Canadian Stroke Best Practices

CANADIAN STROKE BEST PRACTICE RECOMMENDATIONS

Stroke Systems of Care

7th Edition, 2026 Update

Evidence Tables

Virtual Care Principles

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Published Guidelines

Guideline	Recommendations
Acute	
Lou M, Ding J, Hu B, et al. **Chinese Stroke Association guidelines for clinical management of cerebrovascular disorders: executive summary and 2019 update on organizational stroke management** ***Stroke Vasc Neurol*. 2020;svn-2020-000355.**	*Importance of telemedicine* ► Smart phones, tablets and other communication tools can assist neurologists to assess the severity of prehospital stroke and make reasonable clinical decisions for patients with stroke. (Class I, level of evidence A) ► Telestroke can shorten the time of intravenous thrombolysis and improve the thrombolytic rate in patients with AIS. (Class I, level of evidence A) ► Rt-PA intravenous thrombolysis may be as safe and effective as in-hospital thrombolysis in patients with AIS guided by telestroke. (Class IIb, level of evidence B) ► Telestroke can provide guidance and support for rehabilitation treatment and secondary prevention of patients with stroke. (Class IIb, level of evidence C) ► Telestroke can optimise the allocation of health resources and reduce medical costs. (Class IIb, level of evidence C) ► Under the guidance of the government and the overall planning of the national/provincial stroke quality control centre, it may be reasonable to construct a regional stroke telemedicine network. (Class IIa, level of evidence B) *Operation and management of telemedicine* ► Comprehensive stroke centres should actively promote telemedicine, strengthen the integration of medical resources and form a stroke medical network covering the surrounding primary stroke centres or primary hospitals. (Class IIb, level of evidence B)
Hubert GJ, Santo G, Vanhooren G, Zvan B, Tur Campos S, Alasheev A, Abilleira S, Corea F. **Recommendations on telestroke in Europe** ***European Stroke Journal* 2019; 4: 101-109.** **(selected)**	Recommendations for the criteria for, the organization of, and the equipment needed for i) a telemedicine stroke centre (TSC) (hub), ii) a telemedicine-assisted stroke unit (TSU) and iii) the telemedicine-assisted stroke ready hospital unit (TSRH), are presented.
Powers WJ, Rabinstein AA, Ackerson T, Adeoye OM, Bambakidis NC, Becker K, et al; on behalf of the American Heart Association Stroke Council. **2018 Guidelines for the early management of patients with acute**	**1.6. Telemedicine** 1. For sites without in-house imaging interpretation expertise, teleradiology systems approved by the US Food and Drug Administration are recommended for timely review of brain imaging in patients with suspected acute stroke. Class I; LOE A 2. When implemented within a telestroke network, teleradiology systems approved by the US Food and Drug Administration are useful in supporting rapid imaging interpretation in time for IV alteplase administration decision making. Class I; LOE A. 3. Because of the limited distribution and availability of neurological, neurosurgical, and radiological expertise, the use of telemedicine/ telestroke resources and systems can be beneficial and should be supported by healthcare institutions,

Guideline	Recommendations
ischemic stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. ***Stroke.* 2018; Mar;49(3):e46-e110**	governments, payers, and vendors as one method to ensure adequate 24/7 coverage and care of acute stroke patients in a variety of settings. Class IIa; LOE C-EO. 4. Telestroke/teleradiology evaluations of AIS patients can be effective for correct IV alteplase eligibility decision making. Class IIa; B-R. 5. Administration of IV alteplase guided by telestroke consultation for patients with AIS may be as safe and as beneficial as that of stroke centers. Class IIb; LOE B-NR. 6. Providing alteplase decision-making support via telephone consultation to community physicians is feasible and safe and may be considered when a hospital has access to neither an in-person stroke team nor a telestroke system. Class IIb; LOE C-LD. 7. Telestroke networks may be reasonable for triaging patients with AIS who may be eligible for interfacility transfer in order to be considered for acute mechanical thrombectomy. Class IIb; LOE B-NR.
Demaerschalk BM, Berg J, Chong BW, et al. **American Telemedicine Association: Telestroke Guidelines.** ***Telemed J E Health* 2017;23(5):376-89.**	This document focuses on the acute phase of stroke, including both pre- and in-hospital encounters for cerebrovascular neurological emergencies. These guidelines describe a network of audiovisual communication and computer systems for delivery of telestroke clinical services and include operations, management, administration, and economic recommendations. These interactive encounters link patients with acute ischemic and hemorrhagic stroke syndromes with acute care facilities with remote and on-site healthcare practitioners providing access to expertise, enhancing clinical practice, and improving quality outcomes and metrics. These guidelines apply specifically to telestroke services and they do not prescribe or recommend overall clinical protocols for stroke patient care. Rather, the focus is on the unique aspects of delivering collaborative bedside and remote care through the telestroke model.
Schwamm LH, Holloway RG, Amarenco P, Audebert HJ, Bakas T, Chumbler NR et al; on behalf of the American Heart Association Stroke Council and the Interdisciplinary Council on Peripheral Vascular Disease. **A review of the evidence for the use of telemedicine within stroke systems of care: a scientific statement from the American Heart Association/American Stroke Association.** ***Stroke* 2009;40:2616 –2634.**	**Class I recommendations** 1. High-quality videoconferencing systems are recommended for performing an NIHSS-telestroke examination in nonacute stroke patients, and this is comparable to an NIHSS-bedside assessment. Similar recommendations apply for the European and Scandinavian Stroke scales (Class I, Level of Evidence A). 2. The NIHSS-telestroke examination, when administered by a stroke specialist using high-quality videoconferencing, is recommended when an NIHSS-bedside assessment by a stroke specialist is not immediately available for patients in the acute stroke setting, and this assessment is comparable to an NIHSS-bedside assessment (Class I, Level of Evidence A). 3. Teleradiology systems approved by the FDA (or equivalent organization) are recommended for timely review of brain CT scans in patients with suspected acute stroke (Class I, Level of Evidence A). 4. Review of brain CT scans by stroke specialists or radiologists using teleradiology systems approved by the FDA (or equivalent organization) is useful for identifying exclusions for thrombolytic therapy in acute stroke patients (Class I, Level of Evidence A). 5. When implemented within a telestroke network, teleradiology systems approved by the FDA (or equivalent organization) are useful in supporting rapid imaging interpretation in time for thrombolysis decision making (Class I, Level of Evidence B).

