

Use of the Roadmap Positive Activity App in Daily Life Among Dementia Caregivers: Evidence of Feasibility and Acceptability

Kira S. Birditt, Yee To Ng, Lizbeth Benson, Allison Doroshewitz, Angela Turkelson, Noelle Carlozzi, Sung Won Choi

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Abstract

Background: Addressing the needs of at-risk dementia caregivers and their care recipients is an urgent public health priority. Thus, it is imperative to identify modifiable factors that influence caregiver and care recipient mental health to target in personalized interventions.

Objective: The purpose of the present pilot study was to examine the feasibility and acceptability of an mHealth positive activity intervention, the Roadmap app, which has demonstrated effectiveness among other caregiver populations but has not been examined among dementia caregivers.

Methods: A total of 20 dementia caregiver-care recipient dyads were recruited to participate in a 14-day study, during which caregivers were prompted to engage in Roadmap positive activities twice a day, caregivers completed mobile surveys every night, and both dyad members were asked to wear Fitbit® devices. Caregivers also completed a feasibility and acceptability survey at the end of the study. Data were analyzed using descriptive statistics and 2-level multilevel linear models with days nested in participants

Results: The Roadmap app was highly feasible and acceptable among this population. The caregivers participated in a high number of positive activities, completed almost 100% of their nightly surveys, and all caregivers and 16 of their care recipients wore Fitbit® devices. Participants rated the app as easy to use and acceptable. Preliminary results also indicate that using the app is associated with improved mood and better mental health among caregivers and care recipients in daily life over the 14-day period during which they were enrolled in the study.

Conclusions: Overall, this pilot study shows that the Roadmap app is a feasible and acceptable intervention among dementia caregivers, and it should be tested in larger clinical trials.

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Original Manuscript

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Abstract

Background. Addressing the needs of at-risk dementia caregivers and their care recipients is an urgent public health priority. Thus, it is imperative to identify modifiable factors that influence caregiver and care recipient mental health to target in personalized interventions.

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an mHealth positive activity intervention, the Roadmap app, which has demonstrated effectiveness among other caregiver populations but has not been examined among dementia caregivers.

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Results. The Roadmap app was highly feasible and acceptable among this population. The caregivers participated in a high number of positive activities, completed almost 100% of their nightly surveys, and all caregivers and 16 of their care recipients wore Fitbit® devices. Participants rated the app as easy to use and acceptable. Preliminary results also indicate that using the app is associated with improved mood and better mental health among caregivers and care recipients in daily life over the 14-day period during which they were enrolled in the study.

Conclusion. Overall, this pilot study shows that the Roadmap app is a feasible and acceptable intervention among dementia caregivers, and it should be tested in larger clinical trials.

Roughly 11 million Americans provide unpaid care to people living with Alzheimer's Disease and Related Dementias (ADRD) (Alzheimer's Association, 2025). Unpaid caregivers are becoming increasingly vital in the long-term care of this vulnerable population (Ali et al., 2022; Freedman et al., 2022). Caregivers of people living with ADRD (care recipients) provide more hours of care, more hands-on and demanding caregiving, perform more medical and nursing tasks for which they have little or no training, and report greater caregiver burden and worse mental health compared to non-ADRD caregivers (Ali et al., 2022; Anderson et al., 2013; Capistrant, 2016; Freedman et al., 2022; Kasper et al., 2015; Lee et al., 2019). As care responsibilities accumulate, caregivers face their

own health risks, including anxiety, burden, sleep problems, decreased physical activity, and chronic illness (Anderson et al., 2013; Kasper et al., 2015; Lee et al., 2019). These risks, in turn, may harm the mental health of care recipients (Capistrant, 2016). Addressing the needs of at-risk ADRD caregivers and their care recipients is an urgent public health priority (Cella et al., 2007). Thus, it is imperative to identify modifiable factors that influence caregiver and care recipient mental health to target in personalized interventions.

Engaging in positive activities is associated with improved affect, as well as mental and physical well-being among ADRD caregivers and care recipients (Mausbach et al., 2017). Overall, caregivers who engage in fewer pleasant activities report greater depression, higher negative affect, lower positive affect, less positive coping, more negative coping, and more sleep disturbance (Chattillion et al., 2013). Intensive EMA studies have also shown within-person associations between leisure activities and improvements in affect, with some showing improvements in only positive affect and others showing improvements in both positive and negative affect (Cheng et al., 2022). Leisure activities also tend to be more effective when the activities are perceived as more pleasant, when caregivers report greater burden, and when caregivers engage in a variety of activities (Hwang & Kim, 2024; Poon, 2022).

