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Original Research

The Impact of Executive Function on Retention and Compliance in Physical Therapy in Veterans

Elisa F. Ogawa, PhD [a,b,c], Rebekah Harris, PT, DPT, PhD [a,b], Rachel E. Ward, PhD [a,b,d], Mary-Kate Palleschi, BA [a], William Milberg, PhD [a,e,f], David R. Gagnon, MD, PhD [g,h], Ildiko Halasz, MD [h], Jonathan F. Bean, MD, MPH [a,b,i]

[a] *New England Geriatric Research, Education and Clinical Center, VA Boston Healthcare System, Boston MA*
[b] *Department of Physical Medicine and Rehab, Harvard Medical School, Boston, MA*
[c] *Department of Exercise and Health Sciences, Manning College of Nursing and Health Sciences, University of Massachusetts Boston, Boston, MA*
[d] *Massachusetts Veterans Epidemiology and Research Information Center (MAVERIC), VA Boston Healthcare System, Boston, MA*
[e] *Neuroimaging Research for Veterans Center, Translational Research Center for TBI and Stress Disorders, VA Boston Healthcare System, Boston MA*
[f] *Department of Psychiatry, Harvard Medical School, Boston, MA*
[g] *Department of Biostatistics, Boston University School of Public Health, Boston MA*
[h] *VA Boston Healthcare System, Boston, MA*
[i] *Spaulding Rehabilitation Hospital, Boston, MA*

KEYWORDS
Cognition;
mobility;
exercise;

Abstract *Objective:* To examine retention and compliance to a novel physical therapy (PT) treatment among Veterans with and without executive function deficits (EFD+/EFD−).
Design: This study was a preplanned secondary analysis of an ongoing randomized controlled trial.

List of abbreviations: AM-PAC, Activity Measure for Post-Acute Care; D-KEFS, Delis-Kaplan Executive Function System; EFD, executive function deficit; LLWS, Live Long Walk Strong; PHQ-9, Patient Health Questionnaire-9; PT, physical therapy; SD, standard deviation; SPPB, Short Physical Performance Battery; SMART, Specific, Measurable, Action-Oriented, Realistic, and Timed; VIF, variance inflation factor.

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Older adults;
Physical therapy;
rehabilitation

Setting: Outpatient PT at VA Boston Healthcare System.
Participants: Seventy-two community-dwelling middle-aged and older Veterans (mean age, 72 years [range 51-91]; 87% male) with gait speed between 0.5 and 1.0 m/second were recruited from primary care practices.
Interventions: Eight-week moderate-to-vigorous intensity PT program.
Main outcome measure: Veterans' baseline mobility, retention (dropouts), and treatment compliance and posttreatment exercise compliance to 8-week PT treatment were evaluated based on their baseline EFD status.
Results: Of the 72 participants, 22% (n=16) were EFD+. Veterans with EFD+ at baseline had worse mobility performance (Short Physical Performance Battery [SPPB], 7.7 vs 9.5, $P<.001$) and patient-reported mobility (Activity Measure for Post-Acute Care [AM-PAC], 57.6 vs 62.2, $P<.01$) after adjusting for age, gender, number of comorbidities, depressive symptoms, and pain interference. Dropout rates for EFD+ and EFD− were 44% and 25%, respectively ($P>.05$). In multivariable logistic regression modeling, pain interference, depressive symptoms, mobility, and living alone but not EFD status were associated with dropping out. Among study completers, there was no evidence of significant differences in treatment compliance or posttreatment exercise compliance, measured by the number of attended sessions and the number of posttreatment exercise days by EFD status.
Conclusion: EFD+ was associated with poor baseline mobility. Although the dropout rate was higher among Veterans with EFD+, we were unable to conclude whether EFD status impacts retention or compliance due to the small sample size. Further investigation is needed to determine whether EFD status may identify individuals who need additional support during and/or after rehabilitation treatment.

