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Correspondence of Physical Activity and Fruit/Vegetable Consumption among Prostate Cancer Survivors and their Spouses

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Conflict of Interest and Adherence to Ethical Standards

Authors declare that they have no conflict of interest. All procedures, including the informed consent process, were conducted in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000.

Abstract

A healthy diet and physical activity are recommended for prostate cancer survivors. Interdependence theory suggests that the spousal relationship influences those health behaviors and the degree of correspondence may be an indicator of this influence. This study evaluated the correspondence between prostate cancer survivors and spouses regarding physical activity and fruit/vegetable consumption. Baseline data from an ongoing randomized control trial was utilized. Men who had been treated for prostate cancer within the past year and their partners ($N = 132$ couples) completed self-report measures of physical activity, fruit/vegetable consumption, relationship satisfaction, and support for partner's healthy diet and physical activity. Couples reported similar fruit/vegetable consumption and physical activity as indicated by high levels of correspondence. Greater fruit/vegetable correspondence was related to higher relationship satisfaction ($F = 4.14, p = .018$) and greater patient ($F = 13.29, p < .001$) and spouse-rated support ($F = 7.2, p < .001$). Greater physical activity correspondence was related to greater patient ($F = 3.57, p = .028$) and spouse-rated support ($F = 4.59, p = .031$). Prostate cancer survivors and spouses may influence each other's diet and exercise behaviors. Couple-based interventions may promote healthy behaviors among this population.

Keywords

Prostate Cancer; Couples; Exercise; Nutrition

Introduction

Prostate cancer is the most common cancer in the United States, excluding skin cancers (American Cancer Society [ACS], 2014). Improvements in screening and treatment have led to early detection and positive treatment outcomes. The estimated five-year survival rate in the US is approximately 99% (National Cancer Institute [NCI], 2009). Since the population of prostate cancer survivors is large and growing, optimal health and quality of life among prostate cancer survivors is an important public health goal.

Key components of health among prostate cancer survivors are physical activity and diet (Doyle et al., 2006; Keogh & MacLeod, 2012). There are recommended guidelines for both physical activity and diet which may promote health among prostate cancer survivors. In terms of physical activity, recommendations for the general adult population are to engage in at least 150 minutes of moderate or 75 minutes of vigorous activity per week (Haskell et al., 2007; Schmitz et al., 2010). Among prostate cancer survivors, there is evidence that adherence to these physical activity guidelines is correlated with beneficial health effects, such as better health-related quality of life (Blanchard, Courneya, & Stein, 2008; Blanchard et al., 2004) and less incontinence after radical prostatectomy (Mina et al., 2014). Despite the health benefits, only 30% (Bellizzi et al., 2005) to 43% (Blanchard et al., 2008) of prostate cancer survivors meet the recommended physical activity guidelines. In terms of a healthy diet, the dietary guideline for the general adult population is to consume at least five servings of fruits and vegetables per day (Center for Nutrition Policy and Promotion, 2005). Prostate cancer survivors who adhere to the recommended five servings have better health-related quality of life (Blanchard et al., 2008) and physical functioning (Demark-Wahnefried

et al., 2004). Adherence to dietary guidelines is also relatively low, with estimates suggesting that between 16% (Blanchard et al., 2008) and 35% (Demark-Wahnefried et al., 2000) of prostate cancer survivors consume the recommended five servings of fruits and vegetables each day. While there have been studies examining prostate cancer survivors' adherence to these guidelines, little is known about the health behaviors of their spouses and whether the health behaviors of survivors and spouses are related.

There are many factors that may influence cancer survivors' adherence to recommended physical activity and dietary guidelines, including a physician recommendation (Satia, Walsh, & Pruthi, 2009), higher levels of self-efficacy (Pinto, Rabin, & Dunsiger, 2009), and higher levels of behavioral control (Courney et al., 2002). One little-studied but important factor is the influence of one's spouse. Relationship theories, such as the Interdependence theory (Lewis et al., 2006) provide a framework for understanding how partners may influence each other's health behaviors. Interdependence theory suggests that in dyads one person's behavior is not free from the influence of the partner's behavior (Lewis, DeVellis, & Sleath, 2002). The influence of one's partner on one's own behavior is referred to as partner effects (Lewis et al., 2006) which can be health-compromising or health-enhancing (Lewis et al., 2002). Health-enhancing influence is more likely when the behavior change is viewed as meaningful and beneficial for the relationship (Lewis et al., 2006). The theory refers to this process as transformation of motivation, which occurs when couples interpret a health behavior as beneficial or meaningful for the relationship and one's partner (e.g., adopting a relationship perspective), leading to changes in behavior which are health-enhancing (Lewis et al., 2006).

An indicator of partner influence and a key construct in Interdependence theory is the degree of correspondence between couples' behaviors (Lewis et al., 2002; Lewis et al., 2006). Correspondence is measured as the degree of agreement between partners' health behaviors, and it is valuable because the degree of correspondence can facilitate the couple's focus on values, motivations and barriers related to health behavior change (Lewis et al., 2002). High correspondence occurs when partners are cooperative and in agreement that they should address a desired behavior. Low correspondence, or discordance, occurs when partners are in conflict about whether to engage in a health behavior (Lewis et al., 2002.) Research has indicated a high degree of agreement in the general population between partners' health behaviors, including levels of physical activity, diet, alcohol consumption, and smoking (Meyler, Stimpson, & Peek, 2007; Stimpson et al., 2006; Wilson, 2002). There is also evidence that couples tend to correspond with regard to health care practices such as skin cancer screening (Heckman et al., 2013). Furthermore, longitudinal data suggests that when one partner improves his or her health behaviors, the other partner is also likely to do so (Falba & Sindelar, 2008).

