ORIGINAL MANUSCRIPT

A meta-analysis of studies of the effects of case management intervention for stroke survivors across three countries

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Abstract

Purpose: A stroke survivor who is discharged to home care faces many challenges during the transition from the hospital to home, including managing their care at home and engaging in rehabilitation and recovery. Case management was developed to ease the transition from hospital to home and help people with stroke cope with their care management challenges. However, the effects of case management intervention remain inconclusive. Case management was designed to direct care and may represent a novel method for reducing the burden of care. This study was designed to evaluate the effects of case management interventions on mental health outcomes, activities of daily living capacity, physical function, and social function among stroke survivors.

Design: Systematic review and meta-analysis.

Methods: This study included studies examining the impacts of case management interventions for stroke survivors that were published in English and identified by searching eight databases, from database inception to February 20, 2022. Standardized mean differences (SMDs) with 95% confidence intervals (CIs) were used to pool effect sizes using a random-effects model (in Stata 16.0). The revised Cochrane risk-of-bias tool for randomized trials (RoB-2) was used to assess the methodological quality of each study.

Findings: The inclusion criteria were satisfied by eight studies (including a total of 1119 stroke survivors). Case management had positive effects on mental health (SMD: 0.26; 95% CI: 0.07 to 0.45, $p = 0.001$) and activities of daily living (SMD: 0.68; 95% CI: 00.37 to 0.99, $p < 0.001$). However, no significant effects were observed for either physical function or social function.

Conclusion: Case management appears to enhance the mental health and activities of daily living among stroke survivors.

Clinical Relevance: Case management interventions hold promise as efficient, cost-effective, and accessible strategies to positively influence care for stroke survivors. This intervention strategy could be applied to the hospital-to-home transition to guide care among this population.

KEYWORDS
case management intervention, mental health, meta-analysis, rehabilitation, stroke survivors

INTRODUCTION

Stroke is the leading cause of death and disability worldwide (Campbell & Khatri, 2020) and is associated with considerable personal, family, and societal burdens, including high economic and social costs (Chen, Wei, et al., 2021; Wang et al., 2021). In 2019, approximately 101.5 million people were estimated to be living with stroke, and stroke was responsible for over 6.6 million deaths worldwide (Alonso et al., 2021; Virani et al., 2021). Currently, more than 80 million stroke survivors are considered disabled, and this population is estimated to increase over the coming decade, with an expected 50% increase in new stroke survivors each year (Duncan et al., 2021; Mendis et al., 2015).

Stroke episodes are characterized by symptoms including sudden numbness or weakness, confusion, difficulty speaking, difficulty seeing with one or both eyes, and severe headaches without an underlying cause (Centers for Disease Control and Prevention, 2020; Rodgers & Price, 2017). The sudden changes in the condition experienced by post-stroke survivors lead to a variety of obstacles and challenges when performing activities of daily living and can include emotional and behavioral changes (Khazaal et al., 2021; Towfighi et al., 2017). As a consequence of the changes associated with stroke, survivors often experience declines in social engagement, work participation, family engagement, community engagement, and recreational activities (Espernberger et al., 2021; Tse et al., 2017). Approximately 1 in 3 post-stroke survivors (Guo et al., 2021) are estimated to develop depression symptoms in response to their inability to cope with daily stressors and the loss of ability to function independently (Ariful Islam et al., 2016; Saragih, Tarihoran, Batubara, Tzeng, & Lin, 2021a; Towfighi et al., 2017).

Most stroke survivors are eventually discharged from the hospital, and the hospital-to-home transition can introduce several hurdles to recovery and rehabilitation (Clery et al., 2020; Lindblom et al., 2020; Reeves et al., 2019). Caregivers for stroke survivors face difficult challenges during the transition from hospital to home, including emotional, social, and physiological concerns (Grant et al., 2014; Hartford et al., 2019). The transition from the hospital to the home represents a critical window during which stroke survivors and their caregivers must foster self-management skills and establish the groundwork necessary to achieve long-term recovery and rehabilitation following a stroke (Broderick & Abir, 2015; Lin, Xiao, & Chamberlain, 2020a; Reeves et al., 2017b). Prominent challenges faced during the hospital-to-home transition include identifying methods to assist stroke survivors in the management of various factors that affect their mental health, emotional status, and ability to perform activities of daily living (Camicia et al., 2016; Chen et al., 2020; Clarke & Forster, 2015).

