

## Research Article

# Barriers and Facilitators for the Implementation of Exercise Oncology Provision in Germany: A Multilevel, Mixed-Methods Evaluation of the Network OnkoAktiv

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**Background.** Strong evidence supports the beneficial impact of exercise on cancer patients. However, the provision of exercise programs in Germany is highly heterogeneous. Therefore, the network OnkoAktiv (OA) enables patient consultations and referrals from coordinating regional OA centers (RE) into community-based exercise programs (CBEP). **Objective.** The aim of this study was to identify barriers and facilitators for the implementation of OA network structures from the perspective of RE and certified CBEP. **Methods.** This evaluation was executed in a sequential mixed methods design. We conducted 16 qualitative interviews with each leader in RE and the certified CBEP. Then, 89 certified CBEP were invited to a quantitative, cross-sectional survey. **Results.** We identified 11 facilitators each for RE and certified CBEP, 7 barriers for RE and 5 for certified CBEP. Barriers dealt with, for example, financing OA network structures, a lack of knowledge of exercise trainers, inadequate patient referral, and missing collaborations by healthcare professionals (HCPs). Most of the named facilitators were adequate internal organizational resources, support and reachability of OA staffs, and collaboration with HCPs. **Conclusion.** Our findings indicate different challenges for the implementation of OA network structures. Future implementation efforts should consider the evaluation of individual barriers and the development of specific solutions.

## 1. Background

A large body of scientific evidence supports the positive impact of exercise and physical activity on cancer patients and survivors [1]. As a result, the American College of Sports Medicine encourages healthcare professionals (HCPs) to refer patients into cancer-specific, community-based exercise programs (CBEP) [2, 3]. Moreover, a recent review highlights the effectiveness of CBEP to improve quality of life in cancer patients [4], although the translation of exercise recommendations into clinical practice has been a major

challenge. Researchers developed different pathway models in which patients transit from clinical structures into supervised or self-managed exercise programs to guide exercise implementation [1, 3, 5]. Such pathway models have been described as a turning point for the integration of exercise in oncological care programs [6]. However, the involvement of public exercise facilities (e.g. gyms, sport clubs, rehabilitation centers, and physical therapy practices) is crucial for the comprehensive implementation of exercise [7, 8]. Further, considering the increasing number of cancer patients per year [1], the number of qualified professionals