The time period following the diagnosis of cancer may be a period when partners' influence on one another's health behavior becomes stronger. Thus, higher levels of correspondence between partners' health behaviors would be expected. According to Interdependence theory (Lewis et al., 2006), couples facing a health threat may respond with communal coping efforts. Communal coping refers to couples developing a joint view of a health threat and a shared plan to manage the threat (Lewis et al., 2002; Lyons et al., 1998). The time following

a cancer diagnosis is often referred to as a ‘teachable moment’, when both survivors and members of their families are motivated to make health behavior changes (McBride et al., 2000; Schnoll et al., 2013). The idea that a health threat prompts health-enhancing behaviors is supported by research indicating that greater cancer-related distress is associated with positive health behavior changes among cancer survivors, including diet, exercise, and smoking (Mullens et al., 2004; Parker & Gaffey, 2007). Greater correspondence during this time period may assist couples in focusing on motivation and making decisions about health behaviors (Lewis et al., 2002).

Little is known about the degree of correspondence in diet and physical activity practices of prostate cancer survivors and their spouses and the influence of relationship-level (e.g., marital quality) and individual-level (e.g., cancer distress) factors upon couples’ correspondence. The present study addressed these gaps in the research literature by examining physical activity and fruit/vegetable consumption among prostate cancer survivors and their spouses. The study had two specific aims. The first study aim was to explore the degree of correspondence among prostate cancer survivors and spouses with regard to their physical activity and fruit and vegetable consumption. Couples’ correspondence was placed into three categories. First, couples were considered positively concordant, meaning both partners met required physical activity (or fruit and vegetable consumption) guidelines. Second, couples were considered negatively concordant, meaning neither partner met required physical activity (or fruit and vegetable consumption) guidelines. Third, couples were considered discordant, which was defined as one partner met required guidelines for each health behavior and one partner did not. We calculated the proportion of couples that were positively concordant, negatively concordant, and discordant for both physical activity and fruit and vegetable consumption guidelines. Based on prior research and Interdependence theory, we hypothesized that most couples would have high levels of either positive or negative concordance for fruit and vegetable consumption and physical activity. The second study aim was to examine relationship-level and individual-level factors associated with couple correspondence. In terms of relationship factors, according to Interdependence theory, positive support within the relationship for health behavior change is necessary for change to occur (Lewis et al., 2006). Partners in higher quality relationships are more likely to accept one another’s input and influence, and thereby make behavior changes (Lewis et al., 2002). Indeed, better relationship quality has been linked to better health practices (Wickrama et al., 1997). Therefore, we hypothesized greater relationship satisfaction and more support for one’s partner’s healthy diet and engaging in regular physical activity would be associated with positive couple concordance. In terms of individual-level factors, some studies suggest that higher levels of cancer-related distress predict positive health behavior changes among cancer survivors (Park & Gaffey, 2007). Therefore, we hypothesized that survivor or spouse cancer-related distress would serve as a motivator for healthy behaviors among couples and would therefore be associated with positive couple concordance. Other individual-level factors evaluated as possible correlates of couple correspondence included demographic (e.g., age, number of years in the relationship) and medical variables (e.g., disease stage).

Method

Participants and Procedures

The study utilized baseline data from a multi-site, ongoing randomized clinical trial (RCT) examining couple-focused interventions for men diagnosed with prostate cancer and their spouses (second author, unpublished data). Participants were 132 couples in which one partner had been diagnosed with localized prostate cancer and treated within twelve months of recruitment to the study. For clarity, we use the term ‘spouse’ to denote the survivors’ partner, even though there are some partners in the study who were not married to the survivor. Eligibility criteria for the RCT were 1) survivor had a primary diagnosis of localized prostate cancer, 2) survivor had surgery and/or radiation treatment for localized prostate cancer within the last twelve months, 3) couples were married or cohabitating for one year, 4) both partners were ≥ 18 years, 5) survivor or spouse indicated elevated levels of cancer -specific distress, defined as a score of >15 for survivors or > 16 for spouses on the Impact of Events Scales (IES; Horowitz, Wilner, & Alvarez, 1979), at the time of recruitment (due to eligibility for RCT), 6) neither partner had significant hearing impairment which would have precluded intervention participation, 7) lived within one hour commuting distance from the center, and 8) both partners completed informed consent.

Prostate cancer survivors were identified at four comprehensive cancer centers in the Northeastern United States. Research assistants at each site approached eligible couples about participation in the larger study either in person during an outpatient visit or by telephone. The survivor and spouse were given an informed consent form approved by the Institutional Review Board (IRB) at each site and a baseline survey with a stamped return envelope to complete the forms and return by mail. Couples were paid \$50 for completing the baseline survey. IRB approval was obtained prior to the study. The research was conducted in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000.

