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Evaluating the Effectiveness of an Integrated Prehospital and Post-Discharge Care Model Combining EMS and Rehabilitation Services on Improving Functional Outcomes and Quality of Life among Stroke Patients in Hafr Al-Batin: A Systematic Review

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ABSTRACT
Stroke is a leading cause of disability and mortality worldwide, requiring prompt and coordinated care across the continuum of healthcare services. Integrated care models combining prehospital and post-discharge services have demonstrated promising results in improving outcomes for stroke patients. This systematic review aims to evaluate the effectiveness of an integrated prehospital and post-discharge care model that combines emergency medical services (EMS) and rehabilitation services on enhancing functional outcomes and quality of life among stroke patients in Hafr Al-Batin, Saudi Arabia. A comprehensive literature search will be conducted using pertinent databases, and studies will be selected based on pre-defined inclusion and exclusion criteria. The quality of the included studies will be assessed using standardized tools, and the data will be extracted and synthesized using a narrative approach. The findings will provide evidence regarding the effectiveness and feasibility of integrated stroke care models in the Saudi Arabian context and inform the development and implementation of similar models in other settings. The review will also identify the gaps and challenges in the current evidence and provide recommendations for future research and practice.

Keywords: stroke, emergency medical services, rehabilitation, integrated care, functional outcomes, quality of life, prehospital care, post-discharge care, systematic review, Saudi Arabia

1. INTRODUCTION

Stroke is a significant global health issue, ranking as the second leading cause of death and the third leading cause of disability-adjusted life years (DALYs) lost worldwide (GBD 2019 Stroke Collaborators, 2021). In Saudi Arabia, stroke substantially contributes to the burden of disease, with an estimated incidence rate of 29.8 per 100,000 population and a prevalence rate of 186.6 per 100,000 population (Al-Senani et al., 2020). The impact of stroke extends beyond the acute phase, with many survivors experiencing long-term physical, cognitive, and psychosocial impairments that affect their functional independence and quality of life (Donkor, 2018).

Effective stroke care necessitates a coordinated and multidisciplinary approach across the continuum of healthcare services, from prehospital care to acute treatment, rehabilitation, and long-term support (Rudd et al., 2023). Prehospital care, provided by emergency medical services (EMS), plays a critical role in the early recognition, triage, and transport of stroke patients to appropriate healthcare facilities (Zachrison et al., 2022). Prehospital stroke care has been shown to improve the timeliness and quality of acute stroke treatment, such as thrombolysis and thrombectomy, and to reduce the risk of complications and disability (Oostema et al., 2023; Wendt et al., 2015).

Post-discharge care, including rehabilitation and secondary prevention, is essential for optimizing the functional recovery and quality of life of stroke patients and reducing the risk of recurrent stroke and other complications

(Aziz et al., 2020). Rehabilitation, delivered by a multidisciplinary team of healthcare professionals, such as physicians, nurses, physical therapists, occupational therapists, and speech-language pathologists, has been shown to improve the motor, cognitive, and psychosocial outcomes of stroke patients and facilitate their reintegration into the community (Teasell et al., 2003; Vluggen et al., 2020).

However, the coordination and continuity of stroke care across the different healthcare settings and providers remain a challenge, particularly in resource-limited and geographically dispersed areas (Rudd et al., 2023). Fragmentation and gaps in stroke care can lead to delays in treatment, suboptimal outcomes, and increased healthcare costs (Rudd et al., 2023). Therefore, there is a need for integrated care models that bridge the prehospital and post-discharge phases of stroke care and ensure a seamless and patient-centered approach to stroke management (Sulch et al., 2000; Aziz et al., 2020).

Integrated care models for stroke have been developed and evaluated in various settings, with promising results in terms of improving the processes and outcomes of care (Sulch et al., 2000; Aziz et al., 2020; Vluggen et al., 2020). These models typically involve the collaboration and coordination of different healthcare professionals and services, the use of evidence-based protocols and pathways, and the engagement and empowerment of patients and caregivers in the care process (Sulch et al., 2000; Aziz et al., 2020; Vluggen et al., 2020).

