The Impact of Pulmonary Rehabilitation on the Quality of Life in Schoolchildren with Cystic Fibrosis “Pulmonary Rehabilitation and Quality of Life in CF”

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Abstract

Background

Cystic fibrosis is the most common type of severe chromosomal disease among white people. The disease affects several systems, mainly impacting the lungs. The children with cystic fibrosis have a poor quality of life. Self-management programs such as pulmonary rehabilitation can improve the quality of life. The aim of this study was to investigate the impact of pulmonary rehabilitation on the quality of life in the schoolchildren with cystic fibrosis referring to Tehran Children's Medical Center.

Methods

The present study is a clinical trial in which the samples were randomly placed in two groups of 35, the intervention and the control group. The child demographic information and the Revised Cystic Fibrosis Questionnaire (CFQ-R) were used. In this study, the parent’s version was used for 6 to 11-year-old children and the child’s version for 11 to 13-year-old children as a self-report. In the intervention group, during 6 weeks, 12 sessions were held. Then, the CFQ-R was filled out, immediately and 8 weeks after the intervention. The results were analyzed using SPSS V25, considering a significant level.

Results

According to ANOVA, a significant difference was observed in the mean total scores of the quality of life between the two groups, immediately and 8 weeks after the intervention (P-value < 0.001). In addition, intra-group comparisons show that the impact of time was significant in the intervention group (P-value < 0.001).

Conclusions

Since the difference prior to the intervention and after it was significant, this method can improve the quality of life.

Application to practice

: This technique can be used as a nursing intervention in clinical contexts for children who are sick.

Trial registration number:

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2019

Introduction

As the World Health Organization estimates, there are hundreds of millions of people worldwide who suffer from respiratory diseases, which are considered the third leading cause of death globally (Societies., 2017). Cystic fibrosis is the most common severe chromosomal disease among the white population, which is inherited as an autosomal recessive disease and appears during infancy and childhood (Ali Bakhshi R. KR CJ, 2008). There are approximately 70,000 people with cystic fibrosis around the world (CFFoundation., 2016). The incidence rate of this disease in Iran is 1 per 100,000 live births (Havasian M.R. PJ, 2014).

Cystic fibrosis affects several systems and its common symptoms include respiratory symptoms, gastrointestinal symptoms, biliary cirrhosis, and portal hypertension, bone conditions leading to pathologic fractures, urinary incontinence, fatigue, pain, and depressed moods. But the disease mainly targets the lungs (QuittnerA.L., 2016). Pulmonary dysfunction in the patients with cystic fibrosis is due to the accumulation of airway secretions, inflammation, and infection (Hoo Z.H. DT, 2015). The inability of mucosal cilia to clear the airways causes recurrent infection, mucosal plaque, inflammation, and airway obstruction, which consequently reduces pulmonary function in a progressive manner (Mikesell DO Ch. KR, 2017). Cystic fibrosis, like other chronic diseases, results in limited functioning as well as frequent hospitalizations and reduced quality of life (Brucefors A.B. HJ, 2015).

Quality of life is a general and mental concept, based on a one's satisfaction with life (Amerdo P. DR, 2015). Life satisfaction is in turn affected by health. Therefore, the quality of life consists of a wide range of clinical symptoms, functional ability, and health status (KarimiM.BJ., 2016). Health-related quality of life affects one's perception of the impact of a disease on their health, well-being, and cultural performance; in ill children, the family background is also effective (E. Fardell J. VJ, 2017). The disease has different impacts on children's lives due to unique developmental aspects (Matza L.S. PDLRAW, 2013). In children and adolescents with cystic fibrosis, having no hope for future, social stigma, and absenteeism from school reduce the quality of life (Şenses-Dinç G. ÖU, 2018). The results of studies show that children with chronic cystic fibrosis have poor quality of life in Iran and other countries (Kianfar H.R. BB, 2013; Tuna cak H. YE, 2018). Pulmonary rehabilitation can improve health-related quality of life and reduce the symptoms of anxiety and depression (G. C. Spruit M.A. SSJ, ZuWallack R., Nici L., Rochester C., Hill K.,Holland A.E., Lareau S.C., Man W.D., et al., 2013).

