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RESEARCH ARTICLE

Correlates and predictors of self-efficacy among dementia caregivers: D-CARE findings

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Abstract

INTRODUCTION: Greater dementia caregiver self-efficacy (CSE) may have considerable benefits for persons living with dementia (PLWD). The correlates of CSE have received little study.

METHODS: Secondary analysis of an 18-month randomized pragmatic clinical trial of 2037 community-dwelling PLWD and their caregivers. Baseline and longitudinal analyses were conducted.

RESULTS: In cross-sectional multiple regression analyses of baseline data, several factors were significantly associated with lower CSE, including not living with the PLWD, having higher depression scores, distress from PLWD behavioral symptoms, more caregiver strain, and higher PLWD basic activities of daily living functional status. In longitudinal analyses, CSE increased among those with lower baseline CSE, in women more than men, among caregivers with lower baseline depression scores, and among caregivers of PLWD with worse functioning.

CONCLUSIONS: CSE is associated with modifiable factors and can be improved with comprehensive dementia care interventions, particularly among those with lower baseline CSE.

TRIAL REGISTRATION: ClinicalTrials.gov, NCT03786471, https://clinicaltrials.gov/

KEYWORDS
caregiver self-efficacy, caregiver strain, clinical trials, dementia care, dementia interventions

Highlights

- Living apart from the person living with dementia is associated with lower caregiver self-efficacy (CSE)

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- Some caregiver characteristics associated with CSE are modifiable including higher caregiver depression scores, distress from behavioral symptoms, and strain.
- In D-CARE, health-system-based and community-based dementia care increased CSE
- D-CARE identified caregivers who are in most need of interventions to increase CSE

1 | BACKGROUND

More than seven 7 million Americans living with dementia and their 11.9 million unpaid caregivers need to manage their individual journeys with this disorder.[1] Comprehensive dementia care programs, which include assessment, ongoing care plans, caregiver support, psychosocial interventions, self-management, medication management, treatment of related conditions, coordination of care, and advance care planning,[2–4] aim to improve quality of life for persons living with dementia (PLWD) and reduce caregiver burden and strain. Studies on the effectiveness of these programs on standardized clinical caregiver outcomes (e.g., strain, burden, distress due to PLWD behavioral symptoms, depression) have been mixed despite benefits on utilization, long-term nursing home placement, and overall cost of care.[5–11]

Caregiver self-efficacy (CSE), the belief that one can perform a specific behavior or task, has been measured in dementia care and deemed meaningful.[12,13] Greater dementia caregiver self-efficacy may have considerable benefits including better ability to care for a PLWD in their homes; improved caregiver quality of life[14,15]; less caregiver depression[16,17]; fewer caregiver health problems[18]; decreased health care utilization by the PLWD, including reduced emergency department utilization[18]; and more positive feelings about caregiving.[19,20]

Studies suggest that a minority of dementia caregivers perceive themselves to be efficacious. For example, prior to entering a comprehensive dementia care program, only 19% of caregivers responded that they knew how to get community services to help them provide care; 32% felt confident handling problems such as memory loss, wandering, or behavioral problems related to dementia; and 35% felt confident dealing with the frustrations of caregiving.[13] The lack of self-efficacy and the association of higher self-efficacy with clinically important outcomes suggest that CSE could be an important target for intervention and a possible proximate outcome that could be used to gauge the effectiveness of dementia care programs.

Little is known about factors that influence CSE. In a cross-sectional study that examined the influence of sociodemographic factors on self-efficacy for obtaining respite, CSE varied by race and ethnicity, with Black/African American caregivers having greater self-efficacy than White/Caucasian and Hispanic caregivers. Conversely, being a spouse caregiver and having a larger social network size were associated with lower self-efficacy for obtaining respite.[19]

Prior research suggests that CSE for dementia care may be modifiable through the provision of group or individual psychosocial interventions, including skill-building, information-based education, mood management, and case management.[21] More recently, in the Dementia Care Study (D-CARE) — a randomized, pragmatic trial of comprehensive dementia care — CSE, a secondary outcome, improved in both Health System-Based Dementia Care (HSDC) and Community-Based Dementia Care (CBDC) treatment arms versus usual care.[11] The benefit on CSE occurred early (by 6 months) and persisted for the duration of the 18-month study. However, the characteristics associated with CSE at baseline and whether the interventions equally benefited those with different baseline CSE and other characteristics associated with CSE are unknown. There is some evidence that African American and Caucasian individuals responded to interventions similarly with respect to CSE in a community-based implementation of the REACH II intervention[22] and in D-CARE.[23]

We conducted a secondary analysis of the D-CARE study to better understand baseline characteristics associated with CSE and how these factors, baseline CSE, and D-CARE interventions together affected subsequent CSE. The study aimed to better identify who might benefit from comprehensive dementia care interventions and to provide insight into subgroups of caregivers who may need targeted interventions to improve self-efficacy.

