



## Barriers to physical activity participation in colorectal cancer patients during chemotherapy treatment: A qualitative study

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### ABSTRACT

**Purpose:** To explore the barriers that colorectal cancer patients (stage II and III) perceive to participate in physical activity (PA) when involved in adjuvant chemotherapy. Views of relatives and physicians concerning this issue were also included.

**Method:** Qualitative data from ten patients, ten relatives, and ten health professionals were obtained through semi-structured interviews ( $n = 30$ ).

**Results:** Two main themes were identified after data analysis: (a) barriers to PA related to ostomy and adjuvant chemotherapy and (b) barriers related to perceived lack of support for PA. In regard to the first theme, participants reported difficulties associated with the ostomy, limitations of the intravenous chemotherapy device, fatigue and reduced physical fitness, and focusing on cancer and restructuring priorities. Concerning the perceived lack of support for PA, participants referred to their families' overprotection, the health professionals' lack of knowledge and time to prescribe PA, and the lack of PA services in health centres.

**Conclusions:** Further information from health professionals about the recommendations of PA and its benefits during adjuvant chemotherapy could palliate these PA barriers. The offer of specific PA programmes for these patients is also recommended.

### 1. Introduction

Colorectal cancer (CRC) is the third most prevalent cancer and the fourth most common cause of cancer-related death worldwide (Bray et al., 2018). The treatment of CRC usually requires surgery followed by adjuvant chemotherapy. Chemotherapy implies several side effects that impact on patients' health, such as fatigue, disrupted sleep, neuropathy, chronic pain, impaired physical function, impaired cognition, depression, anxiety, and decreased quality of life (Clifford et al., 2018; Fallon, 2013; Pachman et al., 2012; Vrieling and Kampman, 2010).

There is growing evidence about the positive role of PA during and after treatment in CRC patients. Segal et al. (2017) showed that PA involves significant and positive changes for physical aspects of quality of life, such as physical functioning, energy levels, pain, and general health perceptions. Besides, active patients feel less stress, anxiety, negative emotions, and cognitive problems (Basen-Engquist et al., 2014). PA may also improve patients' ability to complete the treatment, prolonging disease-free survival and reducing risk of recurrence and death (McTiernan et al., 2010; Vrieling and Kampman, 2010). In spite

of the described benefits, only about 17–35% of CRC patients comply with PA recommendations (Blanchard et al., 2008; Courneya et al., 2008a, 2008b; Maxwell-Smith et al., 2017; Schmitz et al., 2010; Smith et al., 2017).

Studies focused on analysing the barriers to PA for CRC patients represent a necessary step for the promotion of PA in this population. A systematic review of this topic (Romero-Elías et al., 2017) highlighted some of these barriers. Female participants who were older and had a lower socioeconomic status were more inactive. Disease-specific barriers, such as fatigue, nausea, diarrhoea, or difficulties with the stoma pouch were also reported. Perceived lack of time and insufficient health knowledge were other barriers to PA.

This systematic review (Romero-Elías et al., 2017) identified a clear lack of qualitative studies shedding light on the barriers to PA in CRC patients. As Lynch et al. (2010) suggested, the barriers included in the measures of quantitative studies are pre-established, and a qualitative methodology may be appropriate to identify additional barriers from the perspective of CRC patients.

To our knowledge, only two qualitative studies have focused on

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barriers to PA in patients who had completed active treatment for CRC in the previous 2 years (Hardcastle et al., 2017; Maxwell-Smith et al., 2017). However, no previous qualitative studies have been carried out with CRC patients who were still receiving chemotherapy treatment. Moreover, these two previous studies did not include the views of other social agents who could provide a more complete understanding of the topic under study.

This qualitative study aims to explore the perceived disease-specific barriers to PA in CRC patients during adjuvant chemotherapy, including the perspectives of the patients, their relatives, and their health professionals.

## 2. Methods

### 2.1. Design

A qualitative descriptive study design was adopted using semi-structured interviews. The Critical Appraisal Skills Programme (2018) checklist for qualitative studies was used to assess the quality of this research. The study adjusted favourably to the ten items included in the appraisal tool.

