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REVIEW ARTICLE

Barriers and facilitators to physical activity participation in patients with head and neck cancer: a scoping review

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Abstract

Background Patients with head and neck cancer (HNC) usually experienced disfigurement, dysfunction, and psychosocial distress, leading to a decline in their quality of life. Physical activity (PA) is recommended for such patients. Despite the proven benefits of participating in PA, the compliance of patients with HNC is still poor. Hence, the factors influencing PA participation and adherence in patients with HNC need to be explored.

Objectives This study aimed to (1) identify barriers and enablers of PA in adult patients living with HNC and (2) map barriers and facilitators to the Capability-Opportunity-Motivation-Behavior (COM-B) model.

Eligibility criteria Types of studies: Studies with qualitative, quantitative, and mixed designs were included in this review. Types of participants: The current review takes into account patients with HNC aged 18 years or above. Types of interventions: This review considered all studies focusing on full-body PA. Types of outcomes: This scoping review focused on studies examining health behavior, patients' compliance, and facilitators and/or barriers to PA engagement. Five databases (Ovid Medline, Ovid Embase, CINAHL, Cochrane Library, and PsycINFO) were searched following the methodology for scoping reviews from inception to July 2021.

Data extraction The extracted data included author(s)/year of publication, country, main purpose of the study, sample size/disease site and stage, methodology and methods, type of treatment, and main findings/barriers, or facilitators.

Results A total of 22 studies were finally selected. The top three barriers were physical-related issues, time pressures, and low motivation or interest. Most facilitators included perceived psychological, health, and social benefits and preference for the model of PA. The most frequent COM-B model components were physical capability, automatic motivation, and physical opportunity.

Conclusions Patients with HNC have unique facilitators and barriers to participating in PA. Interventions must leverage facilitators and limit barriers to exercise so as to increase compliance with exercise. Future studies should test the effectiveness of behavioral change measures based on the factors influencing the COM-B model.

Keywords Barriers · Exercise · Facilitators · Head and neck cancer · Scoping review

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Introduction

Head and neck cancer (HNC) includes tumors of the oral cavity, oropharynx, hypopharynx, and larynx. It is the seventh most common cancer worldwide. The 5-year survival rate for HNC is estimated to be around 40–50% following the advancement of cancer treatment and management of HNC in recent years [1, 2]. The increased survival rate for cancer survivors suggests an increase in the need for supportive care for patients. Physical activity (PA) was considered as a promising way of improving HNC patients' health outcomes. A study by Moore et al., including 1.44 million people in European and American countries, found that leisure-time

PA was associated with lower risks of many cancer types, including HNC [3]. Previous studies have reviewed the benefits of PA for patients with HNC. A systematic review of 16 studies assessed the impact of PA performance on health-related fitness and quality of life for patients with HNC, revealing that PA programs facilitated improvements [4]. Patrick systematically reviewed and found that patients gained some objective and patient-reported benefits from PA interventions [5]. However, HNC is now treated using single or multimodality approaches, including surgery, chemotherapy, and radiotherapy, which cause severe treatment-related toxicities having a negative impact on adherence to the PA program. In a survey of 172 HNC survivors, PA participation varied widely from pretreatment to post-treatment, with a decreased after treatment [6].

Patients with HNC were recommended 2 days of strength training and a minimum of 150 min of moderate or 75 min of vigorous aerobic PA per week by several oncologic societies [7–9]. Despite the well-grounded benefits of PA, patients with HNC showed poor compliance with the recommended PA guidelines. The results of some surveys on the percentage of HNC survivors participating in regular exercise varied widely, from 8.5 to 40.1% [6, 10]. Moreover, a recent cross-sectional study showed that although 60.2% of 108 patients reported participating in PA, only 16.7% met the requirements of the World Health Organization guidelines [11]. These findings highlighted the problem of poor compliance with PA in the HNC population.

The unsuccessful intervention may be due to many reasons and largely due to the difficulties in changing behavior [12]. However, it is crucial to establish the relevant influences on the targeted behavior for the success of the intervention. Identifying factors influencing PA engagement and adherence is an important research priority to facilitate the development of effective interventions for people with HNC and hence promote PA adherence [11]. Furthermore, how to make full use of the understanding of barriers and facilitating factors to translate into clinical practice is still not clear.

