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Internet Delivery of PREP-based Relationship Education for Older Couples

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A Dissertation

Presented to the Faculty of Social Sciences

University of Denver

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In Partial Fulfillment

of the Requirements for the Degree

Doctor of Philosophy

_____

by

Benjamin A. Loew

November 2015

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Title: Internet Delivery of PREP-based Relationship Education for Older Couples
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Abstract

Healthy marriage has been associated with increased longevity and better health in later life. At the same time, many older couples will confront age-related stressors that may result in relationship distress, such as declining health, decisions about retirement, and caring for elderly parents and/or adult children. Yet empirical knowledge of relationship dynamics among older couples is limited, and there appears to have been little development, provision, or assessment of research-based relationship services for this population.

In the current study, 93 individuals representing 61 older-adult couples participated in a randomized, waitlist-controlled trial of an online version of the Prevention and Relationship Education Program (PREP). Participants completed questionnaires about their relationship and individual health prior to random assignment, and again one month later. Participants were randomly assigned (at the couple level) to receive access to the online intervention after either the first or second assessment.

Data from the baseline assessment were used to examine older-adult relationship dynamics. Among six relationship dynamics, only positive bonding and skillful communication had significant unique associations with overall relationship satisfaction. Only negative communication had a significant unique association with financial stress, and only positive bonding was significantly, uniquely associated with mental health, and only among men.

At the follow-up assessment, couples who had received access to the online intervention reported significantly greater recent use of skillful communication, on average, than couples assigned to wait-list. Gender moderated this effect, with only female participants reporting increased use of skillful communication following assignment to immediate intervention. Group differences in the secondary outcomes of relationship satisfaction, other relationship dynamics, and physical and mental health did not achieve significance. Intervention participants reported moderate-to-high benefit from and satisfaction with the online program.

In addition to suggesting avenues for research on older adult relationship dynamics, the relationship-science results can inform programming decisions for relationship interventions specifically targeting older adults. Results for the feasibility trial of Internet-based PREP with older adults suggest that online relationship education for this population is feasible, and likely should incorporate strategies for promoting male engagement. Impact was limited but encouraging, thus supporting further research of this nature using larger, longer-term, and more diverse samples of older couples.

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Introduction

Approximately 16% of the population was 62 years of age or older (Howden & Meyer, 2011) and 55% of those aged 65 or higher were married (Administration on Aging, 2011) at the time of the most recent United States census. In the following two decades the older population has been projected to expand at an increasing rate (Administration on Aging, 2011), while the divorce rate for older adults had nearly tripled in the previous two decades (Brown & Lin, 2012). It is thus notable that numerous studies have shown being married in general and healthy marriage in particular to convey significant health benefits (Carr & Springer, 2010; Waite & Gallagher, 2000), and these connections appear to strengthen with age (Umberson, Williams, Powers, Liu, & Needham, 2006). Specifically, marriage and marital quality have been associated with increased longevity (Lillard & Waite, 1995), decreased morbidity across a variety of acute and chronic medical issues (Kiecolt-Glaser & Newton, 2001; Walker & Luszcz, 2009), and better health in older adulthood (Pienta, Hayward, & Jenkins, 2000). Older adults in distressed and conflictual marriages may be unable to reap these benefits, however; marital distress and negative interactions have been found to erode marital benefits, and are associated with increased risk for various health problems in this population (Bookwala, 2005; Umberson et al., 2006).

The negative health impacts of marital discord and conflict are striking given that many older couples face age-related challenges such as retirement, declining health

(physical, emotional, or cognitive), and caretaking for parents. Any of these transitions could induce substantial individual and couple distress via financial strain, social isolation, and difficult decisions about living arrangements and how to spend time (Henry, Miller, & Giarrusso, 2005; Lambert, 2009; Shiota & Levenson, 2007). Notably, marital satisfaction generally tends to decline over the course of marriage (Glenn, 1998; VanLaningham, Johnson, & Amato, 2001). In a review of marital research pertaining to older adults, Lambert (2009) concludes that the stressors most older couples will face, in conjunction with the negative health consequences of couple-relationship distress, establish a need for couple-relationship education to be directed to older adults.

Couple relationship education

Couple relationship education (CRE) programs are non-therapeutic theory- and research-based interventions, often delivered as multi-meeting workshops, in which couples are taught skills and principles believed to foster stable, healthy relationships (recent CRE reviews include Cowan & Cowan, 2014; Halford, Markman, & Stanley, 2008; Markman & Rhoades, 2012; Wadsworth & Markman, 2012). For example, couples may be taught strategies for effectively managing conflict and other relationship stressors, while maintaining positive connections with one another and protecting commitment. Meta-analytic evidence indicates that couples who participate in CRE can understand and implement CRE material and raise their chances for healthier relationships over time (Blanchard, Hawkins, Baldwin, & Fawcett, 2009; Hawkins, Blanchard, Baldwin, & Fawcett, 2008; Hawkins & Fellows, 2011; Hawkins, Stanley, Blanchard, & Albright, 2012).

CRE's utility has recently been criticized (Bradbury & Lavner, 2012; Johnson, 2012; 2013; 2014; Johnson & Bradbury, 2015) based on the limited positive results of large-scale dissemination studies (Bir et al., 2012; Lundquist et al., 2014; Wood, Moore, Clarkwest, & Killewald, 2014), which generally focused on reaching low-income participants. Yet many of the interpretations and arguments expressed in these criticisms were subsequently disputed (Cowan & Cowan, 2014; Hawkins, 2014; Hawkins et al., 2013). Early outcome data from the large-scale dissemination studies showed that the participants with greater socioeconomic disadvantage tended to benefit more from the intervention programs (Amato, 2014; Hsueh et al., 2012; Wood, McConnell, Moore, Clarkwest, & Hsueh, 2010). Similarly, other studies have found CRE's impact to be favorably moderated by the presence of family-of-origin risk factors (Halford, Sanders, & Behrens, 2001; Petch, Halford, Creedy, & Gamble, 2012), as well as history of infidelity (Allen, Rhoades, Stanley, Loew, & Markman, 2012). Furthermore, a recent meta-analysis found small but positive effects of CRE for low-income participants specifically (Hawkins & Erickson, 2015).

One CRE intervention is the Prevention and Relationship Education Program (PREP; Markman, Stanley, & Blumberg, 2010). PREP has been developed through over 30 years of basic and applied research funded by NIH, and is a rigorously-tested, widely-used relationship education program (Cowan & Cowan, 2014). In program evaluation research, couples who received PREP before marriage were found to have decreased negative interactions and enhanced relationship satisfaction two and five years post-intervention (Hahlweg, Markman, Thurmaier, Engl, & Eckert, 1998; Markman, Renick, Floyd, Stanley, & Clements, 1993). PREP has also been shown to improve

communication skills among married couples (e.g., Allen, Stanley, Rhoades, Markman, & Loew, 2011), and to reduce divorce risk among couples with more demographic vulnerability to marital distress (Stanley et al., 2014). One study of PREP did find some initial negative treatment effects, which dissipated by a two-year follow-up assessment (Van Widenfelt, Hosman, Schaap, & van der Staak, 1996).

In sum, while there are some mixed results, the predominance of research supports PREP's effectiveness. Due to this strong overall research base, PREP is the only CRE program listed on SAMHSA's National Registry of Evidence-based Programs and Practices (www.nrepp.samhsa.gov). Furthermore, PREP has been shown to be feasible for diverse sets of couples with specific risks for relationship distress, including those with a spouse in the Army (e.g., Stanley et al., 2005), a spouse in prison (Einhorn et al., 2008), and foster and adoptive parent couples (Loew et al., 2012).

CRE for older couples

Despite the availability of research-based CRE programs for some specific populations and for couples in general (Halford et al., 2010), there do not seem to have been efforts to extend these programs to older couples specifically, despite their specific risks for relationship distress (e.g., Lambert, 2009). Yet encouraging findings about the viability and value of CRE for older couples are provided by studies of interventions for couples in which one partner has a medical problem. Among couples in which the wife had breast or gynecological cancer, training in some of the skills covered in PREP (e.g., communication skills and support strategies) was associated with less avoidance in cancer-coping and better relationship skills relative to a control treatment (Heinrichs et al., 2012). Participants in this study averaged 52 years of age (range of 25 to 80 years).

Similarly, among couples in which one partner had a high cardiac-risk profile, training in communication skills such as problem solving and emotional expressiveness yielded better overall outcomes in health behaviors and relationship satisfaction than an individual-based control treatment (Sher et al., 2014). Participants in this study averaged 63 years of age. These findings provide an important form of support for the goal of providing evidence-based CRE to older adult couples, as rates for health problems of this nature increase substantially in older adulthood (DePinho, 2000).

An important consideration in efforts to reach older couples with CRE is accessibility (Ballard & Morris, 2005). Some of the very dynamics which could be a source of relationship distress for those in later life, such as poor health and retirement, may also exacerbate common barriers to CRE (which is typically delivered in urban centers as evening or weekend workshops; Markman & Rhoades, 2012). In particular, accessing these programs could be quite challenging for the many older adults who live in rural areas, have limited financial resources, or whose health problems might interfere with attending a lengthy workshop. Additionally, many older adults may be uncomfortable to be seen pursuing services that can be conceptualized as a form of mental health treatment (Byers, Arean, & Yaffe, 2012), or might feel 'out of place' given that premarital relationships are often the focus of CRE workshops (Markman & Rhoades, 2012).

Internet-based CRE

Internet delivery of CRE is one way to reduce or eliminate these access barriers, and researchers have begun to find empirical support for the efficacy of both computer- and Internet- based CRE. A one-hour version of PREP for individual college students in

dating relationships, accessed on computers in a research laboratory, was associated with significant improvement relative to a control condition in trust, intimate partner violence, depression, and anxiety at eight weeks post-intervention (Braithwaite & Fincham, 2007). Similar findings were obtained in a replication study that included a ten-month follow-up assessment, and these results occurred even in the contexts of relationship dissolution with and without re-partnering (Braithwaite & Fincham, 2009).

College student couples who received this intervention, known as ePREP, demonstrated greater improvement six weeks post-intervention (relative to control couples) in dedication, constructive communication, physical assault, and psychological aggression. Moreover, greater invention-engagement was generally associated with greater improvement (Braithwaite & Fincham, 2011). In a community sample of married couples, ePREP was found to significantly reduce both physical and psychological aggression through a 1-year follow-up (Braithwaite & Fincham, 2014). The current study utilizes an updated, Internet-based version of ePREP.

In studies of internet-based CRE, married couples instructed to access relationship education workshop materials (articles and exercises) online demonstrated similar post-intervention changes in relationship satisfaction and communication as did couples assigned to a traditional, in-person workshop of six weekly sessions (Duncan, Steed, & Needham, 2009). Individual new and expectant parents randomized to receive an online relationship education program, supplemented with printed resources, reported significantly greater improvements in relationship satisfaction and conflict management during two months of intervention, relative to those assigned to wait-list control (Kalinka, Fincham, & Hirsch, 2012).

Participants in a non-controlled study of an online couple-education program for prostate cancer patients and their partners endorsed high program satisfaction, as well as benefits in terms of couple communication and medical-symptom management (Song et al., 2015). High program satisfaction and utility was reported in a pilot study of an online CRE program consisting of 20 brief audiovisual presentations over the course of about one month (Cook & Tripp, 2013), but program impact results were not included. A leading contemporary model of couple therapy (IBCT) has also been translated into a self-directed online intervention (Doss, Benson, Georgia, & Christensen, 2013), but outcome data is not yet available. Notably, public interest in effective online couple-relationship resources is high (Georgia & Doss, 2013).

PREP has previously been adapted for web-based delivery to a specific population; foster and adoptive parent couples. In a pilot study, couples randomized to a brief version of PREP reported significantly greater post-intervention increases in the knowledge and use of PREP skills than those assigned to a control intervention focused on birth-parent visitations; both groups had similar improvements on more general communication indices (Loew et al., 2012). Participants randomly assigned to a full version of this web-based PREP adaptation had significantly greater average increase in marital satisfaction than those assigned to wait-list, but results on other outcomes were mixed (Delaney, 2014). An important limitation to this latter set of findings is that participants had two weeks to access approximately ten hours of content; this may have been an insufficient amount of time to develop an effective understanding for that volume of material.

Internet-based CRE for older couples

While 'internet fluency' is not universal among older adults, internet use by this group has steadily risen in the 21st century – as of 2013, 59% of Americans aged 65 and older use the internet, and this figure is approximately 70% among those between the ages of 65 and 74. Furthermore, 71% of those 65 and older who use the internet do so daily, and another 11% do so several times per week. In addition, for college graduates age 65 and older, smartphone and tablet-computer ownership rates were 35% and 31%, respectively (Smith, 2014). Internet delivery thus seems to be a viable modality for extending couple-relationship education to many older couples, as well as a means to overcome various access barriers (e.g., program duration, finances, urban location, and discomfort receiving relationship services directly and/or in a group setting) that may be more prevalent among older adults.