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	6. It is recommended that a stroke specialist using high-quality videoconferencing provide a medical opinion in favor of or against the use of intravenous tPA in patients with suspected acute ischemic stroke when on-site stroke expertise is not immediately available (Class I, Level of Evidence B). 7. When the lack of local physician stroke expertise is the only barrier to the implementation of inpatient stroke units, telestroke consultation via high-quality videoconferencing is recommended (Class I, Level of Evidence B). 8. Assessment of occupational, physical, or speech disability in stroke patients by allied health professionals via high-quality videoconferencing systems using specific standardized assessments is recommended when in-person assessment is impractical, the standardized rating instruments have been validated for high-quality videoconferencing use, and administration is by trained personnel using a structured interview (Class I, Level of Evidence B). 9. Telephonic assessment for measuring functional disability after stroke is recommended when in-person assessment is impractical, the standardized rating instruments have been validated for telephonic use, and administration is by trained personnel using a structured interview (Class I, Level of Evidence B). **Class II recommendations** 1. High-quality videoconferencing is reasonable for performing a general neurological examination by a remote examiner with interrater agreement comparable to that between different face-to-face examiners (Class IIa, Level of Evidence B). 2. Implementation of telestroke consultation in conjunction with stroke education and training for healthcare providers can be useful for increasing the use of intravenous tPA at community hospitals without access to adequate onsite stroke expertise (Class IIa, Level of Evidence B). 3. Compared with traditional bedside evaluation and use of intravenous tPA, the safety and efficacy of intravenous tPA administration based solely on telephone consultation without CT interpretation via teleradiology are not well established (Class IIb, Level of Evidence C). 4. Prehospital telephone-based contact between emergency medical personnel and stroke specialists for screening and consent can be effective in facilitating enrollment into hyperacute neuroprotective trials (Class IIa, Level of Evidence B). 5. Delivery of occupational or physical therapy to stroke patients by allied health professionals via high-quality videoconferencing systems is reasonable when in-person assessment is impractical (Class IIa, Level of Evidence B).
Rehabilitation	
National Clinical Guideline for Stroke for the UK and Ireland. London: Intercollegiate Stroke Working Party; 2023 May 4. **Available at:** www.strokeguideline.org.	Recommendations People undergoing rehabilitation after stroke should be considered for remotely delivered rehabilitation to augment conventional face-to-face rehabilitation. Telerehabilitation programmes should: – be personalised to the individual's goals and preferences; – be used when it is considered to be the most beneficial option to promote recovery and should not be used as a substitute for essential in-person rehabilitation; – be monitored and adapted by the therapist according to progress towards goals;

Guideline	Recommendations
	– be supplemented with face-to-face reviews and include the facility for contact with the therapist as required. People receiving rehabilitation after stroke should have an assessment of their ability to use assistive technology and programmes and equipment should be adapted accordingly. Stroke services should ensure adequate technology is available to enable access to telerehabilitation for people with stroke (this could be resourced via grants, community health services, library loan services etc.). People with stroke receiving telerehabilitation should be trained and supported in the use of the appropriate technology. Stroke rehabilitation staff who are recommending the use of telerehabilitation devices should be trained in their use, technological specification and limitations. This should include the review of technologies for appropriateness, safety and information governance (storage of personal data). Therapists should promote engagement and adherence to telerehabilitation through a coaching style relationship with the person with stroke.
Clinical Guidelines for Stroke Management 2017. Melbourne (Australia): National Stroke Foundation.	Weak recommendation New Telehealth services may be used as an alternative approach to delivering rehabilitation, especially for patients who cannot access specialist rehabilitation in the community. It may also be used as an adjunct to in-person therapy. Delivering of specific interventions via telehealth should only be considered for those that have demonstrated benefits.
Winstein CJ, Stein J, Arena R, Bates B, Cherney LR, Cramer SCet al; on behalf of the American Heart Association Stroke Council, Council on Cardiovascular and Stroke Nursing, Council on Clinical Cardiology, and Council on Quality of Care and Outcomes Research. **Guidelines for adult stroke rehabilitation and recovery: a guideline for healthcare professionals from the American Heart Association/American Stroke Association.** ***Stroke* 2016;47:e98–e169.**	**Recommendations: Assessment of Communication Impairment** Telerehabilitation is reasonable when face-to-face assessment is impossible or impractical. Class IIa, Level A **Recommendations: Motor Speech Disorders: Dysarthria and Apraxia of Speech** Telerehabilitation is reasonable when face-to-face assessment is impossible or impractical. Class IIa, Level C
Risk Factor Reduction (Prevention)	
Diabetes Canada Clinical Practice Guidelines Expert Committee. Diabetes Canada 2018 Clinical	7. Telehealth technologies may be used to: a. Improve self-management in underserviced communities [Grade B, Level 2) b. Facilitate consultation with specialized teams as part of a shared care model [Grade A, Level 1A]

Guideline	Recommendations
Practice Guidelines for the Prevention and Management of Diabetes in Canada. ***Can J Diabetes*. 2018;42(Suppl 1): S1-S325**	c. Improve clinical outcomes in type 2 diabetes, including a decrease in A1C, an increase in quality of care (i.e. guideline adherence), a decrease in health service use and cost, and an increase in patient satisfaction and knowledge [Grade A, Level 1A] d. Improve glycemic and CV risk factor control in type 1 and type 2 diabetes [Grade A, Level 1].