Of the 688 eligible couples approached for the RCT, 132 (19%) signed consent forms and completed baseline surveys. The most common reasons provided for refusing participation in the RCT were ‘not needing help’ or ‘not perceiving any benefit to participating’ (16%), ‘being too busy’ (14%), and ‘no interest’ (12%). The participation rate is comparable to reported rates for other couples-based intervention studies with cancer patients (Manne et al., 2014). Comparisons between survivor participants and refusers were made with regard to available data (age, race, disease stage, and time since diagnosis). Participants were diagnosed with significantly higher cancer stage compared to refusers [$t(222) = -3.42, p = .001$].

Measures

Demographic and Medical Information—The baseline survey collected data on survivor and spouse age, race, education, income, marital status, occupational status (working vs. not working) and length of relationship. Data on disease stage, treatment (e.g., radical prostatectomy, radiation), time from diagnosis, and Gleason score was obtained

through medical chart review. The Gleason score is a system of grading prostate cancer. Scores range from 2-10 and indicate the likelihood that a tumor will spread. A higher score indicates that cancer tissue is more abnormal and likely to spread (National Cancer Institute [NCI], 2015).

Physical Activity—The Godin Leisure Time Exercise Questionnaire (GLTEQ; Godin & Shephard, 1985) was utilized to assess physical activity. The GLTEQ contains three questions about the average weekly duration of engagement in strenuous/vigorous, moderate, and mild physical activity over the past month. Reliability and validity of the measure has been strong (Jacobs, Ainsworth, Hartman, & Leon, 1993). For the purposes of the present study, the average weekly physical activity was computed into a dichotomous variable (yes/no) indicating whether the individual met recommended weekly physical activity guidelines (i.e., 150 minutes of moderate or 75 minutes of vigorous or a combination of vigorous/moderate per week). This calculation method has been utilized in prior work with prostate cancer patients (Mina et al., 2014).

Fruit and Vegetable Consumption—An eight item self-report assessment of intake of fruits and vegetables in the past week was utilized to assess consumption (Boger et al., 2004). Fruit and Vegetable Consumption was calculated in servings per day by multiplying consumption frequency by portion size. Prior research suggests that test-retest reliability as measured by reproducibility of reports over a one year period of time are high (.80 and .79, respectively). In terms of validity, the correlations between self-reported fruit and vegetable consumption and plasma carotenoids and vitamin C at baseline were .39, and .37 for fruits and .28 and .30 for vegetables, which is a reasonable figure (Bogers et al., 2004). For the purposes of the present study, the daily fruit/vegetable consumption was computed into a dichotomous variable (yes/no) indicating whether the individual met recommended weekly guidelines (i.e., consumed ≥ 5 servings).

Relationship Satisfaction—The Dyadic Adjustment Scale (DAS; Spanier & Filsinger, 1983) was utilized to assess relationship satisfaction. The scale consists of 32 items. Higher scores indicate higher levels of satisfaction. Sample items include “In general, how often do you think that things between your partner are going well?” and “Do you and your mate engage in outside interests together?” The scale has been widely used and has shown strong psychometric properties in prior use with couples coping with cancer (Manne et al., 2006). Internal consistency in the present study was excellent for patients ($\alpha = .94$) and spouses ($\alpha = .94$).

Partner Support for Physical Activity and Fruit and Vegetable consumption—A 5-item measure adapted from Butterfield and Lewis (2002) was utilized to assess the level of partner support for engagement in regular physical activity and consuming more fruits and vegetables. Items assess the degree of support for partner’s healthy diet and physical activity, the importance of partner’s healthy diet and physical activity, frequency of discussions as a couple about a healthy diet and physical activity, the degree of support provided to one another during the discussion(s), and perception of the quality of the discussion(s). Sample items include “To what degree do you support your partner in having

a healthy diet and being physically active?” and “If you talked at all about having a healthy diet and engaging in physical activity with your partner, how supportive were you to one another?” Responses were made on a Likert-type scale and total scores range from 4-20 with higher scores indicating greater supportiveness. Internal consistency for the present study was acceptable for survivors ($\alpha = .73$) and spouses ($\alpha = .79$).

Cancer-Related Distress—The Impact of Events Scale (IES; Horwitz, Wilner, & Alvarez, 1979) assessed psychological distress related to the prostate cancer. The IES is a 22-item self-report measure focusing on intrusive thoughts, avoidance behaviors, and hyperarousal symptoms associated with a stressor, in this case prostate cancer. Sample items include, “I thought about it when I didn’t mean to” and “I tried to remove it from my memory.” Participants rated how true each statement was for them during the past week using a 6-point Likert scales (0 = *Not at all*; 5 = *Often*). Scores range from 0 to 110. The measure was completed at the time of the baseline survey. The scale has been widely used as a measure of cancer distress (Baider et al., 2003). Internal consistency for the present study was acceptable for survivors ($\alpha = .92$) and spouses ($\alpha = .94$).