One strategy used to improve care for this population is case management, with the goal of integrating services by providing care management to help patients with long-term conditions meet and cope with the challenges associated with recovery and rehabilitation (Mountain et al., 2020; Reeves et al., 2017a). Case management is defined as "a health-care process in which a professional assists a patient with planning, facilitation, care coordination, and advocacy to achieve the best possible healthcare and psychosocial outcomes while also encouraging cost-effectiveness" (Hudon et al., 2019). Case management can assist in directing therapy depending on the circumstances and requirements of those receiving it (Saragih, Tonapa, Lin, & Lee, 2021b). Case management represents a team endeavor in which case managers provide health and human services such as screening, assessment, risk stratification, planning, administration, coordination, monitoring, transitioning and communicating post-transition, and evaluating the care required to meet patient's needs through extensive and integrated health care procedures (Fabbri et al., 2017; Lukersmith et al., 2016; Woodward & Rice, 2015). Consequently, case management interventions are generally considered compelling techniques for decreasing medical care expenses and increasing health care utilization (Brazle, 2019; Joo & Liu, 2017).

The impacts of case management interventions on stroke survivors have been examined in several studies. A randomized controlled trial demonstrated that a 3-month case management intervention decreased depression in a population in the United States ($p < 0.001$) and increased self-care adherence ($p < 0.05$) (Claiborne, 2006); an 8-week case management intervention, however, was found to have no effect on depression ($p = 0.97$) (Reeves et al., 2019). Another 6-month case management program in Canada resulted in a significant improvement in physical function ($p < 0.05$) (Mayo et al., 2009); however, another study conducted over a 12-month period showed no improvement in physical ($p = 0.24$) or social function ($p = 0.24$) (Markle-Reid et al., 2011). Furthermore, a substantial increase in the ability to perform activities of daily living was observed following an 8-week case management intervention performed in the United States among stroke survivors ($p = 0.007$) (Mayo & Scott, 2011). However, no changes in activities of daily living were observed in the United States following a 6-month intervention ($p = 0.47$) (Mayo et al., 2009).

Although these studies have increased our understanding of the potential advantages associated with the use of case management interventions among stroke survivors, the outcomes of this intervention remain uncertain. However, identifying an appropriate intervention that is able to address the physical and social functional limitations, in addition to the mental health and emotional problems experienced by stroke survivors, remains necessary to improve their quality of life. To provide a more comprehensive view of this phenomenon, data regarding the consequences of case management interventions among stroke survivors should be collected and analyzed. The goal of this systematic review and meta-analysis was to assess the effects of case management interventions on stroke survivors' mental health, ability to perform activities of daily living, and physical and social functions.

DESIGN

This review was registered with the International Prospective Register of Systematic Reviews (PROSPERO: CRD42021283266).

This investigation was performed in accordance with the most recent Preferred Items for Systematic Reviews and Meta-Analyses (PRISMA) criteria (Page et al., 2021) (Appendix S1).

MATERIAL AND METHODS

Search strategy

One reviewer conducted a systematic literature search to identify literature indexed from database inception to February 20, 2021, using eight databases: Academic Search Complete, Cochrane library, CINAHL, EMBASE, MEDLINE, PubMed, OVID (UpToDate), and Web of Science. Medical Subject Heading terms were utilized in the search, including "Stroke patients" OR "post-stroke" OR "stroke survivors" OR "after stroke" AND "case management" OR "case management model" OR "case management nursing" OR "case managed" AND "randomized controlled trial" OR "randomized controlled study" OR "randomized" OR "clinical trials" OR "allocation random." Appendix S1 contains an overview of the search strategy.

Eligibility criteria

The PICOS (Population, Intervention/issue of interest, Comparison, Outcome, and Study design) approach was employed to examine the inclusion criteria (Liberati et al., 2009). The inclusion criteria were studies with stroke survivors, intervention groups that included case management interventions, randomized controlled trials, and original research. Studies that did not match the PICOS requirements, studies that did not have full text available, and studies that did not adequately describe their research techniques were excluded.

Study selection and data extraction

Two reviewers assessed the relevance of identified studies based on the title and abstract and removed those that did not meet the PICOS criteria (Amir-Behghadami & Janati, 2020). A full-text screening of the remaining studies was performed, and those that satisfied the inclusion criteria were included in the study. Following the selection of the final papers, two independent reviewers extracted crucial data items, including the author, the year of publication, the country the study was performed in, the research design, the interventionist, the intervention setting, the demographic data of the participants (e.g., total participants, number of women, and age), intervention details (e.g., intervention types compared between groups, frequency and period of intervention, and follow-up), and outcomes. Any disagreements that developed during the process were resolved through a consensus meeting with a third reviewer.

Quality assessment

The methodological quality of the selected studies was assessed by two reviewers using the Cochrane risk-of-bias assessment for randomized trials (RoB-2), and all disagreements were resolved through a consensus meeting with a third reviewer.

Data synthesis and analysis

Because different instruments were used to evaluate the same outcomes across the included studies, the standardized mean difference (SMD) was estimated using a 95% confidence interval (CI) (Liu et al., 2017; Sedgwick & Marston, 2013). The impacts of the intervention on various outcomes were evaluated by integrating data collected using multiple instruments for each study group and comparing the mean and standard deviation between pre- and post-intervention assessments. For both the intervention and control groups, the mean difference and standard deviation were computed, and the SMD effect size (Cohen's d) was calculated (Cahan & Gamliel, 2011; Wilson, 2016).