### 2.2. Participants

Participants were ten CRC patients, ten relatives, and ten health professionals ( $n = 30$ ). Patients (50% female; 35–75 years,  $M = 58.80$ ,  $SD = 12.47$ ) were recruited through the oncology unit of a Spanish hospital (University Hospital of Vinalopó, Elche). Table 1 shows an overview of their clinical characterization, including medical diagnosis, specific stage of the disease, and type/duration of chemotherapy treatment. The following criteria had to be met for their inclusion in the study: aged more than 18 years; confirmed CRC (stage II–III); treated by curative surgery for colon or rectal cancer followed by chemotherapy treatment; and to have finished half of the cycles of the adjuvant

chemotherapy treatment. Exclusion criteria were: metastatic or incurable CRC, and limiting physical/psychiatric symptoms detected by the oncology medical team. Four of the 14 relatives screened at the beginning of the study declined participation, alleging personal reasons. Therefore, ten relatives (23–75 years,  $M = 50.90$ ,  $SD = 17.14$ ) were finally included in the sample; five men (patients' husbands) and five women (two wives, one sister, and two patients' daughters). Finally, the whole oncology team of the hospital participated in the study, including one psycho-oncologist (woman), four oncologists (two men and two women), and five nurses (two men and three women). Health professionals aged between 35 and 55 years ( $M = 40.80$ ,  $SD = 7.70$ ), and accumulated an average of 7.6 years of experience in oncology services.

This research was approved by the Ethical Research Boards of both the hospital and the Miguel Hernández University of Elche. All participants were informed about the research procedures and provided their written consent.

### 2.3. Procedures and data collection

Semi-structured interviews were conducted with each participant and audio-recorded by MR (a sport sciences doctoral student experienced in CRC and exercise). Questions for patients, relatives, and health professionals were developed by MR in consultation with VB, DG and AJ (initials of the other members of the research team), who had expertise in qualitative research and PA promotion. Then, MR established phone contact and carried out several meetings with the oncology unit to explain the purpose of the study. Once the oncologists agreed to participate, they informed the nurses and the psycho-oncologist about the possibility of also being interviewed to determine their perceptions of the barriers that patients might have to overcome during adjuvant chemotherapy. The nurses and the psycho-oncologist also agreed to participate. In addition, at each medical consultation, oncologists informed patients about the study and asked for their participation. If the patients accepted, MR contacted them by phone to arrange a time and

**Table 1**  
Patients' characteristics.

ID	Sex	Age	Diagnosis	Stage of disease	Chemo
1	Woman	64	Adenocarcinoma rectum	pT3N0M0 (IIA)	CAPOX Started: 18/9/17 (5 weeks after surgery) Ended: 22/2/18 (5 months)
2	Woman	61	Adenocarcinoma sigma (colon)	pT3N0M0 (IIA)	CAPOX Started: 23/10/17 (4 weeks after surgery) Ended: 19/4/17 (6 months)
3	Man	75	Adenocarcinoma rectum	cT3aN2M0 (IIIB)	Capecitabina Started: 8/11/17 (7 weeks after surgery) Ended: 3/4/18 (5 months)
4	Man	65	Adenocarcinoma rectum	cT3aN2M0 (IIIB)	FOLFOX Started: 17/1/18 (5 weeks after surgery) Ended: 16/7/18 (6 months)
5	Woman	35	Adenocarcinoma rectum	cT4N0M0 (IIC)	Capecitabina Started: 8/2/18 (4 weeks after surgery) Ended: 30/5/18 (3 months)
6	Man	61	Adenocarcinoma sigma (colon)	pT4pN0M0 (IIC)	FOLFOX Started: 6/3/18 (6 weeks after surgery) Ended: 20/8/18 (6 months)
7	Woman	42	Adenocarcinoma sigma (colon)	pT4bN0M0 (IIC)	FOLFOX Started: 29/3/18 (4 weeks after surgery) Ended: 18/10/18 (6 months)
8	Man	64	Adenocarcinoma sigma (colon)	pT3N0M0 (IIA)	CAPOX Started: 21/5/18 (4 weeks after surgery) Modified to FOLFOX in cycle 5 Ended: 7/12/18 (6 months)
9	Man	70	Adenocarcinoma sigma (colon)	pT3N0M0 (IIA)	Capecitabina Started: 30/5/18 (4 weeks after surgery) Ended: 17/11/18 (6 months)
10	Woman	51	Adenocarcinoma sigma (colon)	pT3pN2aM0 (IIIB)	FOLFOX Started: 18/6/18 (6 weeks after surgery) Ended: 26/12/18 (6 months)