Declines in walking speed and cognition are independent predictors of disability, hospitalization, and loss of independence.[1,2] Among older adults aged 70 years and older, the prevalence of mobility limitation and cognitive impairment is over 25%[3] and 20%,[4] respectively. Furthermore, many older adults experience declines in mobility and cognition simultaneously.[5] This is a significant challenge because over 46% of Veterans receiving care at VA are older than 65 years[6] and compared to civilians, Veterans of all ages manifest greater physical[7-9] and cognitive impairment.[10] Furthermore, compared to individuals who have only mobility decline, individuals who manifest both mobility and cognitive problems may have worse baseline mobility. The added cognitive challenges may also increase the risk of reduced retention and compliance with rehabilitation treatment. However, the impact of these dual sources of decline on physical therapy (PT) outcomes remains unknown.

In PT, continuing with the treatment program (retention) and participation in the prescribed treatment during and after treatment (compliance), are important factors that can influence treatment outcomes. Higher retention and compliance are associated with increased health care savings,[11,12] better functional outcomes, and reduced hospital stays.[13] A systematic review that evaluated barriers to treatment retention within outpatient PT for patients with musculoskeletal problems reported dropout rates ranging from 14%-70%.[12] This review further concluded that poor retention was associated with low physical activity, and higher rates of depression, anxiety, helplessness, and poor social support.[12] In a study that evaluated 556 older adults with impaired balance who were discharged from PT, no interest, poor health, depression, fear of falling, and low outcome expectations were associated with not participating in prescribed posttreatment exercises.[14]

Retention and compliance with PT and exercise treatment are documented to be particularly difficult among people with cognitive problems.[15] Specifically, executive function, a cognitive domain that is responsible for controlling, coordinating, and organizing abilities,[16] may play an important role in long-term physical activity adoption and maintenance.[17] In a study that evaluated exercise retention in community-dwelling older adults, better executive function and self-regulatory strategies (eg, self-monitoring, goal-setting, eliciting social support, reinforcement, time management, and relapse prevention) at the beginning of the program were related to greater levels of self-efficacy for exercise and greater retention.[17]

Live Long Walk Strong (LLWS) is an evidence-based model of PT care that treats patients with gait speed between 0.5 and 1.0 m/second. Gait speed faster than 1.0m/second has been previously suggested as healthy aging.[18] LLWS treatment targets leg power, trunk muscle endurance, timing and coordination of gait, and behavioral coaching (self-efficacy of exercise).[19,20] Although LLWS demonstrated initial proof of concept among civilian older adults with mobility problems, the goal of the parent LLWS study was to evaluate the efficacy of LLWS among middle-aged and older Veterans and identify treatment attributes that collectively facilitate improvements in gait speed.[20] LLWS's behavioral coaching focused on the application of a Specific, Measurable, Action-Oriented, Realistic, and Timed (SMART) coaching protocol which was grounded by social cognitive theory.[21] The behavioral coaching addresses specific personalized goals, barriers, and solutions to exercise to enhance exercise compliance during and posttreatment.[21] Furthermore, in a clinical demonstration project examining the impact of LLWS that incorporated behavioral coaching among civilians, there were no differences in retention based on cognition as measured by a global cognitive screener.[19] However, the impact of LLWS on retention and treatment compliance especially among those with mobility and cognitive challenges was unknown. Therefore, we undertook a preplanned analysis of data collected as part of a clinical trial evaluating LLWS (ClinicalTrials.gov [NCT04026503]).

The aims of the study were to (1) characterize Veterans' baseline mobility based on their baseline executive function status; (2) describe retention (dropout) based on executive function deficit (EFD) status; and (3) describe treatment compliance and posttreatment exercise compliance based on EFD status.

Methods

This study was a preplanned secondary analysis of an ongoing phase II single-blind randomized controlled trial, the LLWS study. The estimated completion date for the parent study is November 2024. Thus, the study design, methods, and eligibility criteria were based on the primary aims of the LLWS study. A detailed description of LLWS design and methods was published previously.[20] Briefly, the LLWS study recruited middle-aged and older-aged primary care participants from VA Boston Healthcare System. Participants were followed for up to 32 weeks. An equal number of individuals were recruited across 3 age groups (50-64, 65-74, 75+), aiming for a diverse representation of physical functioning with at least 40% exhibiting a gait speed below 0.8 m/second. Veterans were randomized into 2 groups: (a) starting 8-week LLWS PT treatment immediately; or (b) 8-week waitlist controls. After 8 weeks, waitlist controls also undergo 8-week LLWS treatment. The eligibility criteria for LLWS included: (1) aged ≥50 years; (2) community-dwelling; (3) ability to speak and understand English; (4) usual gait speed 0.5-1.0 m/second. Exclusion criteria included: (1) presence of a terminal disease; (2) major medical problem, unstable chronic disease, or psychiatric disorder interfering with safe and successful testing and training; (3) myocardial infarction or major surgery in previous 3 months; (4) planned major surgery within upcoming year; (5) Short Physical Performance Battery (SPPB) score <4; (6) use of a walker; (7) Mini Montreal Cognitive Assessment (MoCA) <10; (8) presence of significant disease-specific impairment. This study also excluded Veterans who did not have complete study measures. The LLWS study was approved by VA Boston Healthcare System Institutional Review Board, and written consent was obtained from all Veterans.

