**Supplementary:**

**Table S1.** A summary form of the ultimately selected papers

| **No.** | **First author/ Title** | **Aim or Hypothesis** | **Sample (N=)** | **Country/ Year** | **Tools** | **Methodology/ Study Design** | **Results** | **Conclusion** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | Tzu- Ching Wu et al. /  Telemedicine Can Replace the Neurologist on a Mobile Stroke Unit / (22) | The main purpose of this study was to compare the benefits and effectiveness of neurological evaluation by telemedicine in a mobile stroke unit and on-scene evaluation by a neurologist to determine the eligibility of patients for tissue-type plasminogen activators. Also, the agreement was determined between the remote neurologist and the on-scene neurologist. | Suspected stroke patients  (N=174) | US/ 2014 | **Software:**  Internet, picture archiving and communication system (PACS), SAS version 9.3), R version 3.3.1.  **Hardware:**  Laptop, (CT) scanner, laboratory equipment,  RP-Xpress device, Max life telemedicine,  **scale:**  NIHSS, modified Rankin score (mRS). | Randomized Trial/  This study was conducted to evaluate 174 suspected stroke patients to determine eligibility for tissue-type plasminogen activators. The working procedure was that as soon as a warning about a suspected stroke patient was given, the neurologist at the scene evaluated the patient, and if the patient was suspected of having a stroke, he was transferred to the mobile stroke unit. After the transfer of the patient, pre-hospital procedures such as examination, recording of history and vital signs, CT scan imaging, and other cases were performed by paramedics. The paramedics then notified the remote neurologist to connect to them via telemedicine. CT scan images and clinical information were sent to a distant neurologist for review and consultation. Then, both neurologists announced and agreed upon their final decision regarding the patient's evaluation. | In this study, evaluation, screening, and neurological examination of stroke patients were done with the help of telemedicine and through consultation, recording and sending vital signs, sending laboratory results, and sending and interpreting CT scan results remotely. Also, decisions and therapeutic interventions (injection of tissue-type plasminogen) were made. In 88% of the evaluations, both remote and on-scene neurologists agreed, which is comparable to the simultaneous evaluation of two neurologists who examine patients in the emergency department. For the evaluation of 4 patients, there were technical problems such as malfunction of the telemedicine camera and poor internet connection, and there was disagreement between neurologists only in 20 patients. In general, there was almost complete agreement in the assessments of the bleeding observed on the CT scan, the need for a tissue-type plasminogen activator, and the NIHSS scale. | Neurological evaluations via telemedicine are reliable and accurate, and they are almost equal to in-person evaluations by a neurologist. Therefore, in emergencies, the use of telemedicine is recommended to save time, especially if we use this technology for monitoring in mobile stroke units. Telemedicine supports and complements in-person assessments. |
| 2 | Frederik Geisler et al. /  Telemedicine in Prehospital Acute Stroke Care / (24) | The purpose of this study was to investigate the feasibility and reliability of using telemedicine in a mobile stroke unit and also to compare the accuracy of assessment and treatment decisions of neurologists using two methods of telemedicine in a mobile stroke unit and standard treatment (i.e., evaluation at the scene). | acute ischemic stroke(N=90) | German /2013 and 2014 | **Software:**  Internet, Excel 2016, SPSS Statistics 24.  **Hardware:**  CT scanner, phone, notebook laptop, Vimed car, Vimed Doc,  **scale:**  NIHSS. | Feasibility and interventional study/  Acute ischemic stroke patients based on two studies, PrioLTE2 and TeDir, became analyzed.  Inclusion criteria: patients with acute neurological or non-neurological symptoms that did not require immediate diagnosis or treatment, and exclusion criteria: patients with threatening conditions that required immediate medical intervention in an ambulance or transfer to the hospital.  After recording the history, examinations, and laboratory tests, the neurologist in the mobile stroke unit performed intravenous thrombolysis in patients with acute ischemic stroke. After pre-hospital interventions, eligible patients were selected for remote examination and consultation by another neurologist. Vimed car and Vimed Doc telemedicine systems were used to communicate with the remote neurologist. Finally, the reliability of the diagnoses, NIHSS scores, and treatment decisions of two neurologists was compared. Also, the quality of the video conference and the average completion time for remote counseling were determined. | In this study, telemedicine was used for neurological evaluation and examination, diagnosis (sending CT scan images, ECGs, and vital signs), and remote consultation, as well as for treatment decisions (intravenous thrombolysis).  