Analysis Plan

To address the first aim, we utilized dichotomous variables indicating whether each partner met recommended guidelines for fruit/vegetable consumption and physical activity. As previously described, couples were labeled as positively concordant, negatively concordant, or discordant. There were nine couples in which one partner did not have complete data for the fruit/vegetable measure and seven couples in which one partner did not have complete data for the physical activity measure. Correspondence was only computed for couples with complete data for fruit/vegetable guidelines ($n = 123$) and physical activity guidelines ($n = 125$). The overall proportion of correspondence was calculated and Cohen’s Kappa was utilized to determine whether the level of similarity was larger than what would be expected to occur by chance. To address the second aim, chi-square analyses were conducted to examine differences in concordance patterns for both fruit/vegetable guidelines and physical activity guidelines as a function of possible covariates, which included survivor race, couples’ employment status (both working, one partner working, or neither partner working), and type of treatment (surgery vs radiation). Analysis of variance (ANOVA) analyses were conducted to examine mean differences between the three groups (i.e., positively concordant, negatively concordant, discordant) on demographic (survivor age, survivor education, spouse age, spouse education, household income, length of relationship), medical (stage of cancer, time from diagnosis, Gleason score), and relationship (survivor relationship satisfaction, spouse relationship satisfaction, survivor-rated support for spouse’s engagement in healthy diet and regular physical activity, spouse-rated support for patient’s engagement in healthy diet and physical activity) factors, as well as level of cancer-related distress.

Results

Participant Characteristics

The sample consisted of 132 couples. The mean age was 61 years for survivors and 57 years for spouses. The majority of survivors was White (78%) and had completed college or graduate school (68%). The majority of spouses was White (76%) and had completed at least some college education (61%). Most couples were married (96%). In approximately half of the couples, both partners were working part or full time (54%). There were two same-sex couples in the sample. The mean length of the couples' relationship was 27 years. The average time since the prostate cancer diagnosis was 10 months (Range = 2-26 months). The complete characteristics of the sample are presented in Table 1.

In total, 68% ($n = 174/255$) of the entire sample met fruit/vegetable guidelines and 56% ($n = 143/256$) met physical activity guidelines. Among survivors, 72% ($n = 92/127$) met the fruit/vegetable guidelines and 60% ($n = 78/129$) met physical activity guidelines. Among spouses, 64% ($n = 82/128$) met the fruit/vegetable guidelines and 51% ($n = 65/127$) met physical activity guidelines. Logistic regressions were utilized to examine individual-level and relationship-level factors associated with whether a survivor or spouse met fruit/vegetable or physical activity guidelines. Among survivors, meeting fruit/vegetables guidelines was associated with Caucasian race [Wald $\chi^2(1) = 6.72$, $p = .01$, odds ratio = 10.57, 95% CI 1.78-62.83] and greater spouse-reported partner support [Wald $\chi^2(1) = 5.59$, $p = .018$, odds ratio = .59, 95% CI 0.38-0.91]. Meeting physical activity guidelines was associated with greater time from diagnosis [Wald $\chi^2(1) = 4.41$, $p = .036$, odds ratio = 1.19, 95% CI 1.01-1.41], greater survivor-reported partner support [Wald $\chi^2(1) = 5.02$, $p = .025$, odds ratio = 1.47, 95% CI 1.05-2.07], and greater spouse-reported partner support [Wald $\chi^2(1) = 4.24$, $p = .04$, odds ratio = 1.38 95% CI 1.02-1.86]. Among spouses, meeting fruit/vegetable guidelines for spouses was not associated with any individual-level or relationship-level factors, but meeting physical activity guidelines was associated with greater survivor-reported cancer distress [Wald $\chi^2(1) = 7.71$, $p = .005$, odds ratio = 1.05, 95% CI 1.02-1.09]. Descriptive analyses of survivors, spouses, and total sample in terms of physical activity and fruit and vegetable guidelines are presented in Table 2.

Couple Correspondence with regard to Fruit/Vegetable Consumption and Physical Activity

Approximately 50% of couples ($n = 62$) were positively concordant for fruit/vegetable consumption, 12.2% ($n = 15$) were negatively concordant, and 37.4% ($n = 46$) were discordant. There were 28 couples where the survivor met the guidelines but the spouse did not, and 18 couples where the spouse met the guidelines but the survivor did not. The overall rate of couple concordance for meeting fruit/vegetable guidelines was 62.6%. Cohen's Kappa was $\kappa = 0.131$, $t = 1.48$, $p = .139$, indicating that this level of similarity was not significantly larger than would have been expected to occur by chance and that couples were not statistically more likely to be concordant with regard to fruit/vegetable guidelines. Correlational analyses revealed that couples' scores on the total fruit/vegetable measure were positively correlated ($r = .42$, $p < .001$).

In terms of physical activity guidelines, 36% of couples ($n=45$) were positively concordant, 24% ($n=30$) were negatively concordant and 40% ($n=50$) were discordant. There were 30 couples in which the survivor met guidelines but the spouse did not, and 20 couples in which the spouse met the guidelines but the survivor did not. The overall rate of concordance for meeting physical activity guidelines was 60%. Cohen's Kappa $\kappa = 0.194$, $t = 2.19$, $p = .028$, indicating that this level of similarity was somewhat larger than would have been expected to occur by chance and that couples were statistically more likely to be concordant with regard to physical activity guidelines. Correlational analyses revealed that couples' scores on the total physical activity measure were positively correlated ($r = .25$, $p = .005$).

Demographic, Medical, and Relationship Variables Associated with Correspondence

The demographic correlates of couple correspondence are presented in Table 3.

