BMJ Open Qualitative exploration of the perceptions of exercise in patients with cancer initiated during chemotherapy: a meta-synthesis

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ABSTRACT

Objective To synthesise qualitative literature on (1) the perceptions of patients with cancer of participating in an exercise intervention while undergoing chemotherapy and (2) to inform and guide professionals in oncology and haematology practice.

Design A qualitative meta-synthesis based on Noblit and Hare's seven-step meta-ethnography.

Data sources Six electronic databases: Cochrane Central Register of Controlled Trials (CENTRAL), CINAHL, EMBASE, PubMed, SCI-Expanded—SSCI and Scopus (final search June 2022) were used to identify qualitative literature containing individual or focus group interviews. The transparency of reporting for each study was assessed using the Consolidated criteria for Reporting Qualitative research checklist.

Results The search identified 5002 articles. 107 of which were selected for full-text review. Seventeen articles from five countries with patients undergoing chemotherapy during exercise interventions were included. Eleven articles were included in the meta-synthesis, which comprised 193 patients with various cancer diagnoses, disease stages, sexes and ages. Four main themes were identified: chemotherapy overpowers the body; exercise in battle with side effects; a break from gloomy thoughts; and a question of survivorship.

Conclusions and implications The meta-synthesis emphasised that patients with cancer undergoing chemotherapy and simultaneously participating in exercise interventions may experience momentary relief from overwhelming side effects, even though full bodily recovery may be perceived as a distant prospect. The synthesis offers a sparse empirical basis for gaining insight into what patients experience existentially following exercise interventions. It is up to patients to independently apply the transfer value of exercise to their own existential circumstances.

INTRODUCTION

Worldwide, the rapid increase in ageing population implies an increased cancer risk, influencing the magnitude and societal impact of cancer, which varies across countries, diagnoses and sociodemographics.^{1 2}

STRENGTHS AND LIMITATIONS OF THIS STUDY

- \Rightarrow The validity of the qualitative studies was assessed using the Consolidated criteria for Reporting Qualitative research and found to be justifiable for inclusion.
- \Rightarrow The meta-ethnography approach provided an understanding of individual struggles of patients with cancer undergoing chemotherapy while participating in exercise interventions.
- \Rightarrow Omitting training studies based on predominantly digital health solutions may implicate that our results are not generalisable to this type of training situation.
- \Rightarrow The selection of informants in the synthesis may have resulted in a pre-positive bias toward exercise interventions.

Protected by copyright, including for uses related to text and data mining, Extrinsic risk factors such as smoking, overweight, alcohol, infections and physical inactivity are shown to accumulate inversely with educational level and income.³⁻⁶

training, In recent decades cancer survival rates in economically developed countries have steadily improved,^{7–9} often resulting in years of complex treatment programmes, including <u>0</u> surgery, radiation, immunotherapy and combined multi-drug chemotherapy with or without subsequent haematopoietic stem cell transplantation.^{10–12} Antineoplastic (chemo-therapy) treatment continues to play a significant role, elevating the risk of symptoms and side effects such as fatigue, pain, physical 8 deterioration, and functional and emotional decline.^{13–16} Concurrently, a significant interest has increasingly taken hold in the role of exercise and supportive care following a cancer diagnosis to reduce the disruption patients with cancer experience in their lives,^{17 18} especially in terms of supporting cancer survivorship through secondary and tertiary prevention since avoiding physical

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inactivity is highly prevalent among cancer survivors.^{19 20} However, immediate, and sustainable chemotherapy side effects are one of the most common obstacles to participating in exercise programmes.^{21 22}

In accordance with recent guidelines,²³²⁴ national Danish programmes like Body & Cancer^{25 26} and the Centre for Integrated Rehabilitation of Cancer Patients^{27–29} emphasise the importance of implementing exercise interventions early on to prevent and reduce physiological losses, also in at-risk populations specifically exposed to chemotherapy.³⁰

Generic patient-reported outcomes are validated, for example, using the European Organisation for Research and Treatment of Cancer scale and the Functional Assessment of Cancer Therapy-Anemia subscale,³¹⁻³³ and widely used to measure the significance of exercise for treatment side effects,^{34–39} and its impact on quality of life. These tools, which shed light on the functional and psychosocial aspects of the lives of patients with cancer, provide a number of symptom and side effect subscales. However, current patient-reported scales are not fully tailored to capture the details and scope of the profound experiences of patients regarding side effects while simultaneously participating in exercise-based interventions. To overcome this deficiency, qualitative evidence can help increase understanding of how patients perceive chemotherapy side effects beyond the clinic and interventional context, develop terminology, and transfer this sense of meaning into cancer survivorship.⁴⁰ Existing guidelines, however, seldom reflect qualitative evidence. ^{7 24 41 42} The failure to integrate qualitative evidence into guidelines is possibly due to the epistemological nature and methodology of qualitative research weighted against metaanalyses of powered randomised controlled trials widely accepted in the clinical research community.

