



Perception of the prognostic impact of physical activity among cancer survivors: a narrative review

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Abstract

Purpose Little is known about cancer survivors' perceptions of the prognostic impact of physical activity (PA) and the association between perceptions and PA. Therefore, the present narrative review aimed to identify cancer survivors' perceptions of the prognostic impact of PA, perception barriers, and association with PA.

Methods A literature search was performed via PubMed and Scopus with search terms including “physical activity”, “cancer survivor”, and “perception” in November 2022. Inclusion criteria were studies that investigated cancer survivors' perceptions of the prognostic impact of PA written in English. Studies were excluded for patients undergoing cancer treatment or advanced cancer patients only.

Results Our search identified a total of 13,080 articles, and 14 studies met the inclusion criteria. The study sample size ranged from 8 to 1003 participants. Most studies showed that cancer survivors poorly understood the prognostic impact of PA. Perception barriers were cited as a lack of advice from health care professionals (HCPs). Several studies reported a positive association between the perception of the prognostic impact of PA and actual PA.

Conclusions This narrative review revealed that most reports showed that cancer survivors have a poor perception of the prognostic impact of PA. In addition, the lack of advice from HCPs may also be contributing to the lack of perception among cancer survivors. Therefore, to increase the amount of PA among cancer survivors, it is necessary to improve the perception of the prognostic impact of PA in both cancer survivors and HCPs.

Keywords Physical activity · Oncology · Behavior change · Education · Cancer recurrence · Mortality

Abbreviations

PA Physical activity
HCPs Healthcare professionals
HBM Health belief model

Introduction

Physical activity (PA) is an effective non-pharmacological treatment for improving the physical and mental health of cancer survivors. Many studies have suggested that PA may improve muscle strength, cardiovascular fitness, body composition, bone health, sleep quality, fatigue, depression, and quality of life in cancer survivors [1–7]. Studies have demonstrated that PA has prognostic benefits in breast cancer and colorectal cancer survivors [8, 9]. For example, participation in PA after diagnosis showed a 24% reduction in recurrence and a 45% reduction in mortality in 2987 patients with stage I–III breast cancer [8]. Similarly, in 832 patients with stage III colorectal cancer, participation in PA after diagnosis showed a 40% reduction in recurrence and a 63% reduction in mortality [9]. In addition, biological mechanisms of exercise effects are postulated to modulate metabolism [10, 11], reduce inflammation [10, 12], and improve

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immune function [10, 13]. However, despite the evidence for prognostic benefits of PA, most cancer survivors poorly engage in PA [14–16]. Psychological interventions would be recommended to promote PA in cancer survivors [17]. Previous studies suggest that informing adults about the link between PA and preventing colorectal and breast cancer increased motivation and promoted PA [18–20]. Therefore, the perceived prognostic impact of PA on cancer survivors may promote PA.

Despite this, there is currently limited information about cancer survivors' perceptions of the prognostic impact of PA [21]. Accordingly, we aimed to explore cancer survivors' (1) perception of the prognostic impact of PA, (2) perception barriers, and (3) the relationship between perceptions and PA.

Methods

A literature search was conducted in PubMed and Scopus for articles published before November 2022. The search keywords included #1: (“Exercise” OR “exercises” OR “physical activity” OR “physical activities”) AND #2: (“Neoplasms” OR cancer OR oncology OR “cancer survivor” OR “cancer survivors” OR “cancer patient” OR “cancer patients”) AND #3: (“perception” OR “attitude” OR “recognition” OR “awareness” OR “knowledge” OR “experience”). The inclusion criteria were (1) surveys investigating the perception of the prognostic impact of PA (includes both qualitative and quantitative research) and (2) written in English. Studies were excluded for non-cancer populations, patients undergoing cancer treatment or advanced cancer patients only, for cannot calculate perception rate, surveys of other perceptions of PA effects, and studies not written in English. The studies excluded were case reports, editorials, literature reviews and systematic reviews, clinical guidelines, and conference papers. Perception levels were classified according to the perception rate of the prognostic impact of PA as follows: < 10% as low, > 50% as high, and the remainder as moderate. The perception rate is the percentage of the number of people who perceived the prognostic impact of PA on all participants. For studies that did not describe the perception rate, the author's definition was used to calculate the perception rate and group the perception levels. In qualitative studies, the perception rate of the prognostic impact of PA was calculated from the percentage of all participants. In studies where the perception rate was described only on the Likert scale, the perception level was classified based on the median or mean value. Specifically, in the survey using a 5-point Likert scale, mean or median values of 1 to < 3 were classified as low, ≥ 4 to 5 as high, and the rest as moderate. In the survey using a 7-point Likert scale, mean

