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ORIGINAL ARTICLE

Do people improve health behavior after their partner is diagnosed with cancer? A prospective study in the Danish diet, Cancer and Health Cohort

Nicole P. M. Ezendam[a,b], Randi V. Karlsen[c], Jane Christensen[d], Anne Tjønneland[e], Lonneke V. van de Poll-Franse[a,b,f], Annika von Heymann-Horan[c], Christoffer Johansen[c,g] and Pernille E. Bidstrup[c]

[a]Department of Research, Netherlands Comprehensive Cancer Organisation, Utrecht, The Netherlands; [b]Department of Medical and Clinical Psychology, Tilburg University, Tilburg, The Netherlands; [c]Survivorship Unit, Danish Cancer Society Research Center, Copenhagen, Denmark; [d]Unit of Statistics, Bioinformatics and Registry, Danish Cancer Society Research Center, Copenhagen, Denmark; [e]Unit of Diet, Genes and Environment, Danish Cancer Society Research Center, Copenhagen, Denmark; [f]Division of Psychosocial Research and Epidemiology, The Netherlands Cancer Institute, Amsterdam, The Netherlands; [g]Oncology Clinic, University of Copenhagen, Copenhagen, Denmark

ABSTRACT

Background: The cancer diagnosis is regarded as a stressful life event that is thought to trigger a teachable moment to induce health behavior changes among cancer patients. However, this may also hold true for their partners. We assessed if partners of cancer patients make more health behavior changes compared to persons whose partner remained cancer-free.

Methods: Lifestyles was assessed in the prospective Danish Diet, Cancer and Health study. Logistic regression analyses were used to assess health behavior change among partners of cancer patients ($n = 672$) compared to partners of persons who remained cancer-free ($n = 5534$). Additionally, associations in two subgroups were assessed: bereaved partners and partners of patients who remained alive after cancer.

Results: Partners of cancer patients were more likely to decrease their alcohol intake compared to partners of persons who remained cancer free. This finding could mainly be attributed to bereaved partners. Moreover, bereaved partners were also more likely to decrease their BMI. In contrast to our hypothesis, bereaved partners were more likely to decrease fruit intake and increase sugared beverages compared to partners of persons who remained cancer free. In general, men tended to improve their physical activity, while women tended to worsen their physical activity following the cancer diagnosis of their partner.

Conclusions: A cancer diagnosis in the partner does seem to improve health behavior change only for alcohol intake. Bereaved partners tend to worsen dietary behaviors after the patient's death.

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Introduction

The cancer diagnosis is regarded as a stressful life event that triggers existential considerations and awareness of one's own life style and represents a teachable moment to induce health behavior changes among cancer patients. We propose that the same holds true for the partners of patients, who witness the threatening life event of the cancer diagnosis in the patient.

Partners of cancer patients may share behavioral risk factors with the cancer patient and they are likely to benefit from improved health behaviors as this would decrease their risk for cancer, cardiovascular disease and diabetes [1]. Studies indicate that positive behavior change in one person is associated with similar behavior change in their partner [1–3]. This may be due to mutual motivation which can be the result of a shared trigger, in this case the cancer diagnosis [2,3]. Ultimately, understanding behavioral change among partners following the cancer diagnosis can help in designing health behavioral interventions focusing on partners solely or jointly with the cancer survivor [4,5].

Studies on health behavior change among partners of cancer patients are scarce. A review including eight studies among informal caregivers of cancer patients revealed conflicting information, with some suggesting deleterious changes in behaviors, whereas others found the changes protective [6]. However, quality of the included studies was low due to small samples (five studies had samples between 68 and 109 participants), cross-sectional design, and lack of control groups Only one study included spousal caregivers specifically [7], showing that they were more likely to use cancer screening services, but other health behaviors were not different from controls.

As health and health behaviors generally worsen after the loss of a close relative [8], it is of interest to distinguish between bereaved partners and partners of persons who remain alive. Moreover, as health behavior change is

CONTACT Nicole P. M. Ezendam n.ezendam@iknl.nl Netherlands Comprehensive Cancer Organisation and Tilburg University, PO Box 231, 5600AE Eindhoven, The Netherlands

generally more likely among women [9] and male cancer survivors generally have worse health behaviors [10], health behavior change in the partner is expected to be more prevalent among women than among men.

This study aims to first, assess if adults whose partner is diagnosed with cancer make more health behavior changes compared to adults whose partner remains cancer-free; second, assess if both adults who lose their partner and adults whose partner remains alive after cancer make more health behavior changes compared to adults whose partner remains cancer-free; and third, assess whether health behavior change is different between men and women whose partner is diagnosed with cancer.