To complement the methodology of meta-analyses, leading positioned qualitative researchers have reinforced the ideation of a similar synthesis of qualitative ethnographies.43 44 For example, in relation to cancer interventions, two qualitative meta-syntheses⁴⁵ ⁴⁶ have explored the views of patients with cancer on participating in exercise or psychosocial interventions to support them in coping with their cancer diagnosis and treatment. Hoeck et al (n=33) provide valuable knowledge on the significance of psychosocial interventions,⁴⁶ while Midtgaard et al (n=8) focus on participation in structured supervised training and obtaining primary data related to social interaction.⁴⁵ Both studies, which identify unifying themes related to continuity in re-instituting a purposeful structure in everyday life along with cancer treatment, assert the value of psychosocial research.45 46 These metasyntheses, however, do not focus on whether the exercise interventions compensate for the burden of symptoms and side effects from chemotherapy and the trajectory of a life-threatening disease.

Thus, inspired by meta-ethnography methodology, we aim to synthesise the perceptions of patients with cancer undergoing chemotherapy and the challenges they face

while simultaneously participating in various exercise interventions, but also how the side effects and overall symptom burden impacted this. We seek to provide a deeper understanding to clarify the underlying rationale of exercise oncology and to supplement existing guidelines. Finally, based on our findings, we wish to emphasise areas of future research in cancer survivorship.

METHODS This qualitative meta-synthesis contained the following steps, which are based on Noblit and Hare's seven-step meta-ethnography.⁴⁷
Step 1 Involved the specific research question: how do patients with cancer undergoing chemotherapy perceive the interaction between chemotherapy exposure and a simul-taneous exercise intervention?
Step 2 Comprised a systematic literature search strategy devised to retrieve references related to the study aim and that met the inclusion criteria.
Step 3 Consisted of three authors (CA, CSD, LA) separately reading and rereading the studies to identify and docu-

reading and rereading the studies to identify and document first-order (participant experiences) and secondorder interpretations independent of the main findings and one another. During this process, we aggregated findings from studies that shed light on patient experiences and impact of chemotherapy side effects.

Step 4

Involved two authors (CA, LA) determining how the studies were related. To compare the individual study findings, we drew diagrams containing meaning units to identify the categories that emerged. Four emergent themes were interpreted capturing the main findings of all included studies.

Step 5

Served to strengthen transparency and validity of the four main condensed themes. and involved two authors (CA, LA) examining the patient contributions (positive and negative), empirical based constructs and patient of quotes in each study (online supplemental appendix 1). Similarities and differences in findings were noted, with a special focus on deviant cases (eg, improvement vs nonimprovement in side effects: main theme 2).

Step 6

Entailed three authors (CA, LA, TM) synthesising the four main themes to reach a higher level of abstraction and to develop a third-order interpretation using connectiveness and discussions on existing evidence in exercise oncology.

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Step 7

Involved producing a structured report and discussion of the findings of the synthesis.

Inclusion and exclusion criteria

Inclusion criteria: (1) original qualitative peer-reviewed research articles, (2) interviews (individual or focus group interviews) with patients with cancer irrespective of sex, age, diagnosis and illness status (cancer stage and burden of disease) undergoing an exercise intervention with a client-professional interaction and performed during chemotherapy. All settings for physical exercise (home-based, hospital, community), and type of physical exercise (eg, strength training, endurance training, walking), supervised or unsupervised, group-based or individual. Studies using mixed methods were included if they presented qualitative findings separately.

Exclusion criteria: (1) reviews, meta-syntheses and papers not published in English, (2) studies based on interviews with healthcare professionals or cancer caregivers only and (3) patients with cancer not receiving chemotherapy.

Search strategy

A research librarian (AL) developed a comprehensive search strategy for six electronic databases: Cochrane Central Register of Controlled Trials (CENTRAL), CINAHL, EMBASE, PubMed, SCI-Expanded-SSCI and Scopus (final search June 2022). Online supplemental appendix 2 describes the entire search strategy.

