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ORIGINAL REPORT

AEROBIC EXERCISE IN ADULT NEUROMUSCULAR REHABILITATION: A SURVEY OF HEALTHCARE PROFESSIONALS

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Objective: **To evaluate the current application of aerobic exercise in adult neuromuscular rehabilitation.**
Design: **Cross-sectional survey.**
Participants: **Dutch rehabilitation specialists and physical therapists in specialized centres for slowly progressive neuromuscular diseases and in primary care.**
Methods: **Participants received a self-designed, web-based, questionnaire, including 27 close-ended questions covering 4 categories: respondent profile, application of aerobic exercise, barriers to prescribing aerobic exercise, and need for support to improve the application of aerobic exercise.**
Results: **All respondents ($n = 52$) prescribed aerobic exercise and in a wide variety of neuromuscular diseases, mostly applying sessions of more than 20 min, 2 days per week, over a period of 9–16 weeks, using different exercise modes and methods to target intensity. The majority (81%) agreed that aerobic exercise should be incorporated into neuromuscular rehabilitation. However, all respondents perceived barriers to the application of aerobic exercise in one or more domains, and 77% of the respondents indicated needing support to improve application of this type of training, mostly with respect to screening procedures (54%) and dosing of exercise programmes (48%).**
Conclusion: **Aerobic exercise is widely applied, yet our results raise awareness of the necessity of more evidence based knowledge, in order to develop and implement guidelines in adult neuromuscular rehabilitation.**

Key words: aerobic exercise; neuromuscular disease; rehabilitation; cardiorespiratory fitness.

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LAY ABSTRACT

An important goal of rehabilitation programmes in slowly progressive neuromuscular diseases is to promote physical fitness through aerobic exercise programmes. This survey of Dutch rehabilitation specialists and physical therapists, specialized in neuromuscular diseases, aimed to evaluate how often and what way aerobic exercise is applied in clinical practice. The results showed that all respondents prescribed aerobic exercise and in a wide variety of neuromuscular diseases. However, all respondents also experienced one or more barriers to aerobic exercise and, most importantly, more than three-quarters reported a need for support. The preferred method of support is through the development of guidelines, with a focus on the screening procedures (to assess the need for aerobic training) and design of training programmes. In conclusion, more evidence-based knowledge is needed, in order to develop guidelines to support healthcare professionals in prescribing aerobic exercise in neuromuscular rehabilitation.

In individuals with neuromuscular diseases (NMD), symptoms of muscle weakness, fatigue and pain limit physical activity and contribute to a sedentary lifestyle (1–3). Physical inactivity causes deconditioning (i.e. reduced physical fitness), which in turn worsens health and physical functioning, compromising daily activities and societal participation (2). One of the therapy goals of rehabilitation programmes is to break this vicious cycle through aerobic exercise (AE) to improve physical fitness (4).

There is increasing evidence demonstrating the beneficial effects of AE in various slowly progressive NMD (5–9), but clear guidelines specific for NMD are missing. In recent decades, several international consensus conferences have been held to develop recommendations regarding prescription, monitoring and evaluation of aerobic training in NMD (10, 11). These recommendations are, however, quite general, and lack specificity. For instance, the most optimal training dose, in terms of frequency, intensity, time and type (referred to as the FITT factors (12)) are not specified (13, 14). This hampers the adequate application of AE in this population (15, 16).

To evaluate current practice with respect to the application of AE, we conducted a survey among Dutch rehabilitation specialists and physical therapists working in specialized centres for NMD and in primary care. We aimed to obtain insight into how often and in what way AE is applied, with specific emphasis on the training dose in terms of the FITT factors. Perceived barriers to the prescription, monitoring, and evaluation of AE in NMD, as well as the need for support to improve application, were assessed.

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METHODS

Study design and participants

A cross-sectional survey among healthcare specialists involved in adult neuromuscular rehabilitation care in the Netherlands was conducted using a self-designed web-based questionnaire. The study focused primarily on rehabilitation specialists and physical therapists working in specialized centres (i.e. rehabilitation centres or rehabilitation outpatient clinics of university or general hospitals). In addition, physical therapists working in primary care (i.e. community-based physical therapy practices) were contacted. To guide reporting, the Checklist for Reporting Results of Internet E-Surveys (CHERRIES) was used for quality reporting of web-based surveys (17).

Questionnaire design

In designing the questionnaire, we made use of 2 previous surveys on the application of AE in neurological rehabilitation (e.g. stroke, cerebral palsy, spinal cord injury) in Canada (18) and the USA (19) and of a qualitative study on the experiences of patients and physical therapists with AE in post-polio syndrome (16).

