Maastricht University

Illness perceptions and changes in lifestyle following a gynecological cancer diagnosis

Citation for published version (APA):

van Broekhoven, M. E. C. L., de Rooij, B. H., Pijnenborg, J. M. A., Vos, M. C., Boll, D., Kruitwagen, R. F. P. M., van de Poll-Franse, L. V., & Ezendam, N. P. M. (2017). Illness perceptions and changes in lifestyle following a gynecological cancer diagnosis: A longitudinal analysis. *Gynecologic Oncology*, *145*(2), 310-318. https://doi.org/10.1016/j.ygyno.2017.02.037

Document status and date:
Published: 01/05/2017

DOI:
10.1016/j.ygyno.2017.02.037

Document Version:
Publisher's PDF, also known as Version of record

Document license:
Taverne

Please check the document version of this publication:

• A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
• The final author version and the galley proof are versions of the publication after peer review.
• The final published version features the final layout of the paper including the volume, issue and page numbers.

Link to publication

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

• Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
• You may not further distribute the material or use it for any profit-making activity or commercial gain
• You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the “Taverne” license above, please follow below link for the End User Agreement:

www.umlib.nl/taverne-license

Take down policy
If you believe that this document breaches copyright please contact us at:

repository@maastrichtuniversity.nl

providing details and we will investigate your claim.

Download date: 24 Apr. 2024

Gynecologic Oncology 145 (2017) 310–318

Contents lists available at ScienceDirect

Gynecologic Oncology

journal homepage: www.elsevier.com/locate/ygyno

Illness perceptions and changes in lifestyle following a gynecological cancer diagnosis: A longitudinal analysis

Marlou E.C.L. van Broekhoven [a], Belle H. de Rooij [a,b], Johanna M.A. Pijnenborg [c], M. Caroline Vos [c], Dorry Boll [d], Roy F.P.M. Kruitwagen [e], Lonneke V. van de Poll-Franse [a,b,f], Nicole P.M. Ezendam [a,b,*]

[a] Netherlands Comprehensive Cancer Organization, Utrecht, The Netherlands
[b] CoRPS - Center of Research on Psychology in Somatic diseases, Department of Medical and Clinical Psychology, Tilburg University, Tilburg, The Netherlands
[c] Department of Obstetrics and Gynaecology, Elisabeth-TweeSteden Hospital, Tilburg and Waalwijk, The Netherlands
[d] Department of Gynecology, Catharina Hospital, Eindhoven, The Netherlands
[e] Department of Gynecology and GROW - School for Oncology and Developmental Biology, Maastricht University Medical Center, Maastricht, The Netherlands
[f] Division of Psychosocial Research and Epidemiology, The Netherlands Cancer Institute, Amsterdam, The Netherlands

HIGHLIGHTS

- Most endometrial and ovarian cancer patients do not change their smoking, alcohol consumption or BMI following diagnosis.
- However, some subgroups decreased smoking and alcohol intake.
- More threatening illness perceptions were not associated with positive lifestyle changes.

ARTICLE INFO

Article history:
Received 15 August 2016
Received in revised form 14 February 2017
Accepted 22 February 2017
Available online 6 March 2017

Keywords:
Gynecological cancer patients
Longitudinal study
Latent class growth curve analysis
Lifestyle
Illness perceptions
Survivorship

ABSTRACT

Objective. This study explores patterns of lifestyle change and whether more threatening illness perceptions are associated with lifestyle changes post-treatment for smoking, alcohol consumption and Body Mass Index (BMI) among gynecological cancer patients.

Methods. In total, 395 cancer patients ($N = 221$ endometrial; $N = 174$ ovarian) were included in this secondary analysis of longitudinal data. Lifestyle outcomes were assessed through self-reported questionnaires after initial treatment and 6, 12, and 18 months of follow-up. Illness perceptions were assessed with the Brief Illness Perception Questionnaire (BIPQ). Latent class growth curve analyses were conducted to identify patterns of lifestyle change and linear mixed models using between-subject and within-subject effects to explore the association between BIPQ items and alcohol consumption (glasses/week) and BMI (kg/m^2).

Results. After initial treatment, 15% ($N = 57$) of the patients smoked, 53% ($N = 203$) drank alcohol, and 60% ($N = 236$) were overweight or obese. Overall, smokers made no considerable changes, but one subgroup of low level smokers reported positive decline. A slight decrease was observed for alcohol consumption among low and moderate level alcohol drinker subgroups, whereas BMI remained stable among endometrial cancer patients and increased for ovarian cancer patients. Moreover, patients with lower trust in their treatment to cure the disease drank more alcohol ($\beta = 0.32$ glasses/week [95% CI 0.09; 0.56]).

Conclusions. Change in lifestyle after a gynecological cancer treatment is not self-evident. Moreover, more threatening illness perceptions were not related to a healthier lifestyle. This study underlines the need for lifestyle-promoting activities to facilitate lifestyle improvement among gynecological cancer patients.

© 2017 Elsevier Inc. All rights reserved.

1. Introduction

Endometrial and ovarian cancer are, respectively, the fourth and seventh most frequently diagnosed cancers in women worldwide [1,2]. Nowadays, the five-year survival rate for endometrial cancer patients has increased to 80% and for ovarian cancer patients to 46% [3,4]. The survival rate for ovarian cancer patients is much lower, since this type of cancer is often diagnosed in an advanced stage of the disease [4]. Due to the ageing population, increased incidence, and improved treatment regimens, the number of endometrial and ovarian cancer survivors is growing [4].

Despite the encouraging developments in survival rates, cancer patients are more susceptible to adverse health outcomes compared to the

* Corresponding author at: Netherlands Comprehensive Cancer Organization, Zernikestraat 29, 5600 AE Eindhoven, The Netherlands.
E-mail address: N.Ezendam@iknl.nl (N.P.M. Ezendam).

http://dx.doi.org/10.1016/j.ygyno.2017.02.037
0090-8258/© 2017 Elsevier Inc. All rights reserved.

general population, which can primarily be attributed to the disease and its treatment [5]. However, lifestyle behaviors also play an important role in the survival of cancer patients [5]. Continued smoking, high alcohol consumption, and high Body Mass Index (BMI) are associated with an increased risk for the development of new primary cancers and cardiovascular disease, higher recurrence and mortality rates, and poorer quality of life [6–11]. It is recommended that cancer patients refrain from smoking, minimize the consumption of alcoholic beverages, and pursue a healthy body weight, but the results of several studies showed that the majority of the cancer patients do not meet these recommendations [5,12]. Smoking has a known protective effect on endometrial cancer risk. However, in cancer survivorship it is more beneficial to abstain from smoking to improve prognosis [13]. A cancer diagnosis is often regarded as a health threat that motivates individuals to adopt risk-reducing lifestyle changes to achieve and preserve improved health outcomes [14,15]. Hence, cancer patients are an important target population for the promotion of healthy lifestyle changes [16].

