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Improvement of physical activity levels in children and adolescents after surgery for congenital heart disease: preferences and use of physical therapy

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ABSTRACT

Purpose: After surgery for congenital heart disease in children and adolescents, an active lifestyle is important to achieve and maintain good physical fitness. This study aimed to describe physical activity, as well as the use of patients' and parents' preferences for rehabilitative care after surgery for congenital heart disease.

Methods: This cross-sectional study included patients aged 4–16 years old, who had undergone surgery for congenital heart disease 2 years prior to the study onset. Patients and/or parents were invited to complete questionnaires on physical activity, and on their preferences for, and -use of, rehabilitative care after surgery.

Results: Forty-five of the 92 eligible patients and/or parents completed the questionnaires. The median age of the children was 12.2 years (IQR 7.8–16.1). Two children (4%) met the recommendations for taking part in moderate physical activity and 13 (29%) having done so for vigorous physical activity. Postoperatively 15 children (33%) had had physical therapy in primary care. More than 50% of the patients/parents would have preferred to have had more information on physical activity and to have taken part in an individual exercise program delivered during their primary care.

Conclusion: The majority of eligible patients do not meet public health recommendations for engaging in physical activity and do not use physical therapy after surgery for congenital heart disease. The majority of patients and parents preferred more information as well as individual physical therapy treatments.

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Congenital heart defect; heart surgery; physical activity; physical therapy

► IMPLICATIONS FOR REHABILITATIONS

- Two years after surgery for congenital heart disease children and adolescents are less active compared to typically developing peers.
- Patients with a congenital heart disease and their parents need more information and support regarding stimulation of physical activity and physical fitness after heart surgery.
- In the postoperative process, a well-structured and supportive (individual) rehabilitation program should be introduced to improve physical activity and physical fitness.

Introduction

Congenital heart disease (CHD) is the most common congenital defect in children and affects up to 1% of the population [1]. The majority of these children reach adulthood.

Various studies on physical activity have underlined that in this patient group, an active lifestyle is very important to obtain and sustain good physical fitness. This is even more important in these patients as, compared to healthy peers, they have an increased risk of cardiovascular disease in later life [2,3]. Postoperative rehabilitation could play a role in the promotion of physical activity, but unlike the widespread use of postoperative cardiac rehabilitation in adults, rehabilitation programs are not part of routine care for children after heart surgery to support an active lifestyle or good physical fitness.

Although Arvidsson et al. reported a similar level of physical activity for children after surgery for congenital heart disease as in healthy controls, most studies have reported that children with CHD are less active compared to their peers and more likely to be overweight [4–8]. This low activity level has also been demonstrated with ActiGraph accelerometers [9].

In addition, it is interesting that various studies have shown that physical training of children with CHD is possible and has a positive effect on their physical fitness [10].

In a systematic literature review by Duppen et al. on the effects of physical exercise training programs in patients with CHD, 16 of the 19 papers which included studies concerning a pediatric population reported a beneficial effect on their physical fitness. This positive effect was found with training schemes that were highly variable regarding their content and duration (6–52 weeks) and

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independent of type of supervision or location. [11]. These favorable findings are also reflected in the European guidelines for children with CHD having undergone surgery, which strongly recommend physical activity and sport [12].

In an overview, Eijvogels et al. also emphasize the importance of physical activity as an effective means of prevention of future morbidity and mortality in patients with cardiovascular disease [13].

Despite the potential benefits of physical activity and exercise and ensuing practice recommendations, it remains unclear which factors play a role in this relative underuse. There may be reluctance on the part of patients, their parents and/or health care providers based on fear of risks or side effects, lack of knowledge on the potential benefits, or absence of pediatric cardiac rehabilitation services.

As a first step in the development of interventions to improve the delivery of postoperative care aimed at the acquisition and maintenance of a healthy lifestyle, insight into the current level of physical activity of the included patients and use of relevant services is needed. In that endeavor, the views of patients on the current and future delivery care should be recorded. Therefore, the aim of this study was to investigate (i) The level of physical activity in children and adolescents during the first two years after surgery for congenital heart disease, (ii) Their use of postoperative physical therapy and (iii) Their preferences regarding postoperative rehabilitation.