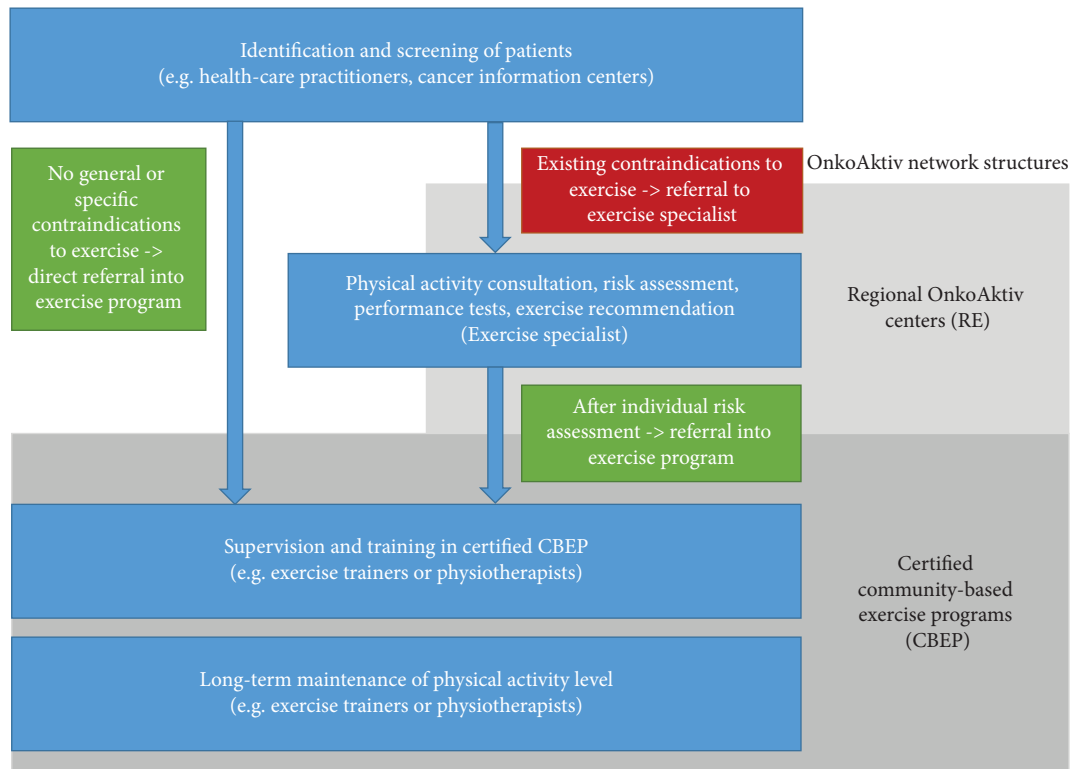


FIGURE 1: The OnkoAktiv pathway model of exercise care and incorporated OnkoAktiv structures; CBEP = community-based exercise programs; RE = regional OnkoAktiv centers.

and supporting exercise facilities will require substantial expansion [6]. In response to these challenges, the network OnkoAktiv aims to certify exercise facilities that offer specific programs for cancer patients, educate exercise professionals in the field of oncology, and connect them to clinical institutions (including HCPs). Together, they provide a comprehensive pathway of exercise care.

**1.1. The OnkoAktiv Pathway of Exercise Care.** The OnkoAktiv pathway starts with the identification and screening of patients in regard of their physical activity level (e.g. insufficient physical activity level or a present symptom that can be evidently managed by exercise). Such screening strategies can be provided by HCPs such as oncologists or nurses. If no general or specific contraindications to exercise (e.g. bone metastasis and cardio-vascular diseases) are indicated, HCP should advise exercise to their patients and refer them to the best available CBEP if possible [2]. If the screened patient needs further evaluation and a clear up for physical activity safety due to complex therapy-related side effects or other indications, they need to be referred to an exercise specialist. Exercise specialists offer individual physical activity consultations and further assessments depending on patients' needs [5]. In the context of OnkoAktiv, exercise specialists are organized in regional OnkoAktiv centers (RE) located in comprehensive cancer centers (CCC) in Germany. Every RE engages as a single coordinating institution that recruits

patients, offers consultations (including risk assessment and triage), exercise recommendation and collaborates within multidisciplinary teams. RE provide access to certified CBEP through patient referral processes and build up their own regional networks. Therefore, OnkoAktiv certifies local exercise institutions based on defined quality indicators which are adopted from the quality seal catalogue SPORT PRO FITNESS by the German Olympic Sports Confederation (DOSB). The certified CBEP can be located in, for example, local gyms, rehabilitation centers, physical therapy practices, or municipal facilities. Within such institutions, exercise trainers provide comprehensive exercise supervision for cancer patients based on physical activity recommendations. They implement the OnkoAktiv quality indicators that assure high-quality exercise program execution. Figure 1 illustrates the pathway model of exercise care and the respective OnkoAktiv network structures.

To this day, OnkoAktiv counts 14 RE and 106 certified CBEP across Germany. Although constantly expanding, an evaluation of the network OnkoAktiv has not been executed yet, compared to other CBEP and exercise oncology networks. For example, Neil-Szatramko et al. [9] reported 58 publications about CBEP evaluations in a recent review. Accordingly, there is a need for an OnkoAktiv network evaluation, precisely the analysis of network implementation barriers and facilitators.

**1.2. Aim of Study.** The aim of this study was to identify barriers and facilitators for the implementation of OnkoAktiv network structures on the levels of RE and certified CBEP.

## 2. Methods

We conducted a cross-sectional, mixed-methods study of the network OnkoAktiv. First, we applied a parallel design of qualitative interviews of RE and certified CBEP. Then, we performed a sequential design for the certified CBEP, in which we developed a quantitative questionnaire. The questionnaire was used to survey all certified CBEP in the network to confirm the results from the qualitative analysis [10]. We aligned our evaluation on the current recommendation of the German network of healthcare science as well as the Medical Research Council framework and evaluation and complex interventions [10–12]. The study protocol has been approved by the Ethics Committee of the Medical Faculty at the University Heidelberg (S-942/2021 and S-915/2019).

