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Psychosocial Needs and Occupational Functioning of Younger Adults after Stroke

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Abstract

The post-stroke experience of younger adults (18-55 years old), is more complex than that of their older counterparts. The sudden change in their lifestyle following a stroke leads to challenges that extend beyond their physical disabilities. Young stroke survivors report cognitive dysfunction, depression, anxiety, fatigue and stigma, which limits their return to work, social relationships and quality of life. These "invisible dysfunctions" impede recovery and their re-integration back into society.

Post-stroke rehabilitation strategies used for older stroke survivors cannot be extrapolated to address the concerns of young stroke survivors. Most interventions that target the non-physical symptoms of stroke are mainly focused on managing anxiety and depression, while failing to address the complexity of the cognitive and emotional dysfunction faced by younger stroke population.

There is moderate evidence for the use of antidepressants, cognitive behavioural therapy, yoga, music therapy and mindfulness-based stress reduction to ameliorate the psychosocial and occupational limitations. Younger stroke survivors have largely unmet needs that include assistance with non-care related activities, intellectual fulfillment, social life, financial challenges and knowledge about their stroke. Rehabilitation strategies in this population are necessary to further identify patient-centered outcome measures and develop measuring tools specific to younger adults, and be able to appropriately target the factors that limit their successful rehabilitation after stroke.

Keywords: *Stroke; Young Adult; Psychosocial Outcomes; Depression; Anxiety; Cognitive; Return to Work; Quality of Life*

Abbreviations

TIA: Transient Ischemic Attack; HADS: Hospital Anxiety and Depression Scale; MADRS: Montgomery–Asberg Depression Rating Scale; FUTURE: Follow-Up of Transient ischemic attack and stroke patients and Unelucidated Risk factor Evaluation study, a large contemporary cohort study from Radboud University Nijmegen Medical Centre, Netherlands; mRS: Modified Rankin Scale; IADLs: Instrumental Activities of Daily Living; MYS: Map Young Persons with Stroke Questionnaire; USER: Utrecht Scale for Evaluation of Rehabilitation; SECRETO trial: Searching for Explanations for Cryptogenic Stroke in the Young: Revealing the Etiology, Triggers and Outcome, a prospective multicenter case-control study of young adults (aged 18-49) presenting with first time, imaging positive ischemic stroke of undetermined origin. This study population is the focus of five different sub-studies; SSRI: Selective Serotonin Reuptake Inhibitors; TCA: Tricyclic Antidepressants; MAOI: Monoamine Oxidase Inhibitors; CBT: Cognitive Behavioural Therapy; BDI: Beck Depression Inventory; WDI: Wakefield Depression Inventory; CALM trial: Coordinated Anxiety Learning and Management trial, a randomized trial assessing the role of behavioural therapy in stroke patients with aphasia; PST: Problem Solving Therapy; SFT: Solution Focused Therapy; SOFIA trial: Adapted Solution Focused Therapy for people with Aphasia, which assesses the role of SFTs in stroke patients with aphasia; IPT: Interpersonal Therapy; MBSR: Mindfulness Based Stress Reduction

Introduction

Limited knowledge exists about the impact of stroke on the younger adult population. Fifteen million people worldwide suffer a stroke each year, and up to 12% are individuals between 18 - 50 years old [1-3]. The two-thirds of patients who survive a stroke, live with significant disability [4,5]. The definition of "young" or "younger" adults varies between studies, but it typically includes those between the ages of 18 and 55 [6-8]. Research in this population is sparse, and etiology, stroke deficits and long-term disabilities cannot be extrapolated from older stroke population [4]. Younger adults live with disabilities for longer, and their quality of life is heavily dependent on cognitive and emotional dysfunction [4]. This further affects their ability to return to their pre-stroke lifestyle, leaving many young stroke survivors unable to return to work or sustain social relationships [9,10].

In this review, we address the impact of these "invisible dysfunctions" on stroke recovery [11], and argue for novel rehabilitation strategies to challenge these issues and implement approaches that will benefit young stroke survivors in the long term. We also discuss interventions that have thus far shown early success in improving the psychological impact of stroke.

Psychosocial Symptoms of Stroke in Younger Adults

The post-stroke experience of the young adults is complex and different than that of their older counterparts. These individuals endure a sudden change of circumstance following their stroke; not only because of their physical limitations, but also because of the longstanding psychosocial challenges they face after stroke. This has lasting impacts on mood, social relationships, return to work and quality of life (Table 1). Young stroke survivors find themselves as a burden on their families and children, and describe stigma as a barrier to social participation [19]. This perpetuates a cycle of dependence and these 'invisible' effects following their stroke challenge recovery and patient's re-integration back into society [11]. In this section, we highlight the complexities of younger adult's post-stroke experiences, and discuss the ultimate need for patient-oriented interventions during their rehabilitation.

