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REVIEW

Quality Improvement in Stroke Rehabilitation: A Scoping Review

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Background: Quality improvement interventions are used extensively in health care, aiming to improve delivery and promote best practice. The impact of quality improvement interventions implemented in stroke rehabilitation remains unclear.

Objective: The aim of this scoping review is to examine the different types of published quality improvement interventions in stroke rehabilitation and their impact on improving the quality of care.

Materials and Methods: A scoping review was performed in the PubMed, Embase and CINAHL databases. QI studies evaluating interventions for stroke rehabilitation patients that were published up to August 2020 were included. The review looked at the types of quality improvement interventions that have been evaluated as well as the improvements/impacts reported for quality improvement interventions for stroke patients in rehabilitation.

Results: We reviewed 1580 studies, twelve quality improvement interventions met inclusion criteria and were included in the current study. Six studies involved organizational change, three studies involved provider education and audit-feedback and three studies involved provider education. Of the twelve quality improvement interventions that have been included, >90% reported improvements (91.6%). In the majority of cases, improvements were noted through implementation of a myriad of interventions. Several facilitators and barriers were noted during implementation and contributed to success or failure of the intervention.

Conclusion: There is paucity of full-text peer-reviewed published research investigating quality improvement interventions for improving the quality of care in stroke rehabilitation. The current review offers value to healthcare providers in terms of key success factors, contextual factors, barriers and facilitators associated with improvements in stroke rehabilitation.

Keywords: scoping review, review, stroke rehabilitation, quality improvement, quality interventions

Introduction

There is clear evidence on the gap between effective practice (obtained from evidence and research) and what happens in practice. This variation in practice has a significant impact on patient outcomes and processes of care.[1] Poor quality of care has attributed to nearly 60% (5 Million of the 8.6 million deaths) preventable through health care.[2] Decreasing unwarranted variations in clinical practice is important both from a safety and a quality perspective.[1] Healthcare leaders use quality improvement (QI) interventions to improve the delivery of healthcare services and promote best practice implementation, thus contributing significantly to greater efficiencies in healthcare delivery.[1] Principles and benefits of quality improvement (QI) have been well established through literature and practice. While typically the health sector was slow in embracing quality initiatives, in the more recent years, QI approaches have become more widespread with the use of different approaches to enact change and improvement.[3]

Many strategies have been proposed to improve quality amongst healthcare providers, including greater standardization of processes and using a myriad of strategies ensuring evidence-based practices are applied in the organization, thus contributing significantly to greater efficiencies in healthcare delivery. Bravata et al in "Closing the Gap" series defined QI strategies as

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> Interventions aimed at reducing the quality gap the difference between health care processes or outcomes observed in practice and those potentially obtainable on the basis of current professional knowledge for a group of patients representative of those encountered in routine practice.

The authors developed a taxonomy of nine QI strategies, including patient and provider education, organizational change, audit and feedback, patient and provider reminders, transfer of clinical data to providers, incentives including financial and legislative, and encouraging self-monitoring or self-management.[4] In addition, developing and putting clinical guidelines and evidence-based pathways into practice also contribute towards decreasing unwanted variation and despite having guidelines in place, unwanted variation still exists.[1]

Furthermore, contextual factors have been ascertained to influence QI success and the Model for Understanding Success in Quality (MUSIQ) details such contextual factors for health. MUSIQ extolls QI implementers undergoing efforts throughout the QI initiatives to optimize contextual factors for the success and effectiveness of QI initiatives.[5] Contextual factors are further categorized into external factors (external motivators, project sponsorships), organizational factors (leadership, senior leader sponsorship, culture, maturity of QI, physician payment structures) microsystem (leadership, culture, capability for improvement, motivation), as well as QI support and capacity (data infrastructure, resource availability, workforce focus), QI team (diversity, physician involvement, expertise, team tenure, prior experience in QI, leadership, decision-making process, QI skills and team norms), and some miscellaneous factors (eg, triggering events, importance of QI tasks).[5] Implementation teams typically involve multiple stakeholders and cross-functional teams of medical teams, administration staff, consumers of health care, pharmacists and many others.[6] Another key to quality improvements in health is involvement of frontline workers where health care is delivered.[2]

Stroke is a healthcare condition that is prevalent and disabling. It is the second most common cause of death in many countries.[7] In addition, the economic consequence of stroke is enormous with annual costs estimated to be $320.1 billion globally for stroke and cardiovascular disease.[8] One of the main issues with stroke is the resultant acquired disability. While most patients survive the initial stroke episode, there are usually longer term consequences and acquired adult disabilities that occur.[7] The majority of post-stroke care is dependent on accessing rehabilitation, which has a significant effect in reducing mortality and dependency. Stroke rehabilitation typically follows a cyclical process that involves assessment, goal-setting, intervention and reassessment.[7]

Given previous studies of QI programs across many medical specialties, it is clear that rehabilitation services are particularly primed to benefit from such programs. Typically, in both acute and subacute rehabilitation facilities, outcome measurements are used for measuring quality, while many factors including multidisciplinary team members, goal setting, communication, the appropriateness of care among others are critical to patient needs.[9] However, there is limited evidence in literature as to the QI initiatives and indicators for stroke rehabilitation.[10,11] In addition, despite the interest in QI in healthcare context, there is a gap in research with little published literature evaluating the use of QI and its impacts within medical contexts, where success was seen and what changes have been observed due to QI.[12] A search for existing reviews on this topic was performed. This included the Joanna Briggs Institute (JBI) Database of Systematic Reviews and Implementation Reports, the Cochrane Database of Systematic Reviews, MEDLINE and CINAHL. No relevant reviews (published or in progress) were identified. Thus, to address this gap in literature, the reported study aims to perform a scoping review to assess the extent to which QI interventions have been reported for stroke patients in rehabilitation, as well as the reported impacts of QI interventions on the rehabilitation of stroke patients.

Methods

Objectives

The objective of the scoping review is to identify and examine the available literature on quality improvement interventions utilized for stroke patients in rehabilitation. The review questions include:

1. What QI interventions have been evaluated for stroke patients in rehabilitation?
2. What improvements/impacts have been reported for quality improvement interventions for stroke patients in rehabilitation?

3. What were the reported barriers and facilitators to the QI interventions improving the quality of care for stroke patients in rehabilitation?

To date, there is no review focused on quality improvement interventions for stroke rehabilitation, their impact on improving the quality of care and the facilitators and barriers to the QI interventions improving quality of care. Given the potential impacts of QI interventions on patient outcomes and processes of care, the current study aimed to address the gap.

Search Strategy

The researchers conducted a scoping review using the Joanna Briggs Institute (JBI) methodology for scoping reviews. Databases searched for scholarly peer-reviewed articles included PubMed and Academic Search Complete/EBCSCO, Embase, CINAHL, JBI Library, Cochrane Library and Grey Literature sources including Google Scholar, Open-Grey and the Grey Literature Report.

Included were studies that evaluated quality improvement interventions for stroke rehabilitation patients that were published from the inception of the databases to August 2020. Data was extracted by one reviewer, and thirty percent of the studies were verified by the second reviewer.

