




Individual and Program Characteristics May Drive Variability in Outcomes After Caregivers Participate in a Tailored Support Intervention

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Abstract

Critically needed programs designed to support family caregivers have shown inconsistent reductions in stress and burden. To explore drivers of improvement in caregiver outcomes after participation in a support intervention we analyzed data from a one-on-one, tailored problem-solving intervention targeting caregiver wellbeing (2015–2019, $n = 503$). We explored data patterns across 21 individual, household, and program-level variables using elastic net regression to identify drivers of improvements, and their relative importance. Baseline subjective burden, baseline depressive symptom scores, baseline caregiver problem solving, African American race, and site and coach fixed effects were the most consistent drivers of changes across the explored caregiver outcomes. Caregiver and program characteristics may be promising avenues to target to decrease distress and burden during intervention design. Interventions focusing on highly distressed caregivers may lead to greater improvements. More research is needed to identify how site or interventionists characteristics drive positive intervention effects.

Keywords

caregiving, veterans, health outcomes, intervention, depression, machine learning, burden, problem solving

What this papers adds

- This study is different from past research in that it explores multi-level drivers of intervention-related outcomes on changes in caregiver wellbeing to provide a broad view of how to improve the effectiveness of caregiver support interventions.
- This study focuses on caregivers of Veterans, a large population of caregivers in the US.

Application of study findings

- This exploratory study generates hypotheses about which drivers at the caregiver, household, and intervention design level may be more likely to influence the success of caregiver support interventions.
- Future studies can test these hypotheses and use results to refine program design and implementation and to tailor cultural appropriate interventions.

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Introduction

As of 2014 there were 18 million family members and friends—otherwise known as family caregivers—providing care for adults with physical, cognitive, and mental health disabilities (Freedman & Spillman, 2014). Caregiving can lead to negative impacts on the caregiver, including health strain, emotional distress, and financial burden due to work disruptions (Lai, 2012). These negative caregiver impacts have the potential to lead to poor outcomes for the care recipient (Kuzuya et al., 2011). However, there is a policy shift towards de-institutionalization in the United States for aging and mental health-related conditions (Runcan, 2012; Yohanna, 2013). Society depends on family caregivers to provide a substantial portion of home and community-based care. However, there is a need to balance the benefits of de-institutionalization with the needs of uncompensated family members and friends who are charged with providing home-based care. Therefore, implementing effective caregiver support interventions is a social and public health imperative.

To date, the majority of the evidence about caregiver support interventions has focused on dementia caregivers and demonstrate small, but positive benefits for caregivers (Gitlin et al., 2016). However, the success of caregiver support interventions for non-dementia caregivers (e.g., caregivers of frail older adults and individuals with chronic conditions, cancer, traumatic brain injury, and mental illness) has been mixed across multiple systematic reviews (Griffin et al., 2013; Lopez-Hartmann et al., 2012; M. E. ; Shepherd-Banigan et al., 2018) (Aksoydan et al., 2019; Corry, et al., 2015). The non-dementia caregiver interventions reviewed in these studies applied a range of approaches to support caregivers, including psychoeducation, skills training, information, resource navigation, social support, psychosocial support (e.g., counseling and stress coping), and problem

solving. These interventions demonstrate minimal, if any, improvement in caregiver burden, stress, and quality of life.

Family caregiving for non-dementia conditions, including chronic pain, traumatic brain injury, and mental illness (specifically PTSD), is highly relevant for the U.S. Veteran population (Shepherd-Banigan, Sherman, et al., 2020b; Van Houtven et al., 2019). Caregiving for Veterans is also a significant public health issue. There are an estimated 5.5 million family caregivers caring for military personnel who require care due to service-related injuries or illnesses. Studies have shown the negative impacts of caregiving on caregiver health and economic status (Ramchand et al., 2014). An estimated 1.1 million caregivers care for Veterans who served in the recent conflicts in Iraq and Afghanistan. These caregivers tend to be younger, managing family and work responsibilities, and to be caring for their spouse (Ramchand et al., 2014). Veteran care recipients are more likely to have a mental illness, a substance use disorder, traumatic brain injury, or chronic pain (Ramchand et al., 2014). As caregiving for Veterans can begin earlier in life, caregiving for Veterans may last for decades and leads to worse physical and mental health outcomes for the caregiver, more family conflict, and higher perceived financial strain (Miller et al., 2019; Ramchand et al., 2014). While these caregivers report providing less help with activities of daily living, they provide their care recipients with more support to deal with stressful situations (Ramchand et al., 2014) and to navigate their health care (Shepherd-Banigan, et al. 2020c). These caregivers have access to Veteran-specific skills training, counseling, and education resources through Veteran Services Organizations, such as the Wounded Warrior Project, Vet Centers, Easter Seals, Operation Homefront, and the Rosalynn Carter Institute for Caregivers. The Department of Veterans Affairs has also scaled up the largest caregiver support program in the US that offers a menu of services

