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Brief Psychosocial Intervention to Address Poststroke Depression May Also Benefit Fatigue and Sleep–Wake Disturbance

Eeeseung Byun[1], PhD, RN, Kyra J. Becker[2], MD, Ruth Kohen[3], MD, Catherine J. Kirkness[1], PhD, RN & Pamela H. Mitchell[1], PhD, RN, FAAN

Abstract

Purpose: This study aimed to determine if brief psychosocial/behavioral therapy directed to reduce poststroke depression would decrease fatigue and improve sleep–wake disturbance.

Design: A preplanned secondary data analysis from a completed clinical trial was conducted.

Methods: One hundred participants received usual care, in-person intervention, or telephone intervention. Depression, fatigue, and sleep–wake disturbance were measured at entry, 8 weeks, 21 weeks, and 12 months following the intervention.

Findings: Fatigue (within: $p = .042$, between: $p = .394$), sleep disturbance (within: $p = .024$, between: $p = .102$), and wake disturbance (within: $p = .004$, between: $p = .508$) decreased over the 12 months in the intervention groups, but not in the control group. This difference was clinically meaningful for wake disturbance and approached the clinically important difference for fatigue.

Conclusions/Clinical Relevance: Reduction in wake disturbance was consistent with clinically meaningful difference standards for patient-reported outcomes, warranting further research in larger samples.

Keywords: Fatigue poststroke; poststroke depression; secondary analysis randomized controlled trial; sleep disturbance poststroke; wake disturbance poststroke.

Introduction

Living Well With Stroke 2 (LWWS2) was a randomized controlled trial to determine the effect of a telephone versus in-person brief psychosocial/behavioral therapy on poststroke depression, compared with usual care (Kirkness et al., 2017). After the conclusion of clinical trials of a nonpharmacological intervention in poststroke depression (Kirkness et al., 2017; Mitchell et al., 2009), we examined the data for secondary aims regarding fatigue and sleep (Kirkness et al., 2017). In this report, we describe the three sets of symptoms—fatigue, sleep disturbance, and wake disturbance—before and after treatment for depression.

Correspondence: *Eeeseung Byun, PhD, RN, Department of Biobehavioral Nursing and Health Informatics, 1959 NE Pacific St., Box 357266, University of Washington, Seattle, WA 98195. E-mail: ebyun@uw.edu*

1 Department of Biobehavioral Nursing and Health Informatics, University of Washington, Seattle, WA, USA

2 Department of Neurology, University of Washington, Seattle, WA, USA

3 Department of Psychiatry and Behavioral Sciences, University of Washington, Seattle, WA, USA

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Background

In the United States, approximately 795,000 new or recurrent strokes occur annually (Benjamin et al., 2019). Although the incidence of stroke has decreased in the United States to the fifth leading cause of death, it is still first or second in the most populous countries of the world (Feigin et al., 2014). Equally important, for those who survive, stroke is the leading cause of disability and lost productivity worldwide (Feigin et al., 2015). Furthermore, the impact of fatigue and sleep disturbance poststroke is not widely recognized (Brodtmann & van de Port, 2013).

Numerous systematic reviews have examined the prevalence of poststroke fatigue. Estimates range from 23% to 75% of people who have had a stroke report fatigue sufficient to interfere with normal activities (Cumming et al., 2016; Hinkle et al., 2017; Kutlubaev & Hackett, 2014; Lagogianni et al., 2018; Moran et al., 2013; Nadarajah & Goh, 2015; Whitehead et al., 2016). These estimates are confounded by varying definitions of fatigue, varying time points after the incidence of stroke when fatigue is measured, and varying measurements of fatigue. Several definitions of fatigue have been put forth in the stroke literature, only

one of which is stroke specific (Lynch et al., 2007; Zedlitz et al., 2012). In creating a workable case definition of poststroke fatigue, Lynch and colleagues used a definition that incorporated "fatigue, lack of energy or increased need to rest every day or nearly every day" and that interfered with everyday activities (Lynch et al., 2007, p. 543). Although not stroke specific, Lerdal et al.'s (2012) definition helped separate fatigue from depression: "Sense of exhaustion, lack of perceived energy or tiredness, distinct from sadness or weakness" (p. 1).