An initial search of PubMed, Academic Search Complete/EBCSCO and CINAHL was done, followed by analysis of the text words in the title and abstract and of the index terms used to describe articles. Secondly, another search was undertaken utilizing the identified keywords and index terms across relevant databases. Thirdly, the reference lists of selected studies were searched for other relevant articles. All studies irrespective of their date of publication were considered for inclusion in the review. Studies translated into English were also considered for inclusion in the review.

The search terms were composed of two constructs. The first construct related to population and was limited to studies focusing on stroke rehabilitation. The second construct related to the intervention and was limited to implementation of a quality improvement intervention. A combination of the two constructs was used to conduct the search. The search strategy used in each of the three databases is detailed in Appendix A.

Inclusion and Exclusion Criteria

Inclusion criteria considered the participants, the concept, quality rating and the context of the studies. To be included, the study must include a QI intervention applied within the area of stroke rehabilitation. QI interventions were defined utilizing the nine definitions of the QI strategies used in the "Closing the Gap" series.[4] Facilitators and barriers were categorized utilizing the Model for Understanding Success in Quality (MUSIQ), which ascertains 25 contextual factors that could influence QI success.[5] There were no exclusions to any healthcare settings and geographic areas. Studies from high- as well as low- and middle-income countries were considered. In addition, the review considered all types of qualitative and quantitative studies of QI interventions in health care including non-randomized controlled studies, quasi-experimental/before and after studies, prospective and retrospective cohort studies, case–control studies, cross-sectional studies and observational studies. The review also considered descriptive epidemiological study designs such as case series, individual case reports and descriptive cross-sectional studies as well as systematic reviews and literature reviews that meet the criteria. Excluded studies included studies that did not include a quality improvement intervention, or only considered organizational audits with no quality improvement intervention, or only considered guideline adherence with no quality improvement intervention, or only looked at the design of a quality improvement intervention or developed a tool and did not include the quality improvement intervention or only implemented a new model of care with no quality improvement intervention.

Quality Rating

All papers that met inclusion criteria were appraised by two independent critical appraisers for methodological quality. Methodological quality was based on using the standardized critical appraisal instruments for Qualitative Research, Quasi-Experimental Studies and Randomized Controlled Trials from JBI to ensure the extent to which studies dealt with the likelihood of bias in design, conduct and analysis.

Results

The initial search yielded 1580 studies. After removing duplicates (146), citations were imported into Rayyan. Both reviewers screened all titles only to determine relevance resulting in 174 articles selected and 1260 excluded. Both reviewers (IS & JK) then reviewed and assessed all titles and abstracts in Rayyan resulting in excluding 135 articles, with 39 remaining. Full-text articles were obtained for included articles. Reviewers excluded 27 studies as per eligibility criteria. No authors were contacted for additional information. Twelve articles remained for inclusion in the current study as demonstrated in PRISMA Diagram in Figure 1.

Synthesis of Results and Methods of Analysis

Twelve peer-reviewed journal articles were included. Study characteristics (author, year, location, study design, population, intervention details and primary outcomes) are described in Table 1. Narrative descriptions of the studies are provided.

Results of Search

The search was purposively broad aiming to scope the current literature, and the included studies were published between 1993 and 2020, with 9 of the 12 (75%) studies published in the last five years. The studies were located in North America; USA and Canada[14–19] as well as Europe; Sweden, England and the Netherlands[20–23] and Australia.[24,25]

Bravata et al's QI definitions[4] were used for the quality interventions, the included studies evaluated interventions involving Organizational Change,[14–17,20,22] Provider Education and Audit-Feedback process[19,24,25] and Provider Education.[18,21,23]

Study Methods and Results

Twelve studies were included, and study intervention descriptors are summarized in Table 1. One study demonstrated no improvement in patient outcomes with the QI intervention[15], and eleven studies demonstrated improvements following

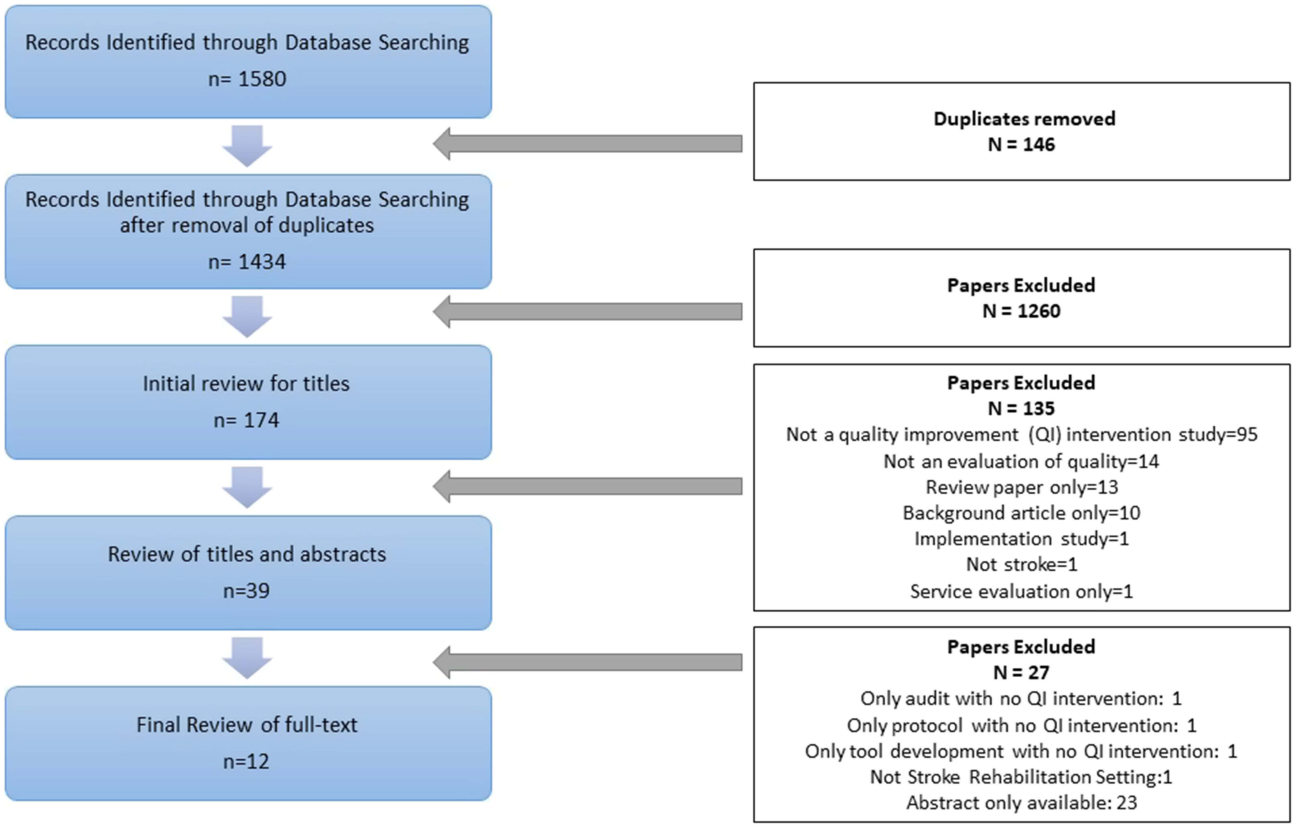

Figure 1 PRISMA diagram.