Cohort and Case Control Studies with sample size > 200 patients, P-prospective, R-retrospective					
Authors	**Title**	**Type**	**Size**	**Inclusion Criteria**	**Outcome measures**
Noortje AMM., *et al* 2015 [2]	FUTURE study	P	437	Age 18-50 with TIA, ischemic stroke	Subjective memory failure (73.5%; p = 0.0004) Subjective executive failure (51.6%; p = 0.00006)
Schaapsmeerders P., *et al* [12]	Long term cognitive impairment after first ever ischemic stroke in young adults	P	277	Age 18-50 with TIA, ischemic stroke	Processing speed (F(1,406) = 35.4; p < 0.0001) Working memory (F(1,407) = 41.7; p < 0.0001) Immediate memory (F(1,412) = 14.0; p = 0.0002) Delayed memory (F(1,408) = 17.7; p < 0.0001) Attention (F(1,396) = 28.6; p < 0.0001) Executive functioning (F(1,409) = 17.2; p < 0.0001)
Ferro JM and Madureira S, 1997	Aphasia type, age and cerebral infarct localization	P	423	First ischemic stroke with at least one non-lacunar infarct confirmed on neuroimaging	Non-fluent aphasia (78%; p = 0.05)
Maijwee NAAM., *et al*. [3]	Long-term depressive symptoms and anxiety after TIA or ischemic stroke in young adults (FUTURE study)	P	1005	Aged 18-50 with first TIA or ischemic stroke (excluding venous infarct)	Prevalence of depression 10 years after stroke: Ischemic stroke (OR 4.7,p = 0.003) TIA (OR 2.8,p = 0.02) Prevalence of anxiety 10 years after stroke: Ischemic stroke (OR 2.9, p = 0.002) TIA (OR 3.0, p = 0.001)
Waje-Andreassen U., *et al*. [10]	Ischemic stroke at a young age -population-based long-term follow-up in Western Norway	R	232	Ischemic stroke patients < 49 years old, with onset between 1988-1997	Patients compared with controls had more: Memory problems (41%, p < 0.001) Anxiety (19.4%, p = 0.009) Depression (29.2%, p = 0.001) Sleep problems (36.1%, p = 0.001)
Ayerbe L., *et al*. [13]	The Natural History of Depression up to 15 years After Stroke	P	4022	Stroke patients from the South London Stroke Register between 1995-2009	Cumulative incidence 15 years' post stroke depression is 55%, with prevalence ranging from 29-39%. The proportion of recurrent episodes of depression is 38% in the second year, and 100% in the 14th and 15th year.
Kappelle LJ., *et al*. [8]	Prognosis of Young Adults with Ischemic Strokes	P	296	Ischemic stroke in age 15-45 years old, treated between 1977-1992	Depression in 46% based on SHFQ, with cause of stroke not influencing depression.
Hannerz H., *et al*. [14]	A nationwide prospective cohort study on return to gainful occupation after stroke in Denmark 1996-2007	P	19,985	Aged 20-57 years old, was gainfully occupied in the year preceding hospital admission, on at least one occasion in 1996-2006, was diagnosed with subarachnoid hemorrhage, intracerebral hemorrhage, cerebral infarction, and non-specified stroke	62% were working 2 years after stroke. *Odds of returning to work higher in:* Intracerebral infarction, OR 1.0 (the reference group) Vs. Subarachnoid hemorrhage OR 0.79 vs. Intracerebral hemorrhage, OR 0.39 *Odds of returning to work lower if:* Elementary occupations, OR 1.0 (reference group) Vs. Occupations that require basic skills, OR 1.50 vs. Technicians/associate professionals, OR 2.33 vs. Professionals OR 3.04 *Adverse prognosis for:* Woman, OR 0.79 Self-employed, OR 0.87 > 50 y, OR 0.61
Trygged S., *et al.* [15]	Income and Education as Predictors of Return to Working Life Among Younger Stroke Patients	P	7081	Aged 40-59 with all major stroke subtypes (except TIA) during 1996-2000 and who do not suffer from concurrent ischemic heart disease	Higher income and higher education associated with a higher probability of returning to work. Predictors include: Education: p < 0.001; University RR 1.34 (1.24-1.44) Income: p < 0.001, 2nd quartile RR 1.39 *1.27-1.51), 3rd quartile RR 1.64 (1.51-1.79) and 4th quartile (highest) RR 2.08 (1.92-2.26) Stroke subtype: p < 0.001, cerebral infarction RR 1 (reference) vs. intracerebral hemorrhage RR 0.77 Days of hospital care: p < 0.001, linear (per 10 days) RR 0.84 (0.81-0.85)
Glozier N., *et al*. [16]	The (ARCOS) Study	P	1423	All cases of first ever and recurrent stroke in adults aged > = 15 years	Off all patients, 53% returned to paid work. Determinants of not returning to work: Psychiatric morbidity, OR 0.39 Non-New Zealand European ethnicity, OR 0.40 Prior part-time employment, instead of full-time, OR 0.36 Not functionally independent after stroke, OR 0.28 (0.13-0.59)
Varona JF., *et al*. [1]	Long-Term Prognosis of Ischemic Stroke in Young Adults	R	272	Aged 14-52 years old with first ever ischemic stroke between 1974-2001	Ability to return to work depended on: Age < 36 y, RR 1.3, p = 0.01 Classical migraine, RR 1.5, p = 0.02 Oral contraceptive use, RR 1.7, p < 0.01 TIA, RR 1.5, p < 0.01 Normal life at discharge, RR 3.9, p < 0.01 Return to work limited by: Unfavourable initial course, RR 1.6, p = 0.05 Severe handicap at discharge, RR 1.3, p < 0.01 Major cardiovascular surgery, RR 1.8, p = 0.02 Cardioembolic stroke, RR 1.6, p = 0.02
Langhammer B., *et al*. [17]	Life Satisfaction the Sunnaas International Network (SIN) Stroke Study	P	230	Severe first-time stroke defined as mRS 3-4.	Life Satisfaction Checklist (LiSat-11) Satisfaction on admission: 11%, at discharge 21%, at 12 months: 31%
Juang H., *et al*. [18]	Using Antidepressants and the Risk of Stroke Recurrence: Report from a National Representative Cohort Study	P	16770	Patients with a first hospitalization with diagnosis of stroke during 2000-2009, excluding those with a prior history of strokes, less than 20 years old or with a prior history of antidepressant or psycholeptic use.	Antidepressant use was associated with a higher risk of stroke recurrence (HR 1.42; CI 1.24-1.62),most often ischemic stroke (HR 1.48, CI 1.28-1.70) but not hemorrhagic stroke (HR 1.22, CI 0.86-1.73) Increased risk of stroke recurrence found with: TCAs only (HR 1.41, CI 1.14-1.74) SSRIs (HR 1.31, CI 1.00-1.73) Other antidepressants (HR 1.46, CI 1.15-1.84) Use of multiple types of antidepressants (HR 1.84, CI 1.04-3.25)