or median values of 1 to < 4 were classified as low, ≥ 6 to 7 as high, and the rest as moderate. In studies that investigated both qualitative and quantitative research, the results of the qualitative studies were classified as a priority.

Results

Study characteristics

PRISMA 2020 flow diagram [22], adapted for the narrative review, is shown in Fig. 1. Our initial search identified 13,080 articles. After a title and abstract review, 59 studies were included, and after a full-text review, 45 studies were excluded, yielding 14 studies identified to have met the inclusion criteria. We included 14 studies published in English between 2013 and 2021 that enrolled 5109 adults (Tables 1, 2 and 3). The study sample sizes ranged from 8 to 1003 participants [23–36]. Eight studies were from North America: five from Canada [29, 30, 33–35], two from the USA [24, 31], and one study included the USA and Canada [36]. Three studies were from Europe: two from Germany [28, 32] and one from the United Kingdom [25]. Other studies included two from Australia [23, 26] and one from Nigeria [27]. The mean participant age was 44.9–68.0 years [23–36]. Breast cancer was the most reported type of cancer (four studies) [23, 24, 27, 31], followed by colorectal cancer (two studies) [25, 29], mixed cancer types (six studies) [26, 30, 32, 33, 35, 36], and two studies were unknown [28, 34]. Of the 14 studies, quantitative studies using questionnaires were the most common methods (12 studies) [24, 25, 27–36]. Quantitative research conducted in two studies used the open questionnaire or self-structured questionnaire [25, 27], nine studies used the closed questionnaire [24, 29–36], and one study used the opened and closed questionnaire [28]. The qualitative studies included three studies using semi-structured interviews [23, 24, 26].

Perception of the prognostic impact of PA among cancer survivors

Five of the 14 identified studies reported low perceptions of the prognostic impact of PA among cancer survivors (Table 1) [23–27]. Furthermore, nine of the 14 studies compared the perceptions of PA's effect on improving cancer survivors' physical and mental health and PA's impact on prognosis [23–25, 27–29, 33, 34, 36]. Most reports showed that cancer survivors had a poor perception of the prognostic impact of PA compared to the effect of PA on improving physical and mental health [23–25, 27–29, 36].