We hypothesized that adults improve their health behavior in terms of diet, physical activity, smoking alcohol, and body mass index (BMI) following their partner's cancer diagnosis as compared to adults whose partner did not get cancer. Moreover, we hypothesized that this improvement in health behavior occurs only among those of whom the partner remains alive after cancer, but not among those who lose their partner after cancer. Furthermore, we hypothesized that women improve their health behavior more than men do [11,12].

Methods

Design and participants

In this study, we used data from couples that were included in the Danish Diet, Cancer and Health study, a prospective cohort study with random sampling designed to assess dietary risk factors for cancer. This Danish cohort is part of the EPIC study, The European Prospective Investigation into Cancer and Nutrition [EPIC website]. Between 1993 and 1997, 57,053 individuals aged between 50 and 64 and not previously diagnosed with cancer, answered baseline questionnaires and provided anthropometrics (35% response). Follow-up questionnaires were sent between 2000 and 2002.

Among the respondents we identified 10,241 couples. Between baseline and follow-up, 9535 couples remained cancer-free of whom 8254 provided follow-up data; in 699 couples one person was diagnosed with cancer, and 672 of their partners provided follow-up data. In seven couples, both persons were diagnoses with cancer and these were excluded. Partners of those diagnosed with cancer were matched (1:8) on gender and 5-year age intervals to people who remained cancer-free, resulting in 5534 matched individuals without cancer. Of the 672 persons who were diagnosed with cancer, 202 died and 470 remained alive until follow-up.

Information on demographics, marital status, and vital status

Information on length of education ($\leq$7, 8–10 years, and $>$10 years) was obtained from the baseline questionnaire. Information on date of birth, gender, marital status at baseline, and vital status (alive or dead) was obtained from the Civil Population Register.

Information on smoking and alcohol intake

Smoking was assessed as never smoker, present smoker, or former smoker, and dichotomized into current smoker yes/no.

Participants were asked to indicate how often they drank each of the following types of alcohol: light beer, ordinary beer, strong beer, wine, fortified wine, and liquor. Number of units was assessed and intake was summed as total number of alcoholic drinks per day.

Information on BMI and physical activity

We used BMI as an indicator of overweight. At baseline, weight and height were measured by trained professionals, and BMI was calculated as (weight (kg)/(height (m)^2). At follow-up, weight was self-reported.

Physical activity was measured using a validated measure, developed for the EPIC study, and based on more extended validated physical activity questionnaires [13,14]. The questionnaire assessed hours per week for three activities (walking, cycling and sports) [13,14]. Therefore, each type of PA was assigned a metabolic equivalent task (MET) estimate according to the compendium of PAs [15]. Findings were presented as total MET hours/week for recreational physical activity.

Information on diet: fruit and sweetened beverages

Fruit intake was assessed with one item asking how often the participants consumed fresh fruit. Sweetened beverage intake was assessed by asking how often participants drank lemonade and soda.

Categorization of all outcomes can be found in Table 2 and a detailed description of the measures in Appendix 1.

Change in health behaviors

We computed for each participant if they increased, decreased or were stable in each health behavior by defining clinically relevant changes. It has been established that a 5% decrease in BMI is clinically relevant for health benefit [16]. We thus defined that if people lost 5% or more of their BMI between baseline and follow-up they were categorized as 'decreased', whereas if they increased 5% or more they were categorized as 'increased'. If a participant was not decreasing or increasing their BMI at least 5% they were considered 'stable'. For all other health behaviors deciding on a meaningful change was less straightforward. We defined a 25% change to be a meaningful change, although we are aware that this is arbitrary. For instance, if someone drinks two alcoholic drinks per day on average, limiting this by 3.5 alcoholic drinks per week (25%) might be both something one tries to achieve and be meaningful.