**Table 2**  
Examples of interview questions.

PA Participation		
Patients		Physicians and Relatives
<ul style="list-style-type: none"> <li>- Do you usually do any kind of sport or physical exercise? Why?</li> <li>- How many days per week do you do moderate and vigorous physical exercise?<sup>a</sup></li> <li>- Do you feel able to do physical exercise during the treatment?</li> <li>- At what point in the treatment do you feel more energised to participate? And at what time less energised?</li> <li>- Have you been informed of the benefits of physical exercise in general? And during the illness and the treatment?</li> </ul>		<ul style="list-style-type: none"> <li>- Do you usually do any kind of sport or physical exercise? Why?</li> <li>- How many days per week do you do moderate and vigorous physical exercise?<sup>a</sup></li> <li>- How much time do you spend walking and sitting?</li> <li>- Do you think that exercising is good for your health? Why?</li> <li>- Do you think that exercising is good for the health of patients with colorectal cancer? Why? What benefits can it bring?</li> <li>- Do you think that physical exercise involves risks in patients with colorectal cancer? What risks? Why? How can those risks be reduced?</li> </ul>
Factors influencing PA participation in CRC patients		
Patients		Physicians and Relatives
<ul style="list-style-type: none"> <li>- What barriers have you perceived to do PA during treatment?</li> <li>- Have you had physical problems, low perception of ability, fear of hurting yourself, boredom, etc.?</li> <li>- How do you think your physical fitness is in general?</li> <li>- Do your relatives support you to do PA?</li> <li>- Do you consider that there are available spaces and facilities to do PA?</li> </ul>		<ul style="list-style-type: none"> <li>- Does X (the family member with cancer or the patient) habitually perform some type of sport or physical exercise? Why? And before the illness?</li> <li>- What barriers do you think he/she finds to do exercise?</li> <li>- What aspects might facilitate his/her participation in PA?</li> <li>- Do you think it would be interesting to incorporate PA and sports professionals into the team of health professionals who care for these patients? What qualifications should these professionals have?</li> <li>- Do you think that exercise could be part of a complementary treatment for CRC patients?</li> </ul>
Quality of life		
Patients	Relatives	Physicians
<ul style="list-style-type: none"> <li>- What symptoms do you have daily (nausea, fatigue, pain, need to lie down, etc.)? How do they affect you?</li> <li>- Do you feel that the disease has affected your social relationships?</li> <li>- Do you think people in your social environment accept your illness?</li> <li>- Do you feel that your illness affects your mood?</li> <li>- Do you enjoy life? Can you work, enjoy leisure time, eat and sleep well?</li> <li>- Are you worried about any other issue?</li> <li>- Do you think that carrying the colostomy bag (if you carry it) affects your day-to-day life?</li> </ul>	<ul style="list-style-type: none"> <li>- How does the disease affect the patient's quality of life?</li> <li>- How does it affect his/her relationship with the family?</li> <li>- How does it affect you?</li> <li>- Do you think that exercise could somehow improve the patient's quality of life and his/her family relationships?</li> <li>- What do you worry the most about this situation (the disease and its effects)?</li> <li>- What encourages you the most to fight and face the situation?</li> </ul>	<ul style="list-style-type: none"> <li>- How has the disease affected his/her quality of life?</li> <li>- How has it affected the relationship with the family?</li> <li>- How did the news of the disease affect him/her?</li> <li>- Do you think that exercise could improve patient's quality of life and the relationship with his/her family in some way?</li> <li>- What worries you the most about this disease?</li> <li>- What is the worst thing about CRC for patients?</li> <li>- What is the best and worst part of your work with CRC patients?</li> </ul>