The Capability-Opportunity-Motivation-Behavior (COM-B) model is a behavioral theory that helps to understand the PA behavior of patients with HNC [13]. COM-B points out that the interaction of ability, opportunity, and motivation causes changes in behavior. Capability includes psychological (knowledge) and physical (skills) abilities; opportunity includes both social (social influence) and physical (environmental resources) opportunities; and motivation includes automatic (emotion) and reflective (belief, intention) motivation. Although the COM-B model has primarily been applied to intervention design, it provided a useful framework for evidence synthesis in a scoping review [14] and could also be used to systematically identify behavior-related barriers and enablers [15], which is an important first step in developing interventions to promote PA in patients.

This scoping review aimed to identify the barriers and facilitators to PA participation for patients with HNC in general practice and to map these factors onto the COM-B model.

Methods

This study employed a scoping review methodology to comprehensively summarize the literature on the barriers and facilitators of PA in patients with HNC. The five-stage scoping framework designed by Arksey and O'Malley was employed alongside Preferred Reporting Items for Systematic Review and Meta-Analysis Extension for Scoping Reviews (PRISMA-ScR) to maximize robustness [16, 17]. The specific methods of scoping review were as follows: (1) identifying the research question; (2) identifying relevant studies; (3) selecting studies; (4) charting the data; and (5) collating, summarizing, and reporting the results.

Stage 1: identifying the research question

"What is known from the existing literature about the barriers and facilitators to patients with HNC participating in PA?" was the research question that guided this review. In this review, PA was defined broadly to subsume leisure-time activity and exercise, including planned, structured, and repetitive exercise and sport, understood as recreational and/or competitive activity that involved skill [18].

Stage 2: identifying relevant studies

We searched five databases, including Ovid MEDLINE, Ovid EMBASE, CINAHL, Cochrane Library, and PsycINFO, from inception to July 2021 by the first author in conjunction with QW. A manual search was also performed on the reference list of the included articles, as well as reviews related to the topic to identify any resources that might be eligible. Some search terms reflected the key concepts of review (HNC cancer, PA, exercise, barriers, and facilitators). The search strategy is shown in Appendix 1. We imported the search results into EndNote X9.1 (Clarivate Analytics) and deleted duplicate and unrelated studies.

Two authors independently screened each title/abstract based on the predetermined selection criteria. The discrepancies were addressed through frequent discussions between the authors. The same process was also applied to full-text review.

Stage 3: study selection

Studies published in peer-reviewed scientific journals from inception to July 2021 were included. The language was limited to English. The types, participants, interventions,

and results of the studies could be considered for inclusion if they met the following criteria.

Types of studies

The qualitative, quantitative, and mixed designs were included. Editorials, commentaries, case studies, and conference abstracts were excluded. Quantitative research consisted of experimental and observational research designs.

Types of participants

Studies involving patients diagnosed with any stage of HNC and aged 18 years or older were included in the review. HNC included malignant tumors that occurred in the head and neck, hypopharynx, larynx, oropharynx, lips, oral cavity, tonsils, salivary glands, nasopharyngeal, nasal cavity, sinuses, and middle ear. Patients in the included studies could be at any stage of treatment, including surgery, radiotherapy, and chemotherapy, either alone or in combination.

Types of interventions

Only studies adopting full-body PA, such as aerobic, resistance, strength, or flexibility, were included. Those involving swallowing or shoulder or leg functional training to meet the specific rehabilitation needs of patients were excluded.

Types of outcomes

The studies involving health behaviors, compliance, and barriers and enablers to participating in PA for patients with HNC were included.

Stage 4: charting the data

The abstracted data included author(s)/year of publication, country, main purpose of the study, sample size/disease site and stage, methodology and methods, type of treatment, and main findings/barriers or facilitators. The first draft of the data charts of five randomly selected studies was completed independently by two reviewers (YN and QW). The chart form was revised through discussion among the research team to extract information from all the included studies. The data were extracted by two authors and checked by the third and fourth authors. Any disagreements were resolved by discussion among the whole team.

Stage 5: collating, summarizing and reporting the results

We used the form of quantity and distribution to describe the included studies and used descriptive methods to summarize the results. First, a numerical synthesis–based report was collated based on the included studies to identify research gaps and enhance the effectiveness of the report. Second, the authors (YN and QW) extracted data for each selected study and coded it as barriers and enablers of PA engagement.

