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Editorial: Stress, mood, and fatigue: Tackling “invisible” obstacles in stroke rehabilitation and recovery

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Editorial on the Research Topic

Stress, mood, and fatigue: Tackling “invisible” obstacles in stroke rehabilitation and recovery

More than one-half of stroke survivors experience ongoing psychological difficulties such as stress, fatigue, anxiety, and depression (1, 2). These ongoing issues create barriers to stroke recovery and rehabilitation. Post-stroke fatigue and depression are associated with increased mortality (3, 4), decreased quality-of-life (5) and poorer functional outcome (6, 7). Similarly, perceived stress is associated with long-term poorer functional outcome (8, 9). Despite being important determinants of stroke outcome and recovery, stress and fatigue are often not specifically addressed as part of stroke rehabilitation programmes. There are limited evidence-based programmes that have been designed to empower and enable stroke survivors to manage these conditions. Likewise, post-stroke depression remains largely underdiagnosed and untreated (10). This may be due to the fact that unlike physical disabilities, these psychological difficulties are “invisible.” This Research Topic was dedicated to this healthcare gap in stroke rehabilitation and the articles published in this issue showcases the clear need to tackle these invisible obstacles.

There is the lack of consensus regarding the nature and type of support that people with stroke might need to manage their fatigue. This issue contains a qualitative study by [Bicknell et al.](#) who describe the experience of post-stroke fatigue during outpatient rehabilitation from the perspective of people with stroke and their carers. Six major themes were identified. The findings suggested that most stroke survivors had to find their own solutions to manage their post-stroke fatigue, and support from caregivers, can lead to both positive and negative experiences. The authors concluded that

post-stroke fatigue should be routinely screened, and appropriate support and education should be provided during rehabilitation.

The paper by [Kliem et al.](#), included in this issue, focused on characterizing the inter-relationships between fatigue, sleep, cognitive functioning and mood. They found that poorer cognition and lower mood at 3 months post-ischemic stroke predicted worse fatigue and daytime sleep at 12 months, controlling for stroke severity, age, sex, and difficulties sleeping at night. As highlighted by the authors, this suggests that interventions addressing both cognition and mood, such as Cognitive Behavior Therapy, may be a promising approach to treating fatigue and sleep difficulties (11, 12).

Perceptual disorders are not uncommon after stroke (13). In this Research Topic, [Chen et al.](#) investigated whether perceived limb heaviness can affect engagement in rehabilitation after stroke. By retrospectively reviewing 108 participants data, they found 37% reported limb heaviness and this, along with strength, appeared to influence engagement in rehabilitation. Solutions targeting altered body perceptions might have a role in promoting better stroke recovery.

Repetitive transcranial magnetic stimulation (rTMS) is a treatment for depression that has shown promise, however relatively few studies have explored its use in post-stroke depression. It is thought that stimulation of the left dorsolateral prefrontal cortex might initiate early stages of synaptic plasticity, supporting improvements in mood. However, it is unclear whether damage to this brain region due to stroke influences efficacy of this treatment. In a case study published in the current issue, [Hordacre et al.](#) applied rTMS as a treatment for post-stroke depression in a patient with ischemic damage to the left middle frontal gyrus. Comprising an acute, daily treatment schedule, followed by weekly maintenance, depression scores were meaningfully reduced, with benefits persisting well beyond completion of the treatment. rTMS appears worthy of further investigation as a treatment for post-stroke depression.

A growing body of evidence has indicated that higher measures of resilience are associated with the lower levels of perceived stress and recovery after stroke (8). However, the study of [Norvang et al.](#), included in this issue, did not find an association of early measurement of resilience obtained within 2 weeks after stroke with activities of daily living at 3 months post-stroke. The authors suggested that the impact of resilience might not apply to physical adversity as compared to psychosocial adversity.

Preliminary evidence suggests that traditional Chinese medicines may also have a role in reducing post-stroke depression. Although not clear, preliminary work suggests acupuncture might evoke similar changes in neurotransmitter

activity and brain connectivity as pharmacological management of depression (14, 15). In this issue, [Luo et al.](#) proposed a protocol for a randomized controlled trial to evaluate efficacy and safety of optimized acupuncture and moxibustion as a treatment for post-stroke depression. The trial will aim to recruit 134 patients, randomized 1:1 to intervention or control. Treatments will be delivered five times per week for 4 weeks.

Racial disparities exist in stroke treatment and care (16). In this issue, [Love et al.](#) provided a protocol that aim to understand if resilience could buffer the effect of racism and psychological stress on quality of life among black stroke survivors in USA.

