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# Efficacy of a dyadic intervention to improve communication between patients with cancer and their caregivers: A randomized pilot trial

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### ABSTRACT

**Objective:** Cancer-related communication is critical for patients' and caregivers' adaptation to illness. This randomized pilot study was conducted to test the feasibility, acceptability, and efficacy of a specific dyadic intervention to improve communication.

**Methods:** A four weekly-session intervention was developed to reinforce cancer-related patient-caregiver communication. Patients receiving treatment for any diagnosed cancer, and their caregivers, were recruited from two oncology clinics in Belgium. Sixty-four patient-caregiver dyads were assigned randomly to intervention and waitlist groups. Cancer-related dyadic communication, dyadic coping and emotional distress were assessed at baseline and post-intervention.

**Results:** The intervention attrition rate was 6 %. Linear mixed models were performed on 60 dyads. Significant two-way group  $\times$  time interaction indicated improvement in participants' cancer-related dyadic communication frequency ( $\beta = -1.30$ ; SE = 0.31;  $p = .004$ ), self-efficacy ( $\beta = -10.03$ ; SE = 3.90;  $p = .011$ ) and dyadic coping ( $\beta = -5.93$ ; SE = 2.73;  $p = .046$ ) after the intervention.

**Conclusion:** These results indicate that the brief dyadic communication intervention is feasible and acceptable, and show preliminary evidence of efficacy.

**Practice implications:** Encouraging patients and caregivers to discuss personal cancer-related concerns may improve their ability to cope with the illness together.

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## 1. Introduction

Cancer causes significant physical, emotional, instrumental, and/or financial impacts on patients and their significant others [1]. Generally, patients' significant others offer instrumental, informational or emotional support. Moreover, one of these significant others often take the caregiver role. The literature from the past three decades contains several models of the ways in which patients and caregivers cope with cancer-related stress [2–7]. These models emphasize that cancer and its consequences activate not only individual, but also dyadic, coping responses to stress [8]. Such responses may or may not lead to individual and dyadic adjustment.

Individual coping has been studied extensively. It can be defined as a subject's specific response to a stressor [9,10]. Dyadic coping is a process in which a subject communicates his or her

stress appraisal to a significant other who perceives, decodes and responds to this signal. Dyadic coping aims to maintain or restore individual and dyadic homeostasis and to return to pre-stressor functioning [3,11]. Shared appraisals, active engagement, open communication, adequate caregiver involvement, reciprocal supportive roles [8,4], self-disclosure, and responsiveness [5] enhance adjustment to cancer-related stress. More particularly, communication about cancer-related stress and about their relationship may help to maintain adequate involvement of patients and their caregivers.

Open and mutual communication and the disclosure of concern are related to the reduction of distress [12,13], and increased relationship satisfaction [13], coping [12], and quality of life [14–16] for patients and caregivers. However, communicating about cancer-related stress may be difficult [17]. Patients and caregivers may avoid communicating about cancer [13,18–20], resulting in a demand-withdrawal communication pattern [13,18]. Avoidance is associated with greater distress and less relationship satisfaction for patients and caregivers [5,13,19]. Factors such as the illness phase [14], emotional distress, and patient-caregiver relationship characteristics [15] influence the

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avoidance of cancer-related topics. However, the ways in which cancer diagnosis, cancer treatment and relationship type influence cancer-related communication processes have not been studied sufficiently. Moreover, most studies of patient-caregiver communication have included spousal dyads and patients with single cancer types [12].

Cancer-related communication can be challenging and not necessarily beneficial [21]. Some studies have shown that emotional disclosure can improve marital satisfaction or reduce distress, whereas others have revealed no effect or a negative effect on distress. One study documented increased of distress among partners of patients with prostate cancer after participation in an intervention designed to improve cancer-related feelings and sharing of concerns, likely because open discussion of their feelings made them more aware of their cancer-related concerns, and possibly due to the existence of a mismatch between patients' need to talk and partners' ability to listen and manage the discussed feelings and concerns [22].

