Patient Education and Counseling 105 (2022) 2888–2898

Contents lists available at ScienceDirect

Patient Education and Counseling

journal homepage: www.journals.elsevier.com/patient-education-and-counseling

A randomized controlled trial assessing behavioral, cognitive, emotional and physiological changes resulting from a communication skills training in physicians caring for cancer patients

Yves Libert [a,b,*,1], Livia Peternelj [a,1], Isabelle Bragard [c], Serge Marchal [d], Christine Reynaert [e], Jean-Louis Slachmuylder [d], Darius Razavi [a,b]

[a] Université Libre de Bruxelles, Faculté des Sciences Psychologiques et de l'Éducation, Brussels, Belgium
[b] Institut Jules Bordet, Clinique de Psycho-Oncologie, Université Libre de Bruxelles, Brussels, Belgium
[c] Université de Liège, Faculté des Sciences Psychologiques et de l'Éducation, Liège, Belgium
[d] Centre de Psycho-Oncologie, Brussels, Belgium
[e] Université Catholique de Louvain, Faculté de Médecine, Brussels, Belgium

A B S T R A C T

Objective: This randomized study assesses behavioral, cognitive, emotional and physiological changes resulting from a communication skills training (CST) for physicians caring for cancer patients.
Methods: Medical specialists (N = 90) were randomly assigned in groups to complete a manualized 30-h CST or to a waiting list. Assessments included behavioral (communication skills), cognitive (self-efficacy, sense of mastery), emotional (perceived stress) and physiological (heart rate) measures. Assessments were made at baseline (both groups), after CST program (training group), and four months after (waiting list group). All assessments were conducted before, during, and after a complex communication task with an advanced-stage cancer simulated patient (SP).
Results: Trained physicians had higher levels of communication skills (from RR=1.32; $p = .003$ to RR=41.33; $p < .001$), self-efficacy (F=9.3; $p = .003$), sense of mastery (F=167.9; $p < .001$) and heart rate during the SP encounter (from F=7.4; $p = .008$ to F=4; $p = .050$) and same levels of perceived stress (F=3.1; $p = .080$).
Conclusion: A learner-centered, skills-focused and practice-oriented manualized 30-h CST induced multilevel changes indicating physician engagement in a learning process.
Practice implications: Trainers should consider the CST multilevel benefits (behavioral, cognitive, emotional and physiological) before, during and after a complex communication simulated task as an innovative way to assess the efficacy of a communication skills learning process.

Introduction

In recent decades, numerous studies have investigated the efficacy of communication skills training (CST) programs. The focus of these programs has been on a range of topics, such as breaking bad news [1], shared decision making [2], end-of-life care [3], clinical trials [4], communication with patients and relatives [5]. CST programs have led to a variety of behavioral changes (e.g., communication skills [1,6–8]), cognitive changes (e.g., self-efficacy [9–12]), emotional changes (e.g., perceived stress [13]) and physiological changes (e.g., heart rate and salivary cortisol [14]). Moreover, some CST programs have benefited physicians and cancer patients by increasing their feelings of satisfaction [15,16]. This impact of CST on patients' outcomes has not always been found [17]. Not enough studies have concurrently assessed behavioral, cognitive, emotional and physiological changes as a result of CST. To our knowledge, only one study to date has assessed, in a breaking bad news (BBN) simulated task, multilevel changes resulting from a CST designed for residents [14]. Results from this study indicated that improvements in self-efficacy and communication skills are associated with elevated physiological arousal, reflecting a higher level of engagement and performance in a BBN simulated task.

Prior research has shown that the optimal CST program should be learner-centered, skills-focused and practice-oriented, conducted in small groups of a maximum of six participants with a duration of at least 20 h [5]. However, a recent Cochrane review [18] reported that the benefits of CST programs seem to be limited to some communication

Abbreviations: CST, Communication skills training; *SP*, Simulated Patient; *CPO*, Centre de Psycho-Oncologie.

* Correspondence to: Institute Jules Bordet, Rue Meylemeersch, 90, Anderlecht 1070, Belgium.
E-mail address: yves.libert@bordet.be (Y. Libert).

[1] These authors contributed equally to this work and should be considered co-first authors.

https://doi.org/10.1016/j.pec.2022.04.012
Received 11 May 2020; Received in revised form 15 April 2022; Accepted 16 April 2022
Available online 21 April 2022

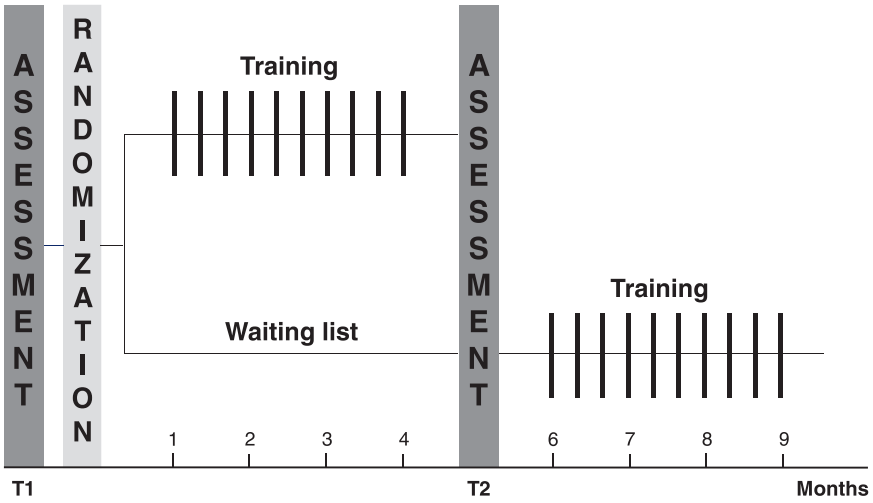

Fig. 1. Study design.

skills (e.g., assessment and supportive skills). Furthermore, the effects found were of low- to moderate-certainty evidence. A better understanding of the learning process of communication skills at the behavioral, cognitive, emotional and physiological levels is necessary to increase the efficacy of CST programs.

It is important to note that the study of CST efficacy is difficult in a clinical setting because medical encounters can vary widely and as such, physician communication skills may vary according to the patients' personality, their disease status, and communication behaviors. The use of standardized simulated patient (SP) encounters has been recommended to reduce these variabilities [19–21].

The objective of the current study was to complete, in a randomized controlled trial, a multilevel assessment of behavioral, cognitive, emotional and physiological changes resulting from a manualized CST program designed for physicians caring for cancer patients and aimed at dealing more optimally with a complex communication task (i.e., addressing uncertainty and hope) [22].

Assessments were made at baseline for both groups, after CST program for the training group, and four months after being placed on the waiting list for the waiting list group. Behavioral, cognitive, emotional and physiological measures were recorded before, during, or after an encounter with an SP diagnosed with advanced stage cancer. It is important to underline that the primary aim of the current paper was not to report the efficacy of this CST program but to assess the cognitive, emotional and physiological changes associated to physicians' communication skills learning.

Methods

Subjects and study design

Participants were French-speaking medical specialists caring for cancer patients who voluntarily took part in the study. This current study was approved by a central ethics committee (Jules Bordet Institute, Cancer Center of the Université Libre de Bruxelles) and all participants provided written informed consent.