Evidence Tables

Telemedicine for Acute Ischemic Stroke

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Mohamed et al. 2024 **Canada** **Systematic review & meta-analysis**	NA	33 studies (2 RCTs), including 12,540 patients with acute ischemic stroke, of whom 7,936 (63.9%) were thrombolyzed. Mean age was 70 years. Mean baseline NIHSS score was 11.	The outcomes of thrombolyzed patients who were treated with telemedicine (TM, 51.7%) were compared with those treated conventionally (face-to-face, 48.3%). Any form of TM was included (telephone consult, videoconferencing) The percentages of all patients treated with thrombolysis and thrombectomy, were compared between TM and conventional groups.	**Primary outcomes:** Process times, good clinical outcome (mRS 0-2) at 90 days, mortality at 90 days, symptomatic intracerebral hemorrhage (sICH)	Mean symptoms onset to iv t-PA times (minutes) were similar for both groups (147.18±25.97 [conventional] vs. 144.09±18.87 [TM], p=0.6327). Mean door-to-needle (DTN) times (minutes) were similar for both groups (73.03±20.04 [conventional] vs. 65.91±25.96 [TM], p=0.321. In 2 studies DTN times were 2x longer in the TM group. The odds of a good clinical outcome were not significantly higher in patients treated conventionally (OR=1.06, 95% CI 0.89–1.29), nor were the odds of 90-day mortality (OR=1.16, 95% CI 0.94-1.43). The odds of sICH were not significantly higher in the TM group (OR=0.99, 95% CI 0.73–1.34, p=0.93). The percentage of all patients who received thrombolysis with t-PA and endovascular mechanical thrombectomy were similar between TM and conventional groups (30.7 vs. 20.5%, p=0.372 and 11.8% vs. 18.7%, p=0.508, respectively)
Ho & Fawcett 2024 **Canada** **Retrospective study**	NA	302 patients with acute stroke treated at a single institution with either endovascular thrombectomy (EVT) or intravenous thrombolysis, using t-PA.	The outcomes of patients who were treated after either a telemedicine (n=55) or in-person assessment (n=247), were compared.	**Primary outcomes:** Door-to-needle (DTN) time for alteplase (tPA) administration, door-to-puncture (DTP) time for EVT, symptomatic intracranial hemorrhage (sICH), and 3-month mortality	There were no significant differences in any of the outcomes between patients treated using telemedicine vs. in-person assessment: DTN 35.5 vs. 33 minutes DTP 86.5 vs. 85 minutes sICH 0% vs. 1.6% 3-month mortality 20.6% vs. 22.1%
Wilcock et al. 2021 **USA**	NA	153,272 patients presenting to hospital with acute ischemic stroke between January 2008 and	The outcomes of patients who were treated at hospitals with and without telestroke	**Primary outcomes:** Reperfusion treatment (thrombolysis or thrombectomy), 30-day	The frequency of reperfusion therapies was significantly higher at telestroke hospitals (6.8% vs 6.0%; difference, 0.78 percentage points; 95% CI 0.54-1.03, p < .001), with

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Prospective study		June 2017. Mean age was 78.8 years, 58% were women.	capacity, were compared, by matching. Matching was done 1:1 using both hospital and patient characteristics. There were 643 hospitals with telestroke capacity (n=76,636 patients) and a similar number of patients and hospitals without telestroke capacity. Hospitals that already had local stroke expertise were excluded.	mortality, spending through 90 days from admission, and days spent living in the community after discharge.	thrombolysis and thrombectomy, individually both significantly higher with telestroke. 30-day mortality was significantly lower in the telestroke hospitals (13.1% vs 13.6%; difference, 0.50 percentage points; 95% CI 0.17-0.83, p =0.003). There was no difference between groups in the number of days spent living in the community after discharge (60.25 vs. 60.22, p=0.93), or institutional spending ($26,560 vs. $26,524, p=0.31).
Ismail et al. 2019 **France** **Systematic review & meta-analysis**	Newcastle Ottawa Scale scores ranged from 6-9	8 studies (n=2,068) including patients with acute ischemic stroke, eligible for treatment with mechanical thrombectomy.	The outcomes of patients who underwent mechanical thrombectomy: a) preceded by IV thrombolysis in a primary stroke center with transport to a comprehensive stroke centre (CSC), or b) IV thrombolysis and direct transport to a CSC, were compared.	**Primary outcomes:** Successful reperfusion modified treatment in cerebral infarction (mTICI) score ≥2b, functional independence at 90 days (mRS score ≤2), symptomatic intracranial hemorrhage (sICH), and 90-day mortality	Mean difference in time from symptoms onset to puncture was significantly shorter in the CSC group (MD= -83.0 5minutes, 95% CI –89.09 to -77.01). Mean difference in time from symptoms onset to successful reperfusion was significantly shorter in the CSC group (MD= -94.33 minutes, 95% CI –100.42 to 88.24). Patients in the CSC group had better functional outcomes at 90 days (RR=0.87, 95% CI 0.77 to 0.98). There were no significant differences between groups in successful reperfusion (RR=1.00, 95% CI 0.92 to 1.10), 90-day mortality (RR=1.21, 95% CI 0.89 to 1.64), or sICH (RR=1.53, 95% CI 0.79 to 2.98).
Kaminsky et al. 2019 **France/USA** **Retrospective study**	NA	207 consecutive large vessel occlusion (LVO) patients ≥18 years who were admitted to one of 6 spoke centers or to the regional comprehensive stroke centre (CSC)	The outcomes of patients who were admitted to a spoke center using telestroke were compared with first CSC admission.	**Primary outcomes:** Favourable outcome (mRS 0-2) at 90 days **Secondary outcomes:** mRS scores at 3 months	132 (63.8%) patients were first admitted to the CSC and 75 (36.2%) to spoke centers before transfer to the CSC. Mean distance between spoke centers and the CSC was 54 miles (range 36–77 miles) with a mean road transport time of 77minutes. IVT was administered significantly more often in the group admitted to spoke centers (81.3% vs 53.8%, p=0.001). MT