The initial COM-B coding framework included the following: (1) Physical capability: Patients had the physical strength, skills, or stamina to engage in PA. (2) Psychological capability: Patients were psychologically able to engage in PA, which involved having the knowledge of how to exercise and obtaining an understanding of its importance. (3) Physical opportunity: Patients had the chance to participate in PA due to environmental factors such as time, physical space, and resources. (4) Social opportunity: Patients had the chance to participate in PA due to interpersonal influence, social cues, and cultural norms. (5) Reflective motivation: Patients intended to participate in PA responsively after the process of reflection, planning, and evaluations. (6) Automatic motivation: Automatic processes, including reactions, desires (wants and needs), impulses, inhibitions, reflex responses, and habits, drove patients to participate in PA.

Moreover, these initial codes were developed into barriers and facilitators in the COM-B framework adopting the method of inductive thematic analysis. The concepts were re-examined and synthesized into ultimate barriers and enablers. In the quantitative and qualitative analyses, any barriers and driving factors that did not conform to the COM-B framework were listed separately. Throughout the process, the disagreement was resolved by the whole team through discussion and negotiation.

Results

A total of 2318 studies were retrieved from the library databases search, and 6 additional citations were found in the reference list review. After deleting duplicate documents, we used the inclusion and exclusion criteria to review 1731 titles and abstracts; 89 of them met the criteria. The full text of these 89 studies was searched and screened. Finally, only 22 studies met the eligibility criteria and were included in this study. The process of study selection is shown in Figure 1.

Characteristics of the included studies

Twenty-two studies included in the review were published between 2007 and 2021. The most common countries in which the studies were conducted were the USA ($n = 6$) [19–24], China ($n = 3$) [25–27], Canada ($n = 3$) [28–30], UK ($n = 2$) [31, 32], Denmark ($n = 2$) [33, 34], India ($n = 2$) [35, 36], Netherlands ($n = 1$) [37], Norway ($n = 1$) [38], Germany ($n = 1$) [39], and Sweden ($n = 1$) [40].

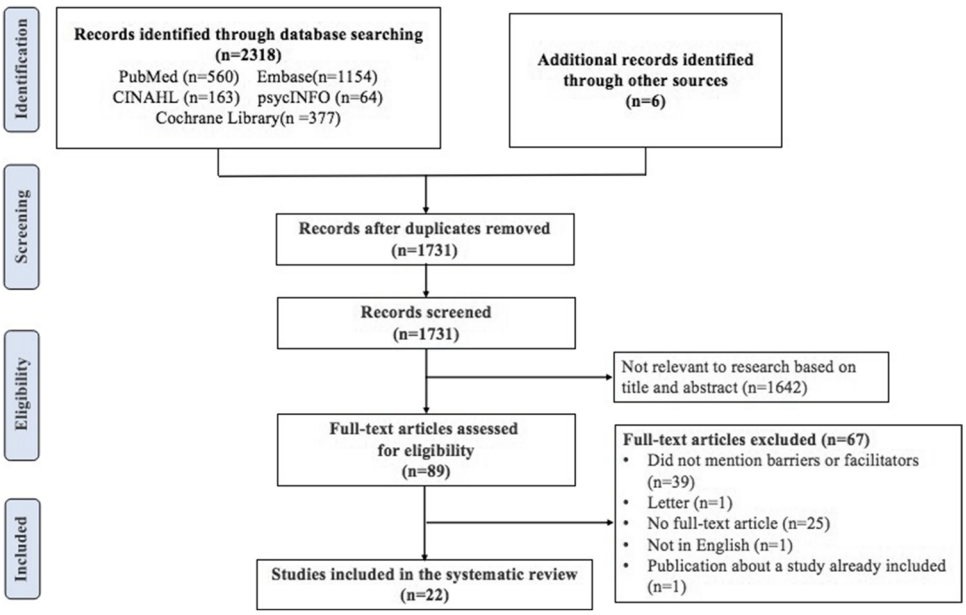

Fig. 1 PRISMA flowchart showing selection of articles for scoping review

The characteristics of the included studies are described in detail in the Appendix 2. The included studies employed three types of research methods: qualitative ($n = 1$) [31], mixed-method ($n = 1$) [28], and quantitative ($n = 20$). Among 20 quantitative studies, 6 used cross-sectional design, and 14 were experimental or pilot trial. Two studies included only patients with nasopharyngeal cancer patients [26, 27], 1 study included only patients with oral cancer [25], and the other 19 studies included patients of HNC. Seven studies used the term "physical activity" [19, 20, 22, 24, 29, 37, 40], while 14 studies used the term "exercise" [21, 25–28, 30–36, 38, 39].