In recent years, there has been an increasing interest in research focusing on the relationship of illness perceptions and health-related outcomes in chronic disorders [17,18]. Illness perceptions comprise several dimensions through which disease is perceived: the extent to which the disease affects life, the duration of the disease (acute/chronic), the own influence of the patient on the disease, helpfulness of the treatment, experienced symptoms, concern about the disease, understanding of the disease, and experienced emotional consequences [19]. Through both cognitive (threat perception) and emotional (fear arousal) responses, more threatening illness perceptions are expected to increase motivation to improve lifestyle [20]. However, defensive mechanisms to control the fear and inability to cope with the threatening illness perceptions may also result in maladaptive coping, which may then not result in behavioral improvement [21–23].

A better understanding of lifestyle behavioral patterns after a cancer diagnosis may provide new insights into effective prevention of the development of adverse health outcomes among gynecological cancer patients to promote long-term survival. Previous research mostly used cross-sectional designs or did not specifically focus on gynecological cancer patients [15,16,24–29]. Due to differences in prognosis between endometrial and ovarian cancer patients, and the lack of research concerning lifestyle of gynecological cancer patients, this longitudinal study could provide a relevant contribution to current knowledge [11]. The objectives of the current study are: (1) to describe longitudinal change patterns of smoking, alcohol consumption, and BMI post-treatment among endometrial and ovarian cancer patients and (2) to examine the influence of changes in illness perceptions on lifestyle. It is hypothesized that cancer patients that report more threatening illness perceptions are more likely to decrease the amount of smoking, alcohol consumption, and BMI.

2. Methods

2.1. Design

This study is a secondary analysis of the longitudinal data of a pragmatic, cluster randomized controlled trial: the ROGY Care Trial (Registrationsystem Oncological GYnecology) [30]. The purpose of the trial was to assess the effects of providing a Survivorship Care Plan (SCP) to improve the information provision and post-treatment care for cancer patients [30]. We presumed that the intervention did not affect lifestyle, since the SCP in this trial did not provide any information on lifestyle changes. Thus we used the data of both trial arms as a prospective cohort study. Data were collected after initial treatment and at 6, 12, and 18 months of follow-up. The study was approved by the medical research ethics committees of the participating hospitals and was executed in concordance with the Declaration of Helsinki (2008) [30].

2.2. Participants and data collection

The eligibility criteria to participate in this study were: (1) newly diagnosed with either endometrial or ovarian cancer as a primary tumor between April 2011 and October 2012, (2) not undergoing palliative care, (3) aged ≥ 18 years, and (4) able to complete a Dutch questionnaire [30]. A total of 296 endometrial and 248 ovarian cancer patients were eligible to participate ($N = 544$). After initial treatment, the eligible participants were invited for participation by sending them the first questionnaire combined with a letter of invitation and an informed consent form. The first questionnaire was completed and returned by 73% of the participants ($N = 395$). For the subsequent waves, response rates were 52% at 6 months ($N = 282$), 46% at 12 months ($N = 248$), and 42% at 18 months ($N = 230$) of follow-up (Fig. 1).

2.3. Measurements

2.3.1. Socio-demographic and clinical characteristics

Socio-demographic (age, educational level, socio-economic status and marital status, and occupational status) and clinical (type of cancer, tumor stage, and treatment regimen) characteristics have earlier been associated with both illness perceptions as well as lifestyle behaviors and were therefore included as confounders in our analyses [6,12,31,32]. Socio-economic status and clinical characteristics (type of cancer, tumor stage, and treatment regimen) of the participants were obtained from the Netherlands Cancer Registry (NCR). Other socio-demographic information, such as age at time of the questionnaire, level of education (low = no/primary school; intermediate = lower general secondary education/vocational training; high = pre-university education/high vocational training/university), partner status (partner = /living together; no partner = divorced/widowed/never married), and occupational status (employed vs. unemployed) were acquired through the self-administered questionnaires.

2.3.2. Smoking and alcohol consumption

Participants were asked to indicate smoking and alcohol consumption through closed-ended questions: “Do you smoke/consume alcohol?” (never, previous, current smoker/drinker). When the participant answered ‘current smoker’, a subsequent question assessed the number of cigarettes smoked per day and cigars and/or pipes smoked per week. The different types of smoking were summed to generate the overall amount of smoking in grams (g) tobacco per week with conversion measures of 1 g tobacco/cigarette, 4.5 g tobacco/cigar, and 3 g tobacco/pipe [29]. The alcohol consumption of the ‘current drinker’ was assessed in glasses of beer, wine, and/or liquor consumed per week. The amounts of glasses consumed were summed to compute total alcohol consumption per week. Smoking and alcohol consumption were measured at initial treatment, 6, and 18 months of follow-up.

2.3.3. BMI

Length (in centimeters) and weight (in kilograms) were self-assessed after initial treatment as part of the questionnaires. In addition, weight was also assessed at 6, 12, and 18 months of follow-up. BMI was calculated as weight in kilograms divided by length in meters squared and categorized following the standards of the World Health Organization (WHO): *underweight* (BMI: <18.5 kg/m^2), *normal weight* (BMI: 18.5 < and >24.99 kg/m^2), *overweight* (BMI: 25.0 < and >29.99 kg/m^2), and *obese* (BMI: >30.0 kg/m^2).

2.3.4. Illness perceptions

As part of the self-administered questionnaires, participants completed a Dutch version of the Brief Illness Perception Questionnaire (BIPQ) after initial treatment, 6 months, and 12 months of follow-up [19]. The BIPQ is a validated instrument developed to assess illness perceptions using the following eight items: consequences, timeline, personal control, treatment control, identity, concern, illness coherence,

and emotional representations [33]. All items were rated on a scale, ranging from zero to ten (0 − 10), to represent the degree to which the disease is perceived as threatening or benign. Reverse scores were calculated for personal control, treatment control, and concern in order to create a concordance in the direction of scales: a higher score indicates a more threatening view and experience of the disease [19]. Internal consistency of the BIPQ items was good (Cronbach's Alpha: 0.79–0.81) for each data wave.

2.4. Statistical analyses

2.4.1. Descriptive statistics

Descriptive statistics were used to describe the socio-demographic and clinical characteristics of the study participants after initial treatment. Data were presented as means with standard deviations (SD) for continuous variables and frequencies (*N*) with percentages (%) for categorical variables. Differences in socio-demographic and clinical characteristics between participants who completed all four questionnaires (full responders) and those who completed three or less questionnaires (lost to follow-up) were assessed using χ^2-tests or Fisher's exact tests for categorical variables and *t*-tests for continuous variables. Accordingly, differences in lifestyle and illness perceptions for endometrial and ovarian cancer patients were assessed. Statistical analyses were conducted using SAS version 9.4 (Statistical Analysis System, SAS Institute, Cary, NC, 1999).

2.4.2. Latent class growth curve analysis

Latent class growth curve analysis (LCGA) models individual trajectories with similar patterns of change over time in distinct homogeneous subgroups (latent classes) [34,35]. For this study, smoking (grams tobacco/week), alcohol consumption (glasses/week), and BMI (kg/m^2) were treated as the dependent continuous variables and time as the independent variable. The trajectories were modeled over three time points (after initial treatment, 6 months, and 18 months of follow-up) for smoking and alcohol consumption and all four time points for BMI. We stratified the analysis for BMI by cancer type (i.e. separately for endometrial and ovarian cancer survivors) due to significant differences in BMI according to the LCGA analysis. More detailed information about this analysis can be found in the Appendix. The analysis was conducted using LatentGold version 5.0.