Sleep disturbance following stroke is most commonly reported in terms of obstructive sleep apnea, with prevalence estimated as high as 60% in ischemic stroke patients (Johnson & Johnson, 2010; Menon et al., 2017). Estimates of the prevalence of poststroke sleep disturbance not attributed to obstructive sleep apnea are scarce. A recent systematic review of global literature indicated nonapnea sleep disturbances at 21.3%–70.6% in stroke survivors, whereas disorders of wakefulness (excessive daytime sleepiness) were cited ranging from 11.5% to 49.5% (Park & Choi-Kwon, 2018). In a more limited review, insomnia was estimated at a prevalence of 49%–68% in three studies, with insomnia related to worse quality of life (Tang et al., 2015). One Korean study showed low self-ratings for sleep problems following stroke (Kim et al., 2017).

Fatigue and sleep disturbance intertwine in depressive symptoms following stroke but are seldom reported separately in reviews of multiple symptoms (Baylor et al., 2014; Wang et al., 2016). Sleep disturbance, fatigue, and depression have been related to cognitive attention (Pearce et al., 2016), and these symptoms are target areas for intervention (Kouwenhoven et al., 2013; Nguyen et al., 2019). Sleep disturbance has been reported as a risk factor for stroke (Koo et al., 2018). In stroke, fatigue and sleep disturbance are closely related (Suh et al., 2014) and influence poststroke disability (Mandliya et al., 2016) and recovery (Hermann & Bassetti, 2016). Depression is also a strong predictor of sleep disturbance in stroke survivors (Suh et al., 2014). These findings suggest a tridirectional relationship among depression, fatigue, and sleep disturbance and that these symptoms may influence each other in this population.

The largest sample that examined all three distressing symptoms simultaneously used the Patient-Reported Outcome Measurement System (PROMIS) and the EuroQOL quality of life instruments to measure patient-reported outcomes in 1,195 stroke survivors (Katzan et al., 2018). Depression and sleep–wake impairment scores were worse for stroke survivors than for the general population, with sleep disturbance about the same (Katzan et al., 2018).

Aim of This Analysis

The primary results of this study, LWWS2, were previously published (Kirkness et al., 2017), and the prior LWWS1 study is included in meta-analyses of effective treatments (Deng et al., 2017). Based on prior research indicating that depression, fatigue, and sleep disturbance may occur separately or co-occur, *this preplanned secondary analysis from the LWWS2 study was designed to determine if brief psychosocial/behavioral therapy aimed at poststroke depression might also improve fatigue and sleep–wake disturbance.*

Methods

Summary of LWWS2 Design and Methods

The LWWS brief psychosocial intervention on depression was described previously (Kirkness et al., 2017; Mitchell et al., 2009); however, the methods are summarized here for clarity on the interaction of depression, fatigue, and sleep disturbance. The parent LWWS2 study (Kirkness et al., 2017) was conducted with the formal approval of the University of Washington Human Subjects Committee and registered as a clinical trial. Recruitment occurred from May 2010 to December 2014, and the trial ended in December 2015, when the last follow-up was completed. This preplanned secondary analysis examining the effect of brief psychosocial/behavioral therapy aimed at poststroke depression on fatigue and sleep–wake disturbance was part of the original analysis plan.

A total of 414 stroke survivors who were within 4 months of an ischemic or hemorrhagic stroke consented to be screened with demographics, the National Institutes of Health Stroke Scale (NIHSS), and the Geriatric Depression Scale (GDS). The GDS is commonly used in depression screening, regardless of age, because it is less sensitive to general physical illnesses than other depression screens (Sivrioglu et al., 2009). Higher scores on the GDS indicate greater severity of depression (0–9, normal; 10–19, mildly depressed; 20–30, severely depressed). In addition, stroke survivors received a two-item fatigue-screening assessment based on case definition by Lynch et al. (2007): "Since your stroke have you *experienced fatigue, a lack of energy, or an increased need to rest every day or nearly every day? Has this fatigue led to difficulty taking part in everyday activities?*" (p. 543).