Table 1: *Cohort and Case Control Studies Evaluating Psychosocial, Cognitive and Return to Work Outcomes in Young Stroke Survivors.*

Cognitive deficits

Cognitive deficits following stroke have long lasting impacts on younger populations. The Follow-Up of Transient ischemic attack and stroke patients and Unelucidated Risk factor Evaluation (FUTURE) study, a large contemporary cohort study from Netherlands, had been investigating the causes and long-term consequences of stroke in young adults. Using neuropsychological tests authors determined that patients aged 18 - 50 years old with an ischemic stroke or TIA, demonstrate impaired processing speeds ($p < 0.0001$), working memory ($p < 0.0001$), immediate memory ($p = 0.0002$), delayed memory ($p < 0.0001$), attention ($p < 0.0001$) and impaired executive function ($p < 0.0001$) [12], and these changes can last up to eleven years or more, with 50% of individuals performing below-average in at least one cognitive domain [3].

In a survey of 1068 patients that examined perceived cognitive deficits, individuals also reported difficulties with completing tasks ($p = 0.04$), engaging in discussions ($p = 0.01$), multitasking ($p = 0.01$) and staying in crowded environments ($p < 0.001$) [20]. These finding debate the assumption that young people recover well in their personal activities of daily living [20].

The findings of cognitive impairments have adverse consequences for both, the individual patient and the society as a whole, as the inability to engage with one's surroundings impairs social functioning and the skills needed to return to work and financial independence [21].

Depression

Post-stroke depression can either manifest in response to acute event and remit, or could occur months after the event, characterized as "late-onset depression", which develops insidiously and has fewer rates of remission [22,23]. Forty five percent of young adults with stroke experience depressive symptoms even twelve years after the event [8,10,24]. Young stroke survivors are also at a higher risk of recurrent depression years following the stroke [13]. Of 1233 patients recruited in the acute phase of their stroke, 100% scored more than 7 on the Hospital Anxiety and Depression Scale (HADS) within 15 years of follow-up, indicating relapse into depression [13].

Depression can also manifest differently with age. Whereas older patients tend to demonstrate a profile of vascular depression, predominantly characterized by anhedonia, depression among younger patients has more psychotic features [25]. This further places them at higher risk for suicide (up to 7%) and suicide ideation (6 - 15%), especially if there is an underlying history of mood disorder prior to the stroke [26,27], or previous stroke, lower education status and concurrent cognitive impairment [27]. This suggest the need to monitor and screen for the risk of suicide in young stroke patients.

However, there is no known association between the etiology of the stroke and risk of depression [2]. In a study of young patients with a first-ever stroke (mean follow-up 6 years), higher Montgomery–Asberg Depression Rating Scale (MADRS) scores were observed with comorbid disease; excessive alcohol consumption ($p = 0.016$), depression prior to the infarct ($p = 0.016$) and severe stroke deficits on admission ($p = 0.043$) [28]. Unemployment status following the stroke further affected the rates of depression in these individuals [28].

Anxiety

Although depression is more prevalent, many young patients also suffer from anxiety following their stroke. The FUTURE Study followed patients for 12 years and when compared to age-matched controls they found that approximately 20% of stroke survivors had anxiety based on HADS scale ($p = 0.009$) [10]. These patients also had lower functional status based on modified Rankin Scale (mRS) and Instrumental Activities of Daily Living (IADLs) ($mRS > 2$ or $IADL < 8$), suggesting that anxiety impacts functional outcomes in young stroke population [2].

As expected, young stroke survivors attribute their anxiety to a stigma and fear that they are treated differently by those around them, or that their relationships are adversely affected following their stroke [9]. This poses a significant burden on these patients as such a behaviour threatens their social relationships. While we understand that stigma exists among patients with disability, there are very few studies that address this issue in young stroke patients.