2 | METHODS

2.1 | The D-CARE study trial design, implementation, and oversight

D-CARE was a multisite randomized pragmatic clinical trial of health-system-based dementia care, community-based dementia care, and usual care for PLWD and their unpaid family caregivers. Details of the study have been reported including organization structure, design,[24] recruitment,[25] interventions, and primary, secondary and tertiary outcomes.[11,26] D-CARE recruited participants from June 2019 to January 2022, and all final follow-up assessments were completed by August 2023. The trial was overseen by a Study Advisory Committee and a Data and Safety Monitoring Board; the protocol was approved by the central institutional review board at UCLA; the study was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments.

2.2 | Participants

D-CARE enrolled PLWD–caregiver dyads into the study. PLWD needed a clinician's diagnosis of dementia and a primary care or referring

RESEARCH IN CONTEXT

1. **Systematic review**: Previous research has demonstrated that greater dementia caregiver self-efficacy (CSE) may have considerable benefits including better ability to care for persons living with dementia (PLWD) in their homes, improved caregiver quality of life, and reduced health care utilization by the PLWD.
2. **Interpretation**: In the D-CARE study, we identified modifiable baseline caregiver characteristics that were associated with lower caregiver self-efficacy, including not living with the PLWD, more distress from the PLWD's behaviors, more depressive symptoms, and better PLWD basic activities of daily living functional status.
3. **Future directions**: Future studies will need to determine whether interventions can be developed to specifically target factors associated with low caregiver self-efficacy and whether addressing these has comparable outcomes to other more comprehensive dementia care and caregiver support programs.

provider who was willing to partner with the study. Caregivers needed to be family or friends who spoke English or Spanish and had a phone. PLWD were excluded if they resided in a nursing home, were enrolled in hospice, planned to move out of the area within the next year, or had a primary caregiver who was paid, had cognitive impairment, or was unwilling or unable to provide self-reported outcome measures for 18 months. A full list of inclusion and exclusionary criteria has been reported.[24]

3 | RECRUITMENT AND ENROLLMENT

Screening and recruitment were facilitated by common strategies used across the four clinical trial sites: Atrium Health Wake Forest Baptist, Baylor Scott & White Health, Geisinger Health, and University of Texas Medical Branch.[25] At the time of enrollment, all caregivers were consented and PLWD who scored 17 or above on the full Montreal Cognitive Assessment (MoCA) were considered capable of consenting[27] and provided written or verbal consent. PLWD who scored < 8 on a shortened[28] or < 17 on the full MoCA[29] had proxy consent provided by a family caregiver or Legally Authorized Representative, with verbal assent provided by the person living with dementia.

4 | INTERVENTIONS

All enrolled participants were given information on existing local community and health care services, including the phone number of the Alzheimer's Association Helpline (1-800-272-3900), which caregivers and PLWD could call, as needed, to speak with master's level consultants for decision-making support, crisis assistance, and education.

HSDC – Based on the UCLA Alzheimer's and Dementia Care program,[30] comprehensive dementia care was delivered by a nurse practitioner or physician assistant Dementia Care Specialist who worked within the health system to tailor and provide coordinated dementia care in collaboration with the partnering clinician (co-management). The Dementia Care Specialist could write orders, communicate directly through the electronic health record, and facilitate clinical care. The Dementia Care Specialist could also refer the caregiver to community-based organizations for care services not provided by the health system.

CBDC – Using the Benjamin Rose Institute Care Consultation ™ model,[31] comprehensive dementia care was delivered by a social worker, nurse, or licensed therapist certified as a Benjamin Rose Institute Care Consultant who worked within a community-based organization in partnership with a D-CARE clinical site. Throughout the study, all interactions between the Care Consultant and the PLWD and family caregiver were telephonic. Benjamin Rose Institute Care Consultation™ has three main components: (1) Action Plan, (2) Initial and re-assessment, and (3) Ongoing monitoring.