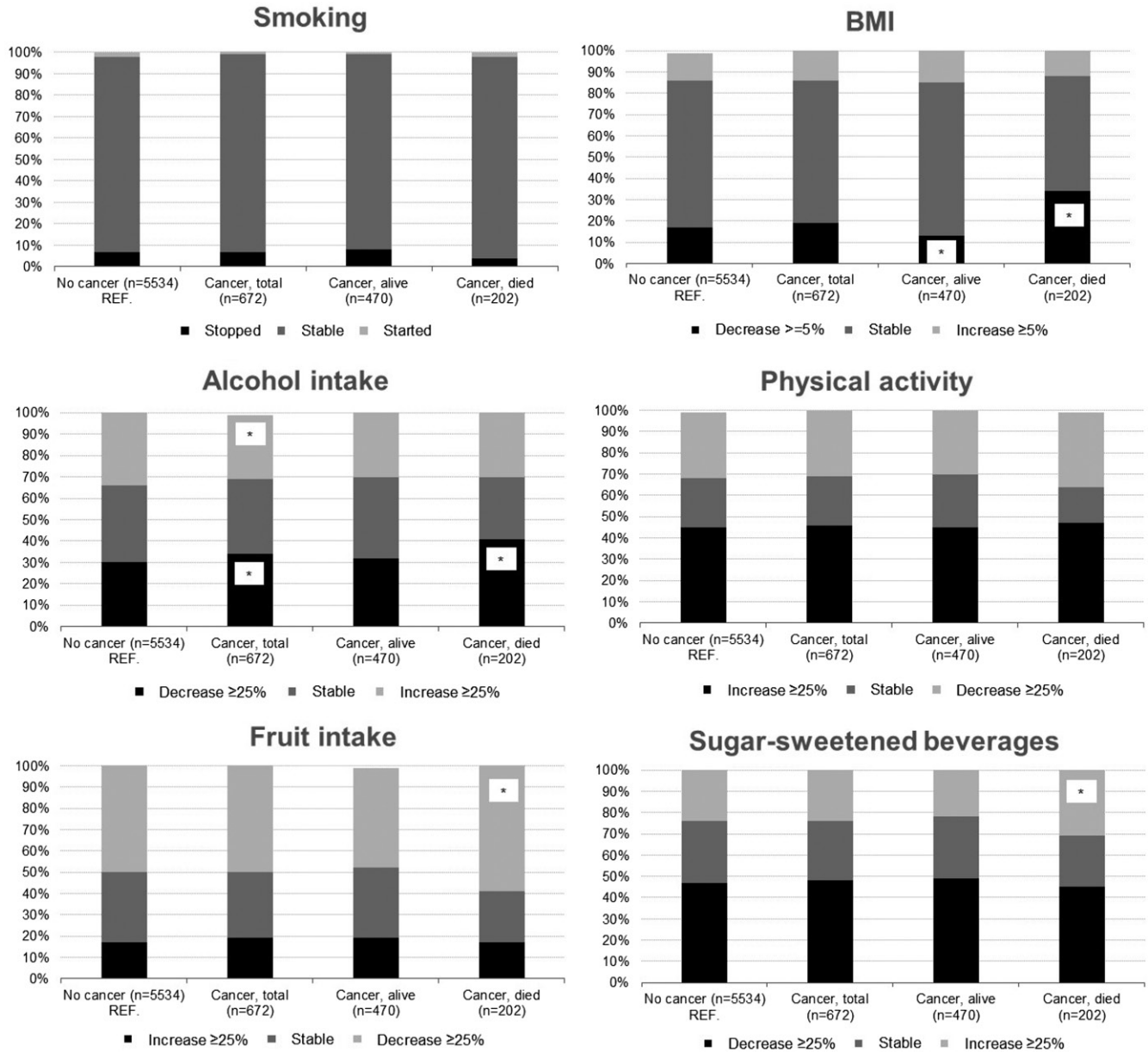

Figure 1. Proportion of partners who changed their health behavior according to cancer status (partners of persons who remained cancer-free ('No cancer'); Partners of persons diagnosed with cancer ('Cancer, total'); partners of persons who remained alive after cancer ('Cancer, alive'); and partners of person who died after cancer ('Cancer, died')). Analyses were adjusted for age, gender and education; * indicates $p < 0.05$ in comparison with the no cancer group.

Statistical analyses

Descriptive analyses were used to describe partners of those who were diagnosed with cancer and those who remained cancer-free, using means and standard deviation (SD) for continuous and percentages for categorical data. Differences between baseline levels of the partners of persons diagnosed with cancer and partners of persons who remained cancer-free were computed using Chi-square for categorical and *t*-tests for continuous outcomes.

We used logistic regression analyses to examine health behavior changes (increase vs. no increase (including either stable or decrease) or decrease vs. no decrease (including either stable or decrease) as dependent variables, according to cancer status of the partner. Health behavior changes included stopping or starting smoking, 25% decrease or 25% increase in physical activity and in alcohol, fruit, and sugared beverages intake, and 5% decrease or 5% increase in BMI. Analyses were adjusted for education, age, and gender. Cancer status, the independent variable, was evaluated in three different ways comparing persons whose partners remained cancer-free with persons whose partner: (1) was diagnosed with cancer (total group), (2) died after cancer (subgroup), or (3) survived after cancer (subgroup). Results are described as odds ratio's with 95% confidence intervals.