Study operations and effects of COVID-19

This study included Veterans who participated in LLWS study from January 2021 to May 2023. To minimize COVID-19 exposures and maintain Veterans' safety during the COVID-19 pandemic, both in-person and virtual assessments were conducted from January 2021 to June 2021 following guidelines from the medical center. Although all study procedures returned to in-person in July 2021, a rise in COVID-19 cases in our region led to the shutdown of all study operations from November 2021 until April 2022. In May of 2022, previously enrolled Veterans whose study participation was interrupted by the shutdown were recontacted and had the option to drop or re-enroll in the study. Re-enrolled participants restarted the LLWS treatment regardless of number of sessions completed before the shutdown.

This study examined all Veterans enrolled in the study regardless of their treatment allocation (eg, treatment/waitlist control). For Veterans who have more than 1 baseline assessment (eg, randomized into the waitlist control or pause in treatment due to study shutdown), the assessment completed in the closest proximity to treatment initiation was used.

Measures

EFD status

Using the baseline assessment, Veterans were categorized into executive function deficit (EFD+) or normal executive function (EFD−) based on their executive function tests (Trailmaking Test and Verbal Fluency). The raw scores were converted into age-adjusted z-scores,[22,23] and Veterans were identified as impaired on each subtest if they performed 1.5 standard deviations (SDs) below age-adjusted norms. The number of impaired subtests was totaled, and EFD+ was defined as impairment on at least 2 out of 5 subtests.

Trailmaking tests

Oral Trail Making Part B was used[24] for virtual assessments, and Delis-Kaplan Executive Function System (D-KEFS)'s Trail Making Condition 4 was used for in-person assessments.[25] Veterans were asked to switch between connecting numbers and letters orally[24] or by using pen and paper.[25] There is a strong correlation between oral and traditional paper trail making test of set-shifting and inhibition and has been validated to be used among older adults.[24,25]

Verbal fluency

D-KEFS's verbal fluency is a validated test of executive function among older adults.[25] The scoring produced 4 subtests: (1) letter fluency, correct number of words starting with assigned letter (eg, F, A, and S); (2) category fluency, correct number of words that belong to the assigned category (eg, animals, boys' names); (3) category switching, correct total number of category words (eg, fruits and musical instruments); and (4) category switching accuracy, correct switches between categories (eg, fruits → musical instruments).[25]

Aim 1 outcome: mobility

Mobility performance was measured using the validated SPPB. The SPPB is a composite score of performance on 3 tasks: standing balance, usual walking time, and chair stand time.[26] Each domain is scored from 0-4 with a total score ranging from 0-12, (higher scores indicating better performance).[26] Gait speed was derived from the SPPB walking test. The faster of the 2 walking trials was used to determine gait speed. Patient-reported mobility was a secondary outcome and was assessed using the T score from the validated Activity Measure for Post-Acute Care Basic Mobility Outpatient short form (higher scores indicating better mobility).[27]

Aim 2 outcome: retention

For the purpose of this study, participants who enrolled and did not complete their postintervention visit were categorized as dropouts. Participants dropped out under different conditions: (1) before starting LLWS treatment; (2) after starting LLWS treatment but before completing the postintervention visit; and (3) after the COVID-19 study shutdown when they decided not to return to LLWS treatment. Retention was defined as the number of participants who completed their postintervention visit and did not drop out of the study.

