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Social support and social control in the context of cancer patients' exercise: A pilot study

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Abstract

Social support is an important factor for exercise among cancer patients, but too much control might elicit reactance and lead to detrimental effects. In this pilot study, 56 dyads (cancer patient + relative) filled out a questionnaire assessing social support, social control, and reactance. After 4 weeks (T2), patients' exercise was assessed with a 7-day recall. About half of the patients did not engage in any self-reported exercise behavior. Relative-reported support was the only variable associated with exercise behavior at T2. Perceived control ($r = .4$) but not perceived support was significantly correlated with reactance. Male patients reported more support, but were also more prone to reactance.

Keywords

cancer, gender differences, physical activity, reactance, social control, social support

Introduction

Exercise has been identified to reduce side effects and improve quality of life in cancer patients both during and post medical treatment (e.g. Mishra et al., 2012a, 2012b; Speck et al., 2010). Furthermore, exercise has the potential to prevent and reduce clinically relevant side effects like pain, nausea, fatigue, lymphedema, and various others (Irwin et al., 2015; Kwan et al., 2011; Meneses-Echávez et al., 2015; Rief et al., 2014; van Waart et al., 2015). Based on these findings, the "Roundtable on Exercise Guidelines for Cancer Patients" recommends a weekly activity of 150 minutes of moderate-intensity exercise (Schmitz et al., 2010). However, it has been shown that only about one-third of adult cancer patients meet these recommended exercise guidelines (Bellizzi et al., 2005; Blanchard et al., 2008). Furthermore, exercise levels decline after cancer diagnosis (Courneya and Friedenreich, 1998; Huy et al., 2012). Patients are confronted with various barriers like fatigue, nausea, or other side effects making it difficult (yet feasible and advisable) for them to engage in exercise (Blaney et al., 2013; Courneya et al., 2008). Therefore, the question arises how cancer patients can be supported in setting up or maintaining a physically active lifestyle.

Social support is an important factor influencing health outcomes (e.g. Berkman et al., 2000; Holt-Lunstad et al., 2010). According to the theory by Uchino (2006)—describing the links between social support and physical health—one pathway for this relation is that supportive others help to increase health behaviors. Social support involves attempts to aid and reinforce someone's own efforts to positively change his or her health behavior (Franks et al., 2006). In contrast, social control refers to interactions that involve influence, regulation, and constraints (Helgeson et al., 2004; Lewis and Rook, 1999) and comprises attempts to change someone's health behavior who has been unable or unwilling to make such changes (Franks et al., 2006). Thus, both social support and social control behaviors are conducted with the intention to protect the recipient's health

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(Khan et al., 2013), but represent two distinct constructs (Helgeson et al., 2004).

In the context of exercise and cancer, social support includes, for example, being physically active together with the cancer patient, encouraging the patient to exercise, or assisting the patient in carrying out exercise (Khan et al., 2013; Sallis et al., 1987). On the other hand, examples of social control behaviors aimed at increasing exercise levels are criticizing the patient for his or her insufficient physical activity, prompting the patient to exercise more, or observing whether the recipient really is exercising (Khan et al., 2013).

Social support has already been identified as a positive determinant of exercise in various populations (e.g. Anderson-Bill et al., 2011; Bauman et al., 2012; Franks et al., 2006; Khan et al., 2013; Van Dyck et al., 2011). A review by Barber (2012) revealed a positive relationship between social support and cancer patients' physical activity in about 50 percent of the included 22 studies. Most studies of this review focused on perceived social support from family and friends, but a few also examined other aspects of social support like having another cancer survivor as role model for exercise (Rogers et al., 2008, 2011) or environmental support from the neighborhood or community (Coups et al., 2009). However, the samples consisted mostly (59%) of breast cancer patients.

In contrast, the findings regarding the direction of the relationship between social control and exercise are inconsistent (see Knoll et al., 2012). The use of pressure (e.g. criticizing, nagging), which can be classified as a social control strategy, was associated with better health behavior (including physical activity) in patients suffering from osteoarthritis (Stephens et al., 2009). Other research findings, however, suggest that social control has a negative impact on exercise in adults suffering from diabetes (Khan et al., 2013; Thorpe et al., 2008). Franks et al. (2006) also found reduced health behavior, including physical activity, as a result of social control in patients participating in cardiac rehabilitation.

