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THE RELATIONSHIP BETWEEN POSITIVE AND NEGATIVE AFFECT AMONG FAMILY CAREGIVERS OF RELATIVES WITH DEMENTIA

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ABSTRACT

In previous research, positive and negative affect have been conceptualized as either bipolar or independent constructs. Moreover, negative affect has received greater attention given its widespread association with psychological distress. The present research expounds these traditional paradigms by using two current models of affect as frameworks to investigate the relationship between positive and negative affect in a sample of 554 family caregivers of relatives with dementia. First, the dynamic model of affect (DMA) proposed by Zautra and colleagues, is a state-level model which suggests that occasion-specific stress influences the relationship between positive and negative affect. The DMA asserts that under conditions of stress positive and negative affect collapse into a single bipolar dimension as information-processing is simplified to negate the uncertainty created by the stressful situation. In contrast, Fredrickson's broaden-and-build theory of positive emotions is a trait-level model which asserts that positive affect broadens individuals' modes of thinking and behaving, assisting them in building personal resources. This model posits an evolutionary function of positive affect based on the accrual of resources that promoted survival among our ancestors and that enhance modern-day coping efforts. Using the DMA to represent state-level relationships between the affects, the hypothesis that positive and negative affect become inversely correlated as caregivers report higher levels of stress was examined. The broaden-and-build theory of positive emotions was used as a framework to investigate the moderating role of trait-level positive affect on the relationship between occasion-specific stress and negative affect. Multi-level modeling analyses indicated support for the DMA. The subjective stressor role overload was the most salient source of stress for caregivers in its relationship to negative affect. It was also the only source of stress that altered the relationship between caregivers' levels of positive and negative affect. Caregivers with higher levels of role overload had a higher inverse relationship between the two affects; as stress levels increased negative affect also increased, driving positive emotion down. While this state-level relationship was significant, trait-level positive affect did not influence the relationship between stress and negative affect; thus the role of trait-level positive affect as a coping resource was not supported.

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INTRODUCTION

After falling out of fashion for decades, the study of emotion reemerged during the early 1980s as a salient focus of inquiry in the field of psychology. Around this time several of the seminal works on the structure of affect were published (e.g., Diener & Emmons, 1984; Russell, 1980; Watson & Tellegen, 1985). This literature sparked a persistent debate concerning the relationship between positive and negative affect. Additionally, this resurgence brought with it attention to the much neglected area of emotion in adulthood. The theoretical and empirical analysis by Schultz (1982, 1985) on emotionality and aging has been credited with advancing the field and generating further research on the topic. The large body of recent literature on emotion regulation in adulthood and age differences and changes in emotionality (e.g., Blanchard-Fields, Stein, & Watson, 2004; Carstenson, Pasupathi, Mayr, & Nesselroade, 2000) and recent calls for life span research on emotion regulation (e.g., Diamond & Aspinwall, 2003) attest to new and exciting developments in the field of emotion research.

These developments reflect a burgeoning interest in the psychology of affect from theoretical and methodological concerns (Reich, Zautra, & Davis, 2003; Russell & Carroll, 1999a, 1999b; Watson & Tellegen, 1999) to the nature of affect in later life (Isaacowitz & Smith, 2003; Ong & Bergeman, 2004) to the role of positive emotions in coping and resilience (Folkman & Moskowitz, 2000; Fredrickson & Joiner, 2002; Tugade & Fredrickson, 2004). New theoretical frameworks and models of affect inform the debate about the relationship between positive and negative affect and incorporate the role of positive affect, which has been traditionally neglected in favor of a focus on distress.

The present study draws from theoretical models of affect in order to examine the relationship between positive and negative affect in a sample of caregivers providing care for their relatives with dementia. In particular, the dynamic model of affect proposed by Reich, Zautra, and Davis (2003) will be used as a framework to guide this research. This contextual model of affect suggests that information processing is reduced under conditions of stress as attention is narrowed to focus on the problem at hand. While positive and negative affect function as separate systems in the absence of stress, high stress situations encourage conservation of resources. The collapse of these systems into a single system drives the affects into an inverse relationship which can be represented along a single bipolar dimension. This is one mechanism through which conservation occurs. Given that caregivers of individuals with dementia face significant stress including behavioral difficulties and functional impairments of the care recipient, this model offers a viable framework to investigate the relationship between the affects in this particular sample.

The chronic stress associated with caregiving makes it important to investigate the role of positive affect in coping and resilience. Effective coping over the long-term is especially important for dementia caregivers, given that the course of the illness is prolonged, highly variable and unpredictable. The present study will employ the broaden-and-build model of positive emotions (Fredrickson, 1998, 2001) to explore the protective effects of positive affect. This model posits that while negative emotions narrow attention to concentrate resources on the problem at hand, positive emotions expand or *broaden* the attentional field. This broadening promotes creative and novel approaches to problem-solving; thus, individuals *build* personal resources as they explore potential solutions to problems.

This dissertation includes four main sections. The first section highlights the major theoretical rationale and empirical findings from which this research draws. Specific attention will be given to the literature that focuses on the theoretical models of affect used to guide the present study as well as prior empirical evidence on caregiving. The second section outlines the major research questions and hypotheses. The third section provides information concerning the sample, procedures used to collect data, and the constructs of interest. Next, results are presented beginning with a description of preliminary analyses. Lastly, the discussion section highlights the major findings and the implications of these findings for prevention and intervention efforts for caregivers.

BACKGROUND AND LITERATURE REVIEW

Positive and Negative Affect

While a wide array of discrete basic categories of affect may be used to represent mood, most researchers agree that these categories can be subsumed under two broad dimensions: positive and negative affect. These dimensions reflect the overall hedonic tone of emotional experience as evidenced by high correlations among discrete emotion terms in self-report measures of mood and factor-analytic techniques. Using laymen's conceptualizations (i.e. mental maps) of affect and multivariate analyses of self-report data pertaining to affective states, Russell (1980) confirmed this structure, describing it as a circumplex model of affect with valence and arousal dimensions. The bipolar valence dimension is represented by pleasure at one extreme and displeasure at the other while the arousal dimension denotes different degrees of arousal or activation. These two dimensions are depicted on vertical and horizontal axes with various positive and negative descriptors falling into each quadrant. While this representation arises from an unrotated orthogonal solution, rotation of the axes results in two broad factors referred to as positive and negative affect. Robust findings across studies support this two-factor conception of affect (see Watson & Clark, 1997). According to Lawton, Kleban, and Dean (1993), it reflects the state of the art in measurement of emotion.

The relationship between positive and negative affect. While dimensional models of affect enjoy wide support, the relationship between the two dimensions is the source of continued controversy. Russell's (1980) circumplex model proposes a bipolar valence dimension, whether this dimension is represented by pleasure at one pole and displeasure at the other or, upon rotation, by positive and negative affect. These bipolar dimensions are inversely correlated, residing 180 degrees from one another on the circumplex, while unrelated affects are perpendicular. As an alternative to this bipolar conceptualization, the bivariate or uncorrelated bidimensional affect model depicts positive and negative affect as independent of one another (Bradburn, 1969; Diener & Emmons, 1984; Reich, Zautra, & Davis, 2003; Zevon & Tellegen, 1982). Researchers have been attempting to disentangle the bipolarity-independence debate since Nowlis (1965) and Bradburn (1969) asserted independence. Their assertion was controversial, given the strong and wide-spread acceptance of the bipolar view. Independence was counterintuitive because bipolarity was rooted in semantic judgments, as Osgood, Suci, & Tannenbaum (1964) had confirmed. However, as psychometrically sophisticated methodological techniques came into being, more complex exploration became possible. According to Russell and Carroll (1999a), the persistent debate emphasizes three salient considerations: measurement error, the multidimensional nature of affect, and time.

Measurement error. Measurement error became a salient issue early in the debate, as researchers emerged to refute initial claims of independence. Generally, these researchers believed that errors of measurement could bias findings towards independence and away from bipolarity. In other words, random error weakens a correlation coefficient. According to Watson (1988) and Diener and Emmons (1984), Bradburn's (1969) Positive and Negative Affect Scales have low reliability. Diener and Emmons (1984) note that the positive affect scale is especially problematic given a ceiling effect that reduces variability, weakening intercorrelations and coefficient alpha. While the negative affect items are not affected by floor or ceiling effects, Watson (1988) suggests that the reliability of both subscales could be increased if additional items were added. The Positive Affect-Negative Affect Schedule (i.e. the PANAS; Watson, Clark, and Tellegen, 1988) and two sets of scales developed by Diener and Emmons (1984) proved highly internally consistent (Watson, 1988).

Nonrandom or systematic measurement error can also mask bipolarity (Russell & Carroll, 1999a). Bentler (1969) refuted Bradburn's (1969) research, citing the influence of nonrandom error in the form of an acquiescent response style. Acquiescence bias refers to a respondent's tendency to agree or disagree with repeated items, without respect to their content. This tendency causes the correlation coefficient to become increasingly positive. Green, Goldman, and Salovey (1993) discuss this concern suggesting that random and systematic error, particularly acquiescence, can widen the gap between observed and latent correlations. As negative correlations are attenuated, affect dimensions appear relatively independent. Green et al. (1993) demonstrated that after controlling for random and nonrandom error in positive and negative affect, correlations that initially appeared close to 0 were closer to -1. While Tellegen, Watson, and Clark (1999) applaud Green et al.'s (1993) analyses for highlighting the importance of controlling for measurement error, they contend that these authors focused on measures of happiness and sadness. They argue that these measures represent their own pleasant-unpleasant dimension which is largely bipolar. Similarly, Barrett and Russell (1998) point out that affect items that are semantic opposites yield strong bipolar relationships when measurement error is controlled. This is not necessarily the case if the items represented are not bipolar opposites.

Multidimensional nature of affect. The argument between Tellegen et al. (1999) and Green et al. (1993) calls attention to the second major concern articulated by Russell and Carroll (1999a) in the independence-bipolarity debate: the multidimensional nature of affect. Green et al.'s (1993) assertion of bipolarity favors a unidimensional model of affect. However, as Tellegen, Watson, and Clark (1999) emphasize only one of Green et al.'s (1993) analyses was formulated to support a multidimensional model. Unlike the studies that focused on measures of happiness and sadness, measures of positive and negative affect similar to those of the PANAS were tested. The items that make up the PANAS imply both activation and valence. As Barrett and Russell (1998) suggest, the positive affect (PA) dimension of the PANAS is actually two different dimensions and could be referred to as “Pleasant and Activated Affect.” Likewise, negative affect (NA) could be renamed “Unpleasant Activated Affect.” When these measures were used, the evidence was strong enough to suggest that the data did not fit a unidimensional model of affect (Tellegen, Watson, & Clark, 1999). As Barrett (1995) reminds us, a conceptual model of affect that is unidimensional does not exist today.

Time frame. Lastly, Russell and Carroll (1999a) discuss the measurement of momentary versus extended affect. These authors point out that Bradburn’s (1969) findings are less surprising when one considers the time frame associated with measurement. Bradburn (1969) measured affect retrospectively over the past few weeks. The more time between measurements, the more likely one’s data will support independence of affects. On the other hand, at any given moment (i.e. momentary affect), positive affect is likely the bipolar opposite of negative affect (Diener & Emmons, 1984). Contrary to both of these findings, Watson (1988) found that the positive and negative affect scales of the PANAS were independent regardless of the time frame. Russell and Carroll (1999a) assert that retrospective ratings are not useful for testing bipolarity since they are subject to numerous biases including the reconstructive nature of memory, the influence of present mood, and the neglect of duration. Caregivers in the present study were asked to report on their own positive and negative affect during the past week.

Correlation between bipolar opposites. The correlation coefficient is affected by the choice of the response format (Barrett & Russell, 1998; Russell & Carroll, 1999a, 1999b; Watson & Tellegen, 1999). According to Carroll, Russell, and Reynolds (1997), a strictly unipolar response format combined with no measurement error, a normal distribution, and a population mean of 0 should yield a bipolar correlation of -.467. Using this information, Russell and Carroll (1999a) compare the theoretic correlation between two variables as a function of the angle between them on a two-dimensional (i.e. valence and activation) circumplex and the response format (i.e. strictly bipolar versus strictly unipolar). The effect of the response format is no longer viable at 90 degrees. Whether a unipolar or a bipolar format is used, the correlation between positive and negative affect items is still zero. On the other hand, an angle of 180 degrees coupled with a strictly bipolar format yields a correlation of -1. At this angle, positive and negative affect items are represented as semantic opposites in valence and activation. It becomes clear that many different relationships emerge as one dissects the affect-arousal circumplex (Watson & Tellegen, 1999, cf. Reich, Zautra, & Davis, 2003) and as Larsen (2000) points out, this model does not fit everyone equally well. As Reich et al. (2003) comment, these relationships are influenced by different forms of cognition and behavior. Different levels of analysis require multiple methods to fully capture these relationships.

The Dynamic Model of Affect

Given evidence that supports both bipolarity and independence (Barrett & Russell, 1998; Reich et al., 2003; Russell & Carroll, 1999a, 1999b), Zautra, Potter, and Reich (1997) propose an integrative model that stresses the importance of contextual factors in affective experience. This Dynamic Model of Affect (DMA) allows for varying degrees of complexity in individuals' information-processing capabilities. According to the model, emotional processing resides on a continuum from simple, unidimensional, and undifferentiated to complex, multidimensional, and differentiated (Reich et al., 2003). Processing occurs in response to environmental stimuli; hence it is bound by contextual factors.

Stress and the DMA. What influences information processing? The DMA posits that the amount of uncertainty occurring as a consequence of stressful events and experiences affects information-processing capabilities (Reich et al., 2003). The more stressful the experience, the stronger the feelings of uncertainty associated with the experience. As a result, information-processing complexity is reduced as attention is narrowed and focused on the problem at hand. Negative reactivity predominates. This reaction enhances coping ability by preparing individuals to react quickly to a stressor. When this happens the DMA predicts that positive and negative affect become highly inversely correlated. A single bipolar dimension represents this coupling of affect. While this coupling of affect under stressful circumstances often leads to an affective pattern characterized by high negative and low positive affect, the reverse pattern of higher positive and less negative affect can also be interpreted as support for the DMA (see Zautra et al., 2001, 2005).

Support for the DMA. Zautra and colleagues (e.g., Reich & Zautra, 1981; Zautra et al., 1997; Zautra, Reich, & Guarnaccia, 1990) offer support for the DMA among diverse groups of participants using different assessment techniques. Reich and Zautra (1981) tested the influence of life events on well-being in a sample of college students. While all students engaging in positive events reported an increase in positive well-being compared to controls, only those students who reported high levels of negative stressful events in the recent past experienced a reduction in negative affect upon engagement in positive events. Likewise, Zautra et al. (1990) investigated the influence of desirable and undesirable life events among a sample of three groups of older adults: those with a chronic disability, recently bereaved older adults, and a control group without either experience. In support of the bivariate (i.e. independent or uncorrelated) model of affect, desirable events were associated solely with positive well-being for controls. In contrast, older adults with chronic disabilities who reported more desirable events reported less distress compared to disabled adults with few such events. Bereaved adults assessed desirable events as neutral or negative, suggesting a potential third variable explanation.

Several tests of the DMA have focused on chronic pain patients (e.g., Zautra et al., 1997; Zautra, Smith, Affleck, & Tennen, 2001). In their initial test of the model, Zautra and colleagues (1997) found greater coupling of positive and negative affect during weeks reported as stressful compared to those deemed positive in a sample of female rheumatoid arthritis patients. The Inventory of Small Life Events (ISLE; Zautra, Guarnaccia, & Dohrenwend, 1986), which measures the frequency of 21 daily events during the preceding week, was used to categorize stressful versus positive weeks. These findings were partially replicated in a sample of women suffering from fibromyalgia (Zautra et al., 2001). A comparison between rheumatoid arthritis patients and those with fibromyalgia was made on the basis of data suggesting that women with the latter condition experience greater uncertainty regarding the future course of their illness. According to the DMA, stress fosters uncertainty and information processing is reduced as attention is narrowed to focus on the problem at hand. When this happens, positive and negative affect collapse into a single bipolar dimension to facilitate conservation of resources, resulting in an inverse relationship between the affects (Reich et al., 2003). Less affective differentiation was found in the fibromyalgia patients although these findings must be interpreted with caution as initial differences in the groups were observed (Zautra et al., 2001). Using the DMA as a model, Pruncho and Meeks (2004) investigated the interrelationships among health-related stress, positive and negative affect, and depressive symptoms in a sample of caregivers for adult children with developmental disabilities. For these caregivers, the dual threat of their own health related stress coupled with the stress of caregiving resulted in a stronger inverse correlation between positive and negative affect.

Although much of the research in support of the model has been conducted among samples of chronic pain patients, other studies corroborate these results among healthy participants. Zautra, Reich, Davis, Potter, and Nicolson (2000) found that under experimentally induced conditions of stress (i.e. a speech stressor task) the inverse correlation between positive and negative affect increased immediately after the stressor for the highly stressed group. Work-related stress was examined in another test of the model. Using the experience sampling method among a sample of white-collar employees, Zautra, Berkhof, and Nicolson (2002) found support for greater inverse correlations between the affects when the employees reported stressful conditions. These authors addressed measurement issues associated with the independence of positive and negative affect in addition to using two distinct statistical approaches to verify their findings (i.e. two-level multivariate hierarchical linear modeling (HLM) and a contingency analysis).

Positive Affect

While a positive dimension is included in models of affect and the positive affect schedule of the PANAS (Watson, Tellegen, & Clark, 1988) is frequently used as an outcome measure, the benefits of positive emotion have been generally overlooked in favor of an emphasis on the understanding, treatment, and prevention of psychopathology. Recently, a focus on positive psychology evident in the professional literature suggests that a shift is taking place. In a large volume on character strengths and virtues, Peterson and Seligman (2004) introduce a "Manual of the Sanities." In the same vein as the Diagnostic and Statistical Manual of Mental Disorders (DSM), their manual sets forth criteria for classification of character strengths.

Similarly, other researchers (e.g., Diamond & Aspinwall, 2003; Folkman, 1997, Folkman & Moskowitz, 2000; Fredrickson, 1998, 2000; Isen, 2000a, 2000b) have honed in on the adaptive benefits of positive affect including the role of positive emotions in coping and resilience.

Broaden-and-build theory of positive emotions. Fredrickson's (1998, 2000) broaden-and-build theory of positive emotions proposes that while negative emotions narrow attention to concentrate resources on the problem at hand, positive emotions (e.g., joy, contentment, love) expand or *broaden* the attentional field. This broadening promotes creative and novel approaches to problem-solving; thus, as individuals explore potential solutions to problems they *build* personal resources that may be physical, social, psychological, or intellectual in nature. Just as negative emotions are understood in terms of specific action tendencies (e.g., fear-escape or anger-attack), Fredrickson (2004) discusses the evolutionary function of positive affect as the "build" part of her broaden-and-build model. As ancestors accrued personal resources that could be used to respond to future threats, chances of survival were maximized.