Aim 3 outcome: compliance

LLWS treatment compliance was measured by the number of treatment visits attended (range, 0-10). After completion of treatments, Veterans were advised to engage in $\geq$3 sessions of exercise weekly. Posttreatment exercise compliance was measured using a self-recorded exercise participation calendar. As part of the behavioral coaching, Veterans were instructed to fill out daily exercise participation to self-monitor exercise participation. After the completion of LLWS treatment, Veterans were given 16 weeks' worth of self-recorded posttreatment exercise calendars (range, 0-112 reported posttreatment exercise days). Participants were instructed to fill in the exercise participation daily (yes/no) and, once the month was over, return it to the LLWS study using prepaid envelopes. If no envelope was received within the first 2 weeks of the month, reminder calls were made.

Adjustment variables

Based on the literature, potential adjustment variables that may impact mobility, retention, and compliance were taken into consideration. Pain interference was assessed using Brief Pain Inventory subscales.[28,29] The Brief Pain Inventory interference addresses pain on an 11-point scale (range, 0-10), and the average score was calculated.[28,29] Depressive symptoms were measured using the Patient Health Questionnaire-9 (PHQ-9; range, 0-27; a higher score indicating worse depressive symptoms).[30] Sociodemographic information was collected, including age, sex, race, and education. Number of comorbidities was measured using the Katz self-administered comorbidity questionnaire.[31,32] Social support was captured by marital status and living status (eg, living alone or with someone else).

Efforts to promote study completion and compliance

In addition to the behavioral coaching, research staff used several strategies to increase retention and compliance. First, reminder calls were made to Veterans prior to each study visit. Second, the physical therapist scheduled out the 10 treatment visits at their initial treatment visit. This allowed for the physical therapist and the Veteran to discuss their schedules and their commitment to the program. Third, if an appointment was canceled, study staff immediately reached out to the Veteran and rescheduled the visit. Lastly, the study staff and physical therapist strived for the best customer service by meeting the Veteran at the entrance of the medical center and guiding them to the appropriate location. This transitioning time was used to build rapport with the Veteran.

Statistical analysis

Due to the small overall sample size, the analysis and interpretation of this study is primarily descriptive. Statistical tests addressing the study aims are considered secondary and exploratory. We viewed plots and employed descriptive statistics for all continuous measures and frequencies and percentages for all categorical variables. Using descriptive statistics, we examined the data distributions and checked for data accuracy and completeness. Statistical significance was determined with 2-tail tests at the significance level of α=0.05. Statistical analyses were performed using STATA software (Version 18, StataCorp[a]). Correlation coefficients between study variables were examined by correlation matrix.

Baseline mobility and baseline EFD status were used to examine aim 1. Differences in mobility by EFD status were compared using independent *t* test and chi-square statistics. To examine whether EFD status was associated with performance and patient-reported mobility, multivariable linear regression analyses adjusting for age, gender, number of comorbidities, depressive symptoms, and pain interference were used. For aim 2, univariate logistic regressions were used to evaluate dropout status and all potential adjustment variables. Statistically significant adjustment variables from the univariate models were further evaluated in the multivariable logistic regression models (pain interference, depressive symptoms, patient-reported mobility, and living alone). Each multivariable logistic regression model evaluated dropout status with EFD status and 1 adjustment variable to further evaluate the additional contribution of the potential adjustment variables while maintaining at least 10 events per predictor.[33] The variance inflation factor (VIF) for each logistic regression was used to evaluate multicollinearity.[34] For the compliance analysis, we excluded participants who dropped out of the study (aim 3). Negative binomial regression models were used to examine LLWS treatment compliance and posttreatment exercise compliance adjusting for age and gender. As an additional analysis, we described the number of attended sessions among participants that dropped out of the study.

Sensitivity analyses

We conducted additional analysis excluding Veterans who did not rejoin the LLWS study after the study shutdown due to the COVID-19 pandemic (aim 2).