Other advantages of Internet-based couple-relationship education include the delivery of program material at a flexible pace, and in a familiar location (home). Enabling access to program content in these ways are strategies that have been recommended for making family-life education programs approachable when targeting older adults (Ballard & Morris, 2005). These forms of accessibility may also facilitate the practice and implementation of program skills and strategies. For one, being able to repeatedly access program content could mitigate age-associated difficulties with new skill learning (Petersen, Smith, Kokmen, Ivnik, & Tangalos, 1992) or implementation (Touron, 2015). The opportunity for repeated access may similarly be useful given that adopting new interaction strategies might require older couples to change longstanding interaction patterns. Additionally, having individuals access program material at home

should allow the recall and use of program techniques to be facilitated by environmental context-dependent memory effects (Smith & Vela, 2001), whereby information recollection is cued by the context in which it was learned.

Couple relationships and older adulthood: Basic science

As noted, the evidence from the limited number of CRE studies that include large portions of older adults (Heinrichs et al., 2012; Sher et al., 2014) supports the viability of Lambert's (2009) call for CRE to be extended to older couples. It is similarly encouraging that basic relationship research with this population has replicated key findings on which PREP is built. For example, the quality of older couples' interactions is associated with their overall relationship quality (Acitelli & Antonucci, 1994; Bookwala & Jacobs, 2004; Henry, Berg, Smith, & Florsheim, 2007; Walker & Luszcz, 2009). In fact, evidence suggests that couple interactions have stronger associations with marital satisfaction for older (ages 60-70) couples than for their middle-aged (40-50) peers (Henry et al., 2007). This result would appear consistent with Socioemotional Selectivity Theory (SST; Carstensen, 1992; 1995; Carstensen, Isaacowitz, & Charles, 1999; Carstensen, Fung, & Charles, 2003), which suggests that older adults prioritize both emotionally meaningful experiences and spending time in close relationships more than younger individuals. SST would thus seemingly posit that close-relationship dynamics are particularly salient to older adults.

Notably, couples researchers have called for CRE interventions to be adapted, at least to a degree, for specific populations' needs, rather than maintaining a 'one-size-fits-all' approach (Halford, Markman, Kline, & Stanley, 2003; Larson, 2004). Different groups and communities present particular contexts and dynamics relevant to

relationships and family, which CRE programs can directly address (Ooms & Wilson, 2004). Further research in several areas is needed to determine how CRE might be adapted to best suit the dynamics and challenges of older adult relationships.

Current study: Older-adult relationship science

Relationship dynamics and relationship satisfaction. The first goal of this study was to replicate findings from prior relationship research (in general and with older adults specifically, as above) that overall relationship quality is associated with the quality of relationship dynamics (*Aim 1*). In the current study, higher levels of relationship satisfaction were specifically expected to be associated with higher levels of skillful communication, positive bonding, forgiveness, dedication, and support, and lower levels of negative communication. Identifying which relationship dynamics best predict overall satisfaction could inform how much the various dynamics are addressed in future adaptations of CRE for older adults.

Relationship dynamics and stress. Contextual stress (in terms of challenging or adverse circumstances or events) is a major component in contemporary theories of couple-relationship functioning (Karney & Bradbury, 1995; Neff & Karney, 2007; 2009). Exploring associations between specific types of stress (financial strain, health problems, social isolation, aging-related transitions, stressful obligations, overall stress) and the relationship dynamics specified in Aim 1 was another goal of this study (*Aim 2a*). Higher levels of stress were expected to be associated with higher levels of negative communication, and lower levels of skillful communication and other positive dynamics.

At least for younger couples, contextual stress also interacts with dyadic behavior to predict relationship quality (Bodenmann, Meuwly, Bradbury, Gmelch, & Ledermann,

2010; Falconier, Nussbeck, Bodenmann, Schneider, & Bradbury, 2015), with higher levels of skillful behavior generally predicting less negative impact of stressors on relationship outcomes. Despite the many age-related challenges older couples may face (Henry et al., 2005; Lambert, 2009; Shiota & Levenson, 2007), however, it appears that research has yet to evaluate whether the interplay between such stressors and older couples' interaction patterns impacts their relationship quality. The other stress-related goal of this study was thus to test whether and how contextual stressors moderate associations between relationship dynamics and relationship quality among older adults (*Aim 2b*). Based on the above literature in which moderating interactions between stress and relationship dynamics predicted relationship outcomes, it was hypothesized that stressors would moderate associations between relationship dynamics and relationship satisfaction in the current sample, such that they would be stronger among individuals reporting higher levels of stress. In other words, contexts of higher stress were expected to magnify the impact of dyadic interactions on overall relationship satisfaction (this hypothesis can also be framed as more positive relationship dynamics buffering against stress negatively impacting relationship satisfaction).

Results of these analyses may inform future CRE programs that target older adults. If age-related social isolation is a strong moderator of communication/satisfaction associations, for instance, or simply predicts a particularly high level of conflictual communication, then couple-based techniques for maintaining family, friend, and community connections could be prioritized when adapting CRE for older adults.

Relationship dynamics and health. Consistent with research on younger couples (e.g., Markman, Rhoades, Stanley, Ragan, & Whitton, 2010), marital satisfaction among

older couples has already been associated with dyadic interactions such as friendly versus hostile behaviors (in general and in conflictual or collaborative contexts; Henry et al., 2007), and support (Acitelli & Antonucci, 1994). While marital satisfaction has therefore been associated with both couple interactions and health among older adults, further research to explore how such interaction patterns themselves may be associated with health, and in particular specific health behaviors (sleep, exercise, and substance use; *Aim 3*), would have value. For example, knowing that escalated but not withdrawn communication predicts substance use or poor sleep among older adults could inform the extent to which de-escalating strategies are emphasized in future CRE adaptations for this population. Higher levels of positive interactions such as skillful communication were expected to be associated with higher levels of physical and mental health as well as health behaviors (better sleep, more frequent exercise, less frequent substance use), while higher levels of negative communication were expected to predict poorer health and health behavior.

Current study: Feasibility of online CRE for older adults

Pilot trial. Building on the successes of ePREP and of Internet-delivered CRE programs, the PREP development and dissemination team PREP, Inc. has designed an Internet-based adaptation of ePREP (Braithwaite & Fincham, 2007; 2009; 2011; 2014). A key goal of the current study was to pilot this program with a sample of older adults in a small randomized, wait-list controlled trial (*Aim 4*). In particular, given that Internet use remains less common among older adults than younger age cohorts (Smith, 2014), it was important to assess the feasibility of Internet-based CRE for providing actionable knowledge to this specific population – even without having adapted program content for

the specific dynamics of older adult relationships. Furthermore, effectively providing CRE access as an incentive for study participation helped ensure that study participants would constitute an appropriate sample for obtaining knowledge to inform future adaptations of CRE for older adults. Participants assigned to immediate intervention were expected to report significantly greater increases in the use of PREP communication strategies at the follow-up assessment than those assigned to delayed intervention. Significantly greater gains in other dyadic dynamics (such as relationship satisfaction), as well as in psychological and physical wellbeing, were anticipated as secondary outcomes of assignment to intervention.

Program satisfaction and utility. As there are relatively few published studies of Internet-based CRE programs, it was important to provide information about participant satisfaction with the study's online intervention. It was similarly valuable to assess whether this study's sample of older adults found the program to be beneficial (Markman et al., 2004). It was hypothesized that immediate intervention participants would endorse agreement with statements about the program being satisfactory and beneficial (*Aim 5*).

Method

Participants

One or both partners from 61 older-adult heterosexual couples participated in this study[1]. Both partners from 32 of these couples (52.5%) participated; the sample thus included 93 total individuals. 46 of these participants (49.5%) self-identified as female, and the average reported age was 67.7 (*SD* = 5.5) years. 85 participants (91.4%) self-identified as European-American (White non-Hispanic), six (6.5%) identified as African-American (Black non-Hispanic), and two (2.2%) provided ambiguous ethnic identity information (e.g., "subcontinental")[2]. No participants reported being American Indian, Asian-American, Hispanic/Latino, or Pacific Islander. The modal education level was a master's degree (*n*=31, 33.3%), followed by bachelor's degree (*n*=26, 28.0%), some college (*n*=14, 15.1%), doctorate (*n*=14, 15.1%), associate's degree (*n*=5, 5.4%), and high school (*n*=1, 1.1%). Educational attainment was ambiguous (e.g., "Reverend") for two participants (2.2%), who were not included in subsequent analyses of this variable. Modal occupational status was retired (*n*=40, 43.0%), followed by employed full-time (*n*=33, 35.5%), employed part-time (*n*=12, 12.9%), self-employed (*n*=4, 4.3%), and homemaker (*n*=2, 2.2%). Occupational status was ambiguous (e.g., "Retired but working") for two participants (2.2%), who were not included in subsequent analyses of

[1] This project was approved by the University of Denver Institutional Review Board on February 23, 2015.

[2] Given the limited ethnic diversity of this sample, ethnicity was dichotomized (majority and minority) for subsequent analyses.

this variable. 35 (37.6%) participants reported having previously been married. 54 (88.5%) of the 61 couples were married, and had been married 34.6 (SD = 15.0) years on average.

Female and male participants averaged 66.4 (SD = 5.1) and 69.0 (SD = 5.6) years of age, respectively, and this difference was statistically significant ($t(91) = -2.33$, $p = .02$). Participants' ethnicity ($\chi^2(1) = 0.60$, $p = .44$), history of prior marriage ($\chi^2(1) = 0.98$, $p = .32$), and occupational status ($\chi^2(4) = 1.75$, $p = .78$) did not significantly differ by gender. Education level differences by gender were marginally significant ($\chi^2(5) = 10.80$, $p = .06$). Z-tests of proportions indicated female participants were significantly more likely to have a master's-level education (45.5% vs. 23.4%), and male participants were significantly more likely to have a doctoral degree (23.4% vs. 6.8%).

Neither age ($t(91) = 0.27$, $p = .79$), gender ($\chi^2(1) = 0.02$, $p = .88$), ethnicity ($\chi^2(1) = 1.44$, $p = .23$), history of prior marriage ($\chi^2(1) = 0.18$, $p = .67$), occupational status ($\chi^2(4) = 3.10$, $p = .54$), nor educational level ($\chi^2(5) = 7.98$, $p = .16$) were significantly different between individuals who participated in the study with versus without their partner. Similarly, neither assigned condition ($\chi^2(1) = 0.19$, $p = .67$), marital status ($\chi^2(1) = 1.81$, $p = .18$), nor marital duration ($t(51) = -0.03$, $p = .98$) were significantly different based on whether a couple was represented in the study by one or two partners.

Participants assigned to immediate intervention (M = 66.5 years, SD = 5.2) were significantly younger than those assigned to wait-list control (M = 69.1 years, SD = 5.5; $t(91) = -2.31$, $p = .02$). Group differences in the gender ($\chi^2(1) = 0.55$, $p = .46$), prior marital history ($\chi^2(1) = 0.26$, $p = .61$), and ethnicity ($\chi^2(1) = 0.21$, $p = .65$) of participants were non-significant. Omnibus tests of occupational status ($\chi^2(4) = 7.23$, $p = .12$) and

education level ($\chi^2(5) = 9.17$, $p = .10$) by group also did not achieve significance. Nonetheless, *z*-tests of proportions indicated that participants assigned to immediate intervention were significantly more likely to be employed full-time (45.1% vs. 25.0%) and to have a master's-level education (43.1% vs. 22.5%), and less likely to have only completed some college (7.8% vs. 25.0%), than those assigned to wait-list control. Couples did not significantly differ by group in either marital status ($\chi^2(1) = 0.53$, $p = .47$) or marital duration ($t(51) = -0.94$, $p = .35$).

Using the Consolidated Standards of Reporting Trials (CONSORT) guidelines for the presentation of randomized controlled trials (Moher et al., 2010; Schulz, Altman, & Moher, 2010), a participant flow chart is presented below (Figure 1).