As shown in Fig. 1, after baseline assessment (T1), physicians were randomly assigned to a 30-h CST program or to a waiting list. Physicians in the training group participated in CST followed by a post assessment (T2). Physicians in the waiting list group were reassessed four months after baseline assessment and received CST after the second assessment. The same assessment procedures were performed at T1 and T2. The process of randomization after baseline allowed for a double-blind assessment at baseline. Of course, after the baseline assessment, raters and the SP were only blind until they may recognize the physician's - trained or untrained - status through his or her use of some learned communication skills.

CST program

The manualized CST program included ten 3-hour sessions (30 h) spread over four to five months. Each training group included three physicians and the facilitator (the first author of this study). The training was conducted at locations and times chosen by the physicians within each group. The CST included theoretical information, modeling, and role-playing. CST techniques were learner-centered, skills-focused and practice-oriented. The content of CST focused on a specific algorithmic model aimed at addressing uncertainty and hope with cancer patients. According to this algorithmic model, communication about uncertainty includes an in-depth assessment of the patients' expectations about their medical, psychological and social future and, if needed an exchange about some unrealistic expectations and an appropriate information giving. Communication about hope includes an in-depth assessment of the patients' wishes about their medical, psychological and social future and, if appropriate valuing their resources to achieve these wishes.

The CST focused on numerous role-playing scenarios that were each based on an actual patient case brought to the group by one of the participant. The role-playing focused on problems in addressing uncertainty and hope with patients and was accompanied by immediate, circular and positive feed-back [23]. In each role-playing scenario, participants were assigned the role of "physician", "patient" or "observer". This study did not use role-play with simulated patients (actors), in contrast with studies of some other research groups [24]. As in the Rapid Cycle Deliberate Practice [25], the facilitator foster psychological safety and proposes evidence-based or expert-derived solutions for errors that occur during role-plays. All role-plays sequences are

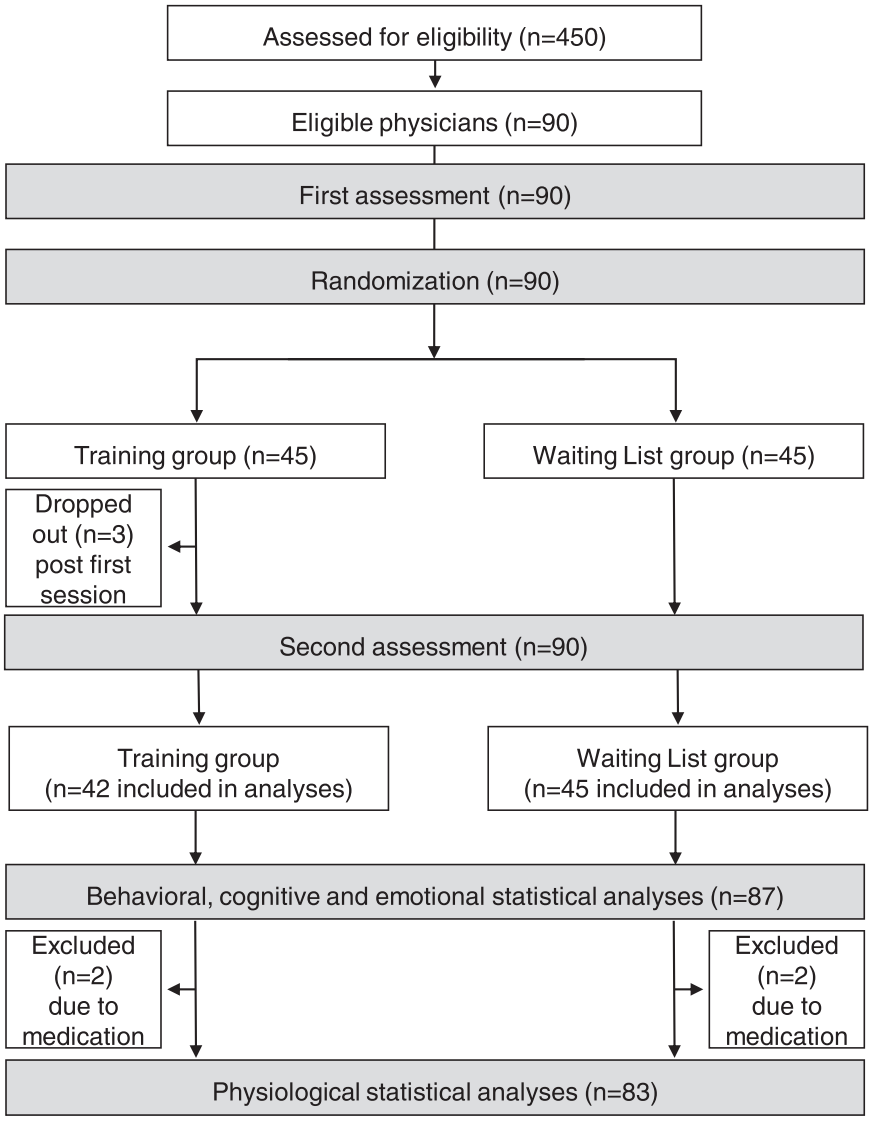

Fig. 2. Flow diagram of the study protocol.

debriefed. All participants are invited to express their perceptions, feelings and proposals about the communication skills performed during the role-play. The facilitator values participants' best proposal to improve the communication quality and suggest if needed a precise recommendation based on the specific algorithmic theoretical model described here above, to be further played and tested. This helps physicians to experiment the impact of communication skills taught "into the shoes" of their patients. This program has been described in detail in Libert et al. [22]. The training manual can be obtained on request from the corresponding authors.

Simulated task and assessment procedure

The simulated task consisted of a medical encounter with an SP with advanced-stage cancer who has requested a meeting with a physician to help cope with concerns. Participants were instructed to respond to the medico-psycho-social concerns of the SP. The SP was instructed to consider several concerns in order to assess precisely the efficacy of the training. The SP was not instructed to represent the average level of concerns expressed by actual patients. Assessments were made for each individual participant and were based on a video recording of the encounter between the participant and the SP. The assessment procedure included: (1) continuous monitoring of heart rate, (2) measure of perceived stress, (3) relaxation exercise, (4) administration of questionnaires, (5) review of the SP's medical chart, (6) administration of questionnaires, (7) encounter with the SP, (8) measure of perceived stress, and (9) administration of questionnaires. The simulated task and assessment procedure have been described in detail in Libert et al. [22].

Behavioral changes

The verbal content of the encounter with the SP was recorded, transcribed and analyzed**.** The physicians' general communication skills (assessment, information and support) were analyzed by the French communication content analysis software, LaComm (Centre de Psycho-Oncologie, Brussels, Belgium; http://lacomm.be). This software

Table 1
Demographic and socioprofessional characteristics of physicians (n = 87).

