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Using the Behavior Change Wheel to Identify and Understand Key Facilitators and Barriers for Lifestyle Care for Postmenopausal Breast Cancer Survivors: A Delphi-Study

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Abstract

Background Optimal approaches to promote sustained adherence to lifestyle and bodyweight recommendations in postmenopausal breast cancer (PMBC) survivors are lacking.

Purpose This Delphi-study aims to identify and understand expert-opinion on potential barriers and facilitators for promoting adherence to these lifestyle and bodyweight recommendations in (clinical) care for PMBC survivors, and to determine potential effective intervention strategies.

Methods The expert panel consisted of oncology Health Care Professionals (HCPs) ($N = 57$), patient advocates ($N = 5$), and PMBC survivors ($N = 38$). They completed three questionnaires: Q1—idea generation; Q2—validation and prioritization; Q3—ranking. The Behavior Change Wheel was used as theoretical framework for analysis. Thematic analysis was applied to identify key overarching themes based on the top-ranked facilitators and barriers. Potential Behavior Change Techniques (BCTs) and intervention strategies were identified using the Behavior Change Technique Taxonomy version 1 and the Behavior Change Wheel.

Results Eleven core categories of key barriers/facilitators for the promotion of adherence to recommendations for lifestyle and bodyweight among PMBC survivors were identified. For each core category, relevant BCTs and practical potential intervention strategies were selected based on suggestions from the expert panel. These included: increasing knowledge about the link between lifestyle and cancer; enabling self-monitoring of lifestyle behaviors followed by evaluation; offering group lifestyle counseling for PMBC survivors, enhancing social support for favorable lifestyle behaviors; and stimulating multidisciplinary collaboration among HCPs.

Conclusions Findings provide valuable insight for the development of interventions changing behavior of PMBC survivors and HCPs toward increased healthy lifestyle (support) behavior.

Lay summary

Optimal approaches to promote sustained adherence to lifestyle and bodyweight recommendations in postmenopausal breast cancer (PMBC) survivors are lacking. This Delphi-study aims to identify and understand expert-opinion on potential barriers and facilitators for promoting adherence to these lifestyle and bodyweight recommendations in (clinical) care for PMBC survivors, and to determine potential effective intervention strategies. The expert panel consisted of oncology Health Care Practitioners (HCPs) ($N = 57$), patient advocates ($N = 5$), and PMBC survivors ($N = 38$). They completed three questionnaires: Q1—idea generation; Q2—validation and prioritization; Q3—ranking. The Behavior Change Wheel was used as theoretical framework for analysis. Thematic analysis was applied to identify key overarching themes based on the top-ranked facilitators and barriers. Potential Behavior Change Techniques (BCTs) and intervention strategies were identified. Eleven core categories of key barriers/facilitators for the promotion of adherence to recommendations for lifestyle and bodyweight among PMBC survivors were identified. For each core category, relevant BCTs and practical potential intervention strategies were selected based on suggestions from the expert panel. These included: increasing knowledge about the link between lifestyle and cancer; enabling self-monitoring of lifestyle behaviors followed by evaluation; offering group lifestyle counseling for PMBC survivors, enhancing social support for favorable lifestyle behaviors; and stimulating multidisciplinary collaboration among HCPs.

Keywords Breast cancer · Lifestyle · Facilitators · Barriers · Behavior Change Wheel · Delphi method

Introduction

Developing postmenopausal breast cancer (PMBC) is, at least partly, related to lifestyle (e.g., physical inactivity, consumption of alcohol) and body fatness (e.g., adult weight gain, and increased body fat) [1–7]. In addition, compared with women without cancer, PMBC survivors have an increased risk of second primary cancers (e.g., a two- to five-fold increased risk for second primary breast cancers) [3], type II diabetes mellitus [4], cardiovascular disease [5], mortality [6], and a diminished health-related quality of life [8, 9]. To decrease these risks and to increase health-related quality of life [10–15], recommendations regarding lifestyle and maintaining a healthy bodyweight have been issued [16]. For example, the World Cancer Research Fund recommends to be physically active (by means of at least 150 min of low intensity exercise per week spread over several days, muscle and bone strengthening exercises at least 2 times per week, limiting sedentary behavior, and prevent sitting too much), to limit alcohol consumption (preferably drink no alcohol), and to be a healthy weight (i.e., body mass index between 18.5 and 24.9) [16]. However, the majority of PMBC survivors does not meet these recommendations [8, 17–21].

Although health care professionals (HCPs) could play a key role in the promotion of favorable lifestyle behaviors [22–24], this is not structurally embedded in clinical care [25]. Sustained lifestyle changes may be harder for PMBC survivors compared with the general population due to impaired physical, psychological, and social functioning caused by cancer and its treatment [26]. In addition, weight gain is common in PMBC survivors following diagnosis. Multiple causes for weight gain have been suggested, such as receiving chemotherapy, low levels of physical activity, and increased caloric intake [27]. Considering that weight gain after diagnosis is common, that the prevalence of overweight and obesity in PMBC survivors is relatively high, and that lifestyle counseling is not structurally embedded in clinical care, further investigation into approaches to promote (sustained) adherence to lifestyle and bodyweight recommendations is warranted.

Numerous studies have shown that lifestyle interventions may result in improvements in lifestyle and bodyweight in cancer patients, however, these improvements are mostly short term [28, 29]. To illustrate, a systematic review showed that less than half of the physical activity and/or dietary interventions achieved successful maintenance of lifestyle changes post-intervention (i.e., at least 3 months following the end-of-intervention) [30]. Moreover, there is a lack of insight into the methods to achieve sustained adherence to lifestyle and bodyweight recommendations.

Lifestyle interventions developed with involvement of patients and local health care professionals are more likely to be effective [31]. Such interventions match with local needs, preferences, and priorities, ensuring the best fit to the needs of relevant stakeholders (i.e., patients and HCPs) [31]. For example, a synthesis of oncology HCPs and PMBC survivors' opinions on needs, preferences, and priorities can be used to identify appropriate types of intervention or intervention components. As such, interventions comprise the needs of relevant stakeholders, and they are likely to be more easily embedded in clinical care for PMBC survivors. A needs assessment often includes the identification of barriers and

facilitators for implementation of an intervention [32]. To our knowledge, no previous studies have assessed potential barriers and facilitators for promoting adherence to lifestyle and bodyweight recommendations in (clinical) care for PMBC survivors. To increase the fit of potential effective intervention strategies in clinical care, this study uses the Delphi method to identify and understand expert-opinion of oncology health care professionals, patient advocates, and PMBC survivors on potential barriers and facilitators for promoting adherence to lifestyle and bodyweight recommendations in (clinical) care for PMBC survivors.

In addition, as interventions are commonly more successful in changing behavior if they are based upon a systematic method of defining the target behavior and matching intervention features in a specific target population and context [33], this study will use the Behavior Change Wheel (BCW) as theoretical framework to systematically categorize facilitators and barriers [33]. The BCW describes targeted lifestyle (support) behavior in line with the Capability-Opportunity-Motivation for Behavior (COM-B) model supported by the Theoretical Domains Framework [33]. The COM-B model explains how changing behavior (B) is the result of changing psychological and/or physical capability (C), social and physical opportunities available (O), and automatic and reflective motivation (M) [31, 33]. By use of the BCW, we aimed to categorize the relevant barriers and facilitators at the individual levels of the PMBC survivor and the HCPs, the intervention level, and the policy level, which could assist those designing and implementing interventions and creating policy to promote favorable lifestyle change in PMBC survivors. Following, in line with the BCW framework, we aimed to determine potential effective intervention strategies for promoting adherence to lifestyle and bodyweight recommendations in (clinical) care for PMBC survivors.