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
		within 6 hours of symptom onset from September 1, 2015 to August 31, 2017. Mean age was 73.5 years, 42% were men. Mean baseline NIHSS was 15.8.			was performed more frequently in patients admitted to a CSC (49.2% vs. 26.7$, p=0.001). Mean time from onset to groin puncture was significantly shorter for patients admitted to the CSC (200±72min vs 303±44min, p<0.0001). There was no significant difference between groups in the percentage of patients who achieved a good outcome (32% spoke center vs 35.1% CSC) or in the mean mRS score (3.8 vs. 3.4)
Porter et al. 2018 **Canada** **Retrospective study**	NA	2,099 adult patients with ischemic stroke who were treated in acute care hospitals and received IV t-PA during two fiscal years 2010/2011 and 2012/2013 (April 1 to March 31). Median age was 72 years, 47% were women.	The outcomes of patients treated using the Ontario Telestroke Program (OTP, n=214) were compared with those treated at regional stroke centres, district stroke centres and non-designated centres (n=1,885)	**Primary outcomes:** 7- and 90-day mortality, symptomatic intracerebral hemorrhage (sICH), and poor functional outcome (mRS ≥3) at discharge Analyses were adjusted for age group, sex, atrial fibrillation, comorbidity score, stroke severity, hospital type, stroke unit, year, telestroke, rural residence	The administration of t-PA using telestroke was not associated with an increased risk of death within 7 or 90 days (adjusted HR=1.29, 95% 0.68- 2.44 and aHR=1.01, 95% CI 0.67-1.50, respectively). The administration of t-PA using telestroke was not associated with an increased risk sICH or poor outcome (adjusted HR=0.71, (95% 0.29-1.71 and aHR=0.75, 95% CI 0.46-1.23, respectively).
Gerschenfeld et al. 2017 **France** **Retrospective study**	NA	159 patients ≥ 18 years, admitted to 2 hospitals (one primary stroke centre [PSC] and one comprehensive stroke centre [CSC]) with a large vessel occlusion of the M1 or M2 MCA, treated with intravenous t-PA. and who were eligible for mechanical thrombectomy (MT),	The outcomes of patients who received MT following t-PA, using the drip and ship model (PSC, n=100) were compared with patients who underwent MT using the mother ship (MS) model (CSC, n=59).	**Primary outcome:** Favourable outcome (mRS ≤2) at 3 months **Secondary outcomes:** Substantial recanalization (TICI 2B or 3) and symptomatic intracranial hemorrhage (sICH)	Median process times from patients in the mothership group were all significantly shorter (onset to needle, onset to puncture, needle to puncture and onset to recanalization). There was no significant difference between groups in the proportion of patients with a favourable outcome (50.8% MS vs. 61% DS, p=0.82 after adjusting for baseline NIHSS score, DWI-ASPECTS, and general anesthesia), or recanalization (79.7% DS vs. 84% MS, p=0.59 using same adjustments). There was no significant difference between groups in the proportion of patients with sICH (3.4% MS vs. 2.0% DS, p=0.65) or median discharge NIHSS scores (6 MS vs. 4 DS, p=0.46).

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
		within 6 hours after symptom onset. Median age was 72 years, 54% were men. Median baseline NIHSS score was 16.			
Zhai et al. 2015 **China** **Systematic review & meta-analysis**	NA	8 studies prospective (n=5), or retrospective (n=3) observational with two-arm designs that examined the use of a telestroke system for delivery of thrombolytic agents. The number of subjects in each study ranged from 45-2,935. Mean baseline NIHSS scores ranged from 10-19	Studies compared the outcomes of patients treated with t-PA through telemedicine vs. traditional in-hospital care	**Primary outcome:** Favourable outcome (using mRS, not defined) **Secondary outcomes:** ICH and mortality	Mean or median time between stroke onset and treatment ranged from 113-188 (telemedicine) and 100-157 minutes (in-hospital). There was no significant increase in the odds of a favourable outcome associated with telestroke (OR=1.28, 95% CI 0.92-1.76, p=0.14). Results from 5 studies included. There was no increased risk of symptomatic ICH associated with telestroke (OR=1.08, 95% CI 0.47-2.5, p=0.85). Results from 5 studies included. There was no increased risk of mortality associated with telestroke (OR=0.95, 95% CI 0.82-1.11, p=0.51). Results from 4 studies included.