<sup>a</sup> The concepts related to the different intensities of PA were explained; PA: Physical Activity; CRC: Colorectal Cancer.

location for the interview. All interviews were performed at the hospital, university, or participants' home, according to their preferences. In the case of patients, interviews were conducted halfway through the treatment, following medical recommendation. After the patients had been interviewed, they were asked if the relatives who shared the most time with them during treatment could also be interviewed. Subsequently, the same protocol as the one applied to patients and health professionals was also applied to those relatives who agreed to participate. Table 2 contains several examples of questions asked to the three groups.

#### 2.4. Data analysis

Qualitative data from the interviews were transcribed verbatim and analysed using QSR Nvivo software (Bazeley and Jackson, 2013). The data were analysed with an inductive thematic analysis (Braun and Clarke, 2006). First, all transcriptions were read carefully to become familiar with the data. Second, any data extracts which represented interesting information related to the aim of the study was coded. This initial coding was inductive and descriptive. Third, inductive reasoning was also used to identify from the codes two main themes ("Barriers related to ostomy and adjuvant chemotherapy" and "Barriers related to

perceived lack of support to PA participation") with their corresponding sub-themes. These themes and sub-themes determined the structure of the results shown in the next section.

Data analysis was led by MR, whereas VB, DG and AJ played the role of 'critical friends' (Smith and McGannon, 2018). According to these authors, the involvement of critical friends during the process of data analysis improves the quality of interpretations and favours a more defensible and plausible data analysis. In a series of three meetings, MR presented the data analysis using diagrams, outlined the codes included in the different themes, and responded to the questions and suggestions of the critical friends. The critical friends helped their colleague to refine the names and contents of the different themes, so as to achieve a more coherent thematic map at the end of data analysis. They also collaborated to improve the write-up of the analysis and the entire article.

### 3. Results

The themes and sub-themes identified in the data analysis are presented in the following sections. Table 3 summarizes the main similarities and differences of participants' views about PA barriers during chemotherapy treatment.

**Table 3**  
Summary on the similarities and differences of participants' views about PA barriers during chemotherapy treatment.

	Differences	Similarities
<b>Barriers related to ostomy and adjuvant chemotherapy</b>		
Difficulties associated with the ostomy	–	Patients, relatives, and health professionals considered that ostomy was a potent barrier to PA, especially at the beginning of the treatment.
Limitations of the intravenous chemotherapy device	Two nurses commented that patients, who had acquired an exercise routine, did not perceive the intravenous chemotherapy device as a main barrier to do PA.	Many patients thought that the chemotherapy device was a barrier to PA participation. They were uncomfortable with the cables and felt ashamed of a large device that could be seen by others through clothing. This idea was supported by relatives and health professionals.
Fatigue and reduced physical fitness	Some patients did not perceive fatigue as a barrier.	Many patients and relatives supported fatigue as the main barrier. Health professionals reported fatigue as the most prevalent side effect of CRC treatment, which was related to less PA.
Focusing on cancer and restructuring priorities	Relatives did not inform about this theme as a barrier to do PA during the treatment.	This barrier was mainly reported by younger patients with children. Oncologists were the main agents who highlighted this issue as a barrier to PA.
<b>Barriers related to perceived lack of support for PA</b>		
Families' overprotection	Patients did not report this issue as a barrier to do PA during the treatment.	Relatives acknowledged that they overprotected patients and influenced on their inactivity during the treatment. This fact was also perceived by health professionals.
Health professionals' lack of knowledge and time to prescribe PA	Nurses declared to have more time to inform about PA, but they demanded specific training before giving some PA recommendations or prescribing any type of PA.	Health professionals mentioned their lack of knowledge and time to prescribe PA. Oncologists recommended "exercise" but they recognized not having enough knowledge for a detailed prescription. Oncologists considered that they should have the possibility of referring their patients to other professionals in charge of PA aspects. Relatives and patients agreed with these ideas and considered essential the oncologist's initial recommendation for PA participation.
Lack of PA services in health centres	–	Patients, relatives, and health professionals informed about the lack of PA services in health centres. All of them reported that exercise programmes should be mandatory for patients. Especially, the youngest relatives and patients suggested that PA should be offered at the hospital as part of CRC patients' treatment.