Patients and methods

Study design and patients

This cross-sectional study included patients with CHD who underwent cardiac surgery at the Leiden University Medical Center (LUMC) between January 2015 and December 2016. The study concerned the once-only completion of a pen-and-paper questionnaire in March 2018. Patients were eligible if they were 4–16 years old at the time of heart surgery, and living in the Netherlands at the time the study was conducted.

The Medical Ethics Review Committee of the LUMC approved the study protocol by evaluating the study as nonmedical research according to the Medical Research Involving Human Subjects ACT (P17234). All patients who were considered eligible for the study received an invitation letter on behalf of their treating pediatric cardiologist, an information leaflet, the questionnaires, including an informed consent form, and a pre-stamped envelope. Young patients (4–11 years) who participated completed the questionnaires with their parents, the older patients (12–16+ years) by themselves. If, after 3 weeks the questionnaires were not returned and patients and/or parents had not indicated that they were not willing to participate, an attempt was made by the Principal investigator (JvE) to contact them by a letter and if there was no response a telephone call was made after 3 weeks.

Assessments

Sociodemographic and clinical characteristics

Clinical characteristics (date of birth, sex, date of last heart operation) and functional classification according to the New York Heart Association (NYHA), class I–IV as determined by the pediatric cardiologist at the last medical visit after heart surgery were extracted from the medical records for all eligible patients by JvE. The principal investigator was supervised by the cardiologist involved in the study (DJA). The risk adjustment for congenital

heart surgery (RACHS-1) was determined by the pediatric cardiologist (DJA) [14].

The following additional information was included in the questionnaire: cultural background of parents (one parent, both or none born in the Netherlands), which parent had helped the child to complete the questionnaires, and what was the highest educational level of this parent.

Self-reported physical activity

To determine the level of physical activity, we used standardized questions on the time spent on moderate intensity physical activity (<60 or >60 min for every day of the week) or vigorous intensity physical activity (<20 or >20 min at least 3 times per week) in summer, winter and both summer and winter [15]. A moderate level physical activity is an activity such as walking briskly or cycling. A vigorous physical activity is an activity resulting in sweating and breathing faster. For the interpretation of the results, we used the outcomes of similar questions administered to Dutch healthy children and youth [16].

Use of postoperative physical therapy

The use of physical therapy after heart surgery was recorded (yes/no). If patients had used physical therapy, additional questions were asked about the advice and/or referral indication (difficulties with daily activities; poor physical fitness; little desire to move; fear of moving; motor development delay; other), mode of delivery (individual or group), location (primary care or other), and the average frequency and duration.

Patients/parents preferences regarding postoperative rehabilitation

Patients and/or parents were asked to rate their agreement with statements on the delivery of information and education about postoperative physical activity, exercise and sports. The statements concerned information and education about the benefits and risks of physical activity, recommended types of exercises, physical activities and sports, need for professional support and preference for who should provide the information (pediatric cardiologist, paper or electronic documentation).

Questions about postoperative training and physical therapy reflected the preferences concerning the setting (primary care, hospital, rehabilitation center) and kind of therapy (personal coaching, group with other children after heart surgery or with other disabled children, distant supervision by e mail).

There were four choices for answering the questions (disagree, slightly agree, strongly agree and totally agree). For the analyses, we combined disagree and slightly agree and combined strongly agree and totally agree. Frequency and duration of intervention preferences were divided into questions about maximum frequency per week and total duration of physical therapy in weeks within and outside the place of living.

Statistical analysis

Data management and analysis were performed using SPSS statistics version 23.0 for Windows (SPSS INC. Chicago IL USA). Data were expressed as means with standard deviation or medians with interquartile range, depending on their distribution. The distribution of the data was tested for normality by the Shapiro–Wilk test for small groups. Categorical variables were expressed as numbers with percentages. Comparisons of the age, sex distribution and time since surgery of patients who did and who did not participate in the study were done by the Mann–Whitney U or Chi-Square tests,

where appropriate. For all analyses, patients were divided into two groups; 4–11 years old and 12–16+ years old, based on age matching questionnaires concerning physical activity and sedentary activity. For all analyses, the level for statistical significance was set at $p < 0.05$.

The results of the two different age groups are presented in percentages and compared with each other. The involvement in physical activity was also compared with the reference group in percentages.