To evaluate if the outcomes were different for men and women, we tested for statistical interaction by adding a gender*cancer status interaction term to all analyses. If *p* values were <.1, stratified analyses by gender were conducted. For a sensitivity analyses to assess if outcomes were different in the first 2 years after diagnosis, when health behavior change might be more likely, we repeated the analyses

among partners of whom the patient was diagnosed in the past two years before follow-up data collection.

SAS statistical software package 9.4 (SAS Institute, Inc., Cary, NC) was used for the statistical analyses. p Values <0.05 were considered significant. Odds ratios are presented with their 95% confidence intervals.

Table 1. Characteristics of partners of persons diagnosed with cancer and partners of persons who remain cancer-free at baseline.

	Partners of persons who remain cancer-free $N = 5534$	Partners of persons diagnosed with cancer $N = 672$
Sociodemographic		
Age		
Range	50–66	50–65
Mean (SD)	57 (4.1)	57 (4.1)
Female, *n* (%)	3022 (55)	367 (55)
Education, *n* (%)		
<=7 years	1915 (35)	242 (36)
8–10 years	2597 (47)	311 (46)
>10 years	1016 (18)	118 (18)
Unknown	6 (0.1)	1 (0.2)
Clinical		
Years since diagnosis		
Range		0.0–6.8
Mean (SD)		2.6 (1.5)
Cancer type, *n* (%)		
Breast		114 (17)
Prostate		72 (11)
Lung		34 (5)
Colorectal		27 (4)
Bladder		26 (4)
Other		399 (59)
Partner died between diagnosis and follow-up, *n* (%)		202 (30)

Partners were matched on age and gender with controls.

Results

In this study, partners of persons who were diagnosed with cancer were between age 50 and 65 years old at baseline and just over half of them were women. Persons with cancer were diagnosed between zero and 7 years prior to the follow-up questionnaire assessment (Table 1). At baseline, partners of persons who were diagnosed with cancer were less often non-smokers and more often heavy smokers compared to partners of persons who remained cancer-free (Table 2). For other behaviors there were no differences.

Partners of persons who were diagnosed with cancer were more likely to decrease their alcoholic drinks (OR = 1.2 [1.04;1.5]; Figure 1; Appendix 2) and less likely to increase their alcoholic drinks (OR = 0.8 [0.7;0.99]; not tabulated) compared to partners of persons who remained cancer-free. In analyses comparing partners of persons with cancer who died and who remained alive with those partners of persons who remained cancer-free, we found that the higher likelihood to decrease the consumption of alcoholic drinks was mainly observed among bereaved partners (Figure 1; Appendix 2).

We did not find an overall effect of cancer status on changes in BMI. However, compared to partners of persons who remained cancer free, we found that partners of persons who remained alive after cancer were less likely to decrease BMI (OR = 0.7 [0.5;0.95]), whereas persons whose partner

Table 2. Health behaviors of partners of persons diagnosed with cancer and partners of persons who remain cancer-free between baseline and follow-up.

	Partners of persons who remain cancer-free $N = 5534$		Partners of persons diagnosed with cancer $N = 672$		p Value*
	Baseline	Follow-up	Baseline	Follow-up	Cancer versus no cancer
Health behavior, *n* (%)					
Tobacco g/day					
Mean (SD)	5.0 (9.9)	3.4 (8.2)	5.5 (9.2)	4.2 (9.6)	.24
0	3862 (70)	4157 (75)	448 (67)	483 (72)	<.01
1–10	551 (10)	416 (8)	63 (9)	44 (7)	
11–20	739 (13)	500 (9)	126 (19)	88 (13)	
≥21	375 (7)	222 (4)	34 (5)	26 (4)	
Unknown	7 (0)	239 (4)	1 (0)	31 (5)	
Alcoholic drinks/day					
Mean	1.6 (1.6)	1.7 (1.7)	1.7 (1.7)	1.7(1.7)	.19
0	97 (2)	175 (3)	14 (2)	18 (3)	.08
1–2	3890 (70)	3546 (64)	440 (65)	273 (65)	
>2	1546 (28)	1669 (30)	218 (32)	201 (30)	
Unknown	1 (0)	144 (3)	0 (0)	14 (2)	
BMI kg/cm^2					
Mean(SD)	26.0 (3.9)	25.8 (3.9)	26.1 (4.3)	25.9 (4.3)	.62
<18.5	28 (1)	41 (1)	5 (1)	6 (1)	.84
18.5–24.9	2389 (43)	2463 (45)	290 (42)	305 (45)	
25–29.9	2362 (43)	2306 (42)	281 (42)	266 (40)	
≥30	752 (14)	712 (13)	95 (14)	94 (14)	
Unknown	3 (0)	12 (0)	1 (0)	1 (0)	
Physical activity MET, h/week, mean (SD)	31.9 (26.2)	32.1 (50.0)	30.7 (25.9)	31.9 (62.5)	.29
Fruit portions/day					
Mean (SD)	1.1 (1.0)	1.7 (1.4)	1.1 (1.0)	1.7 (1.5)	.25
0–1.9	4191 (76)	3035 (55)	517 (77)	363 (54)	.76
≥2	1321 (24)	2497 (45)	152 (23)	309 (46)	
Unknown	22 (0)	2 (0)	3 (0)	0 (0)	
Sweetened beverages glass/day, mean (SD)	87 (175)	59 (146)	86 (170)	53 (131)	.91