**2.1. Study Population and Sampling.** For the qualitative evaluation, we included all RE who has been a part of OnkoAktiv up to June 2021. The interview participants in RE were the responsible and coordinating exercise professionals. Those cancer exercise professionals show higher educational credentials for exercise in oncology to serve patients with special needs (e.g. risk assessment, consultation, and referral) and to administrate collaboration with HCPs and exercise trainers. They own mostly a bachelor and/or master degree in exercise physiology or relevant other degrees in the field of exercise. They are further specialised in exercise oncology through further trainings. For the selection of certified CBEP, we conducted purposeful sampling by the following criteria: year of certification and number of patient referrals. We chose five certified CBEP that have been a member of OnkoAktiv from 2012 to 2019 and five that joined the network from 2020 to 2021. We contacted institutions with the highest referral numbers to make sure they have enough experience to be able to rate the OnkoAktiv services. Our interview participants in CBEP were exercise trainers with basic to advanced educational knowledge about oncological diseases. They provide targeted exercise programming for cancer patients. Depending on the underlying institutional setting, such exercise trainers work as workforce-exercise physiologists with bachelor degrees, although it is not mandatory in most fitness settings.

In the quantitative survey, we surveyed all certified CBEP that have been a member of OnkoAktiv up to 2021. We informed all potential candidates via e-mail about the study and retrieved written informed consent.

### 2.2. Data Collection and Instruments

**2.2.1. Qualitative Interviews.** We developed the interview guideline for both RE and certified CBEP, based on the Consolidated Framework for Implementation Research

(CFIR). Please find the interview guideline in Supplement 1. The CFIR is a validated and widely applied framework that assesses existing and potential barriers and facilitators of program implementation [13–15]. We adapted the guideline questions according to the available services of OnkoAktiv. The interviews were conducted and recorded using a video conference platform. Our interview guideline underwent cognitive pretest discussions and one pilot interview for testing plausibility and tangibility of questions. After each interview, the interviewer provided a postscript with details about date, time, overall impressions, and potential distractions regarding mood, language, or misunderstandings.

**2.2.2. Quantitative Survey.** We developed the quantitative survey based on our qualitative data and an extended literature research [9, 13, 16–19]. The qualitative analysis revealed three main topics for our survey: the evaluation of structures in regard to the network OnkoAktiv, the evaluation of structures to implement exercise programs in regard to the German healthcare system, and solutions for perceived implementation barriers (see Figure 2). The item generation followed the quality dimensions of the structure-process-outcome quality of care model by Donabedian [20]. Items that evaluated parameters regarding OnkoAktiv included e.g. quality of patient referrals, reachability of staff, and re-financing costs. Items that evaluated structures of the German healthcare system included parameters on organizational (e.g. institutional resources and collaborations with HCPs) and system level (e.g. insurance coverage and political regulations). We generated the items for “solutions to network barriers” out of the qualitative interviews and existing literature.

**2.3. Data Analysis.** The qualitative data were analysed by structured content analysis according to Kuckartz et al. [21] and by using the software MAXQDA Version 2020. Each interview was selectively transcribed verbatim based on defined transcription rules [3]. We defined the first set of main- and subcategories a priori (deductive), based on the CFIR framework. All other main- and subcategories were developed inductively. Two exercise scientists (AV; AL and AV; AK) coded each of the first three transcripts of the RE and certified CBEP interviews independently and elaborated subcategories. Then, the second coding process followed. Scientists profoundly discussed all main- and subcodes after analysis have been undertaken and confirmed a general categorical system. The study advisor (JW) verified the categorical system as third, independent person. Then, all data were coded using the elaborate category system. Please find the adapted CFIR-codebook including the domain and construct descriptions in Supplement 2. After the full analysis of data, scientists rated all codes into barriers or facilitators and one scientist (AV and AL) executed a quantitative analysis. For simplification, we reported only codes that emerged more than five times in all interviews. The three scientists were experienced in the transcription and analysis of qualitative interviews and attended educational study courses at university level.