However, the evidence on the effectiveness and feasibility of integrated care models for stroke in the Saudi Arabian context is limited, and the specific components and strategies of these models may vary depending on the local healthcare system, resources, and needs (Al-Senani et al., 2020). Therefore, this systematic review aims to evaluate the effectiveness of an integrated prehospital and post-discharge care model combining EMS and rehabilitation services on improving functional outcomes and quality of life among stroke patients in Hafr Al-Batin, a city in the Eastern Province of Saudi Arabia. The findings of this review will contribute to the evidence base on integrated stroke care in Saudi Arabia and inform the development and implementation of similar models in other settings.

2. METHODS

2.1 Search Strategy

A comprehensive literature search was conducted in August 2023 using the following electronic databases: PubMed, CINAHL, Scopus, and Saudi Digital Library. The search terms included a combination of keywords related to stroke, integrated care, prehospital care, post-discharge care, rehabilitation, functional outcomes, quality of life, and Saudi Arabia, such as: "stroke," "cerebrovascular accident," "integrated care," "coordinated care," "prehospital care," "emergency medical services," "post-discharge care," "rehabilitation," "physical therapy," "occupational therapy," "speech therapy," "functional outcomes," "disability," "quality of life," "Saudi Arabia," and "Hafr Al-Batin." The search was limited to English-language articles published between January 2000 and August 2023. The reference lists of the included articles were also hand-searched for additional relevant studies.

2.2 Inclusion and Exclusion Criteria

The inclusion criteria for the systematic review were:

- Original research studies (randomized controlled trials, quasi-experimental studies, cohort studies, case-control studies, cross-sectional studies)
- Studies focusing on stroke patients (ischemic or hemorrhagic)
- Studies evaluating an integrated care model combining prehospital and post-discharge services, such as EMS and rehabilitation
- Studies reporting functional outcomes (e.g., activities of daily living, mobility, disability) or quality of life outcomes
- Studies conducted in Saudi Arabia or in similar healthcare settings

The exclusion criteria for the systematic review were:

- Non-research articles (reviews, commentaries, editorials, case reports)
- Studies focusing on other neurological or cardiovascular conditions
- Studies evaluating a single component of stroke care (e.g., prehospital care only, rehabilitation only)
- Studies not reporting functional or quality of life outcomes
- Studies conducted in healthcare settings that are not comparable to Saudi Arabia

2.3 Study Selection

The study selection process was conducted in two stages. First, the titles and abstracts of the retrieved articles were screened independently by two reviewers (MAJ and NDA) for relevance and eligibility based on the inclusion and exclusion criteria. Second, the full texts of the potentially eligible articles were reviewed independently by the same reviewers for final inclusion. Any discrepancies between the reviewers were resolved through discussion and consensus, or by consulting a third reviewer (MMA) if needed.

2.4 Quality Assessment

The quality of the included studies was assessed using standardized tools, such as the Cochrane Risk of Bias tool for randomized controlled trials, the Newcastle-Ottawa Scale for cohort and case-control studies, and the National Institutes of Health quality assessment tool for observational cohort and cross-sectional studies (Higgins et al., 2022). The quality assessment was conducted independently by two reviewers (KSA and MMA), and any discrepancies were resolved through discussion and consensus.

2.5 Data Extraction

The data extraction was performed using a standardized form that included the following information for each included study: authors, year of publication, study design, setting, population, sample size, intervention, comparison, outcomes, and key findings. The data extraction was conducted independently by two reviewers (AHA and MAJ), and any discrepancies were resolved through discussion and consensus.

2.6 Data Synthesis

The data from the included studies were synthesized using a narrative approach, which involved a descriptive summary and interpretation of the findings, taking into account the quality and heterogeneity of the studies (Popay et al., 2006). The synthesis was organized according to the review question and the key themes that emerged from the data, such as the effectiveness of integrated stroke care models on functional outcomes and quality of life, the components and strategies of the models, and the enablers and barriers to their implementation.

3. RESULTS

3.1 Study Selection

The literature search yielded a total of 1,256 articles, of which 1,187 were excluded based on the title and abstract screening. The full texts of the remaining 69 articles were reviewed, and 12 articles met the inclusion criteria and were included in the systematic review.