Method

Study Design

In this study, the stages outlined by the BCW framework were followed to determine potential effective intervention strategies. The stages of the BCW framework are: Stage 1—Understand the behavior, Stage 2—Identify intervention options, and Stage 3—Identify content and implementation options [34]. Using the Delphi method, an expert panel provided insight in Stage 1 of the BCW, specifically understanding the targeted lifestyle (support) behavior. During the Delphi-study, experts formulated a list of meaningful ideas concerning facilitators and barriers affecting lifestyle behavior change of PMBC survivors [35]. An expert is defined as knowledgeable and experienced with respect to the subject. As strict consensus was not the aim of this Delphi-study, a three-phase sequence aimed to structure the iterative feedback process was used with a preset number of three questionnaires. This three-phase sequence [36, 37] is illustrated in Fig. 1. Between February and July 2019, experts could respond anonymously to the three questionnaires to minimize peer pressure and enhance the flow of ideas [38]. Following Stage 1 of the BCW framework, intervention options were identified by the research team in line with Stage 2 of the BCW. Thereafter, the research team described content and implementation options based on practical suggestions made by the expert team (Stage 3 of the BCW). The study was approved by the Ethics Review Board of Tilburg

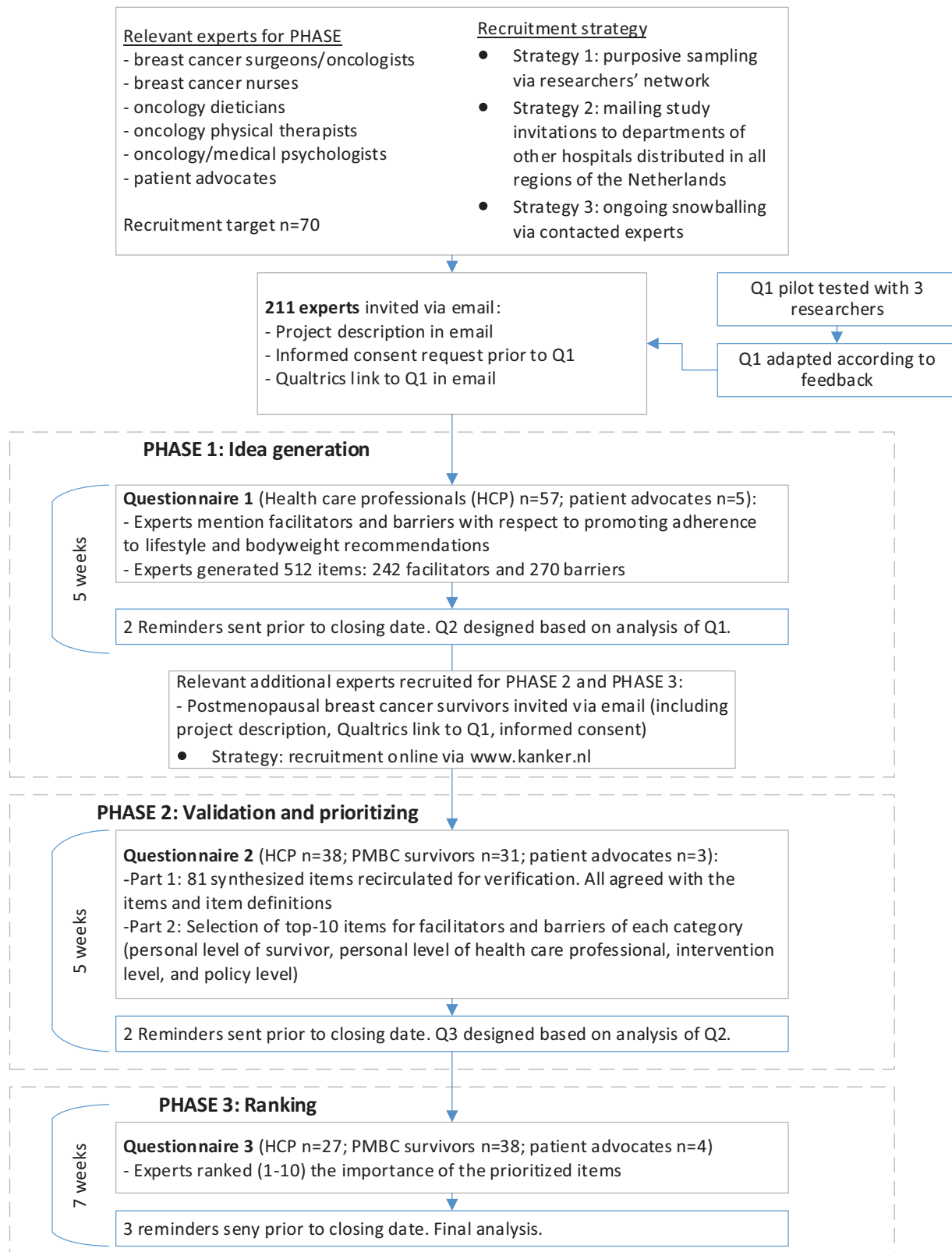


Fig. 1. Delphi-study flow chart. *HCP* health care professional; *Q1* Questionnaire 1; *Q2* Questionnaire 2; *Q3* Questionnaire 3.

University. All participants provided written informed consent. Study methods and results are reported following the Recommendations for Conducting and Reporting of Delphi Studies (CREDES) [39].

Participants

This study aimed to compose an expert panel with diverse relevant experience and knowledge on (the promotion of) healthy lifestyle changes among PMBC survivors. We selected

six main groups of HCPs involved in the health care trajectory of PMBC survivors: (i) breast cancer oncologists, (ii) breast cancer surgeons, (iii) breast cancer nurses, (iv) oncology dieticians, (v) oncology physiotherapists, and (vi) clinical psychologists in the field of oncology. A total of 211 eligible experts were invited with the intention to recruit minimally 7 but preferable 10 HCPs per expert group [35]. In Table 1, the number of participating HCPs in each expert group is presented.

In addition to HCPs, cancer survivors were included as experts. To limit overburdening cancer survivors, Questionnaire 1 only included ideas of patient advocates. Starting from Questionnaire 2, PMBC survivors were included. Recruitment of PMBC survivors was performed via www.kanker.nl, a Dutch website for cancer survivors including an active online patient panel who can be invited for research. In total, 38 out of the approached 134 PMBC survivors participated (see Table 1).

Procedure and Data Analysis

Stage 1 BCW—Understanding the behavior

The Delphi-study provided insight in Stage 1 of the BCW using three questionnaires: Q1—idea generation; Q2—validation and prioritization; Q3—ranking. See Fig. 1 for the Delphi-study flow chart.

Questionnaire 1 (Q1): Idea generation

Panel members were asked to respond to two main questions about listing potential facilitators [1], and potential barriers [2] for promoting a healthy lifestyle in (clinical) care for PMBC survivors. The following question was asked to retrieve facilitators: “Could you name at least 3 possibilities/initiatives to successfully implement lifestyle care among postmenopausal breast cancer patients?” To retrieve barriers, the following question was asked: “Could you name at least 3 barriers to successfully implement lifestyle care among postmenopausal breast cancer patients?” These questions were identical for HCPs and PMBC survivors/patient advocates. Five open-answer options were provided for each question. During analysis, answers were collated, synthesized, and edited to ensure consistent terminology was used for identical ideas. Next, related and comparable items were categorized into a theme. An inter-rater process incorporating

three researchers was used to assist in reaching interpretive congruity [40].

Reported facilitators and barriers mentioned in response to Q1 were categorized into main overarching levels corresponding to the wheels of the BCW (see Column 1, Table 2) [33]: the individual level of PMBC survivor, individual level of HCP, intervention level, and policy level.