To the authors' knowledge, no study in the exercise and cancer domain has focused on social support and social control, and so far only one study analyzed the impact of social control on cancer patients' physical activity levels so far (Helgeson et al., 2004). Helgeson and colleagues investigated the influence of spouse social control on several health behaviors in men with prostate cancer in a longitudinal study. Results showed that spouse social control was ineffective in producing changes in health-enhancing behaviors such as physical activity. Social control related to health-comprising behavior (such as smoking) and health-restorative behavior (such as sleeping) was even associated with poor health behaviors and greater psychological distress (Helgeson et al., 2004).

Overall, the evidence for a negative or no impact of social control on exercise behavior predominates. A construct that could explain the missing positive effect of social control on health behavior or even "boomerang effects" is psychological reactance. Reactance is described as an aversive motivational state that arises when an individual perceives his or her behavioral freedoms as threatened or lost (Brehm, 1966). In order to reduce reactance, individuals try to engage in behaviors that are able to reestablish the freedom that has been threatened. Such behaviors can be contrary to the behavior that was originally aimed by the person who evoked reactance. Reactance can be regarded as a stable personality trait (persons tending to be reactant across many situations) or as a situation-specific state. According to reactance theory, social control should—if perceived as a threat to the personal freedom—evoke reactance, whereas social support should be unrelated to reactance. Empirically, it has been shown among people with diabetes and healthy adults that social control attempts of a spouse can evoke resistance and emotional distress (Rook et al., 2011; Tucker and Anders, 2001; Tucker et al., 2006). To our knowledge, no studies have examined the role of reactance in the field of exercise among cancer patients so far.

When examining the associations between social support, social control, reactance, and exercise, it is important to consider gender aspects. Previous research has investigated differences between men and women regarding health behaviors (Gough, 2013; Helgeson, 2012) and supporting behaviors within a marriage (Neff and Karney, 2005). There are gender differences in how much women and men facilitate their spouses' health behavior: typically, women take more care of their spouses' health, nutrition, and exercise and constrain health risk behavior more than men do toward their wives (Allen et al., 2013; Miller and Wortman, 2002; Zhu et al., 2006). In line with these findings, women are often regarded as "health promotion agents" (Marcell et al., 2010) for their partners. Furthermore, large cross-sectional surveys among (culturally diverse) undergraduates have shown that men had a significantly higher level of trait reactance than women (Seemann et al., 2004; Woller et al., 2007). Therefore, the question arises whether female and male cancer patients differ in the amount of received social support and control by their relatives to engage in exercise and whether they react with a varying extent of reactance.

A limitation of previous research on social influences on physical activity among cancer patients—for example, included in the review by Barber (2012)—is that social support was only assessed by self-reports of cancer patients. According to the conceptual framework by Dunkel-Schetter describing elements of social interactions, three different perspectives of social support should be considered: the recipient's, the provider's, and an outside observer's perspective (Dunkel-Schetter et al., 1992). As relatives, friends, or other persons who actually provide social support did not take part in previous studies, only one perspective could be gained. An exception is a study by Gilliam et al. (2012) which questioned both child and adolescent patients and their caregivers about predictors of physical activity, including family support. They found that the

strength of predictors varied dependent on caregiver and patient reports. To our knowledge, in adult cancer patients, the perspective of relatives has not been included so far.

The first aim of this pilot study was to examine associations between social support and control as perceived by the patient and relative-reported social support and control (research question 1). Additionally, we wanted to explore the associations between social control and social support with reactance (research question 2). A further focus was on possible gender differences within these social factors (research question 3). Finally, we investigated whether social support, social control, and reactance are predictors of cancer patient's self-reported exercise behavior which was assessed 4 weeks later (research question 4).

Methods

The pilot study consisted of two assessment points. At the first measurement point (T1), cancer patients and their relatives took part. After 4 weeks (T2), cancer patients were recontacted. Inclusion criteria for the patients were an age of at least 18 years, currently receiving outpatient treatment or follow-up care, and being accompanied by a relative or a partner who also agreed to participate in the study. Exclusion criteria were inability to follow the study instructions, inpatient treatment, and severe physical constraints which made exercise impossible (i.e. inability to walk or stand). The study was approved by the ethics committee of the medical faculty from Heidelberg University.