2.4.3. Longitudinal linear mixed model

The associations between illness perceptions and alcohol consumption (glasses/week) and BMI (kg/m^2), as the continuous dependent variables, were analyzed with linear mixed models with between and within-subject effects. The small number of participants who smoked in our study ($N = 56$), did not allow further regression analyses in this group. Since alcohol consumption was not measured at 12 months of follow-up, scores were imputed with mean scores of the previous and following wave. The between-subject estimate was used to assess whether differences in the independent variable, BIPQ item, between

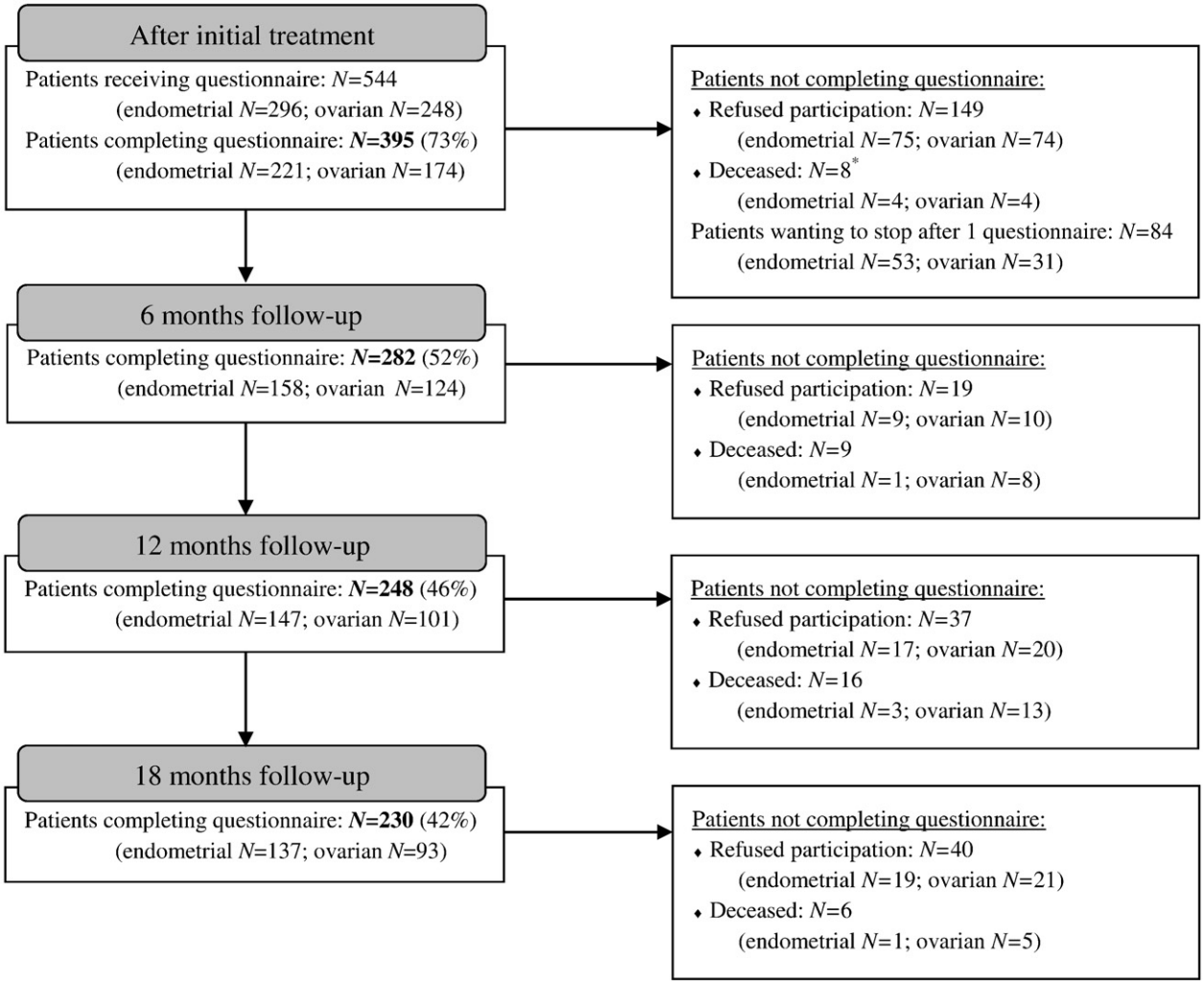

Fig. 1. Flow diagram of endometrial and ovarian cancer patients through the phases of the study. *No questionnaires were sent to those who were deceased after initial treatment or to those wanting to stop after 1 questionnaire. Percentages represent the response rate with respect to the invitation after initial treatment.

participants resulted in differences in alcohol consumption and BMI. The between-subject variable was computed using the participants' average score on the BIPQ item across all time points for alcohol consumption and BMI. The within-subject estimate was used to analyze whether change in BIPQ item within a participant was related to change in the dependent variables and was computed by the difference between a participants' BIPQ item at a certain time point minus the participants' average throughout the study.

In the first step of the linear mixed model (Model 1), the independent variables comprised between-subject and within-subject variables for one BIPQ item together with a variable for time (in months). This procedure was executed using PROC MIXED with a repeated-statement and an unstructured covariance structure in SAS. As the random intercept at the hospital level was not significant we only included a random intercept at the patient level. The second model included all a priori selected confounders: age at time of the questionnaire, cancer type, having a partner, socio-economic status, treatment, and allocation group (Model 2) [12,15]. An additional adjustment was made for trial group allocation since the data originated from a RCT, although there was no significant effect of trial allocation on any of the lifestyle outcomes. As a third step in the analyses interaction terms were included to study whether associations were different for cancer type.

Maximum likelihood estimation was used to account for missing data in all models and to estimate the parameters. Crude and adjusted unstandardized beta coefficients (β) with 95% confidence intervals (95% CI) and *p*-values were presented. For all statistical analyses, *p*-values were considered statistically significant if $p < 0.05$. Statistical analyses were conducted using SAS version 9.4 (Statistical Analysis System, SAS Institute, Cary, NC, 1999).

3. Results

3.1. Characteristics of participants

Full responders were on average three years younger (65 vs. 68 years; $p < 0.01$), were higher educated (low level of education: 13 vs. 28%; $p < 0.01$), and were more likely to have a partner (81 vs. 64%; $p < 0.01$: Table 1) compared to those lost to follow-up. Full responders also predominantly had a lower tumor stage (68 vs. 48%; $p < 0.01$), more often underwent surgery only and less often surgery combined with chemotherapy compared to those lost to follow-up (respectively, 49 vs. 33%; $p < 0.01$ and 32 vs. 49%; $p < 0.01$).

As shown in Table 2, about 60% of the patients were overweight or obese, especially the endometrial cancer patients (79 vs. 35%; $p < 0.01$). A proportion of 15% smoked after initial treatment and half of the participants never smoked. Fifty-three percent of all cancer patients reported to consume alcohol on a regular basis, with more never drinkers among the endometrial cancer patients (47 vs. 35%; $p = 0.01$). Overall, in terms of illness perceptions, more threatening perceptions can be observed among ovarian cancer patients.