Characteristics	Training group (n = 42)		Waiting list group (n = 45)	
	n	%	n	%
Age				
Mean	45		45	
SD	11		10	
Gender[1]				
Male	18	43	10	22
Female	24	57	35	78
Medical specialities				
Oncology/Radiotherapy	19	45	21	47
Hematology	4	10	8	18
Other	19	45	16	35
Oncological practice				
Years				
Mean	15		14	
SD	11		9	
Hours per week				
Mean	27		29	
SD	19		16	
Communication skills training[2]				
Yes	12	28	6	13
No	30	72	39	87

Abbreviations: SD, standard deviation

[1] A statistically significant difference was found between groups (X^2 p = 0.040)

[2] Physicians taking part in previous workshops addressing communication skills with cancer patients lasting at least 20 h

analyzes verbal communication utterance by utterance and identifies turns of speech and the type and content of utterances. Utterances are categorized into the following three main types: assessment, support, and information. LaComm was used because of its sensitivity to change and to avoid inter-rater reliability problems. A validation study has shown that the sensitivity to change of the LaComm is similar to the sensitivity to change of the CRC Workshop Evaluation Manual [26,27]. The explanation of how this software works has been described and published [1,26].

The physicians' specific communication skills (addressing uncertainty and hope) were analyzed by a rating system developed for the current study. This rating system allowed the detailed verbal content of the physician's communication skills to be identified, coded and recorded manually. Specific communication skills were those that corresponded to the algorithmic model designed for the study: checking agreement to address expectations, exploring general expectations, recognizing specific expectations, tackling false expectations, acknowledging remaining expectations, investigating wishes and resources, and negotiating a follow-up.

The SP's expression of concerns about uncertainty and hope was analyzed by another rating system developed for the current study. This rating system allowed the detailed verbal content of the SP's verbal expressions to be identified, coded and recorded manually. Concerns about uncertainty and hope were related to prognosis, treatment, psychological, and social outcomes.

Manuals have been developed for the two rating systems described above. Encounters were rated by a trained psychologist and evaluated for quality by the rater coordinator. In order to carry out this quality control, the rater coordinator reviews all the ratings. Each disagreement between raters was discussed and a decision, based on the rating

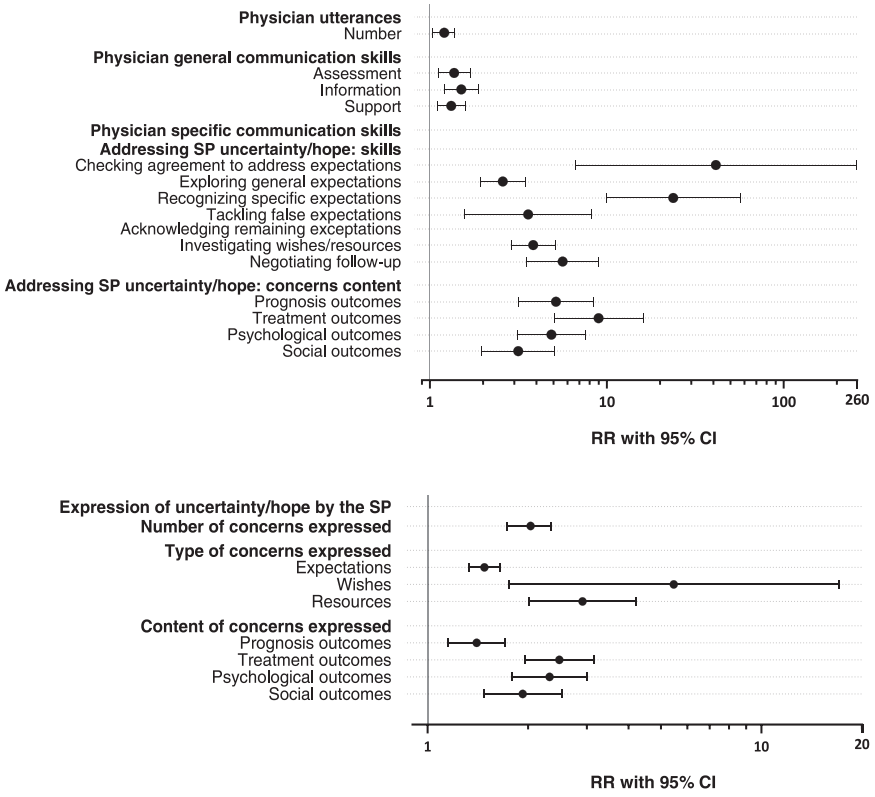

Fig. 3. Physicians' communication skills and the simulated patient's expression of concerns during the SP encounter. Group-by-time effects were assessed with generalized estimating equation (GEE). Abbreviation: SP, simulated patient; RR, Relative Rate; CI, Confidence Interval.

Table 2
Physicians' communication skills with the simulated patient during the encounter (n = 87).

	Training group (n = 42)				Waiting list group (n = 45)				Generalized Estimating Equation*													
	T1		T2		T1		T2		Group Effects					Time Effects					Training Effects				
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	RR	CI			*p*	RR	CI			*p*	RR	CI			*p*
Length encounters																							
Time in minutes	13.5	5.6	15.1	5.2	13.5	5.1	12.2	5.5	1.00	0.85	to	1.18	.992	0.90	0.81	to	1.00	.050	1.25	1.06	to	1.47	.009
Physician words																							
Number	1556	769	1593	661	1628	806	1499	832	0.96	0.78	to	1.18	.670	0.92	0.82	to	1.04	.170	1.11	0.92	to	1.34	.275
Physician utterances																							
Number	97	32	106	32	99	43	90	40	0.99	0.84	to	1.16	.869	0.91	0.82	to	1.01	.064	1.20	1.03	to	1.38	.017
Physician general communication skills																							
Assessment[b]	43	20	50	19	45	21	38	22	0.95	0.78	to	1.15	.580	0.85	0.73	to	0.99	.040	1.37	1.11	to	1.69	.003
Support[c]	39	18	47	23	35	16	32	16	1.11	0.91	to	1.34	.304	0.91	0.80	to	1.02	.117	1.32	1.10	to	1.58	.003
Information[d]	41	20	51	24	47	23	39	18	0.87	0.71	to	1.07	.186	0.84	0.72	to	0.98	.024	1.50	1.21	to	1.88	<.001
Physician specific communication skills																							
Addressing SP uncertainty/hope: skills																							
Checking agreement to address expectations†	0.1	0.4	3.0	2.7	0.1	0.3	0.1	0.3	1.07	0.24	to	4.76	.928	0.75	0.17	to	3.35	.706	41.33	6.62	to	258.00	<.001
Exploring general expectations	5.1	2.9	15.4	7.9	4.4	2.6	5.2	3.2	1.16	0.91	to	1.48	.241	1.18	0.92	to	1.52	.189	2.58	1.92	to	3.47	<.001
Recognizing specific expectations†	0.7	1.0	7.9	5.9	0.8	1.0	0.4	0.8	0.88	0.48	to	1.61	.684	0.50	0.25	to	1.00	.051	23.71	9.90	to	56.83	<.001
Tackling false expectations†	0.4	0.7	1.6	1.7	0.3	0.5	0.3	0.6	1.43	0.65	to	3.12	.371	1.17	0.62	to	2.21	.636	3.59	1.57	to	8.20	.002
Acknowledging remaining expectations	0	0	0.2	0.8	0	0	0	0	–	–		–	–	–	–		–	–	–	–		–	–
Investigating wishes/resources	5.1	3.1	18.1	7.6	6.7	3.6	6.3	3.7	0.75	0.59	to	0.95	.019	0.94	0.76	to	1.16	.549	3.84	2.88	to	5.10	<.001
Negotiating follow-up†	0.9	0.8	3.7	2.2	0.8	1.0	0.6	0.8	1.10	0.69	to	1.76	.683	0.77	0.56	to	1.07	.122	5.62	3.53	to	8.95	<.001
Addressing SP uncertainty/hope: concerns content																							
Prognosis outcomes†	1.8	1.8	8.6	6.3	1.7	1.8	1.6	1.8	1.06	0.69	to	1.61	.794	0.91	0.63	to	1.32	.618	5.16	3.17	to	8.41	<.001
Treatment outcomes†	1.7	1.5	10.3	5.7	1.6	1.8	1.1	1.3	1.06	0.69	to	1.62	.801	0.69	0.43	to	1.11	.126	8.94	5.04	to	16.07	<.001
Psychological outcomes†	2.1	1.6	8.7	5.2	2.6	2.2	2.2	1.7	0.81	0.58	to	1.15	.237	0.85	0.61	to	1.19	.344	4.86	3.12	to	7.56	<.001
Social outcomes	2.5	2.1	9.9	4.7	2.6	2.2	3.2	3.1	0.95	0.70	to	1.40	.944	1.25	0.85	to	1.85	.256	3.14	1.97	to	5.07	<.001

