Increasing Access to Physical Therapy in Hospitalized CF Patients: A Quality Improvement Study

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Abstract

Physical activity in patients with cystic fibrosis has a known influence on both short term and long term lung function. During hospitalization, these patients often receive a physical therapy consult to prevent de-conditioning, in addition to their scheduled airway clearance therapies. The goal of this study was to increase access and experience with physical therapy in order to encourage CF patients to exercise regularly while hospitalized. The patients were surveyed to determine what types of equipment they would be most likely to use. A grant proposal was submitted to the Palmetto Health Children's Hospital Foundation for funding. After this grant was approved, new physical therapy equipment was purchased and put into use in the children's hospital. Surveys of patients who had access to this new equipment reported increased rates of exercise during their hospitalization and they continued to have interest in additional ways to be more active during their stays. Additional feedback from patients is needed to determine what subsequent options should be offered by PT. Later PDSA cycles are anticipated to broaden the types of activities to include active play toys and equipment which would benefit a wider age range of patients.

Introduction

Cystic fibrosis is a chronic disease that results in progressive obstructive lung disease, chronic malnutrition due to pancreatic insufficiency and ultimately a shortened lifespan. Patients with cystic fibrosis have a defect in the CFTR region of chromosome 7, which codes for a chloride channel that is found in the lungs, biliary tract, pancreas, skin, intestines and vas deferns. This defect results in a dysfunctional chloride channel in mucosal epithelial cells that inhibits proper chloride transport and results in decreased osmotic draw of water into those associated mucus membranes. Because of this dysfunction, patients with cystic fibrosis have inspissated mucous within their lungs which is difficult to expectorate and makes the patients vulnerable to repeated infections and progressive decline in lung function. Additionally, the lack of appropriate chloride transport also results in thickened pancreatic secretions that not only block release of enzymes necessary for nutrient absorption but result in eventual auto digestion of the pancreas[3].

One of the most commonly addressed issues in regards to CF is the effect on the lungs. Thickened mucus, poor ciliary function, frequent bacterial and/or fungal infections and chronic inflammation lead to progressive decline in lung function. Lung function is often measured and tracked by spirometry. Forced vital capacity (FVC) and forced expired volume in one second (FEV1) are two of the most commonly monitored parameters. A severe exacerbation may result in permanently diminished values but even an acute episode of poor airway clearance and infection can result in a transient decline. To slow, if not avoid, both the acute and progressive downward slope of these values, several tactics are typically added to a patient's daily treatment regimen. In the setting of an acute exacerbation, antibiotics, whether oral or IV, are initiated against bacteria that have grown in previous sputum cultures. In order to both prevent exacerbation and hasten recovery, airway clearance therapies (ACTs) are of great value. These

therapies help to mobilize secretions for easier expectoration. ACTs include manual chest physiotherapy, vest therapy, handheld vibratory PEP devices as well as coughing techniques used to help expectorate loosened mucus. These therapies may be used in combination with other inhaled treatments such as albuterol, hypertonic saline and dornase alpha.[3]

There has been investigation by many researchers as to the role that physical exercise may play in regards to airway clearance and overall lung function. A study performed by Alexandra Hebestreit, et al, theorized that physical exercise may serve to increase sputum expectoration secondary to vibratory effects and increased levels of ventilation. Additionally, they theorized that exercise may leads to strengthening of ventilatory muscles as well as possibly alter conductance of sodium channels, leading to less sodium reabsorption and increased mucus hydration as a result of exercise. Their study measured nasal potential differences during exercise and showed that there did seem to be an alteration in sodium conductance during exercise and that this may be partly responsible to benefits noted in CF patients who exercise.[1]

Nancy Van Doorn performed a systemic review of RCTs concerning the role of exercise in children with cystic fibrosis. She found that across these trials, exercise was associated with increased pulmonary function, fitness levels, everyday functioning and survival rates. She also found that there were both short term and long term benefits from an exercise program. Patients who participated in an intensive aerobic workout or a strength training session had a short term increase in their FEV1. Additionally, patients who participated in exercise on a regular basis, not only had these short term effects, but also had a long term benefit of decreased rate of decline in FVC. This was very much in line with her claims that increased aerobic fitness leads to an increase in survival. These outcomes varied by location, the level of supervision provided and the length of time these exercise routines were followed. Of importance was the outcome that noted the most benefit from inpatient exercise regimens, although the consideration was given to the lack of compliance to in-home regimens being a likely contributor to that finding.[4]

