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Effects of a Hospital Based Wellness and Exercise Program on Quality of Life of Children with Severe Burns

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Abstract

Objective—To examine the effect of a 12-week Wellness and Exercise (W&E) program on the quality of life of pediatric burn survivors with burns of ≥ 40% total body surface area. We hypothesized this comprehensive regimen would improve physical and psychosocial outcomes.

Methods—Children were recruited for participation upon their discharge from the ICU. They were not taking anabolic/cardiovascular agents. Seventeen children participated in the W&E group and 14 children in the Standard of Care (SOC) group. Quality of life was assessed with the Child Health Questionnaire (CHQ) at discharge and 3 months. Children completed the CHQ-CF 87 and caregivers completed the CHQ-PF 28.

Results—The mean age of children in the W&E group was 14.07y±3.5 and mean TBSA was 58%±11.8. The mean age of children in the SOC group was 13.9y±3.1 and mean TBSA was 49% ±7.8. ANOVA did not reveal statistically significant differences between the groups. Matched paired t-tests revealed that parents with children in the W&E group reported significant improvements with their children's physical functioning, role/social physical functioning, mental health, overall physical and psychosocial functioning post-exercise.

Conclusions—These results are clinically relevant in that a comprehensive W&E program may be beneficial in promoting physical and psychosocial outcomes.

INTRODUCTION

For the past decades outcome research in burns has focused on assessing psychosocial adjustment of burn survivors. Studies have focused on examination of the physical, emotional, social factors, and health dimensions that affect quality of life and functioning [1]. Research has also emphasized the importance of examining functional outcome variables such as how a person functions in diverse social situations [2–5]. Many researchers have advocated using a combination of generic and burn-specific quality of life measures [6–7].

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CONFLICT OF INTEREST STATEMENT

There are no conflicts of interest for any of the authors, financial or personal. The funding sources had no involvement in the study design, collection, analysis and interpretation of the data.

Several studies have specifically examined the impact of physical limitations on psychosocial adjustment. Leblebici et al. (2006) examined the impact of joint contractures on the quality of life of adults using the SF-36. They found that having one or more joint contracture impacted patients' physical functioning, physical role limitations, bodily pain and vitality and contributed to greater functional limitations. Also, burn size was related to poorer psychosocial outcome [8]. In contrast, Anzarut and colleagues (2004) found that burn size was not associated with quality of life outcome [9]. In a study that compared the perceived quality of life of children with and without hand burns, Dodd et al. (2010) found that initially children with hand burns had poorer outcomes, specifically when related to upper extremity functioning; however, children showed improvements two years post-burn [10]. Pavioni et al. (2010) reported that mobility impairment was associated with pain level and this affected quality of life outcome [11].

Research has found that children with severe burns, > 40% of total body surface area (TBSA), often have hypermetabolic and catabolic physiological responses [12] and this often continues up to 12 months post-burn and can be intensified by inactivity [13]. Hart et al. (2000) reported that the hypermetabolic and catabolic states often lead to loss of muscle mass and extreme weakness for individuals with large burns [12]. Several researchers have reported that the physical weakness experienced with severe burns is often accompanied by pain, tachycardia, increased cardiac work, pulmonary lesions, low bone formation, major operative procedures, malnutrition, poor growth and psychosocial stress [14–18]. Prolonged muscle hypermetabolism and catabolism can interfere with burn survivors resuming normal physical activities. Suman and colleagues found that a structured physical rehabilitation program which included aerobic and resistance exercises implemented at 6 months post-burn improved cardiopulmonary exercise capacity, muscle mass and strength, and pulmonary function [19,20]. Exercise training also decreased the number of major functional surgical interventions for release of major joint contractures required for individuals with large burns [13].

At our hospital, a 12-week Wellness and Exercise (W&E) program that includes weekly psychological counseling and daily sessions of occupational and physical therapy and an exercise program of resistance and aerobic exercise is offered to all children ages 7 and older with burns greater than 40% of the total body surface area. This is based on numerous reports of beneficial physical effects of this program on lean mass, muscle strength, cardiopulmonary capacity [19–23]. The benefit of a 12-week structured aerobic program was reported in a study by de Lateur and colleagues (2007), which found that adults who participated in this program significantly improved in their physical functioning compared to those who participated in the standardized burn rehabilitation program [24]. Similarly, Neugebauer and colleagues (2008) reported that children under the age of 7 who participated in a 12-week rehabilitation program that was augmented with music and exercise significantly improved in range of motion [25].