The undoing effect of positive emotions. The experience of positive affect may counteract some of the physiological effects associated with negative emotions. Fredrickson and Levenson (1998) refer to this process as the "undoing hypothesis." "Undoing" is hypothesized to disarm the preparation for a specific action prompted by a negative emotion. These authors tested the hypothesis by inducing anxiety-provoking, negative emotion among their participants. The induction resulted in increased cardiovascular reactivity. In turn, they found that a positive stimulus (i.e. film) enhanced cardiovascular recovery after presentation of fearful stimuli, suggesting a buffering effect of the positive film.

While Fredrickson and Levenson (1998) conceptualize "undoing" in terms of physiological recovery, other researchers assert that positive affect experienced during periods of stress may negate the downward spiral associated with clinical depression (Folkman & Moskowitz, 2000; Moskowitz, Acree, & Folkman, 1998). Fredrickson (2000) alludes to this adaptive function suggesting that positive emotions may have an undoing effect on the cognitive narrowing affiliated with clinical depression. Various findings in the research literature beg this very question. Moskowitz et al. (1998) reported higher levels of negative affect in addition to lower levels of positive affect among bereaved men who became clinically depressed over the course of their study. Positive life events have been shown to moderate stress-related depressive symptoms associated with negative events (Dixon & Reid, 2000) and engaging in positive activities has proven successful as a treatment for depression (Lewinson, Redner, & Seeley, 1991). Presumably, events and activities rated as positive are personally meaningful and participation in these events and activities induces positive emotion. On the whole, these findings illuminate the importance for clinicians and researchers of assessing positive affect in relation to negative affect.

Positive affect and the DMA. Fredrickson and Levenson's (1998) study of cardiovascular reactivity and recovery is cited as evidence of a bipolar relationship between the affects, however, cardiovascular reactivity was stress induced. According to the DMA, while stress is responsible for affect coupling, adaptation to stress is characterized as the successful uncoupling of the affects. The "undoing" effect of the positive film could be interpreted in this same context, like uncoupling. In research on positive affect as a source of resilience for chronic pain populations, Zautra, Johnson, and Davis (2005) actually assert that these models (i.e. the broaden-and-build model and the DMA) offer complementary predictions, the major difference being an emphasis on trait affect in the broaden-and build model and state affect in the DMA.

Caregiving and the Stress Process

Providing care to an individual afflicted with dementia is demanding. The experience of providing care has been associated with negative outcomes including stress, strain, physical and mental health problems, and burden (Aneshensel et al., 1995). Problematic behavior, resistance, and disturbances in mood are particularly stressful for the caregiver. Behavior problems are among the most salient predictors of high levels of caregiver distress (Schulz, O'Brien, Bookwala, & Fleissner, 1995) and have been linked to psychological stress and risk for depression among caregivers (Gaugler, Edwards, Femia, Zarit, Stephens, & Townsend, 2000; Levesque, Cossette, & Laurin, 1995). Likewise, they have been cited as a major cause of institutionalization of the care receiver (Gaugler et al., 2000; Mittelman, Ferris, Shulman, Steinburg, & Levin, 1996).

The stress process model of caregiving. Pearlin and colleagues' (Pearlin, Mullan, Semple, & Skaff, 1990) depict the stress process as it relates to the demands associated with caregiving. Primary stressors represented in their model include measures of objective and subjective stress. Objective stressors faced by caregivers include cognitive impairment, activities of daily living (ADL) dependencies, problematic behavior, and patient resistance, while subjective stressors refer to caregivers' reactions to these stressors. Constructs used to capture subjective stressors include role captivity (i.e. the feeling that one is trapped in the caregiver role), role overload (i.e. the experience of feeling overwhelmed by the demands of providing care) and loss of intimate exchange with the care receiver (Aneshensel et al., 1995). As these feelings persist, caregivers become increasingly vulnerable to negative outcomes such as social isolation, physical and mental health problems, and work and family conflict.

Despite the pervasive focus on the detrimental consequences of providing care, the majority of caregivers have something positive to say about their experiences (Berg-Weger, Rubio, & Tebb, 1998; Farran, 1997; Kramer, 1997; Schulz, Newsom, Mittelmark, Burton, Hirsh, & Jackson, 1997). In recent years, researchers have begun to acknowledge the need to explore positive aspects of caregiving. Positive appraisals of caregiving have been associated with increased positive affect (Braithwaite, 1996; Stephens, Norris, Kinney, Ritchie, & Grotz, 1988, Stephens & Franks, 1999); higher self-esteem (Noonan & Tennstedt, 1997); positive morale and positive states of mind (Stein, Folkman, Trabasso, & Richards, 1997); and improved caregiver well-being (Levesque, Cossette, & Laurin, 1995; Motenko, 1989). The adaptive benefits of positive affect including enhanced coping skills and resilience to stressful circumstances discussed by Fredrickson and other researchers outside of the caregiving arena suggest that higher levels of positive affect may be advantageous to caregivers.

The Current Study

Research on affect in the caregiving literature has been generally limited to the use of negative affect or depression as an outcome measure. Similarly, while positive aspects of caregiving have received attention in more recent literature, there is a dearth of research that investigates the presence of positive affect as a protective factor that may counteract the impact of prolonged negative affect. Moreover, caregiving research to date has not explored the relationship between the affects in response to the experience of caregiving. The present study will draw upon the growing body of work on the psychology of affect (Fredrickson, 1998, 2001; Reich et al., 2003; Russell & Carroll, 1999; Zautra, Potter, & Reich, 1997) and empirical evidence on the stress process and caregiving (Aneshensel et al., 1995; Pearlin et al., 1990) to examine the relationship among positive affect, negative affect, and subjective and objective measures of stress related to caregiving. As the DMA (Zautra, Potter, & Reich, 1997) focuses on the importance of contextual factors in affective experience and the relationship between the affects as a function of stressful experiences, it offers a strong conceptual foundation for the present study. Additionally, the broaden-and-build model of positive emotions (Fredrickson, 1998, 2001) will be used as a theoretical framework to guide an investigation into the buffering effect of trait-level positive affect among caregivers of relatives with dementia.

RESEARCH QUESTIONS AND HYPOTHESES

The present study will address the following research questions concerning the relationships among positive and negative affect, and subjective and objective measures of stress related to caregiving.

Question 1: What are the relationships among stress related to caregiving and caregivers' levels of negative affect?

The relationships among subjective and objective sources of stress as outlined in the stress process model of caregiving (Pearlin et al., 1990) and caregivers' levels of negative affect will be examined. One source of each type of stress will be selected based on the strongest zero-order correlations with the dependent variable, negative affect. It is expected that higher levels of subjective and objective stress will be associated with higher levels of negative affect. Guided by previous stress and coping research (e.g., Lazarus & Folkman, 1984; Pearlin, 1982) that highlights the importance of the appraisal process in dealing with stress, the relationship between subjective stress and negative affect is expected to be stronger, compared to the relationship between objective stress and negative affect.

Question 2: What is the relationship between positive and negative affect?

Because positive and negative affect were assessed at the same measurement occasion (see Russell & Carroll, 1999a) and we did not use measurement scales known to yield independent reports (e.g., Watson, Clark, & Tellegen, 1988), the relationship between positive and negative affect is expected to be negative.

Question 3: Does stress at a particular measurement occasion moderate the relationship between occasion-specific positive and negative affect?

Based on the DMA (Zautra, Potter, & Reich, 1997; Reich et al., 2003), conditions of stress are expected to lead to a stronger inverse relationship between the affects. Beyond this inverse relationship, we make no predictions about the particular affective pattern (i.e., higher negative/lower positive affect *or* higher positive/lower negative affect) that will be associated with it.

Question 4: Are health status and duration of caregiving related to caregivers' levels of negative affect?

These variables will be included in the equation predicting negative affect as they are potential sources of stress for caregivers cited in previous research (e.g., Aneshensel, Mullen, Pearlin, Zarit, & Whitlatch, 1995; Charles, Reynolds, & Gatz, 2001; Pearlin et al., 1990). While health status is expected to show a negative relationship to negative affect (i.e., poorer health status, more negative affect), no predictions will be made concerning duration since it is likely that negative affect ebbs and flows over the course of the caregiving career. While a longer duration of caregiving may contribute to increased levels of negative affect, it is also possible that caregivers adapt to their caregiving roles.

Question 5: What is the relationship between mean total positive affect and negative affect?

Like the expected relationship between positive affect and negative affect discussed above (see *Question 2*), it is expected that mean total positive affect will be negatively related to negative affect.

Question 6: What is the relationship between average levels of stress and negative affect across occasions?

An average stress score will be calculated across the three occasions for each participant from the stress measure that exhibits the strongest relationship to negative affect. We expect this relationship to be similar (i.e., positive) to the relationship between occasion-specific stress and negative affect.

Question 7: Do average levels of positive affect (i.e., mean total levels) moderate the relationship between occasion-specific positive and negative affect?

It is expected that average levels of positive affect will moderate the relationship between occasion-specific positive and negative affect. In particular, caregivers with higher mean levels of positive affect are also expected to have higher levels of occasion-specific positive affect and less negative affect.

Question 8: *Do average levels of positive affect moderate the relationship between occasion-specific stress and negative affect?*

Fredrickson's (1998, 2001) broaden-and-build model of positive affect suggests that trait-level positive affect acts as a coping resource to individuals under stress. Using this model as a theoretical guide, it is expected that as average levels of positive affect increase, the strength of the relationship between stress and negative affect will decrease.

Question 9: Do average levels of stress moderate the relationship between occasion-specific stress and negative affect?

It is expected that higher average levels of stress will strengthen the relationship between occasion-specific stress and negative affect.

METHOD

Two samples of caregivers providing care for relatives with dementia were aggregated to form the larger sample used in the present study. Caregivers from each of these samples participated in separate studies that had similar research designs. Measures used in both studies contained identical or nearly identical items. Caregivers from one of the samples (*Family Cares*; *n* = 150) participated in a larger study designed to investigate the effects of adult day care on behavioral and psychological symptoms of the person with dementia. As part of the treatment group, these participants (*n* = 150) used a specified amount of adult day care services over the course of the study. Because participants in the control group self-selected not to use day care services, this group was not included in the present study. The other sample (*Adult Day Care Collaborative Study (ADCC; n* = 566) used for the purposes of this research was drawn from a similar study which investigated the effects of adult day care on caregivers' own levels of stress and well-being. Of the five hundred sixty-six caregivers and their relatives who participated in the ADCC study, two hundred sixty-one participants belonged to the treatment group while the remainder (*n* = 305) served as controls. While the treatment group was required to use a specified amount of adult day care services, controls did not use day care at any point during the study and only a small amount of respite care. These caregivers did not use day care services because they were unavailable in their local areas. The process of aggregating the samples is far less complex given that the focus of the present study does not involve day care use and the measures are the same or similar across the two studies.

Participants. Participants from the Family Cares study were recruited by program staff at adult day service (ADS) facilities in a mid-Atlantic state. A diagnosis of dementia, as reported by the caregiver, was used as an inclusion criterion. A cognitive test, the Mini-Mental Status Exam (MMSE; Folstein, Folstein, & McHugh, 1975), was administered to the dementia patient to validate the caregiver report. Scores on the MMSE have a possible range of 0 to 30, with a score of 24 or lower representing significant cognitive impairment. Dyads with a care receiver who did not have cognitive impairment (i.e., an MMSE score greater than 24) or a confirmed diagnosis were excluded from the study. To be included in the study, dementia patients and their caregivers were required to live in the same household.

Participants from the ADCC sample were referred from adult day care staff and recruited through newspapers, brochures, and newsletters distributed by local Alzheimer's Association chapters in two mid-Atlantic states. A diagnosis of dementia was also required to participate in this study. If the referring agency did not provide a qualifying diagnosis, the caregiver was asked about the most recent diagnosis or diagnoses made by a doctor concerning their relative's memory problems. Alzheimer's disease accounted for 60.8% of the diagnoses; the remaining cases involved other forms of dementia such as multi-infarct dementia. To be included in the study, caregivers had to identify themselves as the person who spent the most time assisting the relative (i.e. the primary caregiver).

The participants (N = 716) were predominantly women (n = 576; 80%), who were either daughters (n = 276; 39%) or wives (n = 210; 29%) of the care receiver. Just over twelve percent (i.e., 12.4%) of participants were husbands caring for their spouses (n = 89). Eighty-nine percent of the caregivers were European American (n = 639) with a mean age of 60.3 years (range = 18-87; SD = 13.63). A majority (n = 571; 80%) were married or living with a partner and eightyseven percent (*n* = 620) had at least one child. Sixty-seven percent were unemployed (*n* = 479) at the time of the study. Mean educational level was 13.3 years (range = 2-17; *SD* = 2.2). Mean income approached $40,000 (range less than $10,000 - over $100,000; *SD* = $10,000). The mean amount of months spent providing care was 36 (range = 1-288; SD = 34.68). A majority of caregivers reported their general health status as good (*n* = 264; 37%) or very good (*n* = 216; 30%). The mean age of dementia patients was 78.5 years (range = 45-100; *SD* = 7.93) and sixty percent of them were women (women: *n* = 431; men: *n* = 285).

Procedures. Trained interviewers conducted structured interviews with primary caregivers in both studies, who provided information about themselves and their relatives in their own homes. The interviews were designed to gather information about patients' and caregivers' sociodemographic characteristics, patients' mood including behavior and psychological symptoms of dementia, patients' and caregivers' use of health care services and medications, and caregivers' stress and well-being. For Family Cares participants, interviews were conducted at baseline, 3-months, 6-months, and 12-months. Caregivers selected for the ADCC study responded to in-person interviews at baseline, 3-months, and 1-year. A more detailed description of the measures used in the present study follows. As the description indicates, comparable items were used in both studies to assess similar or identical constructs.

Measures

Demographic Characteristics. Caregivers reported on their own *gender*, *age*, *education*, *employment status, general health status,* and the *duration of caregiving.* Gender was assessed with a dichotomous item 0 (male) and 1 (female). Caregivers were asked "How old are you?" and filled in their response in years. Caregiver educational attainment was assessed by the following item: "What is the highest grade of school or year of college you completed?" with possible responses ranging from 0 (no formal schooling) to 17 (post-secondary education, graduate school). Employment status was measured with a dichotomous item, “Are you employed at the present time?,” 0 (no) and 1 (yes). Caregivers responded to a single item regarding their own health status. They were asked “How would you rate your overall physical health at the present time?,” with response options ranging from 0 (poor) to 4 (excellent). Higher scores indicate better health. Caregivers were asked how long they had been assisting the care receiver because of dementia-related problems. This item offers an indication of the chronicity of stress experienced by the caregiver. Caregivers’ responses were converted to total number of months.

Stressful Experiences of Caregiving

Objective Stress

One measure of objective stress will be selected from the following two measures based on the stronger significant zero-order correlation to the outcome under study.

Behavior problems. A behavior problems index was calculated across fourteen behaviors that were measured in both studies using a dichotomous format (0 = behavior did not occur; 1 = behavior occurred). This format was used to assess frequency of behavioral and psychological symptoms of dementia (BPSD) exhibited by the care receiver as reported by the primary caregiver. Caregivers were asked to report only those behavior problems that occurred under their direct supervision. Family Cares participants completed a Weekly Record of Behavior (WRB) that asked whether their relative had any of these problems in the past week. ADCC participants were asked the same questions concerning memory and behavior problems pertaining to the past month. These assessments were derived from the Revised Memory and Behavior Problems Checklist (Teri, Truax, Logsdon, Uomoto, Zarit, & Vitaliano, 1992). Specific behaviors assessed in the present study will include 5 items related to cognitive impairment (e.g., "Forgot what day it is," "Asked the same question repeatedly"), 4 items related to disruptive behaviors (e.g., "Angry or aggressive," "Restless or agitated"), and 5 items related to various behaviors in other domains (e.g., "Woke you up during the night," "Heard or saw things that were not there," "Incontinent"). If behavior problems are used as a measure of objective stress then the frequency of behavior reports will be examined to see whether there are any differences between the two samples. Most problems reported by the caregiver are expected to have occurred in the past week, although the time frames are different.

Provision of assistance with everyday activities. The Personal Activities of Daily Living Scale (PADL) scale (Lawton & Brody, 1969) was used to assess the care receiver's need for help with the following six items: (a) eating, (b) dressing/undressing, (c) grooming, (d) bathing, (e) toileting. A sixth item (i.e. getting in and out of bed) was dropped from the scale because only Family Cares participants responded to it. Caregivers reported their relative's need for help on a 4-point Likert scale ranging from 0 (needs no help) to 3 (unable to do without help). Responses for each item were summed to yield a total score reflecting overall need for help with PADL. Higher scores reflect greater need for help.

Subjective Stress

One measure of subjective stress will be selected from the following two measures based on the stronger significant zero-order correlation to the outcome under study.

Role overload. Participants in both studies reported the extent to which they felt that the demands associated with caregiving impinged upon their time and energy (i.e., "role overload"). The six item scale included three items developed by Pearlin and colleagues (1990) (e.g., "I have more things to do than I can handle") and three items that were developed for the earlier ADCC study using the Pearlin Stress Process model as a theoretical guide (e.g., “I am able to relax”). An additional item (i.e. “I feel responsible for my relative”) was included in only the ADCC study and was therefore dropped from the analysis. Caregivers reported how much of the time during the past month they had experienced feelings of overload using a 4-point Likert scale ranging from 0 (never) to 3 (all of the time). Higher total scale scores indicate more role overload.

Role captivity. Caregivers reported the extent to which they felt trapped in their role as a caregiver with a three-item scale developed by Pearlin and colleagues (Pearlin et al., 1990) (e.g., “I wish I could run away”). Caregivers reported the frequency with which they felt the burden of role captivity using a 4-point Likert scale ranging from 0 (never) to 3 (all of the time), with higher scale scores indicating more role captivity.

Caregiver Affect

Negative affect. Symptoms of depression were used to represent caregivers’ levels of negative affect. The negative affect items from the Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977) were used to assess caregiver reports of the frequency of their own negative affect during the past week. The full 20-item scale asks caregivers to report the frequency with which they have experienced affective and somatic symptoms related to negative affect in the past week. Fourteen items representing the frequency of negative affect were included in the current study (e.g., “I felt sad,” “I felt fearful,” and “I felt lonely”). Response categories ranged from 0 (rarely or none of the time or < 1 day) to 3 (most of the time or 5 – 7 days/week). For the purposes of the present research, the positive affect items (e.g., “I felt hopeful about the future”) were excluded as the positive affect subscale of the Positive–Negative Affect Scale (PANAS; Watson, Clark, & Tellegen, 1988) was used as a measure of caregivers’ positive affect (see below). Somatic symptoms (e.g., “My sleep was restless”), which may reflect caregiving demands and/or other health conditions, were also excluded from the original 20-item scale. Higher scores indicate greater frequency of negative affect.

Positive affect. Caregiver reports of their own positive affect during the past week were assessed using the positive affect subscale of the Positive–Negative Affect Scale (PANAS; Watson, Clark, & Tellegan, 1988). The positive affect subscale of the PANAS contains ten adjectives (e.g., "active," "excited," "enthusiastic") that reflect feelings of positive affect. Caregivers were asked to report how often they had experienced these feelings in the past week on a 5-point Likert scale ranging from 0 (not at all) to 4 (extremely). Higher subscale scores indicate greater positive affect. While questions have been raised about the factor structure of the PANAS and other emotion scales (e.g., Rovine, Molenaar, & Cornell, 1999), the whole of the positive affect subscale was used in the current research so that the number of positive items would be comparable to the number of negative items assessed.