Abbreviations: SP, simulated patient; SD, standard deviation; RR, relative rate; CI, confidence interval; T1: assessment scheduled before the training program; T2: assessment scheduled after training for the training group and 4 months after T1 for the waiting list group.

*Estimated RR based on generalized linear Poisson regression models

†Negative binomial distribution

[b]All question asking analyzed with the LaComm (communication content analysis software).

[c]All acknowledging and reassurance giving analyzed with the LaComm (communication content analysis software).

[d]All information giving analyzed with the LaComm (communication content analysis software).

Table 3
The simulated patient's expression of concerns about her uncertainty and hope during the encounter (n = 87).

	Training group (n = 42)				Waiting list group (n = 45)				Generalized Estimating Equation*															
	T1		T2		T1		T2		Group Effects					Time Effects					Training Effects					
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	RR	CI			p	RR	CI			p	RR	CI			p	
Words expressed																								
Number	906	368	1072	362	864	357	748	321	1.05	0.89	to	1.24	.584	0.87	0.78	to	0.97	.010	1.37	1.16	to	1.61	<.001	
Concerns expressed																								
Number	7.7	2.7	14.7	3.7	7.4	2.8	7.0	1.8	1.04	0.89	to	1.21	652	0.95	0.86	to	1.04	.279	2.02	1.73	to	2.35	<.001	
Type of concerns expressed																								
Expectations	5.3	1.1	7.9	2.1	5.1	1.3	5.1	0.9	1.04	0.95	to	1.14	.361	1.01	0.94	to	1.08	.796	1.48	1.33	to	1.64	<.001	
Wishes†	0.5	0.9	1.9	1.1	0.3	0.8	0.2	0.5	1.53	0.59	to	3.98	.382	0.71	0.26	to	1.93	.506	5.46	1.75	to	17.03	.003	
Resources	1.9	1.7	4.9	1.9	2.1	1.6	1.8	1.2	0.95	0.68	to	1.35	.787	0.88	0.69	to	1.12	.298	2.91	2.01	to	4.21	<.001	
Content of concerns expressed																								
Prognosis outcomes	1.5	0.5	2.4	1.1	1.3	0.5	1.5	0.5	1.14	0.99	to	1.32	.067	1.12	0.98	to	1.28	0.96	1.40	1.15	to	1.71	<.001	
Treatment outcomes	1.8	0.9	3.9	1.5	1.6	0.9	1.4	0.5	1.12	0.90	to	1.39	.328	0.88	0.75	to	1.03	.104	2.48	1.95	to	3.15	<.001	
Psychological outcomes	1.8	0.8	3.5	1.7	1.9	1.0	1.6	0.7	0.96	0.78	to	1.18	.676	0.86	0.73	to	1.01	.070	2.32	1.79	to	3.00	<.001	
Social outcomes	2.6	1.7	4.8	1.8	2.6	1.7	2.5	1.2	0.99	0.76	to	1.29	.935	0.97	0.81	to	1.18	.787	1.93	1.47	to	2.52	<.001	

Abbreviations: SD, standard deviation; RR, relative rate; CI, confidence interval; T1: assessment scheduled before the training program; T2: assessment scheduled after training for the training group and 4 months after T1 for the waiting list group.
*Estimated RR based on generalized linear Poisson regression models
† Negative binomial distribution

manuals, was then taken. An inter-rater reliability score has thus not been performed. The two raters were both blind until they may recognize the physician's trained or untrained status through his or her use of some learned communication skills.

Cognitive changes

Physicians' self-efficacy in addressing uncertainty and hope was measured before the SP encounter with an 8-item self-report questionnaire designed specifically for the current study. Items were scored on a 10-point Likert scale from *"feeling not at all able to…"*, to *"totally able to…"*. The questionnaire showed adequate internal consistency reliabilities (Cronbach's alpha scores were 0.93 for T1 and 0.96 for T2).

Physicians' sense of mastery in addressing uncertainty and hope was measured after the SP encounter with a 8-item self-report questionnaire designed specifically for the current study. Items were scored on a 4-point Likert scale: *"I didn't know the optimal communication skills"*, *"I knew the optimal communication skills but I was unable to use them"*, *"I was able to use the optimal communication skills but under stress"*, *"I was able to use the optimal communication skills without feeling stressed"*. The questionnaire showed adequate internal consistency reliabilities (Cronbach's alpha scores were 0.99 for T1 and 0.98 for T2).

All questionnaire scores assessing cognitive changes were reduced to a total score of 10.

Emotional changes

Physicians' perceived stress was measured before the relaxation exercise (at the beginning of the assessment procedure) and after the SP encounter (at the end of the assessment procedure) with a 1-item self-report questionnaire, using a 10-point Likert scale ranging from "*feeling not at all stressed*" to "*totally stressed*".

Physiological changes

Physicians' heart rate was measured in beats per minute throughout the assessment procedure using an ambulatory digital Holter recorder (Lifecard CF, Temec Instruments and Be.Med Sprl). The recorded heart rate was automatically corrected for artifacts with software (HRV Tools, Heart Rate Variability Software, Delmar Reynolds), and finally hand-corrected. The physiological recording was divided into three periods: relaxation exercise, chart review, SP encounter, each of which was further divided into five periods (from minute 6–10 for relaxation, from minute 0–5 for chart review, and from minute 0–5 for the SP encounter). Mean heart rate levels were calculated for each period. This method has been validated in other studies [14,28–35].

While Meunier et al. study used bi-channel psychophysiological registrations (heart rate and salivary cortisol), this study used only mono-channel physiological registrations (heart rate) as heart rate and salivary cortisol had the same response pattern in Meunier et al. study [14]. Moreover, as cortisol diurnal variation would have required to schedule all assessments of this study at the same time of the day, it was decided not to assess salivary cortisol to ensure the feasibility of this study.