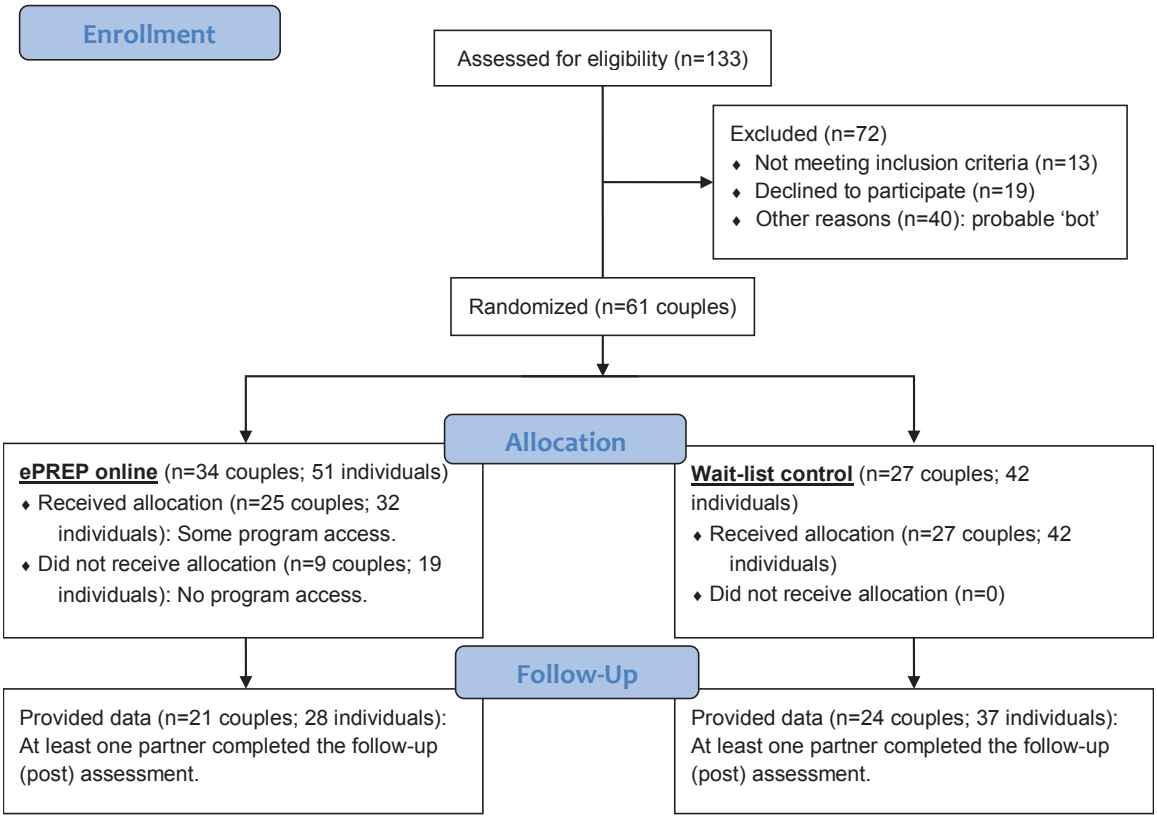

Figure 1. CONSORT 2010 Flow Diagram. Numbers refer to couples rather than individuals except where noted.

Procedures

Recruitment. Information about the study was distributed via social media (specifically, Blogspot, Twitter, and Facebook), healthy-relationship e-mail lists[3], and newsletters of several local Active-Adult Communities (age 55+ residential communities) and religious organizations. These outreach efforts indicated that study participants would receive one month of free access to an online CRE program, that this access would be randomly assigned to occur either immediately or after a one-month delay, and that a $10 Amazon.com gift card would be provided for completing the second of two study questionnaires about one's relational and overall health. They noted that individuals age 62 (when one becomes eligible for partial Social Security benefits) and older were being sought to participate, and briefly described the studies of older adults, relationships, and health discussed in the first paragraph of this report. Lastly they included a hyperlink to a Qualtrics screening questionnaire, and an e-mail address set up for the purpose of managing communication with study participants (oldercouplesresearch@gmail.com).

Screening. The screening questionnaire included questions about relationship status, living situation, and age, as well as questions designed to allow legitimate responses to be distinguished from responses by 'form-completion bots' - computer programs or individuals that repeatedly complete internet surveys in order to receive subject payments or other study incentives (Prince, Litovsky, & Friedman-Wheeler, 2012). For example, respondents were asked to answer at least one of three open-ended

[3] Approximately 45 (73.8%) of the couples represented in the sample were recruited from e-mail announcements about the study through the SmartMarriages.com e-mail list. As such, some study participants were themselves CRE professionals, and most (53; 57.0%) reported having previously taken a marriage- or relationship- education course. Likelihood of prior CRE experience did not significantly differ by assigned condition ($\chi^2(1) = 0.16$, $p = .69$).

questions about their relationship (e.g., "What was the start of your relationship like?"), to identify their strongest memory about 'the group' pictured in a 1960's-era picture of The Beatles, and to indicate what they ate for dinner or supper last night. Lastly, respondents were asked to provide their and their partner's e-mail addresses.

Consent and Baseline Assessment. Completed screens were considered eligible for participation if the respondent endorsed being married or living with their partner in a serious romantic relationship, indicated that they or their partner were of an appropriate age for the study, and the response did not appear to be 'bot'-completed[4]. The self and partner e-mail addresses provided in eligible screens were sent invitations to a questionnaire which consisted of a consent form followed by the baseline or 'pre' assessment. These invitations noted that an individual who wished to participate in the study would need to complete the questionnaire. The consent form described the study in detail, including the potential risks/discomforts and benefits of participation as well as the safeguards of participant confidentiality and data security, so that individuals could make an informed decision about whether to participate. The baseline assessment questions were administered only after an individual indicated that he or she consented to participate in the study. A reminder invitation was e-mailed to individuals who had not responded to the initial invitation within three days.

Randomization. After the first partner in a couple completed the consent-and-baseline questionnaire, the couple was randomly assigned to either the immediate

[4] 'Bot' respondents often skip questions for which an answer is requested but not required, give very brief and/or dysfluent responses to open-ended questions, and provide e-mail addresses consisting of seemingly nonsensical character strings (Prince et al., 2012). In the current study screens were therefore flagged as 'bot' responses due to skipping all three of the open-ended relationship questions, and for providing an e-mail address such as finamnurohx@yahoo.com (this address has been slightly altered from the actual address that was provided).

intervention or wait-list (delayed treatment) conditions[5]. Shortly after completing the consent-and-baseline questionnaire all respondents were notified of their condition assignment via e-mail, at which time they were also provided a resource list consisting of links to five online databases for locating a therapist, as well as national safety hotlines for suicide prevention, domestic violence, and sexual assault.

Intervention Access. Participants assigned to immediate intervention were given access to the online program for one month, mirroring the one-month active intervention phase used in Kalinka and colleagues' (2012) online CRE study. Following their condition-assignment e-mail, immediate-intervention participants were sent program-invitation e-mails which identified the website where the program was located (lovetakeslearning.com/products/home.php) and provided participant-specific passwords to the site, along with instructions to not share their password even with their partner[6]. These invitations also recommended that participants view all of the program's sections/lessons at least once in the following two weeks, and then continue to review the material as needed or desired. Lastly selected program slides were included as an attached file, in case a participant wished to create a hard-copy printout of key program material.

Immediate intervention participants who accessed the program by using their password were not significantly different from those who did not do so in terms of age

[5] The randomization ratio was initially 1:1, but was changed to 2:1 in favor of immediate intervention after 45 couples had been randomized. This change was made to facilitate adequate representation of immediate-intervention participants in the second assessment dataset – an unintended consequence of the study design was that wait-list participants may have had more motivation to complete the second assessment (i.e., to receive intervention access).

[6] This approach allowed the investigator to monitor which participants had accessed the program, without participants having to provide any identifying information to the program's website (which is owned by PREP, Inc.)

($t(49) = .51$, $p = .61$), ethnicity ($\chi^2(1) = 0.02$, $p = .89$), education ($\chi^2(4) = 1.69$, $p = .79$), occupational status ($\chi^2(3) = 5.64$, $p = .13$), and whether their partner was also participating in the study ($\chi^2(1) = 0.17$, $p = .68$). However, female participants were significantly more likely to have accessed the program than males (77.8% vs. 45.8%, $\chi^2(1) = 5.55$, $p = .02$).

Intervention: ePREP online. The online version of ePREP (Braithwaite & Fincham, 2007; 2009; 2011; 2014) developed by PREP, Inc. consists of seven sections or lessons rather than the one-session computer-based version studied previously, and is more extensive than the brief online adaptation of PREP previously tested with foster and adoptive parent couples (Loew et al., 2012). Section titles and CRE principles were as follows:

Section 1: Improving Your Relationship (Risk factors; Communication Danger Signs; Time Out)

Section 2: Filters (identifying and overcoming common impediments to clear communication)

Section 3: The Issues & Events Model (signs of Hidden Issues; using XYZ Statements)

Section 4: Important Conversations (the Speaker-Listener Technique)

Section 5: Problem Solving (discussion before solution; safe communication; team focus)

Section 6: Fun & Friendship (making time; protecting it from conflict; staying creative)

Section 7: Putting It All Together (review/summary)

In addition to its instructional contents each section began with a video introduction by a narrator. Sections contained additional videos to illustrate interaction patterns associated with relationship problems as well as the use of skills to counteract these "communication danger signs" and to generally enhance relationship quality. The first six sections each ended with three questions based on that section's contents, each of which was followed by feedback about the correct answer in order to consolidate good understanding of key program principles. Each lesson was designed to take 30 minutes or less to view, and most lessons recommended follow-up discussion or skill practice.

The program was presented within a viewing frame that integrated a user-directed slideshow of the instructional contents in a navigational panel that identified the program's sections and topics, as well as the user's place in the current section (Figure 2). Content slides were designed to contain only limited amounts of text, to utilize varied visual backgrounds, and to include a variety of images of interactions, individuals, and objects to illustrate the program's principles. Overall, the program was designed to be consistent with recommendations for online adult learning (e.g., Vai & Sosulski, 2011).

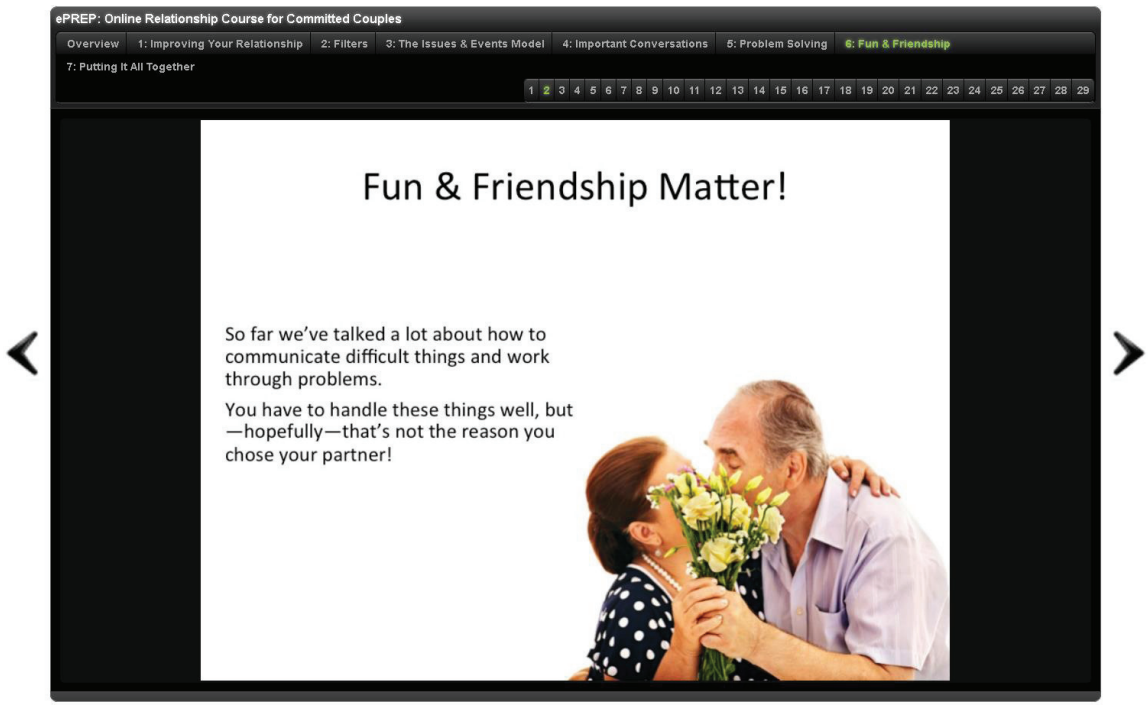

Figure 2. Visual design of intervention program.

Reminder E-mails. Participants were sent reminder e-mails two and three weeks after being randomized, similar to the methodology of previous computer and Internet CRE studies (e.g., Braithwaite & Fincham, 2014; Kalinka et al., 2012). The content of the e-mails varied based on a participant's assigned condition. Delay-treatment participants were informed of the time that remained until they were sent an invitation to the second assessment, that they would receive intervention access as well as a $10 Amazon.com gift card for completing this assessment, and thanked for their patience. Immediate-intervention participants were informed of how much time remained for them to access the intervention. In the two-week reminder they were also provided a study telephone number (720-767-2155) at which they could contact the research coordinator to discuss

how to either begin or increase accessing the program[7]. In the three-week reminder the upcoming invitation for the second assessment was mentioned, as well as the gift card incentive for completing it.