Notes: PRISMA figure adapted from Liberati A, Altman D, Tetzlaff J, et al. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health careinterventions: explanation and elaboration. Journal of clinical epidemiology. 2009;62(10). Creative Commons.[13]

Table 1 Study Characteristics (Design, Type, Population and Primary Outcomes)

Author	Year	Location	Setting	Study Design	Study Type	Population	Outcomes Measures	Results
Falconer, J.A, el al.	1993	USA	Rehabilitation Institute of Chicago (RIC)	Randomized Control Trial (RCT)	Implementation of Critical Path Method (CPM) using multidisciplinary teams. CPM is a project network technique used for visually charting the project steps to develop a project network diagram illustrating activities, relationships, timeframes, costs, schedules.	128 adults admitted with a recent (within 120 days) diagnosis of stroke.	Length of Stay (LOS) Hospital charges Functional status using Functional Independence Measure (FIM), motor function, cognitive function	CPM did not contain costs or improve outcomes of inpatient stroke rehabilitation. Groups demonstrated no statistically significant differences for LOS or functional status. Interaction effects propose that CPM could have selectively advantaged males and patients with lower cognitive functions.
Hancock, N. J, et al	2019	England	Cambridge and Peterborough NHS Foundation Trust (CPFT)	Qualitative	Qualitative PDSA (plan-do-study-act) intervention for technology adoption	A service improvement team of four expert neurological PTs and a group of 13 clinical partners of community-based neurological Physiotherapists (PTs) and Occupational Therapists (OTs).	Integration of the use of "Via Therapy" tool predominantly in mobile app form (a technology utilizing an underpinning algorithm providing evidence-based intervention recommendations) Accessibility of the tool in practice Impact on clinician confidence and treatment planning and provision.	22% increase in confidence and use of evidence-based practice from the baseline and the technology was reported to be simple, easy to use, accessible, concise and straightforward. Changes to the delivery of interventions (dosage and treatment planning) was also reported due to the rapid access of recommended doses through the tool.
Holstege, M. S, et al	2017	Netherlands	16 skilled nursing facilities geriatric rehabilitation	Quasi-experimental/ before and after	Dutch National Program as a prospective longitudinal study to improve quality of care through implementation of integrated case	16 skilled nursing facilities, 743 patients and their healthcare professionals.	Successful rehabilitation as the primary outcome measure was defined as independence in activities of daily living (Barthel Index more than or equal to 15), discharge to home, and a short LOS (in lowest 25% of diagnostic group).	More independence in activities of daily living at discharge, but the combined outcome of successful GR with only patients with traumatic injuries demonstrating significant improvement.
Janzen, S, et al	2016	Canada	Single stroke rehabilitation unit in Southwestern Ontario	Quasi-experimental/ before and after	Knowledge to Action (KTA) Project with audit-feedback process using Rehabilitation Knowledge to action Project (REPAK) and Knowledge Creation (EBRSR) to improve clinical practice guideline (CPG) adherence.	121 patients in a single 26 bed stroke rehabilitation unit and multidisciplinary working group for each knowledge-practice gap identified.	Primary outcome for REPAK was improved adherence to best practice recommendations for stroke rehabilitation. The audit looked at several elements in stroke rehabilitation including the "assessment and management of depression, cognitive screening and assessment, bladder management, intensity of therapy, benzodiazepine use, and the management of hypertension".	Significant and positive influence on clinical practice and patient outcomes including increased depression screening, decreased benzodiazpin use and improved hypertension management. Results of REPAK demonstrated improved adherence to best practice recommendations.

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Table 1 (Continued).

Author	Year	Location	Setting	Study Design	Study Type	Population	Outcomes Measures	Results
Joliffe, L, et al	2019	Australia	Metropolitan inpatient injury rehabilitation unit.	Quasi-experimental/ before and after	Before-and-after study using audit-feedback process and knowledge translation activities	All clinicians (medical staff, nursing staff and allied health staff) working in the unit were involved. During the study period, 58 clinical staff were employees. Fortnightly audit-feedback cycles selected two random patients for audit during the 12 month intervention period.	16 guideline indicators (and 114 observable criteria) were used including "behavioural support plan, care plan, continuity of care, discharge planning, equipment use, patient/family education, goal setting, medical management, medical records, minimally conscious care, safety, patient care regime, post-traumatic amnesia management, roles and responsibilities, therapy and ward rounds".	There was a significant increase in clinician's adherence to guideline recommendation at the end of the intervention. This was at a median 38.8% at baseline and changed to 83.6% at the end of the intervention. After termination of the audit and feedback program, there was a decline of 7% in clinician adherence levels from the completion of the intervention to the follow up stage but continued to be higher than 75% adherence goal.
Oyeyemi, A, and B. Sedenu	2010	USA	Inpatient facility in New York	Quasi-experimental/ before and after	Care Planning Process (patient profiling, treatment tracking and outcome staircasing)	110 stroke patients from the subacute rehabilitation unit that were admitted in the years 2004–2007 (pre-program years were 2004–2005, program years were 2006–2007).	Functional Independence Measure (FIM) scores in daily living: Included admission and discharge total FIM and change in FIM (FIM gain). Length of Stay (LOS): Included the "Total number of days a stroke survivor received at least one of physical occupation and language speech therapy". FIM change at discharge LOS efficiency: Ratio of FIM change to LOS.	Discharge FIM for 2006 group was significantly higher than pre-program. The program years demonstrated significantly better LOS. LOS efficiency improvements demonstrated throughout the program years, with only 2006 improvement significantly greater than the pre-program years.
Perry S.B, H. Zeleznik, and T. Breisinger	2014	USA	Urban, tertiary care trauma center (University of Pittsburgh Medical Center Mercy Hospital)	Quasi-experimental/ before and after	Multidimentional Knowledge Translation Activities Program	2 Physical Therapy team leaders, 10 staff Physical Therapists, 1 Physical Therapy assistant, and 4 to 5 rehabilitation aides. Six therapists were Certified Brain Injury Specialists in a tertiary care trauma centre. The expected caseload was 4–5 patients and 8 visits each day.	Implementation and progression of non-supported gait training (NSGT) NSGT attempts Walking-related outcomes	Results demonstrated increased familiarity and usage of NSGT increased by 69% and 33% respectively.