Satisfaction with the encounter

Physicians' satisfaction with performance in addressing uncertainty and hope was measured after the SP encounter with a 12-item self-report

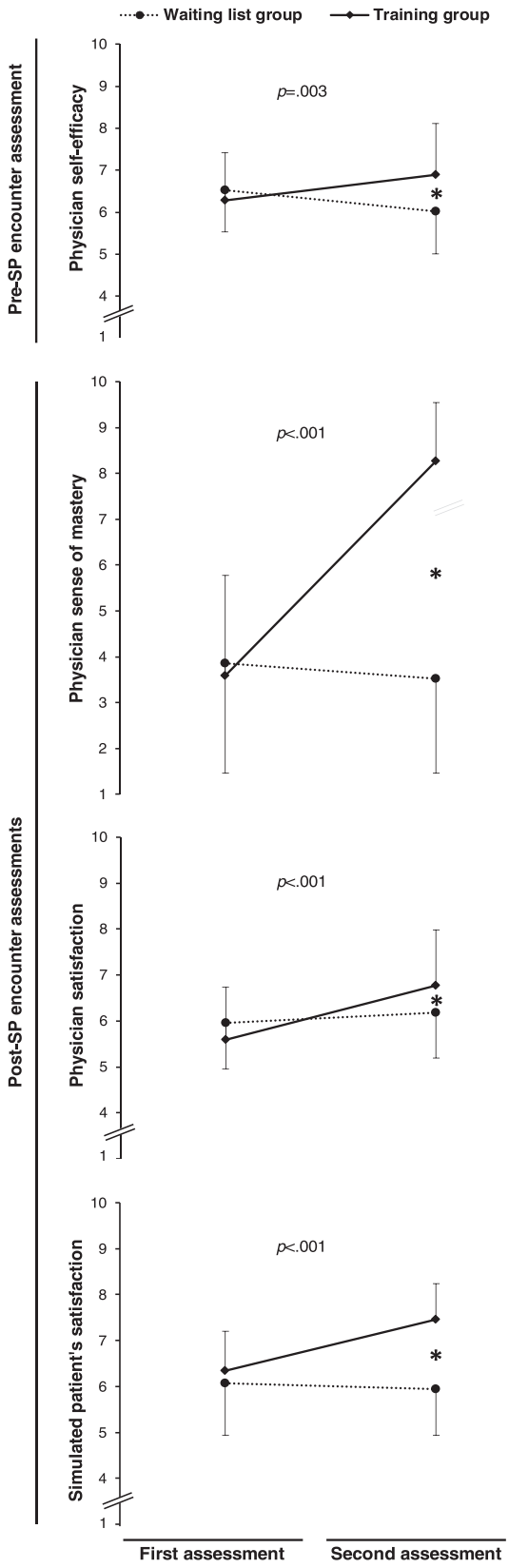

Fig. 4. Physicians' scores of self-efficacy, sense of mastery, satisfaction with the encounter and simulated patient's satisfaction with the encounter at the first and second assessments. Group-by-time effects were assessed with multivariate analysis of variance (MANOVA). Group differences between trained and untrained (waiting list) physicians at the second assessment were analyzed with t-tests (✱). Abbreviation: SP, simulated patient.

questionnaire designed specifically for the current study. Items were scored on a 10-point Likert scale from "*feeling not at all satisfied with…*" to "*totally satisfied with.*". The questionnaire showed adequate internal consistency reliabilities (Cronbach's alpha scores were 0.90 for T1 and 0.89 for T2).

The SP's satisfaction with how well the physician addressed uncertainty and hope was measured after the SP encounter with a 12-item self-report questionnaire designed specifically for the current study. Items were scored on a 10-point Likert scale from, "*feeling not at all satisfied with…*" to "*totally satisfied with…*". The questionnaire showed adequate internal consistency reliabilities (Cronbach's alpha scores were 0.88 for T1 and 0.93 for T2).

Statistical analyses

Statistical analyses included a comparative analysis of sociodemographic data of the training group and the waiting list group at baseline using parametric and nonparametric tests as appropriate (Student's *t* test, Mann-Whitney test and X^2 test). Behavioral, cognitive, emotional and physiological changes were analyzed using Multivariate Analysis of Variance (MANOVA) and Generalized Estimating Equation (GEE) Poisson Regression Models as appropriate. Participants with medications affecting cardiovascular responses were excluded from physiological analyses. All tests were two-tailed, and alpha was set at.05. Analyses were performed with SPSS Version 25.0 for PC (SPSS Inc., Chicago, IL).

Results

Physician characteristics

As shown in Fig. 2, among the 450 physicians asked to participate in the study, a total of 90 physicians registered for the program; 45 of these participants were allocated to the training group (3 physicians dropped out after the first training session) and 45 were allocated to the waiting list group. In total, 87 physicians were included in the statistical analyses on behavioral, cognitive and emotional measures and 83 physicians were included in the analyses on physiological measures (4 physicians were excluded due to medications affecting cardiovascular responses). It should be noted that the flexibility in scheduling of the CST allowed all physicians in the training group to participate in all training sessions.

No statistically significant differences were found in demographics or characteristics between groups with the exception of gender ($p = .040$) with more males in the training group, than in the waiting list group (Table 1). The impact of this difference on the outcomes is difficult to discuss in a longitudinal study as it includes only 87 subjects.

Behavioral changes

As shown in Fig. 3, the GEE revealed significant group-by-time effects (from RR=1.32; $p = .003$ to RR=41.33; $p < .001$) on physicians' general communication skills (assessment, information, support), specific communication skills (addressing uncertainty and hope) and on the SP's expression of concerns about uncertainty and hope (Table 2 and Table 3).

Cognitive changes

As shown in Fig. 4, the MANOVA revealed significant group-by-time effects on physicians' self-efficacy (F=9.3; $p = .003$) and sense of mastery (F=167.9; $p < .001$). T-test analyses revealed significant differences in self-efficacy and in sense of mastery between trained and untrained (waiting list) physicians at the second assessment ($p < .001$) (see Table 4).

Table 4
Physicians' and the simulated patient's subjective self-assessments in the assessment task (n = 87).

Questionnaires	Training group (n = 42)				Waiting list group (n = 45)				MANOVA					
	T1		T2		T1		T2		Group Effects		Time Effects		Training Effects	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	*F*	*p*	*F*	*p*	*F*	*p*
Physician self-efficacy to address uncertainty/hope	6.3	1.7	6.9	1.4	6.5	1.8	6.0	2.0	0.9	.340	0.1	.773	9.3	.003
Physician sense of mastery to address uncertainty/hope	3.6	2.2	8.3	1.3	3.9	2.4	3.5	2.1	33.0	<.001	126.0	<.001	167.9	<.001
Physician perceived stress														
Before relaxation	4.1	2.0	4.0	2.0	3.6	2.0	3.4	2.0	2.4	.128	0.3	.564	0.0	.861
After encounter	3.9	1.8	3.1	2.1	3.5	2.0	3.5	1.8	0.0	.920	4.4	.039	3.1	.080
Satisfaction with the encounter														
Physicians	5.6	1.1	6.8	1.2	6.0	1.6	6.2	1.3	0.2	.666	25.1	<.001	11.4	<.001
Simulated patient	6.3	0.9	7.4	0.8	6.1	1.1	5.9	1.0	25.5	<.001	20.4	<.001	34.1	<.001

Abbreviations: MANOVA, multivariate analysis of variance; SD, standard deviation; RR, relative rate; T1: assessment scheduled before the training program; T2: assessment scheduled after training for the training group and 4 months after T1 for the waiting list group

Emotional changes

As shown in Fig. 5, the MANOVA revealed no significant group-by-time effects on physicians perceived stress (F=3.1; $p = .080$). T-test analyses revealed no significant difference in perceived stress between trained and untrained (waiting list) physicians at the second assessment (see Table 4).

