

COST EFFECTIVENESS
ANALYSES FOR APPROACHES
ADDRESSING GEOGRAPHICAL
INEQUITIES OF STROKE CARE:
A SYSTEMATIC REVIEW

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Rural and small communities have higher mortality rate due to inadequate access to timely stroke.



A total of 15 studies covering multiple facets of stroke care including mobile stroke, telestroke, and decentralization of stroke care were analyzed.



Mobile Stroke Units
Potentially cost effective but depends on high annual number of treated patients and less specialist.



Telestroke
Potentially cost effective but depends on high annual number of treated patients and less specialist.



Decentralization Of Stroke Care
Marginally higher costs but slightly improved the thrombolysis rate.



Introduction

- Stroke and stroke-related death have increased over the last decade¹.
- In acute stroke events, earlier stroke care is related to better outcomes. However, individuals residing in rural and small communities have inadequate access to timely stroke care resulting in a higher mortality rate².
- While some interventions are effective in improving healthcare access in rural and small communities², it is unknown whether these interventions are cost-effective.

Objective

To systematically review cost-effectiveness of organisational stroke care interventions addressing geographical inequities.

Methodology

- We searched PubMed and Embase for articles published between 2012 and 2022 examining the cost-effectiveness of organisational stroke care interventions in rural and small communities.
- Two independent reviewers screened for eligible studies and performed the data extraction.
- The individual studies were narratively synthesised.

Search terms: Search terms were developed by using the advanced searches for ‘economic evaluation’, ‘cost effectiveness’, ‘cost utility’ AND ‘stroke, unit’

Inclusion Criteria

- English language studies
- January 1, 2012 to December 28, 2022
- Include original peer review studies that are economic evaluations, cost-effectiveness analysis, cost utility analyses, or cost benefit analyses, cost-consequence analysis.
- Include studies for organizational interventions, like quality improvement intervention, stroke unit (mobile, traditional stroke, telestroke unit) and stroke management program.
- No further restrictions applied for evaluation perspective, follow-up lengths and participant characteristics.**

Exclusion Criteria

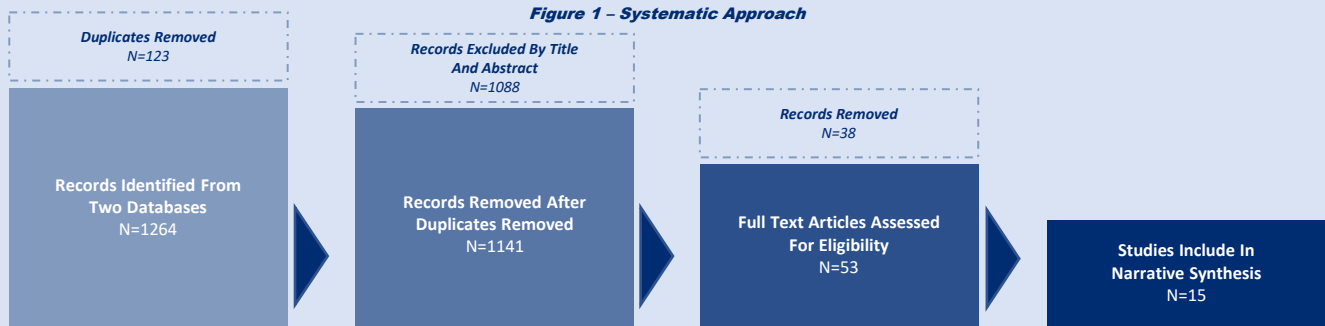
- The study is not an economic evaluation, or the study is a one-dimensional economic evaluation such as a cost of illness study,
- Exclude pharmacological based intervention and medical devices-based studies.
- Exclude abstract and grey literature.

References

- 1 Feigin VL, Stark BA, Johnson CO, Roth GA, Bisignano C, Abady GG, Abbasifard M, Abbasi-Kangevari M, Abd-Allah F, Abedi V, Abualhasan A. Global, regional, and national burden of stroke and its risk factors, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. The Lancet Neurology. 2021 Oct 1;20(10):795-820.
- 2 Hammond G, Luke AA, Elson L, Towfighi A, Joynt Maddox KE. Urban-rural inequities in acute stroke care and in-hospital mortality. Stroke. 2020 Jul;51(7):2131-8.