All in all, 90 cancer patients accompanied by a person were personally approached by the study personnel (M.W. and A.K.); of which 56 patients (62.2%) met the inclusion criteria and agreed to participate. Reasons for not participating were as follows: lack of interest, anticipation of inpatient treatment in the near future, not speaking sufficiently German, and being accompanied by a friend but not a relative.

Four weeks after T1, cancer patients who had participated in the first assessment were again contacted by phone and interviewed (T2). In total, 47 patients (83.9%) completed the study. Of the nine persons who dropped out at T2, seven persons could not be contacted, one person could not be interviewed because of a hospital stay, and one person did not want to take part in the survey anymore. One further patient could not be included in the analyses of exercise behavior due to missing values for this variable.

Procedures

At T1, cancer patients who were accompanied by a relative were approached (at random) in the waiting areas in the outpatient care unit of the National Center for Tumor Diseases Heidelberg/Germany. If they were interested in participating in the study, they provided informed consent prior to receiving instructions for study procedures. Cancer patients at first indicated their exercise behavior within an interview. Thereafter, cancer patients completed a self-administered paper questionnaire that assessed perceived social support and perceived social control for exercise received from the accompanying relative, reactance as well as sociodemographic and medical information. At the same time, relatives completed a paper questionnaire independently from the patient (relatives were told not be in contact with the patient while filling out the questionnaire) regarding social support and social control for cancer patients' exercise and sociodemographic information.

Approximately 4 weeks after T1 ($M = 25.9$ days, standard deviation (SD) = 4.6 days), cancer patients were recontacted by phone. In the second interview, only exercise and some medical information were assessed.

Measures

Self-reported exercise behavior. At both assessment time points, cancer patient's current physical activity behavior was measured with the Seven-Day Physical Activity Recall (Sallis et al., 1985, 1997). They were asked for the frequency and duration of light, moderate and vigorous physical activity, as well as type of physical activity they had carried out on each of the last 7 days. Behavioral descriptors and examples were provided for all three intensities. Unlike the original procedure, we only asked for physical activity behavior during the whole day and not for physical activity at specific times of the day (morning, afternoon, evening). The Seven-Day Physical Activity Recall has demonstrated good reliability and validity in multiple studies (see Sallis et al., 1997 for an overview) and has been used in cancer populations (e.g. Pinto et al., 2005).

Self-reported *exercise* (in minutes per week) was calculated by adding up exclusively moderate and vigorous exercise behavior. According to Caspersen et al. (1985), we regard exercise as "physical activity that is planned, structured, repetitive, and purposive in the sense that improvement or maintenance of one or more components of physical fitness is an objective" (p. 128). This variable was of major interest as it mirrors the exercise guidelines of at least 150 minutes moderate-to-vigorous exercise per week (Schmitz et al., 2010).

In additional analyses, self-reported *exercise plus walking* was used comprising a wider range of physical activity. Beside moderate-to-vigorous exercise, it additionally includes walking for leisure during the last week. As this variable comprises activities with a wide range of different intensities (from light to vigorous), all activities were weighted with its energy expenditure. Therefore, the time spent in an activity was multiplied with the metabolic equivalents (METs) of the activity according to the compendium by Ainsworth et al. (2011) before summing up all activities per week. The final unit of this "leisure time activity" variable was MET-hours per week.

Social support and social control. At T1, social support and social control for exercise were measured with the Spousal

Involvement in Patient Exercise Scale developed by Khan et al. (2013) based on research on spousal involvement in illness management (Franks et al., 2006; Trief et al., 2003). The items were translated into German by native speakers through forward–backward translation. One additional item ("Exercised with me"), which was taken from the Family Support for Exercise Habits Scale (Sallis et al., 1987), was added to the social support scale. The social support scale thus consisted of eight items (in the questionnaire for patients, for example: "He/she listened to my concerns about maintaining an exercise routine") and the social control scale of seven items (in the questionnaire for relatives, for example: "I tried to influence him/her to do more physical exercise"). All items were rated on a scale from 1 (not at all) to 4 (very much) and referred to the last month. Khan et al. (2013) reported good reliabilities for both the social support scale ($\alpha = .90$, daily test–retest $\alpha = .72$) and the social control scale ($\alpha = .90$, daily test–retest $\alpha = .67$). These questionnaires were completed both by cancer patients (perceived social support and control from the accompanying relative) and relatives (relative-reported social support and control) so that reports on social support and social control were independently obtained from two perspectives. In the current sample, Cronbach's alpha for perceived (patient-reported) social support was $\alpha = .91$, and for relative-reported social support, it was $\alpha = .77$. Cronbach's alpha for perceived and relative-reported social control scale were $\alpha = .90$ and $\alpha = .87$, respectively.