To understand the links between engaging in positive activities and mental health outcomes among ADRD caregivers and care recipients, we developed the Positive Activities and Daily Mental and Physical Health among ADRD Caregiver-Care Recipient Dyads Model, which suggests that engaging in Roadmap positive activities will lead to improvements in ADRD caregiver and care recipient mental health via, improvements in caregiver mood and better quality of interactions (as less stressful and more rewarding) between the caregiver and care recipient (Figure 1). The model incorporates aspects of several leading theories in the literature, including Pearlin's stress process model of caregiving, behavioral activation theory, and dyadic illness management theory (Kanter et al., 2010; Lewinsohn, 1974; Lyons & Lee, 2018; Miller et al., 2019). This pilot study examines

associations between engaging in positive activities, mental health, and the potential mechanisms of action (positive and negative mood, appraisals of caregiving as stressful and rewarding)

Existing positive psychology interventions demonstrate that increasing positive activities is beneficial for both the general population and dementia caregivers (Seligman et al., 2005; Sin & Lyubomirsky, 2009). A review of the literature on ADRD caregiver interventions found that cognitive behavioral therapy, which focuses on increasing positive activities and reducing negative thoughts, is more effective than other types of interventions (psychoeducational, mindfulness) (Sin & Lyubomirsky, 2009). For example, when compared to psychoeducation, dementia caregivers who also received pleasant activity scheduling reported decreased depression over four months (Lee et al., 2020). LEAF (Life Enhancing Activities for Frontotemporal dementia family caregivers) intervention, which includes journaling about positive events and gratitude, mindfulness, and acts of kindness, was associated with increased positive affect, reduced negative affect, reduced caregiver burden, and stress over a 5- or 6-week period (Au et al., 2015). These are all fairly high burden interventions (e.g., include several sessions over a long period of time), and as such, there is an urgent need for low burden, scalable interventions for improving mental health among caregivers and their recipients.

Choi developed an app-based mobile health intervention (Roadmap; R01HL146354: PI Choi), the Roadmap App (Cao et al., 2025; Maher et al., 2016), that provides eight positive activity modules for caregivers (Figure 2) (Chaar et al., 2019; Rozwadowski et al., 2020; Runaas et al., 2017, 2018; Shin et al., 2018, 2020). The modules were based on extensive qualitative interviews included in recently published studies (Chaar et al., 2019; Fauer et al., 2018; Rozwadowski et al., 2020; Runaas et al., 2017, 2018; Shin et al., 2018, 2020). This app has demonstrated feasibility, acceptability, and efficacy in caregivers across multiple populations (e.g., caregivers for patients with blood and marrow transplantation, caregivers of pediatric patients with cancer), as well as effectiveness for improving mental health and resilience (Cao et al., 2025). The app has yet to be

tested among dementia caregivers; thus, we will examine the feasibility and acceptability of using the Roadmap app among ADRD caregivers over 14 days, as well as explore preliminary data examining its effectiveness in this population. We address three research questions:

- 1) Is the Roadmap app feasible and acceptable to caregivers of people living with dementia?
- 2) Do ADRD caregivers report engaging in sufficient numbers of positive activities in the Roadmap app, and do they complete a sufficient number of nightly surveys for measuring mood and mental health?
- 3) Is there preliminary evidence that engaging Roadmap app positive activities is associated with better mood, appraisals of caregiving, and mental health among caregivers, and better mental health for care recipients?

Method

Participants

A total of 20 ADRD caregivers participated in the We-Care (Well-Being Enhancement of Caregivers) pilot study. These dyads were recruited from the SWEL-Care (Stress and Well-being in Everyday Lives of Caregivers, PI Birditt) study sample, which included a total of 223 dementia caregivers and their care recipients (Ng et al., 2025). Of the 46 caregivers who were invited to participate in the Roadmap pilot study, 6 indicated they were not interested, 1 was not eligible due to no longer living with PLWD, 1 had incorrect contact information, and 18 were invited via email and phone but did not respond. Of the 20 caregivers who participated, 5 of their care recipients did not participate either because they were not eligible (1 recipient was non verbal, 2 did not have a compatible phone) or declined to wear the Fitbit (1 declined to participate and 1 consented but did not like wearing the fitbit). *Inclusion Criteria.* To be eligible for the We-Care pilot study, caregivers must have completed baseline interviews, and the care recipients must have completed cognitive assessments (T- MOCA) during the SWEL-Care Study. Additionally, caregivers and care recipients had to be 1) living together, 2) be the primary caregiver, and 3) have smartphones that can download

the Fitbit and Roadmap app.

Procedure

During recruitment, ADRD caregivers were told the purpose of the study is “to learn how a mobile health app that promotes well-being (called the Roadmap app) can improve the daily lives and well-being of dementia caregivers and their care partners”. Participants had a consent appointment and onboarding session, in which they learned how to use the Roadmap app and Fitbit®, before starting their 14-day daily assessment.