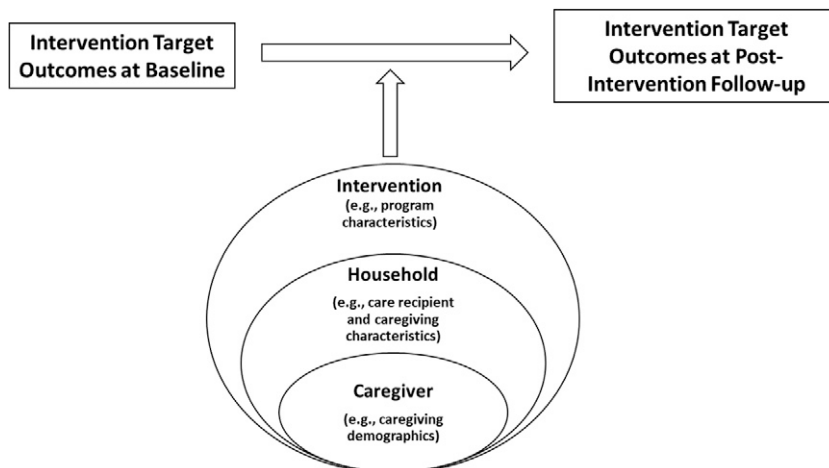


Figure 1. Conceptual Model of Potential Drivers of Outcome Change Scores.

to eligible Veterans and caregivers, including peer support, a crisis line for caregivers, self-care classes, skills building, mental health care, respite, and stipends (Sperber et al., 2018).

Despite these resources, caregiving for Veterans is complex and these caregivers still experience substantial stress and burden (Miller et al., 2019). The effectiveness of caregiver support programs may depend on multiple factors, such as caregiver burden or care recipient condition, that influence how the caregiver is able to engage in the intervention. Targeting interventions to specific caregiver or care recipient factors could optimize intervention-related outcomes. Furthermore, given the inconsistency of findings about the impact of caregiver support interventions on key outcomes for younger caregivers of military Veterans, more evidence is needed to improve the success of these interventions. The aim of this study is to explore drivers of intervention-related outcomes at three levels—caregiver, care-recipient, and intervention—on changes in caregiver mental health and wellbeing outcomes. This study is exploratory as there is no prior theory or evidence to suggest which level or which specific characteristics would be the strongest drivers of intervention-related changes in caregiver outcomes. The selection of drivers to compare is informed by a conceptual framework rooted in the ecological model (Figure 1) (Golden & Earp, 2012). This framework suggests that changes in outcomes from pre- to post-intervention may be influenced by factors at various levels, including caregiver, care recipient and household, and intervention characteristics. Examples of potential caregiver characteristics include caregiver demographic factors, health, and level of subjective burden. Care recipient and household factors might include intensity of caregiving, caregiving tasks, the relationship between the caregiver and care recipient, the care recipient demographic characteristics and health status, household finances, and the presence of children in the household. Intervention characteristics can include intervention duration, content, and mode of delivery.