Results

- A total of 15 studies met the inclusion/exclusion criteria (Figure 1) and covered multiple facets of stroke care including mobile stroke, telestroke, and decentralisation of stroke care.
- Four out of five studies on telestroke were cost-effective compared to standard care. Four studies investigated mobile stroke units (MSUs) and showed mixed result.
- While a cost consequence analysis showed MSU costed more than standard care, another study showed benefit cost ratio of MSU was greater than one. Cost effectiveness increased with less number of specialists.
- Of five studies investigating transferring interventions, prehospital severity-triaging or dispatching neuro-specialist from hub hospitals to nearby hospitals were dominantly cost-effective. Secondary transfer of emergency stroke patients with helicopter in rural areas was cost-effective under standard willingness to pay thresholds. Decentralising stroke care incurred marginally higher costs but slightly improved the thrombolysis rate.
- These studies included both short-term and lifetime horizons; with two using a societal, one using a payer and 11 using a healthcare perspective. Study outcomes included incremental cost per quality-adjusted life years, disability-adjusted life year, deaths averted, and severe disability cases prevented.



Author Year	Setting	Comparators	Analysis Type / Model	Time Horizon Perspective	Outcome	Main findings
Reimer 2019	United States	Mobile stroke unit vs standard emergency medical services	CCA, decision tree	1 year, Healthcare	Inter-hospital transfers and emergency department transfers	The incremental cost between MSU and ST was \$70,613 for 355 patient transports. The MSU avoided 76 secondary interhospital transfers and 76 emergency department encounters.
Morii 2019	Japan	Specialist dispatching system vs standard care	CUA, unspecified	not mentioned, Public	QALY	The specialist depatching system dominated the standard care.
Morii 2019	Japan	Drive and retrieve system vs standard care	CUA, unspecified	3 yrs, Public	QALY	Drive and retrieve system dominated the standard care.
Lund 2022	Norway	Mobile stroke unit vs conventional care	CUA, Markov	lifetime, Healthcare	QALY	Mobile stroke unit is potentially cost-effective compared to conventional care.
Lahr 2017	Netherlands	Different scenarios of stroke care in 9 community hospitals vs current centralised stroke practice	CEA, discrete event simulation	6 mo, Policymaker	% increase in thrombolysis rate	Marginal gains of improving additional community hospitals leads to increasing costs.
Lahiry 2018	Australia	Pre-hospital acute stroke triage (PAST) protocol vs standard care	CUA, decision analytic model with stimulation	not mentioned, Healthcare	DALY	PAST is potentially cost-effective compared to standard care.
Kim 2021	Australia	Mobile stroke unit vs standard care	CUA, unspecified	1 year, Healthcare	DALY	Mobile stroke unit is potentially cost-effective.
Gao 2021	Australia	Telemedicine program vs no-telemedicine program	CUA, markov	25 years Societal + healthcare	QALY	Stroke telemedicine program is potentially cost-effective from societal and healthcare perspective.
Gao 2022	Australia	the Ambulance Clinical Triage For Acute Stroke Treatment (ACT-FAST) algorithm vs standard care	CUA, decision-tree combined with a Markov model	lifetime, Healthcare	QALY	ACT-FAST dominated standard care therapy.
Dietrich 2014	Germany	Prehospital stroke treatment VS conventional treatment	CBA	1year	Benefit-Cost Ratio	Prehospital stroke treatment outweighed its costs at with a bene-fit-cost ratio of 1.96, increased with reduced staff and with higher population density.
Coughlan 2021	UK	Secondary transfer by helicopter emergency medical services (HEMS) compared with ground emergency medical services (GEMS) of rural patients eligible for mechanical thrombectomy	CEA, markov + decision tree	lifetime, unspecified	QALY,NMB	incremental cost-effectiveness ratio (ICER) of \$28 027 when a 60 min reduction in travel time was assumed.
Kim 2022	Australia	Telestroke vs control	CUA, Multivariable regression models and bootstrapping	1 yr, unspecified	QALY	Stroke telemedicine in Australian setting was likely to be cost-effective over a 12-month time horizon.
Switzer 2013	United States	Telestroke vs standard care	CBA, decision tree	5 years, Healthcare(Network hospitals)	discharged home per year	Telestroke network may reduce the costs borne by the network hospitals
Wallut 2020	France	Telestroke vs standard care	CEA, decision-tree combined with a Markov model	3 months, Healthcare	(1)hospital death, (2) death at 3 months, and(3) associated disability 3 months after stroke	Telestroke strategy was slightly more effective and slightly more costly than the usual care strategy.
Whetten 2018	United States	Access to neurological telecare VS without access	CUA, decision tree	3 months, Healthcare	QALY	Neurological telecare may save cost and improve quality-of-life associated for patients presenting to rural hospitals with acute ischemic stroke

Conclusion

Implementing telestroke and prioritising transfers of appropriate patients to primary stroke centres or dispatching specialists offer cost-effective ways to improve stroke delivery in rural and small communities.