ADRD caregivers completed a 14-day intensive daily data collection. Caregivers received daily prompts at 9AM and 6PM to engage in a positive activity of their own choice that day. Each night, caregivers completed a mobile phone survey with questions regarding the well-being of the caregiver and care recipient. Both the caregiver and PLWD wore Fitbit® Inspire devices for 2 weeks (data from which we plan to analyze in a future manuscript). On the last day (Day 14), caregivers received a survey that also inquired about the ease of use of the Fitbit® and the Roadmap 2.0 app.

Caregivers were paid \$1 per nightly survey (total of \$14 for 14 days), \$2 per day for Fitbit data (total of \$28 for 14 days) and \$25 for completion of the in-depth interview. Care recipients were paid \$2 per day for Fitbit® data (total of \$28 for 14 days). Both the caregiver and care recipients were able to keep the Fitbits® once the study was completed.

Measures

Baseline Interview.

The baseline survey, conducted during SWEL-Care between February 2022 to June 2024, included sociodemographic data on the caregiver and care recipient. Caregivers also completed the 11-item Zarit Caregiver Burden scale (Bédard et al., 2001) that assesses feelings of stress and burden regarding the caregiving role. Response options included: Never = 0, Rarely = 1, Sometimes = 2, Quite frequently = 3, Nearly always = 4 and a sum score was calculated. Care recipients completed a Montreal Cognitive Assessment, specifically the telephone MoCA (T-MoCA) (Benge & and

Kiselica, 2021). The T-MoCA has adequate sensitivity and specificity for mild cognitive impairment (MCI). Scores from this measure were used to determine the severity of dementia, which includes: No impairment (26-30 = 0), Mild impairment (18-25 = 1), Moderate impairment (10-17 = 2), and Severe impairment (0-9 = 3) (Benge & Kiselica, 2021).

Nightly Survey

Positive activities. Each night, caregivers were asked to select which of the 8 positive activities from the Roadmap app they engaged with during the day, as well as any other activities, unrelated to the Roadmap app, that they would consider positive (which we controlled for in follow-up analyses).

Caregiver mental health. Caregiver mental health was evaluated with two-item custom short form from the PROMIS Anxiety measure: I found it hard to focus on anything other than my anxiety and My worries overwhelmed me), as well as two-item custom short form from the PROMIS Depression measure: I felt depressed and I felt hopeless. Response options include: Never = 1, Rarely = 2, Sometimes = 3, Often = 4, Always = 5 (Cella et al., 2007). The item scores were tabulated on a preformatted spreadsheet using anonymized participant identifiers; this was then uploaded onto the HealthMeasures scoring service, powered by the assessment center (https://www.assessmentcenter.net/ac_scoring-service) and the relevant *t*-scores were returned.

Caregiver mood. Caregiver mood (positive and negative affect) was evaluated using 2 positive affect items (content, clam, and happy; $\alpha = .73$) and 5 negative affect items (worried, irritated, lonely, stressed, sad; $\alpha = .71$),y (Shaver et al., 1987; Watson et al., 1988). Response options include: Not at all = 1, A little = 2, Somewhat = 3, Quite a bit = 4, A great deal = 5. Average scores of these items were calculated to indicate positive and negative mood each day, with higher scores indicating greater positive and greater negative mood, respectively.

Caregiver appraisals. After reporting on the tasks they did for the care recipient, caregivers

were asked to rate how stressful it was to provide help and how rewarding it was to provide help to the care recipient overall that day from 1 (not at all) to 5 (a great deal).

Care recipient's mental health. Caregivers reported on care recipient's mental health with four-item custom short form from the Neuro-QoL Anxiety measures (uneasy, nervous, worried, difficulty calming down) and four-item custom short form from the Neuro-QoL Depression measure (depressed, nothing could cheer me up, unhappy, nothing was interesting) (Cella et al., 2012). Caregivers were instructed to respond as if they were the care recipient. Response options include: Never = 1, Rarely = 2, Sometimes = 3, Often = 4, Always = 5. Similarly, relevant *t*-scores were obtained from the HealthMeasures scoring service.