Physiological changes

The time course of heart rate observed during the recorded encounters is typical for mental tasks like Social Trier Stress Test or even mental arithmetic (after an initial 'novelty effect' arousal is taper off). As shown in Fig. 5, the MANOVA revealed some significant group-by-time effects on physicians' heart rate levels during the SP encounter for minute 1, minute 2 and minute 5 (F=7.4; $p = .008$ to F=4; $p = .050$). Heart rate levels remained elevated after training for trained physicians compared to untrained physicians whose heart rate levels decreased. T-

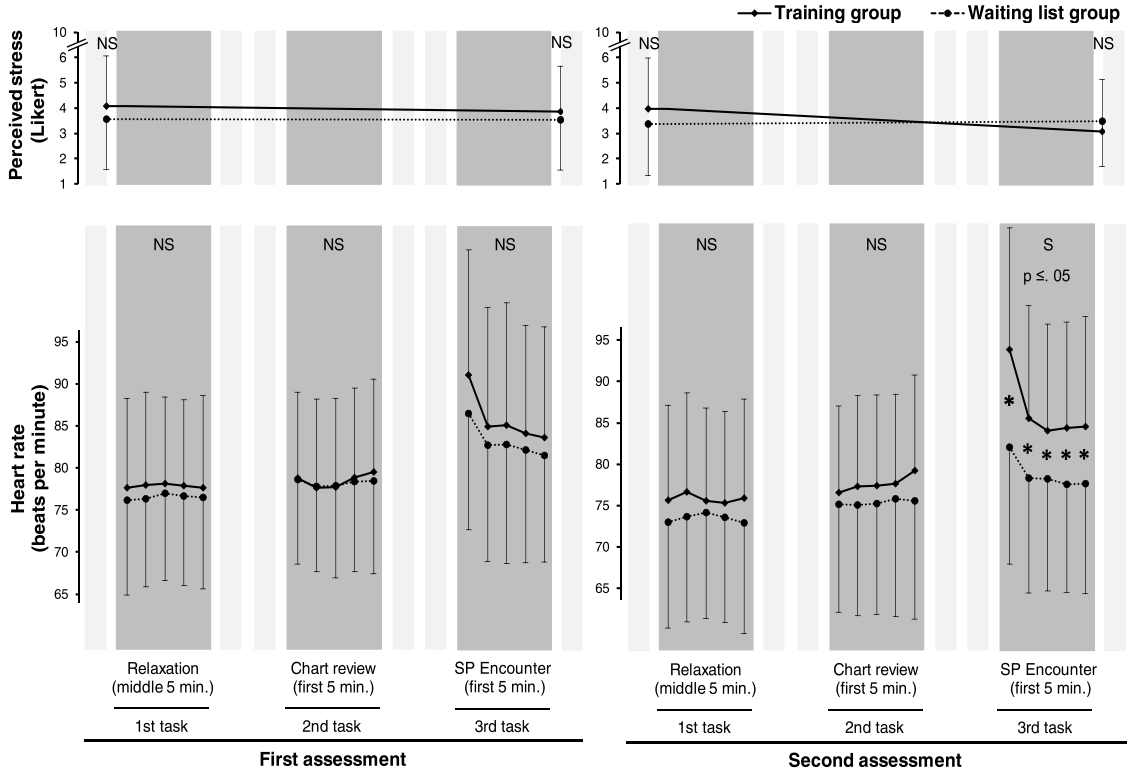

Fig. 5. Physicians' perceived stress and heart rate levels at the first and second assessments. Multivariate analysis of variance (MANOVA) showed significant group-by-time effects on heart rate during the SP encounter for minute 1 ($p < .008$); minute 2 ($p = .050$); and minute 5 ($p = .049$). T-tests showed significant group differences between trained and untrained (waiting list) physicians at the second assessment on heart rate during the SP encounter from minute 1 to minute 5 (✱, from $p < .001$ to $p = .050$). No group-by-time effects or group differences between trained and untrained (waiting list) physicians at second assessment were observed in physicians' perceived stress. Abbreviation: SP, simulated patient.

Table 5
Physicians' physiological arousal in the assessment task (n = 83) *.

Heart rate (beats per minute)	Training group (n = 40)				Waiting list group (n = 43)				MANOVA					
	T1		T2		T1		T2		Group Effects		Time Effects		Training Effects	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	*F*	*p*	*F*	*p*	*F*	*p*
Heart rates during relaxation														
Minute 6	78	11	76	11	76	11	73	13	0.8	.380	5.6	.020	0.3	.576
Minute 7	78	11	77	12	76	10	74	13	1.0	.315	3.1	.082	0.3	.560
Minute 8	78	10	76	11	77	10	74	13	0.3	.610	6.6	.012	0.1	.795
Minute 9	78	10	75	11	77	11	74	13	0.4	.549	7.1	.009	0.1	.704
Minute 10	78	11	76	12	76	11	73	13	0.8	.384	5.9	.017	0.8	.377
Heart rates during chart review														
Minute 1	79	10	77	10	79	10	75	13	0.1	.708	7.0	.010	0.4	.548
Minute 2	78	11	77	11	78	10	75	13	0.2	.640	1.7	.197	1.1	.302
Minute 3	78	11	77	11	78	11	75	13	0.2	.675	1.7	.194	1.0	.311
Minute 4	79	11	78	11	78	11	76	14	0.3	.617	2.5	.115	0.3	.571
Minute 5	80	11	79	12	78	11	76	14	1.0	.320	1.7	.195	1.1	.292
Heart rates during encounter														
Minute 1	91	15	94	15	86	14	82	14	7.7	.007	0.3	.563	7.4	.008
Minute 2	85	14	86	14	83	14	78	14	2.8	.097	2.1	.150	4.0	.050
Minute 3	85	15	84	13	83	14	78	14	2.1	.153	5.3	.024	2.1	.154
Minute 4	84	13	84	13	82	13	78	13	2.9	.093	2.8	.097	3.6	.060
Minute 5	84	13	85	13	82	13	78	13	3.0	.088	1.4	.240	4.0	.049

Abbreviations: MANOVA, multivariate analysis of variance; SD, standard deviation; RR, relative rate; CI, confidence interval; T1: assessment scheduled before the training program; T2: assessment scheduled after training for the training group and 4 months after T1 for the waiting list group.
*For the heart rate analyses, 4 physicians were excluded because they were taking medications that can affect cardiovascular responses.

test analyses revealed significant differences in heart rate during the SP encounter from minute 1 to minute 5 (from $p = .050$ to $p < .001$) between trained and untrained (waiting list) physicians at the second assessment (see Table 5). It should be noticed that physicians kept a high heart rate under the relaxation condition which confirms that such relaxation is difficult to reach in a communication laboratory setting.

Satisfaction with the encounter

As shown in Fig. 4, the MANOVA revealed significant group-by-time effects on satisfaction with the encounter in both physicians and the SP ($F=11.4$; $p < .001$ and $F=34.1$; $p < .001$ respectively). T-test analyses revealed significant differences in physician and the SP's satisfaction with the encounter between trained and untrained (waiting list) physicians at the second assessment ($p < .001$) (see Table 4).