As a non-pharmacological approach targeting the needs of the patients and their families, pulmonary rehabilitation is a treatment strategy recommended to all the people with chronic respiratory diseases across the world (G. C. e. a. Spruit M.A. SSJ, 2013). Pulmonary rehabilitation is a comprehensive intervention that focuses on education, physical exercise, making behavioral changes, improving the

physical and mental status of people with chronic respiratory diseases, and increasing the long-term follow-up of health-related behaviors. Participating in pulmonary rehabilitation programs promotes athletic ability, health-enhancing behaviors, and the levels of physical activity (G. C. e. a. Spruit M.A. SSJ, 2013).

The pulmonary rehabilitation program requires a team consisting of nurses, physicians, physiotherapists, sports physiologists, occupational therapists, psychologists, social workers and nutritionists (Modanloo Sh. RC, 2018). Among them, nurses play a great role in providing supportive and educational interventions to reduce the adverse effects of the chronic disease on the child and the family. Nurses fulfill their role through managing patients (teaching breathing exercises and the physical care needed for physical and breathing exercises), assessing health, performing interventions, and making referrals to other services if necessary (M. McDonald V. RM, 2018). The pulmonary rehabilitation program consists of patient selection and examination, exercises, education, nutritional support, psychological support, and the evaluation of the results of pulmonary rehabilitation (RaiDK.PS., 2020).

Thus, considering the complications and side effects of cystic fibrosis and the role of nurses in providing pulmonary rehabilitation, it was decided to conduct the study entitled “the Impact of Pulmonary Rehabilitation on the Quality of Life in Schoolchildren with Cystic Fibrosis”.

Materials And Methods

This study is a clinical trial. Convenience sampling was done based on the inclusion criteria consisting of the child's fluency in Farsi, no chronic mental disease or other physical illnesses, living with both parents, the parents being aware of the FEV1 level or having a spirometry report, and having a CD Player. The subjects were assigned to the intervention and control groups randomly, based on their medical files’ numbers. Even and odd numbers were placed in the intervention and control groups, respectively. The exclusion criteria consisted of quitting the trainings after two sessions, and the deterioration of the child’s physical condition and his/her hospitalization. The necessary number of subjects in each group was calculated to be 64 according to the sample size determination formula.

The data was collected using two questionnaires:

- The child’s demographic and clinical information questionnaire consists of 8 sections, and covers basic information (age, sex, birth order, lifestyle, number of school absences), nutrition assessment (height, weight, body mass index), systems assessment, spirometry report, etc.

- Revised Cystic Fibrosis Questionnaire

The version for the parents of 6 to 11-year-old children was completed through interviews, and the version for 11 to 13-year-old children was filled out by the child, as a self-report (Groeneveld I. SE, 2012; Henry B. AP, 2003). In order to assess health-related quality of life, the translated Farsi version of the questionnaire was received from the translator and used in the study.

A study was conducted by Ariafar (2016) in Iran to examine the face validity and the content validity of the Farsi version of this questionnaire, the results of which show that all the items of both Farsi versions (parents and children) have acceptable face and content validities. Based on this finding, for all the items, the CVR was calculated to be above 0.49; the CVI, above 0.79; and the impact score, above 1.5 (Talebi M., 2016).

2.1. Revised Cystic Fibrosis Questionnaire (the version for 11 to 13-year-old children)

The questionnaire has 35 main items, 16 of which are scored on a 4-point Likert scale including *always*, *often*, *sometimes*, and *never*. Other 19 items have true/false answers including *absolutely true*, *somewhat true*, *somewhat false*, and *absolutely false*. The obtained scores fall between 0 and 100, and higher scores indicate a better quality of life.

2.2. Revised Cystic Fibrosis Questionnaire (the version for the parents of 6 to 11-year-old children)

The parents' report of the health-related quality of life in the children with cystic fibrosis are assessed using Parent CFQ-R, which consists of 44 items with 4 options. The scores range from 0 to 100, and a higher score indicates a better quality of life.

In the present study, in order to determine the qualitative content validity of the CFQ-R (both versions: for parents and for children), the questionnaires were distributed among 10 faculty members of the School of Nursing and Midwifery, Shahid Beheshti University of Medical Sciences. In addition, in order to examine the face validity, the scale was provided to 10 children and 10 mothers meeting the inclusion criteria. Then the internal consistency reliability and the stability reliability were measured. To examine the internal consistency, the Cronbach's alpha was calculated to be 0.89 and 0.81, and the ICC, 0.94 and 0.91, for the Parent's Version and the Child's Version of CFQ-R, respectively.