To our knowledge, only one study has examined the effects of a structured exercise program on quality of life. Grisbrook and colleagues (2012) found that a structured 12-week exercise program improved the quality of life of adult burn survivors and controls [26]. However, the effects of a W&E program in modifying quality of life in pediatric burn survivors have not been reported. If we could establish or provide evidence of the efficacy of exercise training to improve psychosocial health among pediatric burn survivors, it would add another level of evidence to argue in favor of establishing exercise as a crucial part of the standard of care for burn victims.

In this study we assessed the quality of life of pediatric burn survivors upon their discharge from the acute ICU and at 3 months post-discharge. We hypothesized that as a group,

patients who participated in the structured, hospital based W&E program would show significant improvements with their quality of life relative to patients who received the Standard of Care (SOC). We also hypothesized that an organized and structured W&E program would positively affect the psychosocial outcomes of severely burned pediatric patients as assessed by their parents/caretakers and themselves.

METHODS

Design

The University of Texas Medical Branch Institution Review Board approved this study (IRB #04-157). This was a prospective design that consisted of two groups (W&E group and SOC group). The patient/family was approached 1–2 days after admit for enrollment and consenting into the study. Once the patient was 1 week from being discharged or being discharged from the acute ICU, the patient/family was approached again for re-consenting.

When this study was initiated in 2006, patients were randomly assigned into the 12-week structured hospital based W&E program or to a SOC program which included physical and occupational therapy rehabilitation activities and a prescribed written home exercise program. Those who were randomly assigned to the hospital based W&E program were included in the W&E group and those who were randomly assigned to the SOC program were included in the SOC group. After Hurricane Ike, in September of 2008, patients were allocated into the hospital based W&E group or SOC group based on their acceptance to stay for the 12 weeks at this acute burn care facility or to continue a home-based program. A total of 31 patients participated in this study, 16 patients were randomly assigned and 15 patients were allocated. Ideally this study would have consisted of random assignment of patients into one of the two groups throughout the study. This was not possible given the temporary suspension of operations of this acute burn care facility, the rehabilitation needs of the patients, and the past proven success of the hospital based exercise program with regards to improving exercise capacity, muscle mass and pulmonary function [19,20].

Participants

Pediatric burn survivors between the ages of 7 to 18 years, who sustained burns of ≥ 40% of the total body surface area (TBSA), and received their acute treatment at this acute burn care facility, participated in this study. Children under the age of 7 were excluded from the study because they are generally not developmentally able to participate fully in the intense exercise program [27,28] and testing [29,30]. Patients with significant medical conditions such as kidney, heart, or lung diseases which were determined by chart review and physician physical exam were also excluded. Physical examination of their heart and lung must be normal. Their blood pressure and pulse must be in the safe range, although may be slightly elevated for age due to the hypermetabolic state. Blood urea nitrogen (BUN) and creatinine must be in the normal range. Patients who were taking research related anti-hypertensive and/or anabolic agents such as Propranolol and Oxandrolone were excluded from this study. Consent from the parents/caretakers and assent from the patients was obtained and documented prior to participation in the study.

Instrument

The Child Health Questionnaire (CHQ) by Landgraf, Abgetz and Ware (1996) is a comprehensive, self-report instrument that measures health-related quality of life of children [29]. The CHQ is similar in construction to the SF-36 [31]. It assesses both physical and psychosocial dimensions of health among children and adolescents with diverse medical conditions. The CHQ is a Likert questionnaire where respondents specify their level of agreement or disagreement to a series of statements. It was normed on children ages 5 to 18

and is available in different versions, lengths, and languages. It can be used by multiple reporters including children, adolescents, and parents/guardians [29]. The CHQ was not normed on children with burns but has demonstrated stable reliability and validity and has been found to have accurately discriminated between groups with and without medical conditions.