Power, M, et al	2014	England	Twenty-four NHS hospitals in the Northwest of England	Randomized Control Trial (RCT)	Stroke 90:10 Quality Improvement Collaborative (QIC)	3533 patients across 12 intervention hospitals, 3059 patients across 12 control hospitals	Compliance with two bundles of processes for bundle 1 early hours (brain imaging, antiplatelet administration, swallow screen, weight assessment) and bundle 2 rehabilitation (Ward of 50%+ of stay, physiotherapist assessment within 72 hours of admission, assessment by the occupational therapist within 4 days of admission, mood assessment and rehabilitation goals set).	Demonstrated a modest improvement from baseline in the odds of compliance, in Bundle 1, there was a relative improvement by the end of the study of 10.9% increase in the intervention (with largest differences in administration of aspirin, 95% CI 1.3%, 20.6%). In Bundle 2, there was a relative improvement by the end of the study of 11.2% increase in the intervention (with increases in moods assessment and rehabilitation goals, 95% CI 1.4%, 21.5%) Analysis suggesting some processes being more sensitive to the intervention effect.
Tistad, M, et al	2016	Sweden	Five outpatient stroke rehabilitation centers	Qualitative	Leadership Intervention program to support managers in implementation of national guideline recommendations in outpatient rehabilitation.	Eleven senior and frontline managers and twelve staff members from five outpatient stroke rehabilitation centres.	Categories for participants responses included: Developing a leadership plan with clear goals Intervention content and structure Pertinence beyond stroke rehab Involving Staff Leadership for change	Managers found the intervention beneficial, structure appropriate and content useful and stimulating. All managers developed the leadership plan, with only two of the units identifying goals particular to implementation of the stroke rehabilitation recommendations. Of these two units, only one unit went on to identify leadership behaviours that support implementation. There was limited sense of staff involvement. Majority of managers considered the intervention applicable beyond rehab.
Torres, A, et al	2014	USA	Free-standing inpatient rehabilitation facility	Quasi-experimental/ before and after	Shared Governance Program	All members of the rehabilitation team (physical therapist, occupational therapist, speech therapist, registered nurse and nurse aide).	The team trailed shared governance for 6 months and met weekly for 30 minutes including a facilitator and explored: Improve overall patient outcomes Improve patient centered care	Results demonstrated improvements in staff communication, problem solving, patient outcomes, and staff satisfaction.

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Table 1 (Continued).

Author	Year	Location	Setting	Study Design	Study Type	Population	Outcomes Measures	Results
Vratsistas A, et al	2017	Australia	One stroke service	Quasi-experimental/ before and after	Before-and-after study using audit-feedback and education.	31 stroke unit staff across eight disciplines that included medical, nursing, speech pathology, occupational therapy, orthoptics, physiotherapy, social work, dieticians.	Percentage of eligible patients that receive best practice against targets, through audit data on communication, swallowing, mobility, sensation impairment, neglect, patient education, carer education, anxiety, and depression, return to driving and return to work.	Results demonstrated an increase percentage in stroke patients receiving best practice rehabilitation in the majority (74%) but not all of the targeted areas. The largest changes were in rehabilitation (+100%), assessment (+100%), sensation screening (+92%), and neglect screening (+75%)
Voogdt-Pruis, H.R, et al	2019	Netherlands	Five stroke services	Quasi-experimental/ before and after	Before-and-after study for shared decision-making (SDM). They initially administered a baseline self-administered email questionnaire for validation and quantification of the interview statements. This was followed by an implementation program including decision-making (DM) training, action planning, feedback, regular guidance consultation and coaching and regular team meetings, followed by in-depth interviews and a second email questionnaire was done for validation and quantification after six months.	25 Healthcare Professionals (HCPs) across five stroke services, representing all participating regions and professional disciplines (rehabilitation nurses, occupational therapists, physiotherapists, speech therapists, psychologist, rehab specialist and care manager).	Adoption of shared decision-making.	Results demonstrated strong agreement (>4.0/5) on essential actions for SDM adoption including training, embedding SDM in multidisciplinary meetings, taking patient preferences, wishes and worries in consideration for treatment follow-up, provision of time for practice and apply SDM, using understandable language using teach-back methods, clear intrinsic patient motivation and the major role of stroke patient relatives in adoption of SDM.

program implementation.[14,16–25] Results of the study demonstrated a wide variety and heterogeneity of QI initiatives in stroke rehabilitation; thus, a narrative approach was undertaken in the analysis to address the first and second research question on the types of QI interventions that have been evaluated for stroke patients in rehabilitation and their improvements and impacts and summarised in Tables 1 and 2.

Two studies involved clinician education QI interventions.[18,21] Clinician/provider education includes any intervention that encompasses any of educational workshops, meetings, lectures, educational outreach visits, or distribution of educational materials.[4] One study,[18] looked at multidimensional knowledge translation activities, defined as a process for "moving research findings into action"[18], aiming to encourage behavioral changes in clinical practice for neurologic physical therapists' utilization of a novel gait training method for patients with hemiparesis for inpatients in rehabilitation.[18] In the mid-year survey before the quality improvement project, Perry et al established that 19% and 33% of the therapists were moderate/very familiar and almost always/often used non-supported gait training (NSGT), as opposed to 78% and 66% at the 6 months point.[18] Another study[21] used an exploratory design and involved process evaluation to study a leadership intervention for five outpatient stroke rehabilitation centers in Sweden. The objective was supporting managers with the implementation of guidelines in outpatient stroke rehabilitation settings. Tistad et al showed that managers considered the intervention beneficial with all managers developing a leadership plan. However, just two units identified specific implementation goals.[21]

Several studies involved audit and feedback as well as clinician education QI interventions.[19,24] Audit and feedback involves "providing a summary of the healthcare provider's or the institution's clinical performance that is reported publicly or confidentially to or about the clinician or institute".[4] Using audit-feedback process and knowledge translation activities, one study[24] looked at 16 overarching guideline indicators, with a target for staff adherence to guideline indicators per patient set at a minimum of 75%. Jolliffe et al[24] demonstrated a significantly increased adherence to guideline recommendation. The other study by Janzen et al involving clinician education as well as audit-feedback involved a "Knowledge to Action Project" involving the audit-feedback process with both a knowledge creation cycle and an action cycle. Janzen et al demonstrated considerable success in changing clinical practice and developing a culture supporting using evidence-based practices in stroke rehabilitation.[19] Vratsistas-Curto et al[25] involved clinician education and an audit-feedback intervention. The study involved audit-feedback process, identification of practice determinants, provision of educational materials and education. Audit data explored eleven areas, and the study demonstrated meeting or exceeding the 10% target improvement in 20 out of the 27 areas targeted (74%).