RESULTS

Description of Preliminary Analyses

A series of preliminary analyses was conducted. First, prior to forming the subjective and objective stress scales to be used in these analyses, the items from the scales were subjected to principal components analyses. Next, the percentage of missing data on all variables was explored to determine how to handle missingness. Sample attrition was examined from baseline to occasion two based on caregivers' levels of negative affect and other demographic characteristics using a series of chi-square analyses. Preliminary descriptive statistics were examined and subjective and objective stress measures were chosen based on the strongest zero-order correlations with the dependent variable, negative affect. Next, these data were converted from a person-level data set in SPSS, Version 13, to a person-period level data set, also known as a univariate format. The advantages of using this format are discussed by Singer and Willett (2003). Following the conversion, descriptive analyses of change (e.g., empirical growth plots) were conducted in accordance with guidelines proposed by Singer and Willett (2003). As an addition to these descriptive analyses, a series of t-tests or analysis of variance (ANOVA) tests were conducted to examine the relationships between covariates and substantive predictors and caregivers' levels of negative affect at each measurement occasion.

Principle components analysis. Identical items from the objective and subjective stress scales used in each study were subjected to principle components analysis prior to running any other analyses. First, the suitability of the data for principle components analysis was assessed for the subjective stress scale containing the role overload and captivity items. Inspection of the correlation matrix for these scale items revealed many coefficients of .3 and above. Items not correlated with any of the other items at .3 or above were dropped from the analysis. The Kaiser-Meyer-Oklin value was .91, exceeding the recommended value of .6 (Kaiser, 1970, 1974) and the Bartlett's Test of Sphericity (Bartlett, 1954) was statistically significant ($p < .0001$). A principle components analysis revealed the presence of two factors with eigenvalues exceeding 1, accounting for 39% and 11% of the variance respectively. Additionally, Cattell's screeplot revealed a clear break after the second component. Next, promax rotation, which allows for correlation among the variables, was used to interpret these two components. The rotated solution showed three items with substantial loadings on the first factor only. Of these items, the two with the highest loadings (i.e., .74 and .76) were retained and combined with a third item, which loaded on both factors, but had the highest loading of all the variables on the first factor (.80). These three items (i.e., "I wish I could run away," "I feel trapped by my relative's illness," and "I wish I were free to lead a life of my own") offer the most parsimonious factor solution and have been found in past research to be a highly reliable measure of role captivity (e.g., Pearlin et al., 1990). Three additional items had substantial loadings only on the second factor. Additionally, two items with loadings on both factors were retained, as they had the strongest loadings on the second factor. Two other items with substantial but nearly equal loadings on both factors were retained and combined with the other five items to form the 7-item role overload scale. These items have also been used in past research to measure this construct.

The objective stress scale measuring the care recipient's need for help with personal activities of daily living (PADL) was subjected to principle components analysis separately in the same manner described above. All of the items showed correlations of .3 and above, had a Kaiser-Meyer-Oklin value of .81, and a statistically significant Bartlett's Test of Sphericity ($p < .0001$). A principle components analysis revealed the presence of one factor with an eigenvalue exceeding 1, accounting for 52% of the variance. Additionally, Cattell's screeplot revealed a clear break after the first factor. All items loaded substantially on a single component, making it unnecessary to rotate the solution. The second objective stress measure (i.e., frequency of behavior problems) to be examined for inclusion as a potential predictor variable was not subjected to a principle components analysis. The occurrence of a behavior in one domain (e.g., restless behavior, memory problems, and reality problems) is not expected to be related to the occurrence of a behavior in another.

Missing data. One case was dropped from the analyses due to missing data on the dependent variable at all three measurement occasions, reducing the sample size at baseline to 715. Additionally, one hundred and sixty-one cases were dropped from the analyses because only baseline data were available for these cases. Eliminating these cases further reduced the sample size to five hundred fifty-four at baseline. Data were determined to be missing at random (MAR) with missingness attributed to institutionalization, death, or because the care recipient had stopped using day care. The reader is referred to Zarit et al. (1998) for more information. For participants from the available cases, no variables contained more than 5 percent missing data. Attrition effects were analyzed to investigate whether there was a selection trend for participants who dropped out of the study after completing the baseline interview compared to those who continued on in the study. Since the negative affect items from the CES-D were used as a measure of negative affect, this analysis focused specifically on ascertaining whether participants who were depressed had a higher drop-out rate than those who were non-depressed. To test the attrition effects, chi-square analyses were used to compare group differences in depression among those who dropped out of the study after the first interview versus those who did not. The clinical cut-off for the CES-D scale (i.e., 16 or above indicates clinical depression) was used to divide caregivers into two groups, those who were depressed and those who were not. The results of the chi-square analysis showed no significant differences between the groups, $\chi^2(1, N = 554) = 0.52$, $p > .05$. Chi-square analyses were also used to compare group differences between caregivers who did not return to the study after the baseline interview and those who returned with regard to caregiver characteristics including gender, the caregiver's relationship to the care receiver, race, income, and whether caregivers' relatives attended day care. There were no differences with regard to gender, $\chi^2(1, N = 554) = 0.67$, $p > .05$, race, $\chi^2(1, N = 554) = 0.52$, $p > .05$, income $\chi^2(6, N = 526) = 2.59$, $p > .05$, or relationship, $\chi^2(1, N = 554) = 3.39$, $p > .05$. A significant difference did emerge, however, between those who attended day care and those who did not, $\chi^2(1, N = 554) = 26.82$, $p < .0001$; 32.8% of those in the day care group dropped out of the study after the baseline interview compared to only 16.2% of those in the non-day care group.

These are the participants who were no longer eligible for the study as they discontinued day care use.

Preliminary descriptive statistics. Preliminary descriptive statistics were examined to understand the characteristics of the sample and distribution of variables. This procedure provides information about the relationships among study variables (i.e., zero-order Pearson correlations), distribution of data (e.g., skewness, kurtosis and potential outliers) and the amount of missing data. Variables with the strongest relationships at the zero-order level to the outcomes under study will be included as covariates and predictor variables in subsequent analyses. A subjective stress measure (i.e., role captivity or role overload) and an objective stress measure (i.e., PADL or number of behavior problems) were selected for inclusion as predictor variables based on their zero-order correlations with the dependent variable, negative affect. Because role overload showed a higher correlation with negative affect (r = .42, p<.01), this scale will be used to measure caregivers' subjective stress levels. The PADL scale will be used as an objective stress measure based on its correlation with negative affect (r = .09, p<.05), which was greater than the correlation of .07 found between number of behavior problems and negative affect. Choosing one measure of each type of stress eliminates any potential problems associated with multicollinearity and allows for the most parsimonious model. Table 4 shows all zero-order correlations between study variables. The highest correlations are those between occasion-specific variables at baseline and the mean total values calculated across waves for these same variables (e.g., the r between role overload at baseline and mean total role overload is .91).

Variable distributions were examined and appropriate transformations were performed on variables that were not normally distributed. A square root transformation was performed on negative affect to correct for skewness which ranged from 1.82 at baseline to 1.04 at the third occasion of measurement. The transformation visually improved the distribution, reducing the skew to a more acceptable range of 1.08-.42 across waves. A natural log transformation was performed on duration of caregiving (i.e., number of months that the caregiver reported providing care at baseline) because the distribution differed substantially from a normal distribution with a skew of 2.28 and kurtosis equal to 7.9 (see Tabachnick & Fidell, 2006). The transformation reduced the skew to 1.1 and kurtosis to 0.7. Skewness and kurtosis for all other variables were within acceptable limits.

Descriptive analyses of individual change over time. Empirical growth plots were examined to see how individuals in the sample changed over time (see Figure 1). Visual inspection of these plots showed various patterns of change in negative affect scores among participants across the three measurement occasions. While some individuals showed nearly linear trajectories of low negative affect scores, others showed linear increases in their scores across time. Those with the highest negative affect scores at baseline often showed a substantial decrease in their scores at the second measurement occasion followed by either stability or a slight increase at the third occasion. In contrast, those with low baseline scores often showed an increased score at the second occasion with either a leveling off or a slight decrease at occasion three. Many individuals showed curvilinear trajectories. Further inspection of smooth nonparametric trajectories (see Figure 2) confirmed these preliminary inspections. Separate within-person exploratory ordinary least squares (OLS) regression models were fitted for caregivers' negative affect scores as a function of time (see Table 6; Figure 3). While the rate of change estimates in Table 6 show many individuals with slopes indistinguishable from zero, additional exploratory analyses of the same nature revealed many individuals with modest increases and decreases in slope with many estimates for rate of change in the range of 0.2 to 0.4.

Two extreme cases showed steep increases or decreases in their rate of change with coefficients of -0.96 and 0.77. Individual estimated residual variances and R^2 statistics showed substantial variability in quality of fit from lows of 1-2% to highs of 99% for one participant who showed a nearly perfect linear trajectory. These exploratory analyses show heterogeneity in initial status and rate of change and quality of model fit for a linear change trajectory.

Descriptive analyses of change across people. Despite heterogeneity in patterns of change, on average baseline scores appear to increase sharply from the first to the second measurement occasion and then to decrease slightly or remain stable from occasion 2 to occasion 3, as indicated by the mean trend (Baseline *M* = 6.13, 3-month *M* = 10.23, 12-month *M* = 9.81; prior to square root transformation). While Figures 6 and 7 suggest substantial interindividual heterogeneity in change for a small subsample of participants, on average these individuals show increases in their negative affect scores. The mean initial status (i.e., the intercept) for the entire sample was 2.60 (*SD* = 4.26), indicating that the average participant has an observed negative affect score (i.e., initial level) of 2.60 at occasion one. The mean rate of change was 0.36 (*SD* = 1.20). The large standard deviations for initial level and rate of change suggest that participants are scattered widely around these averages. The bivariate correlation between fitted initial status and fitted rate of change was 0.03. This non-significant correlation coefficient indicates that initial status does not influence rate of change.

Exploring covariates. Based on previous research on caregiving and positive and negative affect as well as significant zero-order correlations with the dependent variable, gender, day care use, health status, relationship between caregiver and care receiver, and duration of caregiving were used as covariates in the present research. Fitted OLS trajectories and line graphs showing mean trends in negative affect scores were explored for selected individuals for each dichotomous variable. Health status was recoded to form two groups (i.e., 0 = poor or fair and 1 = good, very good, or excellent general health) and the relationship variable was collapsed into two categories (i.e., spouse and other). Duration of caregiving was recoded into a dichotomous variable (i.e., 0 = 1-36 months and 1 = 37 or more months). Thirty-six months was the mean number of months that caregivers reported providing care. To provide a more through examination of this variable, another recoding scheme was employed based on the median number of months, which was also the mode (i.e., 24 months; 0 = 24 months or less, 1 = 25-48 months, 2 = 49 or more months). Next, t-tests or analysis of variance (ANOVA) tests were conducted to ascertain which relationships were significant. Overall, visual inspection of OLS fitted trajectories and line graphs for gender showed men had lower initial levels and flatter trajectories when compared to women. The line graph also showed a mean linear trajectory for men while woman showed a curvilinear trajectory with an increase from baseline to the second measurement occasion. Independent samples t-tests revealed significant gender differences in negative affect scores at baseline, $t\ (186) = 2.87$, $p < .01$ and at occasion 2, $t\ (541) = 3.47$, $p = .001$. For both of these occasions, women had higher mean negative affect scores than men. There were no significant gender differences at the third occasion. Caregivers who were using day care had higher initial negative affect levels than those who were not. For day care use, there was a significant difference in negative affect scores at baseline, $t\ (451) = 3.65$, $p < .0001$; caregivers with relatives attending day care had higher mean negative affect levels. This difference was no longer significant at the other measurement occasions. Visual inspection of mean trends showed a consistent relationship between caregivers' negative affect scores and all five levels of health status (i.e., poor, fair, good, very good, and excellent); caregivers with the best general health status showed lower negative affect scores while those with the worse health showed the highest scores. All levels showed incremental increases in negative affect scores as health worsened. Independent samples t-tests confirmed significant relationships between health status and the dependent variable as follows: baseline t (163) = 4.93, p < .0001; occasion 2, t (551) = 4.32, p < .0001; occasion 3, t (345) = 5.14, p < .0001. For all occasions those with poor or fair health had higher mean negative affect scores. Additionally, spouses had higher negative affect scores compared to non-spouses at all three occasions, although this relationship was only marginally significant at occasion 2: baseline t (552) = 2.46, p < .05; occasion 2, t (425) = 1.90, p = .058; occasion 3, t (265) = 2.57, p < .05. Visual inspection of OLS fitted trajectories for duration of caregiving based on the recoding schemes described above showed greater variability in initial level of caregivers' CESD scores; rates of change appeared largely uniform. A visual exploration of mean trends showed diverging scores at occasion 3, with the group who had been providing care for more than 3 years showing an increase in negative affect scores from occasion 2 to occasion 3 compared to the other group whose scores decreased in accordance with the overall mean trend after occasion 2. A one-way analysis of variance was conducted at each occasion using duration coded into 3 groups (i.e., 24 months; 0 = 24 months or less, 1 = 25-48 months, 2 = 49 or more months). A significant relationship emerged between duration and caregivers' negative affect scores at occasion 3, F (2, 343) = 3.78, p < .05. A t-test using months recoded as a dichotomous variable (0 = 1-36 months; 1=37 or more months) revealed a similar finding showing a marginally significant relationship between duration and negative affect scores but only for scores at occasion 3, t (344) = 1.97, p = .05. For both tests, negative affect scores were higher for caregivers who had been providing care longer.

Exploring substantive predictors. The relationship between substantive predictors and the dependent variable was explored by dividing predictors at their medians to create high and low objective (i.e., need for help with PADL) and subjective (i.e., role overload) stress groups. High and low positive affect groups were also created in this way. Next, a visual inspection of the mean trends in these relationships for the high and low groups was conducted using a series of line graphs. The graphs revealed differential patterns of change for objective and subjective stress groups with the greatest discrepancy in negative affect scores observed between the high and low role overload groups. These observed differences reflected both differences in initial level and rate of change. The low overload group had a lower initial level on the dependent measure and a less steep rate of change than the high overload group. While the trajectories of both groups flattened out after the second measurement occasion a substantial difference in negative affect scores remained. The high and low PADL groups showed little discrepancy in both initial level and rate of change although the high PADL group had a slightly higher initial level and a higher score at the second measurement occasion. Unlike the role overload groups, the low PADL group's negative affect scores appeared to be on the decline from time 2 to time 3, when compared to the high PADL group. The high positive affect group showed a lower initial level and a more gradual rate of change, although their negative affect scores did increase from baseline to 3-months. OLS fitted trajectories for a small subsample of selected participants were also examined separately by levels of these predictors to gain a better understanding of intraindividual change. The trajectories showing differences between high and low role overload groups exhibited a clearer pattern with an increase in negative affect scores apparent for individuals in the high overload group when compared to those in the low group. Patterns for PADL groups were less clear as many individuals in the low PADL group showed an increase in negative affect scores while many in the high group showed decreases. Given the mean trends depicted in the line graphs and these intraindividual patterns as well as previous caregiving research, role overload is expected to exert greater influence on negative affect scores. Positive affect trajectories for high and low positive affect groups were also explored in this way. While there appeared to be much variability in these trajectories, many of the low positive affect individuals showed fairly flat trajectories regardless of their initial levels, while those in the high positive affect group showed slight increases in negative affect scores. These increases were offset by low initial levels (See Figure 8).

Testing for significant differences between groups. Next, a series of t-tests was conducted at each measurement occasion to determine whether these observed differences in negative affect scores between high and low objective and subjective stress and positive affect groups were significant. As previously described, all groups were formed by splitting the variables at the median score for each measurement occasion. There were no significant differences on negative affect scores for the PADL groups at any of the measurement occasions; the mean negative affect score at occasion 2 was actually higher for the group with lower PADL scores although this difference was not significant. Significant differences emerged for the overload variable at all 3 occasions, baseline $t\ (428) = 8.91$, $p < .0001$; occasion 2, $t\ (480) = 11.0$, $p < .0001$; occasion 3, $t\ (267) = 7.12$, $p < .0001$; individuals with higher median overload scores had higher negative affect scores. The effect size of the difference in the means was 0.13 at baseline, 0.18 at occasion 2, and 0.13 at occasion 3. Guidelines proposed by Cohen (1988) suggest that 0.14 is a large effect. A significant relationship also emerged between the high and low positive affect groups and negative affect scores at each occasion, baseline $t\ (551) = 7.29$, $p < .0001$; occasion 2, $t\ (541) = 6.68$, $p < .0001$; occasion 3, $t\ (345) = 4.53$, $p < .0001$; individuals with higher positive affect had lower negative affect scores. Moderate effect sizes were found for these relationships (i.e., 0.09, 0.08, and 0.06, respectively).

Analytic Plan

The central goal of the present study is to describe the relationship between caregivers' positive and negative affect (i.e., as measured by their negative affect scores) given their levels of subjective and objective stress across three measurement occasions. While the relationship between individuals' levels of positive and negative affect will be explored at each measurement occasion (i.e., occasion-specific positive and negative affect) given their own levels of caregiving stress at that particular occasion (i.e., occasion-specific stress), it is also possible to investigate the moderating role of average levels of stress and positive affect on these occasion-specific relationships. The mixed modeling procedure in SPSS, Version 13, will be used to conduct these analyses. It has also been described as hierarchical linear modeling (HLM; Bryk & Raudenbush, 1987, 1992) and multi-level modeling (MLM). Mixed modeling is advantageous when compared to the general linear model because it does not require independence of observations as a primary assumption. Thus, it handles correlated data and unequal variances. This analytic technique is appropriate for hierarchical or nested data structures. For the purposes of the present study, there are multiple observations for each person and waves of data are nested within persons. The mixed modeling procedure accommodates two or more levels or units of analysis based on the hierarchical nesting structure of the data; in this case, level-1 units of analysis are waves or occasions of measurement and level-2 units of analysis are persons. The first level of the model is the intraindividual or within-person level while the second level corresponds to the interindividual or between-person level. At level-1 within-person relationships among the covariates and the predictors and the dependent variable at each measurement occasion will be explored. The second level of the model will allow for an investigation into between-person differences in the relationships at level-1 using mean level affect and stress variables. Models will be estimated using full maximum likelihood estimation so that deviance statistics can be used to compare both fixed effects and variance components. In contrast, restricted maximum likelihood permits comparison of variance components only (Singer & Willett, 2003).