Follow-up Assessment. Participants in both conditions were e-mailed invitations to the follow-up or 'post' assessment questionnaire four weeks after completing the baseline questionnaire. A reminder invitation was e-mailed to participants who had not responded to the initial invitation within three days. As warranted, additional reminder invitations were sent one and two weeks following the first reminder. Once a participant completed the follow-up assessment he or she was e-mailed a $10 Amazon.com gift card[8]. Wait-list participants also received their month of intervention access upon completing the follow-up assessment. Specifically, they were sent the same program-invitation e-mail that had been used for the immediate-intervention participants (described above in "Intervention Access"), as well as the e-mail reminders after two and three weeks of intervention access (the prompts to either begin or continue accessing the program).

Participants assigned to the wait-list control group were significantly more likely to complete the follow-up assessment (92.5% vs 58.3%, $\chi^2(1) = 13.19$, $p < .001$). Completing the follow-up assessment was not significantly associated with age ($t(86) = -1.90$, $p = .06$), gender ($\chi^2(1) = 0.73$, $p = .39$), ethnicity ($\chi^2(1) = 0.10$, $p = .75$), education ($\chi^2(5) = 4.55$, $p = .47$), or whether one's partner was participating in the study ($\chi^2(1) =$

[7] While several participants initially or again accessed the program shortly after being sent this e-mail, only two called the phone number; one for assistance with technical difficulty viewing the program, and the other to state that the e-mail had successfully prompted him to access the program.

[8] Partial funding for this aspect of the study was provided by the University of Denver Psychology Department.

0.41, $p = .52$). The omnibus test of occupational status by follow-up completion was also non-significant ($\chi^2(4) = 8.40$, $p = .08$), but z-tests of proportions indicated that participants who did not complete the follow-up assessment were significantly more likely to be employed full-time than those who did (59.1% vs. 28.1%).

Measures

Measures of relationship dynamics and health were administered at both assessments. Demographic information and stress were only assessed at baseline, and program satisfaction was assessed only at follow-up (and only for immediate-intervention participants).

Demographic Information: As reported above, participants were asked to identify their age, gender, ethnicity, education, occupation, marital status, length of marriage (if married), how many times they had previously been married, and whether they had previously taken a marriage- or relationship- education course. Given the aforementioned recent debate about the role of socioeconomic status in CRE's efficacy, participants also completed two items that assessed financial strain (one from Alley & Kahn, 2012; the other adapted from Hibbert, Beutler, & Martin, 2004). Both items were scaled 0 to 4.

Stress. Based on the literature of aging-related challenges that can effect older-adult relationships (Henry et al., 2005; Lambert, 2009; Shiota & Levenson, 2007), participants were asked to rate how much stress they had experienced in the past year from each of 15 different issues (for example, "Retiring," "Losing friends or relatives,"

"Caring for parents")[9]. Items were scaled 0 to 4, with higher ratings indicating higher stress. Item scores were averaged to create aging-related stress subscales (self-health problems, partner-health problems, social isolation, difficult transitions, and stressful obligations), as well as a total scale score. Participants' average total scale score was 0.74 (*SD* = 0.41), with internal consistency of .74. Item and subscale means are presented below (Table 1). As only the Social Isolation subscale had acceptable internal consistency, the other subscales were not directly analyzed in subsequent analyses. However, the "Financial problems" item was averaged with the two financial strain items discussed above to create an index of financial stress, on which the average score was 1.24 (*SD* = 0.82, α = .87).

[9] An existing measure of the importance, valence, and expectedness of various life events was identified (Hughes, Blazer, & George, 1988), but its three-point scaling (positive, neutral, negative) for the valence dimension was a poor fit for the goals of the current study.

Table 1

Aging-Related Stress Item and Subscale Means and Internal Consistencies

Item or Subscale	*M (SD)*	α
Self-Health Problems	0.91 (.54)	.48
My medical or physical health problems	1.33 (.85)	
My emotional or mental health problems	0.72 (.83)	
Declines in my cognitive functioning	0.67 (.63)	
Partner-Health Problems	0.94 (.67)	.57
My partner's medical or physical health problems	1.37 (1.01)	
My partner's emotional or mental health problems	0.81 (.98)	
Declines in my partner's cognitive functioning	0.66 (.74)	
Social Isolation	0.55 (.66)	.74
Loneliness	0.54 (.85)	
Feeling ignored or under-appreciated	0.70 (.89)	
Boredom	0.41 (.70)	
Difficult Transitions	0.67 (.66)	.47
Losing friends or relatives	0.92 (.95)	
Retiring	0.68 (.97)	
Moving	0.41 (.91)	
Stressful Obligations	0.65 (.58)	.27
Financial problems	0.90 (.91)	
Caring for parents	0.35 (.80)	
Supporting children	0.70 (1.02)	

Relationship Satisfaction. A four-item version of the Couples Satisfaction Index (CSI-4; Funk & Rogge, 2007) was used to measure relationship satisfaction. Sample items include "Please indicate the degree of happiness, all things considered, of your relationship," and "I have a warm and comfortable relationship with my partner." One

item is scaled 0 to 6 and the other three are scaled 0 to 5, with higher scores indicating higher satisfaction for all items. Item scores are summed to create a scale score. Participants' average baseline scale score was 15.01 (*SD* = 4.17), and internal consistency was .93. Scores of 13 or lower are characterized as distressed; 30 participants (32.3%) were in this range at baseline.

Skillful Communication. Ten items from the Communication Skills Test (Saiz & Jenkins, 1995; see Stanley et al., 2014) were used to assess self-reported use of the communication skills taught in PREP. Sample items include "When discussing issues, I allow my partner to finish talking before I respond" and "When discussions threaten to boil over, we stop them and take a break." Items are scaled 1 to 7, with higher ratings indicating more frequent skill use. After one item was reverse-scored, item scores were averaged to create a scale score. Participants' average baseline scale score was 4.68 (*SD* = 1.14), and internal consistency was .88.

Negative Communication. Five items previously used to measure frequency of negative couple communication patterns (Stanley, Markman, & Whitton, 2002) were used for this purpose in the current study. Sample items include "Little arguments escalate into ugly fights with accusations, criticisms, name calling, or bringing up past hurts," and "When we have a problem to solve, it is like we are on opposite teams." Items are scaled 1 to 3, with higher ratings indicating greater frequency. Item scores were averaged to create a scale score. Participants' average baseline scale score was 1.58 (*SD* = 0.48), and internal consistency was .85.

Positive Bonding. Nine items from the Couple Activities Scale (Markman, 2000; see Stanley et al., 2014) were used to assess positive relationship connections such as

friendship, fun, and emotional intimacy. Sample items include "My partner is my best friend," "We have a lot of fun together," and "My partner and I are very close." Items are scaled 1 to 7, with higher ratings indicating higher agreement. Item scores were averaged to create a scale score. Participants' average baseline scale score was 5.86 (*SD* = 1.06), and internal consistency was .92.

Forgiveness. Four items from the Marital Forgiveness Scale (see Fincham & Beach, 2002) were used to measure disposition towards forgiving one's partner. Sample items include "I am quick to forgive my partner," and "I think about how to even the score when my partner wrongs me." These items were rated on a 1 to 7 scale, with higher ratings indicating higher agreement. After two of the items were reverse-scored, item scores were averaged to create a scale score. Participants' average baseline scale score was 5.81 (*SD* = 0.95), and internal consistency was .68.

Dedication. Five items from the Dedication subscale of the Commitment Inventory (Stanley & Markman, 1992) were used to measure personal dedication to one's relationship. Sample items include "I want this relationship to stay strong no matter what rough times we may encounter," and "I may not want to be with my partner a few years from now." Items are scaled 1 to 7, with higher ratings indicating higher agreement. After two of the items were reverse-scored, item scores were averaged to create a scale score. Participants' average baseline scale score was 6.50 (*SD* = 0.69), and internal consistency was .72.

Support. The 12-item Multidimensional Scale of Perceived Social Support (MSPSS; Zimet, Dahlem, Zimet, & Farley, 1988) was used to assess perceptions of support from one's partner, family, and friends. Sample items include "There is a special

person who is around when I am in need," "My family really tries to help me," and "I can talk about my problems with my friends." Items are scaled 1 to 7, with higher ratings indicating higher agreement. Item scores are averaged to create subscale scores (partner support, family support, and friend support), as well as a total scale score. Participants' average baseline subscale scores were 5.72 (*SD* = 1.44, α = .93) for partner support, 5.25 (*SD* = 1.27, α = .89) for family support, and 5.42 (*SD* = 1.19, α = .92) for friend support. The average baseline total scale score was 5.47 (*SD* = 0.98), with internal consistency of .89.

Physical and Mental Health. The 36-item Short Form Health Survey version 2 (SF-36v2; Ware, Kosinski, & Dewey, 2003) was used to assess physical and mental health. Sample items include "How much bodily pain have you had during the past 4 weeks?" and "During the past 4 weeks, to what extent has your physical or emotional health problems interfered with your normal social activities with family, friends, neighbors, or groups?" Item scales range from 3 to 6 response options; all responses are re-scored from 0 to 100, and these scores are averaged to create Physical Health and Mental Health scale scores. At baseline, participants' average Physical Health scale score was 82.62 (*SD* = 13.90, α = .91), and the average Mental Health scale score was 80.03 (*SD* = 10.98, α = .87).

Health Behavior. Two items from the Pittsburgh Sleep Quality Index (PSQI; Buysse, Reynolds, Monk, Berman, & Kupfer, 1989) were used to assess amount and quality of sleep in the past month. Three items from the International Physical Activity Questionnaire Short Form (IPAQ-SF; Hallal, Victora, Wells, Lima, & Valle, 2004) were used to assess recent frequency of vigorous, moderate, and casual (i.e., walking) physical

activity. Scores on these three items were summed to create a physical activity total score. Four items developed by the research team assessed frequency of tobacco, alcohol, and illicit drug use, as well as prescription drug abuse, in the past month. Item scaling and means are presented below (Table 2). As any level of tobacco use, drug use, and prescription drug abuse was respectively reported by only one, four, and zero participants, these items were excluded from further analysis.

Table 2

Health Behavior Item Scaling and Mean Scores

Item	*M (SD)*
Sleep	
Quantity (hours per night)	7.05 (0.99)
Quality (1 = *very bad* to 4 = *very good*)	3.26 (0.57)
Physical Activity (days in the past week)	
Vigorous	2.64 (2.24)
Moderate	3.55 (2.18)
Casual	4.26 (2.18)
Substance Use (0 = *none* to 5 = *Five or more times per day*)	
Tobacco	0.01 (0.10)
Alcohol	1.16 (1.12)
Drugs	0.06 (0.36)
Prescription Drug Abuse	0.00 (0.00)

Program Satisfaction and Utility. 11 items assessed immediate intervention participants' ratings of the program's utility (seven items) and their satisfaction using it (four items). Similar items were used in the feasibility study of web-based PREP for

foster and adoptive parent couples (Loew et al., 2012). Sample items include "I would recommend the program to a friend," and "I found the program to be helpful for my relationship." Items are scaled 1 to 7, with higher ratings indicating higher agreement. Item scores were averaged to create program satisfaction and benefit scale scores. The average program satisfaction scale score was 5.63 (SD = 1.29, α = .90), and the average program benefit scale score was 5.35 (SD = 1.12, α = .91).

Results

Analytic Strategy

Relationship-science hypotheses. These analyses were ran in IBM SPSS Statistics (Version 20). First, bivariate correlations were conducted to explore associations between indices of specific relationship dynamics and measures of relationship satisfaction, contextual stress, and health (Aims 1, 2a and 3, respectively). These correlations were done with all 93 participants' baseline data as well as for each gender separately. The separate-gender correlations were conducted as a means to account for the dyadic dependence among individuals participating along with their partners[10], and to explore whether the associations varied by gender (although they were not generally expected to do so). Fisher z-transformations were then applied to the resulting pairs of correlation coefficients to test whether they significantly differed in strength. Additionally, to address shared variance among the relationship dynamics and to assess for unique associations, relationship satisfaction, contextual stress, and health measures were each regressed on the various relationship dynamics with which they significantly correlated, using a stepwise procedure.

[10] The other process that was considered for this purpose consisted of standardizing scale scores by transforming them into z-scores, and using these standardized scale scores to predict one another in a multilevel model, in which partners' scores can be 'nested' within a higher-level couple unit. However this procedure would only approximate correlations and is a poor option for testing bi-directional associations, as the resulting coefficient can differ when one switches which variable within a pair is chosen as the dependent variable.