The questionnaire was designed by 2 researchers (EV and MB) in cooperation with 3 experienced clinicians practicing in neuromuscular rehabilitation. It contained 27 questions covering 4 categories: [category 1] respondent profile (e.g. practice setting and experience in neuromuscular rehabilitation) {$n=8$ questions}, [2] application of AE (e.g. training dose in terms of the FITT factors) {$n=12$}, [3] barriers to prescribing AE {$n=4$}, and [4] need for support to improve application of AE {$n=3$}. All questions were close-ended with a list of response options. Two questions in category 2 regarding the respondent's perception of the role of AE in adult neuromuscular rehabilitation were scored on a 5-point Likert scale (with 1=strongly disagree and 5=strongly agree). Several questions contained "other, please specify", or "please specify" to ensure the most appropriate response (see Appendix S1[1] for the questionnaire).

Prior to distribution of the questionnaire, the time to complete the questionnaire was tested. This took approximately 15 min, similar to the completion time of 13 min found to optimize response rates in online surveys (20).

Questionnaire distribution

A web-based tool, Google Forms (https://docs.google.com/forms/u/0/) was used to distribute the questionnaire. Respondents could complete the questionnaire only once, thus preventing duplication of respondents. Queries prevented missing items, and respondents were able to review and change their answers. In addition, a percentage completion bar made respondents aware of their progress, which is known to enhance response rates (21).

Initially, the questionnaire was distributed through the network of specialized neuromuscular rehabilitation centres acknowledged by the Dutch patient organization for neuromuscular disease (*Spierziekten Nederland*; SN). All rehabilitation specialists ($n=53$) and physical therapists ($n=34$) working in these acknowledged rehabilitation centres received the questionnaire. Potential respondents were contacted multiple times. First, an advance notice of the pending questionnaire was issued. Later that week, an invitation letter was distributed via email, outlining the rationale for conducting the survey, the definition of AE (i.e. planned, structured, and repetitive physical activity performed for extended periods of time and at sufficient intensity to improve or maintain physical fitness), ethical issues (i.e. voluntary participation, anonymity, and no incentives), and containing an electronic questionnaire link. The invitation was sent prior to 09.00 h in order to optimize the response rate. A reminder email with the survey link was sent 2 weeks after the initial invitation, and a second reminder was issued one week later (22).

In order to also reach physical therapists working in a primary care setting, the questionnaire was distributed via the newsletter and LinkedIn profile of the Royal Dutch Society for Physical Therapy (*Koninklijk Nederlands Genootschap voor Fysiotherapie*; KNGF).

The survey was made available for 4 months; for specialized centres between November 2016 and February 2017, and for primary care centres between April and July 2017. Based on a mean response rate for web-based surveys of 50%, and given the known number of invitations that were sent via SN, at least 44 respondents were expected.

Data analysis

Categorical variables were summarized using frequencies and percentages. Percentages were calculated by dividing the frequency of a particular response by the total number of responses for that question. Responses to questions in which "other, please specify" was selected, were reviewed to identify categories and their respective frequencies and percentages were determined. The data from the questions that were scored on a 5-point Likert scale, were reduced by combining "agree" and "strongly agree" responses to form an "agree" category, and response options of "strongly disagree" and "disagree" were combined to form "disagree". Data analysis was performed with SPSS software (version 24.0.0.1).

RESULTS

Respondent profile

From the 87 invitations sent via SN, 13 rehabilitation specialists and 27 physical therapists returned the questionnaire (46% response rate). In addition, 12 physical therapists practicing in a primary care setting returned the questionnaire, resulting in a total of 52 respondents. All but 1 (Flevoland) of the 12 provinces of the Netherlands were represented. Respondents were predominantly working in specialized centres (77%) and had mostly practiced for more than 6 years in neuromuscular rehabilitation (Table I). Nineteen respondents in specialized centres (48%) reported being primarily engaged (i.e. >50% practice time) in neuromuscular rehabilitation, while this was the case for none of the respondents in primary care.

Application of aerobic exercise

All respondents applied AE and in a wide variety of NMD (Fig. 1). AE was mostly prescribed in at least 6 patients per year (81%).