Time metric. Prior to specifying level-1 and level-2 models three different temporal predictors denoting the passage of time were investigated as possible time metrics (See Table 8). The first one was duration of caregiving measured in months at baseline. At the second measurement occasion three months was added to each individual's baseline number of months; twelve months was added at occasion three. A natural log transformation was then performed to normalize duration. Using the natural log of duration as a temporal predictor, the average individual's negative affect score (i.e., true initial status) at baseline was 2.30 and the average rate of true change across the three occasions was 0.19. When the model for duration as the level-1 temporal predictor was compared to the other two models, it was concluded that this model fits less well. The fit statistics including the deviance, the AIC, and the BIC were much larger for this model than for the other two models. Additionally, the variance components for this model were also larger indicating that there is more unexplained variation when each individual's data is associated with duration. Next, the model using the number of months at which each participant was interviewed (i.e., 0, 3, and 12) was compared to a model that represented the measurement occasions as times 1, 2, and 3. For the former model, 0 was used to represent the baseline number of months, the second measurement occasion occurred 3-months later, and the third took place at 12-months. Like the model with duration of caregiving as the temporal predictor, this model fit less well when compared to the other model as evidenced by the higher deviance, the AIC, and the BIC. The variance components were also larger indicating more unexplained variation. While there is a much larger fixed effect for linear growth when the temporal predictor is represented as occasion 1, 2, and 3 (i.e., time-structured), the slope is steeper because the time period is shorter. Based on these analyses the decision was made to use occasion as the temporal predictor. Duration of caregiving will be included as a covariate, thus accounting for the number of months that a caregiver had been providing care across the study. This can be accomplished by creating duration scores for each participant at each occasion of measurement by adding 3-months to each participant's baseline duration report at the second measurement occasion and 12-months to each participant's score at the last occasion of measurement.

The level-1 model. In order to examine changes in the relationship between positive and negative affect, negative affect will be used as the dependent variable in these analyses. Negative affect was chosen over positive affect because the model contains subjective and objective measures of stress, thus negative affect, which has a more direct relation to stressors, is a logical choice. Including positive affect and stress variables as predictors will allow for a test of the relationship between the two affects in response to these two primary sources of stress. At the first-level of the model (i.e., the within-person model), explanatory variables are time-varying factors that may explain change across time in the outcome. At this level, the dependent measure (i.e., negative affect) for each participant will be regressed on linear and quadratic terms representing the respective measurement occasion for each participant across as many as three measurement occasions. Time-varying coefficients, including positive affect, health status, role overload (i.e., subjective stress), and need for help with PADL (i.e., objective stress) will be estimated as fixed effects since only three waves of data were available for these analyses. Possible random effects with only three waves of data include a residual variance, an intercept variance, a slope variance, and an intercept-slope covariance. While the residual variance is included by default and an intercept variance can be specified, no other random effects will be tested in order to reduce the risk of overfitting these models, which contain a number of covariates and substantive predictors.

The equation used to estimate level-1 parameters is as follows:

$$NA_{(ip)} = b_{op} + b_{1ip}\ (\text{occasion-1})_{(ip)} + b_{2ip}\ (\text{occasion-1}^2)_{(ip)} + b_{3ip}\ (\text{duration})_{(ip)} + b_{4ip}\ (\text{PADL})_{(ip)} + b_{5ip}\ (\text{role overload})_{(ip)} + b_{6ip}\ (\text{positive affect})_{(ip)} + b_{7ip}\ (\text{health status})_{(ip)} + e_{ip}$$

In this equation, person *i*'s score on the outcome variable, negative affect at time *p* equals a quadratic function of occasion of measurement centered at the first occasion, b_3 (duration) is the number of months a caregiver had been providing care at each wave of measurement, b_4 (health status) was represented as a continuous variable at each wave of measurement signifying whether overall physical health was excellent (5), very good (4), good (3), fair (1), or poor (0), b_5(PADL) is a continuous measure of objective stress signifying care receivers' need for help with personal activities of daily living at each wave of measurement, b_6(role overload) represents a continuous measure of subjective stress measured at each wave of measurement, and b_7(positive affect) indicates caregivers' levels of positive affect at each measurement occasion. The estimate b_{op} is the random intercept that represents the predicted level of negative affect evaluated at the first occasion of measurement, b_{1ip} is the linear slope for occasion, b_{2ip} is a fixed quadratic term for occasion of measurement squared, $b_{3ip,}$ $b_{4ip,}$ $b_{5ip,}$ $b_{6ip,}$ and b_{7ip} are fixed effects for the respective variables in the equation above, and e_{ip} is the error term. At level-1, the moderating effect of each potential source of stress on the relationship between positive and negative affect will be tested by including interaction terms between positive affect and each source of stress at each measurement occasion. It is also possible to investigate interactions between duration of caregiving and the other sources of stress to see whether duration impacts the relationship between caregivers' levels of stress and negative affect.

The level-2 model. At level-2, the effects of fixed explanatory variables on the three fixed effects (level, linear, and quadratic rates of change) in negative affect across persons will be estimated. Random effects are predicted by the following equations:

$$b_{op} = k_{00p} + k_{01p}x_{ip} + e_{0ip}$$

$$b_{1ip} = k_{10p} + k_{11p}x_{ip} + e_{1ip}$$

$$b_{2ip} = k_{20p} + k_{21p}x_{ip} + e_{2ip}$$

$$b_{3ip} = k_{30p} + k_{31p}x_{ip} + e_{3ip}$$

$$b_{4ip} = k_{40p} + k_{41p}x_{ip} + e_{4ip}$$

$$b_{5ip} = k_{50p} + k_{51p}x_{ip} + e_{5ip}$$

$$b_{6ip} = k_{60p} + k_{61p}x_{ip} + e_{6ip}$$

$$b_{7ip} = k_{70p} + k_{71p}x_{ip} + e_{7ip}$$

where x_{ip} describes a fixed, person-specific variable for the *i*th individual at the *p*th measurement occasion, k_{01p}, k_{11p}, k_{21p}, k_{31p}, k_{41p}, k_{51p}, and k_{61p} are the within-person estimates of the relationship between x_{ip} and the fixed effects for level and rate of change, k_{00p}, k_{10p}, k_{20p}, k_{30p}, k_{40p}, k_{50p}, and k_{60p} represent the level-2 intercepts in each equation, and e_{0ip} through e_{6ip} are error terms. At level-2 predictors include gender, day care use, relation of caregiver to care receiver, and mean levels of PADL needs, role overload, and positive affect. Mean levels represent an average score for each of these variables across the three measurement occasions for each participant. For the stressor variables they serve as a measure of overall subjective or objective stress; for positive affect they represent an approximation of individuals' trait-level positive affect.

Unconditional Means and Growth Models

Prior to including covariates and substantive predictors in these analyses, two unconditional models were estimated. First, the unconditional means model (i.e., empty model or intercept only model), which quantifies and partitions the total outcome variation, was fitted to these data. Model A of Table 9 shows the results of fitting this model. In the table, the parameter γ_{00} represents the grand mean of negative affect across all occasions and individuals, σ_ε^2 is the within-person variance component representing the pooled scatter of each person's data around their own mean, and σ_o^2 indicates the between-person variance or the pooled scatter of individuals' means around the grand mean (Singer & Willett, 2003). The predicted level of negative affect at the first occasion was about 2.93 on the 1-6 scale. The intraclass correlation coefficient (ICC), which quantifies the amount of between-person variance, can be calculated as follows using these variance components:

$$ICC = \frac{\sigma_o^2}{\sigma_o^2 + \sigma_\varepsilon^2} = \frac{0.396}{0.617 + 0.396} = 0.39$$

This number indicates that almost 40% of the variance in negative affect is attributable to differences between caregivers. Similarly, the covariance parameter estimates suggest that individuals do differ in their average negative affect scores and that there is also within-person variation in negative affect. Both the within-person variance component (.62) and the between person variance component (.40) are significant at the .001 level which suggests that there is additional variation to be explained at both levels.

Next, an unconditional growth model with time expressed as the first occasion was estimated so that the intercept referred to the level of negative affect at the first occasion (see Model B, Table 9). This model showed that the average participant had a non-zero level of negative affect at occasion one (2.62, $p<.001$) and that this level changed linearly over time on average (0.38, $p< .001$). While the variance component for initial status was significant (0.30, $p< .001$) indicating that individuals' levels of negative affect at occasion one differ substantially from the group average, the variance component for the linear occasion term was not significant, suggesting that individuals do not differ significantly from the mean trend. The difference in deviance statistics (i.e., 221) between Model A, the "no change" model and Model B, the linear change model, far exceeds the 0.05 critical value of a chi-square distribution on three *d.f.* (i.e., the fixed and random effects for linear occasion and the covariance between the two). Additionally, the AIC and the BIC are substantially smaller indicating a better fit. Model C includes the addition of a quadratic term (i.e., $occasion^2$). Comparing Model B to Model C, the deviance statistic declines by 74.3 (3724.4-3650.1) and the AIC and BIC are also much smaller, all of which suggest a better model fit. With only three waves of data, it is not possible to model variance components for the quadratic term. Possible random effects with only three waves of data include a residual variance, an intercept variance, a slope variance, and an intercept-slope covariance. While the residual variance is included by default and an intercept variance can be specified, no other random effects will be tested in order to alleviate the risk of overfitting these models.

While the ICC associated with the empty model tells us the percentage of between person variation in the dependent variable, it is also possible to calculate the percentage of within-person variation (i.e., the residual variation) in negative affect that is explained by linear time. This can be done by calculating the pseudo-R^2 statistic using the within-person residual variance components for the unconditional means and growth models. The calculation is as follows:

$$\text{Pseudo-}R^2 = \frac{\sigma_\varepsilon^2(\text{unconditional means model}) - \sigma_\varepsilon^2(\text{unconditional growth model})}{\sigma_\varepsilon^2(\text{unconditional means model})}$$

Plugging the values of σ_ε^2 into the formula yields 0.26, meaning that 26% of the within-person variation in negative affect is explained by linear time.

The Level-1 Submodel: Predictors of Negative Affect

The first level (i.e., the within-person level) of the linear mixed model was structured to answer questions concerning intra-individual differences in caregivers' initial status and rates of change in negative affect. Due to limitations associated with only three waves of data, time-varying predictors at level-1 were modeled as fixed effects. Specifically, the following questions were addressed at level-1:

1.) What is the relationship between individuals' levels of positive and negative affect at a particular measurement occasion? Another way of asking this question at the intra-individual level is as follows: When people have higher levels of positive affect do they also report lower negative affect? Of course, the reverse of this question could just as easily be asked.

2.) Do stress levels associated with a particular measurement occasion moderate the relationship between individuals' positive and negative affect scores at that occasion? *or* When people have higher levels of stress, do they also report higher (or lower) levels of positive affect and lower (or higher) levels of negative affect?

3.) What sources of stress influence the relationship between the affects at the within-person level? Does subjective stress (i.e., role overload) and/or objective stress (i.e., need for help with PADL) moderate the relationship between positive affect and negative affect?

4.) Do health status and duration of caregiving influence this relationship?

Table 7 shows summary statistics for positive and negative affect across the three measurement occasions. While positive affect is fairly stable across time, it is at its lowest level at occasion two when negative affect is the highest. At occasion three, positive affect is the highest and negative affect starts to drop off from its previous level. However, because these summary statistics are aggregations, it is not possible to draw conclusions about intra-individual relationships based on mean trends. In the first step of these analyses, time-varying level-1 variables modeled as fixed effects were added to the unconditional means model (i.e., intercept only model) starting with the primary variable of interest, occasion-specific positive affect (see Model A, Table 10). The estimate for γ_{00} (4.25) indicates that the estimated average (true) value of negative affect when positive affect is zero is 4.25. The coefficient for positive affect (i.e., γ_{01}, -0.59) captures the relationship between positive affect and initial status. For each 1 point difference in positive affect, individuals differ by 0.59 points in negative affect. The standard error of 0.04 yields an observed *t*-statistic of 16.47, ($p<.0001$), indicating that the null hypothesis that there is no relationship between positive and negative affect can be rejected. The covariance parameter estimates suggest that adding positive affect to the unconditional means model helps to explain variation in negative affect both between and within individuals. The variance component representing variation between individuals drops more than the within-person variance component when these estimates are compared to the intercept only model (i.e., Model A, Table 9). Thus, the addition of positive affect explains more of the variation between individuals. The percentage can be calculated by subtracting the between person variance component for the conditional means model from the between person variance component for the unconditional means model (i.e., the empty model) and dividing by the latter (i.e., 0.40-0.28/0.40). This tells us that 30% of the explainable variation in negative affect is explained by positive affect. All of the fit statistics (i.e., the deviance, AIC, and BIC) are greatly reduced with the addition of positive affect to the model.

Model B, Table 10 shows the fixed effects of positive affect and the stressor variables for the intercept only. This model includes the two measures of caregiving stress, PADL and role overload, and the coefficients for health status and the natural log of duration of caregiving. The intercept estimate changes to 3.03 as it now represents the estimated average true value of negative affect at initial status when all of the other predictor variables are zero. Although this estimate reflects “zero” stress it is also an estimate of the value of negative affect when positive affect and health status are zero (i.e., poor for health status). It is almost exactly the midpoint on the scale of 1-6, which represents the values of negative affect after a square root transformation. The measures of subjective and objective stress and duration of caregiving are all positively related to negative affect, suggesting that caregivers with higher levels of role overload, those who have been providing care longer, and those whose relatives have greater PADL needs have higher levels of negative affect. The relationship between PADL and negative affect is significant at the $p<.05$ level while the other variables are statistically significant at $p<.001$. The coefficient for health status (coded 0-5, poor to excellent) is negative but in the expected direction telling us that individuals with better health experience less negative affect. The variance components decrease ever so slightly from the previous model, which included only positive affect. It should be noted that the within person variance component is included by default in the random statement and represents the within-person residual (i.e., the error term in a standard regression model) while the between person variance component is specified for the intercept. As time-varying predictors are added to a model it is possible to interpret the decrease in the level-1 residual as potentially explained within person variation. It is not possible, however, to draw conclusions based on changes in the level-2 variance component since the inclusion of predictors at level-1 changes the meaning of the individual growth parameters (see Singer & Willett, 2003). The deviance for this model is reduced to 3515 from 3695, a difference of 180. Moving from Model A to Model B, we add four predictors of initial status so that the former model can be obtained by invoking four independent constraints on the latter (i.e., setting γ_{02} - γ_{05} to 0). Thus, the difference in deviance statistics can be compared to a χ^2 distribution on 4 *d.f.*. As 180 far exceeds the .005 critical value of 14.86, it is possible to reject the null hypothesis that γ_{02} - γ_{05} are 0. The decrease in the AIC and the BIC confirm that Model B is a better fit. Although there is considerable debate over the use of these information criteria, Raftery (1995; c.f. Singer & Willett, 2003) considers a difference of over 10 in the BIC as very strong support for a superior model fit.

Model C, Table 10, includes the interaction terms between all four potential sources of stress (i.e., health status, duration of caregiving, role overload, and PADL needs) and occasion-specific positive affect. Inclusion of these terms in the model, albeit without the effect of time, allows for a preliminary test (i.e., fixed effects at the intercept only) of the hypothesis that occasion-specific stress moderates the relationship between occasion-specific positive and negative affect. The only interaction that is significant is the interaction between positive affect and role overload (β = -0.24, *t*(1387) = - 4.03, *p*<.0001). Additionally, the main effect of role overload retains significance (β = 0.99, *t*(1369) = 6.69, *p*<.0001), suggesting that it exerts a strong positive effect on negative affect. The coefficient for the main effect of role overload (i.e., 1.03) suggests a strong positive relationship for those with "zero" levels of positive affect. The interaction term tells us that for those with "zero" levels of overload, there is no association between positive and negative affect; however, for caregivers with higher overload scores, lower levels of positive affect are related to higher levels of negative affect (See Figure 9). The main effects of duration of caregiving and health status also retain significance (β = 0.22, *t*(1218) = 6.69, *p*<.05; β = -0.25, *t*(1364) = 6.69, p =.001, respectively). In contrast, the coefficient representing need for help with PADL is no longer significant (β = 0.02, *t*(1354) = 0.44, *p*=.66). The variance components do not change which is expected since no random effects or level-2 predictors have been added to the model. Once again, all of the goodness-of-fit statistics exhibit a substantial reduction from the previous model suggesting an improved model fit. The difference in deviance between Model B and Model C is 25. As described above, this exceeds the .005 critical value of 14.86 on a χ^2 distribution of 4 *d.f.*. This value is used because four additional fixed effects have been added to Model C.

Interactions were also tested between duration of caregiving and the other sources of potential stress (i.e., health status, role overload, and need for help with PADL) to assess interactive effects on stress processes associated with duration. Likewise, the interaction of duration and positive affect was also tested. None of these interactions were significant and this was reflected in the goodness-of-fit statistics for this alternative model. Both the AIC (i.e., from 3514 to 3519) and the BIC (i.e., from 3574 to 3598) increased and the deviance statistic remained virtually unchanged.

Next, the occasion variable was added to Model D, Table 11. Adding this temporal predictor allows for an examination of the fixed effects related to the rate of change in negative affect. Since the unconditional growth model previously described (see Table 9) showed significant linear and quadratic effects for rate of change in addition to a substantially improved model fit resulting from the addition of the quadratic term, both terms were included in the current model. The main effects of all of the stress variables were retained as was the significant interaction between role overload and positive affect. The fixed effect for the intercept (i.e., 1.83) changes very little from the previous model as the only difference in the two models is the addition of the occasion term (coded as 0, 1, and 2). Thus, the intercept estimate is the average value of negative affect across persons at the first occasion when all other predictors are zero. Of the predictor variables, health status, role overload, and the interaction of positive affect and role overload retained their consistent and significant associations with negative affect when time was added to the model. All of these variables were significant at the $p<.0001$ level. The coefficients for the temporal variable reflect the estimates previously obtained in the unconditional growth model (i.e., 1.03 for linear time and -0.35 for the quadratic term). The linear term represents the average slope across persons when all other variables are zero. This term informs us that the non-zero level of negative affect at occasion 1 (i.e., 1.83, the fixed effect intercept estimate for the model) changes linearly across time on average. The fixed effect for the quadratic term indicates an average trend of deceleration ($\beta = -0.35$, $t(939) = -10.33$, $p<.0001$). Overall, these coefficients suggest that negative affect is increasing across time on average, but at a decreasing rate. While the level-2 variance component increases slightly, no conclusion can be drawn from this decrease as we have not yet added level-2 predictors to the model. The level-1 variance component decreases from 0.51 to 0.36 suggesting that some of the variation in negative affect has been explained by our temporal predictors. The goodness-of-fit statistics show substantial declines; the difference in deviance is 318 indicating that the null hypothesis can be easily rejected.

The Level-2 Model: Predictors of Negative Affect

At the second level (i.e., the between-person level) of the linear mixed model the coefficients from level-1 serve as the outcome variables at level-2. The explanatory variables at level-2 are time invariant and are considered to be stable characteristics or it may be that they were measured at only a single measurement occasion. Explanatory variables serving as covariates at level-2 for the current study include caregiver's gender, the relationship of caregiver to care receiver, and day care attendance. Substantive predictors are the mean level variables including caregivers' mean levels of positive affect and role overload. Specifically, the following questions were addressed at level-2:

1.) Do levels of negative affect differ by gender?

2.) Do levels of negative affect differ for caregivers who care for their spouses compared to non-spouse caregivers?

3.) Do levels of negative affect differ between caregivers whose relatives attend day care and those who do not attend?

4.) What is the relationship between individuals' mean levels of positive affect and occasion-specific negative affect?

5.) What is the relationship between individuals' mean levels of stress (i.e., role overload) and occasion-specific negative affect?

6.) Does mean positive affect moderate the relationship between occasion-specific positive affect and occasion-specific negative affect?