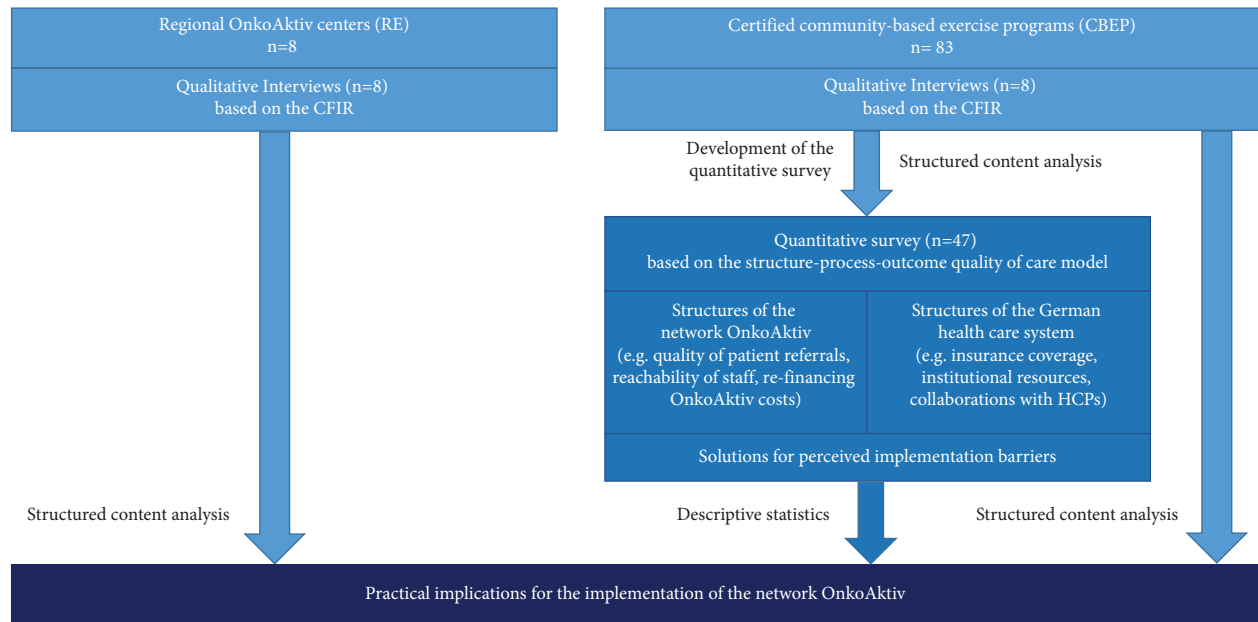


FIGURE 2: Methodological flowchart of the mixed-methods design; RE = regional OnkoAktiv centers; CBEP = community-based exercise programs; HCPs = healthcare professionals.

The quantitative survey of certified CBEP were analysed by calculating descriptive statistics using the programs IBM SPSS Statistics 26 and Microsoft Word Excel 2016. We calculated mean values of the five-point Likert-scale answer formats. Then, we categorized all items with a mean value <3 as barriers and items with a mean value >3 as facilitators. The mean values of = 3 were ranked as neutral items. The rating rules are based on the CFIR rating rules that represent positive or negative influences on the investigated implementation [22]. We translated the bipolar answer format into percentages. Further, we combined our findings of the qualitative interviews and quantitative survey of certified CBEP in the results part to reduce the complexity of our data.

### 3. Results

In the following, we report all facilitators and barriers across CFIR categories for regional OnkoAktiv centers (RE). Then, we report the results of the quantitative survey of the certified community-based exercise programs (CBEP), combined with the results of the qualitative content analysis of certified CBEP interviews. Please find the full list of barriers and facilitators of the qualitative content analysis for RE and certified CBEP with anchor quotes and frequency of codes in Supplement 3.

**3.1. Analysis of Barriers and Facilitators for the Implementation of OnkoAktiv Structures in Regional OnkoAktiv Centers (RE) Based on Qualitative Interviews.** We contacted all eight eligible RE from January to April 2021 by e-mail. All contact persons responded with an interest to participate (100% recruitment rate). Our interviewees were two men

and six women, executing the position of OnkoAktiv coordinators to manage their local OnkoAktiv network. The interviewed RE were located in cancer care clinics ( $n=6$ ), exercise associations ( $n=1$ ), or rehabilitation centers ( $n=1$ ). The mean duration of OnkoAktiv membership was 4 years (min = 2 and max = 8). We analysed eleven facilitators for RE. We found the greatest number of codes in the “inner setting,” within the codings “resources” (structural infrastructure and knowledge of team members), “structural characteristics” (clinical integration and integrated sports association), and “cooperation” (in-house collaboration with HCPs). In the “outer setting” the following facilitators could be analysed for RE: existing CBEP in the geographical periphery, cooperation with university, program location in or near cities, and collaboration with external HCPs. Furthermore, “design and quality of OnkoAktiv structures” as well as “knowledge and belief about the innovation” could be emphasized as facilitators. Last, we rated the “usage of OnkoAktiv material” as a major facilitator for implementation.