Results

Of the 99 patients who were 4–16 years old at the time of heart surgery at the LUMC in 2015–2016, two had died and five were living abroad. Of the 92 eligible patients who were thus invited, 45 patients and/or parents completed the questionnaires. Of the 47 patients who did not complete the questionnaires, eight explicitly declined participation, due to language problems ($n = 2$), psychosocial problems ($n = 2$) or for other reasons such as refusal ($n = 4$). The other 39 patients could either not be reached or did not return the questionnaires despite their verbal consent during the telephone reminder (Figure 1).

Patients and parents

Table 1 shows the clinical and sociodemographic characteristics of the 45 participating patients. About half of the patients were in the age group 4–11 years and the other half in the group 12–16+ years. None of the patients had a neuromuscular disorder or other orthopedic problem which could interfere with their mobility. Most patients were classified as NYHA I after the last surgery.

According to the RACHS-1 classification, 44 patients were entered into category 1–3, 1 patient in category 4, none in 5 or 6. Most of the parents were born in the Netherlands (Table 1).

The group of 47 nonparticipants differed from the participants with respect to a higher proportion of male patients (28/47, 60%) ($p = 0.04$ Pearson's Chi-Square), whereas the median age (10.7 years, IQR 7.3–13.9) ($p = 0.21$ Mann–Whitney U -test) and median time since last surgery were similar (2.2 years, IQR 1.7–2.7) ($p = 0.48$ Mann–Whitney U -test).

Physical activity behavior

Table 2 shows the time spent on physical activity (moderate and vigorous intensity).

Based on activity in both summer and winter, 2/45 children (4%) met the recommendations for moderate intensity and 13/45 (29%) for vigorous intensity physical activity. On average, patients were more physically active on a moderate and vigorous intensity level during summer than winter.

The seasonal difference was present for moderate and vigorous physical activity in the 4–11 age group. In the 12–16+ group the same difference was noted for moderate physical activity but no difference was found between summer and winter for vigorous physical activity.

Based on activity in both summer and winter, the proportion of patients meeting the recommendations for moderate intensity were similar in both age groups (1/22 (5%) in the 4–11 group and 1/23 (4%) in the 12–16+ group). This was also noted for 6/22 (27%) in the 4–11 group and 7/23 (30%) in the 12–16+ group meeting the recommendation for vigorous physical activity.