In yet another study performed by Schneiderman, et al, they theorized much of the same. They discussed that regular exercise led to increased aerobic capacity, activity levels, quality of life, weight gain, lung function, leg strength and a decreased in decline in lung function. They felt that exercise likely led to increased airway clearance and possible ion channel function as well. The outcome of this study showed that if activity levels increased over time, the patient's rate of decline in their FEV1 decreased. They also discussed the possibility that the patients may have been more compliant during this study than they would have been otherwise because of the supervision they were receiving due to the study. This was noted because their rate of increase in exercise over the course of the study was greater than published exercise rates in their non-CF cohorts.[3]

Lastly, a study performed by Nixon, et al, followed CF patients over an 8 year period and looked at their survival rates in relationship to their aerobic fitness in addition to other risks (age, gender, BMI, FEV1, end tidal CO2). This study found that in measuring their fitness as oxygen consumption at peak exercise (VO2 peak), those with a VO2 peak $\geq$82% had increased rates of survival, even when taking into consideration their other risk factors. Additionally, those patients with the lowest level of fitness (VO2 peak $\leq$ 58%), were 3 times more likely to die during the study as those in the highest level of fitness.[2]

The literature has made it very clear that physical exercise can benefit patients in cystic fibrosis and impact their lung function. Because of this, many hospitals incorporate physical therapy into their inpatient hospital protocols and some CF centers utilize physical therapists for their outpatient quarterly visits.

Palmetto Health Children's Hospital has in place a cystic fibrosis admission order set that is used in conjunction with the general admission order set when a CF patient is admitted. This order set includes a place to consult physical therapy at the beginning of every admission. Many hospital admissions are for a full two weeks of intended IV antibiotic therapy and airway clearance. Physical therapy is an important part of preventing reconditioning during these stays. Many patient are on contact precautions and are restricted from using the play rooms or roaming freely. This often requires that patients spend a significant part of this hospitalization in their room. With mobility decreased just due to infection control concerns, where does this leave the patients who would obviously benefit from more consistent and purposeful aerobic activity?

Arnold Palmer Children's Hospital is another facility in the southeast that has a certified cystic fibrosis center and admits CF patients. During their admissions, older patients have access to a small exercise bike that is brought to their rooms and kept there for the duration of their admission. Upon investigation, there were no similar devices available for the CF patients admitted to Palmetto Health. The one exercise bike available was too small for the older patients interested in using it and there was one small foot pedal device to be used. As there are often several cystic fibrosis patients admitted at any given time, there was neither sufficient quantity, variety or appropriate sized equipment to serve the patient population.

The purpose of this study was to improve the access to exercise equipment for the adolescent cystic fibrosis population. Younger children have access to small ride-on toys and bikes that the teenagers are too large to use. By increasing the availability of equipment, the intention was to have the patients exercising more and to improve their overall physical therapy experience while in the inpatient setting.

This project was undertaken by a small team of providers who felt that increasing access to physical therapy equipment would benefit the cystic fibrosis patients. This included Heather Staples, second year pediatric resident; Trey Brown, pediatric pulmonologist and Vivian Dipner, physical therapist. Their goal was to increase the physical therapy equipment available and to get that equipment into the rooms of CF patients and/or have it readily available for their use throughout their hospital admission.

Methods

In developing the design of this study, the physical therapy team at Palmetto Health Children's Hospital was included in the discussions on how to improve physical therapy access for hospitalized CF patients. Vivan Dipner, pediatric physical therapist, was actively involved in discussing equipment that would benefit the patients during their stay. The plan was originally discussed with the primary team of participants, Dr. Heather Staples, Dr. Trey Brown and Ms. Dipner.

After reviewing the needs of the hospitalized CF patients and the available physical therapy equipment, it was determined that that the greatest need resided with adolescent patients. Younger patients had available to them many options: small ride-on toys, smaller exercise bikes and scooters. The older patients were more limited in their choices of equipment to use. It was decided that an anonymous survey of hospitalized adolescent CF patients would be distributed to gauge where their interests were in regards to exercise equipment. They were given a short 5 question survey to complete (see figure 1). These surveys were collected during late October and early November of 2014. The results of these surveys were compiled and reviewed by Dr. Staples and Ms. Dipner. The available equipment offered by Palmetto Health's distributor was then reviewed and several selections were made as possible options to purchase.

Expanding the repertoire of equipment required financial backing to make possible. The decision was made to submit an application to the Palmetto Health Children's Hospital Foundation. The Foundation offers financial support to endeavors that work to improve the health of children in the community by utilizing Palmetto Health Pillars of Performance and align with the long term strategic plan of the hospital. An application was submitted outlining the goals that would be met by purchasing additional equipment for physical therapy. After reviewing the options with Ms. Dipner and the requests by the patients, it was decided to order:

-Schwinn A6 Airdyne Exercise Bike ($999.00)

-Sammons Preston Resistive Pedal Exerciser ($186.85)

-Cando Standard Wt Dumbbell Set w/ Floor Rack ($434.30)

The intended use for this equipment by the physical therapy department was spelled out in detail and provided to the Foundation committee for review in the application (see figure 2).