3.2. Patterns of changes in smoking, alcohol consumption, and BMI over time

No considerable overall change in tobacco use could be observed for all smokers ($N = 65$) in the sample (Fig. 2). One subgroup of low level smokers (39%) showed positive tendencies in terms of a decrease in grams tobacco use, whereas two other subgroups showed an increase in grams tobacco use. High level smokers (5%) smoked on average 175 cigarettes (~9 packs) per week and remained stable throughout follow-up. Overall, alcohol drinkers in this study ($N = 222$) showed a slight decrease (on average 1 glass/week) in intake, accordantly reported by low alcohol drinking (21%) and moderate alcohol drinking (43%) subgroups. High stable alcohol drinkers (15%) drank on average 14 glasses/week. Endometrial cancer patients showed an overall stable high BMI for all subgroups. Ovarian cancer patients had a lower BMI than endometrial cancer patients and showed a slight increase in BMI during follow-up. For both cancer types, the severe overweight subgroups tended to fluctuate over the course of the study (18% of all endometrial cancer patients and 10% of all ovarian cancer patients).

3.3. Relations between illness perceptions and alcohol consumption and BMI

Significant between-subject effects were found with regard to BMI: *consequences* ($\beta = -0.52$ [−0.78;−0.28]), *timeline* ($\beta = -0.53$ [−0.74;−0.30]), *identity* ($\beta = -0.48$ [−0.74;−0.22]), *concern* ($\beta = -0.36$ [−0.60;−0.12]), and *emotional representations* ($\beta = -0.26$ [−0.51;−0.01]) (Table 3a). More detailed, patients with a lower BMI have more threatening illness perceptions and experience more severe effect on their life, longer duration, more symptoms, are more concerned about the disease, or are more emotionally affected compared to participants with less threatening illness perceptions. However, these items did not remain significant after adjustment for covariates.

Patients who were less confident their treatment would cure their disease increased their alcohol consumption (*treatment control,* within-subject effect, $\beta = 0.32$ [0.09;0.56]) (Appendix, Table 3b). More specifically, this longitudinal analysis indicates that a one-point increase in treatment control (i.e. finding treatment less helpful) within a person corresponds to an increase of 0.32 glasses alcohol/week over time. Lastly, only one significant interaction term was found for cancer type and within-subject effect for *emotional representations*. The corresponding coefficients of the subgroup analysis were $\beta = 0.11$ [−0.10;0.32] for endometrial cancer patients and $\beta = 0.15$ [−0.33;0.02] for ovarian cancer patients.

4. Discussion

In this longitudinal study, 15% of all participants smoked, 53% were current alcohol drinkers, and 60% were either overweight or obese after initial treatment. Only one subgroup of smokers decreased/stopped smoking (39% of all smokers) and about two-third of the alcohol consuming patients showed a slight decrease in glasses consumed per week. Endometrial cancer patients had high but relatively stable BMI, while ovarian cancer patients showed a lower average BMI after initial treatment which increased for all subgroups throughout study follow-up. Also, current results indicate no substantial evidence for more threatening illness perceptions being related to a healthier lifestyle as was hypothesized. In contrast, we did find that those who had lower trust in their treatment to cure the disease drank more alcohol.

No comparable longitudinal studies assessing heterogeneous subgroups of lifestyle change in gynecological cancer patients have been conducted to date. We are, however, able to compare overall changes in smoking, alcohol consumption, and BMI among other cancer patients populations. Two studies found similar results for alcohol consumption among male cancer patients as the current study, whereas one study had opposite findings, i.e. they found an increase in alcohol consumption among breast cancer patients [29,36,37]. With regard to change in smoking, three studies found positive changes after cancer diagnosis [29,36,37]. This contrasts with the current study, where no changes were found, and may be explained by the protective effect of smoking on the development of endometrial cancer consequently leading to fewer smokers in our sample with less varying smoking behavior. In concordance with our results on change in BMI for ovarian cancer patients, two studies also found an increase among cervical and endometrial cancer patients [38,39]. However, these results were contradicted by earlier findings among male and breast cancer patients [29,36,37]. Also, endometrial patients in this study had a rather stable BMI. Differences may be explained by cancer populations and its risk behaviors (i.e. endometrial cancer patients are more often overweight or obese) [39]. As variations in lifestyle change among different cancer

Table 1
Socio-demographic and clinical characteristics of the total study population, participants who responded to all four questionnaires, and participants who were lost to follow-up after initial treatment.

Characteristic	*N* (%) Total *N* = 395	*N* (%) Full responders (completed all 4 questionnaires) *N* = 230	*N* (%) Lost to follow-up (completed 1–3 questionnaires) *N* = 165	*p*-Value[1]
Socio-demographic factors				
Age at questionnaire (years)				<0.01
Mean (SD)	66.3 (10.0)	64.9 (9.5)	67.9 (11.0)	
Level of education[2]				<0.01
Low	74 (19.0)	29 (12.8)	45 (27.6)	
Intermediate	256 (65.8)	162 (71.7)	94 (57.7)	
High	59 (15.2)	35 (15.5)	24 (14.7)	
Partner status[3]			106 (64.2)	<0.01
Partner	292 (73.9)	186 (80.9)		
No partner	103 (26.1)	44 (19.1)	59 (35.8)	
Occupational status				0.85
Employed	87 (23.8)	52 (24.2)	35 (23.3)	
Not employed	278 (76.2)	163 (75.8)	115 (76.7)	
Socio-economic status				0.11
Low	78 (19.8)	39 (17.0)	39 (23.6)	
Intermediate	167 (42.3)	95 (41.3)	72 (43.6)	
High	150 (38.0)	96 (41.7)	54 (32.7)	
Clinical factors				
Type of cancer				0.09
Endometrial	221 (56.0)	137 (59.6)	84 (50.9)	
Ovarian	174 (44.1)	93 (40.4)	81 (49.1)	
Tumor stage				<0.01
I	231 (59.7)	154 (67.5)	77 (48.4)	
II	32 (8.3)	16 (7.0)	16 (10.1)	
III	86 (22.2)	42 (18.4)	44 (27.7)	
IV	38 (9.8)	16 (7.0)	22 (13.8)	
Treatment				<0.01
Surgery only	167 (42.3)	112 (48.7)	55 (33.3)	
Surgery and RT	75 (19.0)	45 (19.6)	30 (18.2)	
Surgery and CT	153 (38.7)	73 (31.7)	80 (48.5)	
Comorbidity				0.20
None	39 (10.3)	26 (11.7)	13 (8.3)	
1	109 (28.8)	57 (25.6)	52 (33.3)	
2 or more	231 (61.0)	140 (62.8)	91 (58.3)	

Abbreviations: *N*; number of participants, *SD*; standard deviation, *RT*; radiotherapy, *CT*; chemotherapy.
Note: [1]*p*-Values represent comparisons between full responders and those lost to follow-up, according to *t*-tests and Chi-square/Fisher's exact tests. [2]Level of education: *low* = no/primary school; *intermediate* = lower general secondary education/vocational training; *high* = pre-university education/high vocational training/university. [3]Partner status: *partner* = married/living together; *no partner* = divorced/widowed/never married. The percentages do not always add up to 100, since they were rounded up.

populations and sex have been reported, results of the present study may not be fully generalizable to other cancer types (i.e. breast cancer and male cancer patients).