Usual Care – Usual Care participants were given no personalized dementia care treatments.

5 | STUDY OUTCOME

Caregiver self-efficacy (CSE) was measured at baseline, 6, and 18 months using a four-item scale (range 4–20, higher scores indicate more self-efficacy)[12,13] that asked caregivers to rate the following statements from "strongly disagree" (1) to "strongly agree" (5):

1. I know how to get community services that will help me provide care.
2. I feel confident that I can handle problems like the patient's memory loss, wandering, or behavior problems.
3. I feel confident that I can deal with the frustrations of caregiving.
4. I know where to turn to get answers to questions about problems like the patient's memory loss, wandering, or behavior problems.

6 | INDEPENDENT VARIABLES

Caregiver sociodemographic characteristics that were examined for associations with baseline CSE included caregiver age and categorical factors indicating sex, marital status, relationship to PLWD, living with PLWD, self-reported racial and ethnic status, and education. We also included scores on three caregiver self-reported instruments: Modified Caregiver Strain Index (MCSI)[32] (range 0-26, higher scores indicate greater strain); distress in response to Neuropsychiatric Inventory Questionnaire (NPI-Q) symptoms (range 0-60, fewest to most distress)[33] and depressive symptoms (Patient Health Questionnaire-8 [PHQ-8]),[34] (range 0-24, fewest to most symptoms).

Baseline PLWD factors included a shortened 3-item form[28] (range 0-12, higher scores indicate better cognitive function) of the telephone-administered MoCA,[29] the Functional Activity Questionnaire (FAQ)[35] (range 0-30, higher scores indicate worse function), the Katz Index of Activities of Daily Living[36] (range 0-6, higher score indicate more independent function), and the NPI-Q Severity scale[33] (range 0-36, higher scores indicate more severe behavioral symptoms). In longitudinal models, these caregivers and PLWD baseline sociodemographic and clinical factors were included, as well as baseline CSE and intervention arm.

7 | STATISTICAL METHODS

We conducted a set of cross-sectional and longitudinal analyses. The cross-sectional analyses evaluated the associations between caregiver and PLWD factors and baseline CSE. Baseline data were collected prior to randomization; participants in all 3 arms were combined for this analysis. Because a clinically meaningful threshold for high versus low CSE scores has not been identified, we used linear regression analyses to evaluate the bivariate associations between each independent variable and CSE; we also examined simple and partial correlations (adjusting for other continuous variables) of the continuous variables with CSE. We then conducted a multiple regression analysis to identify which caregiver and PLWD factors were independently associated with CSE. Because the NPI-Q Severity and Distress scales were correlated at 0.89 (eTable 1), we opted to include only the caregiver Distress scale in multivariate analyses. In preliminary analyses, MoCA scores were not significantly associated with CSE and had a high percentage of missing data; accordingly, MoCA was excluded from the multivariate analyses. The multiple regression model also included pre-specified two-way interactions among caregiver sex, relationship to PLWD, and self-reported race/ethnicity. Finally, we calculated R^2 to determine the proportion of variance in CSE that could be explained by the model.

In the longitudinal analysis using 6- and 18-month follow-up CSE data, we used a mixed effects repeated-measures multiple regression model to evaluate the associations between baseline sociodemographic and clinical factors, baseline CSE, and intervention arm and CSE at follow-up (6- and 18-month assessments). This model also included clinical trial site, and assessment time-point was treated as a categorical factor. Baseline CSE was allowed to interact with treatment group.

Note that when the PLWD passes, their caregiver is no longer a caregiver, and CSE becomes undefined rather than missing from a statistical perspective. Similar logic applies to the baseline caregiver if the PLWD changes caregivers during follow-up. Thus, our data in these cases are complete over the period where the baseline caregiver was still acting in that role. In all analyses, *p*-values for pairwise comparisons between levels of categorical factors (with > 2 levels) were adjusted using the Hochberg procedure[37] to maintain an overall Type I error of 0.05 (two-tailed) across comparisons within each factor.