Out of 103 patients, 90 were evaluated and consulted remotely (5 patients were excluded due to connection problems, 4 patients due to data loss, 2 patients due to worsening of clinical symptoms, and 2 patients due to technical problems). All these problems affected distant communication and counseling.  The quality of the video conference was reported to be good and satisfactory. The average completion time for teleconsultation was reported to be between 19+5 and 19-5 minutes. The agreement on assessment and diagnosis between neurologists was high. | Remote evaluation and treatment decisions for emergency patients are technically possible with satisfactory audio-visual quality.  Agreement on diagnoses, neurologic examinations, and treatment decisions is most often consistent with on-scene neurological assessments and can be used in emergencies.  However, technical difficulties remain a limitation associated with the prehospital telemedicine-based approach. |
| 3 | Gary H. Belt et al. /  In-Transit Telemedicine Speeds Ischemic Stroke Treatment Preliminary Results / (25) | This study aimed to determine the feasibility of using teleneurology in an ambulance to evaluate door-to-needle and last-known-well-to-needle times for stroke patients. Also, the efficiency and cost of the patient evaluation were compared with teleneurology methods in the ambulance and patient evaluation in the mobile stroke unit. | ischemic stroke(N=89) | US/ 2015 and 2016 | **Software:** Internet, Stat Plus for Mac (Analyst Soft Inc, version 6).  **Hardware:** InTouch Xpress device.  **scale:**  CPSS. | Feasibility and interventional study/  In this study, stroke patients were evaluated and examined using teleneurology in the ambulance. Histories, examinations, MRI images, and other patient information were sent by paramedics to distant neurologists for review. Also, stroke patients treated with alteplase were evaluated in the mobile stroke unit. Then, the necessary coordination was done with the emergency department of the hospital. Finally, the time required for pre-hospital interventions was compared using two methods. | In this study, primary management, examination, clinical evaluation, remote consultation, and sending MRI images of stroke patients were done using telemedicine in the ambulance.  The average evaluation time using teleneurology in the ambulance was 13 minutes less than the evaluation and management of the patient in the mobile stroke unit without using teleneurology. This study showed the high acceptance of stroke patients and paramedics regarding the use of teleneurology in the ambulance for pre-hospital interventions. In fact, despite the communication challenges, the results of the evaluations were satisfactory. Therefore, teleneurology in the ambulance can be a cheap and scalable alternative to mobile stroke units. | Saving time for treating stroke patients through telemedicine in an ambulance is comparable to a mobile stroke unit. Therefore, telemedicine can be considered a scalable and low-cost method that provides rapid management of emergency patients. |
| 4 | Ahmed Itrat et al. /  Telemedicine in Prehospital Stroke Evaluation and Thrombolysis Taking Stroke Treatment to the Doorstep / (26) | The purpose of this study was to investigate the feasibility, reliability, and adequacy of telemedicine in the mobile stroke unit for the treatment of acute stroke. Also, it was to compare the speed of evaluation of patients through telemedicine in the mobile stroke unit with the evaluation of patients transported by ambulance to the emergency department of the hospital | acute stroke patients (N=100) | US/  2014 and 2015 | **Software:**  Internet, Electronic Medical Records (EMR), REDCap app,  JMP, version 10.0; SAS Institute Inc.  **Hardware:**  mobile CT system (CereTom; NeuroLogica Corporation),  Laboratory equipment, handbook, compact disc, report sheet, hospital bed, RP-Xpress; InTouch Health device, tablet.  **scale:**  not mentioned. | Feasibility and prospective- observational study/  This study was conducted in Cleveland and had 2 phases. The first phase/simulation: the implementation of the mobile stroke unit at the Cleveland Clinic. A simulation scenario of stroke alerts was conducted that tested physician preparation, equipment reliability, and telecommunications.  