All of those screened with clinically important depressive symptoms (GDS score of 11 or greater, indicating depression) were eligible to participate in the randomized trial of a brief behavioral intervention. Inclusion and exclusion criteria are described in Figure 1. A total of 133 participants met the inclusion criteria, and 100 community-dwelling stroke survivors consented to be randomized to a 6-week brief psychosocial–behavioral intervention by telephone, in person, or through usual care. Advanced practice nurses delivered a 1-hour intervention per week for 6 weeks either

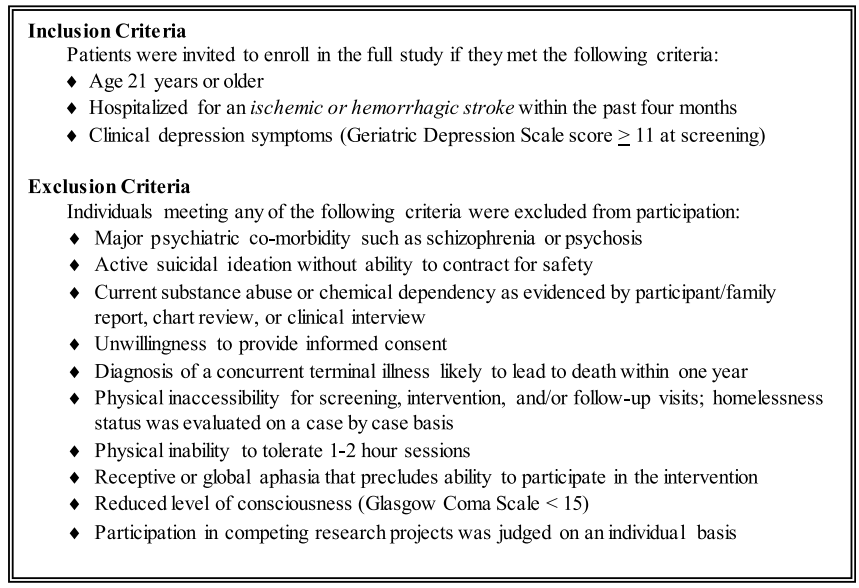

Figure 1. Inclusion and Exclusion Criteria

in person or by telephone over the course of six sessions. Participants in the telephone and in-person arms were taught,

…about the relationship of depression and stroke, that depressive symptoms are observable and modifiable behaviors and that these behaviors can be changed through observation and interaction. Participants were helped to identify activities that they found pleasant to do and to build these into their daily activities. Problem solving approaches were used to tailor this treatment to the circumstances of each participant and the challenges each faced in stroke recovery. (Kirkness et al., 2017, p. 4)

Participants in the usual-care group received an American Stroke Association booklet about stroke and depression and had their regular appointments with their primary provider. Antidepressant medication was recommended to all participants.

Clinical depression was confirmed with the Diagnostic Interview and Short Hamilton (Freedland et al., 2002). Randomization was adaptive with balance achieved on age, gender, severity of stroke, and severity of depression. Depression (the 17-item Hamilton Rating Scale for Depression [HRSD]), fatigue (the PROMIS seven-item scale), sleep disturbance (the PROMIS eight-item sleep scale), and wake disturbance (the PROMIS eight-item wake scale) were measured at entry, 8 weeks, 21 weeks, and 12 months posttreatment. The psychometrics of the depression measures were previously described (Kirkness et al., 2017; Mitchell et al., 2009). Next, we provide detail on the PROMIS measures.

The PROMIS system is one of the National Institutes of Health roadmap initiatives designed to improve the reporting of chronic condition outcomes in clinical research. The PROMIS provides a bank of standardized and validated items to assess key symptoms for a range of child and adult chronic conditions (Buysse et al., 2010; Cella et al., 2016). Short forms of seven to eight items were based on a set of calibrated items that quantify a particular symptom with standardization (*T* scores) referenced to the general population.

The severity and quality of fatigue was measured over the 12-month course of the study by the PROMIS short forms. The *T* scores represent a standardization of the raw sum scores, such that a score of 50 with a standard deviation of 10 indicates the average level of fatigue for the general adult population (Katzan et al., 2018).