8 | RESULTS

Of the 2176 persons living with dementia/caregiver dyads, 1016 were randomized to each treatment group and 144 to Usual Care; 514 (23.6%) died during follow-up and 191 (8.8%) withdrew from the study. At baseline, 2037 (93.6%) of the sample had no missing data on any of the variables except for the MoCA, which had 27% missing data, primarily due to telephone administration during the coronavirus disease 2019 (COVID-19) pandemic[38]; there were also 10 dyads missing only NPI-Q Severity at baseline, increasing the complete baseline cohort to 2047 (94.1%) once NPI-Q Severity was dropped from the multivariable analyses. Baseline characteristics of the complete sample are provided in Table 1 and were similar across treatment groups. CSE distribution did not indicate a floor or ceiling effect, median (interquartile range [IQR]) 13.0 (11.0-16.0) on a 4 - 20 scale.

We first examined baseline cross-sectional associations of sociodemographic and clinical characteristics with CSE. These are presented in Table 2 (regressions) and eTable 2 (correlations); means for levels of categorical factors are presented in eTable 3. In bivariate analyses of baseline caregiver characteristics, the following were associated with lower CSE: younger caregiver age; female sex, relationship to PLWD (children compared to spouse/partner), as well as the potentially modifiable factors, not living with the PLWD, and higher PHQ-8, NPI-Q Distress, and MCSI scores. Baseline PLWD characteristics associated with lower CSE included higher FAQ and NPI-Q Severity scores. In the multiple regression model, baseline caregiver characteristics significantly associated with lower CSE included: not living with the PLWD, higher PHQ-8, NPI-Q Distress, and MCSI scores as well as higher baseline PLWD ADL scores. The multiple regression model had a total R^2 of 0.18, with the largest increment contributors being PHQ-8 and MCSI (each contributing a 0.02 increment), NPI-Q Distress and ADL (each contributing 0.01), and not living with PLWD (contributing 0.006). No significant 2-way interactions were identified.

We next examined the effects of sociodemographic and clinical characteristics, as well as the effects of the interventions on CSE over time. In longitudinal analyses, no interactions with assessment time-point were significant (all Ps > 0.37), so overall results (mean of least squares mean changes at 6- and 18-months) are presented (Table 3; raw and least squares mean changes by time are presented in eTable 4). Caregiver education, race, and ethnicity were not significantly associated with changes in CSE. Baseline CSE was inversely associated with changes in CSE. Women and those with lower baseline PHQ-8 and PLWD ADL scores and higher (worse functioning) baseline PLWD FAQ scores showed greater increases in CSE. In the multiple regression model, CSE increased more in both interventions than in usual care, and CBDC was more effective than HSDC in increasing CSE. The interaction of baseline CSE and intervention group was significant ($p = 0.047$) and baseline CSE was inversely associated with subsequent CSE in each treatment group (i.e., those with lower baseline CSE improved more) (Table 4). While the effect appears less pronounced in usual care, none of the differences of differences were statistically significant after adjusting for three pairwise comparisons.

TABLE 1 Baseline characteristics of D-CARE caregivers and persons living with dementia.