For the intervention, the majority of the studies included resistance training (n=10), two studies included only Tai Chi or/and Qigong [26, 27], and one study included only yoga [23]. Studies with experimental design had an average sample size of 48; the sample size ranged from 8 to 148. The timing of the interventions initiated from the time during chemoradiotherapy ($n = 3$) [27, 36, 38] or in any treatment phase ($n = 10$). Two studies used progressive resistance training (PRT) and nutritional supplements [33, 38]. Most studies involved comprehensive exercise intervention for patients: one study comprised supervised group training, including mobilization, coordination, resistance, stretching, and relaxation exercises [39]; a study included aerobics, strength, flexibility, and balance training [24]; and another study included aerobic (brisk walking) and active resistance exercise program [35].

Tables 1 and 2 present the barriers and facilitators to the participation of patients with HNC in PA, based on the COM-B model, which included six themes.

Barriers

Physical capability-related barriers

Physical capability included demographic factors and physical-related issues. Demographic factors included old age [22, 31], higher education [40], and not married [22]. Physical-related issues included treatment side effects, fatigue, other comorbidities, reduced physical function, lower sleep status, and cancer recurrence. The most frequent physical-related barrier was treatment side effects, which included fatigue [19, 21, 24, 28, 29, 31–36, 40]; head, neck, shoulder, arm pain or dysfunction [31]; dry mouth or throat [19, 31, 32]; muscle weakness [19, 32]; nausea and xerostomia [34]; myelosuppression; oral mucositis; and skin reactions [27]. Comorbidities [19, 21, 22, 28, 31, 35, 39] were also identified as physical-related issues, which included arthritis, dyspnea, back problem, swelling in a foot [31], osteoarthritis [28], prostate cancer, cardiovascular diseases [39], and severe pneumonia [35]. In addition, cancer recurrence [23, 24], reduced physical function[40], and poor sleep [22] were barrier factors.

Psychological capability-related barriers

Lack of knowledge (such as being unsure of what to do) [29], exercise not being part of a regular routine [28], and exercise not being a priority [28, 32] were identified as psychological capability-related barriers.

Table 1 Barriers to physical activity in patients with head and neck cancer ($n = 22$ articles)

Capability-related themes	Frequency	Article citation
C1: Physical capability		
C1.1: Personal characteristics		
C1.1.1: Old age	2	[22, 31]
C1.1.2: Higher education	1	[40]
C1.1.3: Not married	1	[22]
C1.2: Physical-related issues		
C1.2.1: Treatment side effects (e.g., fatigue; head, neck, shoulder, arm pain or dysfunction; dry mouth or throat; muscle weakness; nausea; and xerostomia)	13	[19, 21, 24, 27–29, 31–36, 40]
	7	[19, 21, 22, 28, 31, 35, 39]
C1.2.2: Other comorbidities (e.g., arthritis, dyspnoea, back problem, swelling in a foot, osteoarthritis, prostate cancer, cardiovascular diseases, and severe pneumonia)	2	[23, 24]
	1	[40]
C1.2.3: Cancer recurrence	1	[22]
C1.2.4: Reduced physical function		
C1.2.5: Poor sleep		
C2: Psychological capability	2	[28, 32]
C2.1: Exercise not being a priority	1	[28]
C2.2: Exercise not being part of a regular routine	1	[29]
C2.3: Lack of knowledge such as "being unsure of what to do"		
Opportunity-related themes	**Frequency**	**Article citation**
O1: Physical opportunity	7	[23, 26, 28, 30, 31, 38, 39]
O1.1: Time pressure	4	[23, 30, 38, 39]
O1.2: Distance to program	1	[31]
O1.3: Dry weather	1	[32]
O1.4: Lack of equipment	1	[32]
O1.5: Lack of facilities and/or space		
O2: Social opportunity	1	[36]
O2.1: Lack of family support	2	[24, 39]
O2.2: Family responsibility included care/supervision of relatives or children		
Motivation-related themes	**Frequency**	**Article citation**
M1: Reflective motivation	2	[19, 28]
M1.1: Low exercise discipline	1	[2]
M1.2: Low self-efficacy		
M2: Automatic motivation	10	[19–21, 27, 28, 32, 33, 35, 36, 39]
M2.1: Low motivation or interest	5	[21, 28, 31, 35, 38]
M2.2: Depression	2	[19, 22]
M2.3: Fear of injury or dislodging the tube	1	[28]
M2.4: Be intimidated by the group format	1	[22]
M2.5: Embarrassment due to disfigurement	1	[33]
M2.6: Change of mind		