The seven-item Fatigue Scale measures perceived tiredness, exhaustion, lack of energy, and impact on function in the past 7 days (Cook et al., 2012). The eight-item Sleep Disturbance Scale focuses on perceptions of quality, depth, and restoration associated with sleep, perceived difficulties getting to sleep or staying asleep, and perceptions of the adequacy of and satisfaction with sleep in the past 7 days (Buysse et al., 2010). The eight-item Sleep-Related Impairment Scale (wake disturbance) measures level of waking alertness, sleepiness, and function in the context of sleep–wake over the past 7 days (Buysse et al., 2010). The short forms for sleep and wake disturbance and for fatigue have been fully tested for psychometric stability and, in some cases, for what constitutes a clinically meaningful difference (Buysse et al., 2010; Cook et al., 2012; Katzan et al., 2018; Yost et al., 2011). Developers of the patient-reported outcome instruments have emphasized the need for a metric that make the scores interpretable from the patient point

of view. The minimally important difference or minimal clinically important difference (MCID) has been defined as "a difference in score that is large enough to have implications for a patient's treatment or care" (Yost et al., 2011, pp. 507–508).

Statistical Analysis

In this analysis, we report descriptive data in frequencies with mean and median, as appropriate. Because the mean and median for *T* scores were very close to each other, we used the median to calculate MCID, which is increasingly considered most relevant for patient-reported outcomes. This difference in score is large enough to have implications for patient treatment or care (Angst et al., 2017; Jaeschke et al., 1989). The MCID for the seven-item fatigue *T* score is 3–5 points (Yost et al., 2011). No MCID has been firmly established for sleep measures; however, some authors have estimated MCID using 0.5 standard deviation for the *T* score (Bryant et al., 2018). Fatigue, sleep disturbance, and wake disturbance across usual care, by telephone, and in-person groups were also compared with inferential statistics, using repeated-measures analysis of variance. Statisticians and leading researchers are increasingly supporting less reliance on traditional levels of statistical "significance" and greater use of clinically interpretable measures of the importance of findings (Hayat et al., 2019). Correlational analysis among the *T* scores for sleep and wake disturbance and fatigue and HRSD total scores at all four time points were conducted.

Results

Screening Sample Fatigue and Depression

Fatigue and depression were evaluated for the 414 people who were screened for the intervention study, using the GDS, NIHSS, and the two-item fatigue screen. The screening tools contained no sleep questions. Demographics and relevant clinical features of those screened and those enrolled appear in Table 1. These are reported here to establish the comparability of the population to those reported in prior literature for symptom sequelae of stroke.

Of the 314 who were screened only and not entered in the trial, 76% were fatigued, with 52% of those fatigued enough to interfere with daily activities. Depression (GDS score of 11 or greater) was a factor in fatigue for those who entered the intervention (n = 100), with 96% of those reporting fatigue and 85% reporting severe fatigue. Of those with GDS of less than 11 (n = 314), 46% were severely fatigued, suggesting a prevalence independent of depression. This outcome is consistent with findings from the Nottingham Fatigue Without Depression Study (Hawkins et al., 2017).

Those who were screened only were somewhat older, on average, than those who entered the trial (mean of 66.4 years vs. 60.3 years), had a less severe stroke (NIHSS score of 2.5 vs. 3.4), and had more men than in the intervention group (63% vs. 50%). Other demographics and stroke characteristics were quite similar for those screened only and those enrolled in this study.

Depression, Fatigue, and Sleep Over Time in the Intervention Study

We were able to follow those with GDS scores of 11 or greater and who entered the main study with clinical depression (n = 100). The demographics and clinical characteristics of those participants at entry to the intervention study are also shown in Table 1. The groups were roughly 50% men and women, with an average age of 60 years. The majority were married and living with a spouse or partner. The majority were White. Up to 14% of participants reported more than one race. The mean NIHSS score was 3.4, indicating mild stroke, and 85% had ischemic stroke. The mean HRSD score was 18.5 (moderate depression). More than 70% had a personal history of depression prior to their stroke. When they entered in the trial, 47% of all participants were taking antidepressant medications, such as selective serotonin reuptake inhibitors, monoamine oxidase inhibitors, or tricyclic antidepressants. On average, participants across all three groups perceived themselves as 62% recovered from the stroke.