7). Does mean overload moderate the relationship between occasion-specific role overload and occasion-specific negative affect?

8.) Do average levels of positive affect moderate the relationship between occasion-specific stress and negative affect?

In the next stage of these analyses, the fixed effects for initial level for duration of caregiving and need for help with PADL were removed (i.e., constrained to 0) because their single parameter tests could not be rejected in Model D. Additionally, the fixed effects for rate of change were included for all level-1 variables including duration of caregiving and the PADL variable (see Table 11, Model E). None of the slope coefficients for these variables were significant, although the model fit was improved by constraining the fixed effects of PADL and duration of caregiving for the intercept to 0. This improvement was reflected in the large difference in deviance and a lower AIC statistic, however, the BIC did not support the improvement. The BIC for the previous model (i.e., Model D) was 3252 while the BIC for the current model was 3275. While the AIC is based upon the number of parameters in the model, the BIC is a more stringent criterion, taking into account the sample size and the number of parameters. In a larger sample, a larger improvement is necessary before a more complex model is preferred to a simpler one (Singer & Willett, 2003).

Model F shows the addition of the level-2 covariates, gender, day care use, and relationship of caregiver to care receiver. Prior to running this model, a full model was investigated examining the fixed effects for initial status and rate of change for each of these covariates. No gender differences were found for either of these parameters ($\beta = -0.10$, $t(1154) = -1.16$, $p=.25$ for initial status; $\beta = -0.23$, $t(901) = -1.31$, $p=.19$ for rate of change). While the fixed effect for initial status was significant for the relationship variable ($\beta = -0.22$, $t(1154) =$

-3.13, $p<.01$), the fixed effect for rate of change was not ($\beta = 0.18$, $t(908) = 1.24$, $p=.21$). The relationship between this covariate and the intercept indicated that non-spouses had significantly lower levels of negative affect compared to spouses. The day care use variable was also significant for initial status ($\beta = -0.16$, $t(1154) = -2.39$, $p<.05$) and marginally significant for linear rate of change ($\beta = 0.25$, $t(914) = 1.87$, $p=.07$). The relationship between this covariate and initial status showed that caregivers whose relatives were not using day care at baseline had lower levels of negative affect. The sign for this coefficient changed when the relationship between day care use and linear time was investigated; those caregivers not using day care for their relatives had higher levels of negative affect across time. The parameter estimate of 0.25 indicates that individuals who differ by 1 with respect to the covariate have growth rates that differ by 0.25. While the variance components remain unchanged this can be attributed to modeling only fixed effects associated with these variables. This is a limitation given only three measurement occasions and the complexity of these models; the variance components would likely decrease if random effects were included in these analyses. Because their single parameter estimates were not significant, the coefficients representing the fixed effects for rate of change for gender and relationship of caregiver to care receiver were constrained to 0 in Model F. The slope parameter for day care use and the parameters for the fixed effects of gender, day care use, and the relationship variable at baseline were retained. Of these variables, the relationship variable showed a significant relationship with initial status ($\beta = -0.19$, $t(563) = -3.46$, $p=.001$); non-spouses had lower levels of negative affect compared to spouses. Similarly, as the previous model showed, the relationship between the intercept and day care use was significant ($\beta = -0.16$, $t(1139) = -2.47$, $p<.05$) and the slope parameter for the day care variable was marginally significant ($\beta = 0.24$, $t(910) = 1.78$, $p=.07$). After constraining the slope parameters to 0 for relationship and gender, the relationship between gender and initial status was marginally significant (β = -0.13, $t(545) = -1.87$, $p=.06$) indicating that men have lower levels of negative affect compared to women at baseline. The strong associations between initial status and health status (β = -0.14, $t(1334) = -5.81$, $p<.0001$), role overload (β = 1.01, $t(1427) = 7.86$, $p<.0001$), and the interaction between positive affect and role overload (β = -0.21, $t(1432) = -4.13$, $p<.0001$) did not change. The goodness-of-fit statistics (i.e., the deviance and the AIC) for Model F indicate that Model F is a worse fit than Model E, which included all of the time-varying level-1 variables and their interactions. The BIC, however, is substantially reduced from 3275 to 3253. Because the difference in deviance is considered the most objective standard for model fit (Singer & Willett, 2003), we conclude that the current model is indeed a worse fit than the previous one.

Next, the fixed effects for initial status for the mean level variables (i.e., mean total positive affect and role overload) were added in Model G, Table 12. Additionally, the interaction terms testing the moderation effects of mean level positive affect on the relationship between occasion-specific positive and negative affect and mean level role overload on the relationship between occasion-specific overload and negative affect were added to the model. The significant level-1 coefficients and those representing level-2 covariates from the previous model were retained. This model proved a better fit than the previous model (i.e., Model F). The difference in deviance between the models was 29, exceeding the .005 critical value of 14.86 on a χ^2 distribution of 4 *d.f.* (4 fixed effects were added to Model G). The AIC dropped substantially from 3179 to 3158 although the BIC remained the same. Regarding the covariates, the relationship between initial status and day care use (β = -0.17, $t(1147) = -2.53$, $p=.01$) and initial status and the relationship variable (β = -0.18, $t(560) = -3.32$, $p=.001$) remained significant, however, the coefficient associated with gender at baseline was no longer significant (β = -0.12, $t(537) = -1.56$, $p=.12$). The coefficient representing the relationship between day care use and rate of change was again marginally significant (β = 0.28, $t(907) = 1.92$, $p<.06$). While the coefficients for the fixed effects of initial status for occasion-specific positive affect and health status were significant (β = -0.41, $t(1360) = -2.48$, $p=.01$; β = -0.13, $t(1333) = -5.61$, $p<.0001$), adding the mean level variables and the interactions resulted in a non-significant coefficient for occasion-specific role overload (β = 0.02, $t(1404) = 0.08$, $p=.94$) and a marginally significant coefficient for the interaction between positive affect and role overload (β = -0.09, $t(1438) = -1.61$, $p=.10$). The influence of mean total overload was significant and appeared to override the influence of occasion-specific overload (β = -0.39, $t(1196) = -2.50$, $p<.05$). The interaction between occasion-specific positive affect and mean total positive affect was marginally significant (β = 0.08, $t(1018) = 1.77$, $p=.08$) while the coefficient for the interaction between occasion-specific role overload and mean role overload showed a strong association with the intercept (β = 0.36, $t(1093) = 4.52$, $p<.0001$). Although not significant in this model because of the added interaction term (i.e., role overload*mean total role overload), occasion-specific role overload is strongly and positively related to negative affect in all of the other models; higher levels of role overload are related to higher levels of negative affect. We interpret this relationship for individuals with zero levels of positive affect because the predictors in our models are not mean-centered. On the other hand, for caregivers with zero levels of occasion-specific role overload, the coefficient for mean total overload suggests that higher levels of mean total overload are related to lower levels of negative affect. However, the coefficient for the interaction term between mean total role overload and occasion-specific role overload tells us that as mean total overload increases, the relationship between occasion-specific role overload and negative affect (previously found in all of the other models) gets stronger, indicating a moderating effect of mean total role overload. Prior to interpreting the marginally significant coefficient for the interaction term between occasion-specific positive affect and mean total positive affect, the main effects of these two variables were examined. First, higher occasion-specific positive affect is associated with lower negative affect, for those with no role overload. The coefficient for mean total positive affect indicates that higher levels of mean total positive affect are also associated with lower levels of negative affect. This interpretation holds for individuals with zero levels of occasion-specific positive affect. The coefficient for the interaction term between occasion-specific positive affect and mean total positive affect suggests a moderating effect of mean total positive affect; for caregivers with higher mean total positive affect, the negative association between occasion-specific positive and negative affect is weaker. It should be noted that we also investigated whether mean positive affect moderated the relationship between role overload and negative affect, as occasion-specific positive affect did at level-1. No moderation effect was found ($\beta = 0.13$, $t(1384) = 1.16$, $p=.25$).

In the last model, Model H, Table 13, relationships between the mean level variables and rate of change were tested along with the significant predictors from the previous model. Although none of these relationships were significant, the model fit improved as indicated by the difference in deviance and the AIC. The deviance was reduced by 46 while the AIC was reduced by 30. The BIC increased by about 10. This statistic may be influenced by fluctuations in sample size across the three waves. The relationships for the three covariates (i.e., gender, day care use, and relationship) remain unchanged from the previous model. Although marginally significant in the previous model, the level-1 interaction between occasion-specific positive affect and role overload at the intercept is restored to full significance at the .05 level ($\beta = -0.12$, $t(1438) = -2.02$,

$p<.05$). Similarly, the coefficients representing mean total overload ($\beta = 0.73$, $t(1439) = -3.18$, $p=.001$) and the moderation effect of mean total positive affect on the relationship between positive and negative affect ($\beta = 0.08$, $t(1217) = 1.65$, $p<.05$) were also significant. Likewise, the moderation effect of mean total overload on the relationship between role overload and negative affect ($\beta = 0.43$, $t(1328) = 4.75$, $p<.0001$) remained significant, as they were in Model G. Model H was designated as the final model as it included all of the mean-level variables necessary to test our hypotheses.

DISCUSSION

The current study examined the relationship between positive and negative affect in a sample of caregivers providing care to relatives with dementia. The conceptual foundation for the study was drawn from empirical evidence on caregiving research (e.g., Aneshensel et al., 1995; Pearlin et al., 1990) and two current approaches to affect, the dynamic model of affect (DMA; Zautra, Potter, & Reich, 1997), and the broaden-and-build theory of positive affect (Fredrickson, 1998, 2001). The linear mixed modeling approach used in the study provides information about occasion-specific relationships at the intra-individual level among caregiving stress and positive and negative affect. Additionally, it allows for an examination of the influence of mean-level stress and positive affect on these occasion-specific relationships.

The DMA is a state-level model of affect which suggests that occasion-specific stress influences the relationship between positive and negative affect at a particular occasion. The model asserts that conditions of stress lead to a higher inverse relationship between the affects. This inverse relationship is represented by the collapse of positive and negative affect into a single bipolar dimension as information-processing is simplified to negate the uncertainty created by a stressful situation. While Zautra and colleagues have tested their model in populations experiencing health-related stress (e.g., chronic pain), the current study extends that application by examining the influence of different types of stress experienced by family caregivers of individuals with dementia on this relationship. We chose two primary sources of caregiving stress based on previous research on dementia caregiving (Pearlin et al., 1990): the care receiver's need for help with personal activities of daily living (e.g., bathing, dressing, toileting) was used as a measure of objective stress while role overload (i.e., the extent to which caregivers feel that the demands associated with caregiving impinge upon their time and energy) served as our measure of subjective stress. Health status and duration of caregiving were also included as potential sources of stress for caregivers. Although only small differences in physical health are generally found between caregivers and non-caregivers, these differences appear to be greater for dementia caregivers (Pinquart & Sörensen, 2003). Duration of caregiving has been described in previous research as a marker of the chronicity of caregiving stressors (Aneshensel et al., 1995).

Our analyses indicated that the most salient source of stress for caregivers was the subjective stressor, role overload. This finding has been supported in previous caregiving research linking caregivers' levels of role overload to depressive symptomology and anger (Aneshensel et al., 1995). Role overload showed the strongest relationship to negative affect; for every one-point increase in their levels of role overload, caregivers' negative affect scores showed a corresponding increase. As a measure of subjective stress, role overload represents an appraisal of the degree to which the responsibilities associated with caregiving overwhelm or exhaust the caregiver. While objective stress experienced by caregivers can certainly contribute to legitimate feelings of overload, caregivers dealing with similar levels of objective stress often appraise their situations in markedly different ways. Pearlin (1982) posits societal and cultural influences on stress noting that people with similar life conditions experience differential reactions to stress. Furthermore, stress and coping theory (Lazarus & Folkman, 1984; transactional model of stress and coping) suggests that individuals' cognitive appraisals play a major role in determining both the magnitude of the stress response and the coping strategies that they employ to handle stress. Thus, subjective stress measures which assess caregivers' feelings about their roles may be better predictors of caregiver outcomes than objective stress scales that measure more tangible caregiving experiences. Our findings further reinforce this idea; not only did role overload emerge as the most salient source of stress in its relationship to negative affect, our objective stress measure (i.e., the care recipient's need for help with personal activities of daily living) exhibited the weakest relationship to negative affect of all of the sources of stress, including health status and duration of caregiving.

Our hypothesis that positive and negative affect would show a stronger inverse relationship as caregivers' levels of stress increased was supported; caregivers with higher levels of role overload also reported higher levels of negative affect *and* lower positive emotion scores. While this finding reiterates previous research by Aneshensel et al. (1995) linking caregivers' levels of role overload with negative outcomes like depression, it also offers further empirical evidence in support of the DMA. According to the DMA, stressful experiences invoke changes in the degree of independence between positive and negative affect (Zautra et al., 2001). In other words, they alter the fundamental structure of the affective relationship as evidenced by a lesser degree of differentiation between the affects. Affective space shrinks, complexity is reduced, and the affects collapse into a single dimension. Zautra et al. (2001, 2005) offer that negative affect often crowds out positive affect during stressful experiences. This was the case for the dementia caregivers in our sample; when caregivers' levels of role overload were high, their negative affect levels showed a corresponding increase while their positive affect scores declined.

Although interactions between positive affect and all of the potential sources of stress were tested as predictors of negative affect, role overload was the only predictor that had a moderating effect on the relationship between occasion-specific positive and negative affect. This finding offers insight into the nature of role overload as a particularly debilitating source of stress for caregivers, one that is sufficient enough to disrupt affective dynamics. According to the DMA, the amount of uncertainty occurring as a consequence of stressful events and experiences affects information-processing capabilities (Reich, Zautra, & Davis, 2003). The more stressful the experience, the stronger the feelings of uncertainty associated with the experience. As a result, information-processing complexity is reduced as attention is narrowed and focused on the problem at hand. Negative reactivity predominates. This reaction enhances coping ability by preparing individuals to react quickly to a stressor. When this happens the DMA predicts that positive and negative affect become highly inversely correlated. Feelings of uncertainty may be especially prevalent among the dementia caregivers in our sample. While they may be stress-induced as the DMA suggests, they may also reflect caregivers' concerns about future uncertainties related to their own ability to provide care, financial matters, or the course of their relative's dementia. Of course, future uncertainties of this nature may be presumed stressful. Thus, a bidirectional association between caregiving stress and uncertainty may create a cyclic relationship that is particularly debilitating and difficult to break. If the end result of such a process is an increase in caregivers' levels of negative affect *and* a corresponding decrease in positive emotion, then caregivers may be at risk for clinical depression should this affective pattern persist over time. The impact of high levels of role overload on the caregivers in our sample recalls previous research on the effect of exacerbations in chronic pain on affect relationships among women suffering from rheumatoid or osteoarthritis and/or fibromyalgia (e.g., Zautra et al., 1997; Zautra, Smith, Affleck, & Tennen, 2001). As chronic pain increased, levels of negative emotion also increased and women reported lower levels of positive affect. Such changes in the relationship between positive and negative affect may serve as a marker of chronicity of stressors. Conversely, while the DMA stipulates an inverse relationship between the affects under stress, there may be a point at which a shift takes place; an inverse relationship characterized by higher levels of negative affect and less positive affect may be replaced by an equally inverse relationship but one that favors higher levels of positive affect. A change in the relationship between the affects in favor of higher levels of positive affect may be indicative of adaptation to caregiving stress. While stressful caregiving experiences likely fluctuate in their intensity and may be influenced by various circumstances such as a particular individuals' accessibility to internal and external resources, they generally do not just disappear (at least so long as a person is a caregiver). According to Aneshensel et al. (1995), the day-to-day burden associated with caregiving remains relatively constant, although the demands may vary. Examining the relationship among stress levels and levels of positive and negative affect across a longer period of time could shed light on the role of affective dynamics in the stress process. Of course, the affective patterns discussed herein are not the only possible affective outcomes for individuals who experience chronic stress. Another promising area of research involves the construct of emotional complexity (i.e., a more differentiated relationship between positive and negative affect) and its potential role in emotion regulation (e.g., Labouvie-Vief & Medler, 2002; Ong & Bergeman, 2004).

Although duration of caregiving initially predicted negative affect, this relationship was weak and eventually lost significance as other predictors were added to our models. Similarly, no interactive effects between duration and any of the other stress variables were found. While a longer duration of caregiving has been associated with negative consequences (e.g., declines in physical and psychological health) for the caregiver, more time spent providing care may also facilitate the adaptive processes discussed above as caregivers find constructive ways to manage their specific situations and the emotions that surround them (see Stephens & Zarit, 1989). It is equally possible that it difficult to capture associations among duration of caregiving, stressful caregiving experiences, and affect as these relationships are nuanced and characterized by a large degree of variability among caregivers; thus, a greater degree of precision may be necessary in order to capture them. Although it was not assessed in this study, the illness duration provides additional information about particular challenges (e.g., increases in behavior problems during the middle years of a dementia) that a caregiver may experience. Health status was the other potential source of stress included in our analyses. Although caregivers' with worse health had more negative affect across the three waves, this was not a significant source of stress for the majority of our sample (e.g., 75% reported good, very good, or excellent health, only 3% reported that they had poor health). Additionally, there were no interactive effects between positive affect and health status suggesting that the relationship between positive and negative affect is unaffected by this variable.

Using multi-level modeling we were able to examine between-subject differences in gender, day care use, and the relationship of the caregiver to the care receiver, in the level-1 relationships among the variables. No gender differences emerged in caregivers' negative affect levels and separate analyses showed no differences in levels of positive affect by gender.

Although gender differences have been implicated in previous research on affect, these findings have often revealed differences related to affect intensity (e.g., Carstenson et al., 2000; Diener et al., 1999; Fujita, Diener, & Sandvik, 1991) or contingent upon other influences such as extraversion or neuroticism and marital status (e.g., Diener, Gohm, Suh, & Oishi, 1998; Mroczek & Kolarz, 1998). Thus, we were not surprised by this finding. In contrast, day care use and the relationship between the caregiver and the care receiver were related to negative affect; caregivers with relatives who were attending day care had lower levels of negative affect over time as did non-spouses. While these variables were included as covariates and were not the central focus of the present study, these findings are interesting in their own right and deserve further comment. The relationship between day care use and negative affect lends support for the potential efficacy of day care as an intervention target for family caregivers. This finding is consistent with Zarit et al.'s (1998) study of the beneficial effects of adult day care for family caregivers, from which part of our sample *(n* = 447) was drawn. In their study, the beneficial effects of adult day care use for family caregivers included less stress and better psychological well-being (i.e., less depression and anger). Recently, other benefits associated with adult day care have been reported including improved cognitive status and fewer behavior problems of the dementia patient (Reinertsen, 2006) and reductions in family and work-related conflict associated with caregiving demands (Schacke & Zank, 2006). Further research in this area stands to benefit both caregivers and their relatives who suffer from dementia and other debilitating conditions. Lastly, while caregiving poses unique challenges for spouses (e.g., difficulty dealing with problem behaviors when health is compromised; Connell, Janevic, & Gallant, 2001) and adult children (e.g., role-related conflicts for adult children; Stephens, Franks, & Townsend, 1994; Stephens & Franks, 1999), it may be more difficult for spouses whose lives have been closely intertwined for so many years. A recent meta-analysis by Pinquart and Sörensen (2003) concluded that spouses may benefit more from interventions like adult day care given stronger overall associations between caregiving stressors and psychological outcomes for spouses than for adult children. While none of these variables (i.e., gender, day care use, and relationship) were associated with positive affect, the influence of the relationship between sociodemographic and contextual factors and positive and negative affect holds promise as an area of future research and should adequately reflect the population under study.