Sources and study selection

The final search strategy identified 8358 items, which were then imported into Covidence.org (https://app.covidence.org/reviews/active). Covidence identified 3356 duplicates, resulting in a remaining 5002 items. Three researchers (CA, LA, CSD) then screened the abstracts and excluded 4895 items, resulting in 107 eligible studies for full-text screening. Ninety studies were excluded based on: wrong patient population (n=31); wrong publication type (n=23); wrong setting (n=12); wrong study design (n=10); wrong type of intervention, for example, no exercise intervention during chemotherapy or the exercise programmes stated no time limit or digital health solutions without repeated professional-client face-to-face or video-telephone interaction (n=10); and other (n=4)(online supplemental appendix 3).

The researchers discussed any disagreements before drawing up a final list of 17 articles for quality assessment, 11 studies of which were selected for the qualitative meta-synthesis.

The Consolidated criteria for Reporting Qualitative research (COREQ) checklist⁴⁸ was used to assess each study's transparency of reporting, and the research group added two supplementary criteria concerning ethical considerations. CA, TM, CSD and LA assessed all 17 studies, while MJ, KP, HBL, MM, CA, CSD and LA independently assessed three studies each. After comparing the COREO assessments, CA and LA discussed any differences to reach agreement. Based on the COREO assessment, no studies were excluded from this synthesis.

Figure 1 contains a flow diagram of the search and inclusion process.

Patient and public involvement

None.

RESULTS

Study characteristics

Protected by Seventeen studies from five countries with 418 patients copyrig (18-80 years of age) were included. Table 1 presents the characteristics of the included studies (online supplemental appendix 4 contains the extended version). The studies included patients participating in exercise interventions during adjuvant chemotherapy or chemotherapy for advanced disease. The majority included patients with a mixed cancer diagnosis $(n=249)^{49-54}$ or ing patients with breast cancer (n=99).^{55–60} The remainder of the studies included children, young people and adults r uses with haematological disease,^{61 62} advanced lung cancer or colon cancer.^{63 6}

The interventions lasted 6-24 weeks and the settings varied between hospital-based (n=9),^{49 50 52-56 61 65} homebased (n=4), 57586062 a combination of settings (n=4) 51596364and group-based/supervised (9 out of 17).

text The exercise interventions were cardiovascular and resistance training (n=11), walking programmes (n=2), a mixture (n=3) or tai chi (n=1). Most of the a studies do not report the adherence rate in the interventions, $^{49 53 56-62 64 65}$ but the rate was relatively high (74%-86.9%) for six studies.⁵⁰⁻⁵² ⁵⁴ ⁵⁵ ⁶³ The studies Bun used individual interviews (n=12), $^{49-525455585961626465}$ focus group interviews $(n=3)^{53} \frac{57}{60}$ or a combination training, of both (n=2).^{51 56} One study⁵⁸ used telephone interviews only, while the other studies used face-to-face interviews. , and

COREQ assessment

simi The completeness of reporting varied across studies, with an average score of 19 (range 13-27) out of 32 nems on the checklist clearly documented (online **t** supplemental appendix 5 contains complete COREQ assessment for each study). Low rates of reporting were observed in describing the researcher/interviewer, with sex (item 4), experience and training (item 5) 8 and characteristics (item 8) often not reported. All studies stated their methodological orientation (item 9), adequately described the sample (items 12 and 16), presented consistency between data and the findings (item 30) and clarified major themes (item 31). All studies considered ethical issues, with the exception of two.^{58 59} The validity of the qualitative studies was found to be justifiable for inclusion in the meta-synthesis.



Figure 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram.

Meta-synthesis

Six studies were not included in the synthesis^{52–54 59 60 62} due to the following differences in scope: focused on max test⁵²; quantitative mixed data weighted heavily⁵³; focused on doseresponse effect from prophylactic epoetin alfa^{54 62}; parallel publication on an identical sample⁶⁰; and compared feasibility between intervention and control in a pilot study.⁵⁹

The meta-synthesis included 11 qualitative studies (n=193 patients).^{4–51/55–58 61 63–65} In studies that included adults, the average age was 50.48^{18-78} years, and there were 47 men and 133women. Most studies (n=7)^{49-51 55-58} included patients with breast cancer (n=106), few studies included patients with haematological diseases $(n=21)^{49} \stackrel{50}{_{50}} \stackrel{61}{_{61}}$ or patients with colorectal cancer (n=30), $^{49-51} \stackrel{64}{_{64}}$ and one included patients with advanced lung cancer (n=15).63 One study65 included children aged 8-16 years (n=7 males, n=6 females), most of whom (n=10) had haematological diseases such as acute lymphoblastic leukaemia, acute myeloid leukaemia and lymphoma.