Description of Operation Family Caregiver

Operation Family Caregiver (OFC) is a program administered by the Rosalynn Carter Institute for Caregivers (RCI) to improve military caregivers' well-being, especially in the domains of depressive symptoms, caregiver subjective burden and problem solving. Based on problem solving theory (PST), coaches work one-on-one with caregivers to decrease subjective burden, distress, and health symptoms, and increase coping skills with problem solving, positive problem orientation, and emotional mindfulness. Coaches, who are selected for their familiarity with military culture and have been trained in PST methods, meet individually with the caregivers for eight individual-level sessions over 16–24 weeks, virtually or

in-person. Initial sessions focus on having the caregiver identify their specific problems around caregiving, set goals for those problems, and role-play scenarios to develop problem-solving skills. Later sessions track progress, adapt solutions as needed, and deliver content about other topics, such as safety planning, suicide awareness and prevention, self-care, and information on caregiving-related support services.

Methods

Study design and participants

We conducted a secondary analysis of data collected as part of the OFC program. Using a cohort of caregivers from 2015–2019, we examined baseline characteristics associated with improvements in caregiver psychosocial outcomes following program participation.

To participate in OFC, family caregivers must be English speaking adults providing care to a veteran or military service member due to a traumatic brain injury, post-traumatic stress, or physical disability. After providing informed consent, caregivers completed a baseline assessment; after finishing at least 70% of the program, they also took a follow up assessment. Both baseline and follow up assessments were administered by OFC coaches as part of the program. Of the 1028 participants who began the baseline assessment, 36 were removed because they did not provide any outcome data; of the remaining 992, 503 took the follow-up assessment (51%) and were categorized as “completers.” We restricted our analysis to these 503 completers, except for the attrition assessment that included all 992 with caregiver values at baseline.

Measures

Outcomes. Data from baseline and post-intervention outcome surveys were used for this study. Outcomes included depressive symptoms, subjective burden, and problem solving. We calculated “change scores” for these outcomes as the difference in the score of each outcome measure between the pre- and post-intervention time points. Negative scores indicated a lower value at follow-up compared to baseline.

Caregiver depressive symptoms were assessed using the Center for Epidemiologic Studies Depression Scale (CES-D) (Andresen et al., 1994). Participants self-reported the frequency in the past week with which they experienced the 20 listed symptoms using a 4-point scale from 0 (“rarely or none of the time” / “less than 1 day”) to 3 (“most or all of the time” / “5–7 days”). Positive items were reverse-coded and all items summed (possible range: 0–60; Cronbach's alpha = 0.76 at baseline). With the raw score, lower scores indicate lower levels of depressive symptoms; a negative change score indicates a decrease in depressive symptoms (improvement) from baseline to follow up.

Caregiver subjective burden was measured using the Zarit Burden Interview 4-item screener (ZBI-4) (Bedard et al., 2001). Participants self-reported the frequency with which they experienced feelings of burden related to providing care using a 5-point Likert scale from 0 (“never”) to 4 (“nearly always”). Responses were summed (possible range: 0–16; Cronbach’s alpha = 0.80 at baseline). Lower raw scores indicate less burden; a negative change score indicates a decrease in subjective burden (improvement) from baseline to follow-up.

Caregiver problem solving was assessed using the 25-item Social Problem Solving Inventory-Revised Short Form Scale (SPSI-R:SF) (D’Zurilla et al., 2002, 2004). The SPSI-R:SF elicits affective, cognitive, and behavioral responses to the posed problem solving situations using a 5-point Likert scale from “not at all true of me” (1) to “extremely true of me” (5). The raw total score was calculated and was set to a final score based on age of the caregiver (young adult, middle-aged adult, or elderly adult) per the SPSI score instructions (possible range: 29–140; Cronbach’s alpha=0.67 at baseline). Higher scores indicate greater problem solving abilities; a positive change score indicates an improvement in problem solving skills from baseline to follow-up.

Predictors

Predictors were drawn from the following domains: caregiver psychosocial outcomes at baseline, caregiver demographics, care recipient/household characteristics, and program characteristics. For each outcome model, the baseline values for the remaining two psychosocial outcomes were entered as mean-centered predictors. Caregiver demographics were self-reported by the caregiver and included age (rescaled by 10 years, i.e. 1 unit = 10 year increase and mean-centered), race, ethnicity, highest completed education level, marital status, annual household income, and number of children in the home. Caregiving characteristics, also self-reported, included relationship to care recipient, length of caregiving (in years), and hours of caregiving per day (summed from two items on time spent per day on assisting with daily living and instrumental activities). The care recipients’ chief health complaints, reported by the caregiver as an open-ended response, were categorized into four non-mutually exclusive categories: mental health condition (including PTSD), cognitive health condition (including TBI), physical/pain/musculoskeletal, and other (Shepherd-Banigan, et al., 2020a; Shepherd-Banigan, Jones, et al., 2020). Program characteristics included duration of program (time between first and last session in months, mean-centered), program enrollment year, program site, and coach. Between 2015 and 2019, OFC has been delivered at 13 sites around the US by 16 coaches. Program sites and coaches with <10 participants were grouped into “Other site” and “Other coach” categories, respectively.