State reactance. State reactance was measured with four items of a modified short scale that had been developed for an intervention study on fruit and vegetable intake (Ungar et al., 2013, 2015). The items for this study were adapted to reactions to the behavior of the relatives and asked for cognitions that have been described as typical indicators of reactance (e.g. Quick and Stephenson, 2007; Traut-Mattausch et al., 2008). An example item used in this study is, "Through my relative's behavior concerning my exercise during the last month, I felt very restricted in my personal freedom". Each statement was rated on a scale from 1 (does not apply at all) to 7 (applies completely). Cronbach's alpha of the short reactance scale with four items was $\alpha = .71$.

Statistical analyses

Descriptive statistics were used to examine demographic, medical, and psychological variables as well as exercise for all participants ($n = 56$ patients and $n = 56$ relatives). Participants and non-participants at T2 were compared using *t*-tests (for metric variables) and chi-square tests (for non-metric variables) including any demographic, medical, or psychological variables.

To investigate the research questions, bivariate correlations and *t*-tests were calculated. Pearson correlations were used to analyze associations between perceived and relative-reported social support/social control (research question 1) and between social support/social control and reactance (research question 2). Gender differences regarding perceived and relative-reported social support and social control as well as reactance were analyzed based on *t*-tests (research question 3). To investigate the associations between psychological variables at T1 and exercise behavior at T2 (research question 4), Spearman correlations were used, as the exercise variable had a highly zero-inflated distribution. Because of the clumping at zero, no linear regression could be calculated. Instead, for an additional analysis of research question 4, a linear regression was conducted with *exercise plus walking* (instead of *exercise*) as dependent variable (without clumping at zero). All sociodemographic and medical variables which correlated significantly with the dependent variable were included as covariates in a first step. Perceived and relative-reported social support and social control as well as reactance were included as predictors of *exercise plus walking* in the second step and the adjusted R^2 were compared. Analyses were carried out with IBM SPSS Statistics 21 and employed a significance level of $p < .05$.

Results

Participants

The sample consisted of $N = 56$ cancer patients (53.6% female) with a mean age of 53.6 years ($SD = 12.7$ years, range: 27–75 years) and $N = 56$ relatives (51.8% female, $M_{age} = 52.8$ years, $SD = 13.4$ years). In 89 percent of the dyads, the accompanying relative was the spouse or life partner of the patient. The sociodemographic and medical variables are listed in Table 1. All sociodemographic and medical variables were unrelated to exercise behavior and the psychological variables investigated in this study (all $ps > .05$).

Dropout-analysis: The only significant difference between participants and non-participants at T2 emerged for relative-reported social support, $t(54) = 2.34$, $p < .05$. At T1, relatives of dropouts indicated more social support ($M = 3.44$, $SD = 0.37$) than relatives of participants ($M = 3.00$, $SD = 0.54$). For all other demographic, medical, or psychological variable, no differences were found between patients who did or did not participate at T2 (all $ps < .05$).

Research question 1. Associations between patient-perceived and relative-reported social support and control

Overall, there were significant positive correlations between perceived and relative-reported social support ($r = .431$, $p = .001$) as well as social control ($r = .490$, $p < .001$). Analyzing female and male patients separately, for women we found moderate and significant correlations, whereas

Table 1. Sample characteristics ($n = 56$ cancer patients; $n = 56$ relatives).