Questionnaire 2 (Q2)—Part 1: Validation of categorized items

The first part of Q2 was designed based upon the answers to Q1. The goal was to strengthen construct validity according to the concept of “member checking” [40]. All answers to Q1 (items) were described in an item definition based on the written explanations of the experts. The item definitions were discussed among three researchers until consensus was reached. Afterwards, the items and item definitions were circulated to all participants for verification.

From this moment onwards, PMBC survivors were invited to participate. They were also asked to validate responses provided in Q1. Besides, they were invited to add any possible missing facilitators and barriers. However, none were added.

Q2—Part 2: Prioritizing items

In the second part of Q2, all experts were asked to select their top 10 of most important items on eight lists: lists of facilitators and barriers for each of the four levels of the BCW (personal level of PMBC survivor, personal level of HCP, intervention level, policy level). Then, a weighted combined top 10 was created per list, consisting of both HCPs and PMBC survivors/patient advocates' opinions. To create this weighted combined top 10, points were allocated for a certain position in the top 10 during the analysis, with “item 1” indicating “top priority” receiving 10 points, “item 2” receiving 9 points, and so on. Some categories resulted in less than 10 items following the item generation in Q1; in this case all available items were prioritized.

Questionnaire 3 (Q3): Ranking items

In Q3, all experts were asked to assign weights to all the items in the eight top 10 lists to provide insight in the relative importance of the items to be able to select the key facilitators and barriers. A 10-point Likert scale was used for weighting the items (1 = not important at all, 10 = very important). The experts were not restricted in the assignment of importance. For example, they could assign high weight to all top 10 items or chose to only assign high weight to the number 1 item of the list. Subsequently, key barriers and facilitators were identified by comparing the median ranks of all barriers and facilitators on the weighted top 10 lists retrieved from Q2. A key barrier or facilitator was recognized as having an average score of ≥ 7 Likert scale points in the ranking process with a level of consensus higher than 75% agreement among all expert rankers [41]. The percentage of agreement reflects the part of the expert panel agreeing that it is a top-priority item (i.e., a rank score of higher than 7). Key barriers and facilitators were listed separately for PMBC survivors/patient advocates and HCPs (see Fig. 2).

Then, based on these key facilitators and barriers, overarching core categories were defined. As a reported facilitator may be equivalent to a reversed barrier, the reported key barriers and facilitators were combined. This process has

Table 1 Overview of Delphi Participants

Expert groups	Q1 (n)	Q2 (n)	Q3 (n)
Health care professionals	57	38	27
Breast cancer oncologist	7	4	1
Breast cancer surgeon	11	6	4
Breast cancer nurses	19	15	12
Oncological dieticians	7	2	1
Oncological physiotherapist	9	8	7
Oncological psychologists	4	3	2
Patient advocates	5	3	4
Postmenopausal breast cancer survivors	–	34	38
Total	62	75	69

Table 2 Overview of Core Categories of Facilitators and Barriers for Lifestyle Care, Behavioral Diagnosis, Intervention Functions, Policy Categories, Behavior Change Techniques, and Potential Intervention Strategies

Behavioral diagnosis structured by COM-B ^a components: what needs to change—TDF ^b domains that can be used	Intervention functions ^c	Policy categories ^d	Behavior change techniques (BCTs v1) ^e	Potential intervention strategies
<i>Individual level of PMBC survivor</i>				
Psychological capability				
<i>1. Attention for balance of physical load and load capacity</i>				
- Knowledge	Education, Training, Environmental restructuring, Enablement, Modeling.	Communication/marketing, Service provision.	Information about health consequences, Demonstration of how to perform the behavior, Self-monitoring of outcome of behavior(s), Goal setting (behavior/outcome), Action planning, Graded tasks, Problem solving, Verbal persuasion of capability.	- Provide information concerning physical consequences of cancer and its treatment and the relation to energy balance through educational workshops, pamphlets, or digital advice. - Fill in diaries detailing daily patterns of activities for different periods of the day followed by reflection on when it is more difficult to balance one's physical load and load capacity and why. - Provide support in setting SMART and increasingly difficult goals with respect to physical load, in line with graded tasks, supporting increase of load capacity. - Provide free and accessible sleep counseling for PMBC survivors experiencing sleep problems or low sleep quality. A good night's rest may positively affect the balance between physical load and load capacity.
- Memory, attention, and decision processes				
- Behavior regulation				
<i>2. Attention for stress and coping with stress</i>				
- Knowledge	Education, Training, Environmental restructuring, Enablement, Modeling.	Communication/marketing, Service provision.	Information about health consequences, Information about emotional consequences, Instruction on how to perform the behavior, Demonstration of the behavior, Action planning, Reduce negative emotions, Problem solving.	- Provide information with respect to psychological consequences of cancer and its treatments, and ways to cope with stressors through educational workshops, pamphlets, or digital advice. - Provide free or low budget and accessible mental counseling following the diagnosis breast cancer. - Prompt PMBC survivors to identify potential stressors and discuss ways to overcome them.
- Memory, attention, and decision processes				
- Behavior regulation				
<i>3. Increase PMBC survivors' knowledge of the relation between lifestyle and cancer</i>				
- Knowledge	Education	Communication/marketing, Service provision.	Information about health consequences, credible source.	- Provide generic tips, stress-reduction apps, mindfulness training to deal with stress and invite PMBC survivors to identify strategies specific to their circumstances to deal with (moments of) stress. - Raise knowledge of the relation between lifestyle and cancer through educational workshops, pamphlets or digital advice, or copies of the World Cancer Research Fund cancer prevention recommendations booklets. - It is important that information is provided by a credible source. A HCP is generally seen as a credible source.
Behavioral diagnosis by COM-B^a; TDF^b domains				
Social and physical opportunity				
<i>4. Increase patient-guided care</i>				
- Knowledge	Education, Environmental restructuring, Enablement, Modeling.	Communication/marketing, Guidelines, Environmental/social planning, Service provision.	Information about health consequences, Instruction on how to perform a behavior, Demonstration of the behavior, Restructuring the social environment, Prompts/cues.	- Provide information regarding typical (lifestyle-related) topics that can be discussed during follow-up consultation (e.g., sleep problems, diet, physical activity). PMBC survivors can use this information and apply it to their own situation to prepare questions for their follow-up consultation. - Invite PMBC survivors to indicate the HCPs of their choice (e.g., nurse, dietician, physical therapist, psychologist, etc.) they would prefer to meet with during their follow-up consultation based on their needs and preferences.
- Social influences				
- Environmental context and resources				