The existence of heterogeneity within the measured variables, including mental health outcomes, activities of daily living capacity, physical function, and social function, examined among stroke survivors was examined using meta-analysis. For each variable, heterogeneity was assessed using the random-effects model by Q, τ^2, and I^2; I^2 values of 25%, 50%, and 75% indicated low, moderate, and high heterogeneity, respectively (Higgins et al., 2003). The Egger's test and a funnel plot were used to visualize publication bias (Egger et al., 1997). STATA 16.0 was utilized to determine the effect sizes of the variables in the meta-analysis.

RESULTS

Study selection

A total of 2093 studies were identified among the eight databases, 666 of which were discarded as duplicates. The remaining 1427 papers were examined based on title and abstract, which resulted in 1403 studies being discarded because they did not match the PICOS criteria, as follows: the population of interest was not the research population ($n = 638$); the case management intervention was not used in the trials ($n = 703$); the study was a review study ($n = 57$); the study was not available in English ($n = 5$). The full texts of the remaining 24 studies were assessed against the eligibility criteria, and 16 were removed because they did not employ case management interventions ($n = 7$), were review studies ($n = 7$), were not published in a peer-reviewed journal ($n = 7$), or were not published in English ($n = 2$). The final qualitative synthesis and meta-analysis included eight studies (Claiborne, 2006; Kummarg et al., 2018; Markle-Reid et al., 2011; Mayo et al., 2008; Mayo et al., 2009; Mayo & Scott, 2011; Reeves et al., 2019; Saal
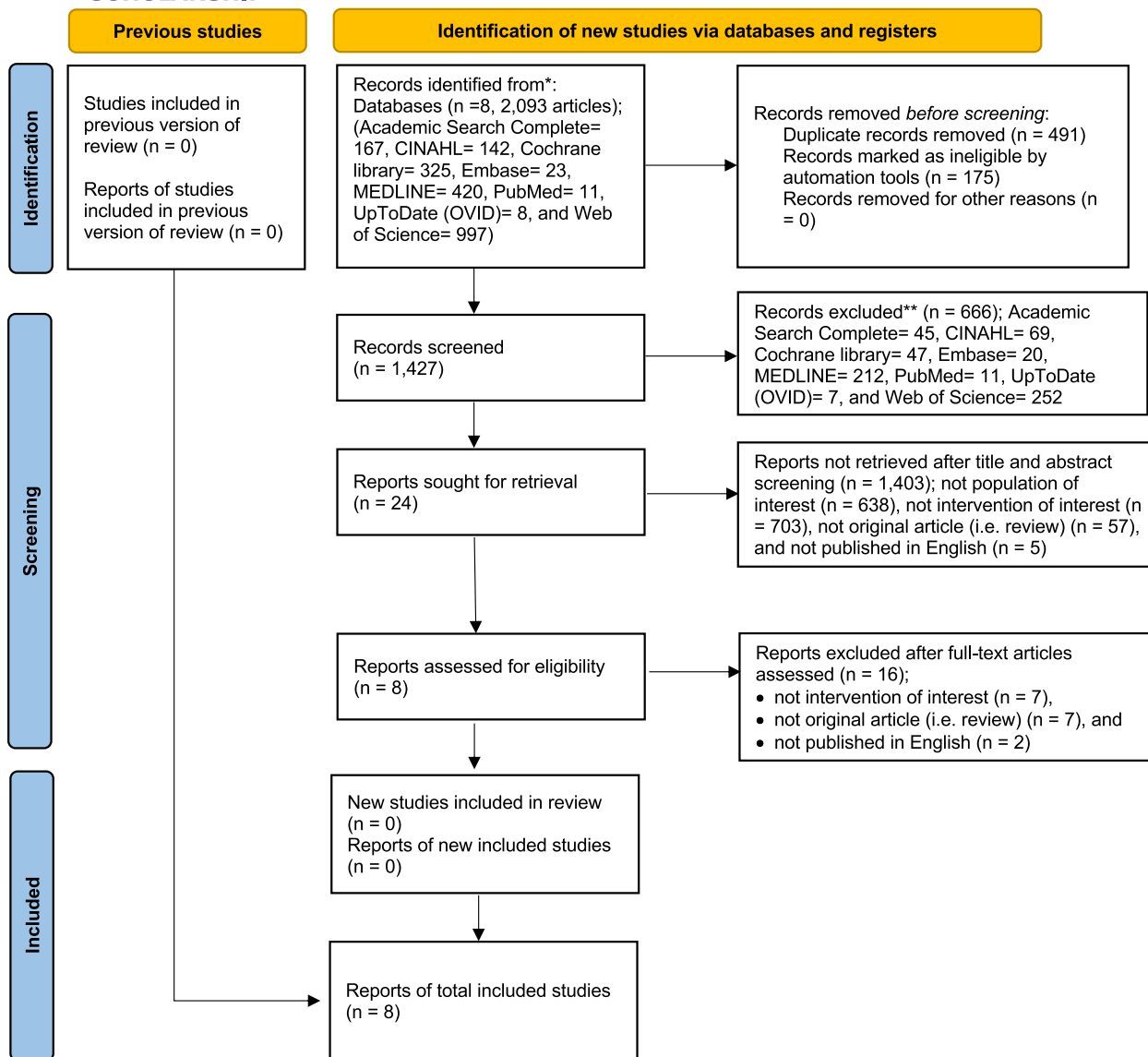
FIGURE 1 PRISMA flowchart diagram