Mobile Stroke Units

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Grotta et al. 2021 **USA** **RCT** ***BEnefits of Stroke Treatment***	CA: ☑ Blinding patient: ☒ assessor: ☑ ITT: ☒	1,515 patients who called 911 with stroke symptoms, of whom 1,047 were last seen well within the previous 4hr 30 minutes (i.e., eligible to receive t-PA). Median age was 66 years, 51% were men.	Patients were randomized (by week) to treatment with a MSU (n=617), equipped with a CT scanner and a point-of-care lab, staffed by a Vascular Neurologist, RN and CT technician or standard EMS transport	**Primary outcome:** Utility-weighted mRS score at 90 days **Secondary outcomes:** mRS at 90 days, time from symptom onset to tPA treatment or EVT,	97.1% of patients in the MSU group received t-PA, vs. 79.5% in the EMS group. Median time from last known well (LKW) to t-PA treatment was 97 minutes in the MSU group vs. 108 minutes with EMS transport. Median time from LNW to thrombectomy treatment was 166 minutes in the MSU group vs. 163 minutes in the EMS group.

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Delivered Using a Mobile Stroke Unit (BEST-MSU)		Median baseline NIHSS score was 9. 32% had a previous stroke or TIA.	to the Emergency Department of a Comprehensive Stroke Centre for possible treatment with t-PA or endovascular therapy (EVT, n=430)	symptomatic ICH and mortality during hospitalization	The mean score on the utility-weighted mRS score at 90 days in patients eligible for t-PA was significantly higher in the MSU group (0.72 vs. 0.66, adj OR for a uw mRS score of ≥0.91, 2.43, 95% CI 1.75 to 3.36). Among patients eligible for t-PA, a higher percentage in the MSU group had a mRS score of 0-1 at 90 days (55% vs. 44%). Among all patients, the mean score on the utility-weighted mRS at discharge was significantly higher in the MSU group (0.57 vs. 0.51; adj OR for a score of ≥0.91, 1.82, 95% CI 1.39 to 2.37). 90-day mortality was 8.9% in the MSU group and 11.9% in the EMS group.
Fatima et al. 2020 **USA** **Systematic review & meta-analysis**	NA	11 studies (7 RCTs and 4 non-RCTs) including 21,297 patients with acute stroke (including ischemic stroke, TIA, ICH, seizures, subarachnoid hemorrhage, subdural hematoma, and neurological noncerebral vascular pathology). Mean age was 70.5 years, mean NIHSS score was 9.6.	The clinical outcomes between patients treated on a mobile stroke unit with thrombolysis (MSU, n= 6,065, 28.4%) and those receiving conventional care with in-hospital thrombolysis (n=15,232, 71.6%), were compared	**Primary outcomes:** Clinical outcome at days 1 and 7 (mRS 0-2 [good outcome], vs. mRS 3-6 [poor outcome]) **Secondary outcomes:** All-cause mortality at day 7, stroke-related or neurological death, and other adverse events	The mean time from alarm to end of CT scan was significantly shorter in the MSU group (28.6 vs. 37.5 minutes, p=0.04). The mean time from alarm to treatment with IV thrombolysis and/or intra-arterial recanalization (where applicable) was significantly shorter in the MSU group (62 vs. 75 minutes, p=0.03). The odds of a good clinical outcome at 7 days were significantly higher among patients in the MSU group (OR=1.46, 95% CI 1.306–2.03, p=0.02, n=3 studies). The odds of in-hospital mortality and adverse events were not reduced significantly in the MSU group (OR=0.98, 95% CI 0.81-1.18, p=0.80, n=6 studies and OR=0.69, 95% CI 0.39-1.20, p=0.19, n=4 studies, respectively). The odds of stroke related, or neurological death were not increased significantly in the conventional care group (OR=1.37, 95% CI 0.81-2.32, p=0.24, n=5 studies).

Telemedicine for Stroke Rehabilitation

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Systematic reviews					
Laver et al. 2020 **Australia** **Cochrane review**	Items where ≥50% of the trials were considered to have low risk of bias included random sequence generation, concealed allocation, blinding of outcome assessment and incomplete outcome data. 70% of trials were considered to be at high or unclear risk of bias for selective reporting	22 RCTs (n=1937) including patients with all stroke types, including SAH at all levels of severity and at all stages stroke recovery. 13 studies excluded participants with significant cognitive impairment and 4 excluded those without a caregiver. 8 trials recruited patients in the acute stage of stroke, following discharge from hospital while the remainder recruited patients in the subacute and chronic stage.	Trials compared telerehabilitation (services delivered using information and communication technologies) programs composed of ≥1 session, compared with in-person or no rehabilitation and trials comparing 2 different types of telerehabilitation. All interventions were delivered in patient's homes, or, in one case, a long-term care facility. 8 studies aimed to enhance care and well-being after discharge through interventions that included goal setting, education about secondary prevention, family therapy, and case management. Studies used customised computer-based training programmes to improve physical function, 4 studies used customised telerehabilitation systems and communication between the participant and the therapist one study involved exercises	**Primary outcome:** Independence in ADL **Secondary outcome:** Self-care & domestic life, mobility, balance, participant satisfaction, HR QoL, depression, upper-limb function, cognitive function, functional communication, cost-effectiveness	14 studies were used in pooled analyses, which included 2 pre-planned comparisons *In person rehabilitation vs. telerehabilitation* At the end of the intervention there was no difference between groups in mean ADL function (MD=0.59, 95% CI -5.50 to 6.68). Results from 2 trials included (n=75). There were no significant differences between groups in measures of balance (MD= 0.48, 95% CI -1.36 to 2.32, 3 trials included, n=106) or measures of upper extremity function (MD=1.23, 95% CI -2.17 to 4.64, 3 trials included, n=170) *Usual care vs. telerehabilitation* At the end of the intervention there were no differences between groups on any of the outcomes assessed (Independence in ADL, mobility, self-reported health-related quality of life, depression or upper-limb function.