Physical opportunity-related barriers

The most frequently physical opportunity-related barrier was time pressure [23, 26, 28, 30, 31, 38, 39], which included lack of time because of work schedules and other commitments [23, 26, 28, 30], the requirement of child-rearing and volunteer commitment [28], excessive time consumption [38], and overlap with physician/physiotherapy appointments [39]. Distance to program [23, 30, 38, 39], dry weather [31], lack of equipment, and lack of facilities and/or space [32] were physical opportunity-related barriers.

Social opportunity-related barriers

Lack of family support and family responsibility were identified as social opportunity-related barriers. Care and supervision of relatives or children were regarded as family responsibilities [39].

Reflective motivation-related barriers

Low self-efficacy and low exercise discipline [19, 28] were identified as reflective motivation-related barriers.

Table 2 Facilitators to physical activity in patients with head and neck cancer ($n=22$ articles)

Capability-related themes	Frequency	Article citation
C1: Physical capability	1	[37]
C1.1: Younger age	1	[37]
C1.1: No unintentional weight loss	1	[37]
C1.2: The absence of comorbidities		
C2: Psychological capability	None	
Opportunity-related themes	**Frequency**	**Article citation**
O1: Physical opportunity	2	[28, 32]
O1.1: Preference for the model of PA		
O1.1.1: There are varied PA preferences among HNC patients (e.g., group structure, supervision, companies, location, type, intensity, frequency, duration)		
O2: Social opportunity	None	
Motivation-related themes	**Frequency**	**Article citation**
M1: Reflective motivation	3	[29, 31, 32]
M1.1: Perceived benefits (e.g., improve heart and lung fitness, improve health or reducing risk of disease, build up muscle strength, lessen fatigue, and improve quality of life)	1 1	[37] [37]
M1.2: A higher PA intention		
M1.3: Perceived behavioral control (PBC)		
M2: Automatic motivation	1	[19]
M2.1: Enjoyment		

Automatic motivation-related barriers

The most frequent automatic motivation-related barrier was lack of motivation or interest [19–21, 27, 28, 32, 33, 35, 36, 39], which included lack of motivation to participate because feeling overwhelmed by the diagnosis and intensive treatments limited participants' motivation to engage in exercise [28] and hence they were unwilling to insist on exercise [27]. Furthermore, depression [21, 28, 31, 35, 38], which included feeling self-conscious or anxious [28] and feeling overwhelmed or emotional distress [38], fear of injury or dislodging the tube [19, 22], being intimidated by the group format [28], embarrassment caused by disfigurement [22], and change of mind [33] were identified as automatic motivation-related barriers.

Facilitators

Physical capability-related facilitators

Younger age, no unintentional weight loss, and no comorbidities were identified as physical capability-related facilitators [37].

Physical opportunity-related facilitators

The model of PA was identified as a physical opportunity-related facilitator. Varied PA preferences were noted among patients with HNC, including PA type, location, company, intensity, frequency, and supervision [28, 32].

Automatic motivation-related facilitators

Enjoyment was identified as an automatic motivation-related facilitator [19].

Reflective motivation-related facilitators

Perceived benefits, higher PA intention, and perceived behavioral control were identified as reflective motivation-related facilitators. Patients believed that PA could improve their psychological, health, social status, and chance of survival in 5 years. Psychological benefits included feeling better and less depressed and an improvement in mental well-being and attitude [31]. Health benefits included weight loss, reduction in blood pressure, and improvement in heart and lung fitness, fatigue, muscle strength, and quality of life [29, 32]. Social benefits included meeting new people and feeling more attractive [32].