Of the participants in the intervention study, 96% experienced fatigue, with 85% of them fatigued enough to interfere with daily activities (screening fatigue item), 93% did not feel full of energy (GDS fatigue item), 41% reported moderate, and 59% reported severe fatigue on the HRSD fatigue severity item. These levels of fatigue did not differ across the three randomization groups at baseline.

Demographics and clinical characteristics were very similar across the two intervention groups and the usual care group (Table 2). As shown in Table 3, at entry to the study, all groups had an average fatigue PROMIS *T* score of ~56, with a standard deviation of 6.3 (median = 55–56). The participants with pleasant events, self-identified events that gave the participants pleasure (e.g., gardening, taking a walk, and viewing art), experienced a decrease in fatigue after the cognitive–behavioral intervention. However, the usual care group continued at the same level of fatigue throughout the year of follow-up. The intervention groups had a greater decrease in fatigue, but the levels did not achieve the MCID of 3 points by 12 months posttreatment (Table 4), although the telephone intervention group reduced at the median level by nearly 3 points (2.7). The difference at 12 months did not reach a .05 level of significance with conventional inferential statistics (Table 3).

Table 1 Selected Demographic and Clinical Characteristics of Screened Only and Enrolled Participants in the LWWS2 Study

Characteristic	Screened Participants (*n* = 314)	Enrolled Participants (*n* = 100)
Age in years, mean (*SD*, min–max)	66.4 (13.6, 21–96)	60.3 (12.7, 23–88)
Gender, *n* (%)		
Male	198 (63)	50 (50)
Female	116 (37)	50 (50)
Marital status, *n* (%)		
Single	42 (13)	13 (13)
Married	166 (53)	51 (51)
Partnered	15 (5)	5 (5)
Widowed	42 (13)	7 (7)
Divorced or separated	49 (16)	24 (24)
Level of education, *n* (%)		
Less than 12th grade	18 (6)	2 (2)
12th grade or general education diploma	51 (16)	19 (19)
Vocational school, AA degree, or some college	137 (44)	41 (41)
Bachelor's degree	64 (20)	25 (25)
Master's degree	29 (9)	7 (7)
Doctoral degree	15 (5)	6 (6)
Current living arrangement, *n* (%)		
Lives alone	69 (22)	23 (23)
With spouse/partner	172 (55)	51 (51)
With relatives	30 (10)	14 (14)
With roommates	17 (5)	2 (2)
Group housing	17 (5)	9 (9)
Other	9 (3)	1 (1) homeless
Type of stroke, *n* (%)		
Ischemic	262 (83)	85 (85)
Intracerebral hemorrhage	43 (14)	10 (10)
Subarachnoid hemorrhage	9 (3)	5 (5)
NIH Stroke Scale total score, mean (*SD*, min–max)	2.5 (2.9, 0–18)	3.4 (3.5, 0–15)
Experience fatigue, *n* (%)		
Yes	240 (76)	96 (96)
No	74 (24)	4 (4)
Experience fatigue enough to interfere with daily activity, *n* (%)		
Yes	162 (52)	85 (85)
No	152 (48)	15 (15)
Geriatric Depression Scale total score, mean (*SD*, min–max)	6 (4.7, 0–25)	17.1 (4.8, 11–30)
Hamilton Rating Scale for Depression total score, mean (*SD*, min–max)	—	18.5 (3.12, 12–27)
Currently taking antidepressant medication, *n* (%)	—	47 (47)

Note. LWSS2 = Living Well With Stroke 2; Max = maximum; Min = minimum; *SD* = standard deviation; NIH = National Institutes of Health; AA = Associate in Arts.

No apparent differential perceptions of recovery emerged across groups (data not shown).

Sleep disturbance *T* scores decreased roughly by 2 points in the combined intervention groups and remained essentially constant in the usual care group over time (Table 3). However, wake disturbance improved by more than 4 points in the intervention groups, suggesting an MCID, and worsened in the usual care group (Table 4). Again, conventional inferential statistics did not show significance at the .05 level between intervention and control groups.