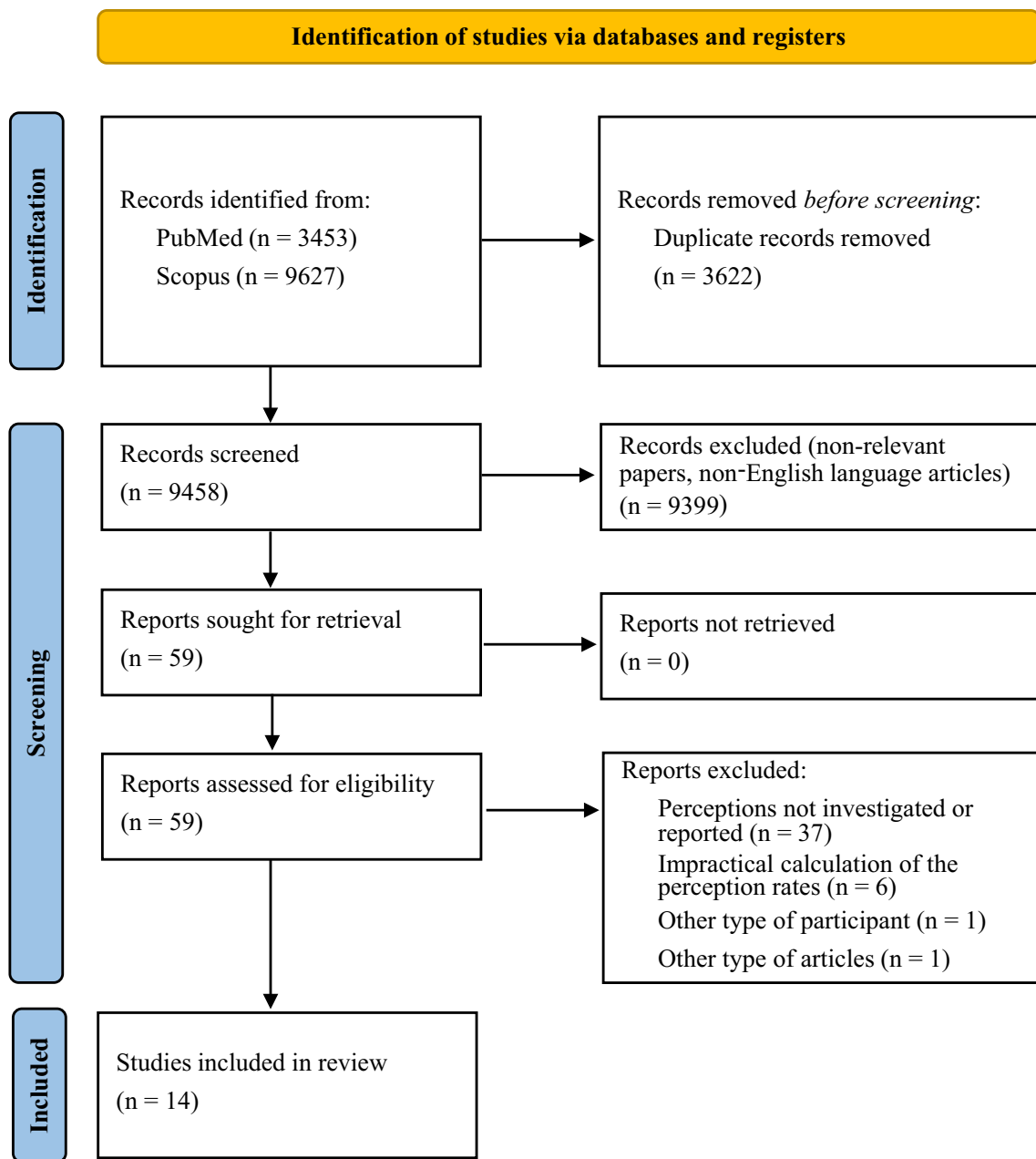


Fig. 1 Flow diagram of the eligible studies on cancer survivors

Perception barriers

Two barriers to cancer survivor perceptions were identified [23, 24, 26]. One barrier was the lack of advice from healthcare professionals (HCPs) [24]. Hirschey R et al. [24] reported that cancer survivors did not learn the effect of PA on recurrence risk reduction from HCPs. The other barrier was that cancer survivors were themselves skeptical of the prognostic impact of PA. Cancer survivors denied the effectiveness of PA for recurrence [26] and felt that PA did not prevent cancer development [23].