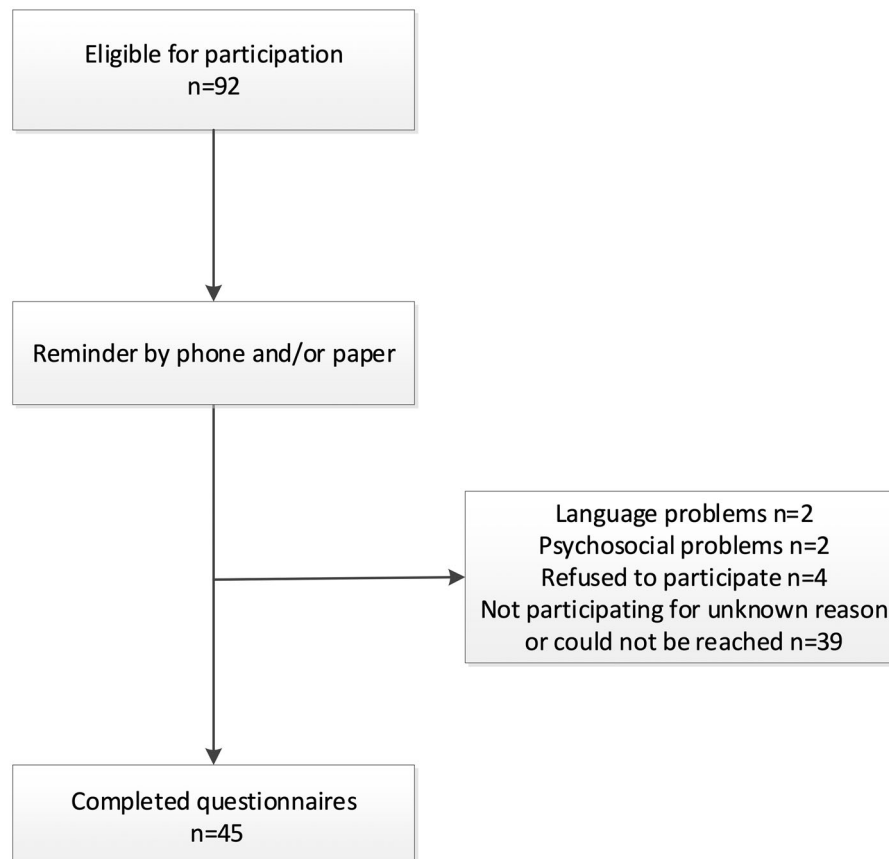


Figure 1. Flow chart showing the number of eligible patients and the completed questionnaires of all children and adolescents of 4–16 years old at heart surgery during 2015–2016.

Table 1. Socio-demographic and clinical characteristics of children and adolescents after surgery for congenital heart disease.

Age category, number (%)	All ages n = 45	Age 4–11 years n = 22 (49%)	Age 12–16+ n = 23 (51%)
Current age in years (median, IQR)	12.2 (7.8–16.1)	7.8 (6.6–10)	16.1 (13.1–17.5)
Time since last surgery in years (median, IQR)	2.3 (1.8–2.9)	2.3 (1.8–2.9)	2.5 (1.8–2.9)
Male gender (number, %)	18 (40)	7 (32)	11 (48)
NYHA classification after heart surgery (number, %)			
NYHA I	32 (71)	16 (73)	16 (70)
NYHA II	13 (29)	6 (27)	7 (31)
RACHS-1, risk category (number, %)			
1	11 (24)	10 (46)	1 (4)
2	16 (36)	5 (23)	11 (48)
3	17 (38)	7 (32)	10 (44)
4	1 (2)	0 (0)	1 (4)
Cultural background (number, %)			
Both parents born in the Netherlands	28 (62)	12 (55)	16 (70)
One parent born in the Netherlands	8 (18)	3 (14)	5 (22)
None born in the Netherlands	9 (20)	7 (32)	2 (9)
Parent completing questionnaire (number, %)			
Mother	34 (76)	14 (64)	20 (87)
Both mother and father	3 (7)	1 (5)	2 (9)
Highest educational level of parent(s) completing questionnaire (number, %)	n = 44	n = 22	n = 22
Low	3 (7)	2 (9)	1 (4)
Medium	16 (46)	11 (50)	9 (41)
High	21 (48)	9 (41)	12 (55)

IQR: interquartile range, that is, 25% to 75% percentile.

Table 2. Involvement in physical activity of children and adolescents after heart surgery and as compared to the national public health recommendation for physical activity.

Age category, number	All ages n = 45	Age 4–11 years n = 22	Reference group*	
			4–11 years n = 1025	Age 12–16+ years n = 23
Meeting to the national public health recommendation for moderate physical activity, no (%)				
Summer	11 (24)	7 (32)	533 (52)	4 (17)
Winter	2 (4)	1 (4.5)	215 (21)	1 (4)
Summer and winter	2 (4)	1 (5)	215 (21)	1 (4)
Meeting to the national public health recommendation for vigorous physical activity, no (%)				
Summer	23 (51)	13 (59)	595 (58)	10 (44)
Winter	17 (38)	8 (36)	400 (39)	9 (39)
Summer and winter	13 (29)	6 (27)	390 (38)	7 (30)

No: number.

*Hildebrandt V.H. BCM, Hofstetter H. Trendrapport Bewegen en Gezondheid 2000/2014. 1 ed. Leiden: TNO; 2015. p. 180.

Figure 2 shows the differences in percentages for the 4–11 years group concerning physical activity and seasonal difference compared to the reference group.

Figure 3 shows these differences for the 12–16+ group.

Use of postoperative physical therapy

In Table 3, the use of physical therapy after heart surgery is presented. Fifteen patients had physical therapy, mostly individual coaching (11/15), at a private practice (10/15), and on the initiative of patients and/or their parents (10/15).

Individual therapy was more common in the 12–16+ group (8/9) compared to 3/6 in the 4–11 group. Physical therapy in a special center/hospital was used less often than in private practice and applied to both age groups.

Children were more often referred to physical therapy on their own initiative in the 4–11 group (5/6) compared to the 12–16+ group (5/9). None of the patients in the 4–11 group and 2/9 patients in the 12–16+ group were referred by the cardiologist or general practitioner.