In this study, after obtaining the necessary permits, offering explanations to the parents, and receiving written informed consents, the sampling was done from Oct 2012 to Feb 2021 (Fig. 1).

At first, the basic data were collected through the researcher-developed demographic and clinical information questionnaires for examining the children and CFQ-R, in both control and intervention groups, after informed consent forms were signed by the parents. The patients in the control group received routine follow-ups, i.e., monthly visits to the cystic fibrosis clinic, and taking the prescribed medications. In the intervention group, pulmonary rehabilitation was performed. The educational content of the sessions and breathing exercises were provided by the research team in the form of a booklet and based on the references of Cystic Fibrosis Foundation documents. Text reviews were done and offered in a booklet by the research team, whose validity was approved by the professors of Pediatric Nursing Department of the School of Nursing and Midwifery of Shahid Beheshti University of Medical Sciences, a pediatric gastroenterology and pulmonology specialist, a physiotherapist, and a nutritionist. Moreover, the researcher was instructed in performing physical exercises by a physiotherapist in a physiotherapy clinic. The training was recorded as videos due to the children's lack of presence in the hospital. The physical

exercises were provided as CDs, and the educational content, in the form of booklets for the parents and stories for the children. Besides, the educational videos were uploaded in the WhatsApp group. The educational content included familiarity with cystic fibrosis and pulmonary rehabilitation, chest physiotherapy through several different approaches, medications and oxygen therapy, the management and the prevention of attacks, and tips on a healthy lifestyle.

Due to COVID-19 pandemic, the intervention was done in 12 sessions (1 in-person and 11 remote sessions) during 6 weeks, in two parts, including education and exercises. At the end of Week 6, after the intervention was completed, CFQ-R was completed in both control and intervention groups. Again, 8 weeks after the intervention, the questionnaires were sent to the mothers' WhatsApp accounts and completed by them.

At the end, in order to observe ethical considerations, the researcher provided the control group subjects with all the educational content in the form of booklets, and the physical exercises as videos in the form of CDs.

In this research, Kolmogorov–Smirnov test was used to examine the normality of the data and the student's t-test, to compare the mean scores between the intervention and the control groups. Repeated-measures ANOVA was also applied with the aim of investigating the relationship between the qualitative variables of the research, in both control and intervention groups. The results were then analyzed using SPSS V25 considering the level of significance of 0.05.

Results

In this study, 47.1% of the children with CF were girls, and 55.7% of them were elementary school children. In addition, 55.7% of them were firstborn, 90% of them lived with their parents, 95.7% had Iranian citizenship, and 4.3% were non-Iranian. According to the results, no significant difference in the variables gender, education, birth order and living with family members was observed between the children in the intervention and control groups. For all demographic variables, the frequency distribution is similar in both groups (P-value < 0.05).

The mean scores of QOL dimensions in children were measured prior to the intervention, and immediately after it, and 8 weeks after it in both groups, as displayed in Table 1 (P-value > 0.05).

Table 1.Comparison of the mean dimensions of quality of life in children with cystic fibrosis in each group over time

QOL Dimensions / Group		Control (n = 35) Mean (SD)	Intervention (n = 35) Mean (SD)
Physical functioning	Pre-intervention	48.41 (20.77)	50.79 (20.11)
	Immediately after the intervention	46.46 (18.31)	66.03 (16.67)
	8 weeks after the intervention	46.45 (18.16)	68.69 (13.18)
	P-value*	0.16	<0.001
Emotional state	Pre-intervention	56.83 (19.75)	59.73 (17.27)
	Immediately after the intervention	49.52 (21.41)	71.33 (14.55)
	8 weeks after the intervention	49.50 (21.36)	70.21 (17.15)
	P-value*	<0.001	<0.001
Body image	Pre-intervention	52.02 (23.35)	57.14 (27.76)
	Immediately after the intervention	46.67 (22.99)	70.16 (19.01)
	8 weeks after the intervention	49.52 (23.69)	66.67 (23.23)
	P-value*	0.03	0.01
Eating disorders	Pre-intervention	54.13 (24.34)	62.69 (27.16)
	Immediately after the intervention	49.05 (19.17)	72.22 (23.72)
	8 weeks after the intervention	52.38 (18.19)	78.57 (19.71)
	P-value*	0.15	<0.001
Treatment burden	Pre-intervention	50.16 (18.15)	54.92 (18.66)
	Immediately after the intervention	49.52 (17.74)	66.98 (16.93)
	8 weeks after the intervention	49.21 (17.10)	67.30 (19.223)
	P-value*	0.91	0.001
Respiratory symptoms	Pre-intervention	57.30 (19.99)	60.39 (23.11)
	Immediately after the intervention	53.81 (20.27)	68.49 (17.86)
	8 weeks after the intervention	52.54 (20.66)	68.84 (20.40)
	P-value*	0.02	0.01
Digestive symptoms	Pre-intervention	58.73 (24.19)	68.69 (25.54)
	Immediately after the intervention	57.13 (25.73)	76.19 (21.91)
	8 weeks after the intervention	58.41 (24.00)	73.96 (23.24)
	P-value*	0.75	0.11
Social limitations	Pre-intervention	17.55 (24.19)	23.40 (30.10)
	Immediately after the intervention	16.73 (23.25)	27.76 (24.83)
	8 weeks after the intervention	18.91 (26.19)	28.16 (37.37)
	P-value*	0.35	0.10