The growing body of coping models has led to increasing interest in dyadic interventions. As caregivers are often the patients' intimate partners, these interventions are frequently couple based. Some recent reviews and meta-analyses have demonstrated significant positive effects of interventions on patients and caregivers as individuals, but as well as on relationship satisfaction [12,23,24] and relationship functioning [24]. However, these interventions often have small to moderate effects. Moreover, most studies have had psycho-educational components, with specific training in coping, problem solving, and communication skills [23–25]. In providing recommendations for intervention programs, the authors of a literature review, concluded that communication is a crucial concept on which intervention developers must focus [12]. Some recently developed interventions have centered on dyadic communication [26–30] with the objectives of improving support between partners by facilitating cancer-related emotional and concerns disclosure. These studies have shown improvements in relationship quality, intimacy [26,27], participants' own communication, close others' communication [22,28], communication quality and dyadic coping [29] for patients and partners. To our knowledge, however, no study has examined how potential negative effects of cancer-related thoughts and feelings disclosure could be mitigated or suppressed. Research on dyadic communication and coping is still in its infancy.

Thus, we developed an intervention that focuses on dyadic communication reinforcement. It is similar to that described by Porter et al. [26], which aims to facilitate patients' disclosure of their feelings about cancer with their partners' assistance. Our intervention aims to facilitate concern disclosure and requests for support equally for patients and their caregivers. In this pilot study, we examined the intervention's efficacy, feasibility, and acceptability. We hypothesized that the intervention would lead only to improvements in cancer-related dyadic communication and dyadic coping (primary outcomes), and that it would have no effect on emotional distress among patients or their caregivers.

## 2. Methods

### 2.1. Study design

For this pilot study, a randomized design was used to examine the feasibility, and acceptability of a test intervention, and to obtain preliminary evidence of its efficacy. All study procedures were approved by the Ethics Committee of Erasme Hospital and Jules Bordet Institute. The study protocol has been registered at ClinicalTrials.gov (NCT03723122).

### 2.2. Sample

No formal power calculation was performed for this study. We determined that a sample of at least 60 dyads was needed to enable measurement of a potential significant clinical change (i.e., 1-point change in mean scores on scales developed for this study). Eligible participants were (1) patients diagnosed with any type of cancer with life expectancies of  $\geq 6$  months, who were undergoing chemotherapy and/or immunotherapy, or were referred by their psychologists; and (2) one designated caregiver (spouse, intimate partner, family member or friend) per patient. All participants were aged  $\geq 18$  years and able to speak and read French. Patients were recruited from the oncology clinics at Erasme Hospital and Jules Bordet Institute (Brussels, Belgium).

### 2.3. Participants recruitment and data collection

Participants were recruited between July 2017 and May 2018. Eligible patients were contacted by phone by the first author. Patients designated the caregiver with whom they wished to participate. After providing written informed consent, patient and caregiver-participants completed a baseline (T1) assessment and were then randomly assigned to the experimental (intervention) and control (waitlist) groups. The statistician on our research team allocated participating dyads according to a computer-generated randomization list. The participants and psychologist were not blinded to randomization. Randomized dyads in the experimental group received the test intervention within the week after randomization. The dyads completed a follow-up (T2) assessment 2 weeks after the end of the test intervention (intervention group) or 6 weeks after baseline (control group). All assessments were performed at the outpatient clinic or at participants' home.

Patient-participants had a variety of cancer types, in various stages and different types of patient-caregiver relationship. As our test intervention was not psycho-educational regarding cancer-related issues, but focused on concerns that patient and caregiver-participants wanted to discuss, this variety was not problematic. The test intervention aimed to reinforce communication between patients and their caregivers by promoting the expression of cancer-related thoughts and feelings and requests for support, regardless of relationship type.

### 2.4. Test intervention

The test intervention was composed of four weekly 60-min sessions held during 1 month. Its implementation was guided by a manual developed by all authors of this article (available on request from the first author). It was delivered by an experienced clinical psychologist (J.T.) who was supervised regularly by the co-authors (N.D., A.L., and D.R.). Intervention sessions were held at the outpatient clinic or at participants' homes.

The test intervention promoted patients' and caregivers' reciprocal disclosure of concerns and requests for support. Sessions content, and objectives are summarized in Table 1. In each session, the psychologist invited the patient and caregiver to perform a video-recorded communication exercise, twice. Debriefing was performed after each exercise, with the participants and psychologist discussing the strategies identified to facilitate dyadic communication during the exercise. The strategies identified were valued by the psychologist. The dyads were given no additional training in specific communication skills during the sessions.