Fatigue

Post-stroke fatigue is a commonly reported symptom that affects over 50% of individuals [29,30]. It often begins in the early stages after a stroke, but can persist for long time. Fatigue dramatically impairs rehabilitation and recovery [9]. In a 4-year follow up of 158 young people with stroke, 86% reported persistent fatigue ($p < 0.05$) on the Map Young persons with Stroke (MYS) questionnaire. Fatigue impacts activities of leisure in 58% ($p < 0.05$) and return to work in 52% ($p < 0.05$) of stroke survivors [29]. Fatigue is also associated with poor outcomes ($p = 0.001$), with many patients reporting an inability to regain pre-stroke functioning [30,31]. Most rehabilitation programs are based on objective deficits like cognition and physical limitations. However, regression analysis of three Utrecht Scale for Evaluation of Rehabilitation (USER) scores suggests that subjective participation in these rehabilitation programs can be largely limited by fatigue and mood [31].

Post stroke deficits in attention and arousal likely results from vascular lesions in the reticular activating system, limbic system and basal ganglia, or the pathways connecting those structures [32]. Interestingly, 36% of young individuals with stroke also suffer from sleep problems, which can further perpetuate the cycle of inadequate effort and poor functioning [10]. It is therefore not surprising that post-stroke fatigue is an independent risk factor that determines return to social activities and paid work [33].

Return to Work

The ability to return to work is an important determinant of life satisfaction in young stroke survivors [34,35], but to those who are part of the workforce, this is a sign of a successful rehabilitation [9].

Most people return to work shortly after stroke (50 - 80%) [14-16,33,36], but long term studies suggest that this percentage diminishes over time. However, when followed for 12 years, only 40% of stroke survivors remained in full-time employment [10].

Individuals who have an unfavourable clinical course with severe handicap at the time of discharge or undergo major cardiovascular surgery or those who suffer from a psychiatric co-morbidity are less likely to return to their prior job or are likely to find an alternative career [1,16]. The most predictive factor for successful return to work is the educational requirement of the job. Individuals from professional backgrounds are more likely to return to work (OR 3.04, CI 2.70 - 3.43) than those whose jobs have minimal to no formal education (OR 1.50, CI 1.38-1.64) [14,15,35]. Higher socioeconomic status was also a positive predictor of return to work [15], while preserved cognitive function and age were less important determinants than the ability to self-care and function well [37-39].

Young individuals who sustain the disabilities of a stroke also cost the economy a loss of their productive years of employment [40]. Therefore, the return to work is not only important to young stroke survivors, but as mentioned before to the entire society.

Quality of Life

Life satisfaction is most dependent on vocational situation, sexual life, physical and mental health. Among young stroke survivors, this is further determined by gender, severity of stroke, marital status, rehabilitation model, country, occupational status and duration of rehabilitation therapy [17]. Young males with short hospital stay, who are in a relationship and employed, are most likely to endorse a better quality of life.

However, whether age is a determinant of quality of life remains a matter of discussion [41,42]. Although the mortality rate among younger adults with stroke is lower, it is reasonable to assume that their quality of life is adversely affected because they live with their disability for longer. This is particularly significant because they tend to endure social challenges such as marital separation, childcare issues and caregiver burnout [43]. In a study of 563 stroke survivors, 14.5% were separated from their spouse, 22% were involved in conflict with their children, and 18.1% were not able to return to their previous residence following their stroke [43]. The factors affecting quality of life certainly vary with age. To most individuals, a low quality of life is characterized by unemployment, motor deficits and speech impairment. More specifically, older individuals are also affected by other comorbidities like diabetes and vascular disease, while

to young individuals, restrictions in their job and/or in leisure activities has major impact to their well-being and quality of life [29]. As such, these important distinguishing factors could help determine more focused strategies in post-stroke care of younger adults.

Recent literature suggests that presence of personal confidence after stroke predicts participation in rehabilitation and return to social activities, regardless of stroke severity [44]. However, whether this post-stroke 'positive affect' translates into improved recovery in young stroke survivors is uncertain.

Future research is necessary to improve and adjust measurement tools according to differences between age groups. More importantly, we need to have enhanced tools to follow young patients over a longer period to adequately assess their quality of life. A study with such goals (among others) is the SECRETO study, a prospective, multi-centre case-control initiative, which anticipates first results in 2019 [45].

Interventions for Young Stroke Survivors with Psychological Symptoms

Rehabilitation strategies currently used to improve the non-physical symptoms in young stroke patients predominantly target depression and anxiety (Table 2). However, the interventions that are typically used to manage these symptoms cannot be reliably extrapolated to stroke patients' needs. This is perhaps because the mood symptoms in stroke patients are usually complicated by other factors like cognitive deficits, abulia, disinhibition and language difficulties [23]. While research in this area in emerging, we discuss current treatments that have shown moderate evidence in managing the psychological consequences after stroke. It is important to note that only few studies focus on young population.