After review of the application, the planning team was informed that the Foundation Committee had approved the request for funds and the equipment was able to be ordered. The use of the equipment was reviewed within the team and was soon offered to hospitalized CF patients for use. After their first admission using the equipment, adolescent patients were re-surveyed concerning their experience with physical therapy and how it compared to previous stays (see figure 3.)

In developing this project, several considerations had to be made. First of all, the patients anonymity was protected by having unlabeled surveys distributed and collected. Additionally, the aspect of storage had to planned. Two of the pieces of equipment ordered are rather large in size and physical therapy had to review their current storage options to ensure that the equipment had a place to be kept safe and in good condition for use. Lastly, the inherent issue with hospitalized CF patients is in keeping them from infecting each other. They are not allowed contact with each other while admitted to protect them from passing bacteria between each other. The issues arose concerning the importance of cleaning the equipment adequately between uses. The physical therapy department took responsibility for this role to prevent cross-infections.

In spite of the fact that only one PDSA cycle was completed, additional cycles are anticipated. Because of the need for grant funding, each PDSA cycle takes a significant amount of time to implement. The entire first cycle took approximately 6 months to complete.

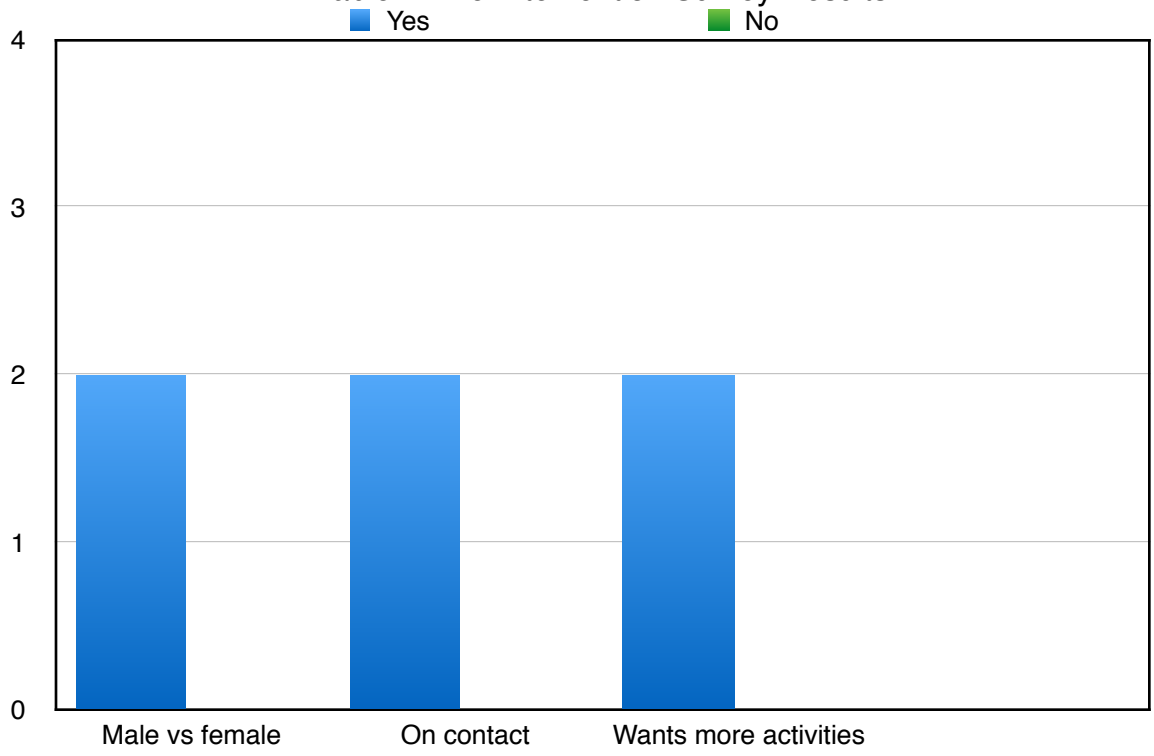
Results

This study was implemented by the core team stated above: Dr. Staples, Dr. Brown and Ms. Dipner. After the submission of the grant application by Dr. Staples, the team was notified of approval for the funds, totaling approximately $2000. At that time, Ms. Dipner placed an order with Patterson Medical Supply for the named equipment. Upon arrival of the equipment, Dr. Staples was notified and the equipment was put into use with the patients. At that time, a follow up survey was constructed and distributed to the patients to fill out.