### 2.5. Outcomes measurements

Participating patients and caregivers completed the same self-reported questionnaires and scales. At T1, they completed a

**Table 1**  
Dyadic communication intervention content and objectives.

Sessions	Instructions to participants	Skills to be acquired
<b>Sessions 1 &amp; 2 (60 min each)</b>		
<b>Video-recorded exercise 1 (5 min)</b>		
Patient	Disclose a cancer-related concern.	Self-disclosure
Caregiver	Listen to the patient's concern.	Listening
<b>Viewing of the recording (5 min)</b>	Identify the strategies used to facilitate dyadic communication.	
<b>Debriefing (20 min)</b>	Discuss identified strategies with the psychologist (if no strategy identified, the psychologist identifies and discusses one).	Self-disclosure Listening
<b>Video-recorded exercise 2 (5 min)</b>		
Caregiver	Disclose a cancer-related concern.	Self-disclosure
Patient	Listen to the caregiver's concern.	Listening
<b>Viewing of the recording (5 min)</b>	Identify the strategies used to facilitate dyadic communication.	
<b>Debriefing (20 min)</b>	Discuss identified strategies with the psychologist (if no strategy identified, the psychologist identifies and discusses one).	Self-disclosure Listening
<b>Sessions 3 &amp; 4 (60 min each)</b>		
<b>Video-recorded exercise 1 (5 min)</b>		
Patient	Request caregiver's support in facing a cancer-related concern.	Support seeking
Caregiver	Listen and respond/negotiate to clearly express how s/he can be supportive.	Negotiation
<b>Viewing of the recording (5 min)</b>	Identify the strategies used to facilitate dyadic communication.	
<b>Debriefing (20 min)</b>	Discuss identified strategies with the psychologist (if no strategy identified, the psychologist identifies and discusses one).	Support seeking Negotiation
<b>Video-recorded exercise 2 (5 min)</b>		
Caregiver	Request patient's support in facing a cancer-related concern.	Support seeking
Patient	Listen and respond/negotiate to clearly express how s/he can be supportive.	Negotiation
<b>Viewing of the recording (5 min)</b>	Identify the strategies used to facilitate dyadic communication.	
<b>Debriefing (20 min)</b>	Discuss identified strategies with the psychologist (if no strategy identified, the psychologist identifies and discusses one).	Support seeking Negotiation

questionnaire soliciting demographic and dyadic information. Patients additionally completed a questionnaire soliciting medical information, and study personnel rated their performance status based on the Karnofsky Performance Status Scale [31], at T1 and T2. Other specific oncological information was collected by medical record review.

Several dimensions of dyadic cancer-related communication were assessed. As existing validated scales do not focus sufficiently on the disclosure of thoughts and feelings in the dyad context, the authors used VASs and developed a scale to measure cancer-related dyadic communication frequency, satisfaction, and self-efficacy.

#### 2.6. Perceived dyadic communication frequency and satisfaction

Perceived cancer-related dyadic communication frequency and satisfaction were measured using six VASs each. Similar to those used to measure pain, our VASs were continuous, each with a 10 cm horizontal line, anchored by two descriptors of extreme values [[32]]. The anchors for dyadic communication frequency were "never" (0) and "always" (10) and those for communication satisfaction were "not at all" (0) and "always" (10). These VASs measured the two dimensions of self-disclosure and the request for support at three levels: subjects' perceptions of their own, their close ones', and their reciprocal cancer-related communication. Total scores for communication frequency and communication satisfaction (0–10) were obtained by summing the six VAS scores and calculating averages.

#### 2.7. Perceived dyadic communication self-efficacy

Perceived cancer-related dyadic communication self-efficacy was measured using a six-dimension scale developed based on Bandura's self-efficacy scale model [33]. The scale assesses the subjects' perceptions about their own (dimensions 1 and 2), their close ones' (dimensions 3 and 4), and reciprocal (dimensions 5 and 6) communication (disclosure and request for support) self-efficacy.

Each dimension was measured using five items rated on a 0–100 scale (0 = not certain; 100 = absolutely certain). For example, a dimension 1 item was "I am able to express my cancer-related stress to my close one" and a dimension 4 item was "My close one knows how to ask me for support to face one of his/her cancer-related stress". Cronbach's alphas values for the six dimensions were 0.97 (range, 0.96 to 0.97), 0.98 (range, 0.97 to 0.97), 0.98 (range, 0.97 to 0.98), 0.98 (range, 0.98 to 0.98), 0.98 (range, 0.97 to 0.98), 0.98 (range, 0.97 to 0.98), respectively. Total scores were obtained by summing the dimension scores.