Although scientific support is limited or lacking, some suggestions might explain the increase in BMI among ovarian cancer patients. Chemotherapy or an oophorectomy might induce early menopause which consequently causes weight gain. Although ovarian cancer is diagnosed at a later age this holds true for part of our participants [40]. Moreover, patients may be less physically active due to the cancer and the cancer treatment and might as a result gain weight [39]. Also, some ovarian cancer patients lose weight pre-diagnosis as part of the side-effects of the cancer (i.e. loss of appetite and enlarged abdomen, which can trigger women to actively lose weight) [41]. The observed increase in BMI after treatment might then be explained by a natural return to basic BMI. It is alarming that our results indicate no decline in BMI, since gynecological cancers, especially endometrial cancers, are obesity-driven malignancies and high BMI is associated with adverse health outcomes later in life [11]. Health care providers are more likely to counsel patients on tobacco cessation rather than diet and exercise, whereas knowledge on the role of obesity in the development of gynecological cancer among patients is often lacking [42,43].

To the best of our knowledge, the current study is the first to assess the role of illness perceptions in lifestyle changes in gynecological cancer patients. Our results do not support the hypothesis that more threatening illness perceptions are related to positive lifestyle changes. In contrast, those who had lower trust in their treatment to cure the disease drank more alcohol. Patients may actively engage in health-damaging behaviors as a maladaptive coping response caused by fear and psychological distress (e.g. depression, anxiety) as part of the disease [44]. Indeed, among cancer patients it has been shown that two specific illness perceptions, cyclic timeline and low coherence, were associated with more disturbed mood and depressive symptoms, which was mediated by a denial or disengaged coping style [21,45]. Coping may thus mediate between illness perceptions and mood in a negative, rather than in a positive way [45]. Lack of lifestyle change may also be explained by low levels of self-efficacy for lifestyle change as patients in our study probably did not receive (extensive) educational material to improve self-efficacy [22,23,45,46]. Patients with different information coping styles may respond different on low self-efficacy. Especially 'blunters' may end up in defensive or fear-control motivation, as they do not seek information [22,23]. In contrast, 'monitors' who actively engage in information search as a result on low self-efficacy, will re-evaluate their self-efficacy and ultimately develop danger-control motivation (i.e. they actively engage in behavior that reduces health threats, such as healthy behaviors). Future studies assessing illness perceptions and lifestyle should therefore take mood disturbance, psychological distress, coping, and self-efficacy into consideration.

4.1. Strengths and limitations

An advantage of this study is its prospective examination of lifestyle behaviors, using four measurement moments to 18 months of follow-

Table 2
Lifestyle and illness perceptions according to cancer type after initial treatment.

	Total $N = 395$	Endometrial $N = 221$	Ovarian $N = 174$	
Lifestyle factors	*N* (%)	*N* (%)	*N* (%)	*p*-Value[1]
Smoking				0.27
Never smoker	195 (49.9)	117 (53.2)	78 (45.6)	
Previous smoker	139 (35.6)	75 (34.1)	64 (37.4)	
Current smoker	57 (14.6)	28 (12.7)	29 (17.0)	
Alcohol consumption				0.01
Never drinker	159 (41.5)	99 (46.5)	60 (35.3)	
Previous drinker	21 (5.5)	6 (2.8)	15 (8.8)	
Current drinker	203 (53.0)	108 (50.7)	95 (55.9)	
BMI				<0.01
Underweight	5 (1.3)	0 (0.0)	5 (1.3)	
Normal weight	154 (39.0)	46 (20.8)	108 (62.1)	
Overweight	118 (29.9)	75 (33.9)	43 (24.7)	
Obesity	118 (29.9)	100 (45.3)	18 (10.3)	
Illness perceptions (BIPQ items)	Mean (SD)	Mean (SD)	Mean (SD)	p-Value[1]
Consequences	5.0 (2.7)	4.1 (2.3)	6.1 (2.6)	<0.01
How much does your illness affect your life? (1: no affect; 10: severely affects life)				
Timeline	4.4 (2.8)	3.4 (2.5)	5.5 (2.7)	<0.01
How long do you think your illness will continue? (1: very short time; 10: forever)				
Personal control*	6.2 (3.0)	6.0 (3.0)	6.3 (2.9)	0.32
How much control do you feel you have over your illness? (1: extreme amount of control; 10: absolutely no control)				
Treatment control*	3.3 (2.1)	3.2 (2.2)	3.4 (1.2)	0.33
How much do you think the treatment can help your illness? (1: extremely helpful; 10: not at all)				
Identity	4.1 (2.6)	3.2 (2.3)	5.2 (2.5)	<0.01
How much do you experience symptoms from your illness? (1: no symptoms; 10: many severe symptoms)				
Concern	5.2 (2.8)	4.6 (2.6)	6.0 (2.7)	<0.01
How concerned are you about your illness? (1: not concerned; 10: extremely concerned)				
Illness coherence*	4.4 (2.8)	4.5 (3.0)	4.4 (2.7)	0.81
How well do you feel you understand your illness? (1: understand very clearly; 10: do not understand)				
Emotional representations	4.7 (2.7)	4.3 (2.6)	5.2 (2.7)	<0.01
How much does your illness affect you emotionally? (1: not affected emotionally; 10: extremely affected emotionally)				

Abbreviations: *N*; number of participants, *SD*; standard deviation, *BMI*; Body Mass Index, *BIPQ*; Brief Illness Perceptions Questionnaire.
Note: [1]*p*-Values represent comparisons between endometrial and ovarian cancer patients, according to *t*-tests and Chi-square/Fisher's Exact tests. *BIPQ items personal control, treatment control, and illness coherence were reverse coded, to create concordance in direction of scale. The percentages do not always add up to 100, since they were rounded up.

up, thereby minimizing recall bias. It is also important to emphasize that an assessment of overall lifestyle change, as is often done in prior studies, may not grasp underlying differences in lifestyle changes for heterogeneous subgroups as was shown in our analysis.

However, some limitations of this study should not go unnoticed. A decrease in response rate was observed during follow-up because participants refused participation or were deceased. Since significant differences were found between those who completed all questionnaires and those lost to follow-up, the findings may have been affected by selection bias. For instance, full completers had a younger age, higher level of education, and were more often married, which have earlier been suggested to influence smoking, alcohol consumption, and BMI [36]. Also, those who completed all questionnaires had a lower tumor stage and were less often treated with surgery combined with chemotherapy compared to those lost to follow-up. This could have resulted in a diluted sample with a better general prognosis and less severe treatment side effects, possibly leading to an overestimation of lifestyle changes and decreased generalizability. Moreover, objective measurements are often preferred when addressing lifestyle, but this study used self-reported measurements to assess smoking, alcohol consumption, and BMI. Through self-report participants tend to underreport the amount they smoke and drink, and their weight [47]. Further, since no data was obtained of lifestyle behavior before the cancer diagnosis, we cannot rule out the possibility that we missed lifestyle changes between diagnosis and treatment, which may have led to an underestimation of lifestyle change. Another limitation is that due to the lack of a sufficient amount of smokers who stopped smoking during the course of the study ($N = 10$), we were unable to analyze smoking cessation, which would have been more clinically relevant. Lastly, we did not correct for the type 1 error caused by multiple testing using individual BIPQ items in the linear multilevel mixed models. Therefore, results should be generalized and interpreted with caution, since the chance of a false positive finding has increased to 33% (0.95^8) by multiple testing.