Association between perception and behavior change or PA

Six of the 14 identified studies reported the relationship between PA and perceptions of the prognostic impact of PA among cancer survivors [28–31, 33, 36]. Eng et al. [33] showed that the perception of the effect of PA on survival contributed to achieving the PA guidelines (at least 150 min per week of moderate-intensity activity). Höh et al. [28] showed that nearly one in two subjects who answered that they regularly engaged in PA five or more times a week fully

Table 1 Low perceptions of the prognostic impact of physical activity among cancer survivors

Perception level	Reference	Country	N	Cancer type	Method	Perception of the prognostic impact of PA
Low	Short et al. [23]	Australia	8	Breast	[Research method] semi-structured interviews	There was a poor perception of the effect of PA on preventing cancer recurrence (number or percentage unknown)
					[Research contents] telephone interviews were conducted to investigate knowledge, self-efficacy, expectations, and goals	Enjoyment of increased energy and mental well-being, rather than prevention of cancer recurrence, was perceived as the outcome expectations of exercise
	Hirshey et al. [24]	US	20	Breast	[Research Method] Semi-structured interviews and closed questionnaire survey	In the semi-structured interviews, the effect of exercise on recurrence and mortality did not come up spontaneously (0%)
					[Research contents] the semi-structured interview comprised open-ended questions about OEE, followed by questions about OEE for the risk of cancer recurrence	When asked explicitly, 30% mentioned a reduction in the risk of recurrence
					OEE questionnaire was investigated on a five-point Likert scale (1 = strongly agree, 5 = strongly disagree)	When asked as part of the OEE measure, the risk reduction was rated with a low level of agreement
	Fisher et al. [25]	UK	479	Colorectal	[Research method] opened questionnaire survey	0.7% perceived the benefits of increasing survival
					[Research contents] the effects of increasing PA were investigated	0.7% perceived the benefit of preventing recurrence
	Hardcastle et al. [26]	Australia	16	Uterine, Colorectal, Breast, Ovarian, Endometrial	[Research method] semi-structured interviews	Only 1 out of 16 participants (6.0%) perceived the benefits on the risk of recurrence
					[Research contents] knowledge of PA guidelines and other information was investigated	
	Odikpo, Chiejina. [27]	Nigeria	94	Breast	[Research method] self-structured questionnaire	7.4% perceived the effect of exercise on reducing the risk of breast cancer recurrence
					[Research contents] knowledge and perceived benefits of exercise in women with breast cancer were investigated	Perceived benefits of other physical activities, such as reduced anxiety (26.6%), improved and maintained health (14.9%), and maintained weight (11.7%), were higher than the perceived benefits of PA in reducing the risk of cancer recurrence

PA physical activity, US the United States, UK the United Kingdom, OEE outcome expectations for exercise

Table 2 Moderate perceptions of the prognostic impact of physical activity among cancer survivors

Perception level	Reference	Country	N	Cancer type	Method	Perception of the prognostic impact of PA
Moderate	Höh et al. [28]	Germany	905	N/A	[Research method] opened and closed questionnaire survey [Research contents] information on cancer and PA and reasons for supporting PA were investigated	37% fully agreed that PA reduces the risk of cancer recurrence Less than 5% of the total respondents answered “relapse prevention” as the reason for PA The effects of PA were more perceived in improving mood (68%), feeling that something can be done to better cope with the disease (61%), and improving physical awareness (58%) than in reducing the risk of recurrence 40.7% perceived prevention of recurrence as a benefit of PA to be a behavioral belief Agreement on reducing the risk of recurrence was: mean = 4.8, SD = 1.8 Other benefits of physical activities, namely improved fitness (69.5%), increased happiness (66.9%), and increased energy levels (60.7%), were more recognized than the perceived effects of PA on the prevention of recurrence The perceived level of benefit of PA in preventing recurrence and health problems was moderate, with mean = 3.88 and SD = 0.33
	Speed-Andrews et al. [29]	Canada	600	Colorectal	[Research method] closed questionnaire survey [Research contents] behavioral beliefs, such as a reduced risk of cancer recurrence, were rated on a 7-point Likert scale (1 = very unlikely, seven = very likely)	
	Price et al. [30]	Canada	123	Breast, colorectal, lymphoma	[Research method] closed questionnaire survey [Research contents] based on a health belief model, perceived benefits of PA for preventing recurrence and health problems were investigated on a scale of 1 (“strongly disagree”) to 5 (“strongly agree”)	