Table 2. Continued

Behavioral diagnosis by COM-B ^a : TDF ^b domains	Intervention functions ^c	Policy categories ^d	Behavior change techniques (BCTs) v1) ^e	Potential intervention strategies
5. <i>Social functioning and (lack of) support from the social environment</i> - Social influences	Environmental restructuring, Enablement, Modeling.	Communication/marketing, Service provision.	Restructuring the social environment, Social support (unspecified), Social support (emotional), Social support (practical), Demonstration of the behavior, Identification of self as role model.	<ul style="list-style-type: none"> - Organize education workshops for family and peers explaining the link between lifestyle and cancer (prognosis), and stressing the positive impact of social support (both emotional and practical) on a healthy lifestyle. The educational workshop can be used to show and teach ways to effectively provide social support. - Raise awareness of the need for social support for PMBC survivors by pamphlets or digital advice. - Provide support on request for PMBC survivors who intend to maintain their social roles in society as much as possible, e.g., for those PMBC survivors who maintain working. - Set up lifestyle counseling as a way to get in touch with fellow PMBC survivors to increase levels of social support (e.g., group counseling, buddy system, online forum).
<i>Individual level of HCP</i> Psychological capability				
6. <i>Increase knowledge concerning the relation between lifestyle and cancer and HCPs skills regarding lifestyle medicine</i> - Knowledge - Cognitive and interpersonal skills - Memory, attention and decision processes	Education, Training, Environmental restructuring, Enablement.	Communication/marketing, Guidelines, Regulation, Service provision.	Information about health consequences, Prompts/cues, Demonstration of the behavior, Instruction on how to perform the behavior, Feedback on the behavior, Feedback on outcome(s) of the behavior, Behavioral practice/rehearsal, Action planning.	<ul style="list-style-type: none"> - Include lifestyle medicine in the curriculum of medical studies for oncology (including medical school). - Provide supplementary training for HCPs concerning the relation between lifestyle and cancer. - Provide optional supplementary training for HCPs concerning lifestyle coaching and motivational interviewing. - Set guidelines and/or rules with respect to the recommended type of lifestyle-related training a HCPs needs to have attained to be able to provide lifestyle advice/counseling.
Automatic and reflective motivation				
7. <i>Creating support for providing lifestyle-care</i> - Professional/social role and identity - Beliefs about consequences - Intentions - Goals - Reinforcement	Education, Persuasion, Modeling, Training, Environmental restructuring.	Communication/marketing, Guidelines, Fiscal measures, Regulation, Environmental/social planning, Service provision.	Information about health consequences, Feedback on outcome(s) of the behavior, Credible source, Verbal persuasion about capability, Identification of self as role model, Demonstration of the behavior, Restructuring the social environment.	<ul style="list-style-type: none"> - Raise awareness of the relation between a healthy lifestyle and cancer prognosis. - Raise awareness of the relation between lifestyle advice provided by a medical professional and favorable lifestyle change. - Present evidence supporting the important role a HCP may have to promote a healthier lifestyle. - Incorporate lifestyle care in the regular care plan by guidelines or rules. - Stress the responsibility of an educated HCP to inform PMBC survivors about the risk of an unhealthy lifestyle and benefits of favorable lifestyle changes for their health and cancer prognosis.

Table 2. Continued

Behavioral diagnosis by COM-B ^a ; TDF ^b domains	Intervention functions ^c	Policy categories ^d	Behavior change techniques (BCTs v1) ^e	Potential intervention strategies
<i>Intervention level</i>				
Physical and social opportunity				
8. <i>Better integration of lifestyle-care in follow-up care</i>				
<ul style="list-style-type: none"> - Environmental context and resources - Social influences 	<p>Training, Restriction, Environmental restructuring, Modeling, Enablement.</p>	<p>Guidelines, Regulation, Environmental/social planning, Service provision.</p>	<p>Habit formation, Habit reversal, Behavioral practice/rehearsal, Adding objects to the environment, Prompts/cues, Restructuring the physical environment, Restructuring the social environment, Demonstration of the behavior, Action planning, Problem solving.</p>	<ul style="list-style-type: none"> - Set guidelines and/or rules about who is responsible for lifestyle care at what time point during the care trajectory. This prevents ambiguity on who is responsible, with the possible consequence that no caregiver provides lifestyle care. - Plan structural cooperation between HCPs of different expertise. - Arrange a collaboration agreement between the hospitals' HCPs and local lifestyle caregivers (e.g., dietitians, physical therapists, psychologists). - Stimulate collaboration among HCPs regarding lifestyle care by setting up a list for referral containing contact details of relevant lifestyle caregivers of several professions. - Discuss lifestyle during multidisciplinary in-hospital consultation. - Hospital caregivers may contact general practitioners if lifestyle care is needed, the general practitioner could coordinate the following lifestyle care. - Repeatedly provide information with respect to lifestyle during the care trajectory and thereafter. As every individual is unique, every PMBC survivor has her own optimal timing and method at which lifestyle care is most effective. - Dedicate a follow-up consultation to lifestyle care. - Policy makers and health insurance advisors can stimulate better integration of lifestyle care by approving lifestyle care for basic health care insurance coverage.
9. <i>Incorporate self-monitoring in lifestyle counselling</i>				
<ul style="list-style-type: none"> - Environmental context and resources 	<p>Training, Environmental restructuring, Enablement.</p>	<p>Guidelines, Service provision.</p>	<p>Instruction on how to perform the behavior, Self-monitoring of the behavior, Restructuring the physical environment, Goal setting (behavior), Goal setting (outcome), Discrepancy between current behavior and goal, Review behavior goal(s), Review outcome goal(s).</p>	<ul style="list-style-type: none"> - Provide information on self-monitoring, setting goals, reviewing the outcome of goals, and adjusting behavioral goals by means of educational workshops, booklets, or digital advice. - Provide tools for self-monitoring to PMBC survivors with respect to sleep, physical activity, smoking and diet. For example, an accelerometer, food/physical activity/sleep diary, wearables/smartwatches. - Discuss (self-monitored) behavior/outcome of behavior and review behavior/outcome goals.
<i>Policy level</i>				
Physical and social opportunity				
10. <i>Availability and accessibility of opportunities for lifestyle-care</i>				
<ul style="list-style-type: none"> - Environmental context and resources 	<p>Environmental restructuring, Enablement.</p>	<p>Fiscal measures, Regulation, Environmental/social planning, Service provision.</p>	<p>Adding objects to the environment, Restructuring the physical environment, Behavior substitution, Problem solving, Action planning.</p>	<ul style="list-style-type: none"> - Policy makers and health insurance advisors can make lifestyle care more accessible and available for PMBC survivors by approving lifestyle care for basic health care insurance coverage. - Increasing the number of facilities to perform or educate healthy behaviors that are favorable for healthy lifestyle change (e.g., sports center, rooms in hospital to provide guidance during rehabilitation, workshop locations for educational lifestyle meetings). For example, a sports facility in the proximity has a positive effect on the level of physical activity [44]. - Provide information on behavior substitution to increase physical activity in the absence of a sporting facility in the proximity. For example, explain the benefit of replacing sitting behavior by increased time of walking.

Table 2. Continued

Behavioral diagnosis by COM-B: ^a TDF ^b domains	Intervention functions ^c	Policy categories ^d	Behavior change techniques (BCTs) v1) ^e	Potential intervention strategies
<p>11. <i>Public perception of lifestyle</i></p> <ul style="list-style-type: none"> - Environmental context and resources - Social influences 	Education, Restriction, Environmental restructuring, Modeling, Enablement.	Communication/marketing, Fiscal measures, Regulation, Legislation, Environmental/social planning.	Information about health consequences, Feedback on outcome(s) of the behavior, Restructuring of the physical environment, Restructuring of the social environment, Reduce prompt/cue, Problem solving, Action planning.	<ul style="list-style-type: none"> - Restriction of mass media with respect to unhealthy diet and snacking. For example, limited commercials of snacks during movies. - Restriction of locations where smoking is allowed. - Restriction of locations where alcoholic beverages are sold. - Replace unhealthy choices by more healthier choices in canteens, sport facilities, hospitals, etc. - Reorganize the supermarket in line with healthy nudging. - Provide information how mass media affects our own lifestyle by educational workshops, pamphlets, and online advice. - Prompt PMBC survivors to identify the moments the public perception of lifestyle affects their lifestyle and discuss ways to overcome them.

HCP health care professional; PMBC postmenopausal breast cancer.

^aCOM-B: The BCW describes target behavior in line with the Capability-Opportunity-Motivation for Behavior (COM-B) model.

^bTDF domain: The Theoretical Domains Framework is a framework synthesizing key theoretical constructs used in relevant behavioral change theories. The TDF framework was developed in collaboration between psychologists and implementation researchers.

^cIntervention functions: An intervention function is a broad category of means how an intervention can change behavior. The BCW describes nine potential intervention functions, including education, training, persuasion, incentivization, coercion, restriction, modeling, environmental restructuring, and enablement.

^dPolicy categories: The BCW describes nine policy categories that are potentially capable of supporting an intervention function. They represent ways in which authorities can help support or enact behavior change, specifically by means of communication/marketing, guidelines, fiscal measures, regulation, legislation, environmental/social planning, and service provision.