While the DMA is a state-level model of affect which asserts that stress affects the relationship between the affects at the time of the stressor, Fredrickson's (1998, 2001) broaden-and-build theory of positive emotions is a trait-level model of affect. This model posits that positive affect broadens individuals' modes of thinking and behaving, assisting them in building personal resources. Further, it suggests an evolutionary function of positive affect based on the accrual of resources that promoted survival among our ancestors and that enhance modern-day coping efforts. Using this model as our theoretical foundation, we assessed the direct effect of mean level positive affect on caregivers' levels of negative affect and the moderating effect of mean level positive affect on the relationship between occasion-specific positive and negative affect. Like those with higher levels of occasion-specific positive affect, caregivers with higher overall positive affect had lower levels of negative affect. While the DMA is a state-level model of affect which asserts that stress affects the relationship between the affects at the time of the stressor, Fredrickson's (1998, 2001) broaden-and-build theory of positive emotions is a trait-level model of affect. This model posits that positive affect broadens individuals' modes of thinking and behaving, assisting them in building personal resources. Further, it suggests an evolutionary function of positive affect based on the accrual of resources that promoted survival

among our ancestors and that enhance modern-day coping efforts. Using this model as our theoretical foundation, we assessed the direct effect of mean level positive affect on caregivers' levels of negative affect and the moderating effect of mean level positive affect on the relationship between occasion-specific positive and negative affect. Like those with higher levels of occasion-specific positive affect, caregivers with higher overall positive affect had lower levels of negative affect. Additionally, higher overall positive affect moderated the relationship between occasion-specific positive and negative affect; caregivers with higher mean positive affect also had a stronger inverse relationship between occasion-specific positive and negative affect (i.e., less differentiated, higher positive and lower negative affect). Although this association must be interpreted as a moderation effect at zero levels of stress, it proffers preliminary evidence that trait-level positive affect influences the degree of differentiation between occasion-specific positive and negative affect. While there is a higher inverse relationship between occasion-specific positive and negative affect as caregivers' levels of overload increase (see above), we see a similar inverse pattern (albeit a weaker association) between occasion-specific positive and negative affect, whether stress is increasing or whether caregivers' stress levels are zero. This is consistent with much of the affect research which suggests that positive and negative affect measured at the same point in time (i.e., momentary affect) are likely opposite of one another (see Diener & Emmons, 1984). Higher levels of overall positive affect further reinforce this pattern as they drive occasion-specific positive affect up while negative affect decreases. If trait-level positive affect is indeed a coping resource as certain researchers (e.g., Hobfoll, 1989; Folkman, 1997; Fredrickson, 1998, 2000) have posited, then its ability to alter occasion-specific affective dynamics may offer a mechanism through which it influences psychological outcomes. The role of trait-level positive affect as a coping resource, however, was not supported by these data; the relationship between occasion-specific role overload and negative affect was unaffected by caregivers' overall levels of positive affect. On the other hand, for caregivers with higher overall levels of role overload, there was a stronger link between occasion-specific role overload and negative affect.

We found more evidence for Zautra and colleagues' dynamic view of affect relationships than for Fredrickson's trait-level approach. Although overall positive affect influenced the relationship between occasion-specific positive and negative affect, this influence disappeared as in the face of role overload. In contrast, as caregivers' levels of occasion-specific role overload increased, higher levels of negative affect (i.e., state-level affect) were linked to lower levels of positive affect. Thus, role overload experienced at a particular point in time appears to alter caregivers' affective dynamics. Whether these relationships are influenced by the type and/or the amount of stress is unclear, especially given the dearth of research in this area. Research by Zautra and colleagues' (2001, 2005) examining the role of trait- versus state-level affect relationships in chronic pain patients is also inconsistent, finding support for both types of relationships. It is possible that certain types of stress such as role overload are more likely to affect information-processing, simplifying cognitive and affective representations and making it possible for caregivers to attend to their respective situations. Role overload is the experience of feeling *overwhelmed* and *exhausted* by caregiving demands and of not having enough time to oneself. The very nature of this sort of stress lends itself to reductions in processing and a shrinking of affective space leading to a unidimensional representation of affect. Conversely, role captivity, which we did not investigate here, is the feeling of being trapped in the caregiving role. Aneshensel et al. (1995) describe role captivity as the tension between what a caregiver must do and be versus what that individual prefers to do or be; thus, there is a strong intrapsychic existential element to this stressor. Because trait-level positive affect can also be described as coming from or residing within the individual, it may be more important as a coping resource that would act to decrease levels of role captivity. In contrast, state-level positive affect may arise out of external situations and circumstances and, thus, may influence more tangible feelings of overload. Given fundamental differences in these two primary sources of caregiving stress, further research is called for to investigate the influence of trait-level positive affect on affect dynamics and caregivers' experiences of role captivity.

Although the relationship between positive and negative affect has been debated from a methodological perspective (e.g., Russell & Carroll, 1999a) for many years, theoretical frameworks that incorporate the influence of contextual everyday life processes on the relationship between the affects have lagged behind these methodological developments. Both the DMA and the broaden-and-build theory of positive emotions represent attempts to bridge this gap, as does the current research. Likewise, the two models share important similarities. Both of the frameworks articulate the deleterious consequences of prolonged negative emotions and the role that stress plays in bringing about such consequences. Additionally, whether it is trait-level positive affect or the experience of positive affect at a particular point in time, each emphasizes the beneficial effects of positive emotions to health and well-being. Notably, they offer practical recommendations that could help caregivers and other individuals circumvent the downward spiral of negative emotions associated with clinical depression. While Zautra and colleagues (Reich, Zautra, & Davis, 2003) advocate strategies to teach what they refer to as "uncoupling" the link between positive and negative affect, Fredrickson and Levenson (1998) use the term "undoing" (i.e., the ability of positive emotions to undo the negative consequences affiliated with negative emotions). One such strategy is the use of cognitive behavioral techniques to address the cognitive narrowing associated with depression that engenders predominantly negative emotional states. Strategies that promote effective emotion regulation and the ability to differentiate emotional states can also help caregivers intercept negative thoughts and feelings before this coupling occurs. Helping caregivers find positive meaning in their caregiving roles (Fredrickson, 1998, 2001; Folkman & Moskowitz, 2000) and encouraging their participation in personal activities that bring about positive emotion (Lewinson, 1991) are other strategies to build positive emotion. The beneficial effects of engaging in pleasant events have been documented for both dementia patients and their caregivers who implemented these events (Teri, Logsdon, Uomoto, & McCurry, 1997). The broaden-and-build theory suggests that the effects of positive emotions accumulate and compound and that there is a reciprocal relationship between positive emotions and positive meaning which leads to an upward spiral in well-being. The implications of each model for optimizing caregivers' levels of health and well-being make future research in this area an important priority. The implications extend to issues of assessment and measurement that account for caregivers' positive and negative emotions and that lay out prevention and intervention strategies based on this information.

This study contributes to the understanding of caregivers' experiences and the influence of those experiences on state- and trait-level affect relationships using the DMA and the broaden-and-build model of positive emotions as guiding frameworks. While the importance of such research is highlighted above in the discussion related to intervention efforts, this study is not without limitations. First, it is difficult to draw inferences concerning the causal role of positive affect as the relationships among variables emerged from assessments taken at the same time. Future research should examine these relationships in participants' daily reports of affect and stress. Further, alternative explanations implicating contextual, cognitive, or personality variables are certainly possible. The homogeneous sample does not allow us to generalize the findings to caregivers of other races and ethnicities. Given prior research (Foley, Tung, & Mutran, 2002) suggesting different correlates of positive caregiving experiences for African American and White caregivers, race is a particularly important demographic characteristic to consider in future research.

The present study offers preliminary findings as to the nature of the relationship between caregivers' positive and negative affect under conditions of caregiving stress. Unlike previous research which has often considered either positive or negative affect in isolation, it illuminates the importance of considering changes in the relationship between the two affects given the caregiving context. Such a framework provides a more complete picture of individuals' mental health status. It may be especially important if changes in this relationship signal either a threshold indicative of chroncity of stressors or an adaptive process that occurs as caregivers adjust to their respective caregiving demands. Further research accounting for caregivers' emotional profiles including changes in their profiles across time in response to a variety of events, risks, and resources may help to explain why some caregivers exhibit adaptive responses to their caregiving roles while others succumb to negative consequences. Most importantly, future research should include prevention and intervention strategies tailored to meet a caregiver's unique emotional needs. These efforts should use the additional information regarding caregivers' levels of positive and negative affect and changes in these levels to develop and implement proximal and distal strategies targeting one or both of the affects. These strategies may foster greater emotional awareness and emotion regulation among caregivers, especially if researchers and practitioners move away from the "one size fits all approach" that generally involves reducing negative emotion without undertaking more comprehensive emotional assessments or considering the context out of which emotions arise.

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APPENDIX: TABLES AND FIGURES

Table 1

Demographic Characteristics of Caregivers at Time 1: Descriptive Statistics (N = 554)

Variables	*M*	*SD*	Range
Gender[a] (% female)	80.4%	.40	0 – 1
Age	60.27	13.63	18 – 87
Race[b] (% white)	89.2%	.31	0 – 1
Relation to care receiver[c] (% adult child)	42.7%	.70	0 – 2
Educational level(years)	13.32	2.23	2 – 17
Income[d]	3.70	1.72	1 – 7
Employment status[e] (% employed)	33.1%	.47	0 – 1
Months providing care	36.21	34.68	1 – 288
Health status[f]	2.28	1.00	0 – 4
Day care use[g] (% day care)	57.2%	.50	0 - 1

[a]Gender: 0 = *male*, 1 = *female*. [b]Race: 1 = *white*, 2 = *non-white*. [c]Relation to care receiver: 0 = *spouse*, 1 = *adult child*, 2 = *other*. [d]Income: 1 = < *$10,000*, 2 = *$10,000-$19,000*, 3 = $20,000-$29,000, 4 = *$30,000-$39,000*, 5 = *$40,000-$59,000*, 6 = *$60,000-$79,000*, 7 = *$80,000+*. [e]Employment status: 0 = *Not employed*, 1 = *Employed*. [f] Health status: 0 = *poor*, 1 = *fair*, 2 = *good*, 3 = *very good*, 4 = *excellent*. [g] Day care use: 0 = *does not attend*; 1 = *attends.*

Table 2

Demographic Characteristics of Relatives at Time 1: Descriptive Statistics (N = 554)

Variables	*M*	*SD*	Range
Gender [a] (% female)	60.2%	.49	0 – 1
Age	78.54	7.93	45 – 100
Race [b] (% white)	89.0%	.32	1 – 2
Educational level(years)	10.91	3.19	0 – 17

[a]Gender: 0 = *male*, 1 = *female*. [b]Race: 1 = *white*, 2 = *non-white*.

Table 3

Stressors and Affect Variables at Time 1: Descriptive Statistics (N = 554)

Variables	*M*	*SD*	Range	α
Behavior problems	9.04	2.89	0 – 15	.68
Need for help with PADL[a]	2.65	1.71	0 – 5	.77
Role overload	1.84	.56	0 – 3	.79
Role captivity	1.24	.87	0 – 3	.81
Negative affect	6.41	5.38	0 – 36	.82
Positive affect	2.22	.73	0 – 4	.87

[a]PADL: *personal activities of daily living*.

Table 4 Caregiver Demographic Variables, Stressors and Outcomes: Baseline Correlations (N = 554)

Variables	1	2	3	4	5	6	7	8	9	10
1. CG Gender	–									
2. CG Age	-.229**	–								
3. CG Education	-.026	-.272**	_							
4. Day Care Use	-.018	.048	-.041	_						
5. Duration of CGing	.034	.081*	.013	-.087*	_					
6. CG Health status	-.072	-.092*	.142**	.031	-.101**	_				
7. Relation	.220**	-.658**	.153**	-.018	-.111**	.033	_			
8. Behavior problems	.051	-.107**	-.010	.020	.039	-.144**	.032	_		
9. Help with PADL	.028	.047	-.019	.074*	.136**	-.057	-.022	.175**	_	
10. Role overload	.215**	-.129**	-.002	.125*	.047	-.252**	.082*	.271**	.148**	_
11. Role captivity	.200**	-.163**	.051	.079*	.014	-.135**	.120**	.224**	.027	.459**
12. Negative Affect	.138**	.042	-.071	.166**	-.002	-.213**	-.060	.069	.093*	.417**
13. Mean Total NA	.117**	-.024	-.077*	.057	.038	-.182**	-.040	.128**	.079*	.354**
14. Positive Affect	-.020	-.084*	.025	-.088*	.012	.299**	.107**	-.076*	-.076*	-.253**
15. Mean Total PA	-.042	-.097**	.038	-.081*	.014	.330**	.127**	-.100**	-.050	-.268**
16. Mean Total RO	.208**	-.098*	-.006	.083*	.033	-.270**	.041	.281**	.130**	.914**
17. Mean Total PADL	.042	.028	-.028	.077*	.139**	-.067	-.002	.185**	.928**	.149**

Variables	11	12	13	14	15	16	17
11. Role captivity	_						
12. Negative Affect	.389**	_					
13. Mean Total NA	.324**	.815**	_				
14. Positive Affect	-.272**	-.331**	-.234**	_			
15. Mean Total PA	-.289**	-.314**	-.295**	.903**	_		
16. Mean Total RO	.442**	.404**	.389**	-.286**	-.331**	_	
17. Mean Total PADL	.022	.091*	.098**	-.042	-.035	.134**	_

Note. CGing = *caregiving*. PADL = *personal activities of daily living*. NA = *negative affect*. PA = *positive affect*. RO = *role overload*. **p* < .05. ***p* < .01.

Table 5 Estimated Bivariate Correlations among Negative Affect (NA) Scores

Variables	Baseline NA	3-month NA	12-month NA
1. Baseline NA	_		
2. 3-month NA	.516**	_	
3. 12-month NA	.436**	.627**	_

Note. NA was measured by the CESD = *Center for Epidemiologic Studies Depression Scale*. **p* < .05. ***p* < .01.

Table 6 Results of fitting separate within-person exploratory OLS regression models for negative affect scores as a function of time

	Initial status		Rate of change			
ID	Estimate	se	Estimate	se	Residual variance	R^2
1017	1.91	0.24	0.03	0.03	0.09	0.48
1035	3.23	0.85	0.09	0.12	1.11	0.36
1071	1.72	0.66	0.20	0.10	0.66	0.83
1101	4.18	0.85	-0.65	0.12	1.09	0.23
1108	3.57	0.56	-0.17	0.78	0.48	0.82
1141	2.57	0.79	0.09	0.11	0.95	0.40
1145	4.54	0.25	-0.03	0.04	0.09	0.42
1146	3.46	0.57	-0.02	0.08	0.51	0.08
1149	2.81	0.21	-0.02	0.03	0.08	0.08
1150	1.73	0.43	0.03	0.06	0.28	0.23
2000	2.71	0.36	0.14	0.05	0.20	0.88
2001	2.48	0.65	0.12	0.09	0.65	0.63
2005	3.41	0.56	0.02	0.02	0.48	0.04
2104	2.85	1.16	0.13	0.16	2.06	0.40
2181	3.13	0.67	-.012	0.09	0.68	0.02
2213	2.06	0.44	0.11	0.06	0.30	0.77
2220	2.15	0.11	-0.02	0.02	0.02	0.48
2222	2.12	0.15	-0.01	0.02	0.03	0.08
2224	1.83	0.13	0.02	0.02	0.03	0.48
2225	2.36	0.49	-0.00	0.07	0.36	0.00
2233	2.40	0.83	0.14	0.12	1.06	0.58
2235	2.26	0.36	0.13	0.05	0.12	0.87
2237	2.37	0.12	0.03	0.03	0.06	0.48
2238	2.54	1.12	0.06	0.16	1.91	0.52
2249	3.24	0.33	0.15	0.05	0.17	0.91
3007	1.95	0.07	0.04	0.01	0.01	0.94
3009	2.08	0.11	0.02	0.02	0.02	0.48
3010	2.54	0.41	-0.04	0.06	0.26	0.28
3011	2.99	1.36	0.01	0.19	2.85	0.01
3014	1.91	0.24	0.03	0.03	0.09	0.48
3025	2.01	0.38	0.03	0.05	0.22	0.21
3026	2.67	0.92	0.06	0.13	1.30	0.17
3027	3.19	0.74	0.07	0.10	0.84	0.33
3028	3.95	0.48	-0.02	0.07	0.35	0.08
3029	2.41	0.94	0.09	0.13	1.34	0.34
3031	2.27	0.04	0.05	0.01	0.00	0.99
3033	2.92	0.38	0.12	0.05	0.22	0.81
3043	1.88	0.17	0.01	0.02	0.04	0.08
3047	1.98	0.34	0.05	0.05	0.18	0.48
3049	3.83	0.91	-0.08	0.13	1.27	0.28
3271	2.17	1.04	0.14	0.15	1.66	0.48

Table 7 Positive and Negative Affect at Three Occasions of Measurement (Observations = 1444)

Occasion	N	Positive Affect		Negative Affect	
		Mean	SD	Mean	SD
Wave 1	554	2.26	0.71	2.53	0.86
Wave 2	543	2.18	0.71	3.20	1.01
Wave 3	347	2.31	0.73	3.13	1.02
Total	1,444	2.24	0.72	2.92	1.01