PA physical activity, SD standard deviation

Table 3 High perceptions of the prognostic impact of physical activity among cancer survivors

Perception level	Reference	Country	N	Cancer type	Method	Perception of the prognostic impact of PA
High	O'Neill et al. [31]	US	186	Breast	[Research method] closed questionnaire survey [Research contents] the impact of performing PA on cancer risk reduction was investigated on the four response options ("decreases chances," "makes no difference," "increases chances," and "don't know")	79% perceived that PA reduces the cancer risk
	Roth et al. [32]	Germany	129	Breast, malignant melanoma, sarcoma, gynecological, gastrointestinal, other	[Research method] closed questionnaire survey [Research contents] behavioral beliefs, such as a reduced risk of recurrence, were investigated on a 7-point Likert scale (1 = very unlikely, seven = very likely)	More than 80% were totally or partially convinced that PA could help to reduce the risk of recurrence
	Eng et al. [33]	Canada	1003	Breast, gastrointestinal, genitourinary, gynecologic, head and neck, hematologic, lung, other	[Research method] closed questionnaire survey [Research contents] the perception of the impact of PA in cancer survivorship domains (overall survival) was investigated on a 7-point Likert scale (1 = very poor, seven = very good)	89% perceived that PA improved 5-year survival
High	Liu et al. [34]	Canada	784	N/A	[Research method] closed questionnaire survey [Research contents] the perception of the impact of PA in cancer survivorship domains (overall survival) was investigated on a 7-point Likert scale (1 = very poor, seven = very good)	89% perceived that PA improved 5-year survival
	Niu et al. [35]	Canada	616	Breast, GI, genitourinary, gynecologic, head and neck, hematologic, lung, skin and sarcoma, thyroid	[Research method] closed questionnaire survey [Research contents] the effect of PA on overall survival was rated on a 7-point Likert scale ranging from "very harmful" to "very beneficial."	85–90% perceived that PA improves overall survival
	Karvinen K et al. [36]	Canada and US	146	Breast, Colon	[Research method] closed questionnaire survey [Research contents] the outcome expectations of PA were investigated using the Multidimensional outcome Expectations for Exercise Scale on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree)	Comparison and validation of the respective outcome expectations for PA showed a significant difference between the physical subscale scores (mean = 4.49, SD = 0.52) and cancer survival (mean = 4.18, SD = 0.85)

PA physical activity, US the United States, SD standard deviation

agreed that PA effectively reduced the risk of recurrence. In addition, perceptions of the prognostic impact of PA were positively associated with PA [29, 30, 36]. O'Neill et al. [31] reported that 18% of all participants perceived PA's effect as reducing cancer risk and were actually engaged in PA.

Discussion

To the best of our knowledge, this is the first study to review the perception of the prognostic impact of PA, perception barriers, and the relationship between perceptions and PA in cancer survivors. Our review revealed three major findings. First, most reports showed that cancer survivors poorly perceived the prognostic impact of PA. Second, the lack of advice from HCPs led to poor perception and engagement on PA among cancer survivors. Finally, multiple reports showed that cancer survivors' PA perception was positively associated with actual PA.

PA guidelines for cancer survivors are published by the American Cancer Society [37]. However, cancer survivors poorly understand the PA guidelines [26, 38]. The results of our review are consistent with the results of previous reports on the lack of progress in implementing PA guidelines. Alternatively, most studies report that cancer survivors better perceived the PA's effects on improving physical and mental functioning than the prognostic impact of PA. This finding suggests that education about the short-term benefits of PA has been effective. In future, it is necessary to educate cancer survivors regarding the long-term benefits of PA, including its impact on prognosis.

Advice from HCPs for PA is essential to increase cancer survivors' perception. However, HCPs also poorly perceive the prognostic impact of PA [39–41]. Further, there is an association between the lack of PA promotion and low

perception of PA [39–41]. Therefore, poor perception by HCPs may impact a lack of advice.