Six studies involved organizational change.[4,14–17,20,22,23] Organizational change involves "any intervention that involves changes in the structure or delivery of care designed to improve the efficiency or breadth and depth of clinical care".[4]

Two studies utilized shared governance and shared decision-making. One study[17] looked at shared governance with a goal to discuss any issues and problems and develop proposed solutions to improve patient-centered care. Torres et al demonstrated improvements in patient outcomes, staff communication, staff satisfaction and problem solving as a result of the QI intervention.[17] Another study[23] using shared decision-making (SDM) in five stroke units. Voogdt-Pruis et al demonstrated the feasibility of implementation of SDM in integrated stroke care[23] and developed an additional eight recommendations for adoption of shared decision-making in stroke care. This included awareness campaigns, organizational ambassadors, essentiality of training, investigating patient personal preferences before treatment as well as involving relatives, implementation through stroke services and embedding shared decision-making in current care chains with clear roles and responsibilities as well as having informative overviews of primary healthcare professionals (HCPs) in the region to support in shared decision-making transfer to primary care.[23]

Two studies were utilizing randomized controlled trials. One study[15] looked at the use of the Critical Path Method (CPM) for containing costs and improving patient outcomes. Falconer et al demonstrated that using the CPM for QI intervention showed no improvement in patient outcomes.[15] No statistical significance was evident between groups for length of stay or hospital charges. Another study[22] evaluated the effects of the "Stroke 90:10 Quality Improvement Collaborative" (QIC) on the uptake of two evidence-based bundles of care (early hours and rehabilitation). The collaborative aimed to improve compliance and reliability of nine processes across early hours and rehabilitation from

Table 2 Summary of Abstracts on Quality Interventions in Stroke Rehabilitation

Author	Year	Location	Study Design	Background and Intervention	Methods	Results	Conclusion
Allen, L, et al	2013	Canada	Quasi-experimental / before-and after	Intervention aimed to improve monitoring of blood pressure managing hypertension in a stroke rehabilitation unit.	Evidence-practice gap identified with a new hypertension strategy developed and implemented. Strategy uptake was assessed six months after implementation.	A significant decrease in mean days without blood pressure measured/ recorded between initial and second audit. No significant difference in mean untreated days amid baseline and post implementation.	Intervention resulted in improved adherence to best practice guidelines for blood pressure monitoring.
Britt, E.J, et al	2010	Canada	Quasi-experimental / before-and after	Intervention aimed to establish reasonable severity-specific LOS targets to aid in reducing LOS without altering patient outcomes.	Functional Independence Measure (FIM) gain and efficiency using three years of patient data (April 2005-March 2008) were summarized and targets for median length of stay were established.	Early results demonstrate 1. LOS reduction 2. Maintenance of patient/staff satisfaction 3. Goal attainment.	Intervention demonstrated success and continued evaluation is necessary.
Bassei, M, et al	2015	Canada	Plan-Do-Study -Act methodology	Intervention aimed for improvements in knowledge and confidence involving patient assessment, management and documentation.	Intervention included a pre and post-test survey, education intervention, and electronic documentation using PDSA.	Improvements were noted in self-rated knowledge and confidence, tactile learning enhanced the didactic teaching methods.	The Plan-Do-Study-Act methodology demonstrated effectiveness in advancing the project in the defined time.
Bayley, MT, et al	2011	Canada	Quasi-experimental / before-and after	Intervention aimed to compare patient outcomes post rehabilitation using an outcome orientated or a process orientated knowledge transfer intervention strategy.	Intervention included training, educational resources, ongoing education session with instruction. Practice audits and focus groups were conducted.	Practice in the process orientated sites demonstrated more changes than the outcome orientated sites. Patients in the process orientated sites were more likely to be discharged home versus outcome orientated sites.	A process oriented knowledge transfer strategy lead to improved adherence to evidence-based practice and resulted in modest recovery benefits.
Bishev, M.	2018	Canada	Quasi-experimental / before-and after	Intervention aimed to provide individual patient care plans and improve rehabilitation intensity.	After conducting gap analysis, multiple quality improvement initiatives and ongoing evaluation changes implemented included interdisciplinary collaborative team rounds models, improved communication and discharge planning and modified workload measurement.	Rehabilitation Intensity (RI)	Improved RI to 123 minutes per active rehab day (a 78% increase from 2010)

Craven, F, et al	2018	Ireland	Lean	Review of existing positive aspects in the Stroke Rehabilitation Unit, identification and implementation of improvement initiatives for service optimization utilizing a person-centered care approach.	Lean methodologies were used, which included process mapping, A3 thinking, gaps analysis. Engagement of relevant stakeholders (patient, staff and executive management). Communication between staff and patients, service structure changes included patient cohorting, referral pathway definition for transferred patients were identified.	Changes included referrals made at point of transfer, each patient being assigned a family liaison key worker and arranged standardized care planning meetings. Access of patients and families to hospital canteen. 90 days review for key areas signifies positive sustainability.	Intervention resulted in positive outcomes for patients and staff and recommended the necessity of on-going QI initiatives and sufficient staffing levels.
Garratt, E, and S, Bolton	2018	England	Quasi-experimental / before-and after	Intervention aimed to consolidate two stroke units into one specialist stroke rehabilitation ward.	A stroke quality improvement plan was developed based on current guidelines and evidence base. Movement of 10 beds from Town A to Town B occurred. Success was measured through defined Key Performance Indicators.	Single-site ward relocation, reaching an average 45 minutes for the therapy session, receiving occupational therapy as well as physiotherapy on admission, and improving Barthel index from admission to discharge.	Quality improvement was evident as a result of this project.
Hahn, N.	2019	Canada	PDSA	Intervention aimed to increase therapy delivery to stroke survivors on a general rehabilitation ward.	Changes included decreased meetings attendance for therapists, optimizations in interdisciplinary rounds aiming to maximize the communication efficiency for clinical staff and operations and patient scheduling changes.	Increase in stroke patients minutes of therapy per day, and total minutes per day therapists spent providing therapy to patients was seen.	Through physician leadership and QI interventions, improvement in care can be achieved without higher costs.
Halabi, M.L, et al	2018	Canada	Quasi-experimental / before-and after	Intervention aimed to evaluate internal processes to increase efficiency using existing resources and to determine the feasibility of expansion.	Six quality dimensions (acceptability, accessibility, appropriateness, effectiveness, efficiency, safety) used for outcome measures. Team meetings held to formulate action plans and score carding methodology used to establish baseline and monitor implementation.	Almost quintupled percent of clients achieving target intensity. Access within 48 hours of discharge for acute care clients increased. Statistically significant change in client performance and satisfaction from 28% to 88 and 84% respectively.	Research recommended the need to select and monitor appropriate outcome to demonstrate efficiency and make informed program planning decisions regarding program expansion.
Liang, J, et al	2019	Canada	Quasi-experimental / before-and after	The intervention aimed to increase the completion rate of stroke investigation workup (SIW) from 43% to 90% by 3 May 2019 in eligible patients admitted for inpatient stroke rehabilitation.	Changes included development of a checklist, a new Holter referral form (HRF) and Holter's procedure. Outcome measures encompassed SIW completion rates and arrhythmia identification rates. Process measures encompassed quantity of successful Holter's placement and HRF completion rates. Balancing measures encompassed staff work time.	Results demonstrated successful placement and reading of 12 Holter monitors, gap identification of gaps in the Holter's ordering procedure and necessary revisions implemented in HRF	Process to increase completion rate of SIW was successful. Satisfaction of both staff and patients with ordering procedure and Holter's placement.

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Table 2 (Continued).