In accordance with Noblit and Hare's seven-step metaethnography⁴⁷ implying a comprehensive process of qualitative condensation, four main themes were identified:

chemotherapy overpowers the body; exercise in battle with side effects; a break from gloomy thoughts; and a question of survivorship, each theme providing a line of argument in the perceptions of patients with cancer of argument in the perceptions of patients with cancer **9**, and similar the perceptions of patients with cancer **9**. The perceptions of patients with cancer **9** and **10** subtlemes emerged within each of the four main themes (table 2). **Main theme 1: chemotherapy overpowers the body**Patients agree to receive chemotherapy in the hope of improving their own chance of survival. For some, the diagnosis and treatment trigger shock and anxiety, disrupting their daily life^{49 51 63}. It was a total shock to

disrupting their daily life^{49 51 63}: 'It was a total shock to receive that diagnosis and of course it affects you negatively ...' (p808).⁶³

Chemotherapy causes negative physical effects, impacting daily life^{49–51 55 57 58 61 63–65}: 'Before the illness I was super strong—on the top ... Now I have hit rock bottom ...' (p366).⁴⁹ Some patients feel that their body had broken down.^{49 51 55 57 58} The patients also describe the deterioration of their physical capacity^{49 50 55 57 58 61 63-65}: 'When I started chemotherapy, I couldn't do more than

Table 1 Chara	acteristics of included studies (n=17)						
Author (reference) Objective	Data collection	Participants	Intervention	Qualitative methodology/analysis	Country	Publication year
Adamsen e <i>t al</i> ⁴⁹	To examine the nature of fatigue in patients with cancer undergoing chemotherapy participating in a six week multi-dimensional exercise intervention	Individual interviews Three timepoints	N=23 Adults with mixed cancer diagnosis	Hospital-based, structured, supervised, group-based	Not specified	Denmark	2004
Adamsen <i>et af</i> ⁵⁰	To explore how young precancer athletes of both genders perceive disease and treatment-related physical fitness, appearance and identity changes while undergoing chemotherapy	Individual interviews Two timepoints	N=22 Young precancer athletes with mixed cancer diagnosis	Hospital-based, structured, supervised, group-based	Phenomenological approach	Denmark	2009
Adamsen <i>et al</i> ⁶³	To explore the feasibility and the experienced health benefits and barriers of participation in the intervention – seen from the patient perspective – in patients with advanced-stage lung cancer while undergoing chemotherapy	Individual and focus group interviews One timepoint	N=15 Former sedentary adults with advanced-stage lung cancer	Hospital-based, structured, supervised, group-based combined with unsupervised home-based	Phenomenological approach	Denmark	2012
Adamsen <i>et al</i> ⁶¹	To explore physically inactive breast and colon patients with cancer prediagnosis exercise history, and attitudes to physical activity and experiences in initiating physical activity while undergoing adjuvant chemotherapy	Individual interviews Two timepoints	N=33 Physically inactive adults with breast cancer (n=25) or colon cancer (n=8)	Physical activity recommendation, counselling in health promotion, and hospital- based, structured, supervised, group-based or home-based individual pedometer intervention or waitlist control group	Interpretative phenomenological analysis (IPA)	Denmark	2017
Andersen <i>et al⁶⁵</i>	To explore the perceptions and management of muscle and joint pain experienced by participants in the Body & Cancer programme who received adjuvant epirubicin, cyclophosphamide followed by docetaxel with haematopoietic growth factor support following surgery for early breast cancer	Individual interviews Two timepoints	N=15 Adults with breast cancer	Hospital-based, structured, supervised, group-based	Phenomenological approach	Denmark	2014
Backman <i>et al⁵⁶</i>	To explore how women with breast cancer experience physical activity during adjuvant chemotherapy treatment	Individual and focus group interviews Two timepoints	N=16 Adults with breast cancer	Hospital-based, supervised, group-based	Inductive content analysis	Sweden	2016
Coon and Coleman ^{®2}	To ascertain how patients with multiple myeloma appraised the experience of participation in a home- based exercise intervention as part of a randomised controlled trial of prophylactic epoetin alfa (EPO) with or with exercise	Individual interviews and confirmatory telephone interview Two timepoints	N=21 Adults with myeloma	Home-based individual training programme, and EPO	Naturalistic inquiry	USA	2004
Hatlevoll e <i>t al</i> ⁶⁴	To explore the experiences of patients with colorectal cancer participating in an individually tailored and supervised exercise programme during adjuvant chemotherapy	Individual interviews Three timepoints	N=15 Adults with colorectal cancer	Individually tailored combination of supervised hospital-based and home-based	Thematic analysis	Norway	2021
Husebø <i>et al</i> ⁶⁰	To explore factors influencing exercise adherence among women with breast cancer while following an exercise programme	Focus group interviews One timepoint	N=27 Adults with early- stage breast cancer	Home-based individual programme with telephone call from the research team	Systematic text condensation	Norway	2014
Husebø <i>et al⁶⁷</i>	To describe how exercise is perceived by woman to influence their physical and psychosocial wellness while receiving chemotherapy	Focus group interviews One timepoint	N=27 Adults with early- stage breast cancer	Home-based individual programme with telephone call from the research team	Systematic text condensation	Norway	2015
							Continued