To assess whether and how contextual stress moderates associations between relationship satisfaction and relationship dynamics among older adults (Aim 2b), baseline relationship satisfaction was regressed on each stress/couple-dynamic interaction term, along with the appropriate measures of stress and couple dynamics. These regressions were conducted only for relationship dynamics that had unique associations with relationship satisfaction in the stepwise regression conducted as part of Aim 1.

Online CRE feasibility hypotheses. Due to the nested nature of the data (specifically, partners being nested within couples), multilevel modeling (MLM) was well-suited for testing whether assignment to intervention had significant effects on the use of PREP skills, other aspects of relationship functioning, and physical and mental health (Aim 4). A model that has been suggested for intervention research with couples (Atkins, 2005) was utilized; Level 1 reflects partner characteristics (e.g., baseline scores, gender), and Level 2 reflects couple characteristics (e.g., assigned condition). In this model couple is the unit of analysis, and analyses include all couples for whom at least one partner completed the follow-up assessment, regardless of how many partners in the couple were participating in the study (i.e., for whom data was available at baseline). The basic equation below demonstrates the structure for the analyses of Aim 4: *i* indexes partners within a couple; and *j* indexes couples.

Level 1: $Y_{ij} = \pi_{0ij} + \pi_{1ij}(\text{baseline score})_{ij} + \varepsilon_{ij}$

Level 2: $\pi_{0ij} = \beta_{00j} + \beta_{01j}\,(\text{assigned condition})_j + r_{0ij}$

$\pi_{1ij} = \beta_{10j} + r_{1ij}$

To test whether assignment to intervention was associated with greater change at the follow-up assessment, baseline scores (π_{1ij}) were controlled for by entering them grand-mean centered at Level 1, in addition to the intercept (π_{0ij}) and error (ε_{ij}) coefficients. As a dichotomous couple-level characteristic, assigned condition (β_{01j}) was entered, without centering, in the Level 2 equation for the intercept coefficient. Intervention moderator analyses were conducted by entering the potential moderator at the appropriate level (e.g., Level 1 for gender), and entering assigned condition in the Level 2 equation for its coefficient. Moderators were entered without centering if dichotomous, and grand-mean centered if continuous (e.g., age, financial stress). These analyses were conducted using HLM 7.01 (Raudenbush, Bryk, Cheong, Congdon, & du Toit, 2013). To assess program satisfaction and utility (Aim 5), descriptive statistics for these measures and for program-use variables were examined.

Aim 1: Relationship dynamics and relationship satisfaction

As hypothesized, participants' baseline relationship satisfaction significantly, positively correlated with their ratings of skillful communication, positive bonding, forgiveness, dedication, and support, and significantly, negatively correlated with negative communication frequency (Table 3). These correlations remained similarly significant among male and female participants separately; comparisons of the male and female coefficients for each relationship dynamic using Fisher z-transformations were all non-significant (all p's > .10). When relationship satisfaction was regressed on all six relationship dynamics in a stepwise model, however, only positive bonding and skillful communication remained as significant predictors.

Table 3

Relationship Satisfaction's Associations with Relationship Dynamics

Relationship Dynamic	*Total* r	*Male* r	*Female* r	*Total* β[a]
Skillful communication	.63***	.66***	.60***	.18*
Positive bonding	.83***	.84***	.82***	.71***
Forgiveness	.48***	.43**	.53***	.05
Dedication	.58***	.54***	.61***	.13
Support	.43***	.52***	.34*	-.01
Negative communication	-.54***	-.42**	-.66***	-.07

[a] Controlling for (other) relationship dynamics that were significant in the final model

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

Aim 2: Relationship dynamics and stress

Financial stress was significantly, negatively correlated with skillful communication and positive bonding, and significantly, positively correlated with negative communication (Table 4a), as expected. Correlations with forgiveness, dedication, and support did not achieve significance, however. Among male participants financial stress was significantly correlated only with negative communication, while for females it was a significant negative predictor of skillful communication and forgiveness. Nonetheless, statistical contrasts of the male and female coefficients for each relationship dynamic were all non-significant (all p's > .10). When financial stress was regressed on its significant correlates (skillful communication, positive bonding, and negative communication) in a stepwise model, it was significantly associated only with negative communication.

Table 4a

Financial Stress's Associations with Relationship Dynamics

Relationship Dynamic	*Total* r	*Male* r	*Female* r	*Total* β[a]
Skillful communication	-.22*	-.09	-.33*	-.06
Positive bonding	-.25*	-.24	-.27	-.13
Forgiveness	-.15	.03	-.30*	
Dedication	-.13	-.26	-.04	
Support	.04	.07	.00	
Negative communication	.30**	.30*	.28	.30**

[a] Controlling for (other) relationship dynamics that were significant in the final model

*: $p < .05$ **: $p < .01$

Social isolation was significantly correlated in the expected direction with all relationship dynamics: indirectly with skillful communication, positive bonding, forgiveness, dedication, and support, and directly with negative communication (Table 4b). The correlations for forgiveness and support did not retain significance for either gender alone, nor did the correlation with skillful communication among women. Nevertheless, statistical comparisons of the male and female coefficients for each relationship dynamic were all non-significant (all *p*'s > .05). When social isolation was regressed on all six relationship dynamics in a stepwise model, only positive bonding remained significant as a (indirect) predictor.

Table 4b

Social Isolation's Associations with Relationship Dynamics

Relationship Dynamic	*Total* r	*Male* r	*Female* r	*Total* β[a]
Skillful communication	-.27*	-.38**	-.14	-.18
Positive bonding	-.60***	-.60***	-.60***	-.60***
Forgiveness	-.23*	-.19	-.28	.08
Dedication	-.44***	-.60***	-.32*	-.13
Support	-.25*	-.25	-.24	.06
Negative communication	.35**	.31*	.43**	.05

[a] Controlling for (other) relationship dynamics that were significant in the final model

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

Total aging-related stress was also significantly correlated with all relationship dynamics as expected: negatively with skillful communication, positive bonding, forgiveness, dedication, and support, and positively with negative communication (Table 4c). As with social isolation, the correlations for forgiveness and support did not retain significance for either gender alone, nor did the correlation with skillful communication among women. Again, however, statistical comparisons of the male and female coefficients for each relationship dynamic were all non-significant (all p's > .10). When the aging-related stress scale score was regressed on all six relationship dynamics in a stepwise model, only positive bonding remained significant as a (indirect) predictor.

Table 4c

Aging-Related Stress's Associations with Relationship Dynamics

Relationship Dynamic	*Total* r	*Male* r	*Female* r	*Total* β[a]
Skillful communication	-.38***	-.50***	-.23	-.02
Positive bonding	-.59***	-.61***	-.58***	-.59***
Forgiveness	-.22*	-.20	-.21	.10
Dedication	-.41***	-.46***	-.35*	-.09
Support	-.23*	-.28	-.21	.07
Negative communication	.38***	.38**	. 34*	.08

[a] Controlling for (other) relationship dynamics that were significant in the final model

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

Given that stress is a much-emphasized and discussed element in contemporary models of couple-relationship functioning (Karney & Bradbury, 1995; Neff & Karney, 2007; 2009), it should be noted that relationship satisfaction was significantly, negatively correlated with financial stress ($r(91) = -.24$, $p = .02$), social isolation ($r(91) = -.57$, $p < .001$), and overall aging-related stress ($r(91) = -.60$, $p < .001$) in the current study. Relationship satisfaction's correlations with social isolation and aging-related stress remained significant for each gender individually, and the correlation with financial stress was non-significant for each gender alone. Male and female correlations between relationship satisfaction and financial stress (-.27 and -.20, respectively) were of similar magnitude as the correlation in the whole sample, however, and gender differences in the coefficients for all three stress and relationship satisfaction correlations were non-significant when compared via Fisher z-transformations. Lastly, when relationship

satisfaction was regressed on positive bonding, skillful communication, and the three stress indices in a stepwise model, only the associations with positive bonding (β = .62, p < .001), skillful communication (β = .18, p = .01), and overall aging-related stress (β = -.16, p = .02) remained significant.

Based on the results for Aim 1, interactions terms were calculated for each of the three stress indices (financial stress, social isolation, and overall aging-related stress) with each of the two relationship dynamics uniquely associated with relationship satisfaction (i.e., positive bonding and skillful communication). Relationship satisfaction was then separately regressed on each of the six resulting stress/couple-dynamic interaction terms, along with the appropriate measures of stress and couple dynamics (i.e., the main effects) in each analysis. None of the interaction terms achieved significance (Table 4d).

Table 4d

Stress Moderation of Associations between Relationship Dynamics and Satisfaction

Interaction Term	*β*	*t*
Financial stress		
With Positive bonding	-.15	-.40
With Skillful communication	.31	.84
Social isolation		
With Positive bonding	-.35	-1.20
With Skillful communication	.45	1.54
Aging-related stress		
With Positive bonding	-.27	-.98
With Skillful communication	.14	.51

Aim 3: Relationship dynamics and health

In contrast to the hypothesis, participants' baseline physical health scale scores were not significantly correlated with any of the six relationship dynamics in this study (Table 5a). Among male participants physical health was significantly correlated with positive bonding, yet the difference between the male and female coefficients (using Fisher z-transformations) was statistically non-significant. Given that correlations between physical health and relationship dynamics were generally non-significant, these associations were not examined in a regression.

Table 5a

Physical Health's Associations with Relationship Dynamics

Relationship Dynamic	*Total* r	*Male* r	*Female* r
Skillful communication	.20	.27	.14
Positive bonding	.17	.30*	.02
Forgiveness	.10	.21	.00
Dedication	.14	.25	.07
Support	.04	.07	-.01
Negative communication	.04	.00	.01

*: $p < .05$

Conversely, mental health was significantly, directly correlated with skillful communication, positive bonding, and forgiveness (Table 5b). These three correlations as well as the one between mental health and dedication were significant in the male portion of the sample, but none of the correlations between mental health and relationship dynamics were significant among the female subsample. The male and female coefficients for skillful communication and positive bonding were significantly different when compared using Fisher z-transformations. As the overall sample's significant correlations between mental health and relationship dynamics appeared to be driven by the strength of these associations among men, mental health was regressed on its significant predictors among male participants, using a stepwise model. Only positive bonding remained significantly associated with mental health in this analysis.

Table 5b

Mental Health's Associations with Relationship Dynamics

Relationship Dynamic	*Total* r	*Male* r	*Female* r	*Male* β[a]
Skillful communication[b]	.27*	.47**	.05	.24
Positive bonding[b]	.30**	.50***	.07	.50***
Forgiveness	.23*	.38**	.07	.18
Dedication	.11	.32*	-.06	.03
Support	.09	.18	-.01	
Negative communication	-.04	-.20	.08	

[a] Controlling for (other) relationship dynamics that were significant in the final model

[b] Male and female *r*-values significantly different at $p < .05$

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

For both sleep quality and physical activity (Tables 5c and 5d, respectively), correlations with relationship dynamics mirrored the unexpected results seen for physical health. That is, neither of these health behaviors was significantly correlated with any of the six relationship dynamics in this study. Furthermore, none of these correlations were significant for either gender alone. As all correlations between these two health behaviors and relationship dynamics were non-significant, comparisons of coefficients by gender were not warranted, nor were regressions of health behaviors on relationship dynamics.

Table 5c

Sleep Quality's Associations with Relationship Dynamics

Relationship Dynamic	*Total* r	*Male* r	*Female* r
Skillful communication	.15	.18	.13
Positive bonding	.16	.25	.07
Forgiveness	.13	.10	.17
Dedication	-.15	-.14	-.15
Support	.04	.00	.06
Negative communication	-.01	-.15	.08

Table 5d

Physical Activity's Associations with Relationship Dynamics

Relationship Dynamic	*Total* r	*Male* r	*Female* r
Skillful communication	.11	.03	.23
Positive bonding	.06	.09	.03
Forgiveness	-.13	-.08	-.15
Dedication	-.16	.04	-.26
Support	.04	-.04	.10
Negative communication	-.16	-.25	-.17

Alcohol use significantly correlated only with positive bonding, and the positive direction of this relationship was unexpected (Table 5e). No correlations between alcohol use and relationship dynamics were significant among men alone, and only the correlation with positive bonding was significant among women. Nonetheless the difference between the male and female coefficients (using Fisher z-transformations) was statistically non-significant. Given that alcohol use correlated significantly with only one relationship dynamic, it was not regressed on these dynamics.