Final Survey

Feasibility and Acceptability. The final evening survey included a study-specific questionnaire (which was based on existing measures of feasibility and acceptability) was used to examine the the feasibility and acceptability of the Roadmap App, the Fitbit, and the study design. (Carlozzi et al., 2022; Carlozzi et al., 2025; Haerens et al., 2007; Kratz et al., 2017; Vandelanotte & De Bourdeaudhuij, 2003). Items regarding Roadmap app use were: 1) The instructions for the Roadmap app set up were easy to understand; 2) The Roadmap app was easy to set up; 3) Did you receive assistance setting up the Roadmap app; 4) The Roadmap app was easy to use; 5) I was confident using the Roadmap app; 6) I am confident that I was using the Roadmap app correctly; 7) What is your overall rating of the design of the screens on the app, including the colors and the layout; 8) Did you receive assistance using the Roadmap app? ($\alpha = 0.89$, excluding Q2). Response options included Strongly Disagree (1), Disagree (2), Neither Agree nor Disagree (3), Agree (4) and Strongly Agree (5). A mean score was calculated for these items and as well as a percentage of agree/strongly agree across the items. Items regarding the use of Fitbit® included: 1) The instructions for the Fitbit® set up were easy to understand; 2) The Fitbit® was easy to set up; 3) Did you receive assistance setting up the Fitbit; 4) The Fitbit® was easy to use; 5) The Fitbit® was comfortable to

wear; 6) The Fitbit® data was easy to sync with my phone; 7) I was confident using the Fitbit; 8) Did you receive assistance using the Fitbit? ($\alpha = 0.76$, excluding Q3). Response options included Strongly Disagree (1), Disagree (2), Neither Agree nor Disagree (3), Agree (4) and Strongly Agree (5). A mean score was calculated for these items and as well as a percentage of agree/strongly agree across the items. (Carlozzi et al., 2022; Carlozzi et al., 2025; Haerens et al., 2007; Kratz et al., 2017; Vandelanotte & De Bourdeaudhuij, 2003) Items regarding the acceptability of the Nightly Surveys included: 1) The nightly survey questions were easy to understand. 2) The nightly survey questions were easy to answer. 3) Answering the nightly survey questions fit easily into my routine. 4) The number of nightly survey questions to answer on the app was reasonable. ($\alpha = 0.77$). Response options included Strongly Disagree (1), Disagree (2), Neither Agree nor Disagree (3), Agree (4) and Strongly Agree (5). A mean score was calculated for these items as well as a percentage of agree/strongly agree across the items. We would consider there to be adequate support for feasibility and acceptability assuming $\geq 80\%$ of the surveys were completed or $\geq 80\%$ of the days included a positive activity, or $\geq 80\%$ of respondents agreed or strongly agreed with the different components of the study (N. Carlozzi et al., 2022).

Analysis Strategy

First, we calculated descriptive statistics to describe the sample, daily appraisals, mood, and mental health outcomes of the caregivers and the mental health of the care recipient. Next, feasibility was examined by an examination of proportions to determine the proportion of days participants engaged in positive activities, the proportion of positive activities that fit into each of the eight Roadmap categories, and the proportion of days participants completed nightly surveys. Additional feasibility and acceptability data was examined by responses on the feasibility and acceptability survey that was completed on the last day of the study.

Regarding preliminary effectiveness, we estimated two-level multilevel linear models (with

day nested within participants) to examine whether there is preliminary evidence of associations between engaging in app-based positive activities and outcomes. We recognize that these analyses are exploratory, given the small sample size and low power. Models revealed substantial within-person variability (range: 43% to 74%) in all caregivers' and CRs' outcomes (see supplemental Table 1). Time (assessed with a variable representing which day in the study and ranged from day 1 to 14) and the total number of positive activities reported over the study period were the predictors. Caregivers' outcomes included positive and negative mood, appraisals of caregiving (rewards and stress), and mental health (anxiety, depression). Care recipient outcomes included anxiety and depression as outcomes in two separate multilevel linear models. Across models, we adjusted for key covariates (caregivers' age, gender, race, burden score, and care recipients' MOCA scores).

Results

Description of the study participants

See Table 1 for the sample demographics. The caregivers ranged in age from 43 to 82 ($M = 61.15$, $SD = 11.69$), and care recipients ranged in age from 38 to 92 ($M = 74.20$, $SD = 11.59$). A total of 60% were White and 40% Black; 75% were female. A total of 35% were adult children caring for parents, and 65% were spousal caregivers. A total of 75% caregivers had attained a college degree or above.

Caregivers reported an average of 21.25 ($SD = 10.84$, range 7-44) caregiving burden. Based on the MOCA categorization, 10% of care recipients had no cognitive impairment, 30% had mild impairment, 25% had moderate impairment, and 35% had severe impairment (see Table 1). Caregivers reported relatively low levels of anxiety, depression, negative mood, and appraisals of stress, and moderate levels of positive mood and appraisals of caregiving as rewarding (Table 2). Caregivers also reported low levels of care recipient anxiety and depression.

RQ2: Is the Roadmap app feasible and acceptable to caregivers of people living with dementia?