Regarding the indication to use physical therapy, the fear of moving was most frequently reported in the 4–11 age group

(6/6). In the 12–16+ age group, bad physical fitness (4/9) or other reasons related to the physical fitness (6/9) were mentioned.

Therapy frequency had been twice (6/15) or once (7/15) weekly in most patients, whereas in the majority, the sessions lasted 0.5 (6/15) to 1 h (8/15), with a median total duration of 13 weeks (range 3–15). In the 12–16+ group, the total duration of medium 5 weeks differs from the 14 weeks of the 4–11 age group (Table 3).

Preferences regarding postoperative physical therapy

Table 4 shows that the majority of patients and/or parents in both age groups indicated that they would prefer to receive more information regarding postoperative physical activity and sports, whereas the optimal timing to resume physical activity and sports was indicated as least important (32/45). The majority of respondents preferred information on paper 31/45 (69%) or orally from the pediatric physical therapist 31/45 (69%) especially in the 12–16+ group 19/23 (83%).

Regarding the delivery of physical activity interventions, more than two-thirds of the respondents indicated they would prefer face-to-face supervision by a physical therapist 35/45 (78%), especially the 12–16+ group 22/23 (96%). As for the preferred site of

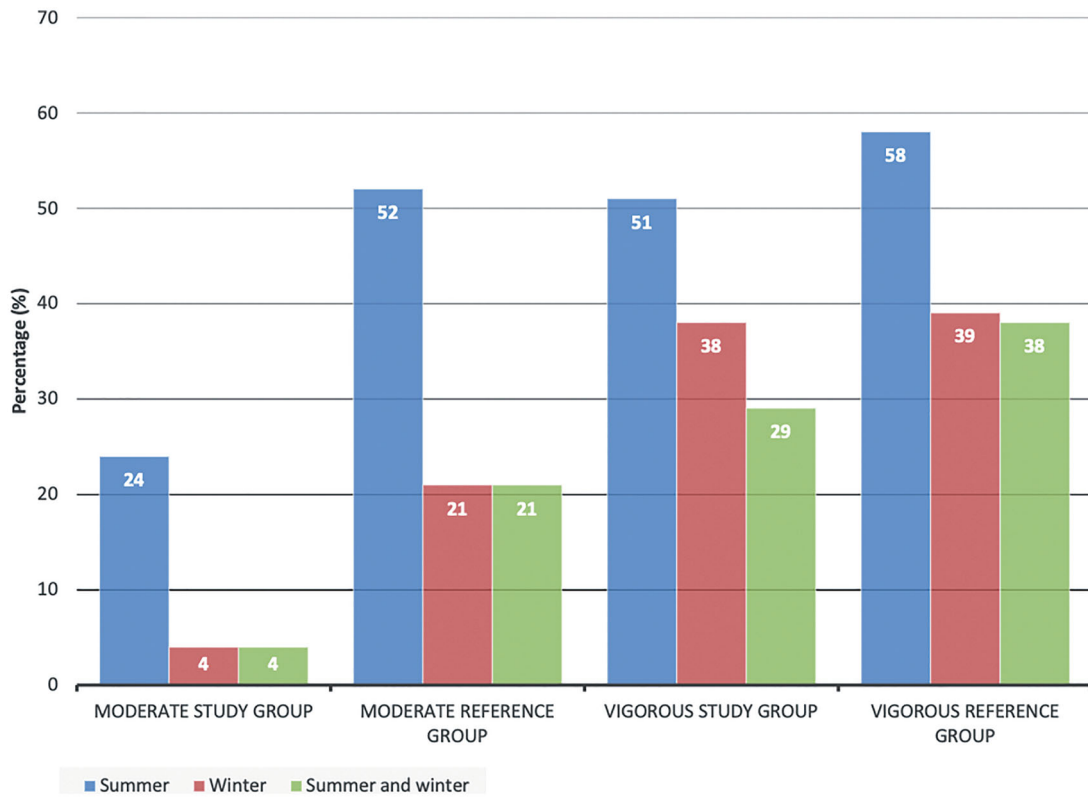


Figure 2. Meeting national public health recommendations 4–11 years (%).