Concordance status for meeting fruit/vegetable guidelines was associated with survivor age [$F(1,19) = 7.00$, $p = .001$] and length of relationship [$F(2,19) = 4.72$, $p = .011$]. Follow-up tests using a Fisher's LSD post-hoc means test showed that patients were significantly older among positively concordant couples compared to negatively concordant couples ($p = .003$) and discordant couples ($p = .035$). Negatively concordant couples reported a significantly shorter relationship length compared to positively concordant couples ($p = .021$) and discordant couples ($p = .003$). Survivor education was the only demographic factor that showed a statistically significant association with concordance in meeting physical activity guidelines [$F(1,21) = 4.63$, $p = .011$]. Survivor education level was significantly lower among negatively compared to positively concordant couples ($p = .025$) and discordant couples ($p = .016$).

The medical correlates of couple correspondence are presented in Table 4. The only statistically significant effect that emerged was disease stage on concordance for fruit/vegetable guidelines [$F(1,20) = 3.96$, $p = .022$]. Fisher's post-hoc test indicated that disease stage was higher for positively concordant couples compared to negatively concordant couples ($p = .006$) and discordant couples ($p = .018$). There were no medical factors significantly associated with correspondence for physical activity guidelines.

The association between relationship factors and couple correspondence are presented in Table 5. For fruit/vegetable guidelines, significant effects emerged for patient relationship satisfaction [$F(2,119) = 4.14$, $p = .018$], survivor-reported partner support [$F(2,120) = 13.54$, $p < .001$] and spouse-rated partner support [$F(2,119) = 7.37$, $p = .001$]. Survivor relationship satisfaction was significantly lower among discordant couples compared to positively concordant couples ($p = .006$), but not negatively concordant couples ($p = .592$). Survivor-reported partner support was significantly higher among positively concordant couples compared to negatively concordant couples ($p < .001$) and discordant couples ($p < .001$). Spouse-reported support was significantly higher among positively concordant couples compared to discordant couples ($p < .001$). For physical activity guidelines, correspondence was significantly associated with survivor-reported partner support [$F(2,122) = 3.7$, $p = .028$] and spouse-reported support [$F(2,121) = 4.46$, $p = .013$]. Survivor-reported support was significantly higher among positively concordant couples compared to negatively concordant ($p = .008$) couples. Spouse-reported partner support was significantly higher

among positively concordant couples compared to negatively concordant couples ($p = .018$) and discordant couples ($p = .008$).

Survivor cancer-related distress was not significantly associated with concordance status for fruit/vegetable guidelines [$F(119) = 2.46, p = .09$] or physical activity guidelines [$F(120) = 1.45, p = .238$]. Similarly, spouse cancer-related distress was not significantly associated with concordance status for fruit/vegetable guidelines [$F(111) = 1.19, p = .308$] or physical activity guidelines [$F(112) = 0.95, p = .39$].

Discussion

A healthy diet and regular physical activity are important for maintaining or improving the health of prostate cancer survivors and their spouses. One method of facilitating the adoption of a healthy diet and regular physical activity may be to harness the positive influence of the marital relationship. In this study, we examined the degree of correspondence between prostate cancer survivors and their spouses in terms of adherence to recommended fruit/vegetable guidelines and physical activity guidelines. We also examined relationship-level (e.g., satisfaction, support) and individual-level (e.g., age, income, cancer stage) factors that might influence couple correspondence.

Overall, the levels of couple correspondence were high for meeting physical activity guidelines and fruit and vegetable consumption guidelines. However, only the rates for physical activity guidelines met statistical significance. For physical activity, the level of similarity was higher than what would have been expected by chance and indicated that couples are more likely to be similar in terms of physical activity guidelines. The majority of couples (60%) were concordant in terms of physical activity guidelines. These findings suggest that when one partner either meets or does not meet the recommended amount of weekly physical activity, the other partner is likely to follow the same pattern. In terms of the fruit/vegetable guidelines, there was a similarly high level of correspondence (62.6%). However, this correspondence level did not reach statistical significance. The lack of significance may be due to the small number of couples that were negatively concordant in this sample ($n = 15$). Overall, our findings are consistent with prior studies illustrating high levels of correspondence among healthy couples for physical activity (Macken, Yates, & Blancher, 2000) and diet (Wenzel et al., 2007) and studies among healthy couples for the adoption of unhealthy behaviors such as smoking (Falba & Sindelar, 2008; Stimpson et al., 2006). Although it is possible that correspondence is an indicator of assortative mating (Macken et al., 2000), the similarity between couples' fruit and vegetable consumption and physical activity suggest possible joint effects and offers preliminary support for the application of Interdependence theory to couples coping with prostate cancer.