Discussion and conclusion

Discussion

To our knowledge, this is the second study to concurrently assess the behavioral, cognitive, emotional and physiological changes resulting from a CST program designed for physicians caring for cancer patients in a randomized controlled trial. The results of the current study corroborate those of Meunier et al. [14] and therefore confirm the multilevel impact of CST programs. It should be underlined that the Meunier et al. study included only residents, while the present study includes medical specialists.

Compared to untrained physicians (those that were placed on the waiting list), trained physicians showed better general (assessment, information, support) and specific (addressing uncertainty and hope) communication skills and the SP more openly expressed concerns with the trained physicians (behavioral level). As it could be anticipated, most important effects are observed in skills that were not present at T1 and remain not present at T2 in the control group, which illustrates the well-known law of initial values in learning studies (the lower the values at baseline, the larger the effect of an intervention). Moreover as it could be anticipated also, a decrease over time, in the use of general communication skills among untrained physicians was observed, that indicates that the participants are reacting to an already known and challenging task "with less involvement" [14,28]. The resulting statistical effects from an increase in trained and a decrease in control physicians might overestimate the efficacy of the program.

In addition, compared to untrained physicians, trained physicians reported higher levels of self-efficacy and sense of mastery (cognitive level), the same level of perceived stress (emotional level), and demonstrated a higher heart rate during the encounter with the SP (physiological level). As expected, trained physicians and the SP exhibited a higher level of satisfaction with the encounter.

These concurrent multilevel observations indicate that the manualized 30-h CST resulted in a learning process. As expected, we observed a training effect. The CST used learner-centered, skills-focused and practice-oriented techniques with small groups of physicians (three per group) and was based on a specific algorithmic model aimed at addressing uncertainty and hope with cancer patients. The flexible scheduling of the CST allowed all physicians in the training group to participate in all training sessions. Furthermore, each participant was able to repeatedly experience specific communication skills related to discussions of uncertainty and hope during role-playing exercises either as a "physician" (about two hundred times), a "patient" (about two hundred times) or an "observer" (about four hundred times).

How to interpret the physiological arousal related to the training found in the current study? After training, a higher level of physiological arousal, as measured through a higher level of heart rate, was observed during the SP encounter. It should be underlined at this level that the results of this study allow to disentangle physicians' increased engagement (increase of mental effort) and a potential increased level of their speech (increase of speaking) which may both increase heart, by counting the number of words expressed by physicians and the SP (see Table 2 & 3). As no increase over time of physician speech level has been noticed and as only the speech level of the SP increases over time, it may be concluded that increased physicians' heart rate is most probably not related to their speech level. Therefore, the higher level of physiological arousal – which was associated with better performance, a higher level of self-efficacy and sense of mastery, without more perceived stress – may be an indicator of an appropriate engagement in performing the task. Trained physicians feel more able to perform the task, they engage in and perform the task better and their level of physiological arousal is elevated.

How to interpret the physiological changes over time observed in the

current study? The heart rate of trained physicians remained elevated during the SP encounter compared to the untrained physicians (waiting list participants) whose heart rate decreased, while there was no increase in perceived stress. The elevated heart rate observed in both groups during the SP encounter at baseline (first assessment) may reflect a response to an unknown task which the participants perceive as "a test" (typical novelty effect arousal) [36,37]. The elevated heart rate observed during the SP encounter in the trained physicians but not the waiting list participants at the second assessment, may reflect an arousal indicating an engagement to respond appropriately to a known task which is now appraised as "a challenge" [14,38]. In other words, this higher level of arousal may reflect an engagement to use reflexively learned communication skills, while maintaining step-by-step attention to a complex task challenges. According to this, the physiological arousal observed in the trained group is indicative of an early learning stage, which requires constant attentional control to enhance performance. It may be hypothesized, that in more advanced learning stages (after more practice, for example) this arousal level would no longer be observed, as constant attentional control would no longer be needed. It should also be noted that there was a tendency for perceived stress to be slightly decreased in trained physicians. The decreased heart rate in untrained physicians, on the other hand, may indicate that the participants are reacting to an already known task "as usually" [14,32]. In other words, this lower level of arousal may reflect a more automatic and less reflexive engagement in performing an already known task.

Some limitations of the current study should be underlined. First, all participants voluntarily enrolled in the study, leading to limitations on the generalizability of the results. The participants may have had a higher level of motivation to learn communication skills than the general population of physicians which may impact the multilevel observations. Second, the current study used an SP for assessment and therefore does not take into account the variability of actual cancer patients and what may arise in the clinical setting. Third, the aim of the current paper was to assess the cognitive, emotional and physiological changes directly related to physicians' communication skills learning. This program may thus be further tested to assess its usefulness in a clinical setting.

It has been argued that including physiological variables in such a study may confuse more than clarify the process of learning communication skills [39]. We are however convinced that physiological variables may give a more global (psychobiological in general and psychophysiological in particular) understanding about the process of acquiring complex communication skills to deal with highly emotional loaded clinical encounters.

Conclusion

A learner-centered, skills-focused and practice-oriented manualized 30-h CST program induced multilevel changes indicating physician engagement in a learning process and acquisition of mastered communication skills.

Practice implications

Results of this psychophysiological study underline the usefulness of a complex communication simulated task to assess the efficacy of CST. As the results of this study confirm those of Meunier et al. [14], there is now sufficient evidence to suggest that a learner-centered, skilled-focused and practice-oriented CST, conducted in small groups, is associated also with a physiological arousal proportional to the complexity of the simulated task, beside the acquired reflexivity about how to deal with the task. Trainers should consider the CST multilevel benefits (behavioral, cognitive, emotional and physiological) before, during and after a complex communication simulated task as an innovative way to assess the efficacy of a communication skills learning process.

Results of this study have numerous research implications. For example, future studies may consider to assess, how longer training and thus a deeper learning, may decrease both perceived stress and physiological arousal, and provide consequently an increased psychophysiological comfort. For example also, future studies may focus on, how much multilevel observations recorded in a simulated task are associated with a transfer of communication skills to clinical practice.

Acknowledgment

This program was supported by the National Cancer Plan of Belgium, the Centre de Psycho-Oncologie, the Université Libre de Bruxelles, and grants provided by the "Fonds National de la Recherche Scientifique–section Télévie" of Belgium (grant number 7.46.04.14).

CRediT authorship contribution statement

Conception and design: Yves Libert, Livia Peternelj, Isabelle Bragard, Christine Reynaert, Darius Razavi, Collection and assembly of data: Yves Libert, Livia Peternelj, Jean-Louis Slachmuylder, Data analysis and interpretation: Yves Libert, Livia Peternelj, Jean-Louis Slachmuylder, Darius Razavi, Manuscript writing: All authors, Final approval of manuscript: All authors.

Conflict of interest

The authors have declared that there is no conflict of interest.

Informed consent

The authors affirm that all personal identifiers have been removed so that participating physicians are not identifiable and cannot be identified through narrative details.