4.2. Implications for future research and clinical practice

To be able to understand and effectively exploit the potential of the threat of a cancer diagnosis to promote healthy lifestyle changes among cancer patients, other factors involved in this issue are worth exploring, such as perceived cause of cancer. When gynecological cancer patients perceive lifestyle to cause development of cancer, they may be more motivated to change lifestyle [28]. The follow-up time of 18 months in this study might be relatively short when it comes to lifestyle changes, as patients are still recovering from treatment. It would be relevant to explore lifestyle changes among gynecological cancer patients on the longer term.

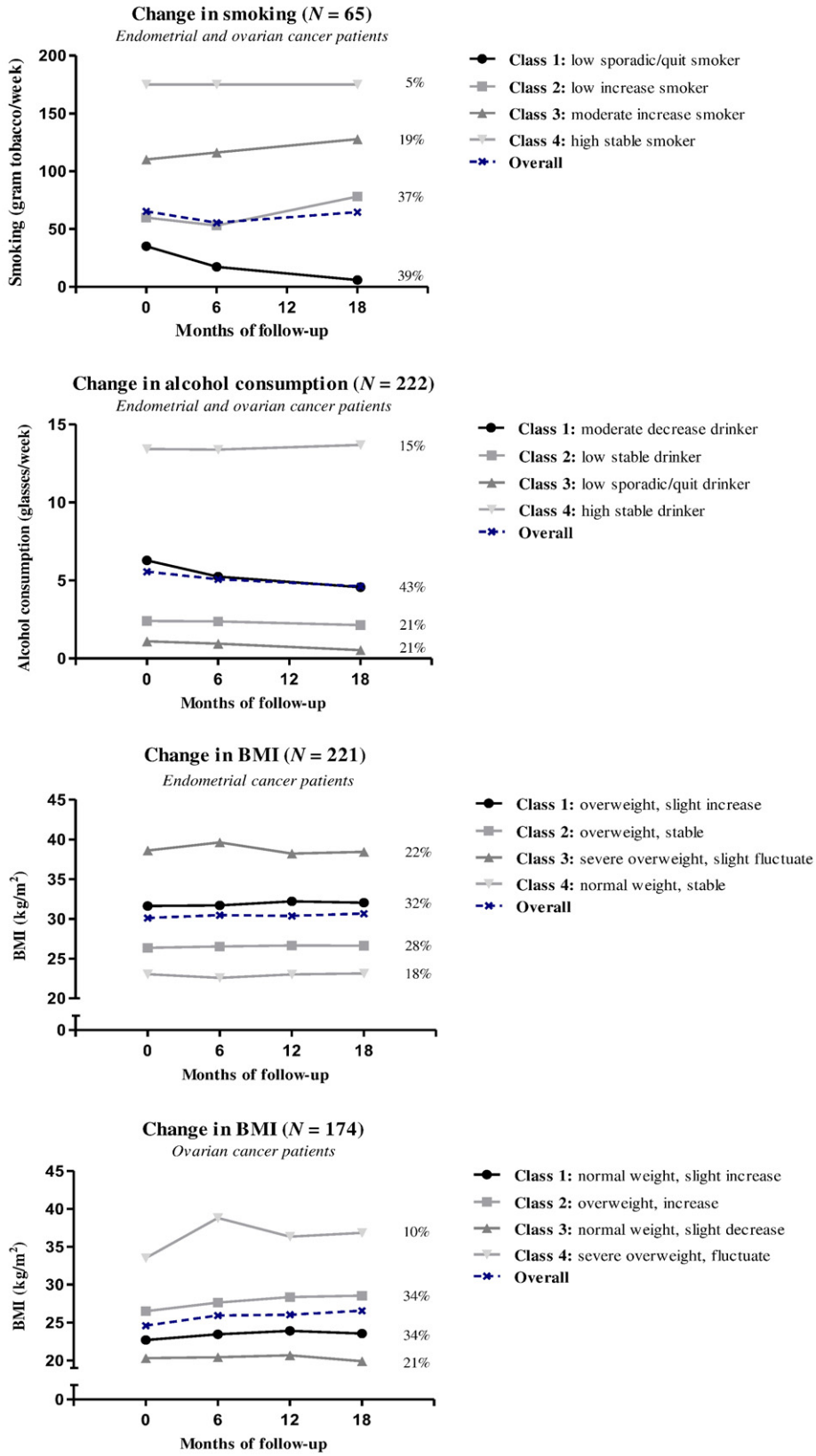

Fig. 2. Smoking, alcohol consumption, and BMI subgroups estimated with latent class growth curve analysis. *Abbreviations: N*; number of participants, *BMI*; Body Mass Index, *kg*; kilogram, m^2; square meter. *Note:* For interpretation purposes: 1 g tobacco = 1 cigarette and 19 cigarettes = 1 pack. Example: on average the smokers smoke about 60 g tobacco/week = 60 cigarettes/week = ±3 packs/week. The percentages represent the class size.

Clinical practice should acknowledge the existence of subgroups with different lifestyle change patterns. In future assessment of lifestyle in cancer patients, insight in lifestyle changes of these subgroups provide opportunities to tailor follow-up care accordingly. It may also be relevant to increase the attention and motivation of health care providers to provide consistent and adequate lifestyle advice to gynecological cancer

Table 3a
Linear mixed models to assess the longitudinal associations between illness perceptions and alcohol consumption and BMI over time with estimates for between-subjects effects.