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Author (reference	i) Objective	Data collection	Participants	Intervention	Qualitative methodology/analysis	Country	Publication year
Ingram <i>et al</i> ⁶⁸	To describe patient perceptions of participating in a structured, home-based exercise programme while receiving adjuvant chemotherapy for breast cancer, including perceptions of facilitators of and challenges to exercise	Individual telephone interviews 12 timepoints – every 2 weeks over 24 weeks	N=8 Adults with breast cancer	Home-based, individual, supervised, customised to each participant's baseline fitness level, activity tolerance and personal preferences	Content analysis	Canada	2010
Knutsen <i>et al</i> ⁶²	To explore patients with cancer experiences with maximal physical capacity testing and patient feelings of safety in using their bodies while participating in a physical intervention programme	Individual interviews Two timepoints	N=100 Adults with mixed cancer diagnosis Oncological (n=80) Haematological (n=20)	Hospital-based, structured, supervised, group-based	Malterud's ^{s6} four step analysis	Denmark	2006
Leak Bryant <i>et al⁶¹</i>	To explore perceived exercise benefits and barriers in adults with acute leukaemia who recently completed an inpatient exercise intervention during induction therapy	Individual interviews One timepoint	N=6 Adults with acute myelogenous leukaemia	In-hospital-based, supervised, individualised, mixed-modality exercise based on the patient's physical limitations or standard care and monitored activity level during hospitalisation period using daily activity logs	Content analysis	USA	2017
Midtgaard <i>et al</i> ⁵³	To examine patient experiences with group cohesion during the intervention and changes in social and emotional aspects of health-related quality of life outcomes	Focus group interviews One timepoint	N=55 Adults with mixed cancer diagnosis	Hospital-based, structured, supervised, group-based	Narrative analysis	Denmark	2005
Murley et a/ ⁵⁹	To evaluate the effects of tai chi on self-efficacy, quality of life and cancer-related fatigue, and to understand the experience and perceived benefits of patients taking chemotherapy involved in a tai chi programme	Individual interviews One timepoint	N=6 Adults with breast cancer	Hospital-based supervised, group based and home-based with video	Inductive thematic analysis	USA	2019
Rørth et al ⁶⁴	To gain insight into the effects and experiences associated with EPO treatment in combination with a structured six-week physical exercise intervention	Individual interviews Three timepoints	N=16 Adults with mixed cancer diagnosis	Hospital-based, structured, supervised, group-based and EPO	Phenomenological approach	Denmark	2011
Thorsteinsson <i>et</i> a/ ⁶⁵	To explore the motivations and barriers for participation in a structured daily exercise programme tailored to each child's needs and involving professional and psychosocial support	Individual interview One timepoint	N=13 Children with paediatric cancer	In-hospital based, individual supervised PA, and group-based physical activities with other children and their ambassadors	Systematic text condensation	Denmark	2019