There was generally support for the feasibility and acceptability of the different study elements (see Table 3). Findings met our a priori specifications for the Fitbit and for the nightly surveys, but fell slightly below what was expected for the Roadmap App. Specifically, overall acceptability of the Roadmap app fell just below our criterion (78.9%), with slightly lower than expected agreement with the following items: The instructions for the Roadmap app setup were easy to understand, The Roadmap app was easy to use, and I am confident that I was using the Roadmap app correctly. The lowest agreement among these items was 72% for confidence in using the app correctly. These items indicate that there are areas to be targeted for improvement in the instructions and in the training of participants in how to use the app.

RQ2: Do ADRD caregivers report engaging in sufficient numbers of positive activities in the Roadmap app, and do they complete a sufficient number of nightly surveys for measuring mood and mental health?

As shown in Table 2, out of the two prompts received each day, caregivers completed 1.67 positive activities per day ($SD = 0.75$) and engaged in at least one app-based positive activity on 87% of days (range 59% to 100%). Caregivers completed an average of 13.25 nightly surveys ($SD=0.85$; min=12; max=14) for a total of 265 days of survey data. Within the Roadmap app, caregivers preferred pleasant activity scheduling followed by savoring, gratitude journal, engaging with beauty, positive piggy bank, signature strengths, random acts of kindness, and love letters (see supplemental Table 2).

RQ3: Is there preliminary evidence that engaging Roadmap app positive activities is associated with better mood, appraisals of caregiving, and mental health among caregivers, and better mental health for care recipients?

As shown in Table 4, correlations indicated that greater self-reported engagement in Roadmap positive activities was associated with better caregiver mental health (lower anxiety, lower

depression), better mood (greater positive affect and lower negative affect), and appraisals of caregiving as more rewarding. There was no association between positive activities and appraisals of caregiving as stressful, nor care recipients' mental health (anxiety and depression).

As shown in Table 5, multilevel models revealed that time in the study (day 1 through 14) was associated with higher positive mood ($B=0.04$; $p<.001$), lower negative mood ($B=-0.02$; $p=.002$), higher appraisals of caregiving as rewarding ($B=0.03$; $p=.01$), lower anxiety ($B=-0.30$; $p<.001$) and lower depression ($B=-0.33$; $p<.001$), but appraisals of caregiving as stressful did not significantly change over time ($B=-0.02$; $p=.10$). Furthermore, those who engaged in more positive activities across the study period also tended to report lower anxiety ($B=-0.27$; $p=.02$) and higher positive affect ($B=0.04$; $p=.001$).

As shown in Table 6, multilevel models showed that time in the study was associated with lower anxiety ($B = -0.29$; $p < .001$) and lower depression among care recipients ($B = -0.18$; $p = .03$). There was no significant association between the number of app-based positive activities a caregiver engaged in during the study period and the mental health of their care recipient.

Discussion

The purpose of this study was to examine the feasibility, acceptability, and preliminary effectiveness of the Roadmap positive activity app among dementia caregivers and their care recipients. Overall, this study revealed support for the feasibility and acceptability of the Roadmap App and provided preliminary evidence of its effectiveness for improved mental health with use.

Overall, respondents reported engaging in the app's positive activities more than 80% of the days, and they completed over 80% of the nightly surveys. These indicators show that using the app is feasible among dementia caregivers (Carlozzi et al., 2022). Further, these rates are consistent with or exceed other studies using the Roadmap app with other populations of caregivers (Cao et al., 2025).

As further evidence of the study protocol's feasibility and acceptability, participants reported

that they found the app, the Fitbit®, and the nightly surveys easy to understand and use. However, this data provided evidence of areas for improvement in future studies. For instance, the caregivers needed a clearer set of instructions for how to use the Roadmap app, which may also increase their confidence in using the app. Caregivers also had some difficulties with setting up the Fitbit®.

When examining whether time in the study and the average number of positive activities were associated with the mental health outcomes and potential mechanisms of action (mood, appraisals of caregiving) we found evidence that the app may be effective. Participating in the study was associated with improved mood, appraisals, and mental health over time among caregivers. Further, caregivers who engaged in more positive activities over the course of the study reported lower daily anxiety, lower negative mood, and greater positive mood. Caregivers also reported that care recipients had better mental health over time. These findings are consistent with previous research showing that engaging in positive activities is associated with improved affect, as well as mental and physical well-being among ADRD caregivers and care recipients (Mausbach et al., 2017). For instance, previous studies show that caregivers who engage in fewer pleasant activities report greater depression, greater negative affect, lower positive affect (Chattillion et al., 2013). A review of the literature on ADRD caregiver interventions found that cognitive behavioral therapy, which focuses on increasing positive activities and reducing negative thoughts, is more effective than other types of interventions (psychoeducational, mindfulness) (Sin & Lyubomirsky, 2009). For example, when compared to psychoeducation, dementia caregivers who also received pleasant activity scheduling reported decreased depression over four months (Lee et al., 2020) and other studies have found that interventions like LEAF (Life Enhancing Activities for Frontotemporal dementia family caregivers), which includes journaling about positive events and gratitude, mindfulness, and acts of kindness, was associated with increased positive affect, reduced negative affect, reduced caregiver burden, and stress over a 5- or 6-week period (Au et al., 2015). This study advances the field by demonstrating that a low-burden, scalable positive activity app may be beneficial for caregivers and

is associated with improvements in well-being. We need to conduct larger-scale intervention studies examining the app and whether it is associated with better mental health over time.