#### 2.8. Dyadic coping

Cancer-related dyadic coping was measured with the Dyadic Coping Inventory (DCI) [34] which is composed of five dimensions: stress communication and supportive, delegated, negative and common coping. Each coping dimension is divided into perception of coping by oneself and perception of coping by one's close one, yielding nine subscales. DCI item responses are structured by a 5-point Likert scale (1, rarely; 5, very frequently), with total scores (sums of item scores) ranging from 35 to 175 (cut-off scores were not considered, given the study objectives). Due to the exploratory nature of the study, only total scores were used to avoid type 2 error. The validated French version of the DCI [35] was used in this study. The instructions were adapted to focus on cancer-related stress. The overall reliability of the scale was good, with an overall Cronbach's alpha value of 0.87. There are no significant correlations between the two communication subscales of the DCI and the communication measures developed for the study ( $r = .00$  to  $.12$ ).

#### 2.9. Emotional distress

Anxiety and depression were measured with the French version of the Hospital Anxiety and Depression Scale [36,37], comprised of 14 items on anxiety and depression subscales. Item responses are structured by a 4-point Likert scale, anchored between "very rarely" to "very often", and total scores (sums of item scores) range

from 0 to 42 (cut-off scores were not considered, given the study objectives). The reliability of the anxiety subscale was acceptable (Cronbach's  $\alpha = 0.78$ ) and that for the depression subscale was good (Cronbach's  $\alpha = 0.80$ ).

### 2.10. Individual coping

Individual coping was measured with the revised French version of the Ways of Coping Checklist (WCC-R) [38,39]. It is composed of 27 items on three subscales: emotion-focused coping, problem-focused coping and seeking of social support. Item responses are structured by a 4-point Likert scale (cut-off scores were not considered, given the study objectives). The overall reliability of the three subscales was good (Cronbach's  $\alpha = 0.81$ , 0.89 and 0.88, respectively).

### 2.11. Statistical analysis

First, chi-squared tests were performed to examine group differences in baseline demographic, dyad, and disease characteristics; differences in age, relationship length, time since diagnosis, and Karnofsky scores were examined using Student's *t*-tests. Second, to test group differences over time, multilevel modeling for dyadic data was used [40–42]. Age, time since diagnosis and disease status (metastatic vs. non-metastatic) were entered into the model as covariates. Main effects included in the model were group (i.e., test intervention vs. control), time (pre vs. post-treatment) and role (patient vs. caregiver). Interaction effects were group  $\times$  time and group  $\times$  time  $\times$  role; a significant two-way interaction (group  $\times$  time) was taken to suggest that the test intervention had an effect on participants. All tests were two-tailed, and the alpha level was set at 0.05. All analyses were performed using IBM SPSS® software, version 25 (IBM Corporation, Armonk, NY, USA).

## 3. Results

### 3.1. Feasibility and acceptability

Of 178 patients who met the inclusion criteria and were contacted, 64 patients agreed to participate with their caregivers (refusal rate = 64%). Reasons for non-participation are: disinterest in the study ( $n = 69$ ), lack of time ( $n = 19$ ), difficulty/fatigue ( $n = 12$ ), lack of a caregiver ( $n = 9$ ), and distress ( $n = 5$ ). The attrition rate between the baseline and follow-up assessments was 6%. Reasons for drop-out in the intervention group were loss of contact ( $n = 1$ ) and disinterest in continuing the intervention due to the lack of cancer-related concern ( $n = 1$ ). Drop-out in the control group was due to death ( $n = 2$ ). The study flow is illustrated in Fig. 1.

In total, 111 intervention sessions were conducted in the outpatient setting [ $n = 40$  (36%)] and at participants' homes [ $n = 71$  (64%)]. The option of home intervention delivery was a reason to participate in the study for 11 (34%) dyads in the intervention group. No major problem occurred during the study, and no negative intervention effect was reported by participants or the psychologist in charge of the intervention.