PA: Physical Activity; CRC: Colorectal Cancer; –: No differences were found between the participants' views.

### 3.1. Barriers related to ostomy and adjuvant chemotherapy

#### 3.1.1. Difficulties associated with the ostomy

Most patients declared that colostomy represented a shock in the early stages after this surgical operation, being a potent barrier to perform PA:

*At the beginning, wearing the stoma is a horrible shock. It was a very negative thing, I was sitting around all day, and I didn't feel like walking or going anywhere (Patient 7).*

Health professionals agreed that, at the beginning, patients felt insecure and embarrassed, and needed some time to adapt to the handling of the pouch. This situation negatively affected the patients, who tended to isolate themselves and reduce their participation in social activities:

*Some patients with a stoma find it difficult to get out on the street and participate in group activities, because the stoma makes sounds, gases pass out and they cannot control either the sound or the smell ... maybe an environment where people understand these issues is better (Oncologist 1).*

Some patients also reported not doing PA because of their fear of getting a hernia. This concern was in line with oncologists' recommendations after ostomy:

*I don't recommend doing PA if they have a stoma. Especially at the beginning, because they don't manage the stoma well and the pouch could break. I tell them to avoid vigorous PA, sudden movements, or resistance training in order not to suffer pain (Oncologist 1).*

#### 3.1.2. Limitations of the intravenous chemotherapy device

Wearing the intravenous chemotherapy device was a barrier commonly reported by the patients. The device consists of a bottle connected to a subcutaneous Port-a-Cath for 48 h. Patients felt uncomfortable because the bottle is very big and is easily noticeable under their clothes. Hence, patients tended to stay at home on those days, which implied a decrease of their PA participation:

*When I didn't do anything ... it was when they put the bottle on me for two days, because it makes a bulge in my body and I don't like it. When I'm receiving the treatment, I don't want to go anywhere. The bottle is like a knapsack, it's very big and can be easily seen (Patient 4).*

According to different health professionals, it was possible to walk and do some exercise while wearing the chemotherapy device. However, the social barriers associated with wearing the device were the main problem, especially for patients living in small towns where they could come across with neighbours and feel obliged to give unpleasant explanations:

*Especially in small towns, my patients don't want to be seen with the bottle. This is not so uncomfortable to walk and exercise, but I think it's more because of the neighbours. They tend to isolate themselves, they don't feel like dealing with people, people ask them questions and they have to respond ... In the city, I think they go more unnoticed ... (Nurse 4).*

For many patients, the bottle was not the only impediment to do PA. They also expressed their concern about the subcutaneous Port-a-Cath and the possibility of receiving a blow while doing exercise:

*I feel overwhelmed with the Port-a-Cath when I do Pilates. I can feel it, I feel weird about it ... I have cables inside, and I was told not to*

receive any blow on it ... (Patient 1).

### 3.1.3. Fatigue and reduced physical fitness

According to many patients, fatigue was the main perceived hindrance to do PA during chemotherapy:

*Fatigue is the main barrier to do PA, now I'm on chemotherapy and I feel tired. I used to walk four or five km a day ... Now, really, the chemotherapy exhausts me ... and I don't have any spirit to do PA (Patient 3).*

Fatigue was also associated with the perception of reduced physical fitness. This situation led some participants to drop out of activities they did in group, such as walking, because they were worried about not being able to keep up with the pace of the group:

*I don't dare to go walking because I don't know how I will respond. Partly, I think I can go with them, but they are used to a pace that I can't follow now (Patient 4).*

*One of the limitations was that he [Patient 4] couldn't keep up with his mates. He was physically able to go walking, but he didn't want to slow down the group or make them wait for him. Sometimes when people do PA in a group, they stop going if they cannot remain at the same level (Psycho-oncologist 1).*

### 3.1.4. Focusing on cancer and restructuring priorities

Some health professionals highlighted the fact that patients were focused on cancer and changed their priorities after diagnosis, especially during the first cycles of chemotherapy. This situation involved a reduction of their PA levels:

*The first months of the treatment, patients are focused on their thoughts, the disease, their survival and overcoming fear. Obviously, in that situation, they aren't going to do the same PA as before having cancer. They have another perspective because their priorities have changed (Oncologist 3).*

However, only patients with young children talked about this barrier to PA. The cancer diagnosis represented a radical change which was difficult to accept and changed their priorities. During this unstable period, they decided to devote their efforts and vitality to attend to priority tasks:

*I stopped PA because ... your priorities change, and you have to save yourself and move on. Until you accept the disease, all your energy is dedicated to do what you have to do ... in my case, my children and my husband. At the end of the day, you do what the body allows you to do (Patient 9).*

## 3.2. Barriers related to perceived lack of support for PA

### 3.2.1. Families' overprotection

The relatives themselves acknowledged that they tended to overprotect the patients due to their health problems. This fact, also perceived by the health professionals, led to a reduction of patients' PA participation, although the patients did not refer to this barrier clearly:

*I overprotected him. I told him not to do certain things and he didn't get up. Maybe this was incorrect but, during the treatment, I was afraid when he carried bags because he had a huge scar. I didn't realise he was being overprotected (Relative 5).*

*I think family members wouldn't let them do PA. One patient loved his motorbike. It was his hobby and now his wife doesn't let him do anything. He doesn't work ... he isn't well ... because he doesn't know what to do. Doing exercising would be very good for them (Nurse 4).*

### 3.2.2. Health professionals' lack of knowledge and time to prescribe PA

Health professionals acknowledged their lack of knowledge to

prescribe PA, an aspect that represented a strong barrier for the promotion of PA in CRC patients:

*What kind of exercises, how to do them, how often, in what way, by what means ... because it's an unfamiliar area for us ... we are unaccustomed to address it with patients. We have that conversation when a patient asks about exercise, but it's difficult to remind all patients about the importance of doing PA (Oncologist 4).*

*I don't have the academic qualifications to decide which exercises the patients can or cannot do. There is no one better than the sport sciences professional to prescribe PA for patients (Nurse 4).*

Some relatives also believed that the oncologists did not have much knowledge about PA prescription, and that this fact caused the oncologists to avoid recommending or prescribing PA:

*Doctors in general didn't say anything about doing exercise. I believe doctors don't have any knowledge of PA. Otherwise, they would have informed us (Relative 4).*

According to relatives and patients, this lack of PA recommendations or prescription was a fundamental barrier to the patients' PA participation:

*He [the patient] would have done everything possible to recover his health ... and I would have taken my father wherever they [the doctors] would have told me (Relative 3).*

*If the doctor had told him [the patient] to do exercise every day, he would have done it more often ... (Relative 4).*

*The biggest barrier to training was not knowing that I could do it (Patient 10).*

Moreover, nurses declared that oncologists did not have enough time to give PA recommendations during consultations, but they spent more time talking with patients and could give some PA recommendations if they received an appropriate training:

*Doctors only have 20 min for each patient [consultation time] but we [nurses] have almost 5 h while delivering the chemotherapy. So ... if we receive training, we could help the patients. It would be great if the hospital organised some workshops about PA for CRC patients (Nurse 1).*

Due to their lack of time and multiple responsibilities, oncologists thought that they should have the option of referring their patients to other health professionals in charge of running PA programmes:

*The oncologist can't be in charge of so many things. It would be interesting for patients to do PA, but the oncologist is not the one who has to run the plan. Oncologists would have to refer their patients to a team in charge of carrying this out (Oncologist 3).*

### 3.2.3. Lack of PA services in health centres

Participants reported that the hospital did not provide PA services for CRC patients. This situation represented a barrier to PA for the patients, who did not know of appropriate places to do PA programmes adapted to their characteristics and needs:

*I don't think that sport centres are prepared for cancer patients ... and I'm not going to go centre by centre asking if they have activities adapted for me, because I don't want to explain my case to everyone (Patient 9).*

