.124A, S34.124D, S34.124S, S34.125A, S34.125D, S34.125S, S34.129A, S34.129D, S34.129S, S34.131A, S34.131D, S34.131S, S34.132A, S34.132D, S34.132S, S34.139A, S34.139D, S34.139S, S34.21XA, S34.21XD, S34.21XS, S34.22XA, S34.22XD, S34.22XS
Subarachnoid Hemorrhage	I60.00, I60.01, I60.02, I60.10, I60.11, I60.12, I60.20, I60.21, I60.22, I60.30, I60.31, I60.32, I60.4, I60.50, I60.51, I60.52, I60.6, I60.7, I60.8, I60.9, I69.00, I69.01, I69.020, I69.021, I69.022, I69.023, I69.028, I69.031, I69.032, I69.033, I69.034, I69.039, I69.041, I69.042, I69.043, I69.044, I69.049, I69.051, I69.052, I69.053, I69.054, I69.059, I69.061, I69.062, I69.063, I69.064, I69.065, I69.069, I69.090, I69.091, I69.092, I69.093, I69.098, I60.2, I69.010, I69.011, I69.012, I69.013, I69.014, I69.015, I69.018, I69.019, S06.6X0A, S06.6X0D, S06.6X0S, S06.6X1A, S06.6X1D, S06.6X1S, S06.6X2A, S06.6X2D, S06.6X2S, S06.6X3A, S06.6X3D, S06.6X3S, S06.6X4A, S06.6X4D, S06.6X4S, S06.6X5A, S06.6X5D, S06.6X5S, S06.6X6A, S06.6X6D, S06.6X6S, S06.6X7A, S06.6X7D, S06.6X7S, S06.6X8A, S06.6X8D, S06.6X8S, S06.6X9A, S06.6X9D, S06.6X9S
Subdural Hematoma	I62.00, I62.01, I62.02, I62.03, S06.5X0A, S06.5X0D, S06.5X0S, S06.5X1A, S06.5X1D, S06.5X1S, S06.5X2A, S06.5X2D, S06.5X2S, S06.5X3A, S06.5X3D, S06.5X3S, S06.5X4A, S06.5X4D, S06.5X4S, S06.5X5A, S06.5X5D, S06.5X5S, S06.5X6A, S06.5X6D, S06.5X6S, S06.5X7A, S06.5X7D, S06.5X7S, S06.5X8A, S06.5X8D, S06.5X8S, S06.5X9A, S06.5X9D, S06.5X9S
Transient Ischemic Attack (TIA)	G45.0, G45.1, G45.2, G45.3, G45.4, G45.8, G45.9
Traumatic Brain Injury	S06.2X0A, S06.2X0D, S06.2X0S, S06.2X1A, S06.2X1D, S06.2X1S, S06.2X2A, S06.2X2D, S06.2X2S, S06.2X3A, S06.2X3D, S06.2X3S, S06.2X4A, S06.2X4D, S06.2X4S, S06.2X5A, S06.2X5D, S06.2X5S, S06.2X6A, S06.2X6D, S06.2X6S, S06.2X7A, S06.2X7D, S06.2X7S, S06.2X8A, S06.2X8D, S06.2X8S, S06.2X9A, S06.2X9D, S06.2X9S

Condition	Associated ICD-10 Diagnosis codes
SOURCE: 2015-2017 ICD-10 code lists sourced from CMS' website and an free search engine https://www.icd10data.com/ICD10CM/Codes	

Appendix C. Emergency department revenue center codes

Revenue Center Code	Description
0450	Emergency room-general classification
0451	Emergency room-emtala emergency medical screening services
0452	Emergency room-ER beyond emtala screening
0456	Emergency room-urgent care
0459	Emergency room-other
SOURCE: Chronic Condition Warehouse Medicare Fee-For-Service Institutional Claims Codebook	

Appendix D. Acute care facility provider number codes

Code Index	Description
0001-0879	Short-term (general and specialty) hospitals where TOB = 11X; ESRD clinic where TOB = 72X
0880-0899	Reserved for hospitals participating in ORD demonstration projects where TOB = 11X; ESRD clinic where TOB = 72X
SOURCE: Chronic Condition Warehouse Medicare Fee-For-Service Institutional Claims Codebook	

Appendix E. Rural referral center provider type codes used in CMS inpatient PPS rules

Provider Type Value	Description
07	Rural Referral Center
15	Medicare Dependent Hospital/Rural Referral Center
17	Sole Community Hospital/Rural Referral Center
22	Essential Access Cmty Hsp/Rural Referral Center
SOURCE: FY2016-FY2018 Acute Inpatient Prospective Payment System Final Rules	