Author, Year	Study Type	No. Studies	Inclusion Criteria	Outcome measures
Thayabaranathan T., *et al*. [46]	Systematic review, Meta-analysis	5	Stroke in >18 years old, any etiology or severity within 6 months prior to study recruitment	Yoga reduces anxiety and depression in the intervention group vs control group. Anxiety MD 6.05 (CI -0.02-12.12), p = 0.05 Depression MD 0.50 (CI -0.01-1.02), p = 0.05
Ulrichsen KM., *et al*. [47]	Systematic review, Meta-analysis	4	Randomized and quasi-randomized trials assessing the benefit of different interventions on fatigue (primary or secondary outcome measure) associated with neurological conditions and acquired brain injury.	Total effect of mindfulness-based strategies on fatigue 0.37 (95%CI -0.58, -0.17)
Nabavi SF., *et al*. [48]	Systematic Review	10	All patients with post-stroke depression	Statistical Evidence for: Antidepressant therapy: Despite benefits, routine use in stroke patients is not generally accepted due to limited evidence of prevention of PSD and known side effect profile Acupuncture: Point-through-point electroacupuncture is effective in decreasing symptoms of PSD Music therapy: Studies are limited, and further research is needed to determine the impact of passive (i.e. listening) and interactive (i.e. singing) music therapy on improving mood symptoms
Lazaridou A., *et al*. [49]	Systematic review	10	Studies, written in English between 1990-2013, which used all types of yoga or relative mindfulness/meditative practices in stroke rehabilitation; included case control, cohort, RCTs, posters and oral presentation.	All studies attributed yoga and mindfulness to positive recovery in stroke rehabilitation.
Lawrence M., *et al*. [50]	Systematic review	4	All studies with: Adults > = 18 years Minor stroke, TIA/stroke The interventions were: mindfulness or integrated interventions	Mindfulness-based interventions are beneficial across a range of psychological, physiological, and psychosocial outcomes including anxiety, depression, mental fatigue, blood pressure, perceived health, and quality of life. No evidence of harm was found.
Pompili M., *et al*. [27]	Systematic Review	16	Search criteria: suicide* AND stroke, suicide* after stroke, suicide* Only articles in English were included	Stroke increases the risk of suicide and suicide ideation, with predisposing risk factors that include concurrent depression, previous mood disorder, prior history of stroke and cognitive impairment.
Hackett ML., *et al*. [23]	Systematic Review and Meta-analysis	16	Patients with stroke with depression on recruitment (fulfilling symptom scores on standard screening instruments, by the DSM-IIIR, DSM-IV, APA 1987 and APA 1994.	13 pharmaceutical agents and 4 trials of psychotherapy revealed: Pharmacotherapy resulted in complete remission of depression but there was an increased risk for adverse events No evidence to support the benefit of psychotherapy
Lynton H., *et al*. 2007	Systematic review and pilot study	4	Included all trials of yoga following stroke, from online and hand searched databases	Systematic review non-conclusive due to limited studies. Pilot study only had 3 participants, and although there were positive trends suggesting the benefit of yoga, these were not statistically significant.
Anderson CS., *et al*. [51]	Systematic Review and Meta-analysis	12	Randomized control trials that compare pharmaceutical agents against placebo or psychotherapy against standard care in preventing depression in patients with stroke	No clear benefit of pharmacological therapy in prevention of depression Significant improvement in mood and prevention of depression with psychotherapy (although treatment effect was small).
DeGroot MH., *et al*. [52]	Systematic Review	1000 articles (13 stroke)	All studies relating to fatigue in neurologic disorders, its mechanism and treatment.	Post-stroke fatigue is common, but it is unclear whether interventions to manage fatigue in other neurologic disorders can be translated to stroke.

Table 2: *Summary of Contemporary Literature on Interventions to Improve Post-Stroke Outcomes.*

Pharmacological Interventions

The non-physical symptoms of stroke are predominantly managed with antidepressants. Several classes of antidepressants, including SSRIs, TCAs and MAOIs, have been associated with decreased incidence of post-stroke depression, better scores on mood rating scales and improvement in functional recovery [18]. This is thought to be secondary to modulating neuronal growth and plasticity through regulating pathways dependent on brain-derived neurotrophic factor signalling [48].

Although antidepressants are likely to result in remission of adverse mood symptoms, they are also associated with a significant side-effect profile. This includes the risk of seizures, delirium and falls; the latter of which is especially relevant in the elderly population [23]. The risk of stroke recurrence on antidepressants is controversial, but is hypothesized to be secondary to the vasoconstrictive effects of serotonin on cerebral vasculature [18,53].

Because of these potential side-effects, antidepressant therapy in post-stroke depression is individual dependent, and its prophylactic use is not currently recommended [48,54].

Non-Pharmacological Interventions

Limited research has examined psychosocial interventions specifically tailored to the needs of young stroke survivors. Here in we present non-pharmacological interventions that have shown moderate effect in managing non-physical consequences of stroke.

Cognitive Behavioural Therapy (CBT) is a technique where the individual works with a therapist, to examine relationships between thoughts, feelings and behavior, and help with recovery [55]. There are several case studies and case series that support CBT use in post-stroke depression [56-58]. However, the only randomized trial investigating the effect between ten sessions of CBT (standard care with 10 sessions of one hour conversations with a community nurse practitioner vs. no intervention) following a stroke, did not show considerable effect in the recovery outcomes [59]. Using the Beck Depression Inventory (BDI) and the Wakefield Depression Inventory (WDI), the impact of these interventions was measured at baseline, at 3 months, and 6 months. At 6 months, there was no significant difference between the intervention groups based on either the BDI (median: No Intervention 13.5, Standard Care 11.5, CBT 11.5; $X^2 = 6.8$; $p = 0.7$) or the WDI (median: No Intervention 21.2, Standard Care 18.5, CBT 17.0; $X^2 = 1.2$; $p = 0.5$) [59].