Non-COM-B theme

We identified barriers and enablers to PA engagement, which did not belong to the COM-B model. Betel-nut and cigarette consumption significantly affected the levels of exercise [25].

Discussion

In this scoping review, we have integrated evidence on the barriers and enablers for patients with HNC to participate in PA and mapped these factors to the COM-B model [13]. In recent years, the number of research and opinion articles in this field has steadily increased, with the majority of the included studies published after 2015. Recently, no systematic reviews focusing on the barriers and/or facilitators of patients with HNC to participate in PA have been found, which might be due to the small number of high-quality-related studies.

This study showed that the physical capability-related barriers majorly limited participation in PA. These included treatment side effects, fatigue, and comorbidities, hindering patients from participating in PA. Previous studies also revealed that cancer and the side effects of its related treatment were a physical barrier to PA participation [41]. The HNC is an anatomical region with many essential structures for swallowing, feeding, speech, and breath. Cancer treatments result in significant physical side effects, such as xerostomia, oral mucositis, difficulty swallowing or speaking, and decreased food intake, which not only interfere with, and delay treatment, but also affect daily activities, impair exercise ability, and reduce quality of life of patients [42, 43]. Besides the specific symptoms of HNC, fatigue was the most severe symptom at all time points [44] and affected patient's compliance to participate in PA [41, 45]. Managing the physical symptoms of patients with cancer and fatigue was an effective measure to promote patients' participation in PA [46]. PA can relieve fatigue, which can form a virtuous circle [47, 48]. Comorbidities such as osteoarthritis and cardiovascular disease may be barriers to PA in HNC survivors [37]. It is significant to tailor personalized PA programs for cancer survivors with specific comorbidities.

Psychological capability manifests primarily through the lack of understanding of the importance of PA behaviors and lack of knowledge, such as being unsure of what to do, which acted as a barrier to behavior change in our study. It seems essential to educate patients on the importance of PA to improve their physical condition and advise them to engage in appropriate physical exercises.

Physical opportunity acted as both an enabler and a barrier for PA engagement. The major physical opportunity-related barriers were time pressures and distance to program. Patients are usually busy with various treatment arrangements and work after treatment [34]. The time and settings of PA interventions need to be tailored according to the patient's situation to ensure optimal attendance [38]. In addition, patients who feel that they have no time or are busy with work can make full use of their leisure time, such as walking up and down the stairs, doing housework, and exercising during office breaks. For those reporting travel distance as the main reason for not attending, embedding the personnel and facilities needed for exercise rehabilitation in a clinical environment may not remain realistic in a medical system with limited resources [49]. Community-based and home-based interventions should be included in future studies, allowing patients to stay at home during the intervention. In addition, home-based exercise via phone or online support is an effective way [49].

However, preference for exercise can be a physical opportunity-related facilitator to patients with HNC. Our study showed that patients with HNC varied in their PA preferences in terms of type, location, company, intensity, frequency, and supervision. For instance, before participating in the PA program, some of the participants stated that they preferred to exercise alone or with their family members, while others preferred to exercise with other cancer survivors or with instructors who had experience in training other cancer survivors after the PA program. Exercising with other patients could provide patients with a sense of comfort and belonging, gain peer support, and motivate them to participate in PA [41]. According to a previous research, patients with cancer appreciated more PA consultations provided by health care professionals (HCPs), and HCPs could influence the PA levels of these patients [50, 51]. Our study further proved this enabler. The communication between cancer survivors and their HCPs provided a "window" to improve the levels of PA among survivors [52]. Therefore, HCPs should receive more education and training to gain a better understanding of the benefits and safety of exercise for cancer survivors and convey this information to patients.

The top three motivation-related barriers were low motivation or interest, depression, and fear of injury or dislodging the tube. For those with low motivation or interest, an important factor was the lack of awareness of the benefits of exercise for disease recovery. Patients appeared likely to regard PA as a healthy behavior when they had a sense of self-efficacy and got positive cues to participate in PA [41]. Therefore, it is obvious that educating patients who are not interested in participating in an exercise program on the potential benefits of exercise and increasing their motivation to promote more exercise participation and persistence are of great importance [32]. Gamification is a novel educational approach that can be quite effective in encouraging people to stick to good behaviors [53]. It has been shown to be a promising way to motivate PA [54]. Hence, we can utilize interventions based on gamification elements, such as points, social interactions, and leaderboards, to boost patients' motivation and promote PA participation [55].