In order to further understand relationship influences, we examined relationship-level factors, including quality and support for the other partner's diet and exercise practices. Relationship satisfaction and partner support for healthy diet and exercise emerged as relationship-level factors associated with concordance. Transformation of motivation, which occurs when couples view a health behavior as beneficial for the relationship (Lewis et al., 2006) may be used to understand the findings. Couples who report greater relationship

satisfaction and support for the other partner's health behaviors may be more likely to experience transformation of motivation and facilitate the adoption of positive health behaviors within the couple (Lewis et al., 2006). We did not measure transformation of motivation, which is typically assessed as the development of a "relationship perspective." This construct has been measured in other studies (e.g., "if my partner engages in better health habits this would benefit our relationship") and found to be a predictor of the level of discussion between couples about health behavior changes such as colorectal cancer screening (Manne et al., 2012). Survivors who were less satisfied in their relationship were more likely to be discordant in terms of meeting fruit and vegetable guidelines. It is possible that less satisfied couples were more likely to eat meals and/or shop separately and thus not have a "shared environment" for diet, which may contribute to differences. Less satisfied couples may also be less likely to encourage each other to consume fruits and vegetables or to accept influence from one another when suggestions are offered. There is evidence that relationship quality plays a role in whether the relationship is linked with better health outcomes (Kiecolt-Glaser & Newton, 2001). In our sample, relationship satisfaction was positively correlated with partner support for healthy diet and exercise, suggesting that the two constructs were related.

Each person's support for the other partner's healthy diet and physical activity was related to positive concordance among couples for both fruit and vegetable and physical activity guidelines. Survivors and spouses who rated higher levels of support within the relationship for a healthy diet and physical activity were more likely to meet guidelines for fruit and vegetable intake and physical activity as a couple. This finding is also consistent with Interdependence theory and the broader literature on the role of social support in diet and physical activity (Park & Gaffey, 2007; Pinto et al., 2008; Reardon & Aydin, 1993). The level of support for health behaviors and the degree to which couples discuss certain health behaviors in a supportive manner with one another plays a role in whether a couple engages in health behaviors together.

In terms of individual-level factors, our findings were mixed. Contrary to our hypothesis, cancer-related distress was not associated with couples' concordance. Although there is some evidence that cancer-related distress is related to adaptive health behaviors (Harper et al., 2007; Park & Gaffey, 2007), the findings are not consistent. One study suggested that cancer-distress was associated with higher intentions to make healthy behavior changes (e.g., healthy diet, weight loss, increased exercise), but not engaging in those health behaviors (Mullens et al., 2004). Another study found that cancer-related distress was associated with lower increases in physical activity (Reardon & Aydin, 1993). Further research is needed to determine the role of cancer-related distress in couples' health behaviors, particularly in non-distressed samples. Couples in a relationship of shorter duration were more likely to be negatively concordant for fruit and vegetable guidelines and older patients were more likely to be positively concordant. It is possible that the tendency to view health behaviors as meaningful to the relationship develops over time. Couples who are older and have been in a relationship for longer periods of time may be more likely to view positive health behaviors, such as fruit and vegetable consumption, as important to the relationship and adopt these positive behaviors. Additionally, older couples may be more likely to be retired or not working, allowing the opportunity to shop and eat more meals

together. However, couples' work status was not related to concordance status suggesting that employment status does not explain this finding. Among survivors that reported lower education, the couple was more likely to have neither partner meeting physical activity guidelines. Prior research has linked physical activity with education (Hong et al., 2007). Finally, survivors diagnosed with higher stage disease were more likely to be in relationships where both patient and partner met fruit and vegetable consumption guidelines. There is evidence that higher tumor stage is associated with greater improvement in health behaviors, such as diet and exercise, among cancer patients (Maunsell et al., 2002; Patterson et al., 2003). Both survivors and their partners may be more concerned about recurrence with a higher staged diagnosis and adopt a healthier lifestyle as a result.

Overall, couples reported higher adherence to fruit and vegetable guidelines (68%) compared to rates reported for American adults, which suggest that only between 27-33% of adults consume the recommended fruits and vegetables (Center for Disease Control and Prevention [CDC], 2009) and prior studies of prostate cancer survivors that found that 16-35% met guidelines (Blanchard et al., 2008; Demark-Wahnefried et al., 2000). The percentage of couples meeting physical activity guidelines (56%) was slightly higher than rates reported for American adults (48%) (CDC, 2014) and prior studies with prostate cancer survivors that found that 30-43% met physical activity guidelines (Bellizzi et al., 2005; Blanchard et al., 2008). It is possible that higher rates compared to the general public reflect the tendency for this population to want to make healthy changes following the prostate cancer diagnosis (Keogh et al., 2013). Additionally, our findings indicated that higher disease stage was associated with positive concordance for fruit and vegetable guidelines. Since participants in our study were more likely to be diagnosed at a higher stage, it is possible that this influenced adherence rates. The sample also consisted of individuals with higher levels of education and incomes. It is possible that these factors and the older age in the sample influenced the overall level of fruit and vegetable consumption and physical activity. Another possibility is that couples have overestimated their diet and exercise practices.