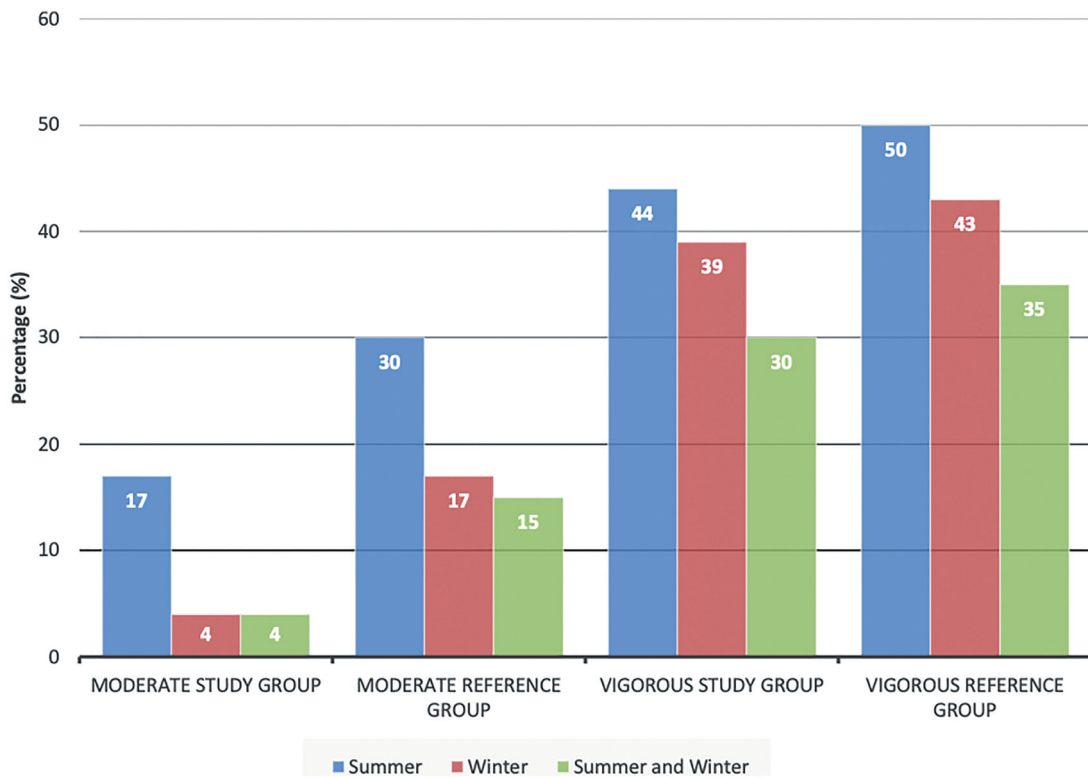


Figure 3. Meeting national public health recommendations 12–16+ years (%).

delivery, primary care was most preferred by all patients 32/45 (71%) especially in the 12–16+ group 20/23 (87%) versus 12/22 (55%) of the 4–11 group.

Overall, the median preferred duration of physical therapy, if provided in the place of living, was 12 weeks (IQR 7–52) and the frequency 2x/week.

Table 3. Physical care use of children and adolescents after heart surgery for improving physical activity.

Age category	All ages	Age 4–11 years	Age 12–16+ years
Physical therapy use after hospital stay (number)	15	6	9
Kind of therapy (number)			
Individual	11	3	8
Groupsession	1	1	0
Both/missing	2/1	1/1	1/0
Setting of therapy (number)			
Special center/hospital	1/2	1/0	0/2
Private practice	10	4	6
Different/missing	1/1	0/1	1/0
Referred by (number)			
Cardiologist/ Family doctor	2/1	0	2/1
Own initiative	10	5	5
Different	2	1	1
Reason for starting physical therapy (number)*			
Difficulties with daily activities	4	2	2
Bad physical condition	6	2	4
Little desire to move	2	6	2
Fear of moving	5	3	2
Motor development delay	2	1	1
Other reason	9	3	6
Range number of reasons, min.-max.	1–4	1–4	1–4
Frequency of physical therapy (x/week) (number)			
2x/week	6	2	4
1x/ week	7	3	4
1x every 2 week	1	0	1
Unknown or only 1 therapy session	1	1	0
Duration of physical therapy/session (hour)			
1/2 hour	6	1	5
1 h	8	4	4
Unknown	1	1	0
Total duration of physical therapy treatment in months (median, IQR)	13 (3–15)	14 (9–16)	5 (3–16)

*Patients could provide more than one answer for each question.