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Table 2 Themes, subthemes and studies (online supplemental appendix 1 contains additional citations)			
Main themes	Subthemes	Studies	
Chemotherapy o	verpowers the body	26 49–51 55–58 61 64 65	
	Negative physical effects impacting daily life	26 49–51 55–58 61 64 65	
	Deterioration of physical capacity	49 50 55 57 58 61 63–65	
Exercise in battle	with side effects	49 50 55–58 61 63–65	
	Fatigue often worsens despite exercise	49 50 57 58 63 64	
	Pain was a key factor following chemotherapy	51 55–58	
	Positive benefit despite side effects	49 51 55–58 61 64 65	
A break from glo	omy thoughts	26 49 55 58 61 63 65	
	Helps with anxiety, despondency, feelings of depression and improves mood	49–51 56–58 61 64 65	
	Advice and supervision from healthcare professionals	49 51 55 61 63 65	
	Social relationships and support from family and friends	51 57 58	
A question of sur	vivorship	26 51 56–58 63 64	
	Dreams and plans after chemotherapy, outlook has changed	51 56–58 64	
	Engaging in physical exercise not viewed as being life-prolonging	50 63	

lie on the sofa and vomit for four days. I was tired ... and my body just refused ...' (p60).⁵⁰

Children with leukaemia describe a significant change in their physical abilities: 'I was the strongest in class before chemotherapy, and now I'm suddenly the weakest' $(p6).^{51}$

There is also a change from engaging in a high to a low level of physical activity, accompanied by body denial when diagnosed: 'I thought I had the perfect body until I got cancer' (p58).⁵⁰

Most patients report that they experience cancer and chemotherapy as invading their bodies, making them feel weak, just as they have difficulty recognising themselves as a powerless victim of cancer.

Main theme 2: exercise in battle with side effects

There is a strong feeling of powerlessness among patients related to the noticeably negative physical changes that cancer and chemotherapy impose on their fitness level and appearance.⁴⁹⁻⁵¹ ⁵⁵⁻⁵⁸ ⁶¹ ⁶³⁻⁶⁵ Patients with various cancer diagnoses and chemotherapy regimens describe that their fatigue often worsens as the treatment programme progresses, despite participating in the exercise interventions^{49 50 57 58 63 64}: 'I have extreme fatigue all the time; I'm more and more tired as chemotherapy goes on' (p240).⁵⁸

In one study⁴⁹ patients emphasise that chemotherapyinduced fatigue can be ameliorated through supervised, high-intensity training and turns into exercise-induced fatigue, which is characterised by temporary physical well-being and relaxation: '... I'm tired, but after physical training I'm tired in a nice way' (p366).⁴⁹

Patients with breast cancer express that pain was a key factor following chemotherapy.^{51 55–58} One patient says: 'I was burning up inside ...' (p6),⁵¹ another stating: 'It was horrific with all that pain ... I felt like an invalid ... I

Protected by copyright, including for uses related couldn't do anything ... No, on those days there was no way that I could exercise' (p660).⁵⁵

On a general level, patients tend to feel that they positively benefit from participating in exercise^{49 51 55–58 61 64 65} despite chemotherapy side effects. Some patients highlight their improved physical capacity as the most striking đ outcome of exercising^{49 56 61 65}: I can see that I have more X muscles and that my body has become tighter. I've gained some weight since I've been here ...' (p367).⁴⁹

Patients with inoperable lung cancer⁶³ only feel a limited benefit from engaging in physical exercise: 'In my case the effects did not last long. I have a blood percent that continuously lowers and then I can't breathe ... so the effect of exercising does not last long' (p810).⁶³

≥ Despite the challenges that arose due to side effects training, and some patients nonetheless participated, even on days when the chemotherapy was doing its best to thwart their bodies' agenda.

Main theme 3: a break from gloomy thoughts

simi Patient quotes show that they believe that physical activity can provide a temporary reprieve from the emotional strain resulting from receiving a cancer diagnosis and treatment.^{49–51} ^{55–58} ⁶¹ ^{63–65} Participation in exercise programmes can be perceived as a helping hand to manage anxiety: 'Physical activity helps with anxiety' **g** (p416).⁶¹ Some patients^{49–51 56–58 61 64} point out that exercise can lessen feelings of despondency and depression: 'Physical activity has been really important ... when feeling down and depressed. Go outside and go for walks doing something!' (pE15).⁵⁷

Children with cancer explain that their lives are characterised by hours of intensive treatment and periods of isolation: 'You don't like having long boring days and feeling bad' (p6).⁶⁵ They point out that exercising together with classmates briefly boosts them physically

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and distracts them from gloomy thoughts: 'Just the fact that you're doing something instead of just lying here ... and you feel a little happier afterwards ... [after physical activity]' (p7).⁶⁵