Because fatigue and sleep–wake disturbances are a component of the multiple symptoms that comprise clinical depression, it is possible that our findings simply reflect the reduction in overall depression found in our main study measured in another way. If so, we should expect to see a strong correlation between the *T* scores, as measured by PROMIS scales, and the overall depression score, as measured by the Hamilton Scale. Correlational analysis among the *T* scores for sleep and wake disturbance, fatigue, and HRSD total scores at all four time points showed only modest correlations at any point beyond entry (data not shown). Another approach might have been to do mediation and moderation analysis with Hamilton changes as it affected sleep, wake, and fatigue scores. However, these analyses presuppose a statistically significant difference in the depression score, which was not the case.

Discussion

Findings indicate that fatigue, sleep disturbance, and wake disturbance are prevalent over the 12 months after stroke.

Table 2 Baseline Demographic and Clinical Characteristics Between the Intervention Groups and the Usual Care Group

Characteristic	Telephone (*n* = 37)	In Person (*n* = 35)	Usual Care (*n* = 28)
Age in years, mean (*SD*, min–max)	61.7 (13.5, 31–85)	58.5 (12.3, 23–83)	60.7 (12.4, 32–88)
Gender, *n* (%)			
Male	19 (51)	17 (49)	14 (50)
Female	18 (49)	18 (51)	14 (50)
Marital status, *n* (%)			
Single	3 (8)	8 (23)	2 (7)
Married, partnered	22 (60)	15 (43)	19 (68)
Widowed, divorced, separated	12 (32)	12 (34)	7 (25)
Level of education, *n* (%)			
Less than 12th grade	0 (0)	2 (5.7)	0 (0)
12th grade or general education diploma	8 (21.6)	5 (14.3)	6 (21)
Vocational school, AA degree, or some college	15 (40.6)	17 (48.6)	9 (32)
Bachelor's degree	8 (21.6)	9 (25.7)	8 (29)
Master's degree	2 (5.4)	1 (2.9)	4 (14)
Doctoral degree	4 (10.8)	1 (2.9)	1 (4)
Current living arrangement, *n* (%)			
Lives alone	13 (35)	6 (17)	4 (14.3)
With spouse, partner	20 (54)	15 (43)	16 (57.1)
With relatives, others	3 (8)	9 (26)	4 (14.3)
Group housing	1 (3)	4 (11)	4 (14.3)
Other	0	1 (3) homeless	0
Race/ethnicity, *n* (%)			
Hispanic ethnicity	1 (3)	1 (3)	3 (11)
More than one race	4 (11)	8 (23)	2 (7.1)
White only	30 (81)	25 (71)	24 (85.7)
Black only	2 (5)	2 (6)	1 (3.1)
Asian only	1 (3)	0 (0)	1 (3.1)
Type of stroke, *n* (%)			
Ischemic stroke	32 (86)	31 (89)	22 (78.6)
Intracerebral hemorrhage	4 (11)	4 (11)	3 (10.7)
Subarachnoid hemorrhage	1 (3)	0 (0)	3 (10.7)
NIH Stroke Scale total score, mean (*SD*, min–max)	3.4 (3.4, 0–15)	3.4 (3.6, 0–14)	3.5 (3.8, 0–12)
Experience fatigue, *n* (%)			
Yes	36 (97)	33 (94)	27 (96)
No	1 (3)	2 (6)	1 (4)
Experience fatigue enough to interfere with daily activity, *n* (%)			
Yes	33 (89)	31 (89)	21 (75)
No	4 (11)	4 (11)	7 (25)
Geriatric Depression Scale total score, mean (*SD*, min–max)	17.0 (4.5, 11–30)	18.5 (5.3, 11–28)	15.5 (4.0, 11–27)
Hamilton Rating Scale for Depression total score, mean (*SD*, min–max)	18.0 (3.1, 12–26)	19.1 (3.2, 14–27)	18.3 (2.9, 13–23)
History of depression, *n* (%)	32 (86)	27 (77)	20 (71)
Currently taking antidepressant medication, *n* (%)	19 (51)	16 (46)	12 (43)

Note. Max = maximum; Min = minimum; *SD* = standard deviation; NIH = National Institutes of Health; AA = Associate in Arts.