Variable	Mean (*SD*)	%
Patient report		
Demographic variables		
Female		53.6
Age (years)	53.58 (12.72)	
BMI (kg/m^2)	25.56 (4.65)	
Marital status		
Married		94.6
Single		3.6
Divorced/widowed		1.8
Currently not working		76.8
Degree of relationship		
Couples		89.3
Parent–child		7.1
Siblings		3.6
Living in one household		89.3
Medical variables		
Type of cancer		
Breast		39.3
Skin		14.3
Colorectal		12.5
Gastric		5.4
Hepatic		5.4
Other		23.2
Time since diagnosis in months	26.31 (33.78)	
Current chemotherapy		57.4
Current radiation therapy		0.0
Previous chemotherapy		20.4
Previous radiation therapy		35.2
Physical activity		
Moderate-to-vigorous exercise at T1[a]	85.98 (181.84)	
Moderate-to-vigorous exercise at T2[a]	90.65 (154.66)	
Leisure time physical activity at T1[b]	16.73 (15.94)	
Leisure time physical activity at T2[b]	18.70 (15.80)	
Psychological variables		
Social support[c]	2.91 (0.83)	
Social control[c]	2.06 (0.84)	
Reactance[d]	1.61 (0.98)	
Relative report		
Demographic variables		
Female		51.8
Age (years)	52.75 (13.42)	
BMI (kg/m^2)	25.58 (3.96)	
Psychological variables		
Social support[c]	3.07 (0.54)	
Social control[c]	2.23 (0.73)	

MET: metabolic equivalent of task; SD: standard deviation; BMI: body mass index.
[a]In minutes per week.
[b]In MET-hours per week, including light, moderate, and vigorous leisure time activities.
[c]On a scale from 1 to 4.
[d]On a scale from 1 to 7.

for men the correlations between perceived and relative-reported measures were lower and not significant (see Table 2).

Research question 2. Associations between social support, social control, and reactance

Analyses revealed significant positive correlations between social control and reactance. This was true for perceived social control ($r = .375$, $p = .004$) as well as for relative-reported social control ($r = .407$, $p = .002$). Perceived social support was not significantly correlated with reactance, but we found a significant association between relative-reported social support and reactance ($r = .303$, $p = .023$).

Research question 3. Gender differences

Gender differences in main study variables are shown in Figure 1. Male cancer patients perceived significantly more social support ($p = .003$) and control ($p < .001$) compared to female patients. Their (mostly female) relatives also reported to support and control them more ($p = .024$). Men reported a higher amount of reactance ($p = .001$).

Comparisons of relative-reported and perceived support and control for male and female relatives separately revealed that male relatives reported significantly higher amounts of social support and social control than the related (mostly female) patients perceived. For female relatives, there were no such differences between relative-reported and perceived social support or social control (see Table 3).

Research question 4. Predictors of exercise at T2

Self-reported exercise at T2 turned out to have a highly zero-inflated distribution, as 63 percent of participants did not engage in any moderate-to-vigorous exercise at T2. Because of this highly skewed distribution, the clumping of zeros, and the resulting missing normality assumption, no linear regression analyses could be performed. Spearman correlations show that self-reported exercise at T2 was positively associated with relative-reported social support at T1 ($r = .324$, $p = .028$). There were no associations with all other psychological variables (see Table 2). Analyzing male and female patients separately yielded different patterns. Among women, relative-reported social support at T1 was highly ($r = .533$, $p = .004$) and perceived social control marginally ($r = .359$, $p = .066$) related to exercise at T2. For men, on the other hand, no variable could be identified as significant predictor of exercise at T2. For men, reactance at T1 was marginally significant ($r = -.392$, $p = .097$): the more men felt restricted in their freedom the less they exercised at T2.

Additional analyses for research question 4

To get around the shortcoming of the "exercise" variable, a further analysis with the broader physical activity

Table 2. Intercorrelations of study variables for the whole sample (above the diagonal) and separated by sex (below diagonal: men—bold, women—italic).

	Variable	1.	2.	3.	4.	5.	6.	7.
1.	Exercise at T2[a]	–	.32*	.06	.32*	.05	.04	−.13
2.	Exercise at T1[a]	**.34**	–	−.03	.09	−.18	−.23°	−.10
		.30						
3.	Perceived social support[b]	**.04**	**−.27**	–	.43**	.65**	.40**	.20
		.24	*.30*					
4.	Relative-reported social support[b]	**.05**	**.30**	**.19**	–	.25°	.60**	.30*
		*.53***	*.07*	*.43**				
5.	Perceived social control[b]	**−.11**	**−.53****	**.44***	**<.01**	–	.49**	.38**
		.36°	*.29*	*.65***	*.20*			
6.	Relative-reported social control[b]	**−.12**	**−.06**	**.11**	**.68****	**.24**	–	.41**
		.23	*−.29*	*.35*	*.44**	*.39**		
7.	Reactance[c]	**−.39°**	**.05***	**.15**	**.36°**	**.37°**	**.37°**	–
		.10	*−.08*	*−.08*	*.02*	*−.02*	*<.01*	