The CHQ was selected for this study to assess the physical, emotional, behavioral, and social well-being of pediatric burn survivors during their acute and rehabilitation phases of recovery. The CHQ-PF 28 was completed by the parents/caretakers for children (ages 7 to 18). The CHQ-CF 87 was completed by children (ages 10 to 18), given that younger children would have difficulty reading and comprehending the questions and rating their own health [29,30]. English and Spanish forms were used and the questionnaire was given in the persons' primary language. For patients and parents/caretakers who had difficulty reading, the questions were read to them either by a trained research assistant or the psychologist collecting the data.

The CHQ-PF 28 is a 28-item questionnaire, which has 13 health concepts ranging in size from 1–3 items. The scales include physical functioning, role/social emotional/behavior, role/social physical, bodily pain, general behavior, mental health, self-esteem, general health perceptions, parental impact – emotional, parental impact – time, family activities, family cohesion, and change in health [29]. The CHQ-PF 28 has variable internal consistency. Information from the normative sample of the CHQ-PF 28 identified reliability coefficients on eight scales ranging from 0.54 to 0.89 [29]. A study from the Netherlands using the parent form of the CHQ-PF 28 with school aged children revealed adequate internal consistency coefficients with the CHQ physical and psychosocial summary measures and the physical functioning scale (Cronbach's $\alpha \geq 0.70$); however, other coefficients were lower [30]. The CHQ-PF 28 demonstrated stable concurrent validity and has been found to have accurately discriminated between groups with and without chronic medical conditions [29,30].

The CHQ-CF 87 is an 87 item questionnaire, which has 12 different health concepts, ranging from 1 to 16 items, to describe quality of life. The scales include physical functioning, role/social emotional, role/social behavioral, role/social physical, bodily pain, general behavior, mental health, self-esteem, general health perceptions, family activities, family cohesion, and change in health [29]. Internal consistency of the CHQ-CF 87 is variable, with some studies showing higher Cronbach's alpha reliability coefficients than others [29]. The CHQ-CF 87 was used with school aged adolescents in Australia to identify their well-being. Results revealed Cronbach's alpha coefficients ranging from 0.75 for physical functioning, 0.89 for mental health, to 0.90 for self-esteem [32]. A comparable study in the Netherlands used this instrument on school aged children and revealed Cronbach's alpha correlations of 0.56 for physical functioning to 0.90 for emotional functioning [33]. The CHQ-CF 87 has demonstrated stable concurrent and discriminate validity [29,32,33].

Scoring of the CHQ (CF 87 and PF 28) followed the guidelines provided in the manual [29], which required summing the items in each scale and recoding and recalibrating them, so that all items were positively scored. Raw scores were then converted to scaled scores (0 to 100). Higher scores indicated better health and quality of life [29].

Hospital Based Wellness and Exercise Program

The hospital based W&E program consisted of various components. First, patients participated in daily physical and occupational therapy sessions, which were tailored for the patient's individual needs. These sessions consisted of positioning and splinting, orthotic treatment of the lower extremity, serial casting, prosthetic interventions if applicable and burn scar management. Second, patients and their caretakers received psychological

counseling to address psychosocial reactions and adjustment to the burn injury. Participants received psychological services once or several times a week depending on the individual needs. Third, there was a supervised, structured, continuous 12-week exercise program which included combined aerobic and resistance training. Patients attended the exercise program 5 days a week. The exercise program was implemented at the 3–6 month post-burn time point when the patients' wounds were 95% healed; the definition of 95% healed being *"7 days after the final autografting procedure"*. Aerobic exercises consisted of approximately 30 minutes of endurance conditioning on a treadmill or cycle ergometer and this was done 5 days per week. Patients exercised at between 70% to 85% of their previously determined peak aerobic capacity (VO_2 peak). All exercise sessions were preceded by a 5-minute warm-up period on the treadmill at an intensity of < 50% of each individual VO_2peak. Resistance exercises consisted of 30 minutes of resistance training, and consisted of 3 sets of 8–12 repetitions of upper and lower body exercises. Eight basic resistive exercises were performed using variable resistance machines or free-weights. The resistive exercises done 3 times per week were: Bench press, leg squats, shoulder press, leg press, biceps curl, leg curl, triceps curl and toe raises. During the first week, the weight or load lifted was set at 50–60% of each individual 3 repetitions maximum (3RM) and performed for 4–10 repetitions for 3 sets. During the second week, the lifting load was increased to 70–75% (3 sets, 4–10 repetitions) of each individual 3RM and continued for weeks 2–6. After this, training intensity was increased to 80–85% (3 sets, 8–12 repetitions) of the 3RM and implemented from weeks 7–12. A rest interval of approximately 1 minute was given between sets. No strength training activities were done outside the supervised training sessions, but both groups attended their normal rehabilitation programs (see Table 1).