Analysis

This analysis uses a single-group pre/post design to explore predictors associated with change in OFC intervention outcomes (operationalized as change scores) that represent caregiver well-being.

Baseline caregiver, care recipient/household, and program characteristics were described using proportions and frequencies (categorical variables) or means and standard deviations (continuous variables). Continuous variables with skewed distributions were categorized (duration of caregiving, number of caregiving hours per day). These characteristics were also compared between those who did and did not complete the follow-up assessment in an attrition analysis; differences were tested using chi-squared tests and two sample t-tests (Table S1).

Values for the OFC target outcomes were reported on their original continuous scales for the overall sample and by predictor at baseline, follow-up, and the change score. The scores for the overall sample were tested for significant change over time using paired t-tests.

This exploratory, hypothesis-generating analysis was intended to identify drivers of improvement in caregivers’ well-being, so a machine learning technique, elastic net regression (Zou and Hastie, 2005), was used. This method is used for variable selection with each of the separate outcome change score models. A form of penalized regression that balances between LASSO and ridge regression penalty parameters (λ_1 and λ_2 , respectively), elastic net shrinks coefficients towards zero and tunes an alpha value between 0 and 1, allowing for the identification of key contributing variables in the model. Elastic net is well suited for highly correlated or large numbers of predictors and is used to create a parsimonious model that allows for a grouping effect of correlated predictors (instead of selecting only one of the predictors) (Schreiber-Gregory & Bader, 2019). We allowed levels within categorical variables to be evaluated in the models separately from one another (i.e., one category may enter the model while the remaining categories do not).

As opposed to exploratory factor analysis—another hypothesis-generating technique—elastic net regression allows us to designate the outcomes of interest and evaluate the associations specifically between the proposed predictors and these outcomes.

We evaluated two selection criteria for the elastic net regression: k -fold cross-validation (CV) and validation average squared error (Kuzuya et al., 2011). For CV, we used $k = 5$, creating five models fit on $k-1$ folds with a one fold held out for validation each time; the set of variables with the lowest mean predicted residual sum of squares statistic was selected as the final model for each outcome. Then we assessed the relative importance of the selected predictors. We present coefficients for the corresponding final models as the primary results. For validation average squared error (ASE), data were partitioned into training

Table 1. Descriptive characteristics at enrollment.

Variable	Overall (N = 503) N (%)
Caregiver demographics	
Age (years), Mean (SD)	40.5 (11.7)
Female gender	487 (97.0%)
Race	
White	351 (71.1%)
African-American	55 (11.1%)
Other	88 (17.8%)
Hispanic ethnicity	111 (22.3%)
Highest education level	
Less than high school degree	17 (3.4%)
High school degree	157 (31.2%)
College degree	263 (52.3%)
Graduate degree	66 (13.1%)
Married/living as married	441 (87.7%)
Annual household income	
≤\$20,000	122 (24.4%)
\$21,000–\$40,000	190 (37.9%)
>\$40,000	189 (37.7%)
Care recipient/household characteristics	
Care recipient is spouse or partner	458 (91.1%)
Duration of caregiving	
<3 years	142 (28.3%)
3–6 years	195 (38.8%)
>6 years	165 (32.9%)
Number of hours/day caregiving	
1–4 hours	176 (35.2%)
5–9 hours	165 (33.0%)
>9 hours	159 (31.8%)
Care recipient health problems	
Pain or musculoskeletal problems	214 (42.5%)
PTSD or other mental health problems	404 (80.3%)
TBI or other cognitive problems	187 (37.2%)
Other health problems	185 (36.8%)
Comorbidity summary score, Mean (SD)	2.0 (1.0)
Program characteristics	
Duration of program (months), Mean (SD)	5.1 (2.8)

Note: sample size varies slightly due to small amounts of missing data (<10 per item)

Abbreviations: SD, standard deviation; PTSD, post-traumatic stress disorder; TBI, traumatic brain injury

(70% of observations) and validation (30%) datasets, with the final models selected based on the lowest validation ASE. We can conclude that the variables retained in the selected models are thus associated with the respective outcomes in this sample.