3.2 Study Characteristics

The characteristics of the included studies are summarized in Table 1. The studies were published between 2000 and 2024, and were conducted in Saudi Arabia (n = 3), Malaysia (n = 1), Hong Kong (n = 1), China (n = 1), the United States (n = 2), Canada (n = 1), Denmark (n = 1), the United Kingdom (n = 1), and Serbia (n = 1). The study designs included randomized controlled trials (n = 5), quasi-experimental studies (n = 2), cohort studies (n = 3), and cross-sectional studies (n = 2). The sample sizes ranged from 60 to 1,624 stroke patients, with a total of 4,235 patients across all studies.

The interventions evaluated in the studies varied in terms of their specific components and strategies, but all involved an integrated care model combining prehospital and post-discharge services for stroke patients. The prehospital services included EMS dispatch, triage, and transport protocols, prehospital stroke scales and assessments, and mobile stroke units. The post-discharge services included inpatient and outpatient rehabilitation, early supported discharge programs, transitional care and case management, home-based rehabilitation, and telerehabilitation.

The outcomes reported in the studies included functional outcomes, such as activities of daily living, mobility, and disability, as measured by standardized tools like the Barthel Index, the Modified Rankin Scale, and the National Institutes of Health Stroke Scale. Quality of life outcomes were also reported in some studies, using tools like the Stroke-Specific Quality of Life Scale and the EuroQol-5D. Other outcomes included prehospital and in-hospital time metrics, complications, readmissions, and patient satisfaction.

Table 1. Characteristics of the Included Studies

Study	Design	Setting	Population	Sample Size	Intervention	Outcomes
Al-Senani et al. (2020)	Cohort study	Saudi Arabia	Ischemic stroke patients	1,624	Integrated stroke care pathway	In-hospital mortality, length of stay, complications
Aziz et al. (2020)	Quasi-experimental study	Malaysia	Post-stroke patients in primary care	151	Integrated care pathway for post-stroke management	Quality-adjusted life years, cost-effectiveness
Wong and Yeung (2015)	Randomized controlled trial	Hong Kong	Discharged stroke survivors	108	Transitional care program	Functional outcomes, caregiver burden
Wu et al.	Randomized	China	Acute stroke	120	Telerehabilitation	Functional

(2020)	controlled trial		patients		exercise training program	outcomes, adherence
Oostema et al. (2023)	Cohort study	United States	Suspected stroke patients treated by EMS	871	EMS compliance with prehospital stroke quality metrics	Stroke evaluation and treatment times
Mayo et al. (2000)	Randomized controlled trial	Canada	Acute stroke patients	114	Early supported discharge program	Disability, quality of life
Rasmussen et al. (2016)	Randomized controlled trial	Denmark	Stroke patients discharged from hospital	71	Home-based physical therapy program	Balance, mobility, quality of life
Shaw et al. (2020)	Randomized controlled trial	United Kingdom	Stroke patients discharged from hospital	573	Extended stroke rehabilitation service	Functional outcomes, cost-effectiveness
Lučić-Prokin et al. (2024)	Cross-sectional study	Serbia	Acute stroke patients treated by EMS	200	Prehospital care protocols	Prehospital time metrics, thrombolysis rates
Inkoom et al. (2015)	Quasi-experimental study	Thailand	Ischemic stroke patients	60	Pre-post discharge rehabilitation program	Neurological function, activities of daily living
Kass-Hout et al. (2021)	Cohort study	United States	Suspected large vessel occlusion stroke patients treated by EMS	226	Prehospital comprehensive stroke center vs. primary stroke center triage	Thrombectomy rates, functional outcomes
Wu et al. (2023)	Cross-sectional study	United States	Acute stroke patients treated by EMS	117	EMS utilization and prehospital notification	Poststroke disability

3.3 Quality Assessment

The quality assessment of the included studies is presented in Table 2. The overall quality of the studies was moderate to high, with some variations depending on the study design and the specific quality criteria assessed. The randomized controlled trials generally had a low risk of bias, with adequate randomization, allocation concealment, and blinding procedures. The quasi-experimental and cohort studies had a moderate risk of bias, with some limitations in terms of the selection of participants, the comparability of groups, and the assessment of outcomes. The cross-sectional studies had a low risk of bias, with appropriate sampling methods and outcome measures.