References

[1] Liénard A, Merckaert I, Libert Y, et al. Is it possible to improve residents breaking bad news skills? A randomised study assessing the efficacy of a communication skills training program. Br J Cancer 2010;103:171–7.
[2] Henselmans I, Smets E, de Haes J, Dijkgraaf MG, de Vos F, van Laarhoven HW. A randomized controlled trial of a skills training for oncologists and a communication aid for patients to stimulate shared decision making about palliative systemic treatment (CHOICE): Study protocol. BMC Cancer 2018;18:55.
[3] Torke AM, Quest TE, Kinlaw K, Eley JW, Branch WT. A workshop to teach medical students communication skills and clinical knowledge about end-of-life care. J Gen Intern Med 2004;19:540–4.
[4] Wuensch A, Goelz T, Ihorst G, et al. Effect of individualized communication skills training on physicians' discussion of clinical trials in oncology: results from a randomized controlled trial. BMC Cancer 2017;17:264.
[5] Delvaux N, Merckaert I, Marchal S, et al. Physicians' communication with a cancer patient and a relative: A randomized study assessing the efficacy of consolidation workshops. Cancer: Interdiscip Int J Am Cancer Soc 2005;103:2397–411.
[6] Barth J, Lannen P. Efficacy of communication skills training courses in oncology: A systematic review and meta-analysis. Ann Oncol 2010;22:1030–40.
[7] Goelz T, Wuensch A, Stubenrauch S, et al. Specific training program improves oncologists' palliative care communication skills in a randomized controlled trial. J Clin Oncol 2011;29:3402–7.
[8] Merckaert I, Delevallez F, Gibon AS, et al. Transfer of communication skills to the workplace: impact of a 38-hour communication skills training program designed for radiotherapy teams. J Clin Oncol 2015;33:901–9.
[9] Ammentorp J, Sabroe S, Kofoed P-E, Mainz J. The effect of training in communication skills on medical doctors' and nurses' self-efficacy: A randomized controlled trial. Patient Educ Couns 2007;66:270–7.
[10] Delvaux N, Razavi D, Marchal S, Bredart A, Farvacques C, Slachmuylder JL. Effects of a 105h psychological training program on attitudes, communication skills and occupational stress in oncology: A randomised study. Br J Cancer 2004;90:106–14.
[11] Fallowfield L, Jenkins V, Farewell V, Saul J, Duffy A, Eves R. Efficacy of a Cancer Research UK communication skills training model for oncologists: A randomised controlled trial. Lancet 2002;359:650–6.
[12] Gibon A-S, Merckaert I, Liénard A, et al. Is it possible to improve radiotherapy team members' communication skills? A randomized study assessing the efficacy of a 38-h communication skills training program. Radiother Oncol 2013;109:170–7.
[13] Bragard I, Etienne A-M, Merckaert I, Libert Y, Razavi D. Efficacy of a communication and stress management training on medical residents' self-efficacy, stress to communicate and burnout: a randomized controlled study. J Health Psychol 2010;15:1075–81.

[14] Meunier J, Merckaert I, Libert Y, et al. The effect of communication skills training on residents' physiological arousal in a breaking bad news simulated task. Patient Educ Couns 2013;93:40–7.
[15] Stewart M. Improving communication between doctors and breast cancer patients. Ann Fam Med 2007;5:387–94.
[16] Wilkinson S, Perry R, Blanchard K, Linsell L. Effectiveness of a three-day communication skills course in changing nurses' communication skills with cancer/palliative care patients: a randomised controlled trial. Palliat Med 2008;22:365–75.
[17] Curtis JR, Back AL, Ford DW, et al. Effect of communication skills training for residents and nurse practitioners on quality of communication with patients with serious illness: a randomized trial. JAMA 2013;310:2271–81.
[18] Moore PM, Rivera S, Bravo-Soto GA, Olivares C, Lawrie TA. Communication skills training for healthcare professionals working with people who have cancer. Cochrane Database Syst Rev 2018;7:CD003751.
[19] Ainsworth MA, Rogers LP, Markus JF, Dorsey NK, Blackwell TA, Petrusa ER. Standardized patient encounters: A method for teaching and evaluation. JAMA 1991;266:1390–6.
[20] Barrows HS. An overview of the uses of standardized patients for teaching and evaluating clinical skills. ACADEMIC Med-Phila 1993;68:443.
[21] Hoppe RB. Standardized (simulated) patients and the medical interview. The Medical Interview. Springer; 1995. p. 397–404.
[22] Libert Y, Peternelj L, Bragard I, et al. Communication about uncertainty and hope: A randomized controlled trial assessing the efficacy of a communication skills training program for physicians caring for cancer patients. BMC Cancer 2017;17:476.
[23] de Figueiredo MN, Rodolph B, Bylund CL, et al. ComOn Coaching: Study protocol of a randomized controlled trial to assess the effect of a varied number of coaching sessions on transfer into clinical practice following communication skills training. BMC Cancer 2015;15:503.
[24] Fallowfield L, Jenkins V, Farewell V, Solis-Trapala I. Enduring impact of communication skills training: results of a 12-month follow-up. Br J Cancer 2003;89:1445–9.
[25] Taras J, Everett T. Rapid cycle deliberate practice in medical education - A systematic review. Cureus 2017;9:e1180.
[26] Gibon A-S, Durieux J-F, Merckaert I, et al. Development of the LaComm 1.0, A French medical communication analysis software: A study assessing its sensitivity to change. Patient Educ Couns 2016.
[27] Booth KMP. Development of a Rating System to Assess Interaction Between Cancer Patients and Health Professionals. London, United Kingdom: Report to Cancer Research Campaign; 1991.
[28] Richter M, Friedrich A, Gendolla GH. Task difficulty effects on cardiac activity. Psychophysiology 2008;45:869–75.
[29] Studer RK, Danuser B, Gomez P. Physicians' psychophysiological stress reaction in medical communication of bad news: A critical literature review. Int J Psychophysiol 2017;120:14–22.
[30] Brown R, Dunn S, Byrnes K, Morris R, Heinrich P, Shaw J. Doctors' stress responses and poor communication performance in simulated bad-news consultations. Acad Med 2009;84:1595–602.
[31] Cohen L, Baile WF, Henninger E, et al. Physiological and psychological effects of delivering medical news using a simulated physician-patient scenario. J Behav Med 2003;26:459–71.
[32] Hulsman RL, Pranger S, Koot S, Fabriek M, Karemaker JM, Smets EM. How stressful is doctor-patient communication? Physiological and psychological stress of medical students in simulated history taking and bad-news consultations. Int J Psychophysiol 2010;77:26–34.
[33] van Dulmen S, Tromp F, Grosfeld F, ten Cate O, Bensing J. The impact of assessing simulated bad news consultations on medical students' stress response and communication performance. Psychoneuroendocrinology 2007;32:943–50.
[34] Shaw J, Brown R, Heinrich P, Dunn S. Doctors' experience of stress during simulated bad news consultations. Patient Educ Couns 2013;93:203–8.
[35] Shaw J, Brown R, Dunn S. The impact of delivery style on doctors' experience of stress during simulated bad news consultations. Patient Educ Couns 2015;98:1255–9.
[36] Gaillard AWK. Stress, workload, and fatigue as three biobehavioral states: A general overview. In: Hancock PA, Desmond PA, editors. Stress, workload, and fatigue. CRC Press; 2001. p. 623–40.
[37] Lazarus RS. Theory based stress measurement. Psychol Inq 1990;1:3–13.
[38] Blascovich J. Challenge and threat. Handbook of Approach and Avoidance Motivation. New York, NY: Psychology Press,; 2008.
[39] Salander P. Including physiological variables in studies might confuse more than clarify. Patient Educ Couns 2014;94:140.

Glossary terms

CST: communication skills training
SP: simulated patient
CPO: Centre de Psycho-Oncologie