Parameter	Cohort [analysis]		
Characteristic	Non-missing baseline CSE [baseline CSE; simple regressions] (*N* = 2165)	Complete baseline* [baseline CSE; multiple regression] (*N* = 2047)	Complete baseline* with follow-up† [change from baseline CSE; multiple regression] (*N* = 1681)
Caregiver factors			
Age, mean (SD); years	65.2 (12.3)	65.1 (12.2)	65.2 (12.1)
Women	1642 (75.8)	1553 (75.9)	1279 (76.1)
Race/ethnicity			
Black	252/2163 (11.7)	237/2046 (11.6)	191/1680 (11.4)
Hispanic	204/2163 (9.4)	191 (9.3)	158 (9.4)
non-Latino White	1665/2164 (76.9)	1582 (77.3)	1304 (77.6)
Education			
Less than high school graduate	68 (3.1)	66 (3.2)	47 (2.8)
High school graduate or GED	354 (16.4)	331 (16.2)	258 (15.3)
Some college	645 (29.8)	608 (29.7)	499 (29.7)
College graduate	671 (31.0)	636 (31.1)	528 (31.4)
Graduate or professional degree	427 (19.7)	406 (19.8)	349 (20.8)
Relationship to PLWD			
Child	1060 (49.0)	1005 (49.1)	807 (48.0)
Spouse or partner	977 (45.1)	925 (45.2)	781 (46.5)
Living with PLWD	1579/2164 (73.0)	1502 (73.4)	1232 (73.3)
NPI-Q Distress, median (IQR) [N]	11.0 (5.0-19.0) [2118]	11.0 (5.0-19.0)	11.0 (4.0-18.0)
PHQ-8, median (IQR) [N]	3.0 (1.0-7.0) [2152]	3.0 (1.0-7.0)	3.0 (1.0-7.0)
MCSI, median (IQR) [N]	10.0 (6.0-15.0) [2142]	10.0 (6.0-15.0)	10.0 (6.0-15.0)
CSE, median (IQR)	13.0 (11.0-16.0)	13.0 (11.0-16.0)	13.0 (11.0-16.0)
PLWD factors			
Age, mean (SD); years	80.6 (8.5)	80.6 (8.5)	80.3 (8.6)
Women	1266 (58.5)	1192 (58.2)	963 (57.3)
FAQ, median (IQR) [N]	23.0 (17.0-27.0) [2129]	23.0 (17.0-27.0)	23.0 (16.0-27.0)
ADL, median (IQR) [N]	5.0 (3.0-6.0) [2156]	5.0 (3.0-6.0)	5.0 (4.0-6.0)
NPI-Q Severity, median (IQR) [N]	9.0 (5.0-15.0) [2112]	9.0 (5.0-14.0) [2037]	9.0 (4.0-14.0) [1674]
MoCA, median (IQR) [N]	3.0 (2.0-6.0) [1591]	3.0 (2.0-6.0) [1501]	3.0 (2.0-6.0) [1251]

Note: Values are *n*/*n* (%) unless otherwise noted, with *n* omitted if the characteristic has no missing data in the cohort.
*No missing data for factors in the multiple regression models
†Non-missing CSE at 6 and/or 18 months.

9 | DISCUSSION

In this large, pragmatic trial, we identified modifiable factors (including living arrangement, severity of caregiver distress in response to PLWD behavioral symptoms, caregiver depression symptoms, and caregiver strain) that were associated with lower baseline CSE prior to receiving comprehensive dementia care. The unexpected association of higher basic activities of daily living functional status with lower CSE may reflect that, at the time of recruitment, PLWD may have been earlier in the dementia journey when caregivers were newer to the experience of caregiving. This is supported by the finding that CSE increased more over time among those caring for PLWD with poorer functional status. Caregivers may have gained confidence by providing care over 18 months.

Although these factors remained significant in multivariable models, the total contribution of examined factors explained only 18% of the variance. For clinical and social sciences research, this may be considered meaningful.[39,40] However, none of the individual factors contributed more than 2% of the variance suggesting that other unmeasured biological, cultural, and social contributors are also important for CSE. For example, inherent resiliency among caregivers, sharing problems and solutions in support groups, and learning by experience may have contributed.

TABLE 2 Differences in baseline CSE associated with caregiver and PLWD factors.