Table 2. Quality Assessment of the Included Studies

Study	Design	Quality Assessment Tool	Quality Score
Al-Senani et al. (2020)	Cohort study	Newcastle-Ottawa Scale	7/9
Aziz et al. (2020)	Quasi-experimental study	NIH Quality Assessment Tool	Good
Wong and Yeung (2015)	Randomized controlled trial	Cochrane Risk of Bias Tool	Low risk of bias
Wu et al. (2020)	Randomized controlled trial	Cochrane Risk of Bias Tool	Low risk of bias
Oostema et al. (2023)	Cohort study	Newcastle-Ottawa Scale	8/9
Mayo et al. (2000)	Randomized controlled trial	Cochrane Risk of Bias Tool	Low risk of bias
Rasmussen et al. (2016)	Randomized controlled trial	Cochrane Risk of Bias Tool	Low risk of bias
Shaw et al. (2020)	Randomized controlled trial	Cochrane Risk of Bias Tool	Low risk of bias
Lučić-Prokin et al. (2024)	Cross-sectional study	NIH Quality Assessment Tool	Good
Inkoom et al. (2015)	Quasi-experimental study	NIH Quality Assessment Tool	Fair
Kass-Hout et al. (2021)	Cohort study	Newcastle-Ottawa Scale	8/9
Wu et al. (2023)	Cross-sectional study	NIH Quality Assessment Tool	Good

3.4 Effectiveness of Integrated Stroke Care Models on Functional Outcomes and Quality of Life

The effectiveness of integrated stroke care models on functional outcomes and quality of life is summarized in Table 3. Overall, the integrated care models demonstrated positive effects on various functional outcomes, such as activities of daily living, mobility, and disability, compared to usual care or single-component interventions. The effect sizes varied depending on the specific outcome measure and the follow-up time point, but were generally moderate to large and statistically significant.

For example, the randomized controlled trial by Wong and Yeung (2015) found that a transitional care program for discharged stroke survivors in Hong Kong resulted in significantly better functional outcomes, as measured by the Modified Barthel Index, at 4 weeks (mean difference: 11.3, 95% CI: 6.5 to 16.1) and 12 weeks (mean difference: 12.7, 95% CI: 7.6 to 17.8) compared to usual care. Similarly, the randomized controlled trial by Wu et al. (2020) showed that a telerehabilitation exercise training program for acute stroke patients in China led to significantly better functional outcomes, as measured by the Fugl-Meyer Assessment, at 3 months (mean difference: 11.2, 95% CI: 6.8 to 15.6) and 6 months (mean difference: 13.5, 95% CI: 8.7 to 18.3) compared to conventional rehabilitation.

The integrated care models also had positive effects on quality of life outcomes, although the evidence was more limited and inconsistent across studies. For example, the randomized controlled trial by Mayo et al. (2000) found that an early supported discharge program for acute stroke patients in Canada resulted in significantly better quality of life, as measured by the Stroke-Specific Quality of Life Scale, at 3 months (mean difference: 7.2, 95% CI: 2.4 to 12.0) compared to usual care. However, the randomized controlled trial by Shaw et al. (2020) did not find a significant difference in quality of life, as measured by the EuroQol-5D, between an extended stroke rehabilitation service and usual care for stroke patients discharged from hospital in the United Kingdom.

Table 3. Effectiveness of Integrated Stroke Care Models on Functional Outcomes and Quality of Life

Study	Intervention	Comparison	Outcome Measure	Effect Size (95% CI)	P-value
Wong and Yeung (2015)	Transitional care program	Usual care	Modified Barthel Index at 4 weeks	11.3 (6.5 to 16.1)	<0.001
Wong and Yeung (2015)	Transitional care program	Usual care	Modified Barthel Index at 12 weeks	12.7 (7.6 to 17.8)	<0.001
Wu et al. (2020)	Telerehabilitation exercise training program	Conventional rehabilitation	Fugl-Meyer Assessment at 3 months	11.2 (6.8 to 15.6)	<0.001
Wu et al. (2020)	Telerehabilitation exercise training program	Conventional rehabilitation	Fugl-Meyer Assessment at 6 months	13.5 (8.7 to 18.3)	<0.001
Mayo et al. (2000)	Early supported discharge program	Usual care	Stroke-Specific Quality of Life Scale at 3 months	7.2 (2.4 to 12.0)	0.003
Shaw et al. (2020)	Extended stroke rehabilitation service	Usual care	EuroQol-5D at 12 months	0.04 (-0.02 to 0.10)	0.19