- **Single factor repeated measures ANOVA (intraclass comparison)**

In order to determine the changes in QOL dimensions over time, a pairwise comparison was done using Bonferroni correction. The results are displayed in Tables 2 and 3 for the intervention and control groups, respectively.

Table 2
Results of Bonferroni's pairwise comparison test to compare the mean dimensions of quality of life in children with cystic fibrosis in the intervention group over time

QOL dimensions	Time	Pre-intervention	Immediately after the intervention	8 weeks after the intervention
Physical functioning	Pre-intervention	-	**-15.24	**-18.20
	Immediately after the intervention	-		-2.96
Emotional state	Pre-intervention	-	**-11.59	**-10.47
	Immediately after the intervention	-	-	1.12
Body image	Pre-intervention	-	**-13.01	-9.52
	Immediately after the intervention	-	-	3.49
Eating disorders	Pre-intervention	-	**-9.52	**-15.87
	Immediately after the intervention	-	-	-6.35
Treatment burden	Pre-intervention	-	*-12.06	*-12.38
	Immediately after the intervention	-	-	-0.32
Respiratory symptoms	Pre-intervention	-	*-8.09	-9.44
	Immediately after the intervention	-	-	-1.35
Digestive symptoms	Pre-intervention	-	*-7.30	-5.08
	Immediately after the intervention	-	-	2.22
Social limitations	Pre-intervention	-	*-4.35	-4.76
	Immediately after the intervention	-	-	-0.41
Energy and wellbeing	Pre-intervention	-	**-14.47	*-10.28
	Immediately after the intervention	-	-	4.19
Educational performance	Pre-intervention	-	*-7.94	-2.22
	Immediately after the intervention	-	-	*5.71
Overall perception of	Pre-intervention	-	-4.44	5.08

health

QOL dimensions	Time	Pre-intervention	Immediately after the intervention	8 weeks after the intervention
	Immediately after the intervention	-	-	*9.52
Weight	Pre-intervention	-	-10.47	*-15.24
	Immediately after the intervention	-	-4.76	-

** P-value < 0.001, * P-value < 0.05

With regard to the dimensions *physical functioning*, *emotional state*, *eating disorders*, *treatment burden* and *energy and well-being*, the differences in the mean scores obtained prior to the intervention, immediately after it, and 8 weeks after it were negative and significant, which indicates an increase in the mean score and the significant impact of time. In the dimensions *body image*, *respiratory symptoms*, *digestive symptoms*, *social limitations* and *educational performance*, the differences in the mean scores were negative and significant before and immediately after the intervention, indicating the significant impact of time immediately after the intervention. In the dimension *overall perception of health*, the only significant difference was observed between the mean scores obtained immediately after and 8 weeks after the intervention, with a positive value, indicating a decrease in the average perception of health. In regard with the dimension *weight*, the difference between the mean scores obtained before the intervention and eight weeks after it was negative and significant, showing an increase in the mean score over this period of time.