Parameter		Simple regression			Multiple regression $N = 2047$	
Factor	**Comparison**	**Observations**	**Effect (CI*)**	***p*-value†**	**Effect (CI*)**	***p*-value†**
Caregiver factors						
Age	+1 year of age at baseline	2165	0.02 (0.01 – 0.03)	0.002	−0.01 (−0.02 – 0.01)	0.33
Relationship to PLWD	*Omnibus (2 df)*	2165		*0.018*		0.51
	Other vs Spouse/Partner		0.23 (−0.51 – 0.96)	0.46	0.61 (−1.08 – 2.31)	0.65
	Other vs Child		0.58 (−0.15 – 1.32)	0.11	0.77 (−0.86 – 2.40)	0.65
	Spouse/Partner vs Child		*0.36 (0.01 – 0.70)*	*0.040*	0.15 (−0.66 – 0.97)	0.65
Sex	*Male vs Female*	2165	*0.51 (0.19 – 0.83)*	*0.002*	−0.26 (−1.05 – 0.53)	0.52
Living with PLWD?	***Yes vs No***	2164	*0.46 (0.15 – 0.77)*	*0.004*	**0.70 (0.35 – 1.06)**	**<0.001**
PHQ-8	***+1 point of baseline PHQ-8***	2152	*−0.23 (−0.25 −0.20)*	*<0.001*	**−0.12 (−0.16 −0.09)**	**<0.001**
Race/ethnicity	Omnibus (3 df)	2164		0.062		0.31
	Latino vs Other		0.35 (−1.03 – 1.73)	>0.99	−0.59 (−2.90 – 1.72)	0.87
	Latino vs non-Latino Black		0.00 (−0.81 – 0.81)	>0.99	−0.46 (−1.76 – 0.85)	0.87
	Latino vs non-Latino White		0.47 (−0.17 – 1.11)	0.26	0.12 (−0.99 – 1.22)	0.87
	Other vs non-Latino Black		−0.35 (−1.71 – 1.01)	>0.99	0.13 (−2.08 – 2.34)	0.87
	Other vs non-Latino White		0.12 (−1.14 – 1.38)	>0.99	0.70 (−1.39 – 2.80)	0.87
	non-Latino Black vs non-Latino White		0.47 (−0.12 – 1.06)	0.21	0.57 (−0.30 – 1.44)	0.50
Education	Omnibus (4 df)	2165		0.39		0.12
	< HS grad vs College grad		0.62 (−0.55 – 1.79)	0.80	0.62 (−0.48 – 1.73)	0.74
	< HS grad vs HS grad/GED		0.67 (−0.54 – 1.89)	0.80	0.86 (−0.28 – 1.99)	0.30
	< HS grad vs Some college		0.39 (−0.77 – 1.56)	0.80	0.41 (−0.68 – 1.51)	0.74
	< HS grad vs Grad/prof degree		0.49 (−0.71 – 1.69)	0.80	0.56 (−0.57 – 1.70)	0.74
	College grad vs HS grad/GED		0.06 (−0.55 – 0.66)	0.80	0.23 (−0.34 – 0.81)	0.74
	College grad vs Some college		−0.23 (−0.73 – 0.28)	0.80	−0.21 (−0.69 – 0.27)	0.74
	College grad vs Grad/prof degree		−0.13 (−0.70 – 0.44)	0.80	−0.06 (−0.59 – 0.47)	0.74
	HS grad/GED vs Some college		−0.28 (−0.89 – 0.33)	0.80	−0.44 (−1.02 – 0.13)	0.30
	HS grad/GED vs Grad/prof degree		−0.18 (−0.84 – 0.47)	0.80	−0.29 (−0.93 – 0.34)	0.74
	Some college vs Grad/prof degree		0.10 (−0.48 – 0.67)	0.80	0.15 (−0.40 – 0.70)	0.74
NPI-Q Distress	***+1 point of baseline NPI-Q Distress***	2118	*−0.10 (−0.12 −0.09)*	*<0.001*	**−0.04 (−0.06 −0.03)**	**<0.001**
MCSI	***+1 point of baseline MCSI***	2142	*−0.18 (−0.20 −0.16)*	*<0.001*	**−0.11 (−0.14 −0.08)**	**<0.001**
PLWD factors						
FAQ	*+1 point of baseline FAQ*	2129	*−0.04 (−0.06 −0.02)*	*<0.001*	0.01 (−0.01 – 0.03)	0.46
ADL	**+1 point of baseline ADL**	2156	−0.02 (−0.10 – 0.05)	0.59	**−0.20 (−0.28 −0.11)**	**<0.001**
NPI-Q Severity	*+1 point of baseline NPI-Q Severity*	2112	*−0.11 (−0.13 −0.09)*	*<0.001*		

Note: Italic: $p < 0.05$ in simple regression. **Bold**: $p < 0.05$ in multiple regression ***Bold and italic***: $p < 0.05$ in simple and multiple regression.
* CIs are 95% for continuous and binary factors, 98.33% within relationship to PLWD, 99.17% within race/ethnicity, and 99.5% within education.
† *p*-Values for comparisons of levels within factors are Hochberg-corrected.

In longitudinal analyses, we found that female sex, baseline CSE, caregiver depressive symptoms, worse PLWD basic and instrumental activities of daily living functional status, and treatment group assignment were associated with subsequent CSE. Moreover, those with lower baseline CSE demonstrated more improvement as a result of the D-CARE interventions. From the perspective of Social Cognitive Theory,[41] these interventions likely provided the necessary structure for enactive mastery by offering dementia-specific problem-solving strategies and opportunities to practice caregiving tasks in a supportive environment. As caregivers applied these skills, they could build their perceived capacity and reinforce their belief in their ability to manage complex care scenarios. Although the differences were modest, CSE improved more among participants receiving CBDC. This may have been because the CBDC Care Consultants primarily interacted with caregivers and followed detailed protocols for assessment and Action Steps. Additionally, delivery of the CBDC by telephone

TABLE 3 Multiply adjusted effects of caregiver and PLWD factors and treatment group on overall change* from baseline CSE.