^eBCT: Behavior Change Techniques are the “active ingredients” of change are defined as “observable, replicable, and irreducible component of an intervention designed to alter or redirect causal processes that regulate behavior.”

previously been described as selective coding, which is part of thematic analysis [40].

In line with the final steps of Stage 1 of the BCW, we then applied our findings to the three BCW components: (C) Capability, (O) Opportunity, and (M) Motivation. In addition, for each core category of the targeted lifestyle (support) behavior (B) we expended the COM-B components to specific TDF domains correlating to the BCW COM-B components. These steps led to a complete behavior diagnosis, completing Stage 1 of the BCW framework.

Stage 2 BCW—Identify intervention options

Following, we continued the analyses with *Stage 2* of the BCW framework, specifically identifying intervention options. In this stage, intervention functions and policy categories were identified for each core category of the target behavior. An intervention function is a broad category of means how an intervention can change behavior. The BCW describes nine potential intervention functions, including education, training, persuasion, incentivization, coercion, restriction, modeling, environmental restructuring, and enablement [33]. The BCW also describes nine policy categories that are potentially capable of supporting an intervention function (communication/marketing, guidelines, fiscal measures, regulation, legislation, environmental/social planning, and service provision). They represent ways in which authorities can help support or enact behavior change [34].

Stage 3 BCW—Identify content and implementation options

Next, in the last stage of the BCW framework, we identified potential Behavior Change Techniques (BCTs) for each of the overarching core categories. BCTs are the “active ingredients” of change defined as “observable, replicable, and irreducible component of an intervention designed to alter or redirect causal processes that regulate behavior” [34]. The Behavior Change Taxonomy (BCTTv1) describes 93 BCTs [42]. Besides specifying potential effective BCTs, we also added practical suggestions for potential intervention strategies based on responses by the expert panel during the Delphi-study.

Results

Table 1 provides an overview of the number of participants per expert group.

Stage 1 BCW—Understand the Behavior

In Q1 of the Delphi-study, without removal of duplicates, a total of 242 facilitators and 270 barriers were mentioned by the experts. After removal of duplicates, in Q2 81 synthesized items were circulated for verification. All experts agreed with the list of items and item definitions. Figure 2 shows the top-ranked facilitators and barriers for both HCPs and PMBC survivors/patient advocates. In addition, the percentage of agreement is shown in this figure. Figure 2 shows, for example, that “psychological consequences of cancer(treatment)” was ranked as a barrier at the individual level of the PMBC survivor with a median rank of 9 by PMBC survivors/patient advocates and with a median rank of 8 by HCPs. There was 95% agreement among PMBC survivors/patient advocates that “psychological consequences of cancer(treatment)” was a top-priority barrier. Among HCPs, 88% agreed that “psychological consequences of cancer(treatment)” was a top-priority barrier (see Appendices A and B). In general, compared with

the PMBC survivors/patient advocates, HCPs indicated lower priority to barriers at the individual level of the HCP and barriers at the intervention level. In addition, PMBC survivors indicated lower priority to barriers at policy level compared with HCPs.

Combined analysis of HCPs and PMBC survivors/patient advocates results on Q2 and Q3, resulted in top-priority lists of items. These were synthesized to main core categories (see [Appendix C](#)). At the individual level of the PMBC survivor the following main core categories were specified: “Attention for balance of physical load and load capacity”; “Attention for stress and coping with stress”; “Increasing PMBC survivors’ knowledge of the relation between lifestyle and cancer”; “Increasing patient-guided care”; “Social functioning and (lack of) support from the social environment” (see [Table 2](#), [Appendices A–C](#)). At the individual level of the HCP the following core categories in line with experts’ responses were identified: “Increasing knowledge concerning the relation between lifestyle and cancer,” “HCPs skills regarding lifestyle medicine,” and “Creating support for providing lifestyle-care” (see [Table 2](#), [Appendices A–C](#)). At the intervention level, the experts agreed that better integration of lifestyle care in follow-up care is needed. In addition, they agreed that incorporating self-monitoring in lifestyle counseling may improve adherence to lifestyle recommendations as well as increase effectiveness of the lifestyle support. At policy level, the experts stressed the importance of availability and accessibility of opportunities for lifestyle care, and the role of public perception of lifestyle (see [Table 2](#), [Appendices A–C](#)).

Stage 2 BCW—Identify Intervention Options

Intervention functions that may intervene with the experts’ core categories of facilitators and barriers are described in [Table 2](#). Below, a few examples will be provided. See [Table 2](#) for an overview of intervention options and corresponding BCW policy categories for all core categories.

Example of selection of intervention options for the main core category “Increase PMBC survivors’ knowledge of the relation between lifestyle and cancer”

To increase PMBC survivors’ knowledge of the relation between lifestyle and cancer *education* was selected as most promising intervention function. For the beforementioned example, the policy categories *communication/marketing* and *service provision* were selected to be able to provide education to PMBC survivors concerning the relation between lifestyle and cancer.

Example of selection of intervention options for the main core category “Better integration of lifestyle care in follow-up care”

According to the experts, the main core category *Better integration of lifestyle care in follow-up care* requires guidelines or rules specifying who is responsible for lifestyle at what time point during the care trajectory as they are often lacking (mentioned as barrier “Ambiguity on who is responsible for lifestyle care”). In addition, collaboration among HCPs should be stimulated, as this may lead to the most effective lifestyle care (based on mentioned facilitator “Organizing cooperation”). Practical strategies to achieve this, in line with expert-opinions, are visualizing a social network of relevant lifestyle caregivers and regional lifestyle

support initiatives, making collaboration agreements, and setting up a list for referral (based on mentioned facilitator “Organizing collaboration,” and barrier “Lack of contact list for referral”).

Stage 3 BCW—Identify Content and Implementation Options

The selected BCTs that may facilitate behavioral change in case an intervention is developed to affect lifestyle (support) in PMBC survivors are presented in [Table 2](#). BCTs were selected for each of the 11 overarching core categories. For example, to increase PMBC survivors’ knowledge of the relation between lifestyle and cancer, a potentially effective BCT could be to provide *information about health consequences* of the current behavior and information concerning the advantageous health consequences following favorable lifestyle change. Particularly, when a *credible source* (e.g., the oncologist) delivers the message. In the last column of [Table 2](#), practical suggestions for potential intervention strategies based on responses by the expert panel during the Delphi-study are listed. Below, examples are provided.

Example of selected BCTs and implementation options

For the main core category “Attention for balance of physical load and load capacity,” the importance of goal setting was mentioned by our expert group as potential effective strategy. Specifically, maintaining or retaining this balance may be achieved by setting SMART and increasingly difficult goals with respect to physical load, usage of *graded tasks*, and discussion of *behavior goals* and the *outcome of behavioral goals* to support increase of load capacity of the PMBC survivors.

Example of potential intervention strategies

With regard to the main core category “Incorporate self-monitoring in lifestyle counselling,” experts mentioned that it is important to indicate how to use *self-monitoring* in behavior change, as well as the importance of *reviewing the behavior goals* together with *reviewing the outcome of goals* following a period of self-monitoring of behavior. Potential tools for continuous monitoring by PMBC survivors that were mentioned were an accelerometer, food/physical activity/sleep diary, and tools like wearables and smartwatches.