*p Values for baseline differences according to cancer status; partners were matched on age and gender with controls.
MET: metabolic equivalent task; MET: h/week ~ hours per week physically active times the MET score of each physical activity.

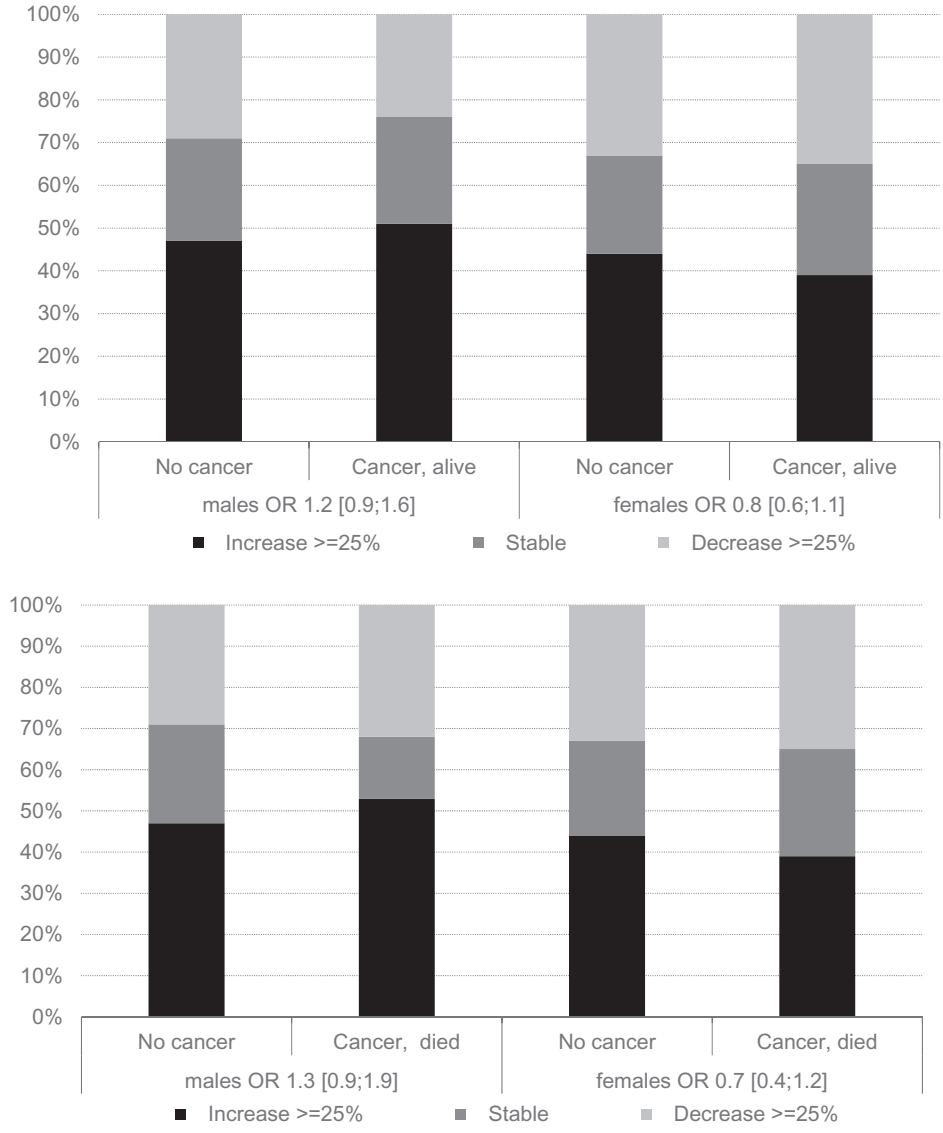

Figure 2. Stratified analysis for males and females in case interactions between gender and cancer status were significant. Proportion of male and female partners who changed their health behavior according to cancer status. Odds ratios (OR) with 95% confidence intervals (CI) for improving versus not improving (stable or worsening) the health behavior. Analyses were adjusted for age and education. (a) change in physical activity among partners of persons who remained alive after cancer ('Cancer, alive') versus partners of persons who remained cancer-free ('No cancer'). (b) Change in physical activity among partners of person who died after cancer ('Cancer, died') versus partners of persons who remained cancer-free ('No cancer').

died were more likely to decrease their BMI (OR = 2.5 [1.7;3.1]) (Figure 1; Appendix 2).