Advice and supervision from healthcare professionals (nurses and physiotherapists) in the hospital-based interventions 49 51 55 61 $^{63-65}$ help to provide reassurance and create a feeling of security that benefits the patients emotionally: 'I think it's important there are professionals ... you feel confident about what they teach you ..., but I feel that they help me put in more effort than I would on my own' (p2304).⁶⁴ Likewise, social relationships and support from the patients' network of family and friends^{51 57 58} also have a positive influence on their emotional state: 'To all my friends I used to do sports with, it became natural to walk with me. If I had a bad day, I could send a text message and they would come and pick me up at home. It's been really nice' (pE16).⁵⁷

Main theme 4: a question of survivorship

Once exercise programmes begin to draw to a close, patients reflect on their own future: 'It was important to me to stop talking about the cancer and start talking about exercise ... to change the subject' (pE16).⁵⁷ Half of the studies^{51 56–58 64} include descriptions of the

patients' dreams and plans after their chemotherapy and once the exercise programmes end. Unsurprisingly, lifethreatening illness and tough treatment regimens leave their mark physically and mentally: '... cancer was the most crucial factor in reconsidering my way of life' (p5).⁵¹

When the patients conclude their training programmes their outlooks change^{51 56–58}: 'After doing the programme, my body is much stronger. I'm doing well mentally [and] I have clear objectives for the future' (p6).⁵¹ The patients express optimism about being able to use their body's new resources as a tool to provide respite from their cancer diagnosis: 'To me, it felt like running away from the illness. I realised that I could do something and even more than before I got sick' (pE18).⁵⁷ A positive interpretation of the importance of exercise for the patients' survival is a recurring feature of the studies that include patients with cancer who receive adjuvant therapy.⁵¹⁵⁶⁻⁵⁸⁶⁴

Patients with inoperable lung cancer⁶³ do not see engaging in physical exercise as being life-prolonging but they do point out that getting together in a group gives them: '... a much clearer sense of their cancer diagnosis and a bleak prospect in terms of dying' (p812).⁶³ Group exercise alleviates the sense of loneliness and isolation in the patients with lung cancer.⁶³ Another study⁵⁰ involving young patients with cancer who had been top athletes prior to their illness but now had advanced-stage cancer likewise does not indicate that they have any explicit expectations regarding their own survival but rather indicate a shift in identity: '... from experiencing one's identity as an athlete to one, powerless cancer victim' (p60).⁵⁰ This underlines the uncertainty patients feel concerning their interpretation of their own chance for survival.

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at physical decline, these experiences surface, though unevenly among participants.⁵⁶ ⁶¹ The emotional benefits of pooled, randomised exercise trials in patients with breast cancer have a minor effect size, though numerous effects from exercise interventions on quality of life have been observed in cancer survivors.⁸⁰

The present meta-synthesis suggests that getting a break from illness and side effects is beneficial since systematically scheduled breaks designed to strengthen the body may trigger a flow of thoughts on recovery and life prospects. However, the sustainability and importance of these breaks remain unclear and cannot be determined based on our meta-synthesis.

The knowledge gathered in this meta-synthesis is generally concerned with the individual struggles that patients undergoing chemotherapy tries to overcome through exercise participation. Nonetheless, these experiences are partly time limited within the context of the interventions, providing only a sparse empirical basis for gaining insight into the patients' existential outlook during and after treatment. Irrespective of cancer diagnosis and prognosis, the patients seldom refer explicitly to their existential situation. It is nonetheless problematic and inadequate that the researchers in the included studies did not discuss and reflect more deeply on this aspect.

It is unclear to what extent the actual exercise intervention context helps the individuals to blot out their existential situation or to switch off gloomy and worrying thoughts. In line with findings in the meta-synthesis by Midtgaard *et al*,⁴⁵ there seems to be a mutual agreement between the participants and the exercise team to facilitate a community. The overall aim of this community is to focus on the physical benefits in parallel with their underlying situation. However, the present and the meta-synthesis by Midtgaard et al⁴⁵ point to different but complementary insights that illuminate the individual struggles with on-the-one-hand the invasive impact of chemotherapy exposure and on the other hand, the potential health promoting gains related group-based exercise interventions. Far less is unfolded in these two meta-syntheses, it leaves participants to independently determine how to take advantage of the transfer value of exercise and apply it to their existential situation.