et al., 2015). Figure 1 depicts the study selection process using a PRISMA flowchart.

Study characteristics

Between 2006 and 2019, eight RCTs were published, including four studies performed in Canada (Markle-Reid et al., 2011; Mayo et al., 2008; Mayo et al., 2009; Mayo & Scott, 2011), three studies conducted in the United States (Claiborne, 2006; Reeves et al., 2019; Saal et al., 2015), and one study performed in Thailand (Kummarg et al., 2018). The described interventionists who administered the case management interventions in the selected studies included a care coordinator (n = 1 study); nurse case managers (n = 5 studies); a nurse and a physiotherapist (n = 1 study); and an interprofessional team of home care service providers, including a

nurse, physiotherapist, occupational therapist, and speech-language pathologist (n = 1 study). The intervention was administered in a hospital (n = 7 studies) and a central community care setting (n = 1 study).

All eight investigations included a total of 1196 stroke survivors. Their ages ranged from 60 to 70.6 years. All studies (n = 8) separated the participants into two groups: those who received normal treatment and those who received the intervention. The intervention group was given a care coordination model that included biopsychosocial concerns, service needs, and self-care practice adherence, as well as evaluations, planning, facilitation, and advocacy for alternatives and resources necessary to fulfill a patient's health requirements. The duration of the intervention ranged from 24 hours to 12 months. The duration of follow-up after intervention ranged from immediately following the intervention to 12 months. Table 1 contains a summary of the included research.

Case management intervention effects for stroke survivors

Mental health

Six studies, which included 930 participants, used the Short Form (36) Health Survey (SF-36) (Claiborne, 2006; Markle-Reid et al., 2011; Mayo et al., 2008), the Mental Health Index (MHI) (Mayo & Scott, 2011), the Patient-Reported Outcomes Measurement Information System-10 (PROMIS-10) (Reeves et al., 2019), and the World Health Organization Quality of Life-BREF (WHOQOL-BREF) (Saal et al., 2015) to measure mental health. The pooled SMD between groups was 0.26 (95% CI: 0.07 to 0.45, $p = 0.01$, $\tau^2 = 0.02$, $I^2 = 43.02\%$; Figure 2; 2.1), indicating that the case management intervention group outperformed the control group in terms of mental health outcomes. Egger's test yielded no significant results ($t = 2.65$, $p = 0.081$).

Activities of daily living

Three studies, which included 555 participants, used the Barthel Index (BI) (Mayo et al., 2008; Mayo et al., 2009) and Instrumental Activities of Daily Living (IADL) (Reeves et al., 2019) to measure the ability to perform activities of daily living. The pooled SMD between groups was 0.68 (95% CI: 0.37 to 0.99, $p < 0.001$, $\tau^2 = 0.05$, $I^2 = 68.61\%$; Figure 2; 2.2), indicating that the case management intervention group outperformed the control group in the performance of activities of daily living. Egger's test resulted in a non-significant result ($t = 0.43$, $p = 0.665$).

Physical function

Six studies, which included 930 participants, SF-36 (Claiborne, 2006; Markle-Reid et al., 2011; Mayo et al., 2009; Mayo & Scott, 2011), the PROMIS-10 (Reeves et al., 2019), and the WHOQOL-BREF (Saal et al., 2015) to measure physical function. The random-effects weighted SMD was 0.05 (95% CI: −0.08 to 0.19, $\tau^2 = 0.00$, $I^2 = 0.00\%$; Figure 2; 2.3), indicating no significant differences in physical function between the intervention and control groups ($p = 0.44$). Egger's test yielded no significant results ($t = 0.76$, $p = 0.448$).