Our brief psychosocial/behavioral therapy for poststroke depression decreased fatigue, sleep disturbance, and wake disturbance over time. The improvement in wake disturbance from the baseline and 12 months suggests an MCID.

The few studies that reported fatigue over time poststroke indicated either an increase in fatigue (measured by the Fatigue Severity Scale) during the first year or a small decrease after 1 year (Naess et al., 2012). The stability in our usual care control group was similar to Lerdal et al. (2012), who also used the Fatigue Severity Scale and found no substantial variation over 18 months in severity of fatigue poststroke. Duncan et al. (2015) reported a decreasing number of poststroke patients who met the case definition of fatigue over a 1-year period; however, Duncan et al. did not measure severity of fatigue.

A few recent reports have described improvement in fatigue with targeted cognitive–behavioral therapy, which has many similarities to the intervention we used. Zedlitz et al. (2012) showed improvement in fatigue with a 12-week cognitive therapy program linked to focused activity. Their treatment included people up to 3 years poststroke. Similarly, Nguyen et al. (2019) reported

Table 3 Mean *T* scores for Fatigue, Sleep Disturbance, and Wake Disturbance Over Time and Results of the Repeated-measures Analysis of Variance ($n = 100$)

Variable	*n*	Min	Max	Mean ± *SD* at T1 (Baseline)	Mean ± *SD* at T2 (8 Weeks)	Mean ± *SD* at T3 (21 Weeks)	Mean ± *SD* at T4 (12 Months)	*p*
Fatigue	100	29.4	83.2	56.2 ± 6.3	55.4 ± 6.8	55.5 ± 6.7	54.5 ± 7.7	Within: .042
Usual care	28			56.0 ± 6.3	56.8 ± 7.4	56.8 ± 6.9	56.2 ± 8.3	Between: .394
Telephone	37			55.9 ± 6.38	55.1 ± 5.9	55.5 ± 6.6	53.5 ± 7.6	
In person	35			56.7 ± 6.3	54.7 ± 7.1	54.3 ± 6.6	54.2 ± 7.3	
Sleep disturbance	100	28.9	76.5	53.3 ± 3.5	52.1 ± 3.1	52.4 ± 3.0	51.9 ± 3.9	Within: .024
Usual care	28			53.4 ± 3.5	52.4 ± 3.0	52.5 ± 2.6	52.9 ± 3.2	Between: .102
Telephone	37			53.5 ± 3.5	52.5 ± 2.8	52.8 ± 2.6	52.0 ± 3.8	
In person	35			53.0 ± 3.6	51.4 ± 3.6	51.8 ± 3.6	50.8 ± 4.5	
Wake disturbance	100	30.0	80.1	56.4 ± 6.2	54.3 ± 6.9	54.0 ± 7.1	54.0 ± 8.1	Within: .004
Usual care	28			54.7 ± 7.4	54.6 ± 7.0	53.9 ± 7.3	56.0 ± 8.4	Between: .508
Telephone	37			56.0 ± 5.7	53.2 ± 7.2	53.1 ± 7.5	52.9 ± 8.0	
In person	35			58.1 ± 5.3	55.2 ± 6.4	55.3 ± 6.5	53.7 ± 7.8	

Note. *p* values are based on repeated-measures analysis of variances tests. Max = maximum; Min = Minimum; SD = standard deviation.

similar improvements with a cognitive–behavioral intervention for poststroke fatigue and sleep disturbance. A very small feasibility study with a cognitive–behavioral intervention for poststroke insomnia also showed improvement in sleep and daytime sleepiness (Herron et al., 2018). Thus, our findings suggest that a brief psychosocial behavioral intervention for depression may also improve symptoms of fatigue and sleep-related impairment in some cases in MCID.

Strengths and Limitations

This study has limitations in that, even though preplanned, it is a secondary analysis of symptoms embedded in but not targeted by the primary intervention. It has a small sample size taken from one geographic region. It is also possible that improvement in fatigue, sleep disturbance, and wake disturbance over time may have been mediated or moderated by improved depression after the intervention, or vice versa. However, because the sleep and fatigue severity items in the Hamilton comprised only 2 of 17 items and because correlations in scores were quite low, this seems unlikely.