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
			delivered remotely plus electrical stimulation		
Tchero et al. 2018 **France** **Systematic review & meta-analysis**	All trials had low risk of bias for their methods of random sequence generation, blinding of outcome assessors, and reducing the risk of attrition bias, except for 3 trials in each domain.	15 RCTs including 1,339 patients recovering from stroke.	Trials compared different models of telerehabilitation vs. standard rehabilitation care or a home-based exercise program. The follow-up period ranged between 4 and 24 weeks.	**Primary outcomes:** ADL, balance	There was no significant difference in Barthel Index scores between groups (SMD= –0.05, 95% CI –0.18 to 0.08, p=.47. Results from 6 trials included). There was no significant difference in Berg Balance Scale scores between groups (SMD= –0.04, 95% CI –0.34 to 026, p=.78. Results from 4 trials included). There was no significant difference in Fugl-Meyer Upper Extremity scores between groups (SMD= 0.5, 95% CI –0.19 to 1.09, p=.10. Results from 2 trials included). There was no significant difference in Action Research Arm Test scores between groups (SMD= -0.06, 95% CI –0.46 to 0.33, p=.75. Results from 2 trials included). There was no significant difference in Stroke Impact Scale (mobility subscale) scores between groups (SMD= 0.18, 95% CI –0.13 to 0.48, p=0.26).
Chen et al. 2015 **China** **Systematic review & meta-analysis**	NA	7 RCTs that included patients ≥18 years who had sustained a stroke and received rehab therapies through telemedicine systems for a minimum of 4 weeks in duration. Mean ages of patients ranged from 53-75 years.	In 6 trials, virtual reality-based training was used to provide rehab therapies, while therapies or support were provided by either the phone or the internet in 2 trials. The control group in most trials was usual or standard care.	**Primary outcome:** Measures of disability or ADL assessment **Secondary outcomes:** Motor function, cognitive assessments, health-related QoL	There was no significant difference in mean Barthel Index scores between groups (SMD=-0.05, 95% CI -0.24-0.13, p=0.57. Results from 6 trials included). There was no significant difference in mean Berg Balance Scale scores between groups (SMD=-0.17, 95% CI -0.70-0.37, p=0.54. Results from 2 trials included). There was no significant difference in mean Fugl-Meyer (Upper Extremity) scores between groups (SMD=0.05, 95% CI -0.09-1.09, p=0.10. Results from 2 trials included).
Studies					
Caughlin et al. 2019 **Canada** **Qualitative study**	NA	6 studies, funded as part of the 2013 Tele-Rehabilitation for the Stroke Initiative. Studies included interventions for	The results from the 6 studies were reviewed with the intention of drawing general conclusions related to cost, efficacy,	General synthesis of lessons learned	Lessons included: (1) Efficacy and cost of telerehabilitation appear to be similar to that of traditional face-to-face management; however, more thorough analyses are needed in this area.

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
		communication disorders and/or aphasia, an interdisciplinary telerehabilitation delivery platform, gaming software for the treatment of cognitive deficits, a coaching program for stroke management and prevention and virtual reality for upper limb training.	acceptance by patients and clinicians, and the role of the technology.		(2) Patients are generally satisfied with telerehabilitation services when trained appropriately and some social interaction occurs. (3) Clinician acceptance may be dependent on appropriate training, ease, and time of use, along with adoption by administrators. (4) Selection of telerehabilitation technology should be based on ease of use and targeted to the skills and abilities of users.

Secondary Stroke Prevention & Cardiovascular Risk Factor Reduction

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Liang et al. 2024 **China** **Systematic review & eta-analysis**	Using the Cochrane risk of bias tool, the overall risk of bias was high in 3 trials, low in 5 trials, with some issues in 5 trials.	13 RCTs including 3,803 participants with a history of stroke or TIA +/- hypertension. Mean ages ranged from 54 to 74 years. Approximately 40% were women.	Trials compared telemedicine and mHealth interventions (T/M interventions) with conventional care interventions. All trials used T/M interventions that included blood pressure monitoring, eHealth reminders, and education, with 5 trials intervening by telephone, 6 by telephone and BP monitoring, and 2 by phone and text	**Primary outcomes:** Improvement in blood pressure, medication adherence	M/T interventions were associated with significant reductions in both SBP and DBP (MD mm Hg= -4.37, 95% CI -5.50 to -3.24 and MD= -1.72, 95% CI -2.45 to -0.98, respectively). M/T interventions were associated with better medication adherence (SMD=0.52, 95% CI 0.03 to 1.00, 4 trials included)