Methodological considerations

In the present meta-synthesis, the research scope was the patients' perceptions of side effects and the body's possible physical and emotional deterioration due to treatment while simultaneously participating in exercise. This approach to data collection (n=11 studies) excluded qualitative studies on exercise performed during chemotherapy that did not meet the overall scoping criteria: emotional habitus,⁵³ VO2max test⁵² and EPO drug evaluation.^{54 62} Likewise, studies were excluded from the metasynthesis due to, for example, wrong population, wrong intervention or wrong study design (online supplemental appendix 3).

One limitation is the omission of exercise studies based on predominantly digital health solutions (distance delivery, mHealth, eHealth), even though our search strategy captured qualitative research on digital health solutions⁸¹ (online supplemental appendix 3). This choice was made mainly because this emerging field is less integrated in the existing meta-analysis of exercise interventions that the present meta-synthesis focuses on. We acknowledge the importance of digital health solutions and their potential benefits, for example, overcoming distance and transport challenges, the availability of wearable devices providing professional guidance, and their cost effectiveness. We recommend that more quantitative and qualitative research be done on the upcoming field of guided exercise and that meta-analysis and metasynthesis subsequently be done on the outcomes.

We have not specifically made a distinction between a findings from adults and children in the meta-synthesis since only one paper included children.⁶⁵ This is a potential limitation and underscores the need of more qualitative research for children with cancer undergoing chemotherapy and participating in complementary exercise interventions.

Most of the included studies were qualitative and performed as part of hospital-based exercise trials, ^{49 50} with two studies exclusively examining primary care settings.^{57 58} Participants were usually recruited from a selected background population that voluntarily signed up for exercise based on their own motivation, which e implies a convenient sampling of informants across the studies. There were predominantly women with breast cancer receiving adjuvant chemotherapy,^{51 55–58} even though some studies strategically recruited participants a from risk populations (advanced treatment, stages of \exists disease, physically inactive lifestyle) using an outreach approach (doctor's recommendation, nurse counselling) in hospital clinics.^{51 61 63 65} This unavoidable selection of ≥ informants may have resulted in a pre-positive bias to exercise interventions since the informants' preferences already coloured their attitudes.

The meta-synthesis was based on every included studies irrespective of their COREQ assessment and thus considerations of internal validity did not influence the emergence of findings and interpretation. We found the studies justifiable for inclusion since they in general were lacking similar information on specific domains, for example, participants knowledge of the interviewer, interviewer characteristics, transcripts return and member checking (online supplemental appendix 5).

The analysis was guided by the empiricism, with no prior or post-theoretical anchor to determine what was selected. To support the external validation of findings, we discussed central aspects and other meta-levels found in the scientific literature. Based on the narrative heterogeneity of patient experiences, ^{49–51 55–58 61 63–65} this meta-synthesis may help in understanding why meta-analyses generally only find an average, small effect size on health-related quality of life domains (eg, fatigue, physical

function, quality of life),^{80 82–85} which may be due in part to the competing interaction, variation, and nuances resulting from chemotherapy and side effects but also the effort to rebuild the body during exercise. The patientreported effect measures applied in the exercise interventions may not capture the most pivotal reasons for patient engagement in exercise, which are, as this synthesis indicates: the fight for survivorship and reconsidering one's life.

Clinical implications

This synthesis highlights the fact that the majority of patients with cancer undergoing chemotherapy experience severe symptoms and side effects irrespective of whether they receive supportive medical treatment or take part in various exercise activities. As new complex cancer treatment regimens are being developed it is becoming a significant challenge for clinical cancer specialists to intervene with regard to side effects. This is why alternatives such as physical activity programmes are increasingly being developed and tested with a view to strengthening the body and potentially reducing side effects, physical deterioration, and emotional distress. Findings from related qualitative studies were aggregated to generate an evidence basis for use by healthcare professionals in oncological and haematological practice. A stronger emphasis on the patient's existential situation and their fight for survivorship could be incorporated in medical clinics as well as in exercise rehabilitation programmes, which may form the core agenda for cancer survivors.

CONCLUSION

This meta-synthesis included qualitative studies (n=11) based on patients with various cancer diagnoses, different disease stages, sexes, and ages participating in group or individual exercise interventions while receiving chemotherapy. It identified four major themes: chemotherapy overpowers the body, exercise in battle with side effects, a break from gloomy thoughts, and a question of survivorship. To a large extent, we found that participants were left to independently determine how to take advantage of the transfer value of exercise and apply it to their existential situation. Our meta-synthesis showed that exercise interventions may provide momentary relief from overwhelming side effects, even when full bodily recovery is perceived as a distant prospect.

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