We then created variable importance plots (*caret* package in R) for the full and final model sets of variables. We present plots ranking the importance of variables for covariates selected in the final model (Figure 2). These plots represent the importance of the variables relative to each other by

rescaling between 0 and 100; more important predictors have higher scores as shown on the graph.

Single imputation with mean (continuous) or mode (categorical) values were used to address intermittent missing data (<2% per variable). Significance for the change scores and attrition analysis are set at $\alpha = 0.05$; a pre-specified threshold of significance was not used for the exploratory elastic net regression models, as these were hypothesis-generating, not hypothesis testing, analyses. Analyses were performed using SAS v9.4.

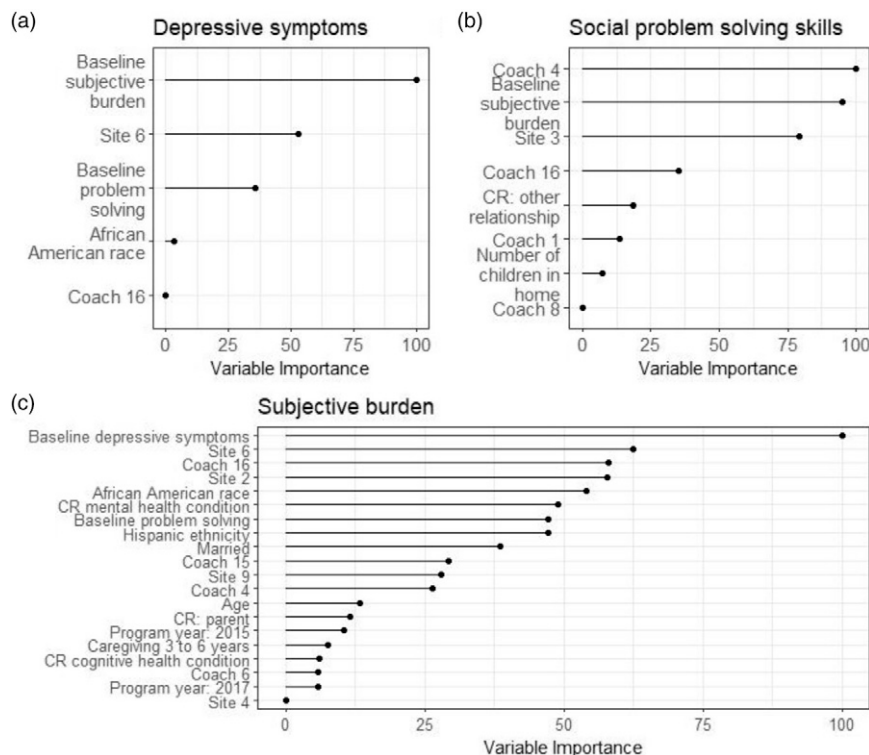


Figure 2. Variable importance ranking of factors selected into the final models for a) depressive symptoms, b) social problem solving skills, and c) subjective burden.

The dataset belongs to RCI and is not publicly available, but coding algorithms will be provided upon request by the authors.

IRB Review

This secondary analysis was reviewed by the Duke School of Medicine Institutional Review Board and was determined to be exempt with a waiver of the informed consent requirement for retrospective data analysis. The original data collection was reviewed and approved by the Georgia Southwestern University Institutional Review Board.

Results

Descriptive characteristics

Our sample included 503 primarily female (97%), partnered (87.7%), white (71.1%) non-Hispanic (77.7%) caregivers (Table 1). Over half of the caregivers had completed a college degree and were working full or part-time. Caregivers had provided care for an average of 6.2 years and spent almost 8 hours a day caregiving. The most common care recipient health problems were mental health problems (80.3%) followed by pain/musculoskeletal (42.5%) and TBI/cognitive problems (37.2%). Caregivers spent on average 5.1 months participating in OFC. Caregivers who completed the follow-up assessment did not significantly differ from those who did not complete the follow-up assessment on any baseline characteristics (Table S2).