Standard of Care Program

The SOC group received a written set of guidelines for physical and occupational therapy and exercise. These activities could be done at home and carried out for 12-weeks. The physical and occupational therapy guidelines included activities to be done at home or included a referral for outpatient physical and occupational therapy, but left to the discretion of patient or family. Patients and their caretakers received psychological referrals and a list of resources if needed for continued psychological services at home. Follow up with these services was dependent on the caretaker. The exercise guidelines included instructions on how to perform combined aerobic and resistance training. It was written based on exactly the same evaluation tests as the hospital-based W&E program. Additionally, it was written as a prescription to be done 5 days a week and implemented at the 3–6 month post-burn time point when the patients' wounds were 95% healed; the definition of 95% healed being "*7 days after the final autografting procedure*". Aerobic exercise prescription consisted of at least 30 minutes of aerobic activities, such as walking, jogging, running, swimming or biking, done 5 days per week. Resistance exercise consisted of 30 minutes of resistance training, which included 3 sets of 8–12 repetitions of overall upper and lower body exercises. Eight basic resistive exercises were prescribed: Bench press (could be push-ups), leg squats (with or without weights), shoulder press, leg press, biceps curl, leg curl, triceps curl and toe raises. All exercises could be done using variable resistance machines or free-weights if available. Therabands or resistive rubber bands were given to all children in case there was no weightlifting machines or dumbbells available. Resistive exercises were done 3 times per week. Because this was an exercise prescription, there was no monitoring, supervision by the hospital staff as this is beyond the capabilities of our resources.

Compliance

Compliance with the W & E program was documented with an attendance log of the patients who showed up to the hospital for their W&E sessions. If a patient did not show up at the

scheduled time, a phone call was made to the patient's apartment or home or the patient was overhead paged. For each patient, an exercise training log was kept by the exercise personal trainer.

Activities prescribed for patients in the SOC group were not monitored as ALL activities whether exercise, physical or occupational therapies were written guidelines or prescriptions. No exercise training logs, logs of physical or occupational therapies were maintained per SOC practice. Psychological referrals were given to those patients requiring additional psychological assistance at home, but follow-up was not monitored.

Surgeries

The number of patients who received surgeries and the total number of surgeries were determined by chart review. The person reviewing the patients' charts was blind to the intervention. Surgeries were documented for the following time point (discharge to 3 months).

Procedure

As mentioned previously, the CHQ-PF 28 was administered to the parents/caretakers of children ages 7 to 18 and the CHQ-CF 87 was administered to patients ages 10 to 18 at discharge and 3 months post-discharge. Patients who participated in the hospital based W&E program were administered the baseline questionnaire upon their discharge from the acute intensive care unit prior to starting the continuous 12-week exercise program. They were administered the subsequent questionnaire at the end of the exercise program. Patients in the SOC group and the parents/caretakers from both groups completed the baseline and follow-up questionnaire at the same time points. Data was collected on children who were admitted to this acute burn care facility between the years 2006 to 2011.

Analysis

The overall research question for this study is whether the hospital based W&E program contributed to significant improvement in the quality of life as compared to those who did not participate in the hospital based W&E program. Three basic questions were derived: 1) were both groups roughly equivalent at baseline; 2) was the improvement in the hospital based W&E group significantly greater than for the SOC group; and 3) was there a significant improvement from baseline to the 3 months within either group? Additionally, we examined if surgery had an impact on outcome.

For this study, data were analyzed using ACCESS and Statistical Analysis System (SAS) software. Grouped information was described using means and ± standard deviations (SD). Changes from baseline to the follow-up assessment were examined in the hospital based W&E and SOC