Results

At the time of analysis, there were n=78 LLWS Veterans. There were incomplete measurements from 6 participants

Table 1 Baseline characteristics of 72 Veterans who enrolled in LLWS study by executive function deficit

	All	EFD− (n=56)	EFD+ (n=16)	*P* Value
	Mean ± SD			
Age (y)	71.5±11.4	70.6±11.5	74.6±11.1	.225
BMI (kg/m^2)	29.4±5.3	28.8±4.0	31.4±8.2	.094
Mini-MoCA	11.8±1.5	12.0±1.4	11.1±1.4	.028
Pain interference	2.1±2.2	2.0±1.2	2.3±2.4	.629
SPPB score	9.1±2.2	9.5±2.2	7.7±1.9	.004
Gait speed (m/s)	0.83±0.14	0.85±0.13	0.75±0.12	.009
AM-PAC	61.2±5.8	62.2±5.7	57.6±4.7	.005
PHQ-9	4.9±4.8	4.8±4.5	5.3±5.9	.685
Phone FITT	39.0±23.2	40.1±25.0	34.7±14.5	.439
Number of comorbidities	3.8±1.7	4.0±1.8	3.1±1.4	.048
		n (%)		
Sex (male)	62 (86.1)	47 (83.9)	15 (93.8)	.316
Race				
White	59 (81.9)	46 (82.1)	13 (81.3)	.885
Black	10 (13.9)	8 (14.3)	2 (12.5)	
Other/More than 1 race	3 (4.2)	2 (3.6)	1 (6.3)	
Marital status (married/living as married)	34 (47.2)	27 (48.2)	7 (43.8)	.752
Live alone (alone)	26 (36.1)	20 (35.7)	6 (37.5)	.896
Education				
High school/GED	13 (18.1)	8 (14.3)	5 (31.3)	.425
Vocational/tech school/some college	28 (38.9)	22 (39.3)	6 (37.5)	
College	16 (22.2)	13 (23.2)	3 (18.8)	
Graduate school	15 (20.8)	13 (23.2)	2 (12.5)	
Health status				
Poor/fair	13 (18.1)	8 (14.3)	5 (31.3)	.297
Good	37 (51.4)	30 (53.6)	7 (43.8)	
Very good/excellent	22 (30.6)	8 (32.1)	4 (25.0)	

Abbreviations: AM-PAC, Activity Measure for Post-Acute Care; BMI, body mass index; GED, General Educational Development; Mini-MoCA, Mini Montreal Cognitive Assessment; Phone FITT, Phone Frequency, Intensity, Time, and Type; PHQ-9, Patient Health Questionnaire-9; SPPB, Short Physical Performance Battery.

where they were missing cognitive measurements (n=4), self-reported mobility (n=1), and depressive symptoms (n=1). Participants with incomplete measures were older (completers: mean age, 71 years vs incompletes: mean age, 78 years), male (n=6), had poorer mobility performance (SPPB: completers, 9 vs incompletes, 7), walked slower (gait speed: completers, 0.83 m/second vs incompletes, 0.73 m/second), and had worse patient-reported mobility (Activity Measure for Post-Acute Care [AM-PAC]: completers, 61.2 vs incompletes, 54.4).

The analytic sample included the n=72 LLWS study Veterans who had complete data. Table 1 shows the descriptive statistics of the sample at baseline based on EFD status (n=72). The average age of Veterans was 72 years, 86% were male, and over 40% were college or graduate school graduates. At baseline, 22% had EFD+. Veterans with EFD+ had worse mobility performance (SPPB $P<.01$; gait speed $P<.01$) and patient-reported mobility (AM-PAC, $P<.01$, table 1). EFD status remained a significant predictor of mobility after adjusting for age, gender, number of comorbidities, depressive symptoms, and pain interference (SPPB adjusted *P* value <.001; gait speed adjusted *P* value <.01; AM-PAC adjusted *P* value <.01, supplemental table S1, available online only at http://www.archives-pmr.org/). There were no significant differences in age, education, pain, or depressive symptoms by EFD status at baseline. We observed a high correlation