Taken together, the articles in this special edition provide interesting insights that build our understanding of the invisible obstacles to stroke recovery and rehabilitation including stress, depression, mood, and fatigue. Several articles suggested potential interventions and trial protocols to mitigate these invisible obstacles, including Cognitive Behavior Therapy, resilience building programs, acupuncture and repetitive transcranial magnetic stimulation. Future studies are needed to better understand the prevalence, pathophysiology, inter-relationships, mechanisms, impacts and trajectory of these issues and more rigorous clinical trials are warranted to investigate the feasibility and efficacy of potential therapeutic interventions. We hope that this Research Topic provides a springboard to encourage more work in this important area.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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References

- Zhan J, Zhang P, Wen H, Wang Y, Yan X, Zhan L, et al. Global prevalence estimates of poststroke fatigue: a systematic review and meta-analysis. *Int J Stroke*. (2022) 2022:17474930221138701. doi: 10.1177/17474930221138701
- Guo J, Wang J, Sun W, Liu X. The advances of post-stroke depression: 2021 update. *J Neurol*. (2021) 2021:1–14. doi: 10.1007/s00415-021-10597-4
- Glader E-L, Stegmayr B, Asplund K. Poststroke fatigue: a 2-year follow-up study of stroke patients in Sweden. *Stroke*. (2002) 33:1327–33. doi: 10.1161/01.STR.0000014248.28711.D6
- Cai W, Mueller C, Li Y-J, Shen W-D, Stewart R. Post stroke depression and risk of stroke recurrence and mortality: a systematic review and meta-analysis. *Ageing Res Rev*. (2019) 50:102–9. doi: 10.1016/j.arr.2019.01.013
- Naess H, Lunde L, Brogger J. The effects of fatigue, pain, and depression on quality of life in ischemic stroke patients: the Bergen Stroke Study. *Vasc Health Risk Manag*. (2012) 8:407. doi: 10.2147/VHRM.S32780
- Christensen D, Johnsen SP, Watt T, Harder I, Kirkevold M, Andersen G. Dimensions of post-stroke fatigue: a two-year follow-up study. *Cerebrovasc Dis*. (2008) 26:134–41. doi: 10.1159/000139660
- Schöttke H, Gerke L, Düsing R, Möllmann A. Post-stroke depression and functional impairments—a 3-year prospective study. *Compr Psychiatry*. (2020) 99:152171. doi: 10.1016/j.comppsy.2020.152171
- Gyawali P, Chow WZ, Hinwood M, Kluge M, English C, Ong LK, et al. Opposing associations of stress and resilience with functional outcomes in stroke survivors in the chronic phase of stroke: a cross-sectional study. *Front Neurol*. (2020) 11:230. doi: 10.3389/fneur.2020.00230
- Ostwald SK, Bernal MP, Cron SG, Godwin KM. Stress experienced by stroke survivors and spousal caregivers during the first year after discharge from inpatient rehabilitation. *Top Stroke Rehabil*. (2009) 16:93–104. doi: 10.1310/tsr.1602-93
- Medeiros GC, Roy D, Kontos N, Beach SR. Post-stroke depression: a 2020 updated review. *Gen Hosp Psychiatry*. (2020) 66:70–80. doi: 10.1016/j.genhosppsych.2020.06.011
- Nguyen S, Wong D, McKay A, Rajaratnam SM, Spitz G, Williams G, et al. Cognitive behavioural therapy for post-stroke fatigue and sleep disturbance: a pilot randomised controlled trial with blind assessment. *Neuropsychol Rehabil*. (2019) 29:723–38. doi: 10.1080/09602011.2017.1326945
- Ymer L, McKay A, Wong D, Frencham K, Grima N, Tran J, et al. Cognitive behavioural therapy versus health education for sleep disturbance and fatigue after acquired brain injury: a pilot randomised trial. *Ann Phys Rehabil Med*. (2021) 64:101560. doi: 10.1016/j.rehab.2021.101560
- Serrada I, Hordacre B, Hillier S. Recovery of body awareness after stroke: an observational study. *Front Neurol*. (2021) 12:745964. doi: 10.3389/fneur.2021.745964
- Leung MCP, Yip KK, Ho YS, Siu FKW, Li WC, Garner B. Mechanisms underlying the effect of acupuncture on cognitive improvement: a systematic review of animal studies. *J Neuroimmune Pharmacol*. (2014) 9:492–507. doi: 10.1007/s11481-014-9550-4
- Liu P, Qin W, Zhang Y, Tian J, Bai L, Zhou G, et al. Combining spatial and temporal information to explore function-guide action of acupuncture using fMRI. *J Magn Reson Imaging*. (2009) 30:41–6. doi: 10.1002/jmri.21805
- Cruz-Flores S, Rabinstein A, Biller J, Elkind MS, Griffith P, Gorelick PB, et al. Racial-ethnic disparities in stroke care: the American experience: a statement for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*. (2011) 42:2091–116. doi: 10.1161/STR.0b013e3182213e24