Due to small number of CF patients admitted during the follow up portion of the study, data points were limited. Additionall surveys are anticipated to be collected over the coming months to continue to round out the feedback concerning this improvement intervention.

In Table 1 below, a summary of the results show that all the respondents who filled out initial surveys were male. Their average age, not listed, was 13 years. The consistent response from the patients was that they desired more activities during their hospitalizations. Additionally, like expected, all the patients surveyed were on contact precautions. This adds an additional

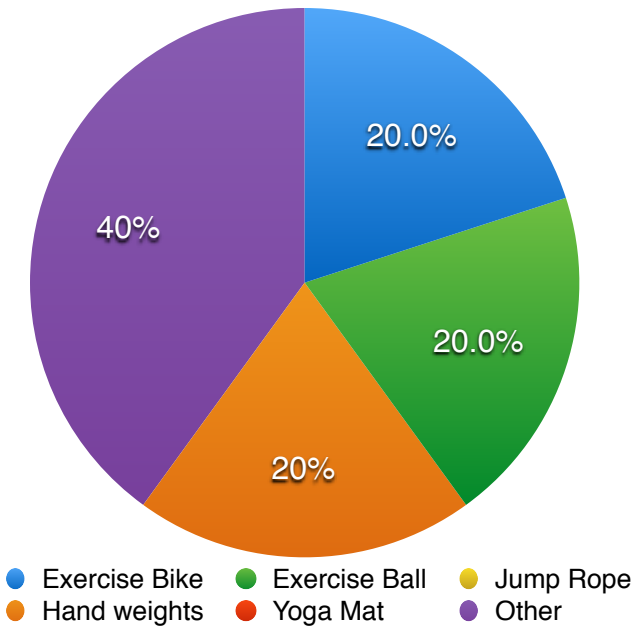
Table 1: Pre-Intervention Survey Results



layer to the patients' restrictions. Most patient scan be in the halls if they have a fresh gown and wear a mask, but they are prohibited from using the well-stocked and enticing play rooms found on each floor of the hospital.

The next table, Table 2, shows the requests made by the patients for equipment. Each patient had the option to fill in a free text space with their own ideas for activities. In the pre-

Table 2: Physical Therapy Requests by Patients

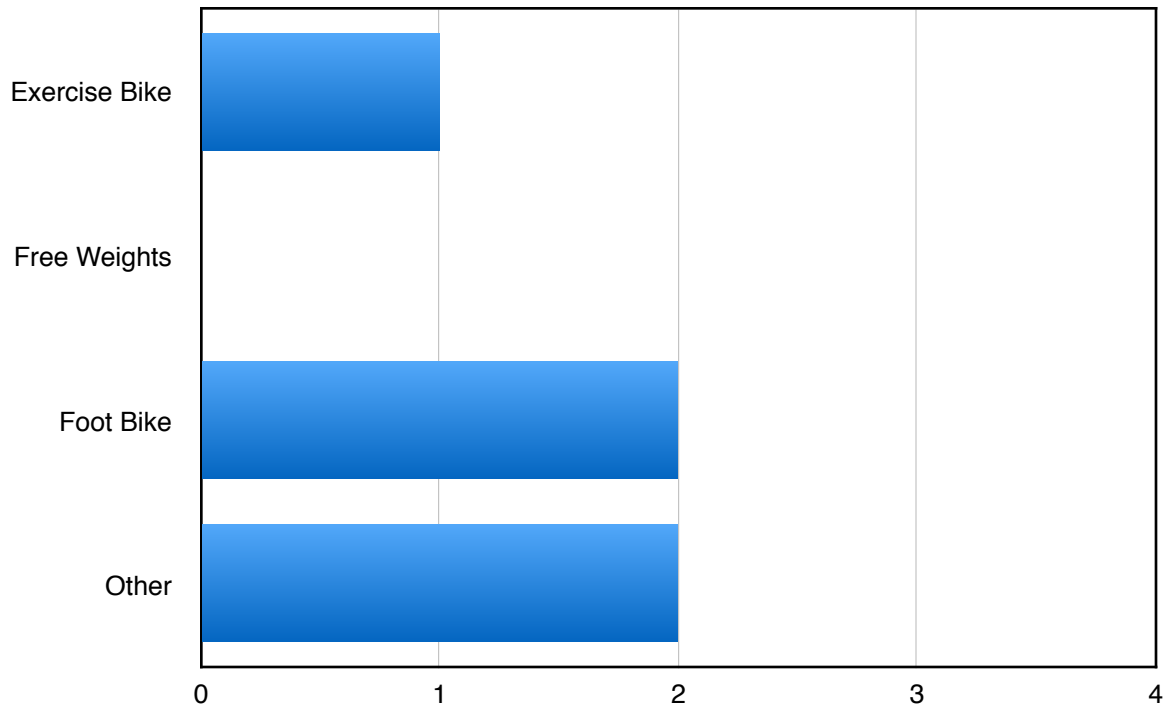


survey, these requests included a treadmill and free weights. Originally, free weights were not considered in the planning meetings but were discussed and priced following these survey results.