The challenge with implementing CBT sessions is the variability in which they are performed. The CBT is not administered with a uniform framework, and its effect dependent on several factors; including the duration and number of sessions, the person administering CBT, and the receptiveness of the individual undergoing therapy. Since stroke survivors are also likely to sustain cognitive or communication deficits, which could compromise their participation in CBT, current therapies need to be restructured to account for such deficits [55].

The CALM trial demonstrated the benefits of behavioral therapy in stroke patients with aphasia, where the focus was on behavioral activation in depression and relaxation [60]. Behavioral therapy did not require communication and instead focused on education and increasing activities that improve mood. This was a randomized trial with 105 patients, where 54 received standard care, and 51 received behavioral therapy [60]. At 6 months, behavioral therapy with an average of 9 sessions was more beneficial for mood ($p = 0.015$), self-esteem ($p = 0.005$)) and even for less depression among stroke patients with aphasia ($p = 0.03$) [60].

While support for CBT in stroke therapy is limited, there is an ongoing effort to create a framework better suited to the needs and limitations of stroke patients. The development of a modified CBT approach for stroke survivors has been suggested, but this initiative has not been investigated in a young population. Further randomized trials implementing a uniform framework are required to determine its benefits in this population.

Problem Solving Therapy (PST) is a brief psychological intervention where the therapist teaches the patient a structured approach to solving their problems. In recently published trial, PST was positively associated with better heath related quality of life and a reduction in avoidant coping in stroke patients [61]. The authors noted that further research on PST in stroke is needed.

Solution Focused Therapy (SFT) is future-focused and goal-directed technique that if centered on solutions [59]. SFT has been found to reduce the intensity of depression and anxiety and enhances self-efficacy compared to controls. The SOFIA trial in Europe is now enrolling stroke patients with aphasia to assess the efficacy of SFT in this population (clinicaltrials.gov) [57].

Interpersonal Therapy (IPT) views interpersonal relationships as potential precipitators and opportunities for recovery in individuals with psychiatric issues including depression, post-traumatic stress disorder, and eating disorders. It has good evidence and is considered an evidence-based treatment of depression in those with co-morbid medical conditions [9]. However, only one study (N~460) has examined the feasibility and effectiveness of IPT in post-stroke depression, and confirmed that combination therapy (IPT plus medication) was effective as a single intervention alone [62-65].

Psychotherapy is described in many variations in the literature, from cognitive behavioural therapy [59], motivational interviewing [66], health education [67], counselling [68], and neuro-linguistic programming [69]. Furthermore, the duration and frequency with which it is provided can vary between individuals. This makes its benefits challenging to assess. Two Cochrane reviews which investigate the effects of pharmacotherapy and psychotherapy in post-stroke depression reveals that psychotherapy is not associated with treatment effect [23,51]. The 2004 review compares 3 trials that involve a total of 745 patients, with outcome measures of depression and dysthymia. Although these studies suggest a small improvement in psychological distress, there was no significant difference between psychotherapy and no intervention [51]. The 2008 review evaluated 4 randomized control trials, one of which was included in the 2004 study [59]. Psychotherapy interventions in 445 patients were, again, not consistent with therapeutic effect [23]. It is important to note, however, that these trials were limited by their methodology; specifically, that they lacked a standardized therapeutic framework.

There have since been at least two new studies that assess benefits of psychotherapy in depression and anxiety, with no long-term evidence of its benefit [60,69]. Interestingly, however, it has shown promising results in post-stroke fatigue [52,70,71]. Nevertheless, psychotherapy needs to find some common ground in its administration before we can truly begin to appreciate its therapeutic benefit.

Yoga: The benefit of yoga in chronic diseases like cancer, cardiac disease and other neurologic illness derives from an improvement in mood and general physical function [72-75]. However, many stroke survivors are limited in their physical ability, and are unable to exert themselves in strenuous activities as they did prior to the stroke [49]. A meta-analysis by Thayabharanathan., et al. [46] reveals that yoga promotes well-being in stroke by ameliorating symptoms of anxiety and depression. The physiology of this benefit is not fully understood; but it is hypothesized to be parasympathetically driven, where body postures and breathing reduce palpitations, blood pressure and signs of restlessness [76]. It also encourages a state of mindfulness, which allows an individual to recognize anxiety and thereby, target and reduce it [77,78].

However, these are primarily observational studies, which confound the true benefits of yoga with any group based activity or shared experience [79]. Moreover, the trials are limited by their small sample size and short periods of follow up (8 - 10 weeks) [72] and were not performed in specific populations such as young stroke survivors.

Mindfulness based stress reduction (MBSR) is a technique that teaches coping strategies and ways to manage behavioural and emotional patterns, to encourage a generalized state of well-being [80,81]. Its benefits have previously been studied in cancer and chronic fatigue syndrome, where it has been shown to relieve symptoms of depression, anxiety and fatigue [77,82-84].

It has also been attributed to alleviate the psychosocial impact of stroke. Firstly, it appears to have an unequivocal treatment effect on fatigue in stroke [47]. The mechanism by which it does so is theorized to be due to increasing grey matter density and altering in neuronal transmissions [85,86]. MBSR also improves symptoms of depression, anxiety and perceived quality of life in the stroke population [50].