Discussion

This Delphi-study aimed to identify and understand expert-opinion on potential barriers and facilitators for promoting adherence to lifestyle and bodyweight recommendations in (clinical) care for PMBC survivors, and to determine potential effective intervention strategies. Expert-opinions on barriers and facilitators resulted in 11 core overarching categories. Specifically, at the individual level of the PMBC survivor: Attention for balance of physical load and load capacity; Attention for stress and coping with stress; Increase PMBC survivors’ knowledge on the relation between lifestyle and cancer; Increase patient-guided care; and Social functioning and; (lack of) support from the social environment. At the level of the HCP the following main core categories were specified: Increase knowledge concerning the relation between lifestyle and cancer; HCPs skills regarding lifestyle medicine; and Creating support for providing lifestyle-care. At the intervention level the following main core categories play a role according to the expert

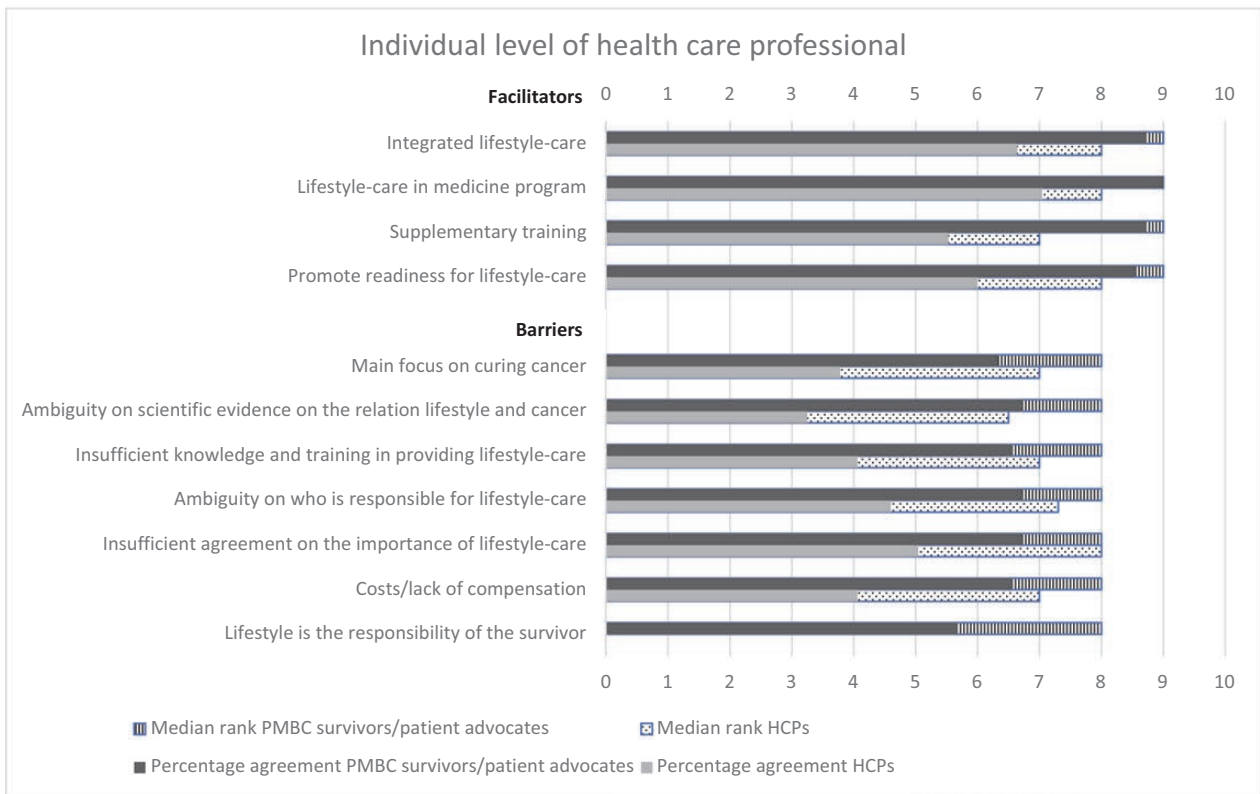
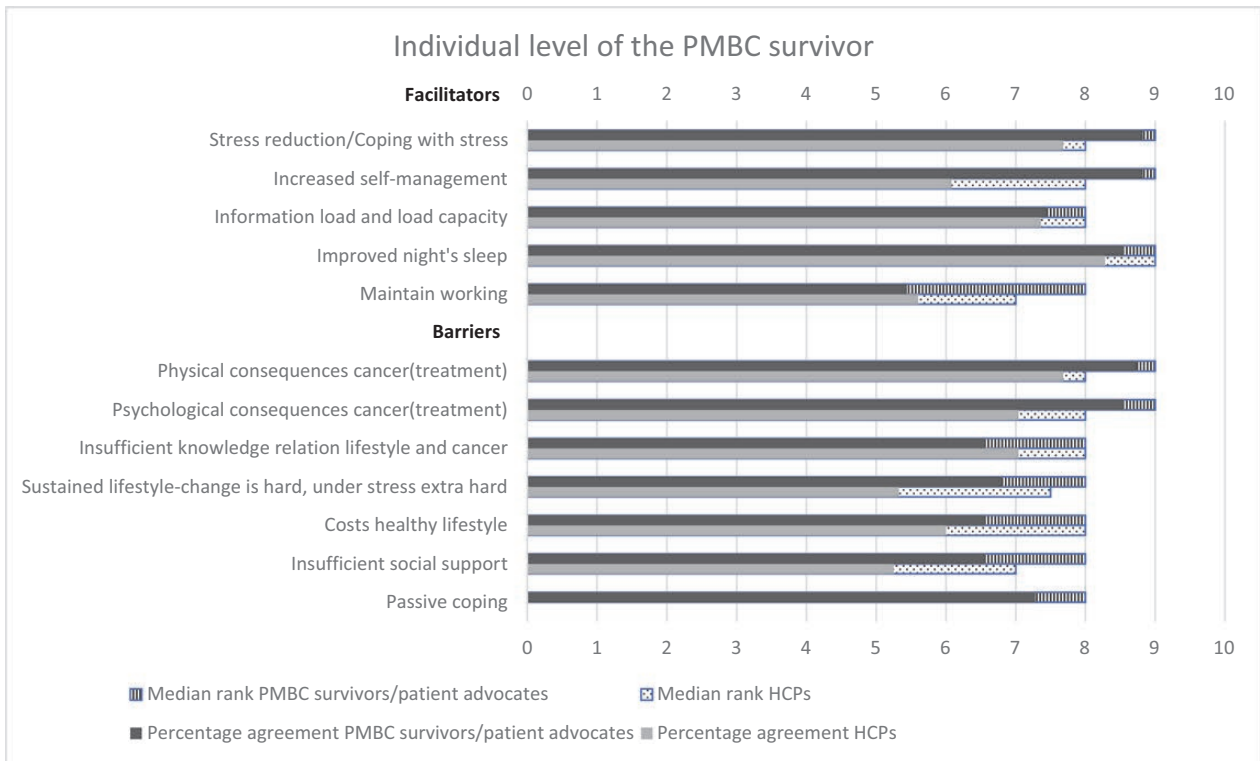


Fig. 2. Ranking and percentage of agreement by the expert panel of top-ranked facilitators and barriers. *Note:* The bars representing median rank, reflect the median of the ranking by the expert panel. The bars representing the percentage of agreement, reflect the percentage of the expert panel agreeing with a rank score higher than 7. In other words, the percentage of agreement visualizes the part of the expert panel agreeing that it is a top-priority item. The item definitions of facilitators and barriers can be viewed in [Appendices A and B.](#)