Illness perceptions	Alcohol consumption ($N = 199$)* (glasses/week)					BMI ($N = 395$) (kg/m^2)				
	Number in analysis[c]	Crude[a]		Adjusted[b]		Number in analysis[c]	Crude[a]		Adjusted[b]	
		β	95% CI	β	95% CI		β	95% CI	β	95% CI
Consequences	$N = 345$	0.18	−0.14;0.50	0.09	−0.27;0.46	$N = 888$	−0.52***	−0.78;−0.28	−0.06	−0.34;0.20
Timeline	$N = 336$	0.18	−0.10;0.47	0.11	−0.24;0.45	$N = 860$	−0.53***	−0.74;−0.30	−0.11	−0.35;0.14
Personal control	$N = 337$	0.03	−0.26;0.32	0.06	−0.24;0.36	$N = 857$	−0.17	−0.41;0.08	−0.07	−0.29;0.16
Treatment control	$N = 331$	0.11	−0.28;0.49	0.11	−0.29;0.51	$N = 845$	−0.11	−0.42;0.20	<0.01	−0.29;0.29
Identity	$N = 341$	0.12	−0.22;0.46	0.01	−0.42;0.40	$N = 884$	−0.48***	−0.74;−0.22	0.05	−0.24;0.34
Concern	$N = 341$	0.16	−0.14;0.45	0.13	−0.21;0.47	$N = 881$	−0.36**	−0.60;−0.12	−0.06	−0.31;0.19
Illness coherence	$N = 331$	0.04	−0.25;0.34	0.05	−0.25;0.35	$N = 859$	0.18	−0.06;0.42	0.18	−0.05;0.41
Emotional representations	$N = 342$	0.05	−0.27;0.36	<0.01	−0.34;0.34	$N = 885$	−0.26*	−0.51;−0.01	0.01	−0.23;0.25

Abbreviations: *N*; number of participants, β; beta-estimate, *CI*; confidence interval, *BMI*; Body Mass Index, *kg*; kilogram, m^2; square meter.
Note: A higher score of illness perceptions indicated a higher endorsement for that item. [a]Only time (months) variable and separate illness perceptions as independent variables with lifestyle (alcohol consumption or BMI) as the dependent variable. [b]Adjusted for age at initial treatment survey, cancer type, marital status, socio-economic status, treatment, and allocation group. [C]Each row in the analyses represents a patient at one time point. *Only drinkers were included for these analyses ($N = 199$). Table 3b containing within subject effect is presented as an appendix. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

patients. Thereby, it is recommended to exploit the threat of a cancer diagnosis through combining lifestyle advice with additional lifestyle interventions, since this study underlines that patients will only make few changes on their own. Also, it is worthwhile to explore the optimal timing to offer these lifestyle-promoting activities in follow-up care. As endometrial and ovarian cancer differ in course of disease, these interventions should be tailored to patients' needs, abilities and circumstances to facilitate and sustain lifestyle changes during cancer survivorship [14,38]. Due to favorable survival rates of early stage endometrial cancer patients, these women constitute an interesting target group for efforts to promote lifestyle changes to minimize adverse health outcomes.

5. Conclusion

In conclusion, our results suggest that spontaneous change in lifestyle after cancer treatment is not entirely self-evident among gynecological cancer patients, but there are subgroups that showed promising patterns of decline for alcohol consumption and smoking. Moreover, no considerable evidence for more threatening illness perceptions being related to a healthier lifestyle was found. This study underlines the need for lifestyle-promoting interventions and counseling to facilitate lifestyle improvements among gynecological cancer patients.

Funding

The ROGY Care trial is supported with grant no. UVT 2010-4743 from the Dutch Cancer Society. Dr. Nicole Ezendam was supported by a Fellowship grant from the Dutch Cancer Society (#UVT-2014-6632).

Conflict of interest

The authors declare that they have no conflict of interest.

Acknowledgements

The authors would like to thank the patients for their willingness to participate in the ROGY Care study. Also, many thanks to the participating hospitals for their commitment in the realization of this study. Special thanks to Erna de Winter for her advice on the ROGY Care data and Dr. Willemieke Kroeze for her support and contribution to this paper as is.

Appendix A. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.ygyno.2017.02.037.

References

[1] L.A. Torre, F. Bray, R.L. Siegel, J. Ferlay, J. Lortet-Tieulent, A. Jemal, Global cancer statistics, 2012, CA Cancer J. Clin. 65 (2) (2015) 87–108.
[2] J. Ferlay, E. Steliarova-Foucher, J. Lortet-Tieulent, S. Rosso, J. Coebergh, H. Comber, et al., Cancer incidence and mortality patterns in Europe: estimates for 40 countries in 2012, Eur. J. Cancer 49 (6) (2013) 1374–1403.
[3] H.E. Karim-Kos, L.A. Kiemeney, M.W. Louwman, J.W.W. Coebergh, E. de Vries, Progress against cancer in the Netherlands since the late 1980s: an epidemiological evaluation, Int. J. Cancer 130 (12) (2012) 2981–2989.
[4] R.L. Siegel, K.D. Miller, A. Jemal, Cancer statistics, 2016, CA Cancer J. Clin. 66 (1) (2016) 7–30.
[5] C.M. Blanchard, K.S. Courneya, K. Stein, Cancer survivors' adherence to lifestyle behavior recommendations and associations with health-related quality of life: results from the American Cancer Society's SCS-II, J. Clin. Oncol. 26 (13) (2008) 2198–2204.
[6] C.M. Nagle, C.J. Bain, P.M. Webb, Cigarette smoking and survival after ovarian cancer diagnosis, Cancer Epidemiol. Biomarkers Prev. 15 (12) (2006) 2557–2560.
[7] N.B. Peterson, A. Trentham-Dietz, P.A. Newcomb, Z. Chen, J.M. Hampton, W.C. Willett, et al., Alcohol consumption and ovarian cancer risk in a population-based case–control study, Int. J. Cancer 119 (10) (2006) 2423–2427.
[8] V.W. Setiawan, K.R. Monroe, M.T. Goodman, L.N. Kolonel, M.C. Pike, B.E. Henderson, Alcohol consumption and endometrial cancer risk: the multiethnic cohort, Int. J. Cancer 122 (3) (2008) 634–638.
[9] K.K. Ward, N.R. Shah, C.C. Saenz, M.T. McHale, E.A. Alvarez, S.C. Plaxe, Cardiovascular disease is the leading cause of death among endometrial cancer patients, Gynecol. Oncol. 126 (2) (2012) 176–179.
[10] A. Smits, A. Lopes, R. Bekkers, L. Massuger, K. Galaal, Body mass index and outcomes of endometrial and ovarian cancer patients, Expert Rev. Qual. Life Cancer Care (2016).
[11] D.W. Cramer, The epidemiology of endometrial and ovarian cancer, Hematol. Oncol. Clin. North Am. 26 (1) (2012) 1–12.
[12] I.M. Kanera, C.A.W. Bolman, I. Mesters, R.A. Willems, A.A.J.M. Beaulen, L. Lechner, Prevalence and correlates of healthy lifestyle behaviors among early cancer survivors, BMC Cancer 16 (1) (2016) 1–18.
[13] D.A. Koutoukidis, M.T. Knobf, A. Lanceley, Obesity, diet, physical activity, and health-related quality of life in endometrial cancer survivors, Nutr. Rev. 73 (6) (2015) 399–408.
[14] W. Demark-Wahnefried, L.W. Jones, Promoting a healthy lifestyle among cancer survivors, Hematol. Oncol. Clin. North Am. 22 (2) (2008) 319–342.
[15] K. Williams, A. Steptoe, J. Wardle, Is a cancer diagnosis a trigger for health behaviour change? Findings from a prospective, population-based study, Br. J. Cancer 108 (11) (2013) 2407–2412.
[16] K.M. Bellizzi, J.H. Rowland, D.D. Jeffery, T. McNeel, Health behaviors of cancer survivors: examining opportunities for cancer control intervention, J. Clin. Oncol. 23 (34) (2005) 8884–8893.
[17] P. Hopman, M. Rijken, Illness perceptions of cancer patients: relationships with illness characteristics and coping, Psycho-Oncology 24 (1) (2015) 11–18.
[18] H. Leventhal, E.A. Leventhal, R.J. Contrada, Self-regulation, health, and behavior: a perceptual-cognitive approach, Psychol. Health 13 (4) (1998) 717–733.
[19] E. Broadbent, K.J. Petrie, J. Main, J. Weinman, The brief illness perception questionnaire, J. Psychosom. Res. 60 (6) (2006) 631–637.
[20] K. Thirlaway, D. Upton, The Psychology of Lifestyle: Promoting Healthy Behaviour, Routledge, New York, 2009.
[21] R.A. Ruiter, C. Abraham, G. Kok, Scary warnings and rational precautions: a review of the psychology of fear appeals, Psychol. Health 16 (6) (2001) 613–630.
[22] K. Witte, Fear control and danger control: a test of the extended parallel process model (EPPM), Commun. Monogr. 61 (2) (1994) 113–134.
[23] J. So, A further extension of the extended parallel process model (E-EPPM): implications of cognitive appraisal theory of emotion and dispositional coping style, Health Commun. 28 (1) (2013) 72–83.