Partners of persons who died after cancer were more likely to decrease fruit intake (OR = 1.5 [1.1;1.9]) and increase sugared beverages (OR = 1.5 [1.1;2.0]) compared to partners of persons who remained cancer-free (Figure 1).

In general, men tended to increase their physical activity, while women tended to decrease their physical activity after the cancer diagnosis of their partner (Figure 2). Further, the sensitivity analysis showed that outcomes were not different among partners of whom the patient was diagnosed in the past 2 years.

Discussion

In line with our hypothesis, partners of cancer patients were more likely to decrease their alcohol intake compared to partners of persons who remained cancer-free. This finding could mainly be attributed to bereaved partners. In line with this, we found that bereaved partners were also more likely to decrease their BMI. In contrast to our hypothesis, bereaved partners were more likely to decrease fruit intake and increase sugared beverages compared to partners of persons who remained cancer-free. In general, men tended to improve their physical activity, while women tended to worsen their physical activity following the cancer diagnosis of their partner.

We hypothesized that the cancer diagnosis would increase awareness of one's health behavior being a risk factor for cancer and other diseases, which we expected to lead to improvements in health behaviors [17]. However, we found limited support for our hypothesis and even found worsening of dietary behaviors, indicating that the stress of being a caregiver or losing someone to cancer may lead to worsening of health behaviors rather than improvement [6,18]. Only one previous study among partners also included a control group, which is essential as health behavior changes may also be expected independent of cancer. Son et al. [7] included 100

care-giving spouses and 400 age- and sex-matched controls in their cross-sectional study. Although results were not significant, caregivers tended to have better health behaviors compared to controls as they were less often current smokers and less often physically inactive. The lack of significant findings might be related to their participant selection, as they only included caregivers, not bereaved partners, and we predominantly found health behavior change among bereaved partners, not among partners of persons who remained alive after cancer. A review of Ross et al. [6], including eight cross-sectional studies among cancer caregivers, showed mixed results regarding whether cancer caregivers changed their health behaviors. Since we observed in our study that for each health behavior there was a group who improved and a group who worsened their behavior, the designs (cross-sectional; no control group), and analyses (group averages) mostly applied in the studies in the review of Ross et al. may not have optimally identified changes in behaviors.

The decrease in alcohol intake, fruit consumption and BMI and increase in sugared beverages were mainly found among bereaved partners, suggesting that these changes might be related to grief rather than the cancer diagnosis of the partner. It has been shown that mental health worsens after bereavement of a partner [19] and maladaptive coping of adults occurs after parental loss [20]. Indeed, a review by Stahl et al. including 34 studies among bereaved elderly concluded that persons who lose their partner worsen their dietary behavior and unintentionally lose weight, which is in line with our findings [8]. This may be explained by the decrease in physical and psychological well-being and changes in behavioral habits after bereavement [8]. However, in contrast to our findings, the review by Stahl et al. found that bereaved persons increased their alcohol intake and tended to decrease their physical activity levels [8]. Different results on alcohol intake might be related to our sample having had a cancer diagnosis which may increase awareness that alcohol represents a cancer risk factor [21]. The review found mixed results on changes in smoking behaviors among bereaved persons, while we found no significant changes in smoking.

An important limitation of our study is that health behavior is self-reported. This might have led to the report of healthier levels of behavior than is true. However, as we studied changes in health behavior, effects on our results will only be present in case reporting bias is different between the groups that we have studied. However, our results do not support this suggestion. The Danish Diet Cancer and Health study includes a relatively healthy cohort, potentially limiting the generalizability of the findings of this study to the general population. In addition, the study sample size did not allow analyses by cancer type, while behavioral changes might be rather different across types of cancer. Another limitation is that we were not able to distinguish between cancer-caregivers and persons of whom the partner recovered from their cancer. Being able to do so might have provided additional insights as both groups may hold different lifestyle patterns. Finally, we made the assumption that improvement of a behavior is always in a certain direction, e.g., increase in fruit intake or decrease in BMI. This, of course, does not always hold true as an increase of 4–6 pieces of fruit might not improve a healthy lifestyle. Strengths of this study are the longitudinal design, the inclusion of a control group and the large sample size. Also, the baseline comparability of the groups assures that people in both groups have similar potential for behavioral change.