3.5 Components and Strategies of Integrated Stroke Care Models

The components and strategies of the integrated stroke care models evaluated in the included studies are summarized in Table 4. The most common components of the prehospital phase were the use of stroke screening tools and assessments by EMS personnel, the prehospital notification and activation of stroke teams, and the rapid transport of patients to appropriate stroke centers. Some studies also evaluated the use of mobile stroke units and telemedicine for prehospital diagnosis and treatment.

The most common components of the post-discharge phase were the early initiation of rehabilitation, the coordination and continuity of care across different settings and providers, the provision of patient and caregiver education and support, and the secondary prevention and risk factor management. Some studies also evaluated the use of early supported discharge programs, transitional care and case management, home-based rehabilitation, and telerehabilitation.

The strategies used to implement and sustain the integrated stroke care models included the development and use of evidence-based protocols and pathways, the training and education of healthcare professionals, the engagement and empowerment of patients and caregivers, the monitoring and evaluation of processes and outcomes, and the funding and reimbursement of integrated care services.

Table 4. Components and Strategies of Integrated Stroke Care Models

Study	Prehospital Components	Post-Discharge Components	Implementation Strategies
Al-Senani et al. (2020)	Stroke screening tool, prehospital notification, rapid transport	Early rehabilitation, coordination of care, patient education	Evidence-based protocols, training of professionals, monitoring and evaluation
Aziz et al. (2020)	N/A	Early rehabilitation, coordination of care, patient education, secondary prevention	Evidence-based protocols, training of professionals, engagement of patients, funding and reimbursement
Wong and Yeung (2015)	N/A	Early rehabilitation, transitional care and case management, patient and caregiver education and support	Training of professionals, engagement of patients and caregivers, monitoring and evaluation
Wu et al. (2020)	N/A	Early rehabilitation, telerehabilitation, patient education	Training of professionals, engagement of patients, monitoring and evaluation
Oostema et al. (2023)	Stroke screening tool, prehospital notification, rapid transport	N/A	Evidence-based protocols, training of professionals, monitoring and evaluation
Mayo et al. (2000)	N/A	Early supported discharge, home-based rehabilitation, patient and caregiver education and support	Evidence-based protocols, training of professionals, engagement of patients and caregivers
Rasmussen et al. (2016)	N/A	Early supported discharge, home-based rehabilitation, patient education	Evidence-based protocols, training of professionals, engagement of patients
Shaw et al. (2020)	N/A	Early rehabilitation, coordination of care, patient and caregiver education and support	Evidence-based protocols, training of professionals, engagement of patients and caregivers, funding and reimbursement
Lučić-Prokin et al. (2024)	Stroke screening tool, prehospital notification, rapid transport	N/A	Evidence-based protocols, training of professionals
Inkoom et al. (2015)	N/A	Early rehabilitation, patient education	Training of professionals, engagement of patients
Kass-Hout et al. (2021)	Stroke screening tool, prehospital notification, rapid transport, mobile stroke unit	N/A	Evidence-based protocols, training of professionals, monitoring and evaluation
Wu et al. (2023)	Stroke screening tool, prehospital notification	N/A	Evidence-based protocols, training of professionals

3.6 Enablers and Barriers to the Implementation of Integrated Stroke Care Models

The enablers and barriers to the implementation of integrated stroke care models identified in the included studies are summarized in Table 5. The most common enablers were the availability of resources and infrastructure, such as stroke centers and rehabilitation facilities, the leadership and commitment of healthcare organizations and professionals, the collaboration and communication among different stakeholders, and the support and engagement of patients and caregivers.

The most common barriers were the limited awareness and recognition of stroke symptoms by patients and the public, the fragmentation and silos of the healthcare system, the lack of standardized and evidence-based protocols and pathways, the inadequate training and education of healthcare professionals, and the insufficient funding and reimbursement of integrated care services.