This study has limitations to address in future research. The prompts for using the Roadmap app should be randomized to determine whether days with prompts are associated with better mental health and what time of day these prompts are most effective. The app should be compared to an attention control to understand whether it is the prompts or the app that is associated with better mental health. The app needs to be tested among a larger sample of caregivers and over a longer period of time. In addition, the study should include a follow-up assessment (s) to understand how long the app is associated with better health. We also need to analyze the Fitbit® data to understand whether the app is associated with improvements in physical health outcomes such as heart rate, activity, and sleep.

Overall, this pilot study showed that the Roadmap app is feasible and acceptable among dementia caregivers. The app may be an effective intervention for caregivers as they navigate daily stress and we need to conduct larger, fully powered trials to understand whether it is associated with lasting improvements in mental health among caregivers and their care recipients. We also need to understand whether mood and appraisals may be key mechanisms of action that account for the effectiveness of the app.

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Table 1

Sample Description (N=20)

Demographics	Mean/%	SD	Min	Max
Caregiver Age	61.15	11.69	43.00	82.00
Black ^b	40%			
Caregiver Female	75%			
Married	70%			
Higher Education	75%			
Relationship to PLWD				
Spouse/partner	65%			
Adult child	35%			
Caregiver Burden	21.25	10.84	7.00	44.00
Duration of help (years)	4.08	2.16	1.50	10.00
Care Recipient Age	74.20	11.59	38.00	92.00
Care Recipient Female	40%			
Care Recipient MoCA Score	13.25	8.23	0.00	29.00
MoCA Dementia Categories				
No impairment	10%			
Mild impairment	30%			
Moderate impairment	25%			
Severe impairment	35%			

Note. Caregiver Age is continuous in years. Black is coded as Black or African American = 1, White = 0. Caregiver Female is coded as Male = 0, Female = 1. Higher education is a binary variable of holding a four-year college degree or higher (Yes = 1, No = 0). The duration of help is continuous in years. Care recipient Age is continuous in years. Care Recipient Female is coded as Male = 0, Female = 1.

Table 2*Descriptive Statistics (N = 20)*

	Mean/ Prop.	SD	Min.	Max.
Number of Positive Activities Engaged in each day	1.66	0.75	0.83	3.54
Proportion of days engaged in positive activity	0.87	0.14	0.58	1.00
Caregiver Daily Anxiety (<i>t</i> -score)	49.23	6.11	43.50	63.52
Caregiver Daily Depression (<i>t</i> -score)	47.17	5.84	41.70	59.12
Caregiver Daily Positive Mood	3.72	0.69	2.75	4.77
Caregiver Daily Negative Mood	1.66	0.47	1.03	2.60
Appraisals of caregiving as stressful	1.87	0.53	1.15	3.64
Appraisals of caregiving as rewarding	3.48	0.93	1.21	4.57
Care Recipient Daily Anxiety (<i>t</i> -score)	48.84	6.22	38.26	59.47
Care Recipient Daily Depression (<i>t</i> -score)	47.06	5.47	37.89	59.51

Note. Number of Positive Activities had a possible range of 0-8, Caregiver Daily Anxiety had a possible raw score range of 2-10. Caregiver Daily Depression had a possible raw score range of 2-10. Caregiver Daily Positive and Negative Mood had a possible range of 1-5. Appraisals of caregiving as stressful and rewarding had a possible range of 1-5. Care Recipient Daily Anxiety had a possible raw score range of 4-20. Care Recipient Daily Depression had a possible raw score range of 4-20

Table 3*Means And Standard Deviation Scores On Acceptability And Feasibility Items In The Day 14 Survey*

	Mean score (SD)	% Agree/Strongly Agree	(n) -
Acceptability			
Roadmap App	3.98 (0.82)	78.9% (71)	
Q1: The instructions for the Roadmap app setup were easy to understand.	3.89 (0.90)	77.8% (14)	