There are a number of limitations of the present study. First, either survivor, spouse, or both, had elevated levels of cancer-specific distress at the time of recruitment, because the couple-based intervention trial these data were taken from targeted couples in which one or both partners were distressed. Neither survivor nor spouse cancer-specific distress was associated with concordance status. Nevertheless, we do not know whether the findings would generalize to a sample of non-distressed couples. Second, the participation rate was relatively low (19%). This participation rate is comparable to prior couples-based intervention studies (Manne et al., 2014). However, there are factors that may differentiate couples who chose to participate from those that did not, which may limit the generalizability of the findings. We were able to evaluate some variables that might predict acceptance into our trial, and found that participants were diagnosed with significantly higher cancer stage compared to refusers. Thus, our sample may have been comprised of a greater proportion of more "ill" patients. When couples were approached to participate in the larger study, they were told that participation possibly included two different types of couples-based interventions, one focused on health. Therefore, other sources of study bias such as marital quality, fruit and vegetable consumption, and physical activity may exist but

were not assessed among study refusers. Third, our measure of diet was fruit and vegetable consumption, which is only one aspect of diet. Future studies may consider additional dietary behaviors such as caloric intake, meat intake, and vitamin levels. Fourth, fruit and vegetable consumption and physical activity were measured via self-report; however, the measures possess good psychometric properties. Future studies may consider additional measures. Fifth, the sample was mostly Caucasian, college-educated, and reported a relatively high income. Therefore, the findings may not generalize to a more diverse sample. Sixth, the study was cross-sectional and we did not assess pre-existing levels of physical activity and fruit and vegetable consumption. Therefore, we cannot determine when the levels of correspondence were established. Finally, there are other factors that were not assessed in the current study which may impact couple correspondence for fruit and vegetable consumption and/or physical activity. For example, couples who both obtain a physician recommendation (Satia et al., 2009), both report higher levels of exercise or dietary self-efficacy (Pinto et al., 2009), and/or both have a relationship perspective on health behaviors (Manne et al., 2012) may be more likely to be positively concordant.

Despite these limitations, our findings suggest that the majority of couples coping with prostate cancer are similar in their dietary and physical activity practices. Higher relationship quality and relationship support for these practices are associated with the degree to which couples adopt similar positive dietary and physical activity practices. Because couples that reported more frequent discussions and a greater degree of support for the other partner's healthy diet and exercise tended to meet recommended guidelines, one way to promote diet and exercise behaviors among couples coping with prostate cancer may be to use a couple-based intervention that focuses on open discussion and facilitating support for these behaviors. Relationship influence is more likely to be health-enhancing when there is trust, respect, open communication, and shared decision-making (Lewis et al., 2002). Therefore, couple-based interventions may incorporate strategies that facilitate building these skills. Future research may explore these behaviors in non-distressed and more diverse samples. Additionally, future research may benefit from including measure of additional relationship constructs, such as the relational perspective.

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Table 1

Characteristics of Study Sample

Variable	Survivor M (SD)	N (%)	Spouse M (SD)	N (%)
Age (Years)	60.7 (7.5)		57.1 (8.8)	
Race				
White/Caucasian		102 (78)		99 (76)
Black/African-American		23 (17)		21 (16)
Asian		1 (0.8)		3 (2)
Hispanic/Latino		4 (3)		6 (5)
Other		1 (0.8)		1 (0.8)
Education				
< High School		3 (2)		3 (2)
High School/GED		15 (11)		16 (12)
Some College/Trade School		24 (18)		32 (24)
College Graduate		43 (33)		36 (28)
Graduate School		46 (35)		44 (33)
Employment Status				
Working (full or part time)		85 (70)		80 (67)
Not working		36 (30)		40 (33)
Household income	\$160,495 (123,736)		\$160,495 (123,736)	
Relationship Length (years)	27.0 (14.2)		27.0 (14.2)	
Stage of Cancer				
I		8 (6)		
II		84 (64)		
III		40 (30)		
Time from diagnosis (months)	10.3 (10.9)			
Gleason Score Prior to Treatment	7.03 (0.8)			
Type of Treatment				

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Variable	Survivor <i>M</i> (SD)	N (%)	Spouse <i>M</i> (SD)	N (%)
Surgery only		106 (80)		
Radiation only		10 (7.5)		
Surgery and Radiation		2 (1)		
Surgery and ADT		5 (4)		
Radiation and ADT		6 (4.5)		
Surgery, Radiation, and ADT		3 (2)		
Cancer Distress Score	23.4 (18.6)		26.5 (21.8)	

Note: ADT = Androgen Deprivation Therapy

Table 2

Physical Activity and Fruit/Vegetable Guidelines

Health Behaviors	Survivor N (%)	Spouse N (%)	Total Sample N (%)
Physical Activity Guidelines			
Met guidelines	78 (60%)	65 (51%)	143 (56%)
Did not meet guidelines	51 (40%)	62 (49%)	113 (44%)
Fruit/Vegetable Guidelines (5 servings)			
Met Guidelines	92 (72%)	82 (64%)	174 (68%)
Did not meet guidelines	35 (28%)	46 (36%)	81 (32%)

Note. Five survivors did not complete the fruit/vegetable measure and three did not complete the physical activity measure. Four spouses did not complete the fruit/vegetable measure and five did not complete the physical activity measure.