The analysis indicates seven barriers for RE. We identified “financing of OnkoAktiv services” and “complexity of OnkoAktiv certification and networking” as implementation barrier. The category “outer setting” revealed two barriers: “time to travel for patients” and “missing referrals and knowledge by HCPs.” The “inner setting” reveals several barriers regarding internal resources such as scarcity of time, staff, and structural infrastructure. Further, “missing certifications and knowledge of exercise trainers” could be defined as a network barrier. Last, for all RE “COVID-19 restrictions” have been a major problem for the implementation of OnkoAktiv structures.

Solutions to barriers for RE are, for example, educational courses for HCPs and exercise trainers to increase their

TABLE 1: Structural, process, and outcome quality items of OnkoAktiv network structures graded into barriers (BA), facilitators (FA), or neutral items (N) based on mean values (M) on a Likert-scale from 1 to 5 and standard deviation (SD).

Structural quality	M	SD	BA	FA
Re-financing of costs for network participation	3.4	0.65	N	N
General network costs	3.5	0.75		x
Promotion/marketing material	3.8	0.91		x
Simplicity of OnkoAktiv quality criteria	4	0.89		x
Website/newsletter	4.2	0.61		x
Certification material	4.3	0.61		x
Patient information letter	4.3	0.64		x
Brochure	4.5	0.60		x
<i>Process quality</i>				
Implementation of marketing strategies	2.4	1.27	x	
Patient referral by OnkoAktiv	2.9	1.42	N	N
Expenditure of work for network activities	3.6	0.64		x
Regular communication with OnkoAktiv members	3.6	1.16		x
Transfer of current knowledge into practice	3.7	1.07		x
Content of educational network meetings	4	0.67		x
Support during certification process	4.4	0.60		x
Reachability of OnkoAktiv staff	4.4	0.78		x
<i>Outcome quality</i>				
Patients satisfaction	3.7	0.97		x
Therapeutical quality	3.7	1.0		x
Professional impression	3.7	1.07		x

Items were categorized as barrier with a mean value <3 and as facilitator with a mean value >3 and mean values of = 3 were ranked as neutral items (neither nor).

specific knowledge about exercise oncology. Further, working materials, guidelines, and individual financing options for exercise programs could decrease structural barriers for RE (see all solutions in Supplement 4).

**3.2. Analysis of Barriers and Facilitators for the Implementation of OnkoAktiv Structures in Certified CBEP Based on the Qualitative Interviews and Quantitative Survey.** We contacted 11 certified CBEP by email or phone call, from which eight agreed to participate in the qualitative interview (response rate 72%). The interviewees were five men and three women, executing their job position as the leading person of exercise therapists within their exercise institution. Selected institutions were gyms or physical therapy practices with special exercise programming for cancer patients. The mean time for OnkoAktiv memberships was 4 years (min = 1 and max = 7). We retrieved 47 quantitative surveys from 83 certified CBEP, which represents 53% of the total number of OnkoAktiv institutions. Participants were 32 men and 15 women working as institutional leader or exercise therapist. Types of institutions were clincial facilities with special exercise programs, physical therapy practices, and gyms. We will further report the quantitative results combined with the findings of the qualitative interviews. The quantitative analysis revealed that close to all (95%) OnkoAktiv institutions ranked the quality criteria for OnkoAktiv certification as easy or neither easy nor complex. Most

TABLE 2: Barriers (BA), facilitators (FA), or neutral items (N) on the level of the German healthcare system to implement exercise programs, based on mean values (M) on a Likert-scale from 1 to 5 and standard deviation (SD).

Healthcare structure and patient contact	M	SD	BA	FA
Pressure for program implementation	4.5	0.56		x
Resource: structural	3.8	1.14		x
Resource: time	3.6	1.12		x
Resource: staff	3.5	1.26		x
Patients psychological condition	2.7	1.11	N	N
Financing of exercise program	2.4	1.22	x	
Complexity of oncological diseases	2.2	0.92	x	
Uncertainty in therapy with acute patients	2	1.29	x	
<i>Healthcare professionals</i>				
Collaboration with oncologists and practitioners	2.5	1.29	N	N
Referral of patients from health care professionals	2.4	1.29	x	
Knowledge of HCPs about exercise	1.8	0.72	x	
Contact: HCPs (e.g. oncologists and nurses)	2.4	1.07	x	
Contact: clinics and ambulances	1.9	1.01	x	
Contact: rehabilitation centers	1.4	0.82	x	
Contact: universities	1.5	0.83	x	
Contact: other exercise institutions	1.5	0.78	x	
Contact: regional OnkoAktiv centers	1.5	0.75	x	