Table 5e

Alcohol Use's Associations with Relationship Dynamics

Relationship Dynamic	*Total* r	*Male* r	*Female* r
Skillful communication	.12	.04	.20
Positive bonding	.21*	.13	.31*
Forgiveness	.17	.24	.05
Dedication	.09	-.09	.23
Support	.00	.13	-.13
Negative communication	-.07	-.01	-.08

*: $p < .05$

Given that associations between overall relationship quality and health have been consistently found in other older adult samples (e.g., Bookwala, 2005; Umberson et al., 2006; Walker & Luszcz, 2009), such correlations were examined in the current study. Relationship satisfaction significantly correlated with mental health ($r(91) = .30$, $p < .01$),

but not physical health ($r(91) = .11$, $p = .30$) or the health behaviors of sleep quality ($r(91) = .12$, $p = .26$), physical activity ($r(91) = -.06$, $p = .58$), and alcohol use ($r(91) = .12$, $p = .24$). The correlation between relationship satisfaction and mental health was significant among men ($r(45) = .51$, $p < .001$), but relationship satisfaction did not significantly correlate with any of the measures of health and health behavior for women. The male and female correlations between relationship satisfaction and mental health were significantly different (at $p < .05$) when compared via Fisher z-transformations.

Aim 4: Feasibility study - Pilot trial

Results of the multilevel modeling analyses that were used to test for group differences in relationship functioning and health at follow-up (controlling for baseline scores) are presented in Table 6. Group was coded 0 = *control* and 1 = *intervention*, thus the intercept coefficient can be interpreted as the predicted follow-up score for the average baseline score, in the control group. The intervention coefficient can be interpreted as the difference between the intervention and control groups' average follow-up scores. As hypothesized, intervention group couples reported significantly greater use of skillful communication than control group couples at follow-up, controlling for baseline levels of skillful communication. Based on the *t*-ratio of the intercept coefficient's group term, this effect was of medium-large size, $d = .63$. Group differences in the secondary outcomes of relationship satisfaction, other relationship dynamics, and physical and mental health did not achieve significance, however.

To further explore effects of the online PREP intervention among older adults, analyses were conducted to assess whether a variety of plausible variables moderated the intervention's impact on the reported use of skillful communication. Specifically, gender,

age, education level, current employment, financial stress, prior marriage, prior CRE experience, relationship distress (according to the CSI-4 scale score cutoff), time spent using the intervention, and whether one's partner was participating in the study were examined as potential intervention moderators[11]. Gender was found to significantly moderate intervention impact on skillful communication – the group term for the intercept coefficient was non-significant when including gender in the model (b = -.16, $t(43)$ = -.73, p = .47), but the group term for the gender coefficient was significant (b = .83, $t(63)$ = 3.36, $p < .01$). As gender was coded 0 = *male* and 1 = *female*, in this analysis the group term for the intercept can be interpreted as the intervention effect for men, and the group term for gender as the difference in the intervention effect between women and men. That is, assignment to intervention was associated with significant increase in the reported use of skillful communication strategies for female but not male older adults. Based on the t-ratio of the gender coefficient's group term, the effect on female skillful communication was large, d = .85.

The group term was non-significant for the coefficient of each other potential moderator; only gender moderated intervention impact on skillful communication. Time spent using the intervention as a measure of dose was tested for intervention-group participants alone (because it did not vary among control-group participants) as a predictor of skillful communication at follow-up, controlling for baseline levels, but the coefficient for this potential moderator also failed to reach significance. To assess whether significant secondary intervention impacts for women might have been obscured in the whole-sample analyses by non-significant impacts among men, analyses of the

[11] Limited sample diversity in terms of ethnicity and marital status precluded analysis of these variables as potential intervention moderators.

eight secondary outcome variables were replicated with gender included in the model. However, the group term for the gender coefficient (and for the intercept coefficient) failed to reach significance in all of these analyses. In other words, no gender-specific intervention effects were significant for the secondary outcome variables.

Table 6

Multilevel Modeling Analyses of Relationship Functioning and Health at Follow-up

	Intercept		*Intervention*	
Measure	*b*	*SE*	*b*	*SE*
Skillful communication	4.89***	.10	.31*	.15
Relationship satisfaction	14.99***	.39	-.10	.56
Positive bonding	5.93***	.06	.08	.08
Forgiveness	5.91***	.10	.07	.16
Dedication	6.49***	.08	.02	.05
Partner support	5.58***	.17	.30	.24
Negative communication	1.57***	.05	-.08	.07
Physical health	83.33***	1.25	.42	1.48
Mental health	82.30***	.95	-.67	1.56

Note: df = 43 for *t*-tests of all coefficients. Reported coefficients for each measure are when controlling for baseline scores on that measure.

*: $p < .05$ ***: $p < .001$

Aim 5: Feasibility study - Program satisfaction and utility

At the follow-up assessment, participants assigned to immediate intervention reported having spent an average of 2.77 (*SD* = 2.21) hours using the online program. They reported having viewed an average of 3.25 (*SD* = 2.76) modules themselves, 2.46 (*SD* = 3.11) modules with their partners, having discussed 3.21 (*SD* = 3.12) modules with their partners, and having repeated 1.04 (*SD* = 1.82) modules for clarity. Among participants who reported discussing at least one module with their partner, discussions were rated as moderately-to-highly helpful, 5.29 (*SD* = 1.49) on a 1 ("not at all" to 7 ("extremely") scale. As noted above, the average program satisfaction scale score was 5.63 (*SD* = 1.29), and the average program benefit scale score was 5.35 (*SD* = 1.12). The items comprising these scales all had seven-point response scales, on which "4" was neutral and "7" indicated strong enthusiasm. The average program satisfaction ($t(27) = 6.66$, $p < .001$) and benefit ($t(27) = 6.41$, $p < .001$) scores were both significantly higher than the neutral response in one-sample tests. They did not significantly differ by gender ($t(26) = .19$, $p = .85$ and $t(26) = .35$, $p = .73$, respectively) or whether one's partner also participated in the study ($t(26) = .00$, $p = 1.00$ and $t(26) = -1.34$, $p = .19$).

Discussion

In this study, an Internet-delivered version of PREP was pilot tested with a sample of older adults in a randomized, waitlist-controlled trial. Additionally, participants' pre-randomization data was used to examine associations between older adults' relationship dynamics and relationship satisfaction, stress, and health. Relationship satisfaction significantly correlated in the expected directions with all six relationship dynamics that were assessed, among the whole sample as well as each gender individually. This pattern of results is similar to prior findings with older adults (Acitelli & Antonucci, 1994; Bookwala & Jacobs, 2004; Henry et al., 2007; Walker & Luszcz, 2009) as well as younger couples (e.g., Markman, Rhoades, et al., 2010) that overall relationship satisfaction is associated with the quality of couple interactions. In conjunction with positive relational impacts from interventions for couples (including many older adults) in which one partner has a medical problem (Heinrichs et al., 2012; Sher et al., 2014), replication of the link between relationship satisfaction and relationship dynamics among older adults supports the suggestion that CRE may have value for this population (Lambert, 2009). Specifically, as for couples in general, older adults may be able to increase their relationship satisfaction by improving their interaction quality through CRE participation.

When controlling for shared variance among the relationship dynamics in this study, only positive bonding and communication skills remained significantly associated

with relationship satisfaction. That fun, friendship, and emotional closeness (i.e., positive bonding) would strongly relate to relationship satisfaction among older adults in particular appears consistent with Socioemotional Selectivity Theory (SST; Carstensen, 1992; 1995; Carstensen et al., 1999; 2003). SST asserts that older adults are more present-centered than younger adults, and prioritize emotionally meaningful experiences and spending time in close relationships rather than focusing on activities with future payoffs. In essence, the positive bonding scale measures the emotional meaningfulness of one's relationship with one's partner. Use of the communication strategies taught in PREP also had a significant unique association with relationship satisfaction. This finding suggests that communicating about issues respectfully, constructively, and in general as a team is a meaningful and distinct aspect of relationship satisfaction even in a stage of life in which individuals may tend to prioritize close emotional connections.

Dedication, partner support, negative communication, and forgiveness did not have significant unique associations with relationship satisfaction in the current study. While unexpected, possible explanations for this result can be identified with respect to each scale. The average dedication score was understandably high (6.50 out of 7, *SD* = .69) given that most of the sample was married and had been for an average of almost 35 years, but this limited variance might be expected to result in limited unique variability after controlling for related constructs with greater variance (i.e., other relationship dynamics). Items on the support scale largely appear to assess emotional intimacy, thus this scale may have been redundant when controlling for the larger positive bonding scale. Negative interaction patterns were on average reported to occur less frequently than "once in a while," and forgiveness items generally assessed how one responds to

one's partner following an emotionally hurtful interaction. These measures may essentially have assessed infrequent instances where communication skills and positive bonding were absent, and therefore had little unique association with relationship satisfaction beyond those two larger scales.

In terms of implications for CRE programming, the results concerning relationship satisfaction and relationship dynamics suggest that appropriate adaptations for older adults might include a primary focus on strategies for maintaining and enhancing positive connections (e.g., protecting fun from conflict, brainstorming), with a second area of emphasis being techniques for communicating safely and collaboratively when issues do arise (e.g., Speaker-Listener Technique, XYZ statements). Both topics are already among the areas typically addressed in CRE programs such as PREP (Markman, Stanley, & Blumberg, 2010). Notably, some older adult couples report 'spending too much time together' to be an aging-related challenge (Shiota & Levenson, 2007). As such, discussing ways in which planned time apart can support positive connections may be a useful addition when adapting CRE for older adults.

These results also suggest that strategies for maintaining commitment and managing negative interactions might be appropriate CRE content to de-emphasize in adaptations for older adults. This conclusion may reflect a sampling artifact, however; negative communication patterns have been associated with negative health outcomes in other older adult samples (Bookwala, 2005; Umberson et al., 2006), and couples in this study were married almost 35 years on average, thus selecting for high levels of commitment in the sample.

Relationship dynamics and stress

Financial stress significantly correlated in the expected directions with both communication scales and the positive bonding scale. The significance of these correlations varied among the single-gender subsamples, but correlation strength never significantly differed by gender. Correlations between financial stress and forgiveness, dedication, and support were unexpectedly non-significant. It should be noted that these three constructs generally assess internal dispositions towards one's partner or relationship, whereas the communication and positive bonding scales measure active, interactional processes. In terms of stress being associated with more frequent negative interactions at the apparent expense of skillful communication and positive connections, these results are consistent with contemporary theories about the role of external stressors in relationship functioning (Karney & Bradbury, 1995; Neff & Karney, 2007; 2009). They build on these theories by suggesting that contextual stress may have less impact on partners' internal dispositions towards their relationship and each other. The moment-to-moment nature of couple interactions may cause these dynamics to be more susceptible to stress-induced negative affect or arousal than global sentiments about one's partner and relationship. For example, preoccupation with the results of a pending medical test might be more likely to result in a 'snippy' remark than to increase one's desire for divorce. This result might stem from the generally low-stress, stable-relationship nature of the current sample; exploration of these dynamics in among more diverse older adults is warranted.

When controlling for shared variance between skillful communication, positive bonding, and negative communication, only negative communication remained

significantly associated with financial stress. This result is intriguing in light of the argument by some couple researchers that external stress may render couples unable to use the strategies taught in CRE. For example, Karney and Bradbury (2005, p. 174) state "… relationship skills training without also addressing the external forces that impede couples' ability to practice those skills may be akin to offering piano lessons to people with no access to a piano." Yet the results for financial stress suggest that external stress is primarily associated with more frequent negative interactions among older adults, and that impacts on positive relationship dynamics such as skillful communication are largely secondary or incidental. That is, skillful communication and positive connection might not occur in the same moments when stress-induced negative interactions are transpiring, but this indirect link between stress and positive processes is a different dynamic than external stress wholly preventing the use of positive interaction strategies. Indeed, rather than preventing the use of CRE techniques, stress may function to increase the potential benefits of using them.

Concerning CRE design for older adults, these results build on the relationship satisfaction findings by suggesting that techniques for disrupting negative communication patterns (such as PREP's Take-a-Break technique) may be particularly useful for older adult couples experiencing financial stress. For example, couples in which a partner's medical problem has resulted in unexpected or prolonged expenses might benefit from a module on how to discuss money safely, and how to get 'back on track' when discussions do escalate.

The aging-related stress scale and its social isolation subscale both significantly correlated in the expected directions with all six relationship dynamics. In fact, the

overall pattern of results was identical for these two stress indices. Correlations with forgiveness and partner support did not remain significant in the single-gender subsamples. Correlations with skillful communication were significant for men and not women, but the strength of these correlations did not significantly differ across gender. As with financial stress, these initial results were broadly consistent with current theories about the deleterious role of stress on couple relationships (Karney & Bradbury, 1995; Neff & Karney, 2007; 2009). However, both social isolation and overall aging-related stress remained significantly associated only with positive bonding (negatively) when controlling for the relationship dynamics' shared variance.