Social function

In three investigations, which included 537 individuals, no significant differences were observed between the intervention and control groups when the SF-36 (Markle-Reid et al., 2011; Mayo & Scott, 2011; Saal et al., 2015) was used to monitor social function. The pooled SMD between groups was 0.33 (95% CI: −0.02 to 0.68, $p = 0.06$, $\tau^2 = 0.07$, $I^2 = 69.78\%$; Figure 2; 2.4). Egger's test yielded no significant results ($t = 0.83$, $p = 0.406$).

Quality assessment for methodology

The RoB-2 was used to evaluate the quality of evidence of the included studies, which were all found to have a low likelihood of bias. The identified high risk of bias domains was primarily linked to the randomization procedure due to a lack of concealment for the intervention groups and the lack of blinding for participants and the intervention provider during participant recruitment. The quality evaluation findings are summarized in Appendix S1. Further, Egger's regression test revealed that the effects of publication bias were minor ($p > 0.05$) for all studies.

DISCUSSION

The results of this meta-analysis suggested that case management interventions substantially outperformed usual care in terms of improving stroke survivors' activities of daily living performance and mental health for 6 weeks to 6 months following the intervention. However, no significant differences in physical or social function were found across groups. Due to the small number of studies that have been conducted within the past decade, the outcomes associated with case management interventions remain equivocal. The present study provides additional evidence that case management may assist stroke survivors throughout the transitional care period. Furthermore, previous studies have shown that case management intervention offers continuity of care when treatment sessions end or follow-up doctor visits become less regular and it appears to benefit a range of different populations than stroke patients (i.e., people with dementia and patients with cardiovascular diseases) (Huntley et al., 2016; Saragih, Tonapa, et al., 2021).

Mental health

Mental health is becoming an increasingly important issue and was examined in six of the eight studies included in this review. Each study used a different case management model, managed by various types of individuals, such as a nurse case manager, a social worker, or as a collaboration between two or more disciplines, and lasting from 6 weeks to 1 year (Claiborne, 2006; Markle-Reid et al., 2011; Reeves et al., 2019; Saal et al., 2015). These studies indicated that stroke survivors who received transitional care via home visits and phone calls had better mental health outcomes than the control group who received standard care. Another study that examined the combination of home visits and mailed letters also showed positive mental health outcomes, including reduced stress and depression levels that lasted for 6 months post-discharge (Ostwald et al., 2014). Stroke survivors also experienced long-term emotional well-being after receiving consultations at a health center six months after stroke (Verberne et al., 2020). This evidence suggests that the mental health of stroke survivors can be supported through various approaches and that these support strategies can be applied at various

TABLE 1 Summary of included studies

No	Author, year/country	Health provider	Setting	Participants (experimental/control)		
				Sample size (N)	Female	Age (years old)
1	Claiborne, 2006/USA	Care coordinator	Hospital	28 $N_i = 16$ $N_c = 12$	NA	≥65
2	Kummarg et al., 2018/Thailand	Nurse case manager	Hospital	76 $N_i = 38$ $N_c = 38$	22	≥60
3	Markle-Reid et al., 2011/Canada	Nurse, physiotherapist, occupational therapist, and speech language pathologist	Central Community Care	82 $N_i = 43$ $N_c = 39$	37	70.6
4	Mayo et al., 2008/Canada	Nurse case-manager	Hospital	190 $N_i = 96$ $N_c = 94$	74	70
5	Mayo & Scott, 2011/Canada	Nurse case manager	Hospital	190 $N_i = 96$ $N_c = 94$	48	70
6	Mayo et al., 2009/Canada	Nurse case manager	Hospital	190 $N_i = 96$ $N_c = 94$	NA	70
7	Reeves et al., 2019/USA	Nurse case manager	Hospital	175 $N_i = 88$ $N_c = 87$	48	66
8	Saal et al., 2015/USA	A nurse and a physiotherapist	Hospital	265 $N_i = 130$ $N_c = 135$	128	≥68.1

Abbreviations: BI, Barthel Index; c, control; CNS, Canadian Neurological Scale; GDS, Geriatric Depression Scale; HRQOL, Health-Related Quality of Life; i, intervention; IADL, Instrumental Activities of Daily Living; MHI, Mental Health Index; NA, Not Available; NIHSS, The National Institute of Health Stroke Scale; PBSI, Preference-Based Stroke Index; PHQ, Patient Health Questionnaire; PROMIS-10, Patient-Reported Outcomes Measurement Information System-10; SF-36, Short-Form 36; WHOQOL-BREF, World Health Organization Quality of Life.

times following a stroke to improve mental health outcomes, indicating that any mental health support provided after a stroke could potentially be beneficial.