In the final table, Table 3, the results of use of the new equipment are summarized. These results are limited by the number of eligible patients hospitalized and available to take the survey after the physical therapy equipment was received and put into use. Additional data is anticipated. In the free-handed comments in the surveys, which are not detailed in the table, patients indicated other equipment they would like to have. This included a “flying turtle”, which is a floor height seat on wheels that works like a bike. Additionally, one patient requested an exercise bike for use. He was given a foot bike for his room and did not have an opportunity to use the new Airdyne bike. This bike is currently having a room renovated for its storage and use by CF patients even with physical therapy is not around to take them to the exercise room. Lastly, some issues arose with the equipment beyond just accessibility to the new bike. The foot bike that was purchased had difficulty with stability on the tile floor of the hospital and impeded use.

In regards to the perception of increased amount of exercise during hospitalization, this resulted in a mixed reviews. Only half of the surveyed patients felt they exercised more than previous stays. This may be due to patient interest or could be secondary to frequent activity at baseline during hospitalizations.

Table 3: Types of Equipment Used Post-Implementation



Discussion

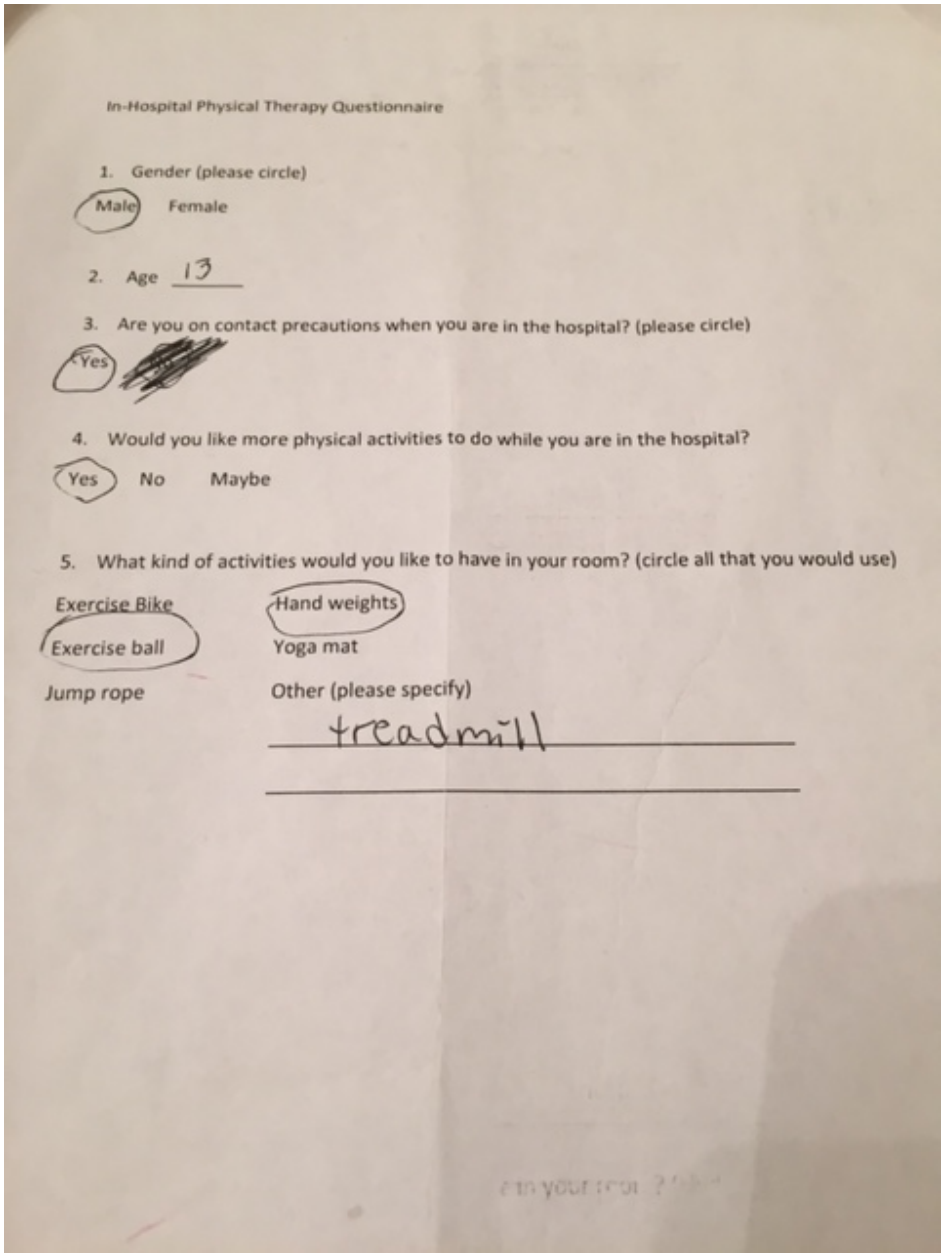
The overall outcome of this study showed that patients did exercise more and had a wider variety of options available to them for physical exercise during their hospitalizations. After the initial study, the patient's requests were strongly considered and free weights were added to the final purchase decision after a request was made. The goal of this intervention was get patients exercising more, as this has been shown to increase both immediate and long term lung function in patients with CF. By utilizing their interests, it was hoped that patients would be more willing to participating in their physical therapy sessions, as well as on their own, during their hospitalizations. The feedback received on the post-survey does seem to support this, with half of all surveyed patients reporting an increased level of activity during their most recent hospitalization.