The current study suggests that partners of persons with cancer make few health behavior changes, which may leave room for behavioral change support for these individuals Furthermore, our results indicate that worsening of certain health behaviors (decreased intake of fruit and increased intake of sugared beverages) may be due to grief [19,20]. As studies show that interventions can decrease risk of complicated grief after bereavement, supporting persons grieving may also prevent a deterioration of health behavior, but this remains unexplored as grief intervention studies generally do not include health behavior as outcome [22]. Differences between men and women in their likelihood to change physical activity might be useful to tailor interventions. A first trial to support cancer patients and their partners in healthy lifestyle change shows encouraging results, including an improvement in physical activity, vegetable intake, and decrease in BMI [23]. However, the number of partners who participated was small ($n = 24$) and no distinction was made between behavioral change in patients and partners.

In conclusion, our results show limited support of our hypothesis as we hardly found health behavioral improvement among partners of cancer patients. Importantly, the likelihood for health behavior change after the cancer diagnosis of the partner differs depending on whether the partner died or remained alive after the cancer diagnosis. Bereaved partners were more likely to worsen their dietary behavior, i.e., decrease fruit and increase sugared beverages intake, but to decrease alcohol intake. In contrast, partners of persons diagnosed with cancer who remained alive generally did not change their health behavior. Future research may assess effects of health behavioral change interventions for both cancer patients and their partners, as these interventions might be necessary to capitalize on the teachable moment.

Ethical approval

The Danish Diet, Cancer and Health study was centrally approved by a Medical Research Ethics Committee. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent

Informed consent was obtained from all individual participants included in the study.

Disclosure statement

No potential conflict of interest was reported by the authors.

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ORCID

Nicole P. M. Ezendam http://orcid.org/0000-0002-5878-4210
Anne Tjønneland http://orcid.org/0000-0003-4385-2097
Lonneke V. van de Poll-Franse http://orcid.org/0000-0003-0413-6872
Annika von Heymann-Horan http://orcid.org/0000-0002-0900-5575
Christoffer Johansen http://orcid.org/0000-0002-4384-206X
Pernille E. Bidstrup http://orcid.org/0000-0002-9704-6800

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Appendix 1. Detailed description of the measures of health behavior

Supplementary file by manuscript 'Do people improve health behavior after their partner is diagnosed with cancer? A prospective study in the Danish Diet, Cancer and Health cohort' by Ezendam et al.

Information on smoking and alcohol intake

Smoking was assessed at baseline as never smoker, present smoker, or former smoker, and dichotomized into current smoker yes/no. At both baseline and follow-up, participants were asked to indicate how much they smoked per day in terms of cigarettes (1 g tobacco/cigarette), cigars (4.5 g tobacco/cigar), cheroots (3 g tobacco/cheroot), and pipes (3 g tobacco/pipe). Smoking was summed as total grams of tobacco per day.

At baseline, participants were asked to indicate how often they drank each of the following types of alcohol: light beer (no. of bottles), ordinary beer (no. of bottles), strong beer (no. of bottles), wine (no. of glasses), fortified wine, e.g., port (no. of units) and liquor, e.g., schnapps (no. of units). The following categories of frequency were used: never, $<$1/month, 1/month, 2–3/month, 1/week, 2–4/week, 5–6/week, 1/day, 2–3/day, 4–5/day, 6–7/day, and $\geq$8/day. At follow-up, separate items were included to measure red wine versus white and rosé wine; and the categories were slightly different: never/rarely, $<$1/month, 2–3/month, 1–2/week, 3–4/week, 5–6/week, 1/day, 2–3/day, 4–5/day, 6–7/day, and $\geq$8/day. The baseline alcohol intake categories 'never' and '$<$1/month' were combined for the analyses. Intake was summed as total number of alcoholic drinks per day.

Information on BMI and physical activity

We used BMI as an indicator of overweight. At baseline, weight and height were measured by trained professionals, and BMI was calculated as (weight (kg)/(height (m)^2). At follow-up, weight was self-reported.