Author	Year	Location	Study Design	Background and Intervention	Methods	Results	Conclusion
Lo, A. and J. Fortin	2014	Canada	Qualitative analysis	Intervention included Rehabilitation Quality and Patient Safety Rounds (QPSRs)	Through qualitative analysis, identification of patient care trends and system process concerns occurred, followed by developing an educational model and reporting structure. Surveys were used to assess safety culture.	Results included practice changes; using visible "W" for wanderer in chart spine for flight risk; prohibiting complex patients discharge on Monday, team huddles, and designations for alternate level of care. Other solutions required longer-term follow-up. Elimination of solutions that were complex, expensive or not in line with patient-centered care models.	Intervention demonstrated improvements to quality and safety. Recommended the requirement of an educational process and reporting structure for sustainability of changes.
Lo, A, and C. Fancott	2015	Canada	Qualitative	Intervention aimed to introduce monthly Quality and Patient Safety Rounds (QPSRs) and assess impact on patient care, team communication and patient safety awareness.	Qualitative evaluation was performed through exit surveys after each QPSR. Structured interviews of eight Stroke team members occurred.	QPSR resulted in changes to clinical practice, are highly valued by the team and increased staff awareness of patient safety, systems-based approach to incident analysis, and improved team cohesion and communication.	QPSRs in stroke rehabilitation have changed practice to decrease risk of future critical incidents, while improving provider knowledge of patient safety concepts and team communication.
Lo, Chang, J. and P. Aikman	2013	Canada	Observational action-research methodology	Following a national stroke audit, provincially coordinated gap analysis was conducted utilizing observational action-research methodology (quantitative and qualitative).	Utilization of a tracking tool for measurement of clinical practices against the guidelines involving acute, inpatient and community rehabilitation.	Gaps in services and inconsistencies in practice and the contributing contextual factors as well as better leading practices were identified. The methodology enabled clinicians to see inconsistencies and formulate actions plans for improvement.	Intervention lead to positive change at the site, health authority, and provincial levels.
Morgan, P, A. Cream, and D.J.I.J.o.S. West	2012	Australia	Quasi-experimental / before-and after	Intervention aimed for formalisation, evaluation and review of Multidisciplinary Seniors meetings as Quality Improvement Projects	Changes included continuous staff training, certification, patient fatigue in relation to therapy reviews, post-discharge patient follow-up, carer support group, better use of available space, patient education and recreation.	Staff education Patient outcomes Satisfaction levels of stroke survivor and family/carer Optimized physical environment	Value added to patient outcomes Improved satisfaction rates of patients/ carers and staff

Pollard, C, and D. Cegile	2018	Canada	Quasi-experimental / before-and after	New rehab service delivery model (POD Model) implemented aiming to add value to patient experience, achieve better patient outcomes, improve program performance, strengthen interprofessional collaboration, and advance best practices and expertise.	The changes included; Improving PT/OT to patient ratios to 1:7 Dedicating a Physiatrist with stroke expertise Designating these 7 Beds for only Stroke Rehabilitation patients Targeted patient scheduling	Indicators include rehabilitation Intensity time, % of patients with target LOS, number of days to access and alignment to Canadian Stroke Best Practices. Since implementation, key performance measures have shown positive results with; LOS, FIM efficiency, % of patients meeting target LOS and patient satisfaction scores.	Research concluded that continuous quality improvement is multi-layered and involves the consideration of structure, processes, accountability and should be grounded by guiding principles.
Pollard, C, and D. Cegile	2019	Canada	Quasi-experimental / before-and after	A POD Model of Care was implemented with positive results. Aim was to improve stroke care in terms of access to rehab, efficiency of care, and patient outcomes.	The designated Stroke Pod had: 1 to 7 Staff to Patient ratio for OT/PT and 0.6 to 7 for SLP. In contrast, a 1 to 10 for OT/PT and 0.6 to 10 ratio were observed for SLP on the mixed PODs. There were dedicated Physiatrist and Advance Practice Nurse and the POD admitted high intensity stroke rehabilitation patients in comparison to a mix of stroke and neurological patients.	Positive results were demonstrated between April 2018 and February 2019 for rehabilitation intensity minutes per day per patient; % of patients meeting their target LOS; number of access days; FIM efficiency.	Resulted in improved care access, positive patient outcomes and efficiencies in patient flow.
Robinson, J, and K. Trow R, McNicoll Whiteman	2018	Canada	Lean	Intervention aimed to address lack of a consistent process for "Rehabilitation Patient Groupings" availability and long team rounds impacting direct patient care.	Lean involved process mapping, staff satisfaction surveys and patient experience questionnaires. Formation of 3 working groups; Rehabilitation Patient Groupings Processes, Rounds Processes and Pass Processes.	Preliminary data demonstrated changes in FIM efficiency and improved Rehabilitation Patient Groupings available in team rounds.	Resulted in improvements in team rounds' processes efficiency, and improvements in both quantitative and qualitative measurements.
Savage, J, et al	2019	Canada	Plan-Do-Study -Act methodology	Intervention aimed to increase rehabilitation intensity.	Plan-Do-Study-Act methodology was used. Analysis of operation by key stakeholders was done and identification of areas for improvement, future state, and steps for achievement of desired future vision was done. Nine Rehabilitation intensity initiatives were implemented.	Pre-implementation median Rehabilitation intensity was 58.6 min. Increased median RI minutes was observed through implementation.	Demonstrated effectiveness of Plan-Do -Study-Act methodology. Staff engagement and involvement improved awareness and provided opportunities for more 1:1 therapy. Recommended continuing monitoring and feedback for sustainability of efforts.

(*Continued*)

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Table 2 (Continued).

Author	Year	Location	Study Design	Background and Intervention	Methods	Results	Conclusion
Sheehan, L, et al	2017	Canada	LEAN methodology	Intervention aimed for a 57% increase in total rehabilitation intensity minutes in a six-month period.	Using LEAN methodology, creation of value stream maps and three sub-groups occurred: "Patient Scheduling and Processes, Environment and Education" aiming to decrease waste.	Results included layout changes of health professional office, finishing "5S" LEAN processes, clean supply room and storage room for interprofessional team, and increased volunteers assisting patients to the gym.	Resulted in increase in rehabilitation intensity.
Sureshkumar, S.M.J.F.H.J.	2020		Plan-Do-Study -Act methodology	Intervention aimed to identify areas of improvement for high-performance teams.	(PDSA) cycle 1 focused on identifying areas of improvement via a survey and a resurvey after implementation with the multidisciplinary team. PDSA cycle 2 improved the morning huddle with introducing a local checklist from SAFER patient flow bundle and recommendations for best practice. Patient safety data element and patient experience element were collected.	The PDSA cycle 1 showed significant change within the four variables: general organization, junior doctor accessibility, efficiency, and patient care. There was an increase in the documentation, discharge summary completion and patient compliments during the QIP period.	Resulted in improved outcomes for multidisciplinary team treatment.
Thornton, M, et al	2015	Canada	Quasi-experimental / before-and after	Intervention aimed to improve physiotherapists' awareness, knowledge and clinical practice for aerobic exercise training post-stroke using knowledge transfer.	Content experts developed an e-learning program of four case-based modules were developed. a pre- post-questionnaire was used for assessing effectiveness in improvements in physiotherapists' knowledge and confidence.	Pilot testing of program content and delivery, and effectiveness in enhancing knowledge and self-efficacy of 25 physiotherapists was presented.	Project is expected to result in positive change to physiotherapists' practice by improving knowledge and self-efficacy in applying the guidelines.
White, J. and C.J.I.J.o.S. Stager	2015	Canada	Quasi-experimental / before-and after	Intervention aimed to introduce changes to patient beds and having a separate general rehab unit. Outcomes included LOS, Alternate Level of Care (ALC), and referral rate.	Intervention included integrating six medical beds into a thirty bed general rehabilitation unit (A2), adding nine stroke rehabilitation beds, creating fifteen dedicated integrated stroke beds as well as site visits, review of staffing models, implementing staff prior learning evaluations and education.	Data demonstrates improvements in LOS, ALC, referral rate, process improvements, seamless transitions, improved patient experience, implementation of quality practices, broader acceptance and utilization of tools and a stronger collaborative practice model.	Improvements in key indicators, patient experience, and quality practices.
Yong-Jae, K. and K. Eun-Jung	2012	NA	FOCUS-PDCA model.	Intervention aimed to develop an integrated care pathway (CP) following FOCUS-PDCA model.	Committee members developed scheduled meetings with documentation for the integrated care pathway and were expounded after FOCUS-PDCA model.	Relevant documents were elaborated to the stakeholders throughout the cycles.	Potentially promotes more structured and efficient care for stroke.