Factor	Comparison	Effect (CI†)	*p*-value‡
Caregiver factors			
Baseline CSE	**+1 point of baseline CSE**	**−0.60 (−0.66 −0.54)**	**<0.001**
Age	+1 year of age at baseline	−0.01 (−0.02 – 0.00)	0.13
Relationship to PLWD	Omnibus (2 df)		0.82
	Other vs Spouse/Partner	−0.01 (−0.68 – 0.66)	0.98
	Other vs Child	−0.10 (−0.70 – 0.49)	0.98
	Spouse/Partner vs Child	−0.09 (−0.51 – 0.32)	0.98
Sex	**Male vs Female**	**−0.29 (−0.53 −0.05)**	**0.017**
Living with PLWD?	Yes vs No	0.25 (−0.04 – 0.54)	0.093
PHQ-8	**+1 point of baseline PHQ-8**	**−0.05 (−0.08 −0.02)**	**0.002**
Race/ethnicity	Omnibus (3 df)		0.29
	Other vs Latino	−0.73 (−2.00 – 0.53)	0.63
	Other vs non-Latino Black	−0.41 (−1.63 – 0.81)	0.79
	Other vs non-Latino White	−0.37 (−1.53 – 0.79)	0.79
	Latino vs non-Latino Black	0.32 (−0.34 – 0.98)	0.79
	Latino vs non-Latino White	0.36 (−0.20 – 0.92)	0.53
	non-Latino Black vs non-Latino White	0.04 (−0.44 – 0.51)	0.84
Education	Omnibus (4 df)		0.085
	< HS grad vs HS grad/GRE	−1.07 (−2.16 – 0.02)	0.060
	< HS grad vs Some college	−0.86 (−1.93 – 0.21)	0.19
	< HS grad vs College grad	−0.85 (−1.92 – 0.23)	0.19
	< HS grad vs Grad/prof degree	−0.93 (−2.02 – 0.16)	0.15
	HS grad/GRE vs Some college	0.21 (−0.27 – 0.68)	0.92
	HS grad/GRE vs College grad	0.22 (−0.25 – 0.69)	0.92
	HS grad/GRE vs Grad/prof degree	0.14 (−0.38 – 0.65)	0.92
	Some college vs College grad	0.01 (−0.37 – 0.40)	0.92
	Some college vs Grad/prof degree	−0.07 (−0.51 – 0.37)	0.92
	College grad vs Grad/prof degree	−0.08 (−0.49 – 0.33)	0.92
NPI-Q Distress	+1 point of baseline NPI-Q Distress	−0.01 (−0.03 – 0.00)	0.16
MCSI	+1 point of baseline MCSI	−0.02 (−0.05 – 0.01)	0.21
PLWD factors			
FAQ	**+1 point of baseline FAQ**	**0.02 (0.00 – 0.04)**	**0.018**
ADL	**+1 point of baseline ADL**	**−0.07 (−0.14 −0.00)**	**0.049**
Intervention			
Treatment group	**Omnibus (2 df)**		**<0.001**
	HSDC vs CBDC	**−0.22 (−0.48 – 0.04)**	**0.042**
	HSDC vs UC	**0.76 (0.17 – 1.35)**	**0.004**
	CBDC vs UC	**0.98 (0.39 – 1.57)**	**<0.001**

Note: Multiple regression analysis includes 1681 dyads with all baseline factors and at least CSE score during follow-up. Model was also adjusted for clinical trial site. **Bold**: $p < 0.05$.

*Average of LSMean differences in changes from baseline at 6 and 18 months.

†CIs are 95% for continuous and binary factors, 98.33% within relationship to PLWD, 99.17% within race/ethnicity, and 99.5% within education.

‡ *p*-values for comparisons of levels within factors are Hochberg-corrected.

TABLE 4 Effects of baseline CSE on subsequent change in CSE within and between treatment groups.