Pearson correlations were conducted for all variables except exercise at T1 and exercise at T2. For the exercise variables, Spearman correlations were used because of strong deviation from normal assumption.
[a]In minutes per week derived from the 7-day recall.
[b]On a scale from 1 to 4.
[c]On a scale from 1 to 7.
°$p < .10$, *$p < .05$, **$p < .01$.

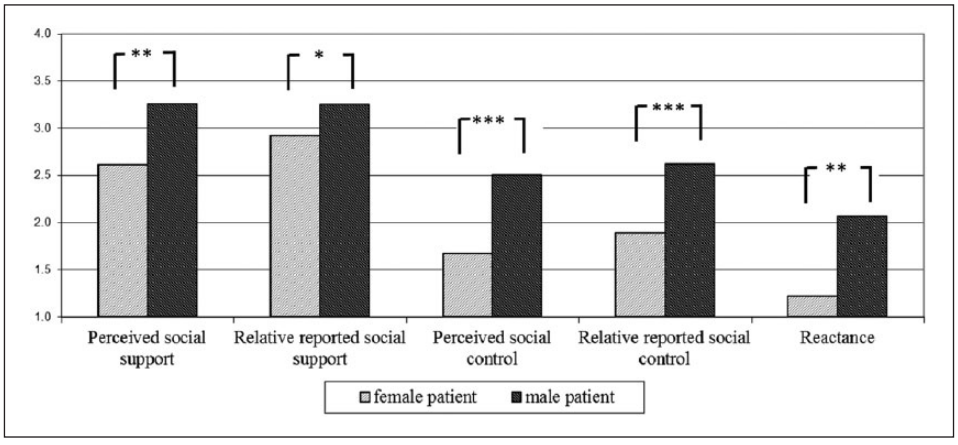

Figure 1. Gender differences in psychological variables (assessed at T1). Social support and social control were assessed on a scale from 1 to 4, and reactance was assessed on a scale from 1 to 7; *t*-tests were calculated. *$p < .05$, **$p < .01$, ***$p < .001$.

Table 3. Comparison of relative-reported and perceived social support and social support separately for male and female relatives.

	Relative-reported		Perceived by patient		*p*
	M	*SD*	*M*	*SD*	
Male relative					
Social support	2.98	0.48	2.65	0.85	.047
Social control	1.93	0.56	1.62	0.65	.040
Female relative					
Social support	3.16	0.58	3.16	0.73	.998
Social control	2.50	0.76	2.47	0.80	.836

SD: standard deviation.

variable was calculated to answer research question 4. The associations between psychological variables at T1 and physical activity at T2 were additionally examined using self-reported *exercise plus walking* (instead of *exercise*) as a broader indicator of physical activity. As most of the participants engaged in (some amount of) *exercise plus walking* (only 11% did not engage in any *exercise plus walking*), this variable could be used as dependent variable in a hierarchical linear regression analyses. The Spearman correlation between *exercise* and *exercise plus walking* was $r = .532$ ($p < .001$). *Exercise plus walking* at T1 and body mass index (BMI) were included as covariates in a first step, as they were the only sociodemographic/medical control variables that significantly correlated with the dependent variable. In the first step of the regression, both variables were significant determinants and explained 56 percent of the variance in *exercise plus walking* at T2 (*exercise plus walking* at T1: $\beta = .702$, $p < .001$; BMI: $\beta = .315$, $p = .003$). In a second step, all psychological variables (assessed at T1) were included. The regression analysis revealed that relative-reported social support was the only psychological variable being a significant predictor ($\beta = .312$, $p = .012$) over and above the control variables *exercise plus walking* at T1 and BMI confirming the above-described correlational analyses. Additional 9 percent of the variance could be explained in the second step.