Cancer recurrence is a major concern for most cancer survivors [42]. Therefore, the positive impact of PA on prognosis may become a cancer survivors' hope and promote behavior change. The health belief model (HBM) can explain behavior change among cancer survivors. The HBM is a behavior change theory model that has been widely used in health promotion and disease prevention studies [43, 44]. The HBM proposes that patients are more likely to engage in health-related behaviors when they perceive the threat of disease and believe that the benefits of the behavior outweigh the barriers [44]. Several previous studies have reported increased PA after HBM-based interventions for patients with type 2 diabetes [45, 46]. An overview of how HBM can be applied to promote behavior change in cancer survivors is shown in Fig. 2. The HBM suggests that when cancer survivors are educated about the prognostic impact of PA, they perceive threats to their prognosis, and the benefits of PA outweigh the barriers, thereby promoting behavior change. Therefore, a higher perception of the prognostic impact of PA among cancer survivors may increase PA through behavior change in HBM.

This review has several limitations. First, the literature search collected only literature written in English, which might have caused selection bias. Second, perception of the effects of PA was limited in comparison and integration because each study used different research methods. Third, studies that did not describe the perception rate were calculated by the author's definition, limiting the perception rate's interpretation. Finally, the population included some patients undergoing cancer treatment, which limited the interpretation of the perception of the effects of PA.

Based on the results of our review, we propose here methods to promote PA in cancer survivors (Fig. 3). The first is to educate HCPs on the importance of the prognostic

Fig. 2 The flow of behavior changes in cancer survivors using the health belief model. PA physical activity

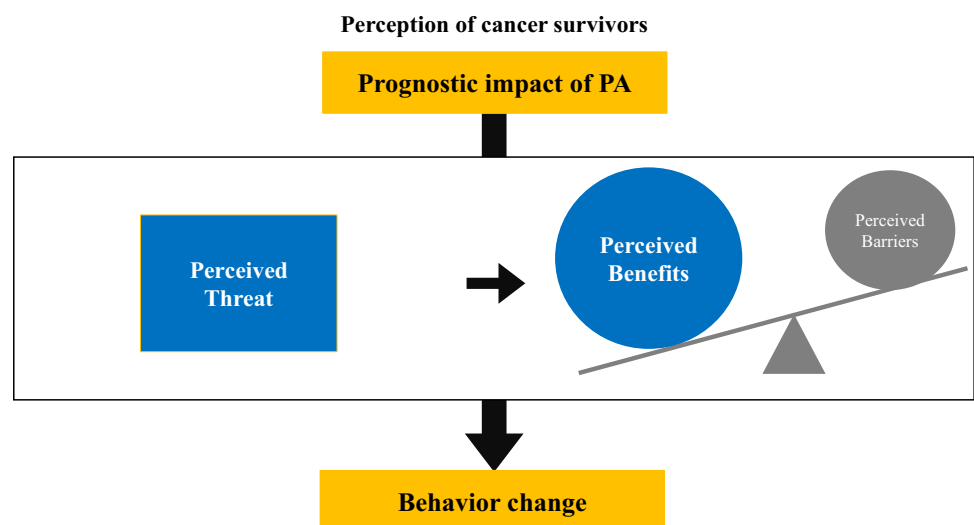
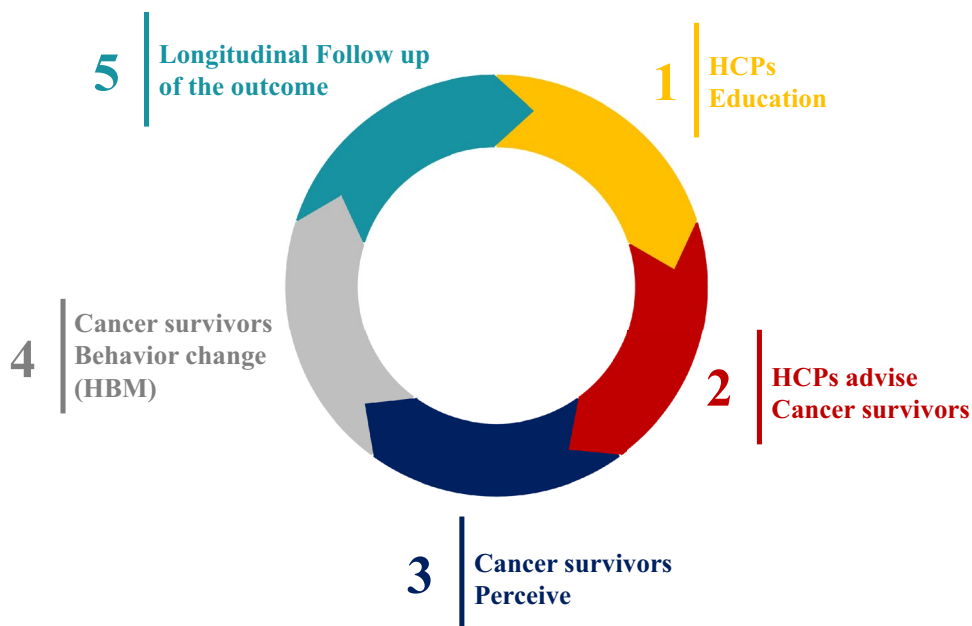