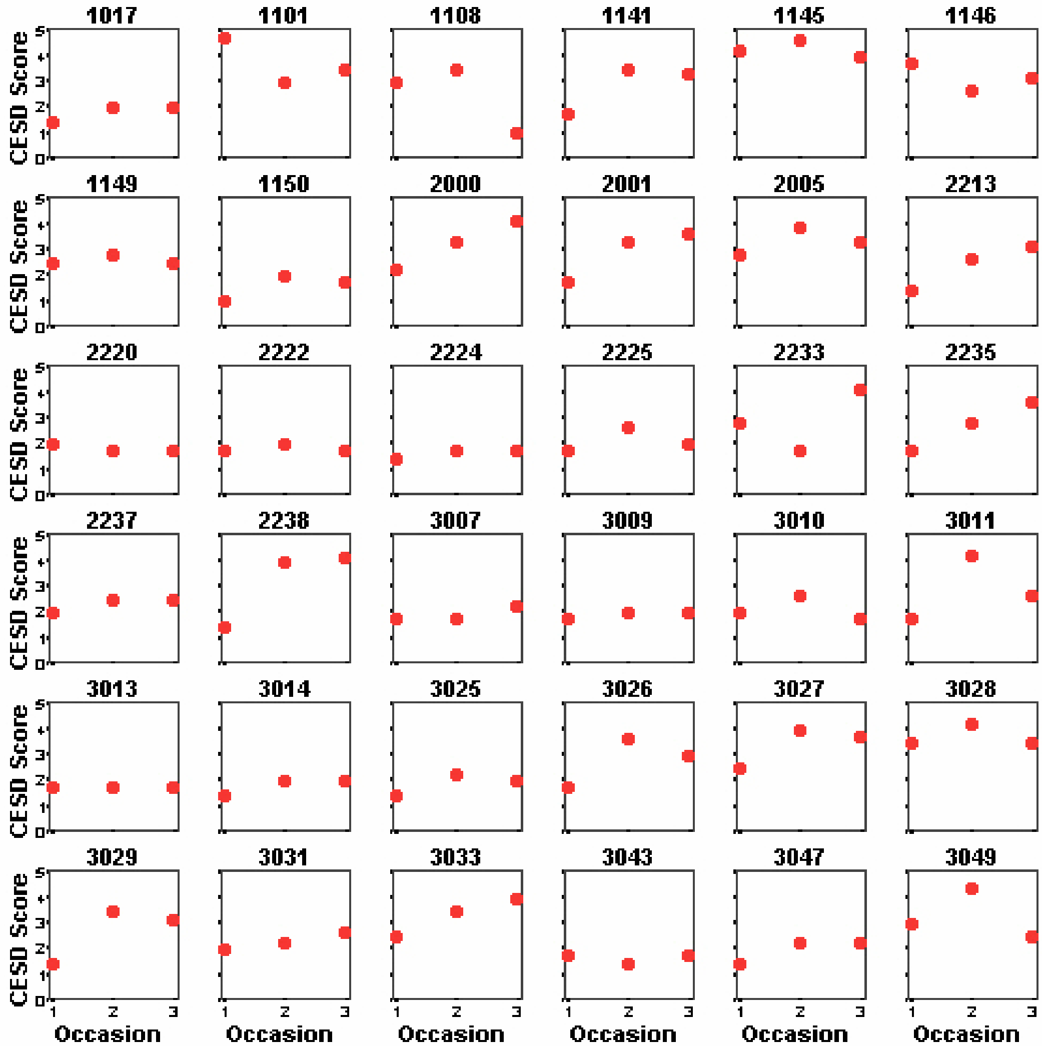

Figure 1 Empirical Growth Plots

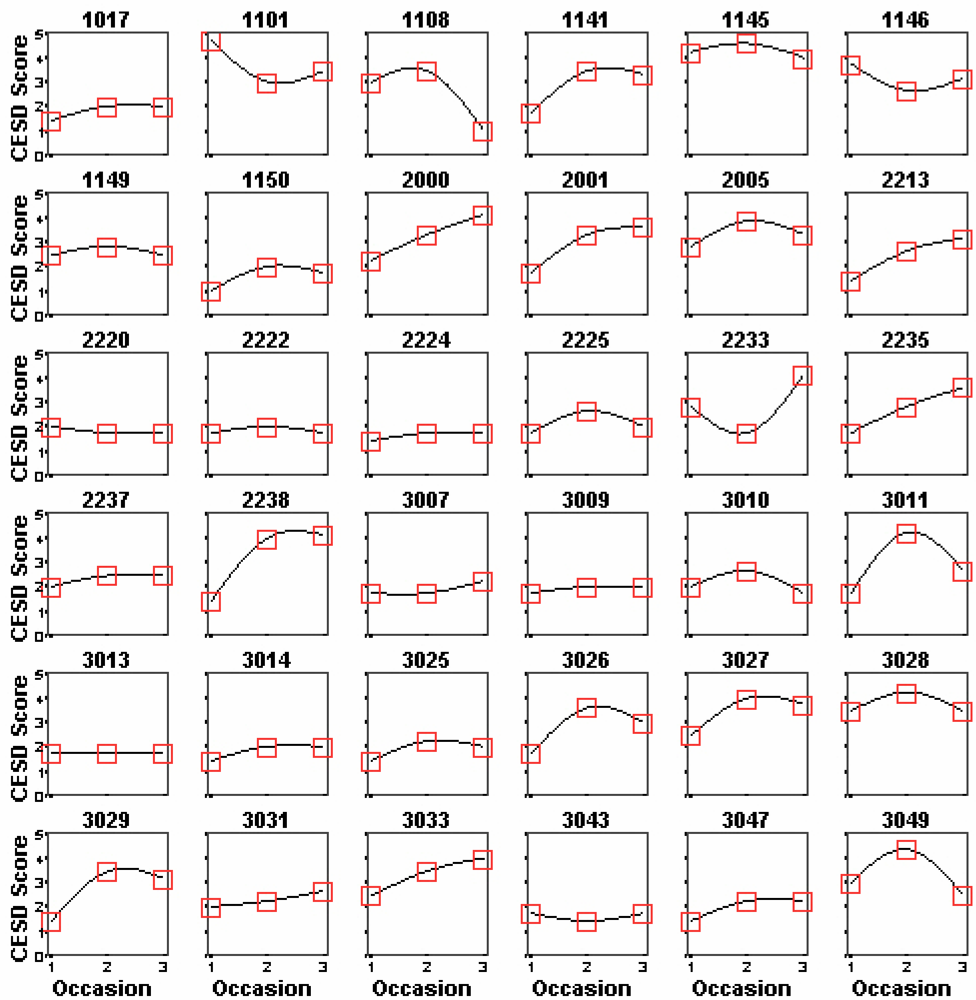

Figure 2 Nonparametric Trajectories

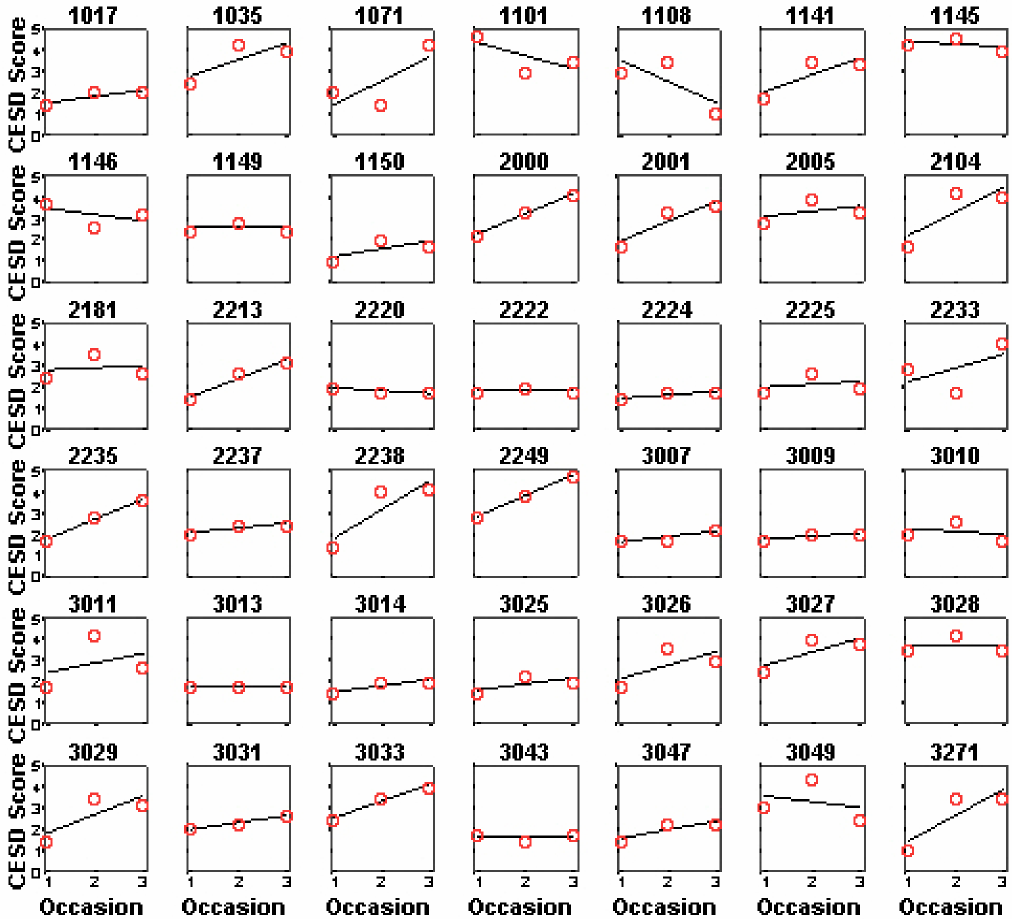

Figure 3 Fitted OLS Trajectories

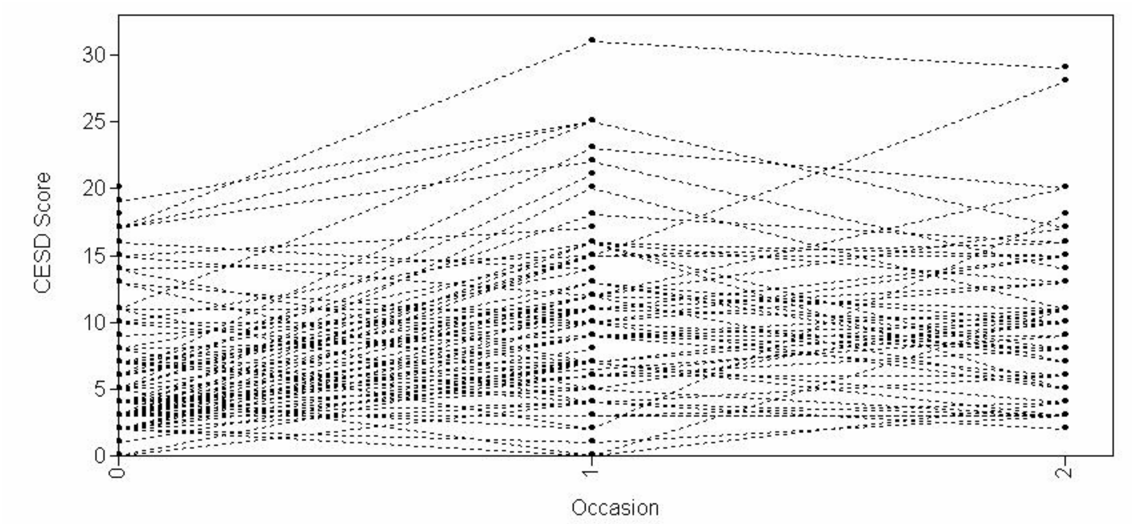

Figure 4 Individual Trajectories

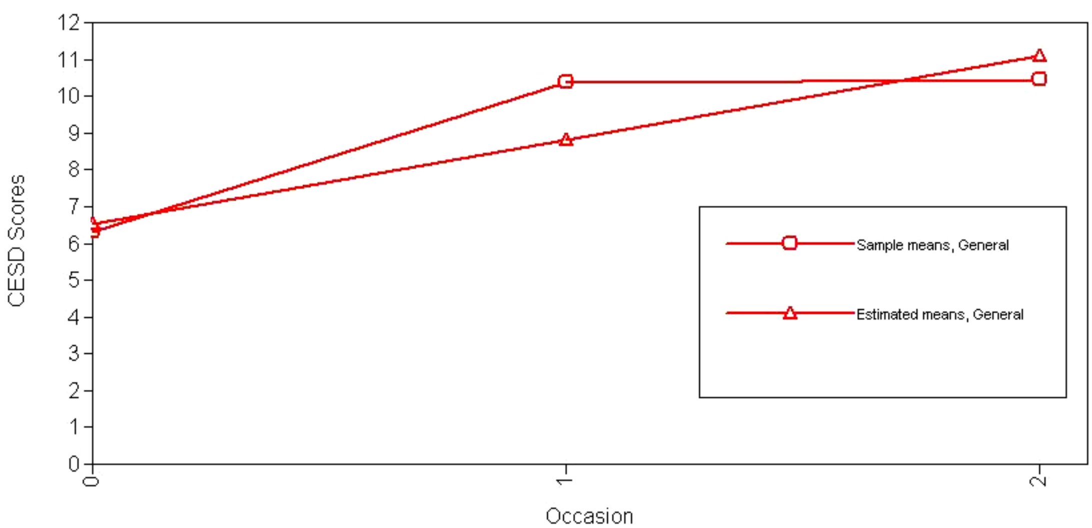

Figure 5 Observed versus Estimated Means

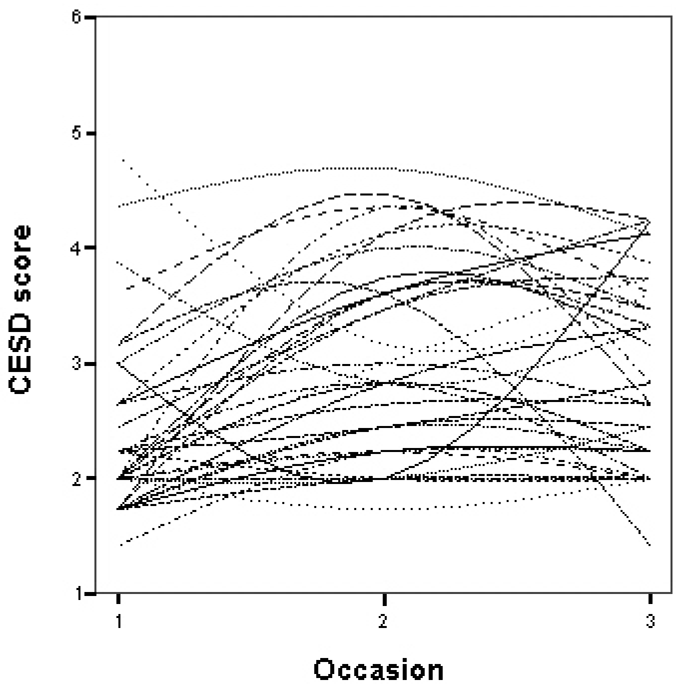

Figure 6 Nonparametric trajectories for a group of selected participants

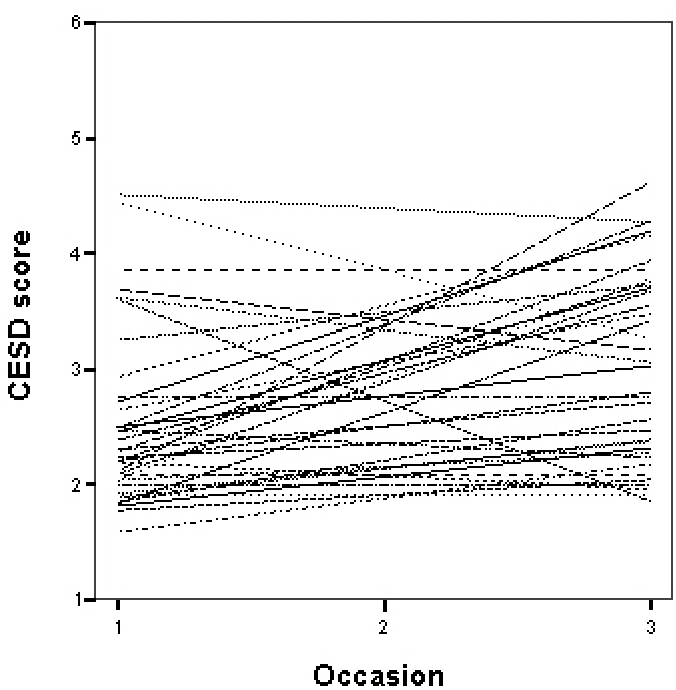

Figure 7 Fitted OLS trajectories for a group of selected participants

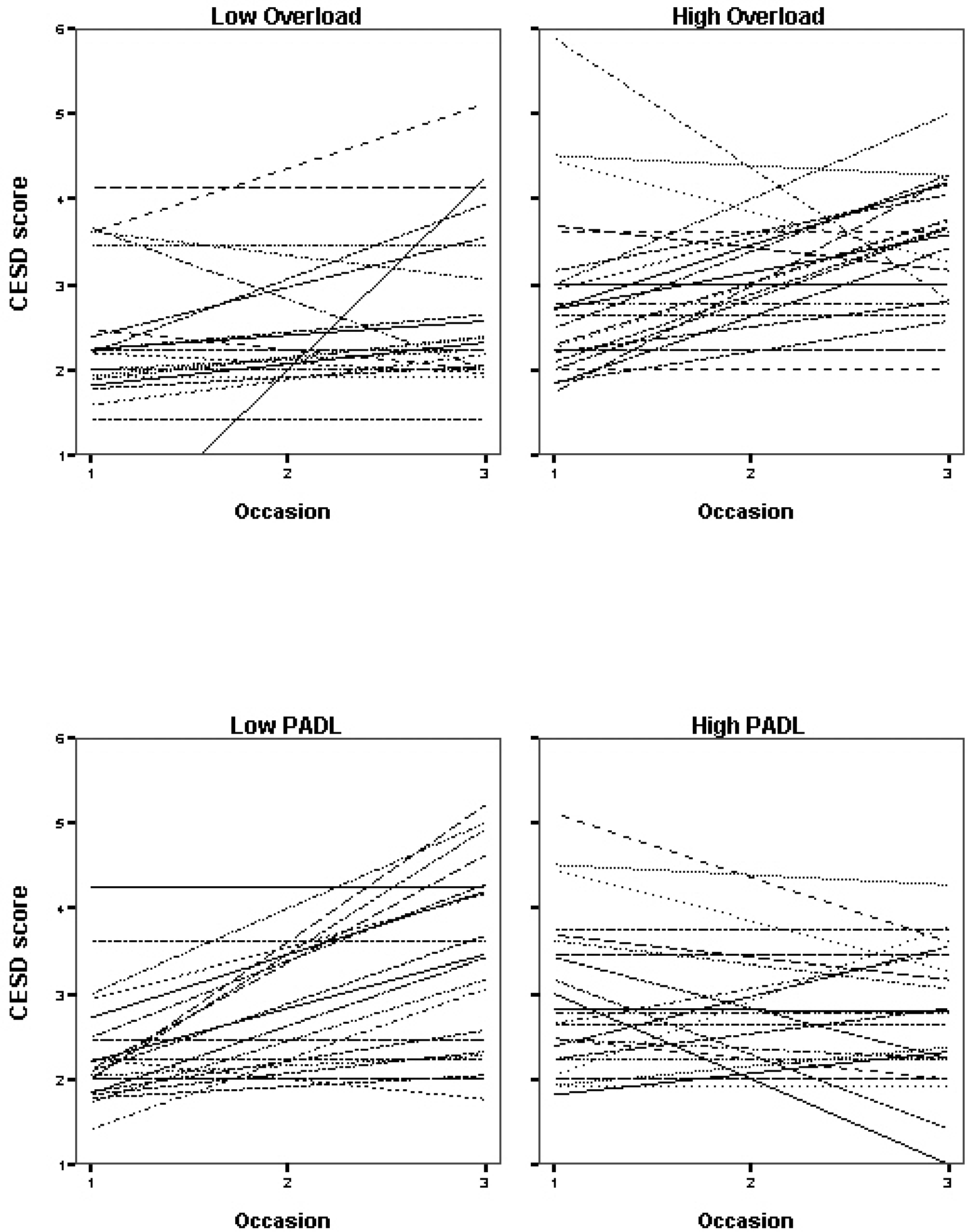

Figure 8 Fitted OLS trajectories: Substantive Predictors by Groups

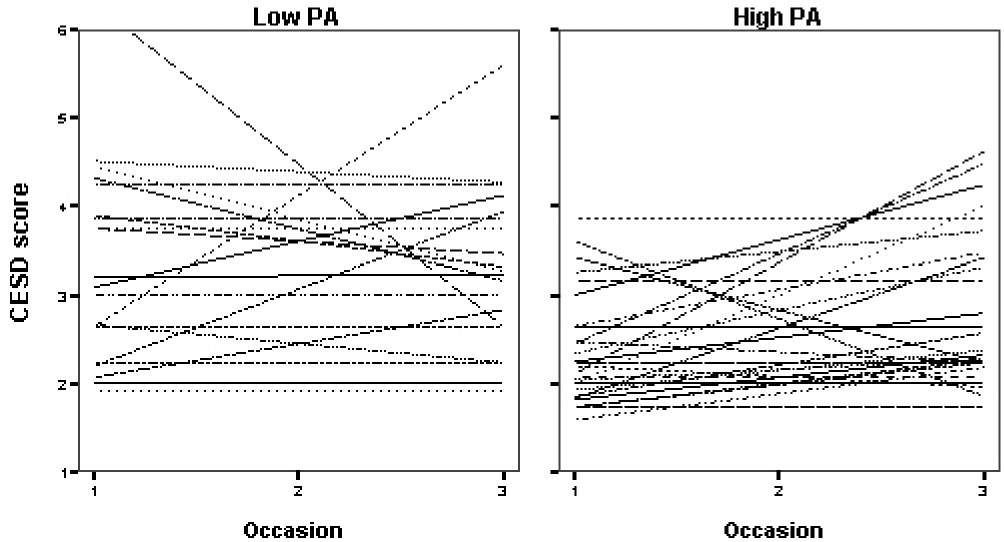

Figure 8 Continued

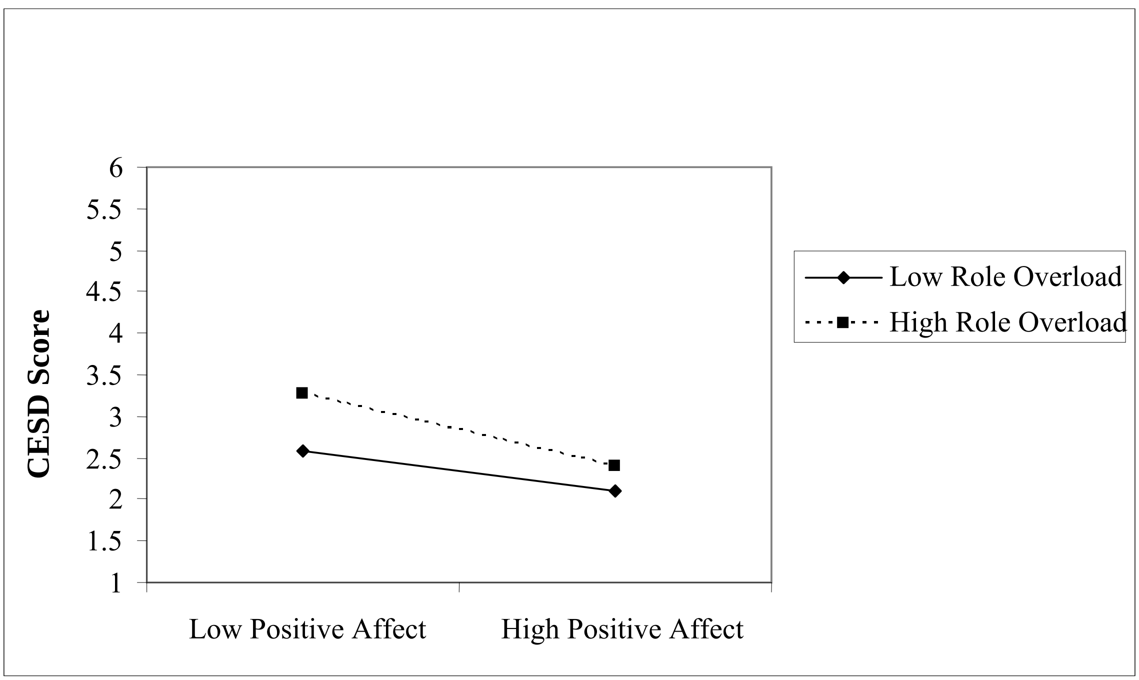

Figure 9 Moderating Effect of Occasion-Specific Role Overload on the Relationship between Positive and Negative Affect

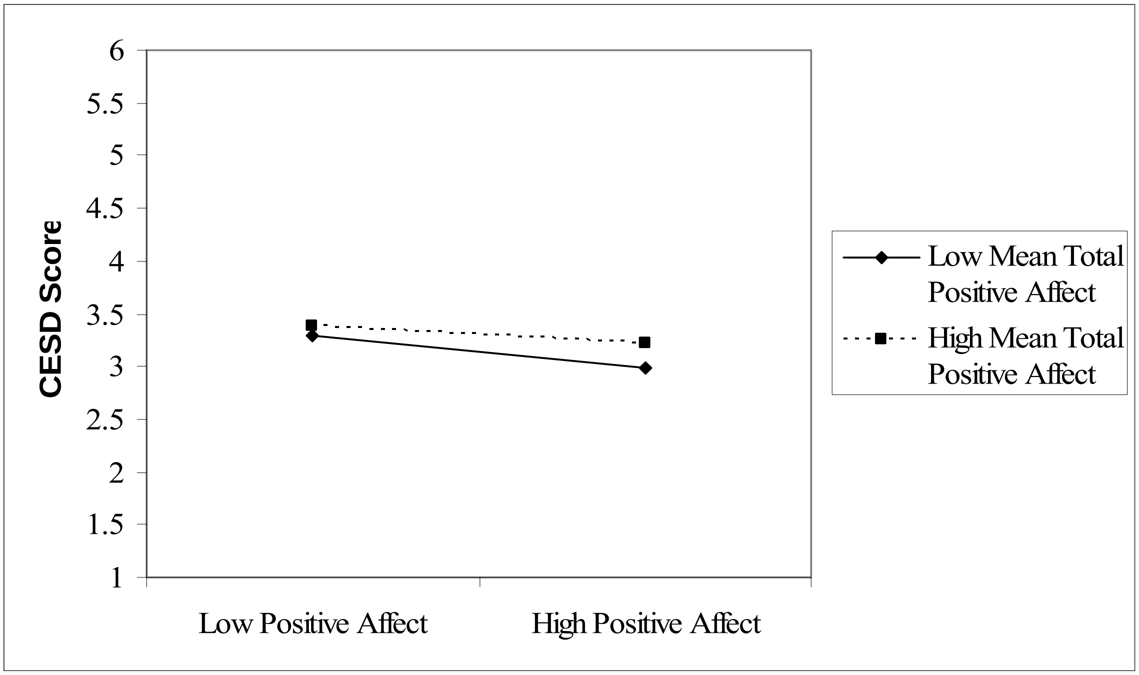

Figure 10 Moderating Effect of Mean Total Positive Affect on the Relationship between Occasion-Specific Positive Affect and Negative Affect

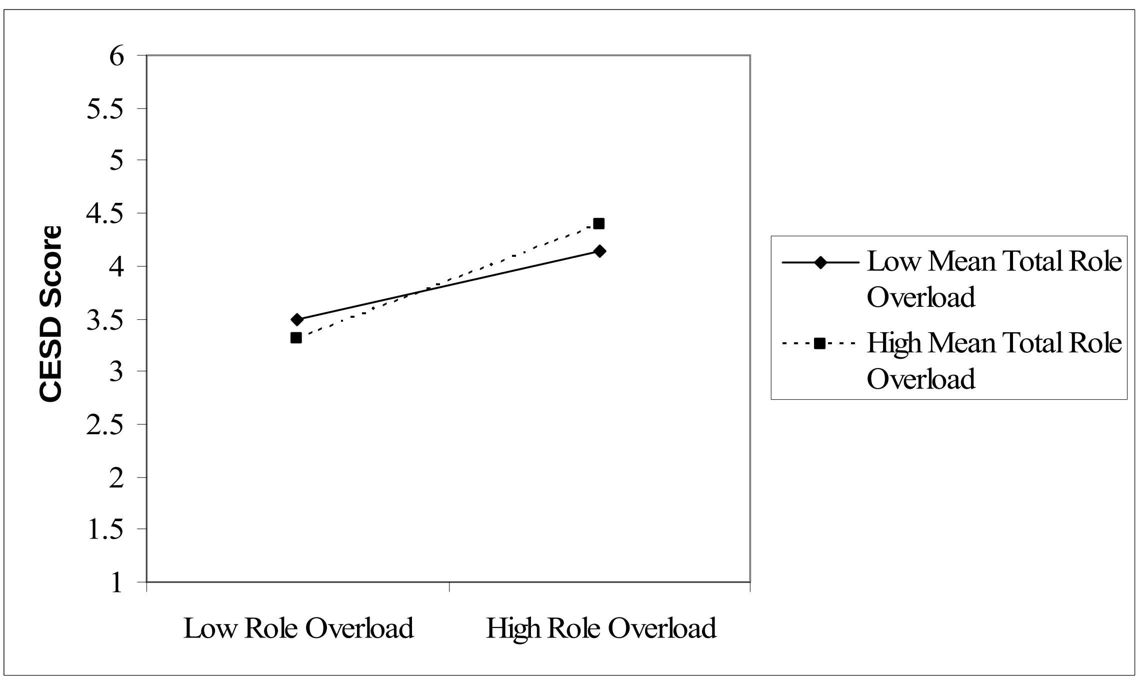

Figure 11 Moderating Effect of Mean Total Role Overload on the Relationship between Positive and Negative Affect

Table 8: Results of using alternative representations for the main effect of TIME (N = 554) when fitting an unconditional growth model

		Parameter	Predictor representing TIME		
			Natural log Duration	Month(0,3,12)	Occasion(Centered, T1)
Fixed Effects					
Intercept		γ_{00}	2.30*** (.12)	2.75*** (.04)	2.62*** (.04)
Linear Rate of Change		γ_{01}	0.19** (.04)	0.05*** (.004)	0.38*** (.03)
Variance Components					
Level-1:	Within-person	σ_{ε}^2	0.59*** (.02)	0.54*** (.03)	0.46*** (.03)
Level-2:	Wave 1 status	σ_0^2	0.93*** (.40)	0.44*** (.04)	0.30** (.05)
	Linear term				
	Variance	σ_1^2	0.06 (.04)	0.001 (.001)	0.03 (.03)
Goodness-of-fit					
	Deviance statistic		3887.3	3832.2	3714.0
	AIC		3899.3	3840.2	3726.0
	BIC		3931.0	3861.3	3757.6

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

Table 9: Comparison of fitting alternative polynomial models to CESD scores (N = 554)

		Parameter	Model A No change	Model B Linear change	Model C Quadratic change
Fixed Effects					
Intercept		γ_{00}	2.93***(.03)	2.62***(.04)	2.53***(.04)
TIME (linear term)		γ_{01}		0.38***(.03)	1.00***(.07)
TIME ^{2} (quadratic term)		γ_{02}			-0.33***(.04)
Variance Components					
Level-1:	Within-person	σ_{ε}^2	0.62***(.03)	0.46***(.03)	0.42***(.03)
Level-2:	Wave 1 status	σ_0^2	0.40***(.04)	0.30***(.05)	0.35***(.05)
	Linear term				
	Variance	σ_1^2		0.03 (.03)	0.04 (.02)
	Covar with wave 1 status	σ_{01}		0.10*** (.03)	0.07*(.03)
Goodness-of-fit					
	Deviance statistic		3945.4	3714.0	3650.1
	AIC		3949.4	3726.0	3658.1
	BIC		3960.0	3757.6	3679.2

*$p < .05$. **$p \leq .01$. ***$p < .001$. Model A is the “no change” trajectory; Model B is the linear change trajectory; Model C is the quadratic change trajectory with a fixed quadratic term only.

Table 10: Comparison of fitting conditional means models to CESD scores using level-1 variables (N = 554)

		Parameter	Model A Positive Affect	Model B Positive Affect/ Stressors	Model C Interaction Terms
Fixed Effects					
Intercept		γ_{00}	4.25*** (.09)	3.03*** (.18)	1.87*** (.49)
Positive affect		γ_{01}	-0.59*** (.04)	- 0.44*** (.04)	0.03 (.20)
Duration		γ_{02}		0.12*** (.03)	0.22* (.09)
Health status		γ_{03}		- 0.12*** (.03)	- 0.25** (.08)
PADL		γ_{04}		0.40* (.02)	0.02 (.04)
Role Overload		γ_{05}		0.42*** (.05)	0.99*** (.15)
PA* Duration		γ_{06}			- 0.05 (.04)
PA* Health		γ_{07}			0.04 (.04)
PA* PADL		γ_{08}			0.01 (.02)
PA* Role Overload		γ_{09}			- 0.24*** (.06)
Variance Components					
Level-1:	Within-person	σ_{ε}^2	0.55*** (.03)	0.52*** (.03)	0.51*** (.02)
Level-2:	Wave 1 status	σ_0^2	0.28*** (.28)	0.20*** (.03)	0.20*** (.03)
Goodness-of-fit					
	Deviance statistic		3695.2	3515.3	3490.4
	AIC		3703.2	3531.3	3514.4
	BIC		3724.4	3573.5	3577.6

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

Table 11: Comparison of fitting conditional growth models to CESD scores using level-1 variables (N = 554)

	Parameter	Model D TIME/TIME^2	Model E Rate of Change Level-1 Variables
Fixed Effects			
Intercept	γ_{00}	1.83*** (.28)	1.42*** (.37)
Positive affect	γ_{01}	- 0.02*** (.09)	0.16 (.14)