Discussion

Social support can help cancer patients to increase their exercise level (see review by Barber, 2012), but social control can have detrimental effects (Helgeson et al., 2004; Khan et al., 2013; Knoll et al., 2012). This pilot study adds to the previous literature in the exercise and cancer domain by focusing on social support and social control and examining the role of reactance. By including not only the patients but also a relative, two different perspectives could be gained and compared: patient-perceived versus relative-reported support and control. Furthermore, gender aspects were explored.

Results yielded that perceived social support and social control were moderately associated with relative-reported support and control. These moderate relations between patient and relative reports are consistent with prior research in the context of social exchange processes among couples dealing with chronic diseases (Benyamini et al., 2007; Hagedoorn et al., 2000; Kuijer et al., 2000; Stephens et al., 2010). Interestingly, moderate associations were only found for female patients. It would be interesting for future research to find reasons for the missing associations between perceived and relative-reported social support and control among male patients.

We also investigated how psychological variables at T1 were related to self-reported *exercise* at T2. Relative-reported social support was the only variable that was significantly related to physical activity across two different measurements of physical activity (self-reported *exercise* and *exercise plus walking*). This is in line with previous studies from other domains, showing that social support has positive effects on physical activity (e.g. Barber, 2012; Bauman et al., 2012; Franks et al., 2006; Fraser and Rodgers, 2012; Khan et al., 2013; Van Dyck et al., 2011), whereas the results regarding social control were inconsistent (e.g. Helgeson et al., 2004; Khan et al., 2013; Stephens et al., 2009; Tucker and Anders, 2001).

Surprisingly, in our study, only relative-reported and not patient-perceived social support revealed to be a significant predictor of patient's *exercise plus walking* at T2. According to the conceptual framework of Dunkel-Schetter et al. (1992), different perspectives of social support should be considered (the recipient, the provider, and outside observer), but the highest priority has perceived social support of the recipient (Dunkel-Schetter and Bennett, 1990). Nevertheless, our results are congruent with evidence from prior research that found that spouses' perceptions of their influence, and not patients' reports, explained patients' dietary adherence (Stephens et al., 2010). Furthermore, Franks et al. (2006) and Khan et al. (2013) have shown that relative-reported social support had a positive effect on health behavior and Grange et al. (2007) reported that practical assistance is perceived as especially supportive. This gap between the theoretical assumption that the perception of the recipient is most influential and empirical findings highlighting the effects of providers' reports has to be further investigated.

Results of this study revealed that male cancer patients felt more supported by their partners than female patients did. Additionally, their (female) relatives reported to support them more in comparison to the report of the (male) relatives of female patients. This result is in line with findings of a study examining the course of spousal support in the context of mainly gastrointestinal cancer surgery (Luszczynska et al., 2007). Another recent study has not only focused on the help by a relative but differentiated between support received by a significant other and support received by friends (Coleman et al., 2014). Results revealed that walking for exercise was only associated with greater friend support. The support by friends might be especially important for women and this might compensate for the lower support of their partners, as buffering effects of family and friend support have been shown among women with breast cancer (Manne et al., 2003). Previous research has shown that women have a wider range of sources of their support (Fuhrer and Stansfeld, 2002) and that they do not nominate their spouse as closest person as much as men do (women: 79.6%, men: 92.4%) (Fuhrer et al., 1999).

Male patients were not only more supported but also more controlled by their female partners. In line with this

result, male patients reported a higher amount of reactance than female patients did. In prior research, such a gender difference had emerged as well (Seemann et al., 2004; Woller et al., 2007). Additionally, we found a positive association between social control and reactance in male patients only. For female cancer patients, there was no association between social control and reactance.

Several limitations of the pilot study have to be mentioned. The study consisted of a small and heterogeneous convenience sample, which threatens external validity. Especially the analyses separately for men and women were based on very small sample sizes. Due to the small sample size, possible analysis options were restricted (e.g. testing moderation effects of gender and other variables of interest; calculating regression analyses and including (more) covariates). The study can be regarded as pilot study and the reported associations have to be investigated in bigger and representative samples. A further limitation of this study is that the analyses of research questions 1–3 are based on cross-sectional data and do not allow any causal assumption. Changes in psychological variables across time could not be explored.