Previous studies found that depression acted as a significant predictor of exercise compliance in patients with

HNC [45]. Similarly, we also found in this study that depression prevented patients from participating in PA. A study revealed that 48.7% of 817 patients with HNC experienced varying degrees of depression, from mild to severe [56]. Poor psychological health prevents patients from participating in PA. Therefore, it is vital to actively pay attention to the mental health of patients. Since higher levels of PA were linked to lower depression symptoms, patients can also improve depression symptoms through PA [57]. Those with drainage in the mouth or throat may be less active due to safety concerns such as fear of dislodging the tube and fear of injury [19, 22]. Hence, patients should be educated on how to exercise safely while wearing drainage and how to identify risk factors and respond to them in time when danger occurs.

In addition, patients with oral cancer felt embarrassed due to altered appearance or disfigurement after surgery and avoided going out in public [22]. This situation was not just in oral cancer. Most patients with HNC experienced facial alterations and impaired eating and speaking functions, causing psychosocial stress such as embarrassment and shame and finally resulting in isolation and negative health consequences [58, 59]. It may be difficult for patients to reconcile such physical changes spontaneously. Therefore, it is crucial to conduct psychological evaluation and support for the patient before treatment, especially when the patient may have changes in appearance.

Perceived benefits were identified as reflective motivation-related facilitators. The studies reported that benefits for patients with HNC, including physical health, mental well-being, and social benefits, facilitated their PA participation [29, 31, 32]. PA has a wide range of effects on health throughout life, many of which are mediated by improving immunity and reducing systemic inflammation [60]. Patients with greater education and household income and a higher professional level were more likely to perceive the potential benefits of PA to their quality of life [29], indicating that much more attention should be paid to patients with lower education level, family income, and social status.

Limitations

First, studies published only in English were included, and hence some studies published in other languages might have been missed. Second, in this study, the terms "exercise" and "physical activity" were used interchangeably, which might have caused some confusion while comparing studies. The third limitation was that our conclusions did not include the views of consulting stakeholders. In addition, the study did not involve a quality assessment of the included studies. Moreover, we only searched the databases including Ovid Medline, Ovid Embase, CINAHL, Cochrane Library, and PsycINFO, and hence some related studies might have been missed. Finally, we chose to include all disease stages to provide a more comprehensive overview of the barriers and facilitators in patients with HNC, which may be a decisive parameter for adherence to regular physical activity and necessitates further research in the future.

Conclusions

This scoping review used the COM-B model of healthy behavior change as a framework to identify factors that promoted and hindered the participation of patients with HNC in PA. The results of this study showed an increase in evidence focusing on factors that affected the participation of patients with HNC in PA, pointing to physical opportunity- and automatic motivation-related barriers as the prominent issues for this population. Reflective motivation mainly included perceived benefits and physical opportunity; for example, preference for the model of PA was a powerful facilitator. Our findings might help tailor novel theory-oriented PA interventions for patients with HNC during their illness recovery.

Based on this review, future research on PA interventions should pay attention to PA compliance and the important role of enablers and barriers in a successful intervention. Technologies such as pedometers or other wearable measurement devices, which can accurately monitor patients, are recommended to reduce bias in measuring results and provide convenience for patients. In addition, more education and training on PA should be given to HCPs so that they can convey this information to patients. In view of the advantages of PA in the community or at home, future research should consider home-based and community-based interventions. Policy makers should pay full attention to the functions of the community and provide patients with powerful professionals and facilities for PA in the community.

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Author contribution Yan Ning and BinQuan Wang conceived and designed the study. Yan Ning, Qian Wang, Wenting Zhao, and Zehuan Jia performed the literature search and data analysis. Yan Ning, Qian Wang, and Yongxia Ding drafted the manuscript. BinQuan Wang, Yongxia Ding, and Wenting Zhao revised the work review and improvement of the manuscript. All the authors have checked and approved the final manuscript.

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Data availability and material The data and materials that support the findings of this study are available from the corresponding author on reasonable request.

Code availability Not applicable.

Declarations

Ethics approval and consent to participate Not applicable.

Consent for publication All authors approved the final version of the manuscript for publication.

Conflict of interest The authors declare no competing interests.

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