Table 3
The results of Bonferroni's pairwise comparison of the mean scores of QOL dimensions in children with cystic fibrosis in the control group over time

QOL dimensions	Time	Pre-intervention	Immediately after intervention	8 weeks after the intervention
Physical functioning	Pre-intervention	-	1.95	1.96
	Immediately after the intervention	-	-	0.01
Emotional state	Pre-intervention	-	**7.31	**7.33
	Immediately after the intervention	-	-	0.02
Body image	Pre-intervention	-	*6.35	3.50
	Immediately after the intervention	-	-	-2.85
Eating disorder	Pre-intervention	-	5.08	1.75
	Immediately after the intervention	-	-	-3.33
Treatment burden	Pre-intervention	-	0.64	0.95
	Immediately after the intervention	-	-	0.31
Respiratory symptoms	Pre-intervention	-	3.49	4.76
	Immediately after the intervention	-	-	1.27
Digestive symptoms	Pre-intervention	-	1.60	0.32
	Immediately after the intervention	-	-	-1.28
Social limitations	Pre-intervention	-	0.82	-1.36
	Immediately after the intervention	-	-	-2.18
Energy and wellbeing	Pre-intervention	-	*3.61	*3.81
	Immediately after the intervention	-	-	0.20
Educational wellbeing	Pre-intervention	-	6.35	6.35
	Immediately after the intervention	-	-	0
Overall perception of	Pre-intervention	-	2.54	2.23

QOL dimensions	Time	Pre-intervention	Immediately after intervention	8 weeks after the intervention
health				
	Immediately after the intervention	-	-	-0.31
Weight	Pre-intervention	-	-9.25	-8.57
	Immediately after the intervention	-	-	0.95

** P-value < 0.001, * P-value < 0.05

In the dimension *emotional state*, the difference between the mean scores obtained before, immediately after and 8 weeks after the intervention was positive and significant, showing a decrease in the mean score. In the dimension *body image*, the difference between the mean scores obtained before and immediately after the intervention was positive and significant. In the dimension *energy and wellbeing*, the difference between the mean scores obtained before, immediately after, and 8 weeks after the intervention were positive and significant, indicating a decrease in the mean scores.

The mean overall QOL scores in both groups before, immediately after, and 8 weeks after the intervention were measured, as displayed in Table 4.

Table4. A comparison of mean overall scores of QOL in children with cystic fibrosis in the control and intervention groups

QOL / Group		Control (n = 35) Mean (SD)	Intervention (n = 35) Mean (SD)	P-value
The mean overall score of QOL	Pre-intervention	41.29 (26.11)	47.63 (26.19)	*0.31
	Immediately after the intervention	34.91(22.59)	63.78 (25.66)	**<0.001
	8 weeks after the intervention	35.54 (21.63)	61.86 (22.69)	**<0.001
P-value		***<0.001	***<0.001	

*** Independent t-test**

** Two-factor repeated measures ANOVA (interclass comparison)

*** Single-factor repeated measures ANOVA (intraclass comparison)

According to the results, the mean scores of QOL dimensions in the children with cystic fibrosis were significantly different in the intervention and control groups immediately after the intervention (P-value < 0.001). The mean scores of QOL dimensions in these children were also significantly different in both groups 8 weeks after the intervention (P-value < 0.001).

Discussion

The general purpose of this study was to determine the impact of pulmonary rehabilitation on the quality of life in the schoolchildren with cystic fibrosis. The findings of this study showed the positive effect of pulmonary rehabilitation on the quality of life in the children with cystic fibrosis in the intervention group compared to the control group.

The results of this study report low scores of QOL in both groups before the intervention. The results of some studies also indicate poor quality of life prior to the intervention in the patients with chronic diseases, which is in line with the findings of the present study. The results of a study conducted on the impact of exercise training on the quality of life and mental functioning in the children with congenital heart disease showed that the level of physical activity and exercise in children who underwent surgery is low, which could reduce their quality of life (KHW., 2017). Another study investigating the effects of parental education on improving the quality of life in the children with cognitive disabilities indicate that the quality of life in these patients was low before the intervention (PaswanAKP., 2021). Moreover, in another study that examined the impact of pulmonary rehabilitation in the children with uncontrolled and partially controlled asthma, the results show that the quality of life (symptoms, activity, the effects of the disease, the overall QOL score, social and physical functioning, physical health, general and mental health, pain, happiness and vitality) is low in these patients, and that the patients with uncontrolled asthma have even much poorer quality of life (SHaN., 2018). In a 2020 study on the impact of pulmonary rehabilitation and nutritional support on quality of life and functional status in the patients with chronic obstructive pulmonary disease, the results showed that the scores of three QOL dimensions (symptoms, activity and the effects of the disease) and the overall QOL score are low in these patients (Korkmaz C. DS, 2020).