On average, caregivers demonstrated statistically significant positive changes in all outcomes across the two time points (Table S2). For example, CESD-20 score decreased by 5.9 points (SD=8.8), Zarit subjective caregiver burden score decreased by 1.9 points (SD=2.9), and SPSI-R:SF score increased, on average, 6.2 (SD = 12.4) points. Table S2 presents the bivariate relationships between the program’s target outcomes and the proposed drivers of change.

Model Results

For the model results, we highlight patterns of drivers that influence changes in the target outcomes based on statistical significance of the coefficient. While coefficients are presented in Table 2, these models are exploratory and therefore we do not emphasize effect size or how strong the effect is. R^2 (derived from the ASE) for the following three models were 0.059 (depressive symptoms), 0.101 (subjective burden), and 0.06 (social problem solving skills). Figures 2a–2c show the importance of selected variables in the final models in ranked order.

CESD-20 score. Statistically significant drivers of improvements in depressive symptoms were baseline higher caregiver subjective burden, lower problem solving skills, African American race (vs. white), and some site and coach fixed effects. Variables that did not appear in the model as being significant drivers included caregiver age, ethnicity, marital status, caregiving characteristic variables, number of

Table 2. Characteristics that are associated with Operation Family Caregiver target outcome change scores from pre- to post-assessment.

Predictor	Caregiver depressive symptoms (CESD)	Caregiver subjective burden (ZBI-4)	Caregiver social problem solving skills (SPSI-R:SF)
	Coefficient	Coefficient	Coefficient
<u>Caregiver outcomes at baseline</u>			
Caregiver depressive symptoms		-0.026	
Caregiver subjective burden	-0.277		0.258
Caregiver social problem solving skills	0.019	0.006	
<u>Caregiver demographics</u>			
Age, 10-year units		0.091	
<u>Race</u>			
African American	-0.429	-0.619	
White	Ref	Ref	
Hispanic ethnicity		-0.453	
Married/partnered		0.358	
Number of children in the home			0.061
<u>Care recipient/household characteristics</u>			
<u>Relationship to care recipient</u>			
Spouse or partner		Ref	Ref
Parent		-0.198	
Other relationship			-1.233
<u>Duration of caregiving</u>			
<3 years		Ref	
3–6 years		-0.036	
CR mental health condition		-0.303	
CR cognitive health condition		-0.097	
<u>Program characteristics</u>			
<u>Year</u>			
2015		-0.051	
2016		Ref	
2017		0.017	
<u>Site</u>			
1	Ref	Ref	Ref
2		-0.341	
3			-5.832
4		-0.025	
5	-1.89	-0.691	
6		0.169	
<u>Coach</u>			
A	Ref	Ref	Ref
B			0.653
C	-0.812	-0.748	3.524
D		-0.401	3.702
E		-0.242	
F			0.11
Other coach ^a		0.034	

Factors that were not selected into any of the three models are omitted from this table.

^aSites and coaches with fewer than 10 participants were grouped together as "Other."

All candidate predictors were entered into each model with the outcome being change score from pre- to post-assessment. Predictors shown here were selected into the final models based on having non-zero coefficients in the final models with the lowest validation average squared error (Kuzuya et al.). Negative beta coefficients for depressive symptoms and subjective burden indicate that the predictor is associated with improvement in those outcomes. Positive beta coefficients for social problem solving skills indicate that the predictor is associated with improvement in that outcome. Observed ranges for the outcome change scores were CES-D (-39, 20), ZBI-4 (-15, 7), and SPSI-R:SF (-38, 56).

children in the home, annual household income, education level, and program duration or program year.

Subjective Burden Score. Statistically significant drivers of improvements in caregiver burden were: baseline higher depressive symptoms, lower problem solving skills, younger caregiver age, African American race (vs. white), Hispanic ethnicity (vs. not), non-married (vs. married), caregiving for a parent (vs. spouse), 3–6 years spent caregiving (vs. less than 3 years), care recipient mental health and/or cognitive conditions, participation in earlier years of the program, and some site and coach fixed effects. Variables that did not appear in the model included number of children in the home, education level, annual household income, number of caregiving hours per day, care recipient pain or musculoskeletal problems, and care recipient other health problems and program duration.