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Table I. Respondent profile

Characteristics	*n* (%)
Female sex	33 (64)
Profession	
Physical therapist	39 (75)
Rehabilitation specialist	13 (25)
Highest degree	
Bachelor's	25 (48)
Master's	18 (35)
PhD	9 (17)
Practice setting	
Specialized centre	40 (77)
Primary care setting	12 (23)
Years in clinical practice	
<6 years	8 (15)
6–10 years	17 (33)
11–15 years	5 (10)
>16 years	22 (42)
Years in neuromuscular rehabilitation	
<6 years	15 (29)
6–10 years	13 (25)
11–15 years	7 (14)
>16 years	17 (33)
Practice time in neuromuscular rehabilitation	
0–50%	33 (64)
51–75%	12 (23)
76–100%	7 (14)

In terms of the FITT factors (Table II), most of the healthcare professionals prescribed 2 exercise sessions per week (frequency) of more than 20 min over a period of 9–16 weeks (time), using a wide variety of exercise modes (type) and methods to target intensity (intensity). Ratings of perceived exertion were most often used to target intensity (83%), followed by standardized walk tests (60%), and a percentage of the maximal heart rate based on submaximal exercise tests (46%).

The majority of respondents (81%) agreed with the statement "AE should be incorporated into treatment programmes of adults with neuromuscular diseases". Underuse (i.e. insufficient training dose) and overuse of AE in adult neuromuscular rehabilitation were reported by, respectively, 58% and 17% of the respondents.

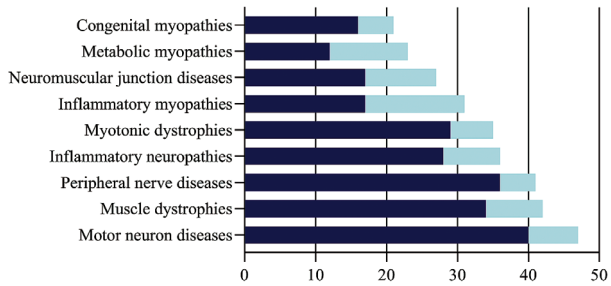


Fig. 1. Application of aerobic exercise in adult neuromuscular rehabilitation. Light bars indicate the number of respondents reporting to treat the neuromuscular diseases in clincal practice; dark bars indicate the number of respondents reporting to prescribe aerobic exercise in that neuromuscular diseases group. This concerned a multiple response variable.

Table II. Training setting and aerobic exercise training dose (in terms of frequency, intensity, time and type (FITT) factors)

	n (%)
Setting[a]	
Rehabilitation centre	25 (48)
Physical therapy practice	25 (48)
At home	23 (44)
Gym	13 (25)
University hospital	11 (21)
General hospital	7 (14)
Format[a]	
Individual training	25 (48)
Mix of individual and group training	24 (46)
Group training	3 (6)
Frequency of exercise	
1 day/week	5 (10)
2 days/week	36 (69)
3 days/week	11 (21)
Intensity of exercise (i.e. methods used to determine target intensity)[a]	
Rating of perceived exertion (e.g. Borg scale)	43 (83)
Standardized walk tests (e.g. 6-min walk test)	31 (60)
% of predicted maximal heart rate based on submaximal exercise test	24 (46)
% of predicted maximal heart rate based on a formula (e.g. 220 minus age)	14 (27)
Threshold values (e.g. anaerobic threshold)	11 (21)
% of maximal heart rate based on maximal exercise test	8 (15)
Talk test	7 (14)
Time per exercise session	
<10 min	3 (6)
11–15 min	5 (10)
16–20 min	10 (19)
21–30 min	25 (48)
>30 min	9 (17)
Type of exercise[a]	
Ergometer exercise (e.g. cycle ergometer, treadmill, arm ergometer)	51 (98)
Overground exercise (e.g. cycling, walking/running)	44 (85)
Swimming	26 (50)
Cross trainer	25 (48)
Circuit training	21 (40)
Motion control video games	5 (10)
Duration of the entire exercise programme	
4–8 weeks	3 (6)
9–12 weeks	18 (35)
13–16 weeks	17 (33)
>16 weeks	10 (19)
Varying	4 (8)

[a]Multiple response variable.

Barriers to application of aerobic exercise

All respondents perceived barriers to the application of AE in their practice in one or more domains (Fig. 2). In specialized centres, the barriers reported most often were, physical inability to perform at a training level (73%), poor motivation (55%), comorbidities (55%), risk of overwork weakness (45%), and fatigue (45%). Respondents working in primary care, most often reported general safety (58%), poor motivation (58%), lack of knowledge about AE prescription in NMD (42%) and comorbidities (42%) as barriers.