### 3.2. Participant characteristic

Sixty-four dyads completed the T1 assessment. Baseline patient and caregiver demographic characteristics, dyad characteristics, and patient disease characteristics are presented in Table 2. Patient-participants in the test intervention group were younger ( $p = .020$ ) and more educated ( $p = .034$ ) than in the control group. About half (48.3%) of the patient-participants had

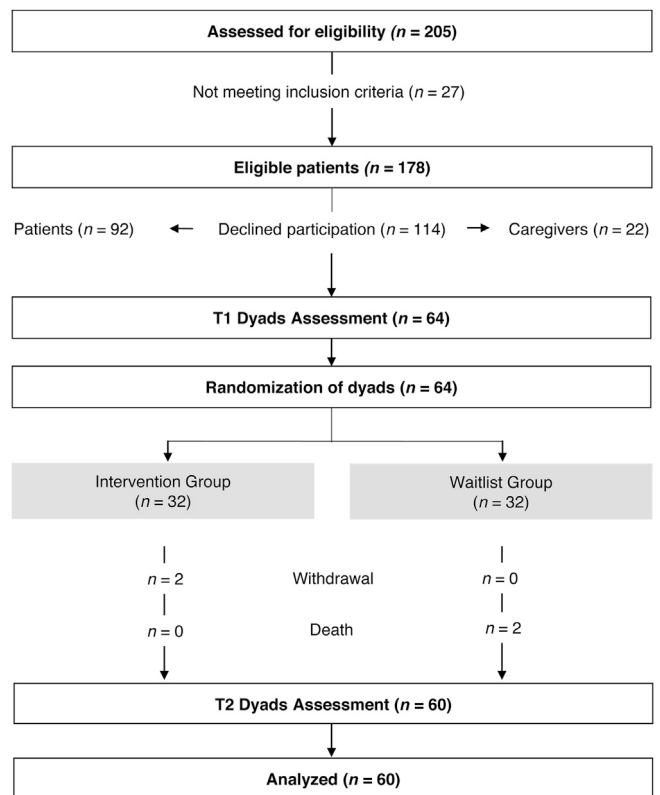


Fig. 1. CONSORT diagram.

metastatic disease and most of them (70%) were receiving chemotherapy.

### 3.3. Dyad characteristics

Seventy percent of dyads were composed of intimate partners. Partners had known each other for a mean of 22.0 [standard deviation (SD) = 14.0] years in the intervention group and 28.0 (SD = 16.3) years in the control group. Most non-spousal dyads were composed of parents and offspring (e.g., mother-daughter, mother-son). Most dyads lived together.

### 3.4. Intervention benefits

Of the 64 randomized dyads, 60 completed the T2 assessment, and some completed at least three of 4 sessions (dyads in the intervention group). Only data from these dyads were examined in this study. Main and interaction effects on the study outcomes are reported in Table 3. Main effects of time were found for communication frequency ( $\beta = -0.79$ ; SE = 0.16;  $p < .001$ ), satisfaction ( $\beta = -0.78$ ; SE = 0.17;  $p < .001$ ), self-efficacy ( $\beta = -7.61$ ; SE = 1.27;  $p < .001$ ) and dyadic coping ( $\beta = -2.92$ ; SE = 0.84;  $p = .001$ ), but not for emotional distress.

The group  $\times$  time interaction was significant for cancer-related dyadic communication frequency ( $\beta = -1.30$ ; SE = 0.31;  $p = .004$ ), dyadic coping ( $\beta = -5.93$ ; SE = 2.73;  $p = .046$ ) and communication self-efficacy ( $\beta = -10.03$ ; SE = 3.90;  $p = .011$ ), but not for cancer-related communication satisfaction or emotional distress. Fig. 2 shows changes in mean scores by group and over time for patient and caregiver-participants. Standardized response means (SRMs) were also considered to estimate changes over time. The SRM for the intervention group was 0.79 (reflecting moderate to large