IQR: interquartile range, i.e., 25–75% percentile.

For physical therapy outside the place of living, the median preferred total duration was 6 weeks (IQR 4–26) in the 4–11 group and 10 weeks (IQR 8–26) in the 12–16+ group.

Discussion

A cross-sectional study in children and adolescents in the first two years after surgery for CHD concluded that the majority of children did not meet the public health recommendations for physical activity and had not used physical therapy in the postoperative phase. Nevertheless, the majority also indicated a need for more information, guidance and support regarding the resumption and maintenance of sport and physical activities.

Physical activity after heart surgery

Two years after heart surgery, the majority of patients did not meet the public health recommendations for health enhancing physical activity and were less active compared to their peers, which is in line with most previous studies [2–5,7–9,11].

The proportion of children with CHD from this study meeting to the national public health recommendation for moderate activity was lower in both the 4–11 and the 12–16+ groups (5 and 4%) compared to a sample of Dutch children from the general population (21 and 15%). In the 4–11 age group, relatively fewer children were vigorously active compared to their Dutch peers (27 vs 38%). In the 12–16+ group, the proportion was in the same range (30 vs. 35%) [16].

This is not in line with the results of Arvidsson et al., who concluded that the physical activity level was similar in patients with CHD and healthy controls [6]. However their study was not comparable to ours regarding age (4–16+ years vs 9–11 and 14–16) and method of assessment (questionnaires vs activity monitor) [6].

Physical therapy use after heart surgery

In contrast with other studies, in the present study the use of postoperative rehabilitation, in particular physical therapy was taken into account.

Regarding the proportion of children with CHD using physical therapy or other forms of rehabilitation after surgery, comparisons with other studies cannot be made, as such studies have not yet been conducted. It is however conceivable that there may be differences among countries, depending on health care system and availability and accessibility of physical therapy and rehabilitation.

Despite the national differences, in the European guideline for children with CHD, Takken and others advise to comply with public health recommendations by participating in moderate to vigorous physical activity also to conduct more research to gain greater knowledge about the optimal training program to improve physical fitness [12].

Patients preferences for care use after heart surgery

Regarding the preferences for potential interventions after surgery, care use is hardly discussed in the literature except for care delivery in care centers. Therefore, no comparisons with other countries or centers could be made [17].

Parents and children in this study indicate that there is more need for information and support for improving physical activity than is currently available. This is in line with the study of Williams et al. who concluded that although health care providers in the participating United Kingdom pediatric cardiac clinics consider physical activity to be very important, specific advice and recommendations are underutilized and promotion of exercise need to be provided to clinicians and their support team [18]. Lunt et al. underlined this coaching task of the physical therapist to improve physical activity as a movement expert [8].

Table 4. Preferences of children, adolescents and their parents for more information and a better use of physical therapy to improve physical activity.

	All ages <i>n</i> = 45	Age 4–11 years <i>n</i> = 22	Age 12–16+ years <i>n</i> = 23
Information			
Need for more information regarding postoperative physical activity and sports (number,%)			
Advantages and disadvantages or risks of physical activity and sports	23 (51)	11 (50)	12 (52)
Timing of starting with physical activity and sports	13 (29)	5 (23)	8 (35)
Adequate intensity of exercise and sport	19 (42)	9 (41)	10 (43)
Adequate frequency of exercise and sport	20 (44)*	10 (45)**	10 (43)
Recommended types of physical activity and sports	22 (49)	11 (50)	11 (48)
Need for and benefits of professional supervision by a physical therapist	22 (49)	15 (68)	17 (74)
Specific home exercises	28 (62)	14 (64)	14 (61)
Mode of delivery of information: preferences for			
Pediatric cardiac surgeon or cardiologist	26 (58)	11 (50)	15 (65)
Pediatric physical therapist	31 (69)	12 (55)	19 (83)
Written information; paper leaflets	31 (69)	15 (68)	16 (70)
Written information; electronic e.g., website or App	18 (40)	6 (27)	12 (52)
Video information or instruction, e.g., YouTube or DVD	19 (43)	10 (46)	9 (41)*****
Postoperative rehabilitation / physical therapy			
Setting: preferences for			
Primary care	32 (71)	12 (55)	20 (87)
Hospital	14 (31)	5 (23)	9 (39)
Rehabilitation center	16 (36)	5 (23)	11 (48)
Maximum distance to travel for coaching (km, median (IQR))	10 (10-20)	10 (10-20)	10 (8-20)
Face-to-face supervision by physical therapist	35 (78)	13 (59)	22 (96)
Group therapy with other children after heart surgery	27 (61)*	11 (50)	16 (70)
Group therapy with other disabled children.	14 (31)	7 (32)	7 (30)
Distant supervision by internet or e mail	19 (42)	9 (41)	10 (44)
Frequency and duration of intervention			
Within neighbourhood/place of living			
Maximum frequency/week (median, IQR)	2 (2-3)	2 (2-3)***	2 (2-2)
Total duration (weeks (median, IQR))	12 (7-52)	12 (6-52)****	12 (9-52)
Outside place of living			
Maximum frequency/week (median, IQR)	2 (1-2)	2 (1-2)***	1 (1-2)
Total duration (weeks (median, IQR))	10 (6-26)	6 (4-26)*****	10 (8-26)