[24] A.L. van Puffelen, M.J. Heijmans, M. Rijken, G.E. Rutten, G. Nijpels, F.G. Schellevis, Illness perceptions and self-care behaviours in the first years of living with type 2 diabetes; does the presence of complications matter? Psychol. Health 30 (11) (2015) 1274–1287.
[25] J.D. MacInnes, The illness perceptions of women following acute myocardial infarction: implications for behaviour change and attendance at cardiac rehabilitation, Women Health 42 (4) (2005) 105–121.
[26] M. Decruyenaere, G. Evers-Kiebooms, M. Welkenhuysen, L. Denayer, E. Claes, Cognitive representations of breast cancer, emotional distress and preventive health behaviour: a theoretical perspective, Psycho-Oncology 9 (6) (2000) 528–536.
[27] L.D. Cameron, Illness risk representations and motivations to engage in protective behavior: the case of skin cancer risk, Psychol. Health 23 (1) (2008) 91–112.
[28] C. Rabin, B. Pinto, Cancer-related beliefs and health behavior change among breast cancer survivors and their first-degree relatives, Psycho-Oncology 15 (8) (2006) 701–712.
[29] P.E. Bidstrup, S.O. Dalton, J. Christensen, A. Tjonneland, S.B. Larsen, R. Karlsen, et al., Changes in body mass index and alcohol and tobacco consumption among breast cancer survivors and cancer-free women: a prospective study in the Danish Diet, Cancer Health Cohort. Acta Oncol. 52 (2) (2013) 327–335.
[30] L.V. van de Poll-Franse, K.A. Nicolaije, M.C. Vos, J.M. Pijnenborg, D. Boll, O. Husson, et al., The impact of a cancer Survivorship Care Plan on gynecological cancer patient and health care provider reported outcomes (ROGY Care): study protocol for a pragmatic cluster randomized controlled trial, Trials 12 (2011) 256.
[31] A. Hjartaker, E. Lund, Relationship between dietary habits, age, lifestyle, and socioeconomic status among adult Norwegian women. The Norwegian Women and Cancer Study, Eur. J. Clin. Nutr. 52 (8) (1998) 565–572.
[32] L. Stafford, M. Berk, H.J. Jackson, Are illness perceptions about coronary artery disease predictive of depression and quality of life outcomes? J. Psychosom. Res. 66 (3) (2009) 211–220.
[33] E.J. de Raaij, C. Schröder, F.J. Maissan, J.J. Pool, H. Wittink, Cross-cultural adaptation and measurement properties of the Brief Illness Perception Questionnaire-Dutch Language Version, Man. Ther. 17 (4) (2012) 330–335.
[34] J. Hodgekins, M. Birchwood, R. Christopher, M. Marshall, S. Coker, L. Everard, et al., Investigating trajectories of social recovery in individuals with first-episode psychosis: a latent class growth analysis, Br. J. Psychiatry 207 (6) (2015) 536–543.
[35] D.S. Nagin, R.E. Tremblay, Analyzing developmental trajectories of distinct but related behaviors: a group-based method, Psychol. Methods 6 (1) (2001) 18–34.
[36] R.V. Karlsen, P.E. Bidstrup, J. Christensen, S.B. Larsen, A. Tjonneland, S.O. Dalton, et al., Men with cancer change their health behaviour: a prospective study from the Danish diet, cancer and health study, Br. J. Cancer 107 (1) (2012) 201–206.
[37] L.E. Hackshaw-McGeagh, C.M. Penfold, E. Walsh, J.L. Donovan, F.C. Hamdy, D.E. Neal, et al., Physical activity, alcohol consumption, BMI and smoking status before and after prostate cancer diagnosis in the ProtecT trial: opportunities for lifestyle modification, Int. J. Cancer 137 (6) (2015) 1509–1515.
[38] M.P. Schlumbrecht, C.C. Sun, M.S. Huang, F. Zandstra, D.C. Bodurka, Lifestyle modification in cervical cancer survivors: an ongoing need, Int. J. Gynecol. Cancer 24 (3) (2014) 570–575.
[39] K. Matsuo, A. Moeini, S.S. Cahoon, H. Machida, M.A. Ciccone, B.H. Grubbs, et al., Weight change pattern and survival outcome of women with endometrial cancer, Ann. Surg. Oncol. 1-10 (2016).
[40] S.S. Faubion, K.L. MacLaughlin, M.E. Long, S. Pruthi, P.M. Casey, Surveillance and care of the gynecologic cancer survivor, J. Women's Health 24 (11) (2015) 899–906.
[41] J. Hippisley-Cox, C. Coupland, Identifying women with suspected ovarian cancer in primary care: derivation and validation of algorithm, BMJ 344 (2012).
[42] A.M. Jernigan, A.I. Tergas, A.J. Satin, A.N. Fader, Obesity management in gynecologic cancer survivors: provider practices and attitudes, Am. J. Obstet. Gynecol. 208 (5) (2013) 408. e1–e8.
[43] A.L. Beavis, S. Cheema, C.H. Holschneider, E.L. Duffy, M.W. Amneus, Almost half of women with endometrial cancer or hyperplasia do not know that obesity affects their cancer risk, Gynecol. Oncol. Rep. 13 (2015) 71–75.
[44] A.N. Pala, P. Steca, Illness perceptions and coping strategies among individuals diagnosed with HIV, J. Behav. Med. 38 (4) (2015) 620–631.
[45] R.V. Gould, S.L. Brown, R. Bramwell, Psychological adjustment to gynaecological cancer: patients' illness representations, coping strategies and mood disturbance, Psychol. Health 25 (5) (2010) 633–646.
[46] I. Ajzen, Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior, J. Appl. Soc. Psychol. 32 (4) (2002) 665–683.
[47] R.L. Monk, D. Heim, A. Qureshi, A. Price, “I have no clue what i drunk last night” using smartphone technology to compare in-vivo and retrospective self-reports of alcohol consumption, PLoS One 10 (5) (2015), e0126209.