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
			messaging. Most trials also provided additional non T/M interventions such as face-to-face interventions. Most interventions were provided daily to weekly, lasting from 3-36 months.		
Jaén-Extremera et al. 2023 **Spain** **Systematic review & eta-analysis**	PEDro scores ranged from 3 to 9. 23 trials were described as good (PEDro 6-8).	28 studies including 5,460 persons from the general public with one or more of the following conditions or habits: diabetes, hypertension, obesity, hypercholesterolemia, sedentary lifestyle and smoking.	Telemedicine and e-health interventions targeted at the 6 conditions: Diabetes (n=13), hypertension (n=6), obesity/overweight (n=7), hypercholesterolemia (n=0), tobacco use (n=0), exercise and sedentary lifestyle (n=2), were compared with usual care. Interventions included remote consults, remote monitoring, combined consults + monitoring, and websites.	**Primary outcomes:** Varied, depending on targeted condition	E-health interventions were associated with a significant decrease in hemoglobin A1c in persons with diabetes (Hedges *g* =-0.432, 95% CI -0.522 to -0.341; 10 trials). E-health interventions were associated with a significant decrease in systolic and diastolic blood pressure in persons with hypertension (Hedges' *g* =-0.775, 95% CI -0.887 to -0.663; 6 trials and Hedges' *g* =-0.447, 95% CI -0.572 to -0.321; 4 trials, respectively). E-health interventions were associated with a significant decrease in weight (Hedges' *g* =-0.628, 95% CI -0.739 to -0.517; 7 trials). Two trials assessed telemonitoring to improve activity levels in sedentary persons. Neither trial reported a significant benefit.
SPRINT INDIA trial collaborators **India** **RCT**	CA: ☑ Blinding: Patient ☒ Assessor☑ ITT: ☑	4,298 patients, recruited from 31 centres, following a first stroke (83% ischemic), between 2 days and 3 months after symptom onset), with a mRS score of 2–5, and who had to possess a working personal mobile cellular device for receiving SMS	Patients were randomized to an intervention or control group. Patients in the intervention group received 68 regular short SMS messages and 6 short videos that promoted risk factor control and medication adherence and an educational workbook, in	**Primary outcome:** A composite of recurrent stroke, high-risk transient ischaemic attack, acute coronary syndrome, and death at 1 year **Secondary outcomes:** Stroke risk factors, lifestyle habits	515 patients did not complete the 1-year follow-up. The trial was stopped for futility after interim analysis at 67% of recruitment goal. The primary outcome occurred in 119 (5.5%) of 2,148 patients in the intervention group and 106 (4.9%) of 2,150 patients in the control group (adjusted OR=1.12, 95% CI 0.85–1.47; p=0.370). There were no significant differences between groups in the individual components of the primary outcome.

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
		messages. Median age was 56 years, 72% were men. Mean NIHSS scores was 4. 10% of patients received revascularisation therapy.	one of 12 languages, and the control group received standard care. Patients in the intervention group received a daily SMS message for the first 6 weeks, then an SMS message 2x/week until 6 months and, thereafter, one message a week until 1 year.		Patients in the intervention group were more likely to reduce or quit drinking alcohol, reduce smoking and be more compliant with medications. There were no significant differences between groups with respect to blood pressure, lipid profiles, BMI, exercise, or fasting blood sugar at one year.
Deng et al. 2022 **China** **Systematic review & eta-analysis**	Among the RCTs, the most common sources of bias were a lack of blinding of participants and/or assessors	32 RCTs with arteriosclerotic cardiovascular disease (ASCVD) including coronary heart disease CHD (n=12), revascularization procedure (n=16), myocardial infarction (MI, n=8), acute coronary syndrome (ACS, n=5), ischemic stroke (n=2), and peripheral artery disease (PAD, n=3). Mean age ranged from 56 to 70 years. 20% were women.	Trials compared the outcomes between a telemedicine of secondary prevention (TOSP) group, through which participants received remote intervention by investigators using mobile devices (text messages, phone calls, mobile applications, mobile websites, e-mails, or other remote monitoring) and a usual secondary prevention group (control group) in which participants received usual care or secondary prevention treatment without telemedicine intervention. The duration of follow-up ranged from 2 months to one, with 3-6 months being most frequent.	**Primary outcome:** Body mass index (BMI), systolic blood pressure (SBP), diastolic blood pressure (DBP), cholesterol, blood glucose and smoking cessation	There was no significant difference between groups in BMI change (MD= –0.16, 95% CI –0.33 to 0.01, n=14 trials). Mean changes (mm Hg) in both SBP and DBP were significantly greater in the TOSP group (MD=- 0.72, 95% CI –1.42 to –0.01, n=12 trials and MD= –2.06, 95% CI –4.24 to –0.1, n=15 trials, respectively). At 10 weeks to 36 months, there was no significant difference between groups in LDL-chol (mmol/L) change (MD= –0.02, 95% CI –0.22 to 0.18, n=12 trials). There was no significant difference between groups in fasting glucose (mmol/L) or hemoglobin A1c (%) change MD= -0.04, 95% CI –0.15 to 0.23, 3 trials and MD= –0.03, 95% CI –0.08 to 0.13, 3 trials, respectively). Smoking cessation at the end of follow-up was significantly higher in the TOSP group (RR= 0.74, 95% CI 0.59–0.94, n=5 trials).