Duration	γ_{02}	0.01 (.03)	
Health status	γ_{03}	- 0.14*** (.02)	- 0.08* (.03)
PADL	γ_{04}	0.01 (.01)	
Role Overload	γ_{05}	1.04*** (.13)	1.05*** (.18)
PA* Role Overload	γ_{06}	- 0.22*** (.05)	- 0.24** (.07)
Rate of Change			
Intercept			
TIME (linear term)	γ_{10}	1.03*** (.07)	1.89* (.90)
TIME ^{2} (quadratic term)	γ_{11}	- 0.35*** (.03)	- 0.78 (.46)
Positive affect	γ_{12}		- 0.28 (.33)
Duration	γ_{13}		0.02 (.07)
Health status	γ_{14}		- 0.11 (.08)
PADL	γ_{15}		- 0.01 (.03)
Role Overload	γ_{16}		0.06 (.43)
PA*Role Overload	γ_{17}		- 0.03 (.18)
Variance Components			
Level-1: Within-person	σ_{ε}^2	0.36*** (.02)	0.34*** (.02)
Level-2: Wave 1 status	σ_0^2	0.24*** (.02)	0.25*** (.02)
Goodness-of-fit			
Deviance statistic		3172.9	3122.5
AIC		3194.9	3164.5
BIC		3252.9	3275.2

*p < .05. **p < .01. ***p < .001. Note: Coefficients shown under rate of change in Model E are for linear rate of change only; quadratic effects were not significant for any variable.

Table 12: Comparison of fitting conditional growth models to CESD scores adding level-2 variables (N = 554)

		Parameter	Model F Level-2 Covariates Fixed Effects	Model G Mean level Variables Fixed Effects-Intercept
Fixed Effects				
Intercept		γ_{00}	2.14*** (.26)	3.72*** (.48)
Gender		γ_{01}	- 0.13 (.07)	- 0.11 (.06)
Day Care Use		γ_{02}	- 0.16* (.06)	- 0.04* (.05)
Relation to Care Receiver		γ_{03}	- 0.20** (.06)	- 0.19** (.06)
Positive affect		γ_{04}	- 0.02 (.10)	- 0.41* (.17)
Health status		γ_{05}	- 0.14*** (.02)	- 0.13*** (.02)
Role Overload		γ_{06}	1.03*** (.13)	0.02 (.23)
PA* Role Overload		γ_{07}	- 0.22*** (.05)	- 0.10* (.06)
Mean Total PA		γ_{08}		- 0.16* (.12)
Mean Total Overload		γ_{09}		- 0.41** (.16)
Mean Total PA*PA		γ_{10}		0.08 (.04)
Mean Total OL*OL		γ_{11}		0.34*** (.08)
Rate of Change Intercept				
TIME (linear term)		γ_{10}	1.03*** (.07)	0.89*** (.10)
TIME^2 (quadratic term)		γ_{11}	- 0.31*** (.03)	- 0.31*** (.05)
Day Care Use*TIME			0.24 (.14)	
Variance Components				
Level-1: Within-person		σ_{ε}^2	0.36*** (.02)	0.35*** (.02)
Level-2: Wave 1 status		σ_0^2	0.23*** (.02)	0.23*** (.02)
Goodness-of-fit	Deviance statistic		3151.4	3122.6
	AIC		3179.4	3158.6
	BIC		3253.0	3253.1

*p < .05. **p < .01. ***p < .001. Note: Coefficients shown under rate of change are for linear rate of change only; quadratic effects were not significant for any variable. The coefficient for day care use*linear time was marginally significant for Model F, p = .08, as was initial status for gender, p=.06.

Table 13: Comparison of fitting conditional growth models to CESD scores adding level-2 variables (N = 554)

Fixed Effects		Parameter	Model H Mean level Variables Fixed Effects-Rate of Change
Intercept		γ_{00}	3.69*** (.53)
Gender		γ_{01}	- 0.12 (.07)
Day Care Use		γ_{02}	- 0.18** (.07)
Relation to Care Receiver		γ_{03}	- 0.19* (.06)
Positive affect		γ_{04}	- 0.34* (.17)
Health status		γ_{05}	- 0.13*** (.02)
Role Overload		γ_{06}	0.06 (.23)
PA* Role Overload		γ_{07}	- 0.11* (.06)
Mean Total PA		γ_{08}	0.03 (.12)
Mean Total Overload		γ_{09}	- 0.72** (.17)
Mean Total PA*PA		γ_{10}	0.08* (.05)
Mean Total OL*OL		γ_{11}	0.43*** (.08)
Rate of Change			
Intercept			
TIME (linear term)		γ_{10}	0.61 (.68)
$TIME^2$ (quadratic term)		γ_{11}	- 0.19* (.33)
Day Care Use*TIME		γ_{12}	0.27* (.13)
Variance Components			
Level-1: Within-person		σ_{ε}^2	0.33*** (.02)
Level-2: Wave 1 status		σ_0^2	0.23*** (.02)
Goodness-of-fit	Deviance statistic		3076.6
	AIC		3128.6
	BIC		3265.6

*p < .05. **p < .01. ***p < .001. Note: Only significant coefficients are shown under rate of change.

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Ph.D.	Human Development And Family Studies, Minor in Gerontology	Pennsylvania State University	2007
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Teaching Assistant (to Dr. Heidi McDonald): HDFS 301: Values and Ethics in Human Development – (Fall, 2003; Penn State University)
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Gerontological Society of America (2001-Present)
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PUBLICATIONS

Robertson, S. M., Zarit, S. H., Duncan, L. G., Rovine, M. R., & Femia, E. E. (2007). Family caregivers' patterns of positive and negative affect. *Family Relations, 56,* 12-23.

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