The limitations to this study are tied closely with the relatively small population of CF patients in the community. Although there are often 2-3 patients with CF admitted at any one time, not all patients were old enough to participate in the study. Additionally, the study coordinators could not anticipate how many eligible patients would be available and admitted, as well as able to take a post-survey during the survey period. This limited the number of surveys completed after the equipment was purchased, but more surveys are anticipated to be completed in the coming months.

Additionally, this study was limited by the funding available to purchase equipment. The foundation at the Children's Hospital was very generous in approving the application for grant funding and that money was utilized to purchase the most variety and best quality equipment possible. The next phase of this study is anticipated to include additional grant requests to expand the options available to the patients. The current idea being discussed includes providing "activity packs" to the younger patients to keep them active. These may include jump ropes, hula hoops, bubbles, foam balls with plastic basketball hoops and other types of play equipment. These packs could cater to the younger patients while some items may be of interest to the adolescent patients as well. The overhead cost for this next phase would be less but if demand increases for the larger equipment, additional pieces may need to be considered for purchase as well.

In conclusion, this study was successful in adding to the arsenal of physical therapy equipment available for cystic fibrosis patients and increased their chances of engaging in activity during their hospitalization. Their activity level is key in maintaining and managing their lung function, especially during a prolonged hospitalization when they are often more immobile than they would be in their home environment. These vulnerable patients will need continued, diligent attention to be sure their hospitalizations provide the benefit they intend to impart.

Figure 1



In-Hospital Physical Therapy Questionnaire

1. Gender (please circle)

Male Female

2. Age 13

3. Are you on contact precautions when you are in the hospital? (please circle)

Yes

4. Would you like more physical activities to do while you are in the hospital?

Yes No Maybe

5. What kind of activities would you like to have in your room? (circle all that you would use)

Exercise Bike
Hand weights
Exercise ball
Yoga mat
Jump rope
Other (please specify)
treadmill

Figure 2

APPLICATION FOR FUNDING FROM
CHILDREN'S HOSPITAL 2015 FOUNDATION

1. Manager and Department

Name: Heather Staples, MD PGY-2 Pediatric Resident

Department: Pediatrics /Manager: Trey Brown, MD (Peds Pulmonology)

Email Address: heather.staples@palmettohealth.org

Phone Number: Work 434-7020/ Cell 407-353-6258

2. Budget Request

*Budget Amount Requested: FY2015 $2020.15

3. Pillars of Performance

Check all that apply:

People____Quality_X__Service_X__Finance____Growth_X__Community_X__

4. Please Include:

A. Program Description

As a quality improvement initiative, the pediatric pulmonology department is requesting funds to expand the physical therapy options available to cystic fibrosis patients during prolonged hospitaizations. Many patients are on contact precautions and are limited in physical activity options outside of their hospital room.

B. Needs Assessment

After review of current equipment available to patients for in-room therapy outside of formal therapy sessions, there are very few items usable for these patients. Currently, there is one portable exercise bike that is intended for small children and not useable for the older children or adolescents. There is also

currently only one foot bike available. Adolescent CF patients were surveyed on interests which included: exercise bikes and hand weights.