Items were categorized as a barrier with a mean value <3 and as a facilitator with a mean value >3 and mean values of = 3 were ranked as neutral items (neither nor).

participants perceived the costs for general network tasks as low or neutral ( $M=3.5$  and  $SD=0.75$ ). Although the detailed analysis of certification criteria indicated that 53% of institutions made structural alterations to meet certification requirements, we could identify similar facilitators in the qualitative interviews. Our interviewee highlighted “high adaptability of OnkoAktiv structures” and “low complexity of certification” as network facilitators. OnkoAktiv materials (e.g. certification material ( $M=4.3$  and  $SD=0.61$ ) patient information letter ( $M=4.3$  and  $SD=0.64$ ), and brochure ( $M=4.5$  and  $SD=0.60$ ) have been ranked as good to very good in the quantitative survey (see Table 1), just as our interview participants. Additionally, process quality shows overall high ratings in the survey. Please find the bar graph of the OnkoAktiv process quality parameter in Supplement 5. Also, support during certification process and reachability of OnkoAktiv staff have been graded as very good. Our data shows that OnkoAktiv increases the therapeutical quality in 50% of institutions ( $M=3.7$  and  $SD=1.0$ ) and patients’ satisfaction ( $M=3.7$  and  $SD=0.97$ ) in around 60%. Further 70% rated a higher professional impression due to the OnkoAktiv certification ( $M=3.7$  and  $SD=1.07$ ).

In contrast, patient referral by OnkoAktiv ( $M=2.9$  and  $SD=1.42$ ) and the implementation of marketing strategies and materials ( $M=2.4$  and  $SD=0.91$ ) scored lowest in our survey (defined as barriers), with more than 50% of participants saying they receive rarely to none of these OnkoAktiv services. Same results, indicating the qualitative interviews in which “missing marketing strategies” have been ranked as a network barrier. Furthermore, 90% of

OnkoAktiv institutions reported that OnkoAktiv did not support outreach to or increased attention of HPCs and medical institutions. The following table (see Table 1) presents barriers (BA), facilitators (FA), neutral items (N) regarding the structural, and process and outcome parameters of OnkoAktiv.

Solutions to barriers on the level of CBEP are for example the expansion of exercise program promotion by oncology clinics and patient referrals by HCPs, to increase overall attention of oncological CBEP. Additionally, different marketing materials such as print media or photos and texts for social media can be provided by OnkoAktiv.

*3.3. Analysis of Barriers and Facilitators on the Level of the German Healthcare System for the Implementation of Oncological Exercise Programs in Certified CBEP Based on the Qualitative Interviews and Quantitative Survey.* Our data revealed different facilitators on the level of the German healthcare system to implement oncological exercise programs. First, survey respondents reported that there is a medium to high pressure to implement oncological programs because of the low program availability in their regions. We also identified “low regional competition” and “need for program or strategic change” in our qualitative interviews. Around 80% of participants rated their time, staff and structural resources as adequate for the implementation of oncological exercise programs. Similarly, our interviewee emphasized available resources as important facilitators for program implementation in the qualitative interviews. On the other hand, we also identified several barriers. As seen in Table 2, most participants rated general exercise program funding in oncology as difficult ( $M = 2.4$  and  $SD = 1.22$ ). Likewise, our interviewee in the qualitative interviews reported great problems in the general funding of oncological exercise programs. Further, respondents ranked the knowledge about exercise and cancer of HCPs as inadequate and assessed their collaboration as low to not existent. Likewise, “missing cooperation and referrals by HCPs” was a major barrier in the qualitative analysis. The following table (see Table 2) presents all implementation barriers (BA), facilitators (FA), or neutral items (N) on the level of the German healthcare system.

Solutions to barriers on the level of the German healthcare system are located on the network level, such as to increase patient referrals by HCPs and exercise program promotion by clinics. Also, accelerate regional networking with other exercise institutions. Financial barriers need to be handled by finding different financial options for exercise programs.