Q2: The Roadmap app was easy to set up.	4.11 (0.83)	83.3% (15)
Q4: The Roadmap app was easy to use.	4.06 (1.00)	77.8% (14)
Q5: I was confident using the Roadmap app.	4.06 (1.11)	83.3% (15)
Q6: I am confident that I was using the Roadmap app correctly.	3.78 (1.06)	72.2% (13)
Fitbit®	4.12 (0.44)	89.8% (97)
Q9: The instructions for the Fitbit® set up were easy to understand.	4.11 (0.58)	88.9% (16)
Q10: The Fitbit® was easy to set up.	3.94 (0.73)	83.3% (15)
Q12: The Fitbit® was easy to use.	4.00 (0.91)	88.9% (16)
Q13: The Fitbit® was comfortable to wear.	4.22 (0.65)	88.9% (16)
Q14: The Fitbit® data was easy to sync with my phone.	4.17 (0.51)	94.4% (17)
Q15: I was confident using the Fitbit	4.28 (0.58)	94.4% (17)
Nightly surveys	4.32 (0.55)	91.7 % (66)
Q17: The nightly survey questions were easy to understand.	4.39 (0.61)	94.4% (17)
Q18: The nightly survey questions were easy to answer.	4.28 (0.75)	94.4% (17)
Q19: Answering the nightly survey questions fit easily into my routine.	4.22 (0.81)	88.9% (16)
Q20: The number of nightly survey questions to answer on the app was reasonable.	4.39 (0.70)	88.9% (16)
Feasibility	% (n) - Total Completion	
Nightly Surveys	94.6% (265)	

Table 4

*Bivariate Correlations Between Positive Activities Engagement And Caregivers And Cr Outcomes
(Day-Level Correlations)*

	Number of positive activities engaged in
1. Number of positive activities engaged in	1.00
2. Engaged in ANY positive activity	0.54 ***
3. Caregiver Daily Anxiety	-0.24 ***
4. Caregiver Daily Depression	-0.16 **
5. CG Daily Positive Mood	0.34 ***
6. Caregiver Daily Negative Mood	-0.21 ***

7. Helping PLWD stressful	-0.09
8 Helping PLWD rewarding	0.12 *
9. Care Recipient Daily Anxiety	-0.10
10. Care Recipient Daily Depression	-0.07

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 5
Multilevel Models Examining Caregiver Outcomes As A Function Of Time in the Study And Total Number Of Positive Activities Reported Over The Study Period

	Daily Anxiety (t-score)		Daily Depression (t-score)		Positive Mood		Negative Mood		Helping PLWD stressful		Helping PLWD rewarding	
	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>
Intercept	68.39***	9.26	61.86***	9.89	1.79	1.06	2.67***	0.64	1.85	1.05	4.29*	1.79
Time in Study	-0.30***	0.08	-0.33***	0.07	0.04***	0.01	-0.02**	0.01	-0.02	0.01	0.03*	0.01
Total Number of Positive Activities across study period	-0.27*	0.11	-0.06	0.12	0.04**	0.01	-0.01**	0.01	-0.01	0.01	0.02	0.02
Covariates												
Caregiver Age	-0.19	0.11	-0.17	0.12	0.01	0.01	-0.01	0.01	0.00	0.01	-0.01	0.02
Black	-4.41	2.31	-6.76**	2.47	0.49	0.26	-0.49**	0.16	-0.24	0.26	-0.09	0.45
Caregiver Female	-2.73	2.86	-0.12	3.06	0.06	0.33	-0.09	0.20	-0.23	0.33	0.07	0.55
Caregiving Burden	0.21*	0.10	0.18	0.10	-0.01	0.01	0.02**	0.01	0.02	0.01	-0.01	0.02
Care Recipient MoCA Score	-0.02	0.13	-0.14	0.13	0.00	0.01	-0.01	0.01	0.00	0.01	-0.05*	0.02
Observations	265		265		265		265		263		263	

p* < .05. *p* < .01. ****p* < .001.

Table 6

Multilevel models examining care recipient outcomes as a function of time and number of positive activities across the study period.

	Care Recipient Daily Anxiety (t-score)			Care Recipient Daily Depression (t-score)		
	<i>b</i>		<i>se</i>	<i>b</i>		<i>se</i>
Intercept	44.02	***	9.04	38.69	***	9.01
Time in study	-0.29	***	0.08	-0.18	*	0.08
Total Number of Positive Activities across study period	-0.06		0.11	0.02		0.11
Covariates						
Caregiver Age	0.05		0.11	0.04		0.11
Black	-4.09		2.25	-2.62		2.25
Caregiver Female	-2.70		2.80	-1.27		2.79
Caregiver Burden	0.41	***	0.10	0.35	***	0.10
Care Recipient MoCA Score	-0.01		0.12	0.13		0.12
Observations	264			264		

* $p < .05$. ** $p < .01$. *** $p < .001$.