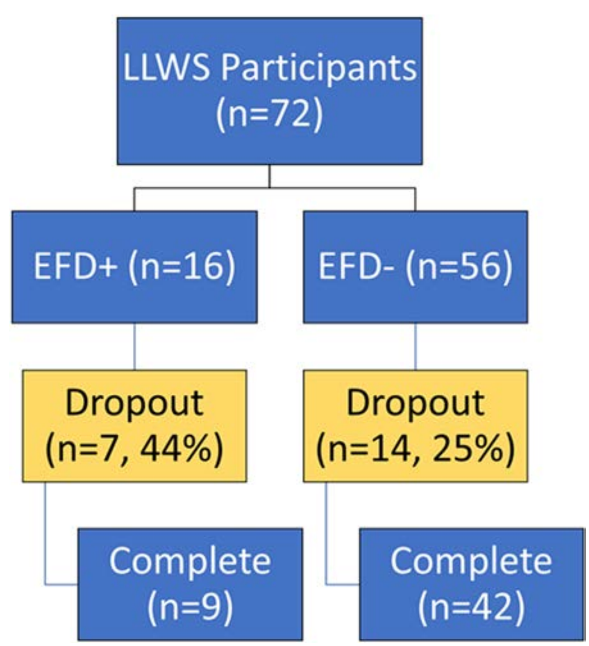

Fig 1 Study enrollment and participation flow diagram (n=72).

Table 2 Baseline characteristics of 72 Veterans who enrolled in LLWS study by dropout status

	Completers (n=51)	Dropouts (n=21)	*P* Value
	Mean ± SD		
Age (y)	72.3±11.4	69.6±11.5	.378
BMI (kg/m^2)	28.9±4.9	30.7±6.1	.186
Mini-MoCA	11.61±1.50	12.2±1.4	.131
Pain interference	1.70±1.84	3.07±2.79	.016
SPPB score	9.1±2.25	9.0±2.27	.753
Gait speed (m/s)	0.84±0.13	0.81±0.14	.443
AM-PAC	62.3±5.33	58.6±6.19	.012
PHQ-9	3.86±3.98	7.33±5.91	.005
Phone FITT	39.3±20.1	38.2±30.0	.869
Number of comorbidities	3.8±1.7	4.0±1.91	.680
	n (%)		
Sex (male)	46 (90.2)	16 (76.2)	.143
Race			
White	43 (84.3)	16 (76.2)	.357
Black	7 (13.7)	3 (14.3)	
Other/More than 1 race	1 (2.0)	2 (9.5)	
Marital status (married/living as married)	30 (58.8)	4 (19.1)	.004
Live alone (alone)	12 (23.5)	14 (66.7)	.001
Education			
High school/GED	8 (15.7)	5 (23.8)	.242
Vocational/tech school/some college	21 (41.2)	7 (33.3)	
College	9 (17.7)	7 (33.3)	
Graduate school	13 (25.5)	2 (9.5)	
Health status			
Poor/fair	9 (17.7)	4 (19.1)	.970
Good	26 (51.0)	11 (52.4)	
Very good/excellent	16 (13.4)	6 (28.6)	

Abbreviations: AM-PAC, Activity Measure for Post-Acute Care; BMI, body mass index; Mini-MoCA, Mini Montreal Cognitive Assessment; PHQ-9, Patient Health Questionnaire-9; SPPB, Short Physical Performance Battery.

between EFD status with mobility (*P*<.05), and pain was highly correlated with mobility and depressive symptoms (all *P*<.05, supplemental table S2).

Figure 1 shows enrollment and participation based on EFD status. Overall, 21 (29%) of 72 Veterans dropped out of the LLWS study. Reasons for dropping out after enrollment include loss to follow-up (n=6), medical complications (n=2), problems with transportation or inability to keep appointments (n=2), COVID-19-related health concerns (n=2), COVID-19 study shutdown (n=5), or other (n=4). Those who dropped out of the study reported higher pain interference, greater patient-reported mobility limitation, greater depressive symptoms, were not married, and lived alone (all *P*<.05). There were no differences in age, education, or global cognition between participants that completed the study protocol and those that dropped out (table 2).

Dropout rates were 44% (n=7) among EFD+ and 25% (n=14) among EFD−. In both univariate and multivariable logistic regression models, EFD did not predict the likelihood of dropping out. However, other factors such as pain

Table 3 Multivariable logistic regression evaluating executive function status and additional predictors of dropout status (n=72)

	Model 1 R^2=0.02		Model 2 R^2=0.08		Model 3 R^2=0.11		Model 4 R^2=0.08		Model 5 R^2=0.16	
	OR (SE)	*P* Value	OR (SE)	*P* Value	OR (SE)	*P* Value	OR (SE)	*P* Value	OR (SE)	*P* Value
EFD status*	2.33 (1.38)	.152	2.31 (1.43)	.175	2.43 (1.55)	.164	1.50 (0.95)	.518	2.71 (1.80)	.133
Pain interference			1.32 (0.16)	.024						
PHQ-9					1.16 (0.07)	.011				
AM-PAC							0.89 (0.05)	.036		
Live alone									6.92 (4.06)	.001

NOTE. Models 2-5 include EFD status and 1 additional adjustment variable as independent variables per model.
R^2 calculation: R^2 values are based on McFadden's pseudo R^2.
Abbreviations: AM-PAC, Activity Measure for Post-Acute Care; PHQ-9, Patient Health Questionnaire-9; OR, odds ratio; SE, standard error.
* EFD status (Executive Function Deficit Status): Reference=no deficit.