72% to an average of 90%. Power et al demonstrated a modest improvement from baseline in the odds of compliance corresponding to a relative improvement of 10.9% in the Early Hours Bundle and 11.2% in the Rehabilitation Bundle.[22]

Another study[16] evaluated improvements in geriatric rehabilitation service delivery through a national quality improvement program aiming to incite self-organizing capacity to develop integrated care through developing or improving the care pathway for the patient group. Holstege et al used two cohorts of patients, baseline and one-year post-implementation follow-up cohort.[16] At 1-year post-implementation, there was similarity in successful rehabilitation between the cohorts for stroke rehabilitation, but with additional independence in activities of daily living in the follow-up cohort. Another study[14] looked at improving care planning aiming for the most efficient resource utilization to maximize outcomes for stroke survivors. After implementing the program, Oyeyemi and Sedenu demonstrated a significantly decreased length of stay as well as a consistent improvement in length of stay efficiency.[14] Finally, one study[20] using a PDSA (plan-do-study-act) intervention for technology adoption investigated the integration of the use of a "Via Therapy" tool predominantly as a mobile app with clinical partners. Hancock et al demonstrated a 22% increase in confidence and use of evidence-based practice from the baseline. The technology was found to be concise, straightforward, accessible, simple and easy to use with changes to intervention delivery reported.[20]

In addition, twenty-three quality improvement studies in stroke rehabilitation were documented in abstracts only.[26–48] The studies demonstrated a mix of QI initiatives including twelve quasi-experimental/before and after studies, two qualitative studies, five plan-do-study-act (PDSA) cyclical studies, one action research study and three lean methodology studies. All studies reported positive outcomes and conclusions. The studies are summarized in Table 2 (Summary of Abstracts on Quality Interventions in Stroke Rehabilitation).

To address the third research question, the researchers subsequently considered the role of different barriers and facilitators to the QI interventions in improving the quality of care for stroke patients in rehabilitation utilizing narrative analysis and summary in Table 3. The Model for Understanding Success in Quality (MUSIQ) was used to ascertain contextual factors that could influence QI success.[5] One study did not report improvement, while the rest of the studies reported improvements following the intervention, with many reporting on the impact of contextual factors impacting the intervention results. When assessing contextual factors, several authors agreed on the impacts of external environment,[16,22] as well as organizational factors.[16,19–21,24] In addition, QI support and capacity,[14,23] microsystem[21] and the QI team[14,17,18,24,25] were seen to also have an impact on QI initiatives in the current research.

Several authors in the current review report organizational factors were important facilitators of success including the role of senior leadership and sponsor support in contributing to the success of the intervention. Jolliffe et al concluded that the strong senior management support and organizational support facilitated success.[24] Tistad et al suggested that mobilizing knowledge into clinical practice is complex and support from senior management especially for prioritization and discussion was integral for success.[21] In addition, several authors concurred with Kaplan et al on the importance of the maturity of QI interventions and sophistication of programs and their contribution to success. Duration of programs was identified as

Table 3 Contextual Factors in the Research Utilizing MUSIQ

Contextual Factor	Hancock et al (2019)	Holstege et al (2017)	Jolliffe et al (2019)	Oyeyemi and Sedenu (2010)	Perry et al (2014)	Power et al (2014)	Tistad et al (2016)	Torres, A et al (2014)	Vratsistas-Curto et al (2017)	Voogdt-Pruis et al (2019)
External environment		x				x				
Organization	x[a]	x	x				x			
QI support and capacity				x						x
Microsystem							x			
QI team			x	x	x			x	x	

Note: [a]"x" symbol = represents confirmation for this contextual factor (vertical axis) having an impact on QI initiatives in this current research (horizontal axis).

important. Holstege et al recommended longer follow-up periods are sometimes necessary to detect changes in outcomes after quality interventions. They recommended that future studies should look at specific components of the quality interventions that contribute to specific outcome improvements.[16] Jolliffe et al also advocated for high incidence of implemented cycles, a long 12-month program duration contributing to higher adherence (>75%) to the program and intervention success.[24] In addition, clear prescribed guidelines and ease-of-use are important for success. Janzen et al also concluded that for QI success, clear, comprehensive and prescriptive guidelines are essential.[19] Vague recommendations, which are difficult to apply and challenging to measure, contribute to lower success and compliance rates of interventions. Hancock et al concluded that the usability and accessibility of the used intervention contributed to success.[20]

Holstege et al confirmed that external factors (societal and organizational) could have affected the study outcome.[16] Power et al also stated that national and regional attention to stroke at the time of the intervention contributed to improvement.[22] They also stated that regulation, clinical leadership, and research implementation contributed to the better care for the stroke patients during the intervention. In addition, they concluded that the effects of interventions could be specific rather than generalizable; thus, certain care processes would have more improvement in collaborative programs such as simple, controllable, geographically bound changes, rather than others that could be less tractable.[22]

QI support and capacity were noted to be important contextual factors. Oyeyemi and Sedenu, concluded that incentives and fiscal factors could also have contributed to some of the improvements in the intervention.[14] In addition, Voogdt-Pruis et al discussed the impact of the availability and ease-of-use of the intervention as well as access and training involved as facilitators for success.[23] At the microsystem level, Tistad et al in the current study also concurred with MUSIQ as to the importance of leadership and culture for QI success and suggested that significant improvements could be made through formal training interventions being incorporated into the normal work settings.[21] Furthermore, mentoring managers and tailoring interventions within specific contexts could also contribute to success. Identifying specific indicators for change relevant to the context as well as monitoring performances and outcomes were found to have a positive influence on the intervention.[21]