Problem Solving Score. Statistically significant drivers of improvements in problem solving scores included baseline higher caregiver subjective burden, more children in the home, caregiving for a spouse (vs. other relationship), and coach and site fixed effects. Variables that did not appear in the model as being significant drivers of improvement included caregiver depressive symptoms, most caregiver demographic variables, duration of caregiving, care-recipient condition, program duration, and year in the program.

Taken together, these results suggest that consistent drivers across OFC target outcomes include caregiver higher baseline depressive symptoms, higher baseline subjective burden, lower initial problem solving, African American race, and site/coach fixed effects.

Results from the models selected by validation ASE were similar to the CV models in that the same variables were generally selected by both techniques; the validation ASE models did, however, select more variables overall in each model relative to CV and correspondingly had slightly higher R^2 levels (0.110–0.145). Also, variable importance plots for the full set of predictors (results not shown, available upon request) closely mirrored the results from the selected variables shown in Figures 2a–2c.

Discussion

We explored drivers of change in the target outcomes of a coaching intervention for family caregivers that were designed to improve problem-solving skills and reduce depressive symptoms and subjective caregiver burden. In our data, drivers that appeared in at least two models included baseline subjective burden and depressive symptoms scores, caregiver race, and intervention factors (i.e., site and coach fixed effects).

Subjective burden appeared to be driven by the highest number of factors and was the most predictive of all outcomes, though only marginally. Our results suggest that some caregivers could benefit more from caregiver support interventions. These caregivers include those who identify as

African American and caregivers who report higher subjective burden and more depressive symptoms prior to the intervention. Similar to prior work, our findings also suggest that intervention factors, including coach and site, may play a role in moderating target outcomes (Gitlin et al., 2003). Hence, we found evidence for consistent drivers at two levels of our proposed model: caregiver and intervention.

One surprising finding was the lack of influence that caregiving intensity and duration had on changes in outcomes with intervention. Previous research has shown that caregivers who spent more hours per day providing care and who work outside the home experience higher levels of burden and stress (Family Caregiver Alliance [FCA], 2016b, 2016a; Pinciotti et al., 2017). Therefore, we might expect these individuals to experience greater improvements after participating in a program like OFC. Over 50% of caregivers in our sample worked full or part-time and nearly 30% provided 10 hours or more of care per day. Therefore, while our sample included working caregivers, external jobs, and more hours spent providing caregiving, these factors were not identified as drivers of program outcomes.

Research, Policy, and Program Implications

This exploratory analysis intends to motivate a conversation regarding how to design and evaluate caregiver support programs. These programs are essential for all types of family caregivers, yet it is unknown which elements of these programs are most helpful and which caregivers such programs should target. As a result, our findings are relevant for researchers, policy-makers, and program implementers who aim to support all populations of family caregivers. Following our exploratory quantitative analysis, this area of research would benefit from testing the hypotheses that we generated, incorporating qualitative inquiry to understand the mechanisms of effect by program and caregiver factors, and using those results to refine program design and implementation.

Caregivers in military families experience higher stress than non-military caregivers, resulting in a 40% increase in probable major depression and anxiety (Ramchand et al., 2014). High levels of stress are related to the severity of health impairments, presence of a mental health illness, time spent caregiving, and helping the care recipient cope with stressful situations (Ramchand et al., 2014). One potential policy solution is to put in place provisions that allow health care staff to more directly link caregiving and Veteran health programming through referral processes, shared electronic health records, or other structural mechanisms. As determinants of caregiver stress are related to care recipient health, our results demonstrate that programs like OFC, that have benefits for caregivers with higher stress levels, could be situated within Department of Veterans Affairs Medical Centers (VA) or Vet Centers where Veterans receive their health care. Currently caregiver and Veteran programming within VA are not always aligned (Shepherd-Banigan, et al., 2020c), but VA already has dedicated caregiving programming. Therefore,

more purposeful attempts to integrate caregiver programming into Veteran health care could reduce caregiving stressors and increase resilience and coping.