Health has different aspects, each of which can change the quality of life. Chronic diseases, due to their nature, can affect one or more aspects of one's health and influence the quality of life. Inappropriate diet due to the disease, the lack of physical activity and exercise, the lack of symptom control and not following the treatment procedures, inappropriate care, no care follow-ups, unskilled caregivers, the lack of knowledge and the lack of patients' training are the factors that can affect one's quality of life. Another factor is impaired mental health in patients and caregivers due to frequent hospitalizations, the lack of hope for recovery, frequent follow-up treatments, the nature of the disease, pain and specific behaviors in patients and caregivers that can reduce quality of life (Modanloo Sh. RC, 2018; Taghizadeh B. MA, 2017).

Due to COVID-19 pandemic, the sampling was prolonged and there were difficulties in applying face-to-face interventions.

Conclusion

In the present study, the quality of life in the children with cystic fibrosis, as a chronic disease, was improved immediately after and 8 weeks after pulmonary rehabilitation sessions were done, and child care follow-up procedures were performed by the mothers. The results of some other studies indicated improved quality of life after the intervention, which were in line with the current findings. A clinical trial

study investigating the impact of pulmonary-rehabilitation-based ERAS program on pulmonary complications, pulmonary functioning, and the quality of life after lung cancer surgery showed that health-related quality of life improves after pulmonary rehabilitation (Zheng Y. MM, 2020).

In a 2018 clinical trial which examined pulmonary functioning, aerobic capacity and the quality of life during 10 weeks of aerobic exercise training in in schoolchildren with asthma, it was found that several weeks of aerobic exercises can have positive effects on pulmonary functioning, aerobic capacity and the quality of life in these children (Abdelbasset W. A, 2018). Another study investigated the impact of respiratory interventions and primary palliative care on the quality of life and the mental health of the patients with cystic fibrosis and followed up with them for 3 and 6 months. The results showed that the interventions enhanced the patients' quality of life, and also reduced depressive symptoms in them (Friedman D. LR, 2019). Due to the respiratory problems, the patients with cystic fibrosis and asthma usually avoid exercising, while exercise can strengthen the respiratory muscles, remove airway secretions, and affect the patient's appetite, diet and mental health, helping to improve the quality of life.

However, the results of a study conducted in Colombia (2018) on the impact of pulmonary rehabilitation and training in the patients with asthma show that the quality of life improved only in the dimension physical activities, with no significant change in other dimensions. Thus, these findings are inconsistent with the results of the present study, which show improvement in all QOL dimensions (Betancourt-PeñaJea, 2018). According to the components of the program implemented in the Colombian study, the pulmonary rehabilitation program focused mostly on exercising and strengthening the respiratory muscles, while training in other dimensions was limited to one theoretical session, which can explain this inconsistency with the present study.

The results of the present study, which investigated the impact of pulmonary rehabilitation on the quality of life in schoolchildren, show that performing pulmonary rehabilitation and providing follow-up care and education for mothers and children can help improve children's quality of life in all dimensions. One of the advantages of this intervention is focusing on doing the physical exercises that have helped to improve the children's physical condition. According to the results of the study, it can be concluded that pulmonary rehabilitation is an effective intervention, and is recommended to improve the quality of life in the children with cystic fibrosis.

It is recommended to perform other studies on the impact of pulmonary rehabilitation in cystic fibrosis patients in other age groups.

The present study followed the codes of human subject protection issued by regional medical ethics committees and is approved by the School of Nursing and Midwifery of Shahid Beheshti University of Medical Sciences under the ethics code IR.SBMU.PHARMACY.REC.1399.074 and the clinical trial code IRCT20161024030474N4.

Abbreviations

$$n \geq 2\frac{(z_{\alpha/2}+z_{\beta})^2\sigma^2}{(\mu_1-\mu_2)^2}$$

ERAS: Enhanced Recovery After Surgery

Declarations

Clinical Application of the Findings

The results should be implemented in the form of thorough and comprehensive pulmonary rehabilitation programs at the patient's bedside and in the related departments and clinics.

Ethical Approval and Consent to participate

The present study followed the codes of human subject protection issued by regional medical ethics committees and is approved by the School of Nursing and Midwifery of Shahid Beheshti University of Medical Sciences under the ethics code IR.SBMU.PHARMACY.REC.1399.074 and the clinical trial code IRCT20161024030474N4 and the participants were in the project by signing the informed consent.