## 4. Discussion

Overall, our study findings indicate different barriers and facilitators for regional OnkoAktiv centers (RE) and certified community-based exercise programs (CBEP). Importantly, facilitators and barriers need to be distinguished between the network OnkoAktiv and the general healthcare system. The most discussed barriers for RE dealt with financing

OnkoAktiv network services as well as missing knowledge of exercise trainers. The most named facilitators for RE were internal organizational resources as well as collaboration with HCPs. In contrast, certified CBEP reported inadequate patient referral by OnkoAktiv, missing marketing strategies, collaboration, and referrals by HCP, followed by problems in financing exercise programs as major implementation barriers. Facilitators were the support and reachability of OnkoAktiv staff, and as well as the low work expenditure for OnkoAktiv network tasks. In the following, we will discuss the most important barriers and facilitators for certified CBEP and RE classified into the CFIR categories. Finally, we will describe the practical implications for each CFIR domain according to our findings.

*4.1. Innovation Characteristics of OnkoAktiv.* The certification processes of RE and certified CBEP have been an important pillar for quality management within the network. The certification supports a high standard of quality parameters, guarantees professional supervision of patients, and promotes the continuous education of exercise trainers. From the perspective of RE and TI, the certification criteria of OnkoAktiv were perceived as feasible. Although half of the certified CBEP made structural alterations to meet certification requirements. Further, the financial aspect of program implementation has been a major challenge for OnkoAktiv institutions. RE reported that financing the OnkoAktiv services (e.g. patient consultations, risk assessments) has been the highest financial burden. In contrast, certified CBEP emphasized OnkoAktiv network costs as low. Although they reported problems clearing costs with healthcare insurances. Missing healthcare coverage and financing options of oncological CBEP are still major problems for program execution. Similar results reporting existing oncological CBEP in the US, Canada, and Australia [16, 18, 23–26] as well as in two current reviews [4, 9]. For instance, the Canadian Survivorship Exercise Program (SEP) by Santa Mina and colleagues revealed that funding has been a core problem for program implementation. Hence, they have been financially supported by the Canadian hospital foundation and different fundraising initiative [25]. Also, Kennedy et al. described program costs as a core issue in the execution of a co-located exercise clinic [16]. Granger et al. reported perceived barriers including lack of time and funding from physiotherapists perspective in regard to the implementation of exercise into lung cancer clinical care [26]. Santa Mina et al. have recommended several funding streams for the long-term maintenance of the CBEP, such as national granting agencies, insurance companies, private donors, corporate sponsors, or grant applications [25]. The high adaptability of OnkoAktiv structures can help to find suitable funding streams and adapt OnkoAktiv services to the individual exercise institution.

*4.2. Inner Setting of OnkoAktiv Institutions.* In the inner setting that describes, e.g. the structural characteristics, team culture and internal communication of institutions, RE reported inadequate resources in regard to time, staff, and

organizational structures. In contrast, the certified CBEP rated their internal resources as adequate for program execution. This underlines a different resource availability for RE and TI. The rehabilitation and exercise oncology model of care (ActiveOnco) highlighted the fact that exercise program development is limited by the cost of human resources, physical resources and public funding that limit the extent and overall adoption of exercise [27]. As a solution, the survivorship exercise program (SEP) integrated a multidisciplinary team to spread tasks and working load across team members. For example, the medical director oversees patient's health status and refers potential patients into SEP. Exercise prescription and programming are provided by exercise trainers, and researchers contribute expertise and develop new approaches to deliver exercise to patients. Further, the SEP was supported by the patient support and education department of the comprehensive cancer treatment and research center to increase their personal and structural resources [25]. Additionally, networking with local associations and the municipal commune might support the allocation of communal facilities to increase training spaces. The foundation of an independent sports association might further increase the provision of equipment and structural resources.