Music Therapy: The benefit of music therapy in stroke stems from animal models that suggest that a positively stimulating environment enhances post-stroke recovery and functioning. A minimum of 1 hour a day of active listening showed recovery in both verbal memory and focused attention, as early as 3 months after a stroke. Patients in this study were also found to be less agitated and confused compared to groups that had no intervention [87]. Music therapy also improves symptoms of depression and anxiety, although the latter outcome was not significant [87,88]. Additionally, more sessions were associated with an improvement in social interaction and behavior [89].

Music therapy is believed to enhance neuromodulation and plasticity, which tends to be highest in the first weeks and months after a stroke [90]. Through modulating pathways in the limbic and paralimbic structures, music therapy stimulates emotional processing and social cognition [91]. Therefore, patients benefit from music interventions implemented in the acute periods of stroke recovery [92].

Discussion

While the severity of stroke is milder and the physical prognosis after stroke is more favorable in younger adults than in the elderly, the long-term psychosocial consequences, as well as its risk for recurrence, is higher due to their longer life expectancy [2]. Limited literature on young stroke survivors suggests that the impact of stroke on psychosocial and occupational outcomes has the greatest effect on quality of life in this population. A significant percentage of younger adults with stroke are disabled by their resulting cognitive deficits, anxiety, depression and fatigue, resulting in an inability to fully return to work or their pre-stroke life. This inevitably risks a poor prognosis in the long-term, and can cause a devastating impact on patients, their families, as well as on society [19].

Recovery in stroke is primarily focused on physical rehabilitation, leaving behind largely unmet needs. In a survey of 315 young stroke survivors, these were identified to be assistance with non-care related activities (19%), intellectual fulfillment (17%), social life (15%), financial challenges (24%), physiotherapy (15%) and knowledge about their stroke (45%) [9,93]. It is important to recognize these needs because they limit young stroke survivors to engage with people around them, and further impede the recovery process.

However, we currently lack standard measurements of those needs when we follow young stroke patients in stroke prevention clinics. For example, most papers employ standard scales to assess functionality (mRS) and mood symptoms (BDI, HADS, WDI) after stroke, regardless of an individual's age. From the limited research on the post stroke experience of the younger adult, it had been recognized that these measurement tools do not adequately capture the symptom burden in young patients [10,94]. As highlighted in table 3, there is also a lot of variability in how psychosocial symptoms are measured in this population, which challenges comparison between studies.