Additionally, more than half of participants did not engage in any moderate-to-vigorous self-reported exercise. This made the analysis of the exercise variable difficult. As the sample size was too small for appropriate regression models accounting for this zero-inflated distribution (e.g. by calculating a Poisson–Gamma regression; Brown and Dunn, 2011), only Spearman correlations were conducted. The limitations of bivariate correlations have to be kept in mind, as they cannot control for any covariates and do not allow any causal interpretation. However, an additional analysis with *exercise plus walking* (no clumping at zero) instead of exercise was conducted allowing to use a linear regression. The finding of such a high proportion of sedentary cancer patients is in line with previous research. For example, in a study by Speed-Andrews et al. (2012), 46 percent of colorectal cancer patients were classified as completely sedentary (i.e. 0 min/week physical activity).

Furthermore, there are some limitations regarding the measurements of study variables. It has to be considered that several versions of the 7-day questionnaire have been used in past research. We applied a version that was more refined than the original one but which was also less accurate with regard to the time windows during the day than other/more recent versions (Sallis et al., 1985). Good reliability and validity for several versions of the questionnaire have been shown in multiple studies (see Sallis et al., 1997 for an overview). The calculation of MET values from self-reported exercise is accompanied by some inaccuracies, although interviewers asked for detailed descriptions of the activities. Regarding the measurement of state reactance, it has to be acknowledged that the used scale has not been validated so far. However, it has shown good internal consistency in other contexts (Ungar et al., 2013, 2015).

Finally, the fact that we cannot report the stage of disease is a serious limitation, as we could not analyze possible associations to relative's support or control. However, recent research has shown evidence that exercise interventions are also feasible in advanced cancer patients undergoing chemotherapy treatment (Kuehr et al., 2014; Lowe, 2011).

A strength of this pilot study was the dyadic design. In contrast to previous research regarding exercise behavior among cancer patients, not only the patients but also a close relative (mostly the husband or wife) who accompanied the patient to treatment was included in the study. Thereby, two different perspectives of social support and control could be gained and compared. Additionally, this study was a first attempt to examine the role of reactance regarding exercise behavior in cancer patients.

Future studies should investigate social support and control and the role of reactance with a bigger and more representative sample and (accordingly) more detailed analyses. Additionally, research should broaden its view and also look at the whole family, friends, physicians, and further parts of patients' networks (Wesley et al., 2013). Different sources of social support and social control should be compared. Thereby, it would be necessary to include relationship satisfaction or the quality of the relationship (Cousson-Gélie et al., 2013) in future studies as it has been shown to be a relevant moderator between social control and health behavior (Knoll et al., 2012). Additionally, it has been shown that sharing similar health behavior values within couples leads to increased health behavior in healthy adults (Skoyen et al., 2013). This should be investigated within couples, in which one partner has cancer, as it might interact with cancer-specific relationship awareness (Manne et al., 2014). Furthermore, future research should not exclusively focus on social support, social control, and reactance but put them in the context to other factors which have found to be important to predict cancer patients' physical activity (social cognitions, environmental factors, etc.). Finally, research should test the relations found in this correlational study within experimental designs. For example, one randomly chosen group of relatives could be coached how they can support the patient to become physically active without evoking reactance.

Our study has direct practical implications. Results support the need to integrate relatives in the promotion of exercise among cancer patients. It was shown that especially relative-reported support—not perceived social support—was a predictor of engaging in physical activity. If this result of our pilot study is confirmed in other studies, relatives should be reinforced to support their partners. For example, an information event addressing relatives of cancer patients could inform about basic rules regarding exercise during cancer treatment like exercise guidelines and contraindications. Furthermore, information on psychological mechanisms should be provided (e.g. support vs.

control) and relatives should be made aware of the danger to evoke reactance. A study by Aymanns et al. (2013) has shown that higher self-ascribed competence to help was associated with an increased provision of social support. All in all, it is important that patients and relatives should not feel an obligation to exercise (this could create distress and reactance) but see physical activity as a possibility to actively deal with their disease by their own choice.

In conclusion, this study showed that only a minority of participants were reporting engagement in meaningful levels of exercise despite its positive effects on well-being during active treatment (Mishra et al., 2012b; Speck et al., 2010). The study examined how patients can be supported to increase their exercise level by integrating two perspectives: the view of the patients as well as their relatives. The distinction between social support and social control seems promising as only support was positively related to exercise. Interesting gender differences emerged and revealed that reactance might play a role especially for male cancer patients.

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