Strengths include a longitudinal design and measurement of these distressing symptoms over a 12-month period in the first year poststroke. Furthermore, the standardized patient-reported outcome measures allow direct comparison with other studies using PROMIS measures. Wake disturbance improved in the intervention groups, indicating an MCID. The use of MCID provides a clinically meaningful alternative to traditional statistical significance.

Implications for Clinical Practice and Future Research

The prevalence of fatigue, sleep disturbance, and wake disturbance underscore a need for provider sensitivity to recognize fatigue and sleep disturbance in stroke survivors, as well as the umbrella condition of depression. These

Table 4 Median *T* Scores for Fatigue, Sleep Disturbance, and Wake Disturbance Over Time and Differences of Median Between Baseline and 12 months ($n = 100$)

	T1 (Baseline)			T2 (8 Weeks)			T3 (21 Weeks)			T4 (12 Months)			Difference Between T1 and T4 Medians
Variable	*n*	Median	Range	*n*	Median	Range	*n*	Median	Range	*n*	Median	Range	
Fatigue													
Usual care	28	55.0	25.0	26	56.8	29.0	25	56.8	25.0	24	56.2	38.0	+1.2
Telephone	37	56.4	29.2	34	55.0	22.5	33	56.4	25.9	33	53.7	31.4	−2.7
In person	35	56.4	25.3	31	53.7	29.0	29	55.1	26.7	30	54.4	29.8	−2
Sleep disturbance													
Usual care	28	53.3	16.2	26	52.2	10.6	25	52.2	8.3	24	53.3	12.8	0
Telephone	37	54.3	12.7	34	52.2	12.7	33	52.2	10.4	33	52.2	19.0	−2.1
In person	35	53.3	18.4	31	51.2	14.1	29	51.7	15.2	30	50.1	20.8	−3.2
Wake disturbance													
Usual care	28	54.7	33.0	26	54.5	29.3	25	53.4	28.3	24	55.0	29.8	+0.3
Telephone	38	57.2	21.7	34	54.0	28.1	33	51.6	29.7	33	52.9	32.1	−4.3
In person	35	58.2	20.0	31	56.1	27.0	29	55.1	21.7	30	54.0	27.6	−4.2

Key Practice Points

- Fatigue, sleep disturbance, and wake disturbance are prevalent over the 12 months poststroke.
- Brief psychosocial/behavioral therapy for poststroke depression may decrease fatigue, sleep disturbance, and wake disturbance.
- Targeted interventions focusing on fatigue, sleep and depression may improve these symptoms as well as stroke recovery, and rehabilitation nurses could play a pivotal role in providing these interventions.

symptoms may impede stroke survivors' ability to manage stroke care, such as rehabilitation, which could lead to rehospitalization. Rehabilitation nurses need to assess fatigue, sleep–wake disturbance, and depression early after stroke and provide support for stroke survivors. Targeted interventions focusing on fatigue, sleep–wake disturbance, and depression, such as cognitive–behavioral intervention (Herron et al., 2018; Nguyen et al., 2019; Zedlitz et al., 2012) and psychoeducation (Ostwald et al., 2014), may improve not only these symptoms but also stroke recovery. In a clinical trial, a nurse-led cognitive–behavioral intervention reduced cancer-related fatigue in persons with ovarian cancer during and after chemotherapy (Zhang et al., 2018). Rehabilitation nurses could play a pivotal role in providing interventions targeting fatigue, sleep, and depression for stroke survivors and improving their health. The suggested improvement of fatigue and some sleep-related symptoms with psychosocial–behavioral interventions indicate a need to replicate this study with a larger sample size and longitudinal designs that encompass longer periods. These findings suggest that interventions focused on fatigue and sleep and wake disturbances early following stroke may have the potential to prevent negative longer term health outcomes.

Conflict of Interest

The authors had National Institutes of Health funding related to the topic of this article but do not have any conflict of interest with respect to this analysis.

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