These two measures' identical pattern of associations with all six relationship dynamics raises the possibility that both may have functioned to assess an identical aspect of stress, particularly given that a different pattern of associations was found for a third measure of stress (i.e., financial stress). In that regard it is notable that the aging-related stress scale instructed participants to rate how much stress they had experienced (in the last year) due to each potential stressor, rather than simply whether or how often they had experienced each one. As such, both the overall scale and the social isolation subscale may have functioned to measure participants' tendency to experience stress, or stress sensitivity (Bale, 2006). This possibility may explain why these measures of stress had significant unique associations only with positive bonding. Greater sensitivity to stress may involve more frequent preoccupation with worry and rumination, including about one's relationship. Such processes might well interfere with feelings of emotional closeness to one's partner, as well as with opportunities for positive connection. Similarly, if someone returns from the grocery store upset because they were delayed due

to traffic, this affect could limit the extent to which this individual and his or her partner subsequently enjoy cooking the meal together.

In terms of adapting CRE for older adults, these results suggest the particular importance, for those with high levels of stress or high proneness to stress, of strategies for maintaining and enhancing positive connections. Incorporating some specific techniques may be appropriate and useful, such as protecting date night by scheduling worry time, staying present-centered in conversation via mindfulness, and knowing when and how to seek support from one's partner. Including thorough discussion of effective individual stress-management techniques may also be important and beneficial when working with (or in programs specifically for) highly stress-sensitive older adults.

While contextual stress interacts with dyadic behavior to predict relationship quality among younger adults (Ledermann et al., 2010; Rauer et al., 2008), interactions between stress and relationship dynamics were not significantly associated with overall relationship satisfaction in the current sample. Thus the hypothesis that contexts of higher stress would magnify connections between dyadic interactions and overall relationship satisfaction was not supported, but stress did not weaken such associations either. Given that CRE is designed to enhance relationship dynamics, these findings suggest that CRE may be equally impactful for both high- and low- stress older adult samples. Yet replicating these analyses in higher-stress older adult samples would provide a more robust (and comprehensive) understanding of CRE's prospective utility across risk or demographic vulnerability in older adults. Relatedly, when relationship satisfaction was simultaneously regressed on positive bonding, skillful communication, and the three stress indices, only associations for the relationship dynamics and the overall aging-

related stress scale remained significant. As the latter measure may function as an index of stress sensitivity given that it assesses levels of stress rather than frequency of stressors, this result suggests that stress itself may only have indirect impact (i.e., not above and beyond relationship dynamics and mental health) on relationship satisfaction among older adults. Therefore, older adults may be able to use skillful communication, positive bonding, and adaptive coping techniques (notably all of these are core CRE topics, particularly in CRE for higher risk populations) to buffer against contextual stress negatively impacting their relationship satisfaction via relationship dynamics and mental health. Replication of this analysis as well in an older adult sample with higher levels of stress is important to assess whether the finding generalizes among older adults.

Relationship dynamics and health

Physical health and relationship dynamics were not significantly correlated in the overall sample. Physical health did correlate with positive bonding for men but not women, yet the strength of these correlations did not significantly differ. This result was unexpected given that associations between older adults' health and couple-relationships have been well documented (Pienta et al., 2000; Walker & Luszcz, 2009), including some studies of links between health and couple interactions (Bookwala, 2005; Umberson et al., 2006). It may be that the sample's generally high socioeconomic status buffered against associations between relationship dynamics and health, specifically by protecting health to the extent that poorer relationship dynamics could not predict poorer health. Another possibility is that the strength of such associations simply did not tend to achieve significance in the current sample. Indeed, while in the total sample physical health correlated (non-significantly) in the expected direction with all relationship dynamics

except negative communication, the strongest correlation was with skillful communication, $r = .20$. This value represents an association of small-to-medium effect size and is very meaningful from a public health perspective (i.e., 4% of the variance in older adults' overall physical health can be explained by their use of skillful communication techniques). However, this sample of 93 older adults only provided power of .49 to detect significance for associations of that magnitude (according to the program G*Power; Faul, Erdfelder, Buchner, & Lang, 2009).

Mental health, on the other hand, correlated significantly and positively (as expected) with skillful communication, positive bonding, and forgiveness. These three correlations, as well as the one between mental health and dedication, were significant among male but not female participants. Moreover, the male coefficients for skillful communication and positive bonding were significantly greater than the female ones. These results are intriguing, as prior studies of the connections between relationship quality and mental health among older adults have not found gender differences (Whisman & Uebelacker, 2009; Whisman, Uebelacker, Tolejko, Chatav, & McKelvie, 2006). Research on connections between older adults' physical health and relationship functioning has tended to find either no gender differences (Bookwala, 2005; Lillard & Waite, 1995; Umberson et al., 2006), or stronger associations among women (see Kiecolt-Glaser & Newton, 2001). Thus replication of the current results is important to determine whether they may reflect cohort changes in the associations between relationship functioning and male mental health. It is also possible that these findings are a sampling artifact, as spiritual and mental health care providers were likely over-

represented in the current sample, and such individuals may be more willing than other older adults to acknowledge varying levels of mental health functioning.

When controlling for shared variance among relationship dynamics, only positive bonding remained significantly associated with mental health (among men). This result is similar to that for the aging-related stress scale in suggesting the added value, for older adults with mental health vulnerabilities, of positive partner connections as well as CRE strategies for nurturing these. It also suggests that this dynamic is either stronger for or specific to older adult men. Perhaps American culture is less accepting of men having close emotional relationships with friends and family than it is for women, resulting in the apparent particular importance of positive partner connections for male mental health (as seen here). As with relationship satisfaction, the association between mental health and positive bonding is notably consistent with Socioemotional Selectivity Theory (Carstensen, 1992; 1995; Carstensen et al., 1999; 2003), which predicts that older adults prioritize emotionally meaningful experiences and spending time with close others. As noted, positive bonding measures the intersection of these dynamics.

Sleep quality and physical health did not have significant associations with relationship dynamics. While such connections had been anticipated, it was not entirely surprising that they did not occur given the generally non-significant associations between physical health and relationship dynamics. Nonetheless, it is also quite possible that these two dimensions of health are simply not among the mechanisms by which overall health has been associated with relationship functioning in prior older adult samples.

Interestingly, alcohol use frequency was significantly correlated with positive bonding among the overall sample (and among women but not men, although the difference in the genders' coefficients was non-significant). While alcohol use had been expected to correspond to poorer relationship functioning, it was instead associated with higher levels of positive bonding. Since the positive bonding scale does incorporate shared fun, however, this result is not illogical. Furthermore, rather than suggesting that heavy levels of alcohol use predict high positive bonding, it merely suggests that moderate alcohol use is associated with greater positive bonding than no alcohol use: in this sample, the modal amount of alcohol use in the past month was none. The median alcohol use frequency was "a few times" in the past month. Only one participant (1.1%) reported having more than two drinks per day, and none reported having five or more drinks per day. It should also be noted that alcohol use (particularly at moderate levels) has been associated with health benefits among older adults (McDougall, Becker, Delville, Vaughan, & Acee, 2007; St. John, Snow, & Tyas, 2010), so the association between positive bonding and alcohol use may well be a connection between better relationship functioning and better health.

Feasibility study

Assignment to immediate intervention was associated with significantly higher skillful communication at the one-month follow-up assessment, controlling for baseline scores, than assignment to delayed intervention. In other words, older adult couples (represented by either one or both partners) given one month of access to an online version of PREP reported significantly greater growth in the use of communication skills taught in PREP than control group couples. This result can be seen as a successful

manipulation check, as it appears to demonstrate the basic feasibility of Internet-based CRE for providing older adults with actionable knowledge of tools for healthy couple-relationship interactions. As such, it relates to two nascent lines of CRE research which have important potential.

First, the intervention's short-term impact on the reported use of skillful communication replicates similar findings for prior Internet-based CRE programs (Duncan et al., 2009; Kalinka et al., 2012). It also replicates similar findings for the previous Internet-delivered adaptation of PREP (Loew et al., 2012), and for the computer-delivered PREP adaptation from which this study's intervention was derived (Braithwaite & Fincham, 2011). The result therefore builds on a literature which demonstrates benefits of computer-based CRE for a variety of couples, including college student couples (Braithwaite & Fincham, 2011), new and expectant parents (Kalinka et al., 2012), married community couples (Duncan et al., 2009), and foster and adoptive parents (Loew et al., 2012). Although some couples may prefer the face-to-face connection offered by traditional CRE workshop models, Internet-based CRE has advantages over traditional delivery methods in terms of affordability, privacy of participation, and flexibility in the timing and amount of access. It may also facilitate the learning and implementation of CRE strategies by way of environmental context-dependent memory effects (Smith & Vela, 2001). These advantages may be particularly relevant for older adults, by potentially mitigating age-associated difficulties with the learning (Petersen et al., 1992) or implementation (Touron, 2015) of new skills. Internet delivery has tremendous potential to expand general access to CRE given the high level of public interest in effective online couple-relationship resources (Georgia & Doss,

2013), and this intervention's apparent impact on skillful communication supports further research, development, and dissemination of online CRE.

This result also demonstrates the basic feasibility of CRE and PREP in particular for older adults as a specific population, insofar as represented by the current sample with its inherent limitations (discussed below). Interventions for couples in which one partner has a medical problem have shown positive relational impacts; these samples include large proportions of older adults (Heinrichs et al., 2012; Sher et al., 2014). However, CRE for the direct purpose of older adult relationship enhancement has not previously been studied, despite the range of aging-related challenges that many such couples will face (Henry et al., 2005; Lambert, 2009; Shiota & Levenson, 2007). While many older adults' relationships are long-term and stable, as was common in the current sample, older adult divorce rates (Brown & Lin, 2012) and the overall size of the older adult population (Administration on Aging, 2011) are both increasing. Furthermore, prior research has identified connections between relationship dynamics and health (Bookwala, 2005; Umberson et al., 2006), relationship dynamics and overall relationship quality (Acitelli & Antonucci, 1994; Bookwala & Jacobs, 2004; Henry et al., 2007; Walker & Luszcz, 2009), and relationship quality and health (Pienta et al., 2000) among older adults. Therefore the intervention's significant impact on reported skillful communication suggests that CRE has potential to benefit older adults' relationship satisfaction and health. These important possibilities merit further study with larger, longitudinal, and more diverse older adult samples.

The impact of intervention on skillful communication was fully moderated by gender; reported skillful communication significantly increased for female participants

assigned to the intervention, but did not significantly change among men assigned to intervention. CRE meta-analyses that have examined gender (Hawkins et al., 2008; Hawkins & Fellows, 2011) have not found it to moderate CRE's impacts, but engaging men in CRE is a known challenge (Markman & Rhoades, 2012) which seemed apparent in the current study, as men were significantly less likely than women to access the online program. That men were less likely to use the intervention seems likely to have contributed to the fact that assignment to intervention was not significantly impactful among men. It is also possible (but not apparent in program satisfaction data) that male participants generally did not understand the program's presentation of PREP communication tools, did not judge these techniques to be useful, or that male older adults require more time than female older adults to begin implementing new interaction techniques. Future research on older-adult CRE might test these possibilities, and use the study-design phase to explore options for promoting male participants' engagement with the intervention.

It is interesting that certain variables failed to moderate intervention impact. For example, prior exposure to CRE might have been expected to result in diminished intervention response (as individuals with such experience could already be aware of the strategies presented in the program). That prior CRE experience did not moderate intervention impact suggests that online delivery of CRE may add value compared to other delivery methods, perhaps by allowing program content to be accessed in the day-to-day context in which it might be utilized (i.e., at home), and by allowing it to be revisited as desired. The lack of moderation by prior CRE experience also supports the

value of 'booster' sessions to sustain individuals' use of CRE techniques (Markman & Rhoades, 2012).

Lack of partner participation in the study might also have been expected to yield diminished intervention impact, but did not. This result seemingly suggests that CRE for older adults may be similarly impactful whether provided to one or both partners in a couple, but it is possible that 'solo' participants in the current study shared intervention access with their partners despite being instructed to not do so. Indeed, eight intervention participants whose partners were not participating in the study completed the follow-up assessment; three of these individuals reported having viewed modules with their partner, and four of them reported discussing modules with their partner. Therefore further research is needed to explore the efficacy of Internet-based CRE for older adults when delivered to one versus both partners. Couple interventions delivered to one partner within a couple have been found to be impactful (Wadsworth et al., 2011), including the computer-delivered adaptation of PREP from which the current study's intervention was developed (Braithwaite & Fincham, 2007; 2009). Relatedly, time spent using the intervention did not significantly predict its impact, but the accuracy of this self-reported data is unknown. Moreover, a high amount of time spent using the intervention might indicate a high level of engagement with the material for some individuals, but among others it might reflect difficulty understanding or utilizing PREP strategies.