Table 3
Demographic Correlates of Correspondence between Partners Meeting Guidelines

	Fruit & Vegetable Guidelines			Physical Activity Guidelines			χ^2 (df)	χ^2 (df)
	Both Meets	One Meets	Neither Meets	Both Meets	One Meets	Neither Meets		
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)	
Survivor Race ^a								
Caucasian	52 (53.6)	35 (36.1)	10 (10.3)	34 (35.8)	30 (41.1)	22 (23.2)	0.451 (2)	
Non-Caucasian	9 (36.0)	11 (44.0)	5 (20.0)	11 (37.9)	10 (34.5)	8 (27.6)		
Couple Work Status								
Neither working	10 (52.6)	7 (36.8)	2 (10.5)	8 (42.1)	6 (31.6)	5 (26.3)		
One Working	17 (54.8)	11 (35.5)	3 (9.7)	13 (40.6)	13 (40.6)	6 (18.8)	1.242 (4)	
Both Working	29 (46.8)	25 (40.3)	8 (12.9)	21 (33.9)	27 (43.5)	14 (22.6)		
Survivor Age	<i>M</i> (SD) 62.74 (7.86)	<i>M</i> (SD) 59.20 (6.17)	<i>M</i> (SD) 55.73 (7.54)	<i>F</i> (df) 7.00** (2,119)	<i>M</i> (SD) 60.37 (8.37)	<i>M</i> (SD) 61.07 (7.64)	<i>F</i> (df) 0.08 (2,121)	
Spouse Age	56.84 (13.75)	56.78 (6.71)	49.20 (10.79)	3.02+ (2, 120)	56.38 (11.73)	53.53 (13.67)	0.49 (2,122)	
Survivor Education	7.20 (1.86)	6.52 (1.88)	6.40 (2.06)	2.14 (2, 119)	7.07 (2.03)	5.90 (1.67)	4.64* (2,121)	
Spouse Education	7.02 (1.95)	6.24 (1.91)	6.20 (1.94)	2.51+ (2, 119)	6.98 (1.89)	6.47 (2.08)	0.91 (2,121)	
Household income	175.01 (156.97)	156.69 (84.11)	135.25 (76.87)	0.58 (2, 104)	197.54 (176.20)	133.29 (77.26)	2.61+ (2,107)	

+ $p < .10$;

* $p < .05$;

*** $p < .01$;

^a Only Survivor race is presented because only 4 couples were of mixed race. Household income is in \$1000s.

Table 4
Medical Correlates of Correspondence between Partners Meeting Guidelines

	Fruit & Vegetable Guidelines				Physical Activity Guidelines							
	Both Meets		One Meets		Neither Meets		Both Meets		One Meets		Neither Meets	
	N (%)	N (%)	N (%)	N (%)	N (%)	χ^2 (df)	N (%)	N (%)	N (%)	N (%)	N (%)	χ^2 (df)
Surgery												
Yes	53 (48.6)	43 (39.4)	13 (11.9)			1.74 (2)	43 (38.4)	44 (39.3)		25 (22.3)		3.11 (2)
No	9 (64.3)	3 (21.4)	2 (14.3)				2 (15.4)	6 (46.2)		5 (38.5)		
Stage of Disease												
	<i>M</i> (SD)	<i>M</i> (SD)	<i>M</i> (SD)	<i>M</i> (SD)	<i>M</i> (SD)	<i>F</i> (df)	<i>M</i> (SD)	<i>M</i> (SD)	<i>M</i> (SD)	<i>M</i> (SD)	<i>F</i> (df)	
	3.11 (0.81)	3.04 (0.76)	2.47 (0.91)			3.96* (2,120)	3.07 (0.75)	3.02 (0.77)		3.13 (0.97)	0.18 (2,122)	
Time since Diagnosis												
	9.57 (4.32)	11.42 (17.37)	10.71 (5.97)			0.70 (2,117)	9.76 (4.25)	8.96 (4.66)		13.68 (21.75)	1.72 (2,119)	
Gleason Score												
	7.16 (0.98)	6.80 (0.67)	6.93 (0.26)			2.65+ (2,118)	6.91 (0.73)	7.18 (0.97)		7.03 (0.68)	1.28 (2,120)	

+ $p < .10$;

* $p < .05$;

** $p < .01$

Table 5
Relationship Correlates of Correspondence between Partners Meeting Guidelines

	Fruit & Vegetable Guidelines				Physical Activity Guidelines			
	Both Meets	One Meets	Neither Meets		Both Meets	One Meets	Neither Meets	
	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>F</i> (<i>df</i>)	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>F</i> (<i>df</i>)
Length of Relationship	25.54 (15.36)	28.96 (12.41)	15.94 (14.91)	4.72* (2,119)	27.26 (12.87)	22.86 (14.94)	27.94 (17.13)	1.49 (2,121)
Survivor Relationship Satisfaction	121.51 (15.33)	112.61 (15.92)	115.19 (19.68)	4.14* (2, 119)	116.32 (16.97)	115.90 (15.82)	118.83 (18.14)	0.31 (2, 121)
Spouse Relationship Satisfaction	116.99 (17.82)	111.05 (20.88)	110.06 (17.92)	1.62 (2,118)	114.33 (19.91)	111.05 (18.50)	114.77 (19.78)	0.47 (2,120)
Survivor report of Partner support	18.40 (1.77)	16.41 (2.42)	16.07 (3.15)	13.54** (2,120)	18.02 (2.02)	17.34 (2.50)	16.53 (2.46)	3.70* (2,122)
Spouse report of Partner Support	18.45 (2.01)	16.60 (2.99)	17.33 (2.55)	7.38** (2,119)	18.44 (1.90)	17.06 (3.04)	17.03 (2.30)	4.46* (2,121)

*
 $p < .05$;

**
 $p < .01$