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
Kuan et al. 2022 **Malaysia** **Systematic review & eta-analysis**	Among the RCTs, the most common sources of bias were a lack of blinding of participants and/or assessors Among the 20 non RCTs, 7 studies were considered to be of high quality using the Ottawa-Newcastle scale	72 studies (52 RCTs), including 127,869 participants who were at risk for cardiovascular disease, or who had established vascular disease. 34 studies (n=13,269) contributed data to pooled analyses. 39 studies included patients with heart failure, 19 addressed secondary prevention. Mean ages ranged from 39 to 86 years. 35% were women.	Telemedicine interventions were classified according to the WHO and included remote consultations between patients and health-care providers (n=22), remote monitoring of patient's health or remote monitoring of diagnostic data (n=19), transmission of medical data to health-care providers, and consultations for case management between health-care providers (n=0). In some studies, interventions were combined. Interventions included telephone consults, emails, web-based platforms, interactive telemanagement video sessions, monitoring from implantable devices, and smartphones.	**Primary outcome:** Cardiovascular-related mortality **Secondary outcomes:** Hospitalization secondary to cardiovascular causes, all-cause mortality, all-cause hospitalization, and changes in cardiovascular risk factors (blood pressure, lipid profile, BMI)	Follow-up ranged 3–79 months. Combined remote monitoring and consultation was associated with a significant reduction in the risk of cardiovascular mortality in patients with heart failure compared with the control condition (RR=0·83, 95% CI 0·70–0·99; 8 trials, n=4,795). Combined remote monitoring and consultation was associated with a significant reduction in the risk of cardiovascular hospitalisation in patients with heart failure compared with the control condition (RR=0.71, 95% CI 0.58-0.87; 9 trials, n=4,548). Combined remote monitoring and consultation was not associated with a significant reduction in the risk of all-cause mortality compared with the control condition (RR=0·90, 95% CI 0·77–1·06; 7 trials, n=5,115). A small number of trials (3-4) examined changes in vascular risk markers. Remote consultation was not associated with a significant reduction in systolic or diastolic blood pressure. Remote monitoring and consultation for secondary cardiovascular disease prevention was associated with significantly reduced systolic blood pressure. Remote consultation was associated with a significant reduction in BMI.
Kraft et al. 2017 **Germany** **Systematic review & eta-analysis**	6/11 RCTs had concealed allocation, none blinded participant, 3 blinded outcome assessor,	13 RCTs (n=2,672) including adults with previous stroke or TIA	Trials compared telephone-based counselling or support, or web-based interventions, including video lectures, support for caregivers, and educational messages. Many interventions were nurse-led.	**Primary outcome:** Those for which pooled analyses were possible	Pooled analysis was possible only for blood pressure. The reduction in SBP from baseline to end of treatment was significantly greater in the intervention group (MD=-6.14 mm Hg, 95% CI -10.41 to -1.87, p = 0.005). Results from 4 studies included.

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
	11/11 had reporting bias		Duration of follow-up ranged from 8 weeks to one year		
Liu et al. 2017 **USA/China** **Systematic review & meta-analysis**	9/13 presented adequate sequence generation, 8/13 reported allocation concealment, 5/13 had blinded assessment of outcomes, 12/13 applied the intention-to-treat principle in analysis and all described the losses	13 studies (11 RCTs) that included adults being treated for diabetes, hypertension, and hyperlipidemia, followed for a minimum of 6 months	Trials assessed mobile Health (mHealth) interventions for HbA1c control (n=6), smoking cessation (n=7), hyperlipidemia (n=2) and hypertension (n=2). Interventions included smart phone applications to improve medication compliance or self-monitoring, short text or video message to facilitate the communication between health care providers and patients (diabetes) and short text/video message and internet and cell phone-based programs (smoking cessation) Control conditions included usual and a variety of sham interventions	**Primary outcome:** Treatment effect size (SMD, Hedge's g, odds ratio)	No clinical trials of the role of mHealth on either primary or secondary stroke prevention were found. All included trials examined vascular risk factor reduction. mHealth interventions were associated with a significant reduced HgbA1C compared with control condition (SMD=0.44, 95% CI -0.82 to -0.06, p=0.02). Results from 6 trials included, 663 participants. mHealth interventions were associated with significantly increased odds of smoking cessation at 6 months (OR=1.54, 95% CI 1.24-1.90, p= 0.0001). Results from 7 trials included, 9,514 participants. Pooling of data was not possible for the outcomes associated with hypercholesterolemia and hypertension.
Widmer et al. 2015 **USA** **Systematic review & meta-analysis**	The majority of included RCTs were assessed as being at low risk of bias for all components, with the exception of	51 studies (n=23,962 participants). No details of inclusion criteria or eligibility criteria for participants are reported. Mean age was 54 years, 54% were men.	Trials compared any element of digital health interventions (DHI) including telemedicine, web-based strategies, email, mobile phones, mobile applications, text messaging, and monitoring sensors that lasted ≥1 month.	**Primary outcomes:** CVD events (including MI, stroke, or revascularization, hospitalizations, and all-cause mortality) and CVD risk factors ((total cholesterol, LDL-cholesterol, HDL-cholesterol, and	39 studies focused on primary prevention and 13, on secondary prevention. Overall, DHI significantly reduced the risk of CVD events (RR=0.61, 95% CI, 0.46–0.80, p<0.001). Results from 9 RCTs included. DHI was associated with a significant reduction in Framingham 10-year risk percentages (−1.24%; 95% CI −1.73%, −0.76%; P<0.001. Results from 6 studies included).

Study/Type	Quality Rating	Sample Description	Method	Outcomes	Key Findings and Recommendations
	blinding of participants, whereby none were blinded to the treatment group assignment			triglycerides, glucose, and Framingham Risk Scores [FRS])	Overall, DHI was associated with significant reductions in weight (MD=-2.7, 95% CI -4.49 to -1.05, p=0.002) and BMI (MD=-0.17, 95% CI -0.32 to -0.01, p=0.03). Among primary prevention studies, there was a significant reduction in SBP (MD= −2.12 mmHg, 95% CI−4.15 to −0.09, p=0.04, results from 23 studies included). There were also significant reductions in total cholesterol (MD=−5.39 mg/dL, 95% CI, −9.80 to −0.99, p=0.02, results from 13 studies included) and glucose (MD=−1.38 mg/dL, 95% CI −2.13 to −0.63, p<0.001. Results from 6 studies included). Among the secondary prevention studies, there were no significant reductions in the DHI group in SBP, weight, cholesterol or glucose indices.

Abbreviations

ADL: activities of daily living	CI: confidence interval	HR QoL: health-related quality of life
HR: hazard ratio	ITT: intention-to-treat	MD: mean difference
mRS: modified Rankin Scale	NA: not assessed	OR: odds ratio
RR: relative risk	SMD: standardized mean difference	t-PA: tissue plasminogen activator.

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