**Table 2**  
 Patients and caregivers demographic, dyadic and disease characteristics at baseline.

	Patients				p-value	Caregivers				p-value
	Intervention Group (n = 30)		Waitlist Group (n = 30)			Intervention Group (n = 30)		Waitlist Group (n = 30)		
	N	(%)	N	(%)		N	(%)	N	(%)	
<b>Demographic characteristics</b>										
<b>Gender</b>										
Male	9	(30.0)	10	(33.3)	.781	15	(50.0)	15	(50.0)	.999
Female	21	(70.0)	20	(66.7)		15	(50.0)	15	(50.0)	
<b>Age</b>										
Mean (SD)	53.1	(11.8)	59.4	(8.3)	.020	49.1	(14.1)	55.8	(14.6)	.074
<b>Cultural background</b>										
Western Europe	26	(86.6)	27	(90.0)	.801	26	(86.6)	25	(84.3)	.919
Other	4	(16.7)	3	(10.0)		4	(13.3)	5	(16.7)	
<b>Education</b>										
Elementary school	0	(0.0)	0	(0.0)	.034	1	(3.3)	1	(3.3)	.296
High school	7	(23.3)	16	(53.3)		8	(26.7)	15	(50.0)	
Undergraduate	9	(30.0)	8	(26.7)		9	(30.0)	5	(16.7)	
Graduate or higher	14	(46.7)	6	(20.0)		12	(40.0)	9	(30.0)	
<b>Dyadic characteristics</b>										
<b>Relationship type</b>										
Partner	21	(70.0)	21	(70.0)	.999	21	(70.0)	21	(70.0)	.999
Other (family member, friend)	9	(30.0)	9	(30.0)		9	(30.0)	9	(30.0)	
<b>Relationship length (years)</b>										
Partner										
Mean (SD)	22.0	(14.0)	28.0	(16.3)	.098	22.0	(14.0)	28.0	(16.3)	.098
Other										
Mean (SD)	33.7	(13.8)	33.3	(17.1)	.759	33.7	(13.8)	33.3	(17.1)	.759
<b>Living together</b>										
Yes	25	(83.3)	24	(80.0)	.816	25	(83.3)	24	(80.0)	.816
No	5	(16.7)	6	(20.0)		5	(16.7)	6	(20.0)	
<b>Disease characteristics</b>										
<b>Time since diagnosis (months)</b>										
Mean (SD)	21.8	(30.2)	24.2	(31.6)	.758	–	–	–	–	–
<b>Karnofsky</b>										
Mean (SD)	78.2	(10.2)	79.0	(13.9)	.302	–	–	–	–	–
<b>Cancer primary site</b>										
Colorectal	11	(36.7)	16	(53.3)	.314	–	–	–	–	–
Mammary	4	(13.3)	3	(10.0)		–	–	–	–	–
Other	15	(50.0)	11	(36.7)		–	–	–	–	–
<b>Metastatic</b>										
Yes	16	(53.3)	13	(43.3)	.796	–	–	–	–	–
No	14	(46.7)	17	(56.7)		–	–	–	–	–
<b>Treatment type</b>										
Chemotherapy	19	(63.3)	23	(77.7)	.521	–	–	–	–	–
Immunotherapy	6	(20.0)	4	(13.3)		–	–	–	–	–
Other	5	(16.7)	3	(10.0)		–	–	–	–	–

Data are presented as n (%) unless otherwise noted. M, mean; SD, standard deviation.

**Table 3**  
 Mean scores and standard deviations by groups and main and interaction effects significance levels.

	Baseline		6 weeks		p-value by Group	p-value by Time	p-value by Role	p-value by Group × Time
	M	(SD)	M	(SD)				
<b>Perceived dyadic communication frequency</b>								
Intervention Group (n = 30)	4.4	(2.5)	6.1	(2.4)	.186	< .001	.862	.004
Waitlist Group (n = 30)	4.5	(2.5)	4.8	(2.6)				
<b>Perceived dyadic communication satisfaction</b>								
Intervention Group	5.1	(2.7)	5.9	(2.1)	.980	< .001	.387	.091
Waitlist Group	5.3	(2.1)	6.1	(2.2)				
<b>Perceived dyadic communication self-efficacy</b>								
Intervention Group	54.6	(24.4)	70.2	(17.7)	.067	< .001	.407	.011
Waitlist Group	58.9	(23.9)	62.7	(23.0)				
<b>Dyadic Coping Inventory</b>								
Intervention Group	123.4	(17.3)	130.1	(17.0)	.267	.001	.769	.046
Waitlist Group	125.9	(13.6)	125.6	(14.4)				
<b>Hospital Anxiety and Depression Scale</b>								
Intervention Group	14.6	(7.4)	13.9	(7.4)	.289	.195	.221	.525
Waitlist Group	13.1	(6.3)	13.0	(6.6)				

M, Mean; SD, Standard Deviation.