Activities of daily living

Three studies from the last decade demonstrated that case management interventions managed by individual case managers lasting from 3 weeks to 3 months could effectively improve activities of daily living capacity (Mayo et al., 2008; Mayo et al., 2009; Reeves et al., 2019). Two of these three studies were coordinated by stroke nurses, and the third was managed by a social worker. These studies suggest that stroke nurse specialists may play unique roles in leading and providing individualized stroke-specific transitional care (Chen, Xiao, et al., 2021). Person-centered discharge planning and transitional care managed by stroke nurses have

been suggested to reduce unnecessary hospitalizations for stroke patients during the 30 days following discharge to home (Condon et al., 2016; White et al., 2015). Case management conducted by social workers also resulted in improvements in activities of daily living capacity (Reeves et al., 2019). Both interventions used similar approaches, including home visits and monitoring via telephone calls. The current study found that at the first home visit by neurology nurses, approximately 64.2% to 91.4% of patients were able to perform activities of daily living without assistance (Pugh et al., 2021). The key treatments for stroke survivors and caregivers following discharge to the home included home visits paired with weekly telephone follow-up and biweekly at-home visits (Lin, Xiao, Chamberlain, Newman, et al., 2020). These interventions allow case managers to continue encouraging participants to track their activities of daily living and progress toward transitional care goals (Lin, Xiao, Chamberlain, Newman, et al., 2020).

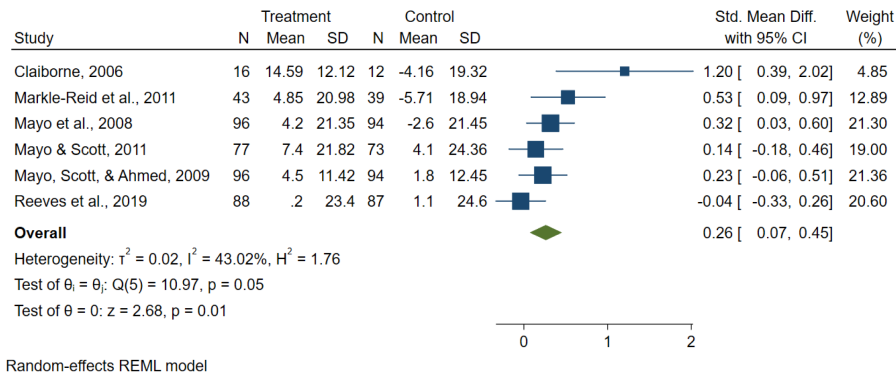| Intervention types		Intervention length/follows-up length	
Experimental group	Control group		Outcomes
Received care coordination model; biopsychosocial issues, service needs, and adherence to self-care practices	Usual care	3 months/ Baseline and 3 months	Physical and mental component (SF-36); depression (GDS); adherence to self-management practices
Nurse case management	Standard care	24 h/Baseline and 24 h after treatment	Stroke severity (NIHSS)
Received self-management program, promoted behavioral change, and home visit	Usual home care services	12-month/Baseline and 12 months	Cognitive status (SPMSQ); depression (CES-D); Quality of life: physical, mental, social function (SF-36); reintegration normal living (RNLI)
Received the case-management intervention; assessment, planning, facilitation, and advocacy for options and services to meet an individual's health needs through communication and available resources to promote quality cost-effective outcomes	Usual care	6 weeks/6 weeks, and 6 months	Physical and mental component (SF-36); depression (GDS), activities of daily living (BI), reintegration normal living (RNLI); Stroke severity (PBSI)
Received the case-management intervention	Usual care	6 weeks/6 weeks post-intervention, and 6 months	Mental Health (MHI); Physical and social function (SF-36)
Received the stroke Case Manager	Usual Care	6 weeks/6 weeks post-intervention and 6 months	Cognitive status (CNS); Physical and mental component (SF-36), activities of daily living (BI); depression (GDS);
Receive self-management program, care coordination, information access, and patient engagement	Usual Care	3 months/1 week and 3 months	Physical and mental health (PROMIS-10); depression (PHQ); Activities of Daily Living (IADL)
Received standard care, assessment, and health education; stroke warning signs and symptoms, risk factors and risk management, ambient-assisted living, coping strategies, outpatient therapies, self-help after stroke, and advance care planning	Usual Care	3 months/Baseline and 12 months	Physical, mental health, and social function (WHOQOL-BREF); depression (GDS)

Physical function

The results of the present study demonstrated that case management interventions did not significantly improve physical function (Claiborne, 2006; Markle-Reid et al., 2011; Mayo et al., 2009; Mayo & Scott, 2011; Reeves et al., 2019; Saal et al., 2015). Individual and interprofessional teams conducting home visits and telephone calls are inadequate to achieve desired outcomes. Only one case management intervention applied rehabilitation therapy sessions during the home visit (Saal et al., 2015). A recent comprehensive analysis found that home-based rehabilitation applied in lower-income nations resulted in greater increases in physical function than rehabilitation applied in more industrialized countries (Chi et al., 2020). This phenomenon was influenced by many barriers, ranging from stroke rehabilitation infrastructure and a shortage of physiotherapists and occupational therapists (Pandian et al., 2017). In more developed countries, neurorehabilitation facilities are often equipped with modern, high-technology equipment, such as virtual reality-assisted rehabilitation (Zhang et al., 2021). All of the studies that examined physical function outcomes in this study

were performed in developed countries, such as the United States, which may indicate that stroke survivors in developed countries have access to adequate health care facilities and staff rather than relying on home care (Claiborne, 2006; Reeves et al., 2019; Saal et al., 2015).