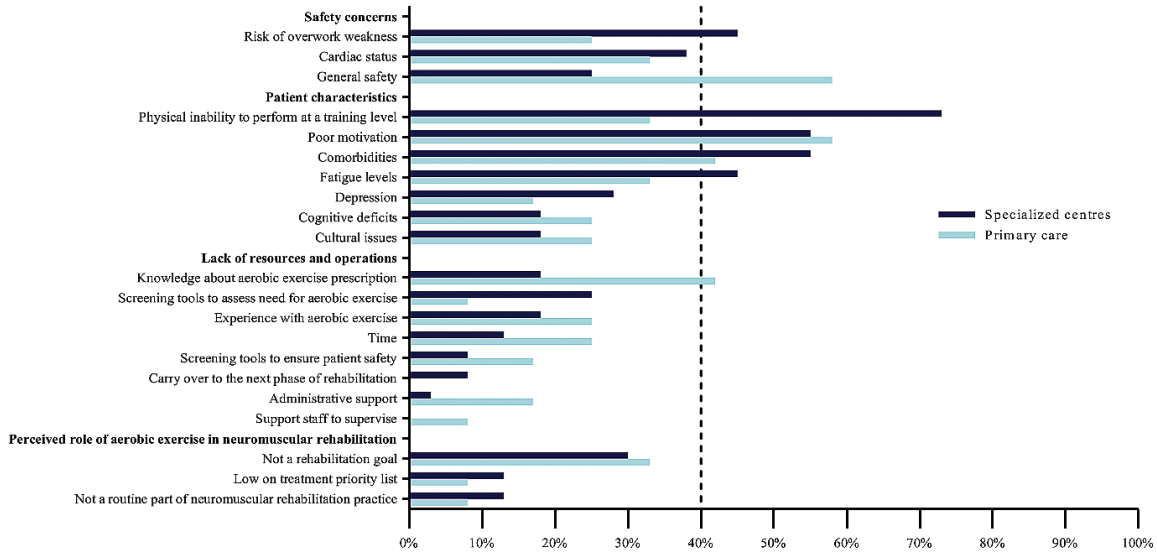


Fig. 2. Perceived barriers to prescribing aerobic exercise in adult neuromuscular rehabilitation. Dark and light bars indicate the number of respondents reporting the item as a barrier to prescribing aerobic exercise in respectively specialized centres and primary care. This concerned a multiple response variable.

Need for support

The majority of respondents (77%) reported the need for support to improve the application of AE in neuromuscular rehabilitation. Most support is needed with respect to the screening procedure (54%) and dosing of exercise (48%), while monitoring and evaluation were reported by, respectively, 33% and 31% of respondents. The preferred means of support was via a guideline (71%), followed by the availability of an (online) course (62%) and e-learning (58%).

DISCUSSION

This study provides an insight into the current application of AE in adult neuromuscular rehabilitation in the Netherlands from the perspective of a healthcare professional. All respondents applied AE in various NMD, and programmes generally included sessions of more than 20 min, conducted 2 days per week, over a period of 9–16 weeks, using several different methods to target intensity and exercise modes. Despite the strong agreement among healthcare professionals that AE should be incorporated into treatment programmes, they experienced several barriers. More than three-quarters of respondents indicated the need for support to improve the application of AE in neuromuscular rehabilitation, preferably through the development of guidelines and education, covering, in particular, the screening procedure and dosing of training programmes.

Application of aerobic exercise

Although this survey indicates that AE is applied widely in adult neuromuscular rehabilitation, healthcare professionals appear to be rather reserved with respect to the training dose they prescribe, and to struggle with determination of the target intensity. Therefore, it is questionable whether AE is applied effectively in current care.

The most optimal FITT factors for AE in NMD have not yet been described (13, 14). In the general population (23), and other clinical populations, such as stroke (24), hypertension (25) and type 2 diabetes (26), there is consensus that AE requires the frequent (i.e. 3–5 days weekly) use of large muscle groups, for prolonged periods of time (≥20 min per session). Previous studies demonstrating positive effects of AE in various NMD also made use of these characteristics (5–9), and, in this respect, it is interesting to note that a lower frequency is mostly used in clinical practice.