Lastly, financial stress and relationship distress might have been expected to moderate intervention impact, yet they did not. These results suggest that both external and intrinsic stress neither prevent nor facilitate the use of CRE techniques. Thus they support neither the argument that environmental stress precludes benefiting from CRE

(Karney & Bradbury, 2005), nor findings that risk factors and stress are associated with increased benefit from CRE (Allen et al., 2012; Halford et al., 2001; Petch et al., 2012; Stanley et al., 2014). It is important to note that any of these variables could significantly moderate intervention impact in a larger, longitudinal, or more diverse sample, and should be tested as moderators if such samples become available.

Intervention impacts on the secondary outcomes; relationship dynamics other than skillful communication, and physical and mental health, were all non-significant. Given the importance of gender in understanding the intervention's impact on skillful communication, gender was tested as a potential moderator of intervention impacts on the secondary outcome variables. These analyses also failed to reveal significant intervention impacts. This study's Internet-based adaptation of PREP may not have been beneficial to aspects of older adult relationships (and health) other than the use of communication strategies taught in the program. Yet the group coefficient for partner support was of similar magnitude to the group coefficient for reported skillful communication, and could have reached significance with a slightly smaller standard error (which it might have had if more participants had completed the follow-up assessment, or in a slightly larger overall sample). Group coefficients for almost all relationship dynamics and for physical health were in the expected direction, and CRE generally impacts communication skills more strongly than other outcomes (Hawkins et al., 2008; 2012). Even impacts that did not achieve significance in the small current sample could be meaningful from a public health perspective.

The limited time in which participants' use of PREP strategies could have impacted their more general or sentiment-driven indices of relationship functioning, such

as relationship satisfaction and dedication, is another important consideration. This dynamic is particularly relevant in the current sample, as implementing new interaction techniques may have required changing entrenched patterns within long-term marriages. Notably, the computer-based adaptation of PREP from which this study's intervention was derived has demonstrated positive impacts on a range of relationship and mental-health outcomes at longer-term follow-ups, albeit with younger samples (Braithwaite & Fincham, 2007; 2009; 2011; 2014). Significant short-term increases in relationship functioning from other recent adaptations of PREP have also been limited largely to skillful communication (Allen et al., 2011; Loew et al., 2012), but this pattern has not precluded important impacts on other relationship outcomes over time, even when short-term impacts dissipate (Stanley et al., 2014). In sum, further research with larger samples and longer-terms follows-up could build on these encouraging pilot findings by enabling stronger and more comprehensive tests for impacts of Internet-based CRE for older adults.

Participants randomized to immediate intervention reported relatively high satisfaction with and benefit from the program, although these ratings were slightly lower than those for the previous Internet-delivered adaptation of PREP, for foster and adoptive parent couples (Delaney, 2014; Loew et al., 2012). Unlike that adaptation, however, this feasibility study's intervention was not extensively (or at all) customized for the population to which it was delivered. Furthermore, prior CRE experience was normative in the current sample. As such, even moderate levels of satisfaction and benefit are encouraging endorsements of the experience and value of using this study's online version of PREP. More broadly, these results converge with other prior studies (Duncan

et al., 2009; Kalinka et al., 2012) that support the feasibility of self-directed, Internet-delivered CRE.

Limitations and future directions

Limited socio-economic generalizability is a significant limitation of the current study. Ethnic minority and economically vulnerable individuals were substantially under-represented in the current sample, which had a marked over-representation of persons with graduate-level education and previous CRE experience. Additionally, the Internet-based nature of this study means that its results cannot be generalized to the sizeable minority of older adults who do not use the Internet, a behavior which is itself strongly linked to socioeconomic factors such as income and education (Smith, 2014).

While it is possible that relationship dynamics are less associated with other aspects of functioning and are less responsive to CRE among more vulnerable older adults, it may instead be that such associations and intervention impacts would be larger. Demographic risk factors and external stressors could at times operate as shared challenges which magnify connections between relationship dynamics and broader measures of wellness. Relatedly, there may be more opportunity to enhance relationship functioning among couples whose relationships have been negatively impacted through the presence of risk factors and stressors. These possibilities have been suggested by several studies in which CRE's impact was favorably moderated by various risk factors (Allen et al., 2012; Halford et al., 2001; Petch et al., 2012; Stanley et al., 2014). In sum, whether and how the current findings generalize to more at-risk older adults is an empirical question, albeit one which will necessitate the use of different recruitment strategies than the ones utilized for this study.

Specifically, the low-risk homogeneity of the current sample is due in part to the small level of interest generated by most recruitment efforts. For example, even though recruitment materials emphasized that participation would be private and that improving relationship functioning might have health benefits, advertisements in large active-adult communities' newsletters typically yielded only one or two completed screens. That this study offered a smaller financial incentive than is usually provided in CRE outcome research may explain some of the unexpected recruitment difficulty. Not including a 'brick-and-mortar' retailer option for the incentive may have contributed as well – while most older adults use the Internet (Smith, 2014), relatively few may do so for the purpose of online shopping (Lian & Yen, 2014). Future research in this area might also facilitate recruitment by making efforts to address possible data security concerns in recruitment materials, and by enlisting the help of trusted care professionals (such as physicians and clergy members) who work with older adults.

The recruitment strategy that was relatively successful for this study was outreach to a large e-mail list of individuals with an expressed (by virtue of list membership) personal or professional interest in couple-relationship enhancement. Consequently nearly half of participants had a graduate-level education, and more than half had prior CRE experience. As such, they may have been more interested in and willing to utilize CRE techniques than typical CRE trial samples. On the other hand they may already (i.e., before receiving intervention) have been familiar with many of the strategies presented in PREP, thus providing for a relatively robust test of the intervention's ability to impact the use of communication skills and other relationship dynamics.

Despite the potential challenges of recruiting a diverse sample of older adults for this type of research, efforts to build on the results of this feasibility study are important given the previously-established links between relationship functioning and health among older adults (e.g., Bookwala, 2005; Umberson et al., 2006; Walker & Luszcz, 2009). A more diverse and larger sample would be necessary to examine potential demographic moderators such as ethnicity and marital status (e.g., married or cohabiting).

Another limitation to the current study that might be addressed in a subsequent trial is that funds were not available to adapt intervention content and appearance for the particular population to which it was presented. Tailoring CRE programs in this way has been recommended (Halford et al., 2003; Larson, 2004), and previous trials of PREP for specific populations have successfully used customized interventions (e.g., Allen et al., 2011; Loew et al., 2012). In addition to the programmatic adaptations suggested by this study's results (e.g., increased focus on strategies for maintaining positive connections), other customizations might include the exclusive use of pictures and videos featuring older adults, and example scenarios or added modules about aging-related challenges such as health problems and retirement. Such adaptations would, ideally, enhance participants' sense of connection with the program, and thereby their efforts to utilize program strategies as well.

The current findings are also limited in that they do not include long-term follow-up data. Short-term impacts on the use of program strategies such as skillful communication are important demonstrations of CRE feasibility and efficacy. At the same time, a longer-term follow-up assessment allows more time for program strategies to be utilized, and to impact broader constructs such as overall relationship satisfaction.

Allowing adequate time for CRE techniques to be employed may be a particularly relevant consideration with older adult couples, for whom adopting new interaction patterns may require altering longstanding methods of relating to one another.

A notably unfortunate limitation to this study is that the Aging-Related Stress scale may not have functioned the way it was intended to, as a broad measure of contextual stress. This possibility was suggested by the measure and its social isolation subscale having identical patterns of associations with all six relationship dynamics assessed in this study, in contrast to the different pattern of associations between relationship dynamics and a third measure of stress. While these results do not prove that the measure was flawed, examination of the scale reveals that it confounds stressors' presence and emotional impact. In hindsight, this measure simply should have instructed participants to rate how often they had experienced each stressor in the past year, rather than how much stress they had experienced due to each one. As is, the scale may function as a measure of stress sensitivity rather than contextual stress, and cannot justifiably be used to test hypotheses about the role of aging-related challenges in older adults' relationship functioning.

While intervention participants on average spent a seemingly acceptable amount of time using the program, particularly given that many of them had prior CRE experience, it is also true that a greater level of activity would have provided a stronger test of the intervention. Two procedural changes might have been useful in this regard. First, while reminder e-mails were sent two and three weeks into the one-month intervention phase, initiating weekly reminder e-mails one week into this phase might have served to increase the average amount of time participants spent using the

intervention. Doing so might also have increased the average length of time prior to the follow-up assessment in which participants were able to experience the effects of using program strategies. Secondly, conducting this study during spring or autumn might have limited the negative impacts of participant vacationing on program use – several participants identified vacations as a barrier to program access in open-ended feedback on the follow-up assessment, or in replies they sent to the reminder e-mails.

Relatedly, despite an equivalent number of men and women having consented to participate in the study, male participants were significantly less likely to access the online program. This difference was surprising given that Internet use is more prevalent for male than female older adults (Smith, 2014). However, men being less motivated to participate in CRE is a common challenge in this field (Markman & Rhoades, 2012), and online delivery did not resolve this issue, at least for older adult men. Future Internet-based CRE for older adults might seek to use early participant communications to emphasize that CRE focuses on providing useful tools, rather than dwelling on the past. It is also possible that the name of the program's website (lovetakeslearning.com) functioned as a deterrent to some male participants; specifically, a less emotion-focused web address might have been preferable.

Another limitation about participation pertains to the follow-up assessment, which participants randomized to immediate intervention were significantly less likely to complete (than participants assigned to delayed intervention). It would seem that obtaining access to the intervention may have functioned as an important incentive for the control group participants. Yet it may also be that immediate intervention participants who did not learn from the program were disinclined to complete the second assessment,

biasing the treatment-outcome analyses. A larger financial incentive for completing post-intervention assessments would likely improve response rates in future studies of CRE for older adults, particularly given that full-time employment was also negatively associated with follow-up completion in the current study.

A final limitation, while unfortunately common in CRE outcome studies, is that program usage was only assessed broadly, rather than at the level of whether or how much participants accessed each particular section. Having such data would enable important questions about the mechanisms of CRE's impacts (Rauer et al., 2014; Wadsworth & Markman, 2012) to be explored.

Conclusion

Despite the relatively homogeneous and low-risk nature of this feasibility study's sample, its results can contribute to empirical knowledge of relationship dynamics and relationship intervention for older adults. Consistent with Carstensen's prominent theory of lifespan motivation (Socioemotional Selectivity Theory; Carstensen, 1992; 1995; Carstensen et al., 1999; 2003), positive partner connections such as fun, friendship, and emotional closeness were more strongly associated with older adults' relationship satisfaction than were other relationship dynamics. However, use of the strategies for constructive and collaborative communication that are taught in PREP also accounted for unique variance in relationship satisfaction. Financial stress was uniquely associated only with more frequent negative communication, among various relationship dynamics, suggesting that at least for older adults, external stress facilitates negative interaction patterns more than it hinders positive ones. Unexpectedly overall mental health was associated with relationship dynamics (namely positive bonding) only among men,

suggesting an impactful connection between positive partner connections and older adult males' mental health. In addition to suggesting avenues for future research on older adult relationship dynamics, these results can inform programming decisions for relationship interventions targeting older adults.

Older adults randomly assigned to an Internet-based version of PREP generally reported being satisfied with and benefiting from the program, even though it had not been customized for older adults, and most of the sample had previously taken a CRE course. Couples assigned to the intervention reported greater average increase in the use of PREP communication skills after one month than couples assigned to wait-list control, although these gains were specific to female participants. Female participants were also significantly more likely to access the program. These results suggest that online CRE for older adults is feasible, although it should incorporate strategies for promoting male engagement. While assignment to intervention did not significantly impact secondary relationship and health outcomes, this pattern is not uncommon in short-term evaluations of CRE programs, particularly for smaller feasibility studies (e.g., Loew et al., 2012). Moreover, short-term impacts on skillful communication alone can be followed by broader long-term impacts (Stanley et al., 2014). The computer-based PREP adaptation from which the current study's intervention was developed has impacted a variety of relationship and mental health outcomes at longer-term follow-ups than the one used in this study (Braithwaite & Fincham, 2007; 2009; 2011; 2014), and a previous Internet-based CRE intervention has shown increasing impacts over time (Kalinka et al., 2012).

The small feasibility trial of Internet-based PREP in an older adult sample demonstrated limited but encouraging impact, thus supporting further research of this

nature using larger, longer-term, and more diverse samples of older couples. Internet delivery has several advantages over traditional methods for CRE dissemination (e.g., affordability, privacy, and flexibility in the timing, location, and amount of access), and these may be particularly helpful for reaching older adults. CRE for older adults has not previously been studied, but appears to be an important area for future research given the growing older adult population (Administration on Aging, 2011) and divorce rate (Brown & Lin, 2012), aging-related risks for relationship distress (Henry et al., 2005; Lambert, 2009; Shiota & Levenson, 2007), and relationship functioning's connections with older adult health (Pienta et al., 2000) and longevity (Lillard & Waite, 1995).

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