Fig. 3 A circulation diagram to promote physical activity among cancer survivors. *HCPs* health care professionals, *PA* physical activity, *HBM* health belief model



impact of PA. The second is to encourage HCPs to advise cancer survivors on the prognostic impact of PA. The third is to enhance cancer survivors' understanding by repeated counseling on the prognostic impact of PA. The fourth is to encourage cancer survivors to change their behavior to increase PA based on the HBM. The fifth is to follow-up longitudinally for the outcome of cancer survivors who increase PA. Finally, to inform HCPs and patients of the success story based on the accumulated experiences and analysis, thus generating a positive feedback cycle. Karvinen et al. [47] investigated the effect of an intervention of online learning of PA on oncology nurses. Exploratory data analysis revealed that PA counseling improved self-efficacy, but no significant change was observed in counseling practice or PA knowledge among cancer survivors. Therefore, further research is required on the education of HCPs on PA first to substantiate our hypothesis.

Conclusions

This narrative review revealed that most reports showed that cancer survivors have a poor perception of the prognostic impact of PA. In addition, the lack of advice from HCPs may also contribute to the lack of perception among cancer survivors. Higher perceptions were associated with higher PA. Therefore, to increase the levels of PA among cancer survivors, it is necessary to improve the perception of the prognostic impact of PA in both cancer survivors and HCPs.

Author contributions Conceptualization, KS and TN and TO and YY and MK and RS and KS; methodology, KS and TN and TO and YY and MK and RS and KS; writing—original draft preparation, KS and TN and TO and YY and MK and RS and KS; writing—review and editing, KS and TN and TO and YY and MK and RS and KS and TI and NM and RU and AS and TN and HF. All authors have read and agreed to the published version of the manuscript.

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Data availability All data generated or analyzed during this study are included in this published article.

Code availability Not applicable.

Declarations

Conflict of interest K.S. (Katsuyoshi Suzuki) and T.O. and Y.Y. and M.K. and R.S. and K.S. (Keisuke Suzuki) and T.I. and N.M. and R.U. and A.S. and T.N. (Tamae Nishizawa) and H.F. have nothing to disclose. T.N. (Tateaki Naito) received a lecture fee from ONO Pharmaceutical CO. Ltd and Helsinn Healthcare SA and research funding from Otsuka Pharmaceutical CO. Ltd. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results. The authors report no other conflicts of interest in this work.

Ethical approval This project is a narrative review, and thus, ethics approval is not applicable.

Consent to participate Not applicable to this narrative review.

Consent to publish Not applicable to this narrative review.

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