The second/operational phase: included the operationalization of the stroke mobile unit. The evaluation of 100 patients was done with the help of A neurovascular specialist and neurologist through telemedicine in the mobile stroke unit. The working method was that first the EMS team performed an initial assessment of stroke patients. If the patient was suspected of having a stroke, he was transferred to the mobile stroke unit. After taking the patient's history and information, the mobile stroke unit team transferred him to the mobile stroke unit. Secondary assessment and monitoring of vital signs were performed while the patient was in the mobile stroke unit. All CT images and tests of the patient were recorded in the EMR and registry and sent to the neurologists through telemedicine. Treatment, including intravenous thrombolysis, was initiated on-site if necessary and continued during transfer to the receiving hospital. Finally, the evaluation of patients using the telemedicine method in the mobile stroke unit and the evaluation in the hospital emergency unit were compared. | In this study, triage, neurological evaluation, sending and interpreting CT images, sending laboratory results, vital signs, and treatment (intravenous thrombolysis) of patients were done using telemedicine based on mobile stroke units.  The evaluation of 99 patients through telemedicine was successfully performed in the mobile stroke unit. One of the connection problems was due to an error by the pre-hospital emergency team. 93 evaluations were done without any data transmission problems. There were 6 cases of video interruptions, but these interruptions did not affect clinical care and were quickly resolved. There were 5 cases of delay in sending CT scan images. In general, there was no significant difference in the time required to interpret the CT scan images between the two evaluation methods (telemedicine evaluation in the mobile stroke unit and evaluation in the hospital emergency unit), but the time to perform venous interventions was shorter in the telemedicine method. | Prehospital evaluation and treatment of stroke patients is possible using telemedicine based on mobile stroke units and is associated with the lowest failure rate and fewest technical problems. Therefore, it can overcome the high costs of the mobile stroke unit. These systems allow professionals to monitor multiple mobile stroke units and expand geographic coverage. |
| 5 | Mary Bilotta et al. /  A Novel Use of Prehospital Telemedicine to Decrease Door-to-Computed Tomography Results in Acute Strokes / (27) | The purpose of this study was to evaluate the feasibility and evaluation of acute stroke patients through telemedicine in the ambulance to reduce the time to perform a CT scan before reaching the emergency department of the hospital and finally to decide on thrombolysis treatment. | acute stroke patients(N=52) | US /2016 and 2017 | **Software:** Internet, Minitab version 17.2.1.  **Hardware:**  Tablet, mounting system,  Headphones.  **scale:**  Cincinnati Prehospital Stroke Scale (CPSS), NIH-8 scale. | Feasibility and retrospective- interventional study/  Seventeen ambulances were provided with equipment to perform a video examination of stroke patients by the hospital's emergency physician. Ambulance paramedics requested a video examination for patients whose evaluation score was positive. Then, the emergency physician also performed another evaluation and for the patients whose scores were positive at this stage, the decision was made to provide CT scan services. After completing the CT scan, the emergency physician and colleagues completed the evaluations and reviewed the patients' laboratory tests. Indeed, a retrospective review of patients who underwent telemedicine evaluation and patients who did not undergo telemedicine evaluation was performed. Finally, the time intervals were analyzed and accordingly the patients eligible for thrombolysis were determined. | In this study, neurological evaluation, examination, diagnosis, remote consultation, interpretation of CT scan images, review of laboratory results, and treatment decisions (thrombolysis services) were performed through telemedicine in the ambulance.  Out of 275 stroke patients, 52 cases underwent remote evaluation with telemedicine. 4 time periods were analyzed for eligibility to receive CT scan and thrombolysis services, including time from the moment of entering the emergency department to the order for the CT scan, time from the order for the CT scan to the start of the examination, time from the moment of the order for the CT interpretation T-scan by the radiologist, and the total time from arriving at the emergency department to the final interpretation of the CT scan results. Savings were made in all these 4 periods. | Remote pre-hospital consultations before the patient enters the emergency department provide the awareness and information needed for the doctor to perform a modified neurological examination. Video examinations facilitate the processes as soon as the patient arrives at the hospital emergency unit, which leads to a reduction in the time of receiving CT scan services and improves treatment decisions for patients eligible for thrombolysis. |