Social function

Three studies included in this study assessed the effects of case management treatments on social functioning; however, none of these studies found significant results (Markle-Reid et al., 2011; Mayo & Scott, 2011; Saal et al., 2015). Although not significant, one case management showed clinical improvement among stroke survivors under interprofessional rehabilitation care, which included health care specialists and specialists with non-healthcare backgrounds, such as social workers and personal support workers (Markle-Reid et al., 2011). More research and further developments in the design of interprofessional stroke rehabilitation approaches appear to be promising strategies for improving the

2.1 Mental Health

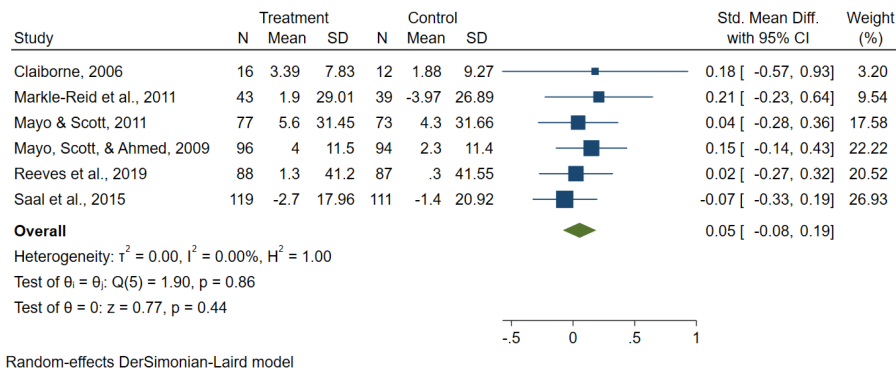| Study	Treatment N	Mean	SD	Control N	Mean	SD	Std. Mean Diff. with 95% CI	Weight (%)
Claiborne, 2006	16	14.59	12.12	12	-4.16	19.32	1.20 [0.39, 2.02]	4.85
Markle-Reid et al., 2011	43	4.85	20.98	39	-5.71	18.94	0.53 [0.09, 0.97]	12.89
Mayo et al., 2008	96	4.2	21.35	94	-2.6	21.45	0.32 [0.03, 0.60]	21.30
Mayo & Scott, 2011	77	7.4	21.82	73	4.1	24.36	0.14 [-0.18, 0.46]	19.00
Mayo, Scott, & Ahmed, 2009	96	4.5	11.42	94	1.8	12.45	0.23 [-0.06, 0.51]	21.36
Reeves et al., 2019	88	.2	23.4	87	1.1	24.6	-0.04 [-0.33, 0.26]	20.60
Overall							0.26 [0.07, 0.45]	

Heterogeneity: $\tau^2 = 0.02$, $I^2 = 43.02\%$, $H^2 = 1.76$
Test of $\theta_i = \theta_j$: Q(5) = 10.97, p = 0.05
Test of $\theta = 0$: z = 2.68, p = 0.01

Random-effects REML model

2.2 Activities of daily living

Study	Treatment N	Mean	SD	Control N	Mean	SD	Std. Mean Diff. with 95% CI	Weight (%)
Mayo et al., 2008	96	1.3	2.05	94	-.5	1.97	0.90 [0.60, 1.19]	33.26
Mayo, Scott, & Ahmed, 2009	96	2.8	3.25	94	.1	3.74	0.77 [0.48, 1.07]	33.51
Reeves et al., 2019	88	.39	3.47	87	-.92	3.51	0.38 [0.08, 0.67]	33.23
Overall							0.68 [0.37, 0.99]	

Heterogeneity: $\tau^2 = 0.05$, $I^2 = 68.61\%$, $H^2 = 3.19$
Test of $\theta_i = \theta_j$: Q(2) = 6.35, p = 0.04
Test of $\theta = 0$: z = 4.35, p = 0.00

Random-effects REML model

2.3 Physical function

Study	Treatment N	Mean	SD	Control N	Mean	SD	Std. Mean Diff. with 95% CI	Weight (%)
Claiborne, 2006	16	3.39	7.83	12	1.88	9.27	0.18 [-0.57, 0.93]	3.20
Markle-Reid et al., 2011	43	1.9	29.01	39	-3.97	26.89	0.21 [-0.23, 0.64]	9.54
Mayo & Scott, 2011	77	5.6	31.45	73	4.3	31.66	0.04 [-0.28, 0.36]	17.58
Mayo, Scott, & Ahmed, 2009	96	4	11.5	94	2.3	11.4	0.15 [-0.14, 0.43]	22.22
Reeves et al., 2019	88	1.3	41.2	87	.3	41.55	0.02 [-0.27, 0.32]	20.52
Saal et al., 2015	119	-2.7	17.96	111	-1.4	20.92	-0.07 [-0.33, 0.19]	26.93
Overall							0.05 [-0.08, 0.19]	