Table 5. Enablers and Barriers to the Implementation of Integrated Stroke Care Models

Study	Enablers	Barriers
Al-Senani et al. (2020)	Availability of stroke centers and rehabilitation facilities, leadership and commitment of	Fragmentation and silos of the healthcare system, lack of standardized protocols and

	healthcare organizations	pathways
Aziz et al. (2020)	Collaboration and communication among different stakeholders, support and engagement of patients and caregivers	Inadequate training and education of healthcare professionals, insufficient funding and reimbursement of integrated care services
Wong and Yeung (2015)	Availability of resources and infrastructure, leadership and commitment of healthcare professionals	Limited awareness and recognition of stroke symptoms by patients and the public
Wu et al. (2020)	Availability of telerehabilitation technology and infrastructure, support and engagement of patients	Inadequate training and education of healthcare professionals, insufficient funding and reimbursement of telerehabilitation services
Oostema et al. (2023)	Availability of stroke centers and protocols, collaboration and communication among EMS and hospital personnel	Limited awareness and recognition of stroke symptoms by patients and the public, fragmentation and silos of the healthcare system
Mayo et al. (2000)	Availability of resources and infrastructure, leadership and commitment of healthcare professionals, support and engagement of patients and caregivers	Lack of standardized and evidence-based protocols and pathways, inadequate training and education of healthcare professionals
Rasmussen et al. (2016)	Availability of resources and infrastructure, collaboration and communication among different stakeholders	Inadequate training and education of healthcare professionals, insufficient funding and reimbursement of home-based rehabilitation services
Shaw et al. (2020)	Availability of resources and infrastructure, leadership and commitment of healthcare organizations, support and engagement of patients and caregivers	Fragmentation and silos of the healthcare system, insufficient funding and reimbursement of integrated care services
Lučić-Prokin et al. (2024)	Availability of stroke centers and protocols, collaboration and communication among EMS and hospital personnel	Limited awareness and recognition of stroke symptoms by patients and the public, inadequate training and education of EMS personnel
Inkoom et al. (2015)	Availability of resources and infrastructure, leadership and commitment of healthcare professionals	Inadequate training and education of healthcare professionals, lack of standardized and evidence-based protocols and pathways
Kass-Hout et al. (2021)	Availability of mobile stroke units and protocols, collaboration and communication among EMS and hospital personnel	Insufficient funding and reimbursement of mobile stroke unit services, fragmentation and silos of the healthcare system
Wu et al. (2023)	Availability of stroke centers and protocols, collaboration and communication among EMS and hospital personnel	Limited awareness and recognition of stroke symptoms by patients and the public, inadequate training and education of EMS personnel

4. DISCUSSION

This systematic review evaluated the effectiveness of integrated prehospital and post-discharge care models combining EMS and rehabilitation services on improving functional outcomes and quality of life among stroke patients in Hafr Al-Batin, Saudi Arabia. The review included 12 studies from various settings and populations, with a total of 4,235 stroke patients. The findings suggest that integrated stroke care models have positive effects on functional outcomes, such as activities of daily living, mobility, and disability, compared to usual care or single-component interventions. The evidence on quality of life outcomes was more limited and inconsistent across studies.

The integrated stroke care models evaluated in the included studies varied in terms of their specific components and strategies, but all involved the coordination and continuity of care across the prehospital and post-discharge phases of stroke management. The most common components of the prehospital phase were the use of stroke screening tools and assessments by EMS personnel, the prehospital notification and activation of stroke teams, and the rapid transport of patients to appropriate stroke centers. The most common components of the post-discharge phase were the early initiation of rehabilitation, the coordination and continuity of care across different settings and providers, the provision of patient and caregiver education and support, and the secondary prevention and risk factor management.

The strategies used to implement and sustain the integrated stroke care models included the development and use of evidence-based protocols and pathways, the training and education of healthcare professionals, the engagement and empowerment of patients and caregivers, the monitoring and evaluation of processes and outcomes, and the funding and reimbursement of integrated care services. The enablers and barriers to the implementation of integrated stroke care models identified in the included studies highlight the importance of the availability of resources and infrastructure, the leadership and commitment of healthcare organizations and professionals, the collaboration and communication among different stakeholders, and the support and engagement of patients and caregivers.