**4.3. Outer Setting of OnkoAktiv Institutions.** The outer setting covers parameters such as the degree to which an institution is networking with other external organizations or under external competitive peer pressure for program implementation. Here, RE and certified CBEP reported that collaboration with HCPs and their referral of patients into CBEP have been fundamental barriers. Overall, there is inadequate collaboration between certified CBEP and several target groups, such as HCPs, clinics and ambulances, rehabilitation centers, and other exercise institutions. We found several reasons for the lack of collaboration. Research shows that lack of time, workload and availability of CBEP are the most important barriers for HCPs, next to concerns regarding program safety and patients health status [28, 29]. Ijsbrandy et al. identified further organizational barriers, for example, poor communication, ineffective collaboration, and undefined roles [19]. Although, several authors revealed that 50–75% of HCPs promote physical activity to patients [28–31]. Further, 75% of oncological nurses inquired about physical activity during visits, giving to around 65% of patients some kind of physical activity recommendation. However, their data indicated that nurses struggle with the “right recommendation” and are often unsure what to recommend [32]. Our data shows that the lack of knowledge of HCPs about exercise has been a major barrier. This can be resolved by educating HCPs about physical activity counselling and referral. Fowles and colleagues showed that HCPs felt significant more confident in providing exercise recommendation for patients after participating in an exercise is medicine workshop [33]. Additionally, regular educative events, such as educational meeting, outreach audits, feedbacks, and computerized reminders can increase professional expertise [34]. Moreover, a coordinated, supportive network can enhance referrals of patients and information

sharing by HCPs [3, 35]. Schmitz et al. engaging clinicians to assess, advise, and refer patients into CBEP and further support them through exercise guidelines and consultation material [2]. Santa Mina et al. shows clinical pathways, individualized according to the environmental context, to support HCPs in their exercise consultations [3]. Additionally, marketing strategies and further trainings have been ranked highest as network enablers in our study. Therefore, OnkoAktiv plays an important role in the development of regional, supportive micronetworks between HCPs and exercise professionals as well as the provision of educative events and materials. Such materials might include implementation guidelines, brochures, marketing templates, educational videos or inhouse trainings.

**4.4. Practical Implications.** Barriers and facilitators range across CFIR domains, which necessitate an individual evaluation of existing barriers within the OnkoAktiv institutions. We defined specific practical implications to resolve different barriers for the OnkoAktiv implementation. For example, if RE perceives a lack of knowledge among exercise trainers, specific educational courses need to be introduced. Further, if certified CBEP do not access enough resources for their marketing and program promotion, a variety of promotional materials for network members, patients and HCPs (e.g. newsletters, social media, flyer, and brochures) should be created and provided by OnkoAktiv. We summarized all practical implications for RE and certified CBEP based on the CFIR domains in Supplement 3.

**4.5. Limitations.** Our paper must be interpreted in light of several limitations. First, our target groups were limited to the institutions of the network OnkoAktiv in Germany, and we assumed to only picture the larger OnkoAktiv institutions in which patients has been referred. Smaller institutions could be underrepresented due to missing referral records. For the qualitative interviews, the social desirability of our interview partner could have affected the description and disclosure of information. The overall assessment of program implementation was negatively influenced by the COVID-19 pandemic. Further, the quantitative part was limited to the number of surveys retrieved, which was around 50% of the total number of OnkoAktiv institutions.

## 5. Conclusion

This study identified several barriers and facilitators for the implementation of the network OnkoAktiv using a mixed-methods approach. Our findings indicate that RE and certified CBEP face multiple, different challenges for the implementation of OnkoAktiv. Future implementation efforts might consider the evaluation of individual barriers of RE and the certified CBEP (e.g. missing referrals and knowledge by exercise and HCPs, financing options) and specifically develop solutions to promote and support the successful implementation (e.g. conduct regular educational courses, apply multiple funding streams, support collaboration with HCPs).



## Abbreviations

CBEP: Community-based exercise programs  
 HCPs: Healthcare professionals  
 PA: Physical activity  
 CCC: Comprehensive cancer centers  
 CFIR: Consolidated framework for implementation research  
 M: Mean value  
 SD: Standard deviation  
 n: Number  
 N: Neutral  
 BA: Barrier  
 FA: Facilitator.

## Data Availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

## Ethical Approval

The study protocol has been approved by the Ethic Committee of the University Clinic Heidelberg (S-942/2021 and S-915/2019).

## Conflicts of Interest

JW invented and founded the network OnkoAktiv and is currently a member of the association board. The other authors declare that they have no conflicts of interest.

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## Supplementary Materials

Supplement 1 (.docx): Interview guidelines for regional OnkoAktiv centers and certified training institutions. Supplement 2 (.docx): CFIR domains, constructs, and definitions including the adaptation to the network OnkoAktiv with specific examples. Supplement 3 (.docx): Barriers and facilitators for the implementation of OnkoAktiv structures in RE/CBEP and practical implications. Supplement 4 (.docx): Solutions to network barriers for certified training institutions. Supplement 5 (.docx): Bar graph of the OnkoAktiv process quality parameter. (*Supplementary Materials*)

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