Reported median and % concern valid percentages based on the number of answers provided by all patients, unless stated otherwise.

n* = 44; *n* = 21; ****n* = 20; *****n* = 18; ******n* = 17; ******n* = 22.

IQR: interquartile range, i.e., 25% to 75%.

In the Netherlands, physical therapists are generally experienced as the experts in movement and sports, including taking a key role in several rehabilitation programs. The main problem in the rehabilitation of children after CHD surgery is that they visit the pediatric cardiologist on a regular basis and get their advice on moving and sports in a more general and not very specific way. By starting a joint effort between cardiologist and physical therapist, a more reliable and effective rehabilitation program can be offered to these children and their parents. This is supported by the present study where a need for more support among patients and their parents is found.

Limitations

There are some limitations to this study. First of all, this study was a single-center study in the Netherlands, although follow up took place in two different hospitals with different cardiologists.

Secondly, we included only patients between 4–16 years old at time of surgery causing a selection, as a result of which the children, who had surgery in the first year after birth are not included in the current study and their care use and preferences to care use are unknown.

In addition, information of patients and their parents about care need and care use after heart surgery more than 2 years ago would probably be less reliable.

Thirdly 45/92 (49%) of all patients completed the questionnaires.

Although the response rate was quite favorable, the total sample size in this study was relatively small. Unfortunately, we were, due to limited resources, not able to extend the cohort and repeat the survey, yet we recommend for future studies to

increase the sample size, for example, by including more hospitals where pediatric cardiac surgery is executed.

Fourthly, the use of self-reported questionnaires for physical activity might lead to incorrect presentation of the reality [19]. Possibly, the help of parents could have been a corrective factor when completing the questionnaires.

Finally, the majority of the parents, who assisted with completing the questionnaires, had a high educational level, hence patients and parents with a higher socioeconomic status are probably overrepresented in this study.

Clinical relevance and implications for practice

Patients and their parents participating in this study clearly indicated that they would want more information and guidance after heart surgery to improve physical activity level and physical fitness. Thus, there are ample opportunities for the development of postoperative interventions matching needs and sports of children and adolescents after heart surgery at a local practice with an individual approach by a personal physical therapist. The pediatric cardiologist plays an important role in this by referring these young patients to a physical therapist after heart surgery.

Conclusion

The majority of children and adolescents do not meet public health recommendations for physical activity and do not use physical therapy after surgery for congenital heart disease. There is a clear need for more information and individual physical therapy treatment after a heart operation to optimize the physical fitness. A close collaboration between pediatric cardiologist and

physical therapist is therefore of crucial importance to set up a well-structured rehabilitation program in order to achieve the improvement of physical activity and physical fitness.

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- All authors have read the manuscript and agree to it being submitted.
- All authors meet the appropriate authorship criteria and nobody meeting these criteria has been omitted from the list of authors.
- This manuscript has not been submitted for publication elsewhere.

Ethical approval

This study was approved by the Medical Ethics Review Committee of the LUMC.

Informed consent

Informed consent was obtained from all individual participants included in the study.

Disclosure statement

The authors declare that they have no conflicts of interest.

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