At baseline, physical activity was measured using a validated measure, developed for the EPIC study, and based on more

extended validated physical activity questionnaires. The questionnaire assessed hours per week for three activities (walking, cycling, and sports) in the winter and the summer. At follow-up, walking and cycling were assessed both as recreational and commuting to work, and physical activity was subdivided into light, moderate, and vigorous activity. Shortness of breath for each activity could be indicated (all the time, some of the time and not at all). Different types of physical activity require different energy expenditure, which are expressed as metabolic equivalent task (METs). Therefore, each type of PA was assigned a MET estimate according to the compendium of PAs. MET scores were calculated by taking the average of summer and winter physical activity for each activity as well as summed for the three activities, and multiplied by the hours per week and by the MET score, resulting in total MET hours/week for recreational physical activity.

Information on diet: fruit and sweetened beverages

Fruit intake was assessed with one item asking how often the participants consumed fresh fruit. Sweetened beverage intake was assessed by asking how often participants drank lemonade and soda. At follow-up, there was a distinction between light or sugared, where we included only the sugared lemonade and soda in the current study. The questions format was how often they eat/drink these food categories. Answering categories included: never, <1/month, 1/month, 2–3/month, 1/week, 2–4/week, 5–6/week, 1/day, 2–3/day, 4–5/day, 6–7/day, and ≥8/day. At follow-up the answering categories were slightly different: never/rarely, <1/month, 2–3/month, 1–2/week, 3–4/week, 5–6/week, 1/day, 2–3/day, 4–5/day, 6–7/day, and ≥8/day. Total fruit intake was computed as the number of pieces of fruit per day.

Appendix 2. Proportion of partners who changed their health behavior according to cancer status. Odds ratios (OR) with 95% confidence intervals (CI) for improving versus not improving (stable or worsening) the health behavior

Supplementary file by manuscript 'Do people improve health behavior after their partner is diagnosed with cancer? A prospective study in the Danish Diet, Cancer and Health cohort' by Ezendam et al.

	Partners of persons who remain cancer-free ('no cancer')	Partners of persons diagnosed with cancer ('cancer')			Cancer total versus no cancer (ref)		Cancer partner alive versus no cancer (ref)		Cancer partner died versus no cancer (ref)	
	N = 5534 *N* (%)	Total *N* = 672 *N* (%)	Partner alive at FU *N* = 470 N(%)	Partner died before FU *N* = 202 *N* (%)	OR	CI	OR	CI	OR	CI
Smoking										
Stopped	388 (7.0)	44 (6.6)	36 (7.7)	8 (4.0)	0.9	0.7; 1.3	1.1	0.8; 1.5	0.6	0.3; 1.2
Stable	5046 (91)	617 (92)	428 (91)	189 (94)						
Started	95 (1.7)	10 (1.5)	5 (1.1)	5 (2.5)						
Alcohol										
Decrease >=25%	1604 (30)	226 (34)	144 (32)	82 (41)	**1.2**	**1.04; 1.5**	1.1	0.9; 1.3	**1.7**	**1.2; 2.2**
Stable	1935 (36)	232 (35)	173 (38)	59 (29)						
Increase >=25%	1850 (34)	200 (30)	140 (31)	60 (30)						
BMI, mean (SD)										
Decrease >=5%	946 (17)	128 (19)	60 (13)	68 (34)	1.1	0.9; 1.4	**0.7**	**0.5; 0.95**	**2.5**	**1.7; 3.1**
Stable	3837 (69)	449 (67)	340 (72)	109 (54)						
Increase >=5%	739 (13)	94 (14)	69 (15)	25 (12)						
PA, MET h/week										
Increase >=25%	2323 (45)	279 (46)	191 (45)	88 (47)	1.01	0.9; 1.2	0.98	0.8; 1.2	1.1	0.8; 1.5
Stable	1198 (23)	140 (23)	108 (25)	32 (17)						
Decrease >=25%	1595 (31)	192 (31)	126 (30)	66 (35)						
Fruit, portions/day										
Increase >=25%	956 (17%)	125 (19%)	90 (19%)	35 (17%)	1.1	0.9; 1.3	1.1	0.9; 1.4	1.04	0.7; 1.5
Stable	1820 (33%)	205 (31%)	157 (33%)	48 (24%)						
Decrease >=25%	2755 (50%)	342 (51%)	223 (47%)	119 (59%)						
Sugared beverages ml/day										
Decrease >=25%	2580 (47%)	318 (48%)	228 (49%)	90 (45%)	1.03	0.9; 1.2	1.1	0.9; 1.3	0.9	0.7; 1.2
Stable	1607 (29%)	185 (28%)	136 (29%)	49 (24%)						
Increase >=25%	1296 (24%)	163 (24%)	100 (22%)	63 (31%)						

FU: follow-up; PA: recreational physical activity; ref: reference group; MET metabolic equivalent task; MET h/week ~ hours per week physically active times the MET score of each physical activity; analyses were adjusted for age, gender, and education.