Finally, MUSIQ discussed extensively the role of QI teams in intervention success,[5] which was further confirmed by many authors in the current study. Jolliffe et al mentioned that regular attendance of key staff in the intervention influenced the regularity of feedback during the intervention, however as they were looking at a sustainability in the program, this was an acceptable limitation during implementation.[24] They also confirmed the importance of non-aversive clinician-led feedback as well as shared goals to QI success. Vratsistas-Curto et al also discussed team actors that contributed to lack of behavioral changes, which included lack of staff monitoring, staff turnover, smaller interventions, and absence of familiarity or concurrence with the proposed assessments and interventions.[25] Oyeyemi and Sedenu concluded that improvements in staff expertise as a contributing factor for success.[14] Torres et al also concluded that improved communication impacted intervention success.[17] Perry et al discussed team diversity and norms, concluding that an "active" approach demonstrated better adherence that just relying on mailed guidelines, and that practice style traits (seekers, receptive, traditionalists and pragmatists) also influenced intervention success.[18] The researchers also stressed the importance of change agents on-site. They concluded that some of the challenges included complexity of patient cases, time availability, the drive for persistence over longer periods of time and change resistance.

Discussion

The purpose of this review was to identify QI interventions used in stroke rehabilitation settings and the impacts and improvements reported in the QI interventions. Our search identified twelve studies with QI interventions in stroke rehabilitation that met review criteria.

In addition, there were twenty-three quality improvement studies in stroke rehabilitation where only conference abstracts were available. The types of intervention in these abstracts were briefly discussed in the results section of this review and are presented in Table 2. This suggests that quality interventions were implemented for stroke rehabilitation and discussed in relevant conferences, however no further endeavours were attempted to develop a full journal paper to further describe and discuss the interventions. This suggests there may be four categories of QI studies, those that are published as full papers in peer review journals, published as conference abstracts, presented at conferences but the abstracts are not published and even perhaps not published or presented, thus suggesting that the QI studies published as

full papers are the tip of the iceberg. The studies reported in the identified abstracts were not included in the full review due to the lack of comparable detail on the interventions and study findings.

The review identified heterogeneous interventions with largely positive results. Less than 10% of the studies reported no improvement after a quality intervention. The majority of QI interventions were involving organizational change in the structure or delivery of care,[4,14–17,20,22] two clinician education QI interventions[18,21] and two audit and feedback as well as clinician education QI interventions.[19,24] With the limitations and heterogeneity in intervention types, designs, contextual factors and outcomes in the reviewed primary studies of QI interventions that are typical in QI literature, the researchers encountered challenges in assessing of the evidence across heterogeneous studies with limited ability to quantitatively synthesize results and thus a narrative analysis approach was undertaken. In addition, the researchers summarized evidence, grouping evidence by settings, study design, type, population, methods, intervention results and outcome measures. On the other hand, this very heterogeneity reflects the wide diversity of interventions in practice for stroke rehabilitation QI interventions that are likely to impact improvements in practice and contributing significantly to this gap in literature.

Various contextual factors, barriers and facilitators throughout the studies contributed to the success of the interventions. Contextual factors in the QI interventions in the current review impacted on improvement outcomes following implementation. The characteristics of the setting in the study where no improvement after the quality improvement intervention could have impacted intervention effectiveness.[15] This included specialization, professional (turf) issues, external regulations including cost-containing policies and procedures, goal flexibility, poorly defined outcomes, unclear relationship between services and outcomes as well as multiple, non-integrated patient care management may have contributed to limiting the effectiveness of the CPM intervention. The majority of the studies reported quality improvements with contextual factors including external environment, organizational factors, QI support and capacity, microsystem and the QI team impacting intervention success.[14,16–25] Thus, researchers and clinicians implementing QI interventions would benefit from taking into consideration reported barriers and facilitators for quality improvement for stroke patients in rehabilitation.

Many limitations were discussed in the current studies, with size, generalizability and data issues emerging as the main themes. The majority of authors discussed size and generalizability as well as absence of cost analysis as limitation of the research. In the study by Hancock et al (2019), authors had only one PDSA cycle throughout the project, thus limitations of a small data set, inability to perform costs analysis as well as the use of one community setting were observed during application.[20] Jolliffe et al mentioned that implementation in just one site limits the generalizability and possibility of scaling-up, adoption and delivery across multiple organizations. Finally, using multiple indicators might also limit implementation in multiple sites. They recommended implementing in both public and private hospitals as well as including cost/benefit analysis along with any evaluation of efficacy.[24] Oyeyemi and Sedenu also confirmed that small sample size and a one-center study is a limitation in the study.[14] Perry et al stated limitations in absence of control groups and non-randomization.[18] Vratsistas-Curto et al also mentioned small file numbers as a study limitation.[25] Power et al had limitations in not non-generalizability beyond the English context. They suggested further studies investigate causal mechanisms linking improved performance to improved outcomes, as well as more sophisticated evaluation mechanisms for collaboratives.[22] Some of the limitations in Voogdt-Pruis et al including non-representation of the study population to the entire population, the possibility of missing certain barriers and facilitators by the late adopters and the absence of patient and patient-representative participation in the study.[23] Data issues and missing data were also mentioned as limitations in several studies. Perry et al stated limitations in missing data and unclear documentation in the intervention.[18] Vratsistas-Curto et al also recorded inaccuracy of written medical records.[25] Power et al had limitations in not capturing additional processes of care, variation in completion rates as well as data collection bias.[22]

Thus, it could be said that the QI interventions undergone to date for stroke rehabilitation demonstrated improvements through implementation of the different interventions (>90%). However, despite the importance of QI interventions for improving the delivery of health care in stroke rehabilitation, many contextual factors, barriers and limitations in the implementation and evaluation of QI interventions can be seen influencing the effectiveness of the intervention. The current research concurred with MUSIQ on many of the contextual factors underlying success in QI, where more specifically the role of the organization and the QI team have been discussed by the majority of authors in the current study as playing a role in success. Designing and supporting QI interventions taking into consideration the facilitators, limitations, contextual factors and recommendations posed by the researchers in the current study would contribute to better and more generalisable QI interventions in stroke rehabilitation.

Limitations

There were limitations in the current study. Firstly, due to the limited number of studies as well as the quality of some studies that met review criteria, the strength of conclusions is limited. Secondly, there was a wide range of study types, settings and methods, leading to wide heterogeneity in the studies that met inclusion criteria, thus performing a meta-analysis for the results was not possible. Thirdly, our search might not have been exhaustive despite searching multiple databases using comprehensive and validated search strategies. Finally, categorizing articles by type of intervention even with assistance of predefined tools and classification schemes is partly subjective.

Conclusions

There is paucity of research investigating QI intervention for improving the quality of care in stroke rehabilitation. Reviewing 12 studies that included quality improvement interventions in stroke care can offer value to healthcare providers in terms of key success factors associated with improvements in this particular clinical setting of stroke rehabilitation. In more than 90% of cases, improvements were noted through implementation of multicomponent interventions, and the majority of studies raised the impact of contextual factors through intervention implementation.

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Disclosure

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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