Nevertheless, many health professionals, and the youngest relatives and patients, suggested that PA should be included in the hospital as part of the CRC patient's treatment:

*Patients would do PA if it was established as another therapy. They would surely do it, and successfully (Oncologist 3).*

*I believe that PA should be compulsory, and the hospital should offer a PA programme for patients (Relative 3).*

*I would like to access a PA programme for cancer patients where we could encourage each other (Patient 1).*

Finally, one nurse thought that the incorporation of sport sciences professionals in the team of health professionals is necessary to create and offer such PA services in health centres:

*A professional in sport sciences with knowledge of cancer is the figure who should prescribe and run the PA programme (Nurse 4).*

#### 4. Discussion

As recommended by Kendall et al. (2009), this qualitative study followed a multi-perspective approach, which included the view of patients, relatives, and health professionals, and was useful to provide a more complete understanding of the topic under study. Our findings revealed that ostomy and adjuvant chemotherapy entailed several barriers to PA which could be framed in both a physical and a psychosocial dimension. With regard to the physical barriers, and in line with previous research (Russell, 2017; Saunders, 2018), patients were worried about suffering a hernia or breaking the ostomy bag with vigorous PA and sudden movements. Patients also expressed their concern about receiving a blow while doing PA or getting injured while wearing the Port-a-Cath. As other studies have pointed out (Blaney et al., 2013; Lynch et al., 2010), the fatigue associated with chemotherapy was another physical barrier to their PA participation.

Nevertheless, ostomy and adjuvant chemotherapy also involved important psychosocial barriers to PA. Patients undergoing a treatment phase with a recent diagnosis were worried about their survival and felt afraid, insecure and uncertain. The stoma, the ostomy pouch, and the intravenous chemotherapy device also involved important body changes that were difficult to accept. Patients also reported that they could not control the sound or smell of their ostomy pouch or that the chemotherapy device made a strange bulge in their body easily seen by others. These aspects led patients to avoid social activities or situations in which they could feel obliged to give explanations about very private, unpleasant, or embarrassing issues. Similar findings were reported by Saunders and Brunet (2019), who highlighted that having a stoma can be a barrier to PA when cancer survivors isolate themselves to avoid social exposure. The fact that patients felt fatigue and reduced physical fitness also had social implications in the PA context which have not been underlined in previous research. For instance, in some cases, participants decided to stop walking with their mates because they were not able to keep up with their pace and did not want to be a burden to the group. Therefore, the psychosocial aspects associated with ostomy, chemotherapy, and fatigue were also strong barriers to PA in CRC patients.

The patients of this study were in a confused phase of their lives, in which they were focused on cancer and they had restructured their priorities. In these conditions, it seems logical that the focus and energy were aimed at recovery, survival, and priority tasks such as looking after children, instead of participating in PA. However, this probably occurred because PA was not conceptualized and considered as an official part of their treatment by the health system, health professionals, patients, and relatives. Otherwise, patients (and their families) would have understood that PA was one of the priority tasks they had to carry out in their fight against CRC. In fact, cancer patients tend to think about the reasons of their disease during treatment, and are usually open to changes in their lifestyle which could improve their health (Henriksson et al., 2016).

This important point is linked to the barriers related to the lack of support for PA identified in our study. In line with previous studies with CRC patients (Saunders, 2018) and patients with prostate cancer (Cormie et al., 2015), the fact that the patients and families did not receive precise recommendations for the patients to do exercise was a very strong barrier to do PA. This lack of information and knowledge, together with the logical concern about the patients' health, made relatives overprotect the patients and promote their inactivity. This last finding is consistent with the results reported by Henriksson et al.

(2016).

According to our findings, the fact that health professionals did not give precise PA recommendations was related to their lack of knowledge about this topic. This situation seems to be quite common. In a survey completed by 323 CRC clinicians from the UK (Anderson et al., 2013), only 52% reported that they were familiar with guidance for lifestyle advice (diet and PA) for CRC patients, and 50% of responders said that they would value additional training in this area. In the case of the oncologists, another reason for not giving precise PA recommendations was that they had little time to interact with their patients during consultations. Moreover, oncologists felt swamped by so many responsibilities and demanded more professionals on their health teams to take charge of PA aspects, so that they could refer their patients to these professionals. In a qualitative study with health professionals carried out by Koutoukidis et al. (2018), whereas some health professionals thought they should encourage CRC patients to lead a healthier lifestyle, others thought they were not the right person to provide lifestyle advice, given their limited knowledge on the topic and other priorities during their short consultations.