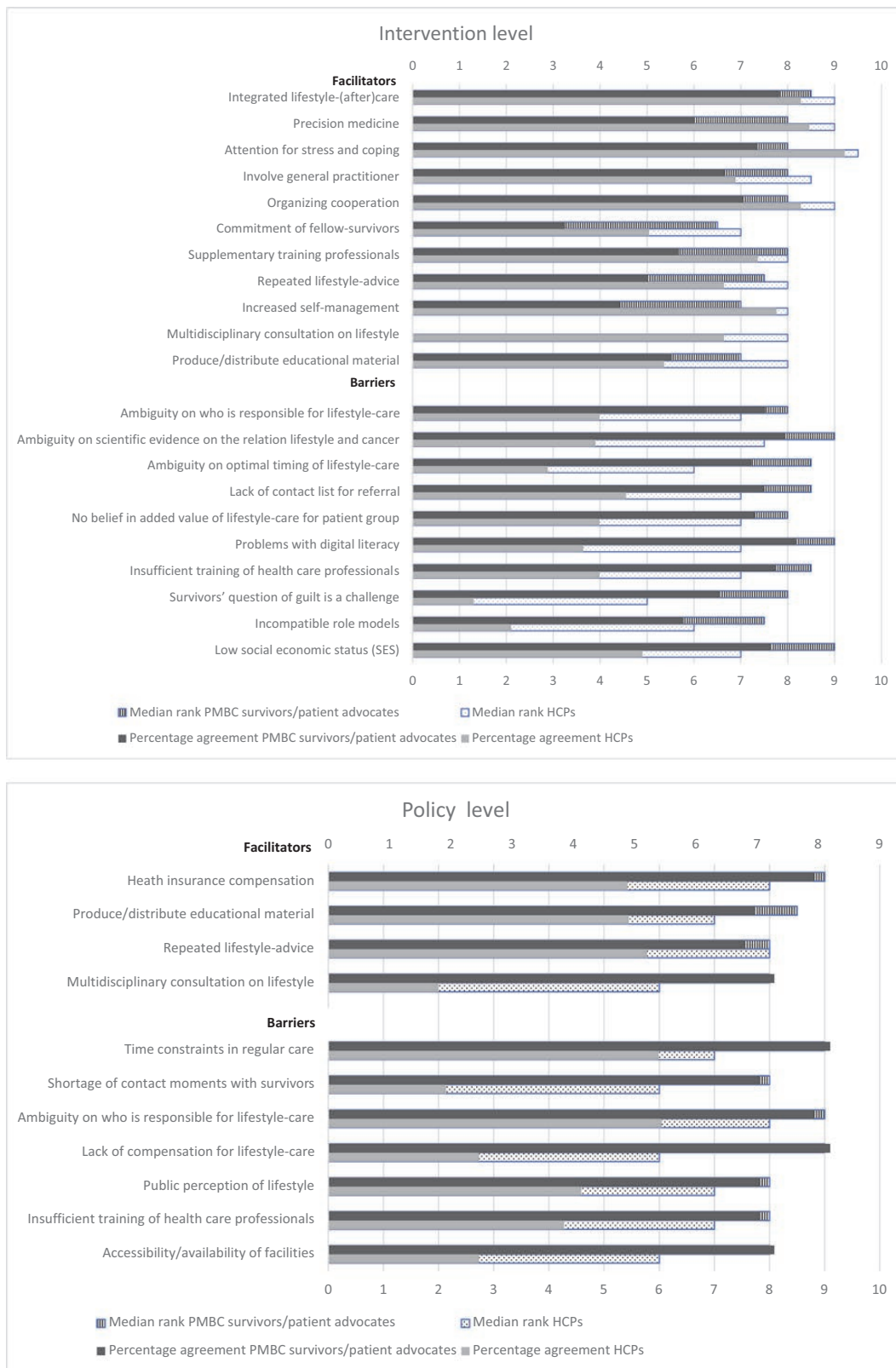


Fig. 2. Continued

panel: Better integration of lifestyle care in follow-up care; Incorporate self-monitoring in lifestyle counseling. Last, the following main core categories were specified at the policy level: Availability and accessibility of opportunities for lifestyle care and the Public perception of lifestyle. In

addition, adopted on these 11 core overarching categories, potential effective BCTs were selected. Overall, across main categories, the following BCTs were suggested: providing information about health consequences; demonstration of the behavior; providing instruction on how to perform the

behavior; restructuring the social and physical environment; goal setting; problem solving; and action planning.

Thus far, no other studies have provided insight into barriers and facilitators for promoting lifestyle (support) in PMBC survivors based on expert-opinion of HCPs and PMBC survivors. A previous systematic review of qualitative studies did however provide insight into main themes relevant to achieve long-term weight loss [43]. Specifically, the following main themes relevant for sustainable weight-loss interventions were mentioned: using continuous monitoring (self-monitoring and external monitoring); stimulating intrinsic and extrinsic motivation; goal setting (self-defined and externally defined); cope with enduring challenges (intrinsic and extrinsic challenges); overall encouraging and discouraging experiences. In accordance with this systematic review, our results indicate incorporation of the usage of self-monitoring, and the usage of goal setting as potential effective strategies to promote adherence to lifestyle and bodyweight recommendations. In addition to the findings of this review, effective social support and effective strategies to cope with stress are both helpful to cope with the challenge of the breast cancer diagnosis and treatment according to the expert panel.

In line with previous studies, especially the PMBC survivors and patient advocates stressed the important role the HCP may play in stimulating and providing support for obtaining a favorable lifestyle [22–24]. An important barrier both HCPs and PMBC survivors mentioned is the ambiguity that exists among publicly available information regarding the relation between lifestyle and cancer. To overcome this barrier, the World Cancer Research Fund has published digital advice and several recommendation booklets which can be requested for usage in clinical practice [1]. Also, the experts mentioned that for PMBC survivors it may be useful to organize educational workshops on the relation between lifestyle and cancer and the health benefits of lifestyle change. By this means *information would be provided about health consequences*. In addition, during the workshop it could be *demonstrated how to perform the behavior*, and *instructions could be provided on how to perform the behavior* in daily life. For HCPs, supplementary training concerning the relation between lifestyle and cancer, as well as concerning lifestyle coaching and motivational interviewing may be fruitful. During this training they could be *instructed how to perform the behavior*, *demonstrated how to perform the behavior*, and *rehearse/practice* by themselves the newly adopted *behaviors*. The instructor and other attendees could provide *feedback on the behavior*. In addition, they can *plan future actions* incorporating the new behavior in clinical practice.

It should be noted that the suggested BCTs and intervention strategies may vary with regard to the potential difficulties that can be expected to be encountered while implementing them. For example, whereas the suggested BCTs and intervention strategies for the core category “Increase PMBC survivors’ knowledge of the relation between lifestyle and cancer” (e.g., providing information about health consequences by means of a leaflet provided by the HCP as credible source) are relatively easy to implement, the suggested BCTs and intervention strategies for the core category “Increase knowledge concerning the relation between lifestyle and cancer and HCPs skills regarding lifestyle medicine” (e.g., include lifestyle medicine in the curriculum of medical studies for oncology) are relatively harder to implement. Furthermore, some of the BCTs and intervention strategies mentioned for

the core category “Public perception of lifestyle” at the policy level are relatively difficult to implement. For example, the suggested intervention strategy to restrict mass media with respect to unhealthy diet and snacking will be difficult to implement. However, some of the other strategies mentioned for this core category are relatively easier to implement, such as “Prompt PMBC survivors to identify the moments the public perception of lifestyle affects their lifestyle and discuss ways to overcome them,” which could be addressed during an individual consultation. Which HCP could address this at what point in time during the care trajectory could be agreed on at the institutional level to better integrate lifestyle care into follow-up care for PMBC survivors.

Study Strengths and Limitations

A strength of this study was the inclusion of six relevant HCP expert groups as well as a PMBC survivor expert group, resulting in a good representation of HCP’s and PMBC survivors. In addition, using a theoretical approach (i.e., BCW) specifically developed for aiding systematic intervention development increases the applicability of the results in the development of future interventions and policy.