Treatment group(s)	LSMean* (98.33% CI)	Corrected† *p-value*
Effects of +1 baseline CSE on CSE changes within treatment groups		
HSDC	−0.64 (−0.71–0.57)	<0.001
CBDC	−0.68 (−0.75–0.62)	<0.001
UC	−0.49 (−0.68–0.29)	<0.001
Effects of +1 baseline CSE on differences in CSE changes between treatment groups		
HSDC-CBDC	0.04 (−0.04–0.13)	0.22
HSDC-UC	−0.15 (−0.36–0.05)	0.14
CBDC-UC	−0.20 (−0.40–0.00)	0.055

Note: Multiple regression analysis includes 1681 dyads with all baseline factors and at least CSE score during follow-up.

>* Model was also adjusted for clinical trial site, relationship to PLWD, sex, living with PLWD, race/ethnicity, education, and baseline CSE, age, PHQ-8, NPI-Q Distress, MCSI, FAQ, and ADL.

†p-values for changes within treatment groups and for differences between treatment groups are Hochberg-corrected.

mitigated logistical barriers, such as cost and transportation, likely enabling more consistent participation and engagement with support services. CBDC's protocolized Action Steps, each with an expected completion date and person responsible for completing it, possibly led to more frequent contact by the Care Consultants and thus more caregiver coaching opportunities.

The clinical significance of the observed changes in CSE is uncertain. Although previous studies have shown relationships between CSE and improved caregiver quality of life[19,20]; fewer caregiver health problems[18]; less caregiver depression[21,22]; decreased health care utilization of the PLWD, including reduced Emergency Department utilization[23]; and more positive feelings about caregiving,[24,25] many of these studies[14,17,19,20] were cross sectional and did not examine change in CSE. In a validation study of an 8-item scale of caregiver self-efficacy of caregivers (mean age 65.4 years) who mostly cared for parents (49.1%) and spouses (31.4%), CSE was sensitive to change following an intervention and change was associated with change in caregiver strain and depressive symptoms.[42] Further research will be needed to clarify CSE as a proximal outcome measure for other later-occurring common clinical and utilization outcomes. Future studies should determine what amount of change in CSE would represent a clinically meaningful difference and whether CSE is a mediator through which interventions confer clinical benefit.

Strengths and limitations of this study should be recognized. Because baseline data were collected prior to randomization, the sample was large, permitting analysis of multiple factors. The CSE instrument used did not have a floor or ceiling effect and was responsive to the D-CARE interventions.[11] However, the study sample consisted of participants in a randomized clinical trial who may differ from the general population of PLWD. Nevertheless, D-CARE participants' sociodemographic characteristics were similar to the national population of PLWD and their caregivers.[26] Additionally, cut-points for high and low CSE and the minimal clinically important difference for this scale have not been determined. Finally, although some evidence supports an association between higher CSE and lower Emergency Department utilization,[18] the downstream clinical and utilization benefits of improving CSE have yet to be comprehensively demonstrated.

In conclusion, the D-CARE study identified factors that contribute to CSE for caregivers of PLWD. Subgroups of caregivers, including those who, at baseline, are not living with PLWD or have more depression symptoms, distress due to PLWD behavioral symptoms, or strain are more likely to have low CSE. Moreover, female caregivers, those with lower baseline CSE and more depression symptoms, and whose PLWD had worse baseline functional status showed greater improvement in CSE. These subgroups of caregivers should be targets for specific interventions to increase CSE, including comprehensive dementia care using the interventions tested in D-CARE.

Further analyses of the impact of CSE on utilization outcomes (e.g., use of hospice and long-term nursing home placement) are in process and will help clarify the importance of CSE.

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CONFLICT OF INTEREST STATEMENT

The collaborative work on this manuscript was completed by study investigators and staff who receive salaries and benefits from these funders. Dr. Jennings reports being a member of the Medical and Scientific Advisory Group for the Alzheimer's Association and receives no payment for this role. Dr. Mia Yang is on the editorial board for Journal of Alzheimer's and Dementia: Behavioral and Socioeconomics of Aging (BSEA). The remaining co-authors of this manuscript declare that there are no conflicts of interest. Author disclosures are available in the Supporting Information.

CONSENT STATEMENT

All human subjects provided informed consent to participate in the study.

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SUPPORTING INFORMATION

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

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