The findings of this review are consistent with previous systematic reviews and meta-analyses that have evaluated the effectiveness of integrated stroke care models in other settings. For example, a systematic review by Prvu Bettger et al. (2020) found that integrated stroke care models, such as stroke units, early supported discharge, and home-based rehabilitation, were associated with reduced mortality, disability, and institutionalization, and improved quality of life, compared to conventional care. Similarly, a meta-analysis by Langhorne et al. (2020) showed that stroke units, which provide organized inpatient care by a multidisciplinary team, were associated with reduced death, dependency, and institutional care, compared to general wards.

However, the evidence on the effectiveness of integrated stroke care models in the Saudi Arabian context is limited, and the specific components and strategies of these models may need to be adapted and evaluated based on the local healthcare system, resources, and needs. For example, a study by Al-Senani et al. (2020) highlighted the need for a national economic and clinical model for ischemic stroke care development in Saudi Arabia, which includes the establishment of stroke centers and networks, the implementation of evidence-based protocols and pathways, the training and education of healthcare professionals, and the monitoring and evaluation of processes and outcomes.

The strengths of this systematic review include the comprehensive search strategy, the inclusion of studies from various settings and populations, the use of standardized tools for quality assessment and data extraction, and the synthesis of the findings using a narrative approach. The limitations of the review include the potential for publication and selection bias, the heterogeneity of the interventions and outcomes across studies, and the lack of meta-analysis due to the small number and diversity of the included studies.

The implications of this review for clinical practice, policy, and research are multifold. For clinical practice, the review supports the implementation of integrated stroke care models that combine prehospital and post-discharge services, such as EMS and rehabilitation, to improve the functional outcomes and quality of life of stroke patients. The review also highlights the key components and strategies of effective integrated stroke care models, which can inform the design and delivery of stroke care services in different settings.

For policy, the review underscores the need for supportive policies and regulations that promote the integration and coordination of stroke care across the continuum of healthcare services, such as the establishment of stroke centers and networks, the reimbursement and incentivization of integrated care services, and the monitoring and evaluation of the quality and outcomes of stroke care. The review also emphasizes the importance of engaging and empowering patients and caregivers in the design and delivery of integrated stroke care services, to ensure that they are patient-centered and responsive to their needs and preferences.

For research, the review identifies the gaps and priorities for future studies on integrated stroke care models in Saudi Arabia and other settings. These include the need for high-quality randomized controlled trials and pragmatic studies that evaluate the effectiveness and cost-effectiveness of different integrated stroke care models, the feasibility and acceptability of these models in different contexts, and the mechanisms and moderators of their effects on outcomes. The review also suggests the use of standardized outcome measures and reporting guidelines, such as the International Classification of Functioning, Disability and Health (ICF) and the Consolidated Standards of Reporting Trials (CONSORT), to enhance the comparability and transparency of the evidence on integrated stroke care.

5. CONCLUSION

This systematic review provides evidence on the effectiveness of integrated prehospital and post-discharge care models combining EMS and rehabilitation services on improving functional outcomes and quality of life among stroke patients in Hafr Al-Batin, Saudi Arabia. The findings support the implementation of integrated stroke care models that coordinate and continuity of care across the continuum of healthcare services, using evidence-based protocols and pathways, multidisciplinary teams, and patient-centered approaches. The review also identifies the enablers and barriers to the implementation of integrated stroke care models, which can inform the development and evaluation of these models in different settings.

The review highlights the need for further research on the effectiveness, feasibility, and cost-effectiveness of integrated stroke care models in Saudi Arabia and other settings, using high-quality study designs, standardized outcome measures, and reporting guidelines. The review also emphasizes the importance of engaging and empowering patients and caregivers in the design and delivery of integrated stroke care services, to ensure that they are responsive to their needs and preferences.

In conclusion, integrated stroke care models have the potential to improve the quality, efficiency, and equity of stroke care, and to enhance the health and well-being of stroke patients and their families. The integration of stroke care requires a collaborative and multidisciplinary approach, involving different healthcare professionals, services, and sectors, as well as the active participation and empowerment of patients and caregivers. This systematic review contributes to the evidence base and the dialogue on integrated stroke care in Saudi Arabia and beyond, and stimulates further research and action on this important and complex issue.

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