The present study also has some limitations. First, we intended to incorporate at least seven participants per expert group in Round 1 of the Delphi-study. However, the HCP expert group of psychologists did not consist of a minimum of seven participants but of four participants. In addition, the expert group of patient advocates consisted of five participants. Even though these expert groups consisted of a lower number than 7, we did receive a lot of input (i.e., rich qualitative data) from the participating psychologists and patient advocates, suggesting that these groups of HCPs were still well represented in the Delphi-study. Next, due to dropout we choose to re-invite PMBC survivors and patient advocates for Questionnaire 3 who did not participate in Questionnaire 2. This may have resulted in a slight change in difference of allocated weight to the top-ranked barriers and facilitators. In addition, we categorized the facilitators and barriers that seemed most relevant for a specific level of the BCW, however, it should be kept in mind that most key facilitators and barriers coherently affect multiple levels. Lastly, our expert panel did not include policy makers and general practitioners. As this study indicates a potentially important role of policy makers in promoting lifestyle support among PMBC survivors, it is recommended to also include policy makers in future studies and while designing lifestyle interventions. In addition, both HCPs and PMBC survivors mentioned the potentially important role a general practitioner may play to provide or promote lifestyle support, especially during follow-up care. As the experts mentioned that general practitioners should be included in social HCP networks regarding lifestyle support provision, it is also recommended to include general practitioners in future studies as well as in the design of lifestyle interventions.

Although the amount of scientific literature on the effectiveness of BCTs is increasing, the evidence for the long-term effectiveness of BCTs, particularly among (PMB) cancer survivors, is limited. It is important to note in this context, that the active ingredients (i.e., the BCTs) in behavioral interventions tend to be underreported in scientific publications, which complicates building scientific evidence on the effectiveness of specific BCTs [44]. Typically, a combination of different BCTs are applied in behavioral interventions, with

evidence suggesting that the application of a higher number of BCTs is associated with intervention effectiveness [45].

To address the main core category “Increase PMBC survivors’ knowledge of the relation between lifestyle and cancer,” the current study suggests to apply the BCTs *information about health consequences* and *credible source*. Although previous research confirms a link between the BCT *information about health consequences* and (increasing) knowledge as a mechanism of action through which a behavioral intervention may change behavior [46], to our knowledge there currently is little evidence that the BCT *information about health consequences* is related to long-term behavior changes. A meta-analysis on maintaining smoking abstinence following a stay in a smoke-free institution in adult smokers up to 18 months after discharge did identify the BCT *information about health consequences* as promising in terms of probable effectiveness and feasibility [47]. A previous randomized controlled trial among individuals with Lynch syndrome has shown that provision of health promotion materials (including information about health consequences) increased knowledge on lifestyle recommendations for cancer prevention but did not affect adherence to these recommendations [48]. These findings are in line with the premise that multiple determinants of health behavior change need to be targeted with suitable BCTs in order to achieve (sustained) health behavior change. A recent systematic review of the literature on determinants of health behavior changes after a cancer diagnosis has shown that lack of information or advice from health care professionals and lack of knowledge on health benefits were frequently mentioned as barriers to lifestyle changes and that perceived/anticipated benefits were frequently mentioned as a facilitator in qualitative studies [49]. These qualitative findings highlight the importance of information provision by HCPs and suggest that the BCTs *information about health consequences* and *credible source* may play an important role in inducing health behavior changes in cancer survivors. However, future research should be conducted to further elucidate the role of these BCTs in achieving sustained health behavior changes.

To address the main core category “Attention for balance of physical load and load capacity,” the current study suggests to apply the BCTs *goal setting*, *action planning*, and *graded tasks*. These BCTs have been related to maintenance of behavior change in previous studies [29, 47, 50, 51]. Two previous studies specifically focused on maintenance of behavior change in cancer survivors [29, 50]. A systematic review and meta-analysis on maintenance of physical activity behavior change in cancer survivors found that the BCTs *action planning* and *graded tasks* were present in the “very promising” and “quite promising” studies while most often absent from the “not promising” studies [50]. A systematic review on (maintenance of) weight-loss intervention effects in cancer survivors after completion of active treatment showed that the BCTs *goal setting (behaviour)* and *action planning* were used in effective interventions [29]. Previous studies in healthy adults are in line with the results of these studies among cancer survivors [47, 51]. A systematic review and meta-analysis of physical activity interventions for healthy physical inactive adults showed that maintenance of intervention effects was associated with the BCTs *action planning* and *graded tasks* [51]. Another meta-analysis has shown that the BCTs *goal-setting (behaviour)* and *action planning* were characterized as “promising” in terms of probable effectiveness and feasibility in maintaining smoking abstinence

following a stay in a smoke-free institution up to 18 months post-discharge [47].

In general, future research is needed to assess the long-term effectiveness of BCTs. In order to be able to adequately assess the long-term effectiveness of BCTs using systematic reviews and meta-analyses and to be able to build scientific evidence on the (long-term) effectiveness of BCTs, researchers publishing the results of behavioral interventions should specifically report on the BCTs used in their interventions. Ideally, in addition to an effect evaluation of their intervention, researchers should include process evaluation analyses to gain more insight into the active ingredients of their intervention.

In conclusion, this Delphi-study specified 11 core categories of key barriers/facilitators for promotion of adherence to recommendations for lifestyle and bodyweight in (clinical) care for PMBC survivors. Together with the selected relevant BCTs and practical potential intervention strategies based on suggestions mentioned by the expert panel, this study provides valuable insight for the development of interventions changing behavior of PMBC survivors and HCPs toward increased healthy lifestyle (support) behavior.

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Compliance with Ethical Standards

Authors’ Statement of Conflict of Interest and Adherence to Ethical Standards Sandra J.M. van Cappellen-van Maldegem, Floortje Mols, Jacob C. Seidell, Anja de Kruif, Lonneke V. van de Poll-Franse, and Meeke Hoedjes declare that they have no conflict of interest.

Authors’ Contributions Sandra J.M. van Cappellen-van Maldegem (Conceptualization [equal], Data curation [lead], Formal analysis [equal], Investigation [lead], Methodology [equal], Project administration [lead], Resources [equal], Software [lead], Validation [equal], Visualization [equal], Writing – original draft [lead]), Floortje Mols (Funding acquisition [supporting], Supervision [equal], Writing – review & editing [equal]), Jacob C. Seidell (Conceptualization [equal], Funding acquisition [supporting], Methodology [equal], Supervision [equal], Writing – review & editing [equal]), Anja de Kruif (Conceptualization [equal], Formal analysis [equal], Methodology [equal], Validation [equal], Writing – review & editing [equal]), Lonneke V. van de Poll (Supervision [equal], Writing – review & editing [equal]), and Meeke Hoedjes (Conceptualization [equal], Formal analysis [equal], Funding acquisition [lead], Methodology [equal], Resources [equal], Supervision [lead], Validation [equal], Visualization [equal], Writing – review & editing [equal])

Ethical Approval The study protocol was approved by the medical ethical review board METC Brabant (the Netherlands), according to the Dutch Medical Research Involving Human Subjects Act (WMO).

Transparency Statements (1) Study registration: This study was not formally registered. The study protocol has been previously published. (Van Cappellen-van Maldegem, Sandra JM, et al. “Towards OPTimal Timing and Method for promoting sUstained adherence to lifestyle and body weight recommendations

in postmenopausal breast cancer survivors (the OPTIMUM-study): protocol for a longitudinal mixed-method study.” *BMC Women’s Health* 21.1 (2021): 1–14.) (2) Analytic plan preregistration: The analysis plan was not formally preregistered. The analysis plan has been described previously in the published study protocol. (3) Analytic code availability: There is no analytic code associated with this study. (4) Materials availability: Materials used to conduct the study are not publicly available, however can be requested from the corresponding author.

Data Availability

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Supplementary Material

Supplementary material is available at *Annals of Behavioral Medicine* online.

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