Functional Status	
Modified Rankin Scale (mRS)	Measures the level of functional independence following a stroke. Ranges from 0-5
The Lawton Instrumental Activities of Daily Living Scale (IADL)	Assess the ability to perform tasks necessary to live independently in the community. The score ranges from 0 (low function, dependent) to 8 (high function, independent).
Barthel Index Score	Measures disability and dependence. Total score ranges from 0–20; lower scores indicating increased disability
Utrecht Scale for Evaluation of Rehabilitation (USER)	Measures physical and cognitive independence and subjective complaints (pain, fatigue and mood)
Map Young Persons with Stroke (MYS) questionnaire	A Swedish questionnaire with 59 questions with International Classification of Functioning, Disability and Health (ICF) components: body functions/impairments, activities/limitations, participation/restrictions and contextual factors (i.e. personal and environmental factors)
Glasgow Outcome Scale (GOS)	Assess functional outcome based on one of five categories: Dead, Vegetative State, Severe Disability, Moderate Disability or Good Recovery
Functional Independent Measure (FIM-3)	Measures the level of patient's disability and indicates how much assistance is required to carry out activities of daily living. It consists of 18 items composed of 13 motor and 5 cognitive tasks, with scores ranging from 18 (lowest) to 126 (highest) indicating level of function.
Instrumental Activity Measure (IAM)	Developed as a supplement to FIM score. Unlike the FIM score, it measures instrumental activities required to live in the community.
Depression	
Hospital Anxiety and Depression Scale (HADS)	A self-assessment scale developed to detect symptoms of depression, anxiety or emotional distress., The score ranges from 0 to 21, depending on severity.
Beck Depression Inventory	A 21-question self-assessment scale to detect depressive mood symptoms. Scored from 1-40, depending on severity.
Montgomery –Asberg depression rating scale (MADRS)	A 10-item diagnostic questionnaire that is administered by an assessor, to assess for depressive symptoms in a patient. Scores range from o to over 34, depending on severity.
Duke Depression Evaluation Schedule	A diagnostic interview instrument; includes the Center for Epidemiologic Studies Depression Scale, Carroll Rating Scale, NIMH Diagnostic Interview Schedule and the Montgomery-Asberg Depression Scale.
Centre for Epidemiologic Studies Depression Scale (CES-D)	A self-report questionnaire with 20 questions. The scores range from 0-60, based on the likelihood of depression.
Carroll Rating Scale	A self-rating scale for depression, based on 12 yes/no questions, with each yes counting a point on the scale.
NIMH Diagnostic Interview Schedule (DIS)	A structured interview to assess symptoms of depression
Self-Rating Depression Scale (SDS)	A 20-item self-rating scale to assess the psychological and somatic symptoms of depression
Cognitive function	
Mini-Mental State Exam	Assess mental status with an 11-question to measure five areas of cognitive function: orientation, registration, attention and calculation, recall, and language. The maximum score is 30. A score of 23 or lower is indicative of cognitive impairment.
Checklist for Cognitive and Emotional consequences (CLCE-24)	A structured clinical interview developed to evaluate subjective cognitive, behavioural and emotional complaints. It consists of 13 items concerning cognitive complaints and 9 items addressing emotional and behavioral complaints, with each item scored as 0 (not present), 1 (doubtful), 2 (present, but not affecting daily life) or 3 (present and negatively affecting daily life).
Wechsler Adult Intelligence Scale-Revised (WAIS-R)	A general test of intelligence that consists of 6 verbal subtests and five performance subtests. The verbal tests are: Information, Comprehension, Arithmetic, Digit Span, Similarities and Vocabulary. The Performance subsets are: Picture Arrangement, Picture Completion, Block Design, Object Assembly and Digit Symbol. The scores derived are Verbal IQ, Performance IQ and Full Scale IQ.
Boston Diagnostic Aphasia Examination	A neuropsychological battery used to evaluate adults suspected of having aphasia
Auditory-verbal learning test (AVLT)	By asking participants to recall 15 unrelated words, evaluates short-term auditory-verbal memory, rate of learning, learning strategies, retroactive, and proactive interference, presence of confabulation of confusion in memory processes, retention of information, and differences between learning and retrieval.
Digit Span Test (DST)	Assesses short term verbal memory by testing of forward and backward digit span. Testing ceases when the subject fails to accurately report either trial at one sequence length or when the maximal list length is reached (9 digits forward, 8 backward). The total number of lists reported correctly is combined across forward span and backward span to produce a Wechsler total correct score.
Babcock story recall test (BSRT)	Verbal memory measure; a 29-item story is presented for up to 5 trials until the subject gets at least 15 points
Token test	Assesses auditory comprehension in persons with developmental and acquired disorders affecting language.
Semantic verbal fluency (SVF)	Assesses verbal fluency by asking participant to generate a series of words in a limited period
Corsi's block-tapping board	Assesses visuo-spatial short term working memory by mimicking the tapping of a series of identical, spatially separated boxes
Similarities testing	Tests verbal abstraction
Raven's progressive matrices (RPM)	A non-verbal group test that assesses abstract reasoning by asking participants to determine the missing geometric piece from the puzzle
Fatigue	
Checklist of Individual Strength (CIS-2OR)	Measures severity and behavioural consequences of fatigue with 20 statements on a 7-point scale from "yes, that is true" to "no, that is not true"
Fatigue Severity Scale	A 9-item questionnaire that assesses impact of fatigue on daily living, with scores ranging from 1 (completely disagree) to 7 (completely agree)
Multidimensional Fatigue Inventory (MFI-20)	Self-rating scale that assesses for the presence of emotional, physical and cognitive symptoms of fatigue.
Return to Work	
General Health Questionnaire (GHQ-28)	A general health screening questionnaire to assess psychiatric comorbidity, with scores ranging from 0-28.
Unmet needs	
Southampton Needs Assessment for people with stroke (SNAQs)	A questionnaire that assesses responder characteristics, impact of the stroke, information received and needed, socio-economic status, family life, financial difficulties etc.
Quality of Life	
Stroke specific quality of life (SSQOL)	An assessment designed to determine health related quality of life (HRQOL) specific to stroke
Short-Form General Health Survey (SF-36)	A patient-reported survey of health which is scored from 0 to 200, depending on the disability that the patient experiences because of underlying disease.
Sickness Impact Profile (SIP)	A 136-item behaviourally based measure of health status; reflects alterations in daily behaviour related to disease.
Life Satisfaction Instrument (LiSat-11)	Self-assessment questionnaire; measures perceived life satisfaction based on vocation, financial status, leisure, family, relationships etc
A combination scale of LiSat-9, HSQuale and Barthel Index	HSQuale is a 54-item instrument that reflects quality of life in young patients with hemorrhagic stroke

Table 3: *Available Measurements for Non-Physical Symptoms/Outcomes.*

Rehabilitation strategies need to focus on providing emotional and practical support to young patients during their periods of transition. This can be achieved through effective communication between patients, families and health professionals and providing suitable coping strategies like yoga or mindfulness to help their recovery in the long-term [19,46,47]. It is also beneficial to inform and obtain the support of employers, as this makes the process of returning to work easier, which inadvertently translates to improved life satisfaction in this patient population [11,95].

Finally, educating individuals about their psychosocial risks following a stroke, providing them with adequate resources, and appropriately referring them to specialist agencies (for example, smoking cessation services, psychological assessments, social workers, etc.) can equip them to better manage themselves and alleviate their fear of stroke recurrence [93]. Furthermore, it helps them to be more engaged in rehabilitation process and ensures that their individual needs and priorities are met and appropriately followed through the process of care.

Limitations

The lack of standardized tools for the measurements of psychosocial needs and occupational functioning are major limitations of this review. Additionally, most studies are from Scandinavian countries or Western Europe, and have little heterogeneity in the study population. These studies also use different variables and tools to assess the degree of psychiatric and cognitive dysfunction in these patients. Some studies also emphasize how the mRS scale does not assess complex tasks of daily living, that might better characterize the challenges of younger stroke survivors [10], and this could further underestimate the true degree of disability that these individuals sustain.

Conclusion

The young stroke population represents a significant rehabilitation challenge to an individual as well as society. There is an urgent need to better understand the complexity of psychosocial consequences following stroke in younger individuals using patient-reported outcome measures, so that patient-oriented interventions can be rapidly developed.

Conflict of Interest

The authors of this study have no conflicts of interest to disclose.

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