Table 4 Negative binominal models evaluating compliance among completers (n=51)

	Model 1a: Attendance IRR (95% CI)	Model 1b: Attendance IRR (95% CI)	Model 2a: Post Exercise Participation IRR (95% CI)	Model 2b: Post Exercise Participation IRR (95% CI)
EFD status				
Ref: EFD−	1.01 (0.80-1.28)	1.02 (0.80-1.29)	1.11 (0.85-1.44)	1.09 (0.84-1.43)
Covariates				
Age		1.00 (0.99-1.01)		1.00 (0.99-1.01)
Gender Ref: male		1.03 (0.74-1.43)		0.91 (0.3-1.31)

NOTE. EFD status (reference=no deficit). Univariate negative binominal models evaluating association of EFD status on attendance (model 1a) or post exercise participation (model 2a). Models 1b and 2b further includes adjustment variables (age and gender). Model 2a and 2b include offset variable of total number of reported days.
Abbreviations: CI, confidence interval; EFD, Executive Function Deficit; IRR, incident rate ratio; Ref, reference.

interference, depressive symptoms, patient-reported mobility, and living alone predicted dropouts (table 3). Veterans who did not rejoin the study after the COVID-19 shutdown were included as dropouts in all models. As a sensitivity analysis, excluding these Veterans did not materially alter the findings (overall dropout: 26%, EFD+: 40%, EFD−: 21%).

Among completers, there were no differences in treatment compliance (treatment attendance, total 10 sessions) based on EFD status after adjusting for age and gender (attended sessions: EFD+ mean, 9.4 [SD, 0.2] vs EFD− mean, 9.3 [SD, 0.2]; incident rate ratio, 1.02 [confidence interval, 0.8-1.29]; table 4). Of the 21 dropouts, half (n=11) dropped out before participating in LLWS treatment. The remaining dropouts attended 1 session (n=1), 2 sessions (n=4), 3 sessions (n=1), 4 sessions (n=3), and 5 sessions (n=1). There were no differences in posttreatment exercise compliance based on EFD status adjusting for age and gender (number of exercise days/number of reported days through self-recorded exercise calendars: EFD+, 47.8/57.6; EFD−, 57.6/77.5; incident rate ratio, 1.09 [confidence interval, 0.84-1.43], table 4). There was no evidence to support that EFD was associated with compliance.

Discussion

The major findings of this study demonstrate that Veterans with EFD+ had worse mobility at baseline. We also observed a higher rate of dropout among EFD+ compared to EFD− (44% vs 25%). We deem this nearly 2-fold difference as clinically meaningful but not statistically significant (P>.05). Our overall sample size was small. In addition, a small sample of Veterans with EFD+ limited the statistical power to detect differences. Thus, we were unable to conclude whether there were differences in retention and compliance between EFD status.

In this sample, 22% of Veterans were categorized as EFD+. The prevalence of EFD is not well documented among older adults or older Veterans. One population-based epidemiologic study reported the prevalence of EFD to be around 33% among community-dwelling Hispanic and non-Hispanic White persons of a similar age in rural southern Colorado.[35] In our study, to prevent over-categorization, we used a cutoff of 1.5 SD below the age-adjusted mean to identify impairment and used 2 or more impaired tests as the classification for having EFD+. Thus, the observed rate of EFD+ was clinically substantial. In addition, our findings align with the previous literature demonstrating the strong relationship between executive function and mobility.[36,37] EFD status was highly associated with baseline mobility when measured using performance-based, and patient-reported measures of mobility were considered. These findings suggest that Veterans experiencing EFD exhibit lower baseline mobility levels at the beginning of treatment. Furthermore, we observed sex differences that may be clinically meaningful but were not statistically significant. We had limited statistical power to detect differences among categorical characteristics based on EFD status. Future investigation is warranted to assess the impact of LLWS treatment on Veterans with EFD+ and determine if Veterans with EFD+ require supplementary resources for optimal rehabilitation outcomes.