Heterogeneity: $\tau^2 = 0.00$, $I^2 = 0.00\%$, $H^2 = 1.00$
Test of $\theta_i = \theta_j$: Q(5) = 1.90, p = 0.86
Test of $\theta = 0$: z = 0.77, p = 0.44

Random-effects DerSimonian-Laird model

2.4 Social Function

Study	Treatment N	Mean	SD	Control N	Mean	SD	Std. Mean Diff. with 95% CI	Weight (%)
Markle-Reid et al., 2011	43	11.92	35.24	39	-2.88	31.58	0.44 [0.00, 0.88]	27.59
Mayo & Scott, 2011	77	13.9	29.35	73	-3.7	31.32	0.58 [0.25, 0.91]	34.10
Saal et al., 2015	119	.4	30.12	111	-.6	32.19	0.03 [-0.23, 0.29]	38.32
Overall							0.33 [-0.02, 0.68]	

Heterogeneity: $\tau^2 = 0.07$, $I^2 = 69.78\%$, $H^2 = 3.31$
Test of $\theta_i = \theta_j$: Q(2) = 7.29, p = 0.03
Test of $\theta = 0$: z = 1.85, p = 0.06
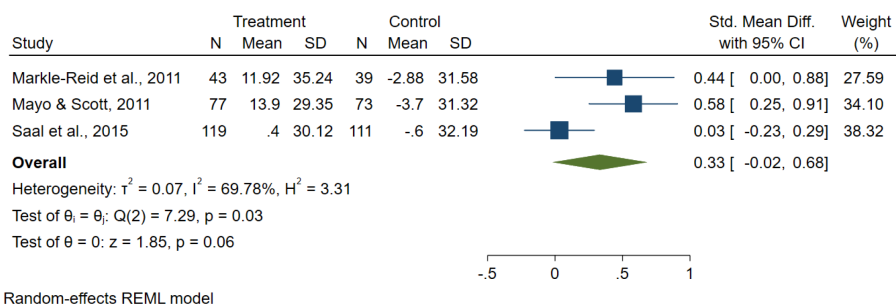
Random-effects REML model

FIGURE 2 Forest plot of case management approaches for stroke survivors

social functions of stroke survivors. Norrving et al. (2018) formed an action plan for supporting the assisted release of stroke survivors in Europe for 2018–2030, which included social and support workers, in addition to specialized therapists, aiming to provide specialist rehabilitation and social assistance in a home setting (Norrving et al., 2018). This approach appears to be a reasonable

strategy to accommodate the unmet social needs of stroke survivors (McKevitt et al., 2011).

LIMITATIONS

Our study has certain limitations and merits that should be acknowledged. Overall, this study identified that case management might benefit patients' mental health and capacity to perform activities of daily living after stroke. However, more studies remain necessary to establish robust evidence to support case management interventions among stroke survivors because only eight studies were identified during the period from 2006 to 2019, which is an inadequate level of research to validate the current findings. Future trials examining different cultural approaches in different countries remain necessary as stroke remains a global burden. Furthermore, this analysis only included studies published in English; therefore, major findings from studies reported in other languages were excluded. Furthermore, the features of each included study differed significantly. As a result of the small sample size in this study, several statistical analyses, including meta-regression and moderator analyses, for example, could not be performed.

CONCLUSIONS AND RELEVANCE FOR CLINICAL PRACTICE

Finally, this systematic review and meta-analysis found that case management may be useful for improving mental health and the capacity for activities of daily living among stroke survivors. Overall, the results of this study indicate that case management interventions are beneficial for stroke survivors. Case management interventions were designed to guide care among this demographic and are recommended to assist patients during the hospital-to-home transition. This information may be utilized to guide future research when designing strategies for proper care planning among these groups. Future intervention studies to assess the efficacy of case management interventions among stroke survivors are urgently needed to contribute additional information to the evidence base.

CLINICAL RESOURCES

Stroke Signs and Symptoms | cdc.gov

AUTHOR CONTRIBUTIONS
Study conception and design: IDS, FHC. Data collection: IDS, ISS. Data analysis and interpretation: ISS, IDS. Drafting of the article: IDS, ISS, DET, SS. Critical revision of the article: All authors.

CONFLICT OF INTEREST
None.

DATA AVAILABILITY STATEMENT
Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

Appendix S1