An important finding in line with this is that more than half of the respondents reported underuse in their current practice. Substantial underuse was also reported in previous studies by both practitioners (27) and patients (28), even though this concerned general physical therapy treatment in NMD. A study in stroke rehabilitation showed that, despite clear recommendations for moderate- to-vigorous intensity AE, physical therapists commonly prescribed light intensities (19). The authors relate this to safety concerns, which, supported by the perceived barriers in the current study,

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may also be the case in NMD. Traditionally, individuals with NMD are discouraged to exercise for fear of overwork weakness (29). Despite accumulating evidence for the safety of AE in a wide variety of NMD (8, 30–32), this idea may still influence healthcare professionals in prescribing AE in this group.

Exercise intensity is the most critical component in ensuring an adequate dosage to elicit a training effect (23). It is therefore important to note that our respondents used several different methods to determine target intensity. This same pattern was seen among physical therapists in stroke rehabilitation (18, 19), and, in line with the large support need with respect to dosing of exercise, it probably reflects the difficulties that healthcare professionals experience related to exercise intensity prescription in NMD. Together with the reported frequent use of unreliable methods to determine individual target intensity in NMD, such as those based on the (age-)predicted maximal heart rate (33, 34), this emphasizes the need for the development and more consistent use of methods to determine the intensity and other FITT factors for AE in NMD.

Perceived barriers

In addition to the reported underuse, respondents identified several barriers to the application of AE in adult neuromuscular rehabilitation. The most commonly perceived barriers concern safety and patient characteristics, including the physical inability to perform at a training level, poor motivation, comorbidities and fatigue.

The physical inability to perform at a training level was more often reported as a barrier to exercise by respondents working in specialized centres compared with those working in a primary care setting. This may reflect the more complex cases that are usually treated in specialized centres, and is in line with the majority of respondents experiencing comorbidities as a barrier in this setting. The comorbidities that respondents were referring to in this context are unknown; these might be directly associated with the NMD, such as cardiac involvement in muscular dystrophies (35), but it may also concern comorbidities that are unrelated to the disease.

That more than half of the respondents identified poor patient motivation to exercise as a barrier, while most respondents agreed that AE should be part of treatment programmes in NMD, underlines the need for clinicians to develop strategies to enhance motivation (3, 36). Fatigue was also often reported as a barrier. This confirms findings from previous studies (13, 37), but contradicts the growing evidence that physical activity and AE have beneficial effects on fatigue in NMD (14, 38, 39), and should thus, from this perspective, be promoted.

Another interesting finding is that insufficient knowledge about AE prescription was often reported as a barrier, especially in the primary care setting. A possible explanation is the low caseload; while 48% of the respondents in specialized centres reported being primarily engaged in neuromuscular rehabilitation, this was the case for none of the respondents in primary care. This highlights that attention should be given to continuing education of physical therapists, not only in specialized centres, but also in primary care. A model in which care is delivered by a restricted number of trained professionals who collaborate within regional networks, as has proven successful in Parkinson's disease (40), might also be considered in NMD.

Need for support

More than three-quarters of respondents indicated needing some kind of support to improve the application of AE in neuromuscular rehabilitation. Most support was required with respect to the screening procedures and dosing of training programmes. To our knowledge, this need for support has not yet been reported, although it is in line with previous studies mentioning the difficulties healthcare professionals experience with regard to finding a balance between improving physical fitness and preventing overburden in NMD (15, 16). A guideline is the preferred means of support, with evidence-based guidance on the prescription, monitoring and evaluation of AE.

Study limitations

Although adult neuromuscular rehabilitation in the Netherlands is organized in, and coordinated by, specialized centres, physical therapy, including the prescription of AE, is often provided close to home, in a primary care setting. The generalizability of our results might, therefore, be restricted by the relatively low number of respondents practicing in a primary care setting. Moreover, response bias may have occurred, since it is possible that physical therapists with a specific interest in neuromuscular rehabilitation may have been more inclined to respond to the survey than those less interested.

Implications

These survey results emphasize the need to improve the application of AE in current practice. The preferred way to achieve this is through the development and implementation of guidelines addressing current evidence-based knowledge regarding AE application in NMD. Future research should focus on improving strategies to enhance motivation, the role of comor-

bidities in relation to training prescription, and the development of methods to specify the optimal FITT factors for AE in NMD.

Conclusion

AE is widely applied in adult neuromuscular rehabilitation in the Netherlands, yet healthcare professionals are cautious regarding the training dose they prescribe, and appear to struggle with determination of the target exercise intensity. Despite strong agreement among respondents that AE should be incorporated into treatment programmes, they also identified several barriers to its application, and reported a high need for support. The results of this survey raise awareness of the necessity for more evidence-based knowledge, in order to develop and implement guidelines on AE in adult neuromuscular rehabilitation.

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