C. Goals and Objectives of Program

1. To increase physical activity in hospitalized cystic fibrosis patients

- Provide exercise equipment that will be useable in a patient's room, particularly when the patient is on contact precautions.
- Provide recommendations from physical therapy as to frequency and duration of use of equipment.
- Encourage positive feedback from staff to patient when compliance is noted
- Survey patients on satisfaction re: physical therapy at discharge
- Review improvements in physical therapy results with therapists at discharge

2. To re-inforce physical therapy goals during prolonged stays

- Provide instruction during physical therapy sessions on use of equipment between sessions
- Provide chart for patient's room to document use of equipment between therapy sessions
- Review charts with physical therapist at discharge

D. Target Population

- Inpatient cystic fibrosis patients, particularly aged 10+

E. How does this program contribute to the welfare of the children in this community?

- There are 30,000 cystic fibrosis patients in the country and it is the most common fatal genetic disease in the U.S. The Cystic Fibrosis Foundation guidelines recommend treatment at a certified CF Center. There are only 3 centers that meet this criteria in South Carolina, with one housed at the USC/Palmetto Health facility in 9 Medical Park. Increasing positive patient outcomes through multi-modal interventions improves both patient care and strength of the CF Center here at Palmetto Health.

5. Budget Proposal: (please include)

A. Overall projected program budget: $2020.15

Expenses itemized:

• Schwinn A6 Airdyne Exercise Bike	$999.00
• Sammons Preston Resistive Pedal Exerciser	$186.85
• Cando Standard Wt Dumbbell Set w/ Floor Rack	$434.30

- Shipping $400.00

B. **Projected income itemized:** No projected income

C. Describe specific expenses that will be funded by Children's Hospital Monies: Please see above itemization.

6. Explanation of Need:

A. How does it identify with the current Strategic Plan (Long Range Plan):

- This effort fulfills the Service pillar in working to provide quality service and care to our patients. Physical therapy is a major component of cystic fibrosis care. Physical fitness has been shown to affect pulmonary function, aerobic fitness and strength as reported in a review article in Diability and Rehabilitation in 2010.
- The Quality pillar would also be benefited by this program as it would assist with reducing morbidities associated with poor physical fitness, in particular with lung function in CF patients.
- The Growth pillar is also addressed by this project as it would further the development of care for chronically ill children. It would also expand the capabilities of the physical therapy department in providing a broader scope of care to our hospitalized patients.
- Lastly, the Community pillar is addressed by expanding the options available to our patients who choose to utilize our CF Center and Children's Hospital as the source of their care. Increased physical fitness and activity is known to increase patient's sense of well-being and in turn, satisfaction with their care.

B. **If it does not address the LRP, why should it be funded:** N/A

7. **Other sources of funding which you have sought** (check appropriately and explain):

A. Palmetto Health Funding_____

B. USC School of Medicine_____

C. Other: <u>No other sources of funding have been sought as this is a newly developed quality improvement project.</u>

8. Give detailed explanation of how program would continue after initial funding period:

This project involves purchasing durable medical equipment. There would be no need for initial funding for this project unless the quantity of items proves to be insufficient for the inpatient population needs.

A. **If this is a program that has been funded in the past year, please give justification/need for continued support:** N/A