Consent for publication

"Not Applicable"

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Availability of supporting data

"Not Applicable"

Authors' contributions

AB carried out the Pulmonary rehabilitation in cystic fibrosis studies, participated in the sequence alignment and drafted the manuscript. A carried out the Pulmonary rehabilitation. B participated in the sequence alignment. D participated in the design of the study and performed the statistical analysis. C conceived of the study, and participated in its design and coordination and helped to draft the manuscript. All authors read and approved the final manuscript.

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Conflict of interest

Authors declare no conflict of interest.

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Figures

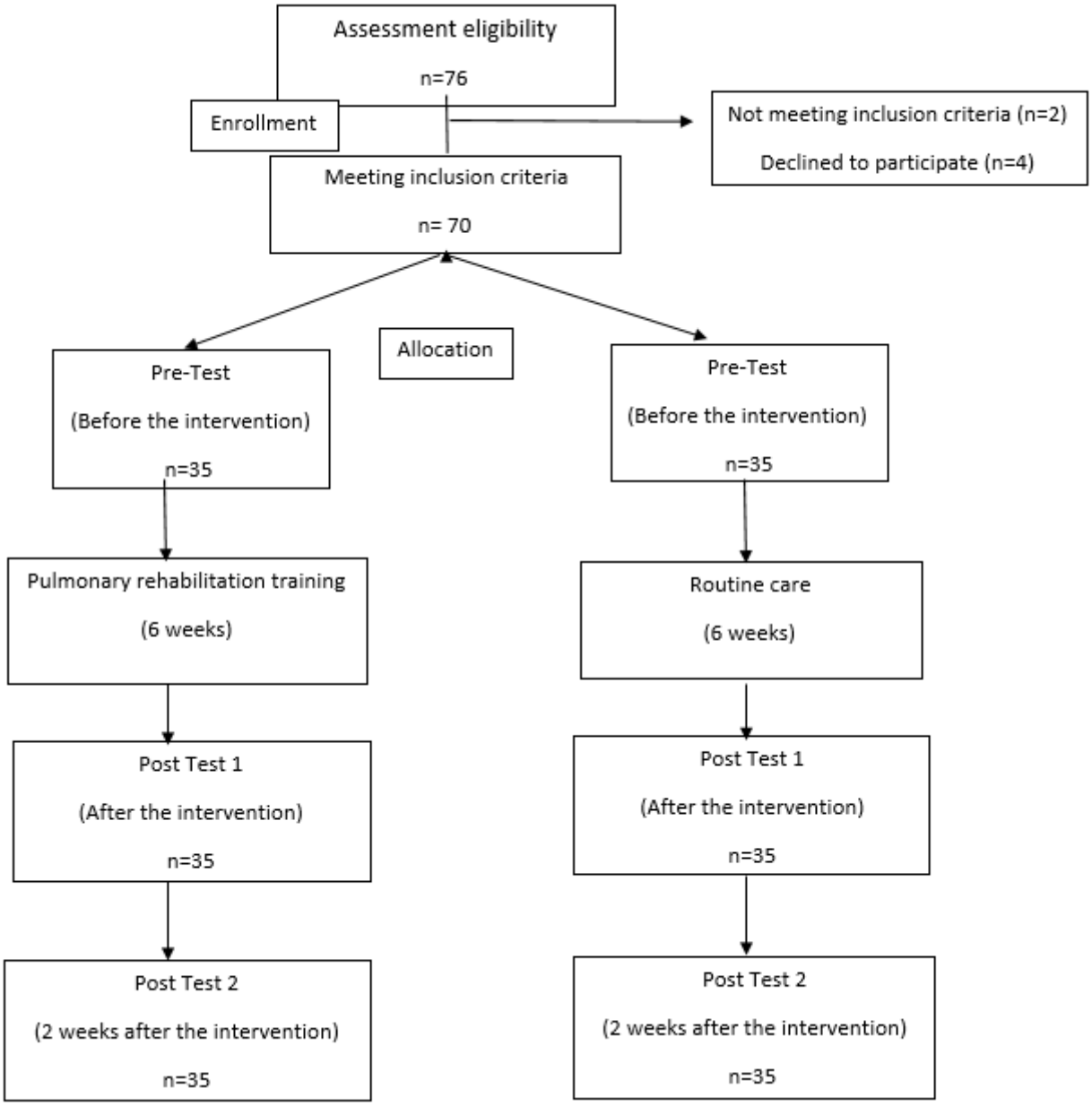

Figure 1

Diagram of CONSORT