Finally, the lack of PA services in health centres represents a potent structural barrier to PA in CRC patients. This barrier is especially serious, taking into account that the services which can be offered by conventional sport and fitness centres are far from the special needs of CRC patients.

##### 4.1. Implications for practice and research

This study has several implications for practice and research. Psychological intervention with patients would be necessary to empower them to face the fears, concerns, and insecurities associated with CRC, ostomy, and chemotherapy. Patients should also receive more technical training to improve their management of the ostomy pouch and the chemotherapy device to feel more confident.

It is necessary to provide patients and families with very clear information regarding what exercises patients can or cannot do at the different stages of CRC and its treatment. Oncologists could prescribe PA for CRC patients and give general PA recommendations, which could be extended by nurses, who have more time to interact with and talk to the patients. Then, specific training in PA recommendations for CRC patients would be desirable for these health professionals. However, to design and supervise the type, frequency, intensity and duration of exercise that is desirable for each patient is not an easy matter. Therefore, the incorporation of sport sciences professionals into the health teams led by oncologists would be essential to provide PA services in hospitals and health centres. In this way, oncologists could refer their patients to professionals in charge of designing, implementing, and evaluating the effects of PA programmes in CRC patients.

Family members should also be educated on the benefits of PA (Segal et al., 2017) and the potential consequences of inactivity during and after treatment (e.g., reduced physical function, increased dependence on daily tasks, muscle and bone loss, and potential risk of falls). This knowledge could help family members to see PA as a complementary treatment, and would be especially interesting for those families who tend to overprotect CRC patients.

The PA services in hospitals and health centres could offer counselling for PA, personal training sessions, or group PA programmes in which patients could do exercise with other participants who are in a similar situation. Previous research on PA and cancer supports this argument. For instance, Haas and Kimmel (2011) informed about the benefits of performing group PA sessions to build camaraderie and support in these patients. The systematic review by Segal et al. (2017) also provides evidence on this matter, suggesting that exercising in a group and under supervision (by exercise professionals) can enhance patients' motivation and optimize their safety and options to do PA. However, light or moderate at-home exercises might also be a suitable



option for patients who have received surgery and just started chemotherapy. In this way, fatigue, fear of sudden blows, potential pouch breakages associated with vigorous movements, and feelings of embarrassment related to the stoma, the ostomy pouch, and the intravenous chemotherapy device could be prevented.

Future studies, from a qualitative, longitudinal, and case study perspective could analyse the changes in the barriers to PA over the different phases, from CRC diagnosis until recovery or decease. Upcoming research should also gather data concerning older adults' perspectives on this topic. In the present study, only three of the ten participant patients were over 65 years old. Considering that CRC is the most common cancer among the elderly, and the increasing proportion of elder patients in the coming years, the view of this population should be considered. Finally, future research could analyse what kind of PA programmes would be better to palliate each one of the negative side effects of ostomy and chemotherapy (e.g., hernia after ostomy, fatigue, disrupted sleep, chronic pain, depression, or neuromuscular impairment due to neurotoxicity). The cost-effectiveness assessment of PA services and specific PA programmes would also be necessary.

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### CRedit authorship contribution statement

**María Romero-Eliás:** Conceptualization, Methodology, Software, Formal analysis, Investigation, Writing - original draft, Writing - review & editing. **Vicente J. Beltrán-Carrillo:** Conceptualization, Methodology, Supervision, Project administration, Writing - review & editing. **David González-Cutre:** Conceptualization, Methodology, Supervision, Project administration, Writing - review & editing. **Alejandro Jiménez-Loaisa:** Methodology, Visualization, Writing - review & editing.

### Declaration of competing interest

The authors declared no potential conflicts of interest with respect to the research, authorship and publication of this article.

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