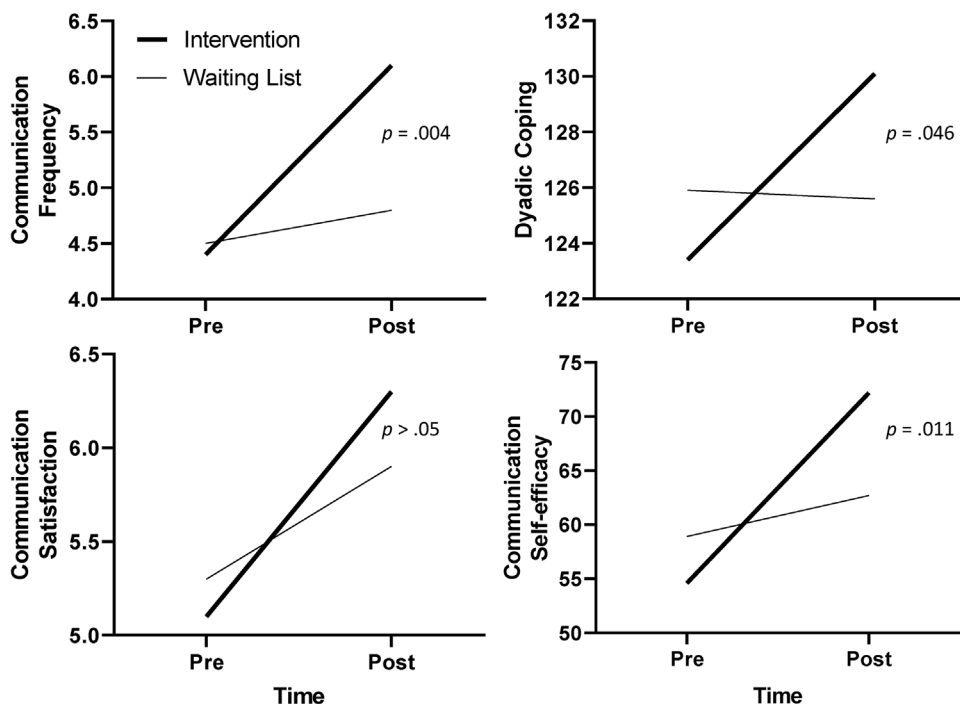


Fig. 2. Group-by-Time Interactions: changes in mean scores for communication frequency, satisfaction, self-efficacy and dyadic coping.

clinical changes over time) and that for the control group was 0.29 (small clinical changes over time).

#### 4. Discussion and conclusion

##### 4.1. Discussion

This randomized pilot study had first the primary objective of assessing the feasibility and acceptability of a brief dyadic communication intervention, and the second objective of examining the intervention's efficacy. The results indicate that the brief dyadic intervention was feasible and acceptable. The refusal rate was similar to the average refusal rate from studies assessing psychosocial interventions for couples coping with cancer [23]. The attrition rate was lower than the average attrition rate from those studies. This may be explained in large part by the delivery of our intervention at participants' homes upon request which many participants reported added value and facilitated participation; most participating caregivers were professionally active and not always available to attend sessions at the outpatient clinic. Most importantly, the very low attrition rate in this study reflects participants' regular provision of feedback to the psychologist regarding their satisfaction with the intervention content.

Regarding efficacy, participants reported global increases in their cancer-related dyadic communication frequency, self-efficacy, and coping after the test intervention. These findings suggest that this brief dyad-based pilot intervention designed to allow patients and caregivers discuss their personal cancer-related concerns could effectively improve communication and adaptation. These preliminary positive effects are congruent with those observed for another cancer-related dyadic communication intervention [29]. No main effect of role was found for any outcomes, indicating that the effect of the promotion of mutual disclosure about cancer-related thoughts and feelings and mutual

requests for support did not differ between patients and caregivers.

Contrary to our hypothesis, no improvement in cancer-related communication satisfaction was observed. The satisfaction scale assessed participants' perceptions of their cancer-related communication "skills". Like any emotionally loaded communication, cancer-related communication between patients and caregivers is difficult to initiate and requires specific skills to be satisfying. The intervention likely did not improve participants' communication skills sufficiently to result in significant improvement in their dyadic cancer-related communication skills satisfaction.