Figure 1

Positive Activities and Daily Mental and Physical Health among ADRD Caregiver-Care Recipient Dyads Model

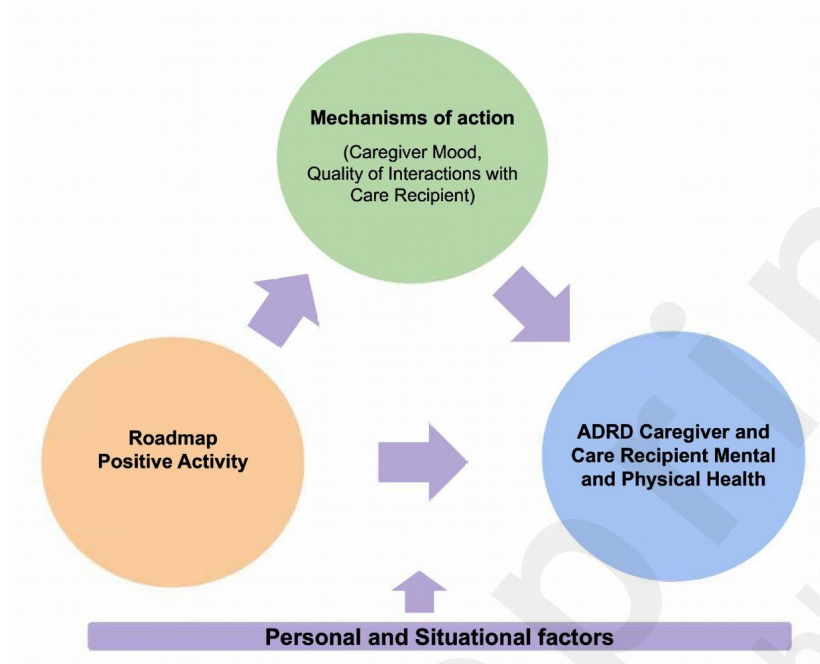


Figure 2*Roadmap positive activity app*

Positive Piggy Bank 	The participant enters the things that made him/her happy throughout the day in the positive piggy bank. At the end of the day, participant will “close the account” and open the piggy bank and read and savor all of the deposited memories.
Pleasant Activity Scheduling 	Set aside a small block of time in the day for a positive activity (e.g., watching a favorite show, bubble bath, having ice cream with friend). This is an “appointment” just as serious as any other appointment.
Gratitude Journal 	The participant will write down 3 things for which the participant is grateful for that day.
Random Acts of Kindness 	Do 5 acts of kindness - including something kind for oneself. Self-care is important (e.g., bubble bath, massage, walk in park, popsicle).
Savoring 	Spend a few minutes savoring two everyday experiences (e.g., coffee, sunshine, call from friend). Participant is to be mindful while savoring the experience and use all the senses to solidify the memory.
Signature Strengths 	Participant will identify the top 7 character strengths using a brief questionnaire (e.g., kindness, creativity, perseverance, bravery, intelligence). The participant will use one of these strengths in a new way that day.
Love Letters 	Finding ways to express warmth, care, deep positive regard, and authentic appreciation to those we love is important to us (the giver) to express, and for the receiver to hear and experience. The participant will be instructed to think about the love they have for the person they are providing care for and write a brief love letter to this person.
Engaging with Beauty 	The participant will be instructed to create a Beauty Log where they will add observations about different types of beauty - to look for beauty as they go through the day. And when they observe something that is beautiful, add it to their log in text or photo form.

Supplementary tables

Supplemental Table 1

Proportion of total variance due to between-person and within-person differences

	Between-person differences	Within-person differences
Caregivers		
Daily anxiety (<i>t</i> -score)	0.57	0.43
Daily depression (<i>t</i> -score)	0.57	0.43
Daily positive mood	0.52	0.48
Daily negative mood	0.49	0.51
Helping PLWD stressful	0.27	0.73
Helping PLWD rewarding	0.54	0.46
Engaged in ANY positive activity	0.26	0.74
Number of positive activities engaged in	0.34	0.66
Care Recipients		
Daily anxiety (<i>t</i> -score)	0.56	0.44
Daily depression (<i>t</i> -score)	0.50	0.50

Supplemental Table 2*Percent of days respondents engaged in each Roadmap positive activity*

Positive Activity	Days	
	<i>N</i>	Percent
Pleasant Activity Scheduling	98	37.0%
Savoring	70	26.4%
Gratitude Journal	67	25.3%
Engaging with Beauty	57	21.5%
Positive Piggy Bank	48	18.1%
Signature Strengths	47	17.7%
Random Acts of Kindness	44	16.6%
Love Letters	10	3.8%
None	33	12.5%

Note. Participants could engage in more than one activity per day.