| 6 | Tzu-Ching Wu et al. /  Prehospital Utility of Rapid Stroke Evaluation Using In-Ambulance Telemedicine A Pilot Feasibility Study / (12) | This study aimed to investigate the feasibility and reliability of using telemedicine in an ambulance to identify, evaluate, and triage acute ischemic stroke patients. | acute ischemic stroke (N=10) actors. | US /2014 | **Software:**  internet, STATA version 13.  **Hardware:**  In-Touch RP-Xpress, desktop computer, charger.  **scale:**  NIHSS. | feasibility and interventional study/  10 simulated scenarios (each conducted 4 times) with different stroke severity levels from 0 to 27 and different stroke syndromes were performed by ambulance paramedics and trained actors. Using telemedicine equipment, neurologists evaluated actors remotely and collected data (e.g., vital signs and glucose values). Each scenario was recorded for evaluation by another neurologist. The location of each scenario varied from 3 to 10 miles from the emergency department to various locations.  In general, the feasibility of this study was reported to be 80% without significant technical limitations. Reliability of video interpretation was defined as 90% concordance between data obtained during the telesessions and those obtained from the recorded scenarios. | In this study, telemedicine was used in an ambulance for triage, neurological assessment, examination, teleconsultation, sending vital signs and glucose levels, and treatment decisions (tissue-type plasminogen activator) to actors simulating an acute stroke scenario. Out of 40 scenarios, in 34 cases, remote consultation was done without technical problems. 6 scenarios were not completed due to technical problems. In 3 scenarios, the problem was a weak internet connection, and in 2 scenarios, the problem was the telemedicine device (that is, the automatic software update and restarting of the device, which led to a waste of time); and in 1 scenario, the problem was the Wi-Fi hotspot battery running out and being charged with an inappropriate charger and internet disconnection. Overall, the agreement between neurologists for the NIHSS scale in tele and recorded sessions was reported to be high. Also, the remote interrater agreement for the NIHSS scale was excellent and moderate. | Measurement of actors simulating acute stroke is possible and reliable through telemedicine. Therefore, this technology can be used for pre-hospital interventions. |
| 7 | Jason M. Lippman et al. /  Mobile Tele stroke During Ambulance Transport Is Feasible in a Rural EMS Setting: The iTREAT Study / (23) | The purpose of this report was to describe an ambulance telemedicine platform for prehospital assessments and observational examinations to improve the diagnosis and treatment of stroke patients. | acute stroke actor  (N=1) | US /2013 | **Software:**  Internet,  Jabber Video for iPad; Cisco, Inc., San Jose, CA app,  Motion X GPS app (Full power Technologies, Santa Cruz, CA).  **Hardware:**  Apple II iPad with retina display,  iPad protective case,  RAM mount,  RAM tablet cradle,  Antennae,  power supply,  Cradle Point modem,  Cradle Point 6-foot cable,  SIM card,  Pelican case.  **scale:**  NIHSS,  A Standardized 6-point scale (video rating scale). | Feasibility study/  In this study, a mobile telemedicine platform around an ambulance was designed for neurological evaluation and observational examination of an actor simulating a stroke scenario. 6 primary ambulance routes were determined along the main routes. All designated routes had transit times of approximately 20 minutes or more and supported areas were designated as rural. The initial development of this platform was done by testing the connectivity of the technology along these 6 ambulance routes in a rural network. The quality of the video conference was determined simultaneously and independently by two evaluators inside the ambulance and in the hospital. | In this study, telemedicine was used for triage, neurological assessment, screening, observational examination, diagnosis, and prehospital treatment of an actor who simulated a stroke scenario. A total of 30 tests were completed along 6 ambulance routes. The average video quality was given a score of 4.51, and the average sound quality was given a score of 5.00. The most common complaint associated with reviewers' poor video quality scores was image freezing, with reviewers citing pixelation and loss of fluidity as the main issues. Poor vocal scoring was mainly associated with the delayed vocal flow. | Prehospital assessment of acute stroke patients via ambulance-based videoconferencing is feasible and can be implemented using low-cost components and commercial data networks. This platform can be extended to deprived and rural areas, as well as a wide range of emergencies. However, further research is needed to demonstrate reliability and clinical efficacy in a live patient setting. |