Importantly, the test intervention did not increase participants' distress over time. As expected, no main or interaction effect on emotional distress was observed. This result is congruent with the recent review, finding that dyadic interventions based on problem solving and skill improvement do not reduce emotional distress [43]. Our intervention was designed to improve communication skills, and was probably too brief to significantly reduce emotional distress.

The results of this study were obtained using multilevel modeling for dyadic data which permits a focus on the reciprocal influence of data between two dyad partners, allows for imbalance in data quantities, and accommodates different covariate types. Multilevel modeling also permits simultaneous examination of main effects and interactions of categorical, continuous, and semi-continuous independent variables [42].

##### 4.2. Study limitations

This study has some limitations. First, the sample was small. Our intervention needs to be replicated with a larger sample to adjust test intervention effects for different covariates (e.g. relationship types). With a larger sample and greater homogeneity of dyad and disease characteristics, generalizability could also be

further studied. Second, the control condition was a waitlist. The use of an attention control group probably would have allowed more specific assessment of whether the observed treatment effects were due to specific components of the test intervention, to nonspecific therapeutic effects, or to the dyads' spending of time together in the test intervention sessions. Third, although all patients were receiving cancer treatment, the diversity of diagnoses and treatments may have resulted in diversity of patients' and caregivers' concerns. Fourth, the heterogeneity of dyad relationships (e.g., spousal vs. non-spousal) may have influenced the intervention effects. Dyad relationship type may be controlled in further studies. Fifth, a third assessment could have been performed to examine the long-term efficacy of the test intervention. Finally, some scales, especially the communication measures, used in this study are not validated, and the DCI is not validated for non-spousal dyads.

#### 4.3. Conclusion

In conclusion, this study confirmed the feasibility and acceptability of a brief dyad-based pilot intervention centered on dyadic communication skills. Although the study was conducted with a small sample, it provides preliminary evidence of the intervention's efficacy. This intervention should certainly be assessed further, in terms of long-term benefits and benefits transfer in everyday patient-caregiver communication. Given the high non-participation rate and small sample, the generalizability of the intervention also should be examined further.

#### 4.4. Clinical implications

The flexibility of delivery setting (outpatient or home) is an important feature of our intervention that may explain the low attrition rate. For example, fatigue or professional schedules may reduce the availability of patients and caregivers, respectively, to attend sessions at hospitals. Further dyadic interventions thus should be deliverable at hospitals, at participants' homes or by teleconsultation.

The results of this study also provide interesting complement to those reported by Porter et al. [23,24]. The intervention in these previous studies targeted patients' emotional disclosure with their partners' assistance. One strength of our study is that the test intervention equally targeted patients' and caregivers' emotional disclosure and requests for support. As shown in another study, caregivers tend to avoid cancer-related discussions and hold back more during those discussions than do patients [44]. Thus, caregivers may underestimate some aspects of their own communication. However, associations between caregivers' cancer-related communication self-efficacy and patients', and caregivers' ability to cope with cancer have been demonstrated [45]. For this reason, caregivers' emotional disclosure was considered to be a key-component of dyadic adaptation improvement in the present work. The results of this pilot study indicate that patients and caregivers benefited equally from the test intervention. It means that the promotion of caregivers' emotional disclosure does not seem to be harmful for caregivers or patients. Our results also highlight that the encouragement of patients' and caregivers' discussion of personal cancer-related concerns may improve their ability to cope with the illness together.

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#### Ethical statement

All study procedures were approved by the Ethics Committee of Erasme Hospital and Jules Bordet Institute (P2016/013). Study protocol has been registered at ClinicalTrials.gov (NCT03723122).

#### Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

#### CRedit authorship contribution statement

**Julien Tiete:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Visualization, Writing - original draft, Writing - review & editing. **Nicole Delvaux:** Conceptualization, Funding acquisition, Methodology, Project administration, Resources, Writing - review & editing. **Aurore Liénard:** Conceptualization, Methodology, Software. **Darius Razavi:** Conceptualization, Funding acquisition, Methodology, Project administration, Supervision, Validation, Writing - original draft, Writing - review & editing.

#### Declaration of Competing Interest

No conflict of interest has to be reported.

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