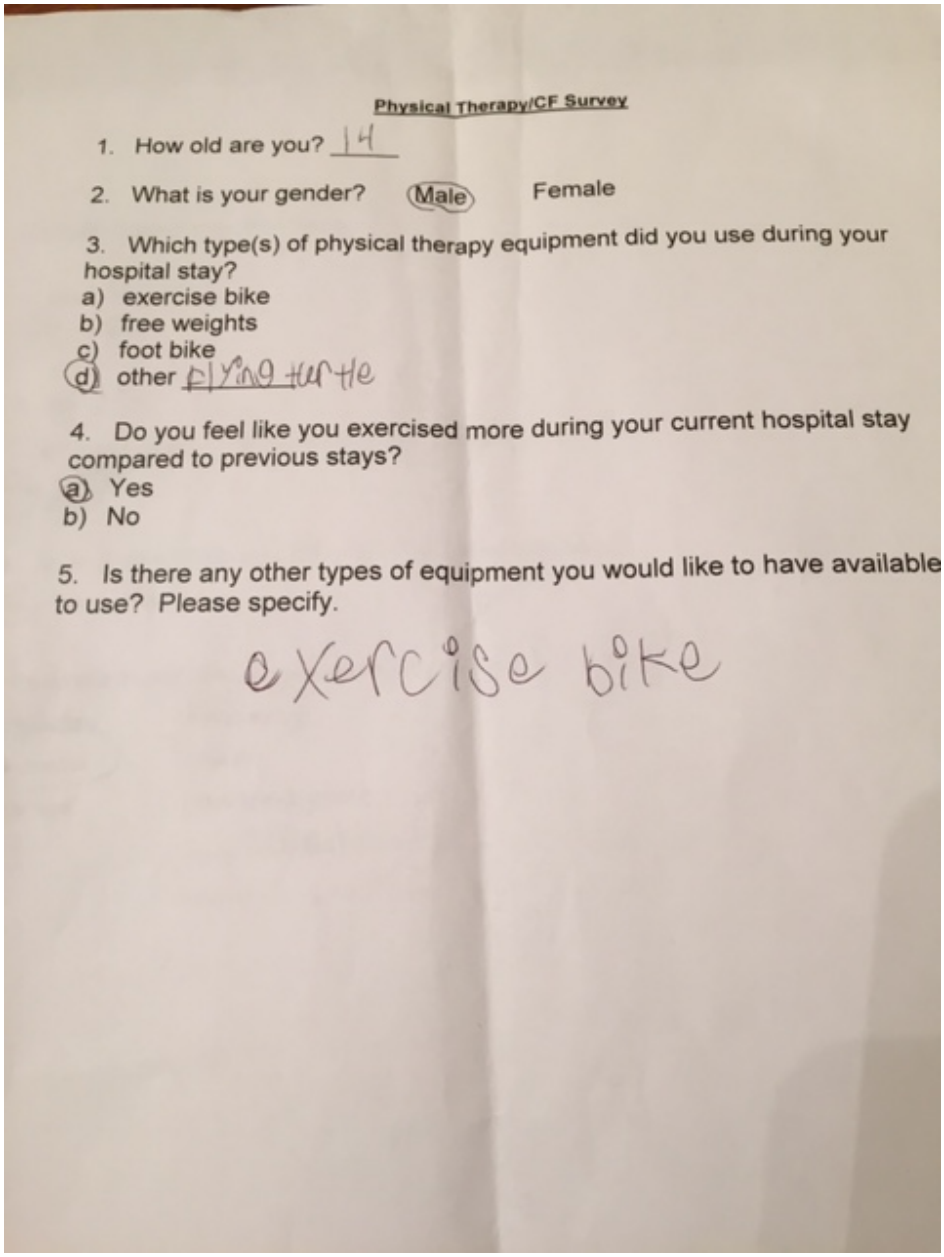
The Children's Hospital Administrative Medical Committee has defined a program for the purposes of distributing funds in this manner:

"A program is a system of services designed to meet the health care needs of a targeted population. A program is supported by a full complement of resources including personnel, equipment, physical space, and time. Once established, the program is recognized by both the professional and lay members of the community for its quality and depth of service. After the initial funding period by the Children's Hospital the program should be financially self sufficient."

Please note that if your request is funded, you will be asked to submit an annual Foundation Stewardship Report and program update at the end of the fiscal year. Your compliance with the review process will reflect upon current and future funding requests.

Signature of requester: _____
Signature of Director/Medical Director: _____
Date of Application: _____

Figure 3



Physical Therapy/CF Survey

1. How old are you? 14

2. What is your gender? (Male) Female

3. Which type(s) of physical therapy equipment did you use during your hospital stay?
a) exercise bike
b) free weights
c) foot bike
(d) other flying turtle

4. Do you feel like you exercised more during your current hospital stay compared to previous stays?
(a) Yes
b) No

5. Is there any other types of equipment you would like to have available to use? Please specify.

exercise bike

Sources

[1]Hebesteit, Alexandra, et al. (2001). "Exercise Inhibits Epithelial Sodium Channels in Patient with Cystic Fibrosis." *American Journal of Respiratory Critical Care Medicine*. Vol 164, pp 443-446.

[2]Montgomery, Gregory and Michelle Howenstine. (2009). "Cystic Fibrosis." *Pediatrics in Review.* Vol 30, pp 302-310.

[3]Nixon, Patricia, et al. (1992). "The Prognostic Value of Exercise Testing in Patients with Cystic Fibrosis." *The New England Journal of Medicine*. Vol 327 (No 25), pp 1785-1788.

[4]Schneiderman, Jane E, et al. (2014). "Longitudinal relationship between physical activity and lung health in patients with cystic fibrosis." *European Respiratory Journal.* Vol 43, pp 817-823.

[5]Van Doorn, Nancy. (2010). "Exercise programs for children with cystic fibrosis: A systematic review of randomized controlled trials." *Disability and Rehabilitation.* Vol 32 (1), pp 41-49.