We observed clinically but not statistically significant differences in dropouts. We did not have an adequate sample size to evaluate this aim. Nonetheless, our results indicate that future studies among EFD+ individuals should consider additional recruitment and retention strategies and revised recruitment projections. Similarly, we did not find evidence of differences in compliance measured by treatment attendance or self-recorded exercise calendars based on EFD status. Attendance for both EFD groups was higher compared to other previous studies that examined physical activity intervention attendance.[38]

Although the study's overall dropouts were high, Veterans who stayed in the study were dedicated to the treatment. Participation in posttreatment exercise was also high among both groups. On average, Veterans reported to be exercising more than 5 days per week. Although there were no differences, it is important to note that Veterans with EFD+ only turned in around 50% of the provided calendar, whereas Veterans without provided 70% of their calendars. This may suggest that we need to explore different ways of recording participation in home exercises instead of using self-recorded exercise calendars, especially for those with EFD+. For example, we may be able to better capture Veterans' exercise routines outside of treatment by using an automated text messaging system which has widespread use in the Veterans Health Administration.[39]

There were noteworthy incidental findings. Dropouts were associated with pain interference, depressive symptoms, mobility, and living alone. Specifically, EFD status and living alone explained 16% of the variance in dropouts. Furthermore, compared to Veterans who lived with someone else, Veterans who lived alone demonstrated increased odds of dropping out by more than 6 times. Living alone was likely representative of their social support. Previous studies have also shown that people with greater social support are more likely to participate in leisure physical activity.[40] Thus, we may need to provide additional support to those who are living alone to improve treatment completion. Moreover, we may need to pay closer attention to Veterans' pain interference and depressive symptoms to improve retention and compliance with PT treatment.

Study limitations

There were potential limitations of this study. First, our overall sample size was small. In addition, there were insufficient numbers of participants with EFD+ to make sufficiently powered statistical inferences. Second, LLWS study was conducted during the COVID-19 pandemic; thus, we faced many challenges that led to protocol modifications. For example, we combined both virtual and in-person cognitive test measures for this study. We were able to use age-adjusted z-scores to determine impairment in executive function; thus, we were able to use both measures. In addition, this study's overall dropout rates were higher than we anticipated based on the non-Veteran and Veteran literature.[41-46] This was in part likely due to the pandemic, with uncertainty, anxiety, and attrition all resulting from COVID-19 pandemic infection rates and consequentially impacting research operations at our medical center. It is important to note that our sensitivity analyses accounting for COVID-related dropouts did not materially alter our findings. However, we cannot discern whether our high dropout rates were due to COVID-19 concerns or the nature of the treatment. Lastly, our analysis was a secondary analysis of a research study, which by its nature provides restrictions on treatment protocol and study variables. The relevance of our findings to the operations of LLWS in clinical care settings should be interpreted with caution. Despite these limitations, the strength of this study is noteworthy. To our knowledge, this study is the first study to evaluate the role executive function status plays in retention and compliance to PT care targeting middle-aged and older Veterans with mobility problems. The information gathered from this study could be used to inform the design of future research protocols and clinical demonstration projects evaluating LLWS or similar programs targeting mobility.

Conclusions

In conclusion, we found that baseline EFD was present among a large percentage of Veterans enrolled in the LLWS study and EFD+ was associated with poor mobility. We found no evidence to support that there were differences in retention or compliance measured by attendance and self-recorded postexercise participation calendars based on EFD status. However, we observed a greater dropout rate among EFD+. Further research is needed to determine whether EFD status may identify individuals who need additional support during and/or after rehabilitation treatment.

Supplier

a. STATA software (Version 18); StataCorp.

Corresponding author

Elisa F. Ogawa, PhD, Research Physiologist, New England GRECC, VA Boston Healthcare System, 150 South Huntington Ave, Jamaica Plain, MA 02130. *E-mail address:* Elisa.Ogawa@va.gov.

Disclosures

There are no conflicts of interest to declare.

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