At a program level, our results can help caregiver support program developers meet the needs of caregivers who might benefit the most. Our results might also inform modifications to interventions to better address the needs of caregivers who need the most support, but might not be able to engage due to lack of time, high caregiver burden, or high levels of distress. Studies show that 25% or fewer caregiver of younger Veterans engage in caregiver education and training services (Ramchand et al., 2014; Sperber et al., 2018). One approach might be to offer interventions through multiple delivery modalities. For example, overwhelmed and distressed caregivers may not feel that they have capacity to attend an in-person course, yet they might be able to attend virtually. Alternately, distressed caregivers might benefit from a group setting intervention where they can receive emotional support from others in similar situations. Program implementers also need to tailor culturally appropriate interventions for caregivers from minority groups to maximize the acceptability of caregiver support programs for groups, such as African American caregivers, who might experience more positive intervention-related outcomes.

Strengths and Limitations

Our study leveraged a unique dataset that captured information about caregivers who participated in a caregiver coaching intervention, their care-recipients, and intervention-related factors. With this rich dataset and machine learning techniques, we were able to compare the relative influence of specific caregiver characteristics and explore which drivers at which levels were most important for changes in caregiver outcomes. Our work suggests that baseline caregiver emotional wellbeing and race may be more important drivers of intervention effects than factors, such as caregiving intensity and duration, which have always been assumed to drive caregiver wellbeing. Moreover, our findings suggest that information about caregiver and intervention factors should be captured in future research to understand intervention effects.

This study also has some limitations. First, our study population is a unique group of caregivers who may not fit the caregiver prototype. In the U.S., the average caregiver is a white female around age 49 caring for an aging spouse; our sample was also predominantly white and female but with a median age of 40 (AARP and the National Alliance for Caregiving, 2020). The large majority of participants cared for a military veteran of whom 80% had mental illness. Military caregivers face a unique set of circumstances and experiences and may have access to a distinct set of resources. Therefore, the drivers of changes in outcomes may be different for this group. Second, our sample is a convenience sample of program participants rather than a nationally representative sample of caregivers for which effects may not generalize to non-OFC caregivers or non-completers.

Third, a large proportion of individuals (~50%) who started OFC did not complete the post-intervention assessment and were not included in the analytical models. Individuals who did not complete OFC were not statistically different on any measured characteristics at $p < 0.05$. Fourth, while we examined drivers of change in intervention target outcomes, we are not able to attribute changes between pre- and post-intervention assessments to the intervention because we did not have a non-intervention control group; therefore, we cannot verify whether observed changes are due to secular trends, regression to the mean, or unmeasured confounding. Finally, we may be missing information about critical drivers of outcomes, including which program content participants actually receive and the severity of the care recipient's condition. In sum, future research is needed to validate these findings in another sample with a comparison group so that drivers of intervention effects can be directly estimated.

Conclusion

We show that both caregiver and programmatic characteristics may influence the benefits received from caregiver coaching interventions, such as OFC. Family caregivers are the backbone of the U.S. long-term care system, yet too often their efforts are unrecognized despite the fact that caregivers experience high rates of emotional, financial, and physical stress (May, 2020). The U.S. health and social systems will increasingly rely on family caregivers due to demographic shifts in the U.S. population and as Veterans who served in the recent Middle East conflicts age with complex conditions. Military caregivers will require substantial support to manage their caregiving duties while trying to live their lives, including raising families and working. Caring for both an adult and dependent children is associated with worse caregiver reported health status which could indicate higher levels of stress (Do et al., 2014). While the support needs of this cadre of family members is becoming more visible, it remains imperative to bolster our knowledge about how to decrease distress and burden in a data-driven and personalized way based on caregiver attributes.

Declaration of Conflicting Interests

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IRB Review

This secondary analysis was reviewed by the Duke Health Institutional Review Board (PRO00105250) and was determined to

be exempt with a waiver of the informed consent requirement for retrospective data analysis. The original data collection was reviewed and approved by the Georgia Southwestern University Institutional Review Board (Pro FA15-009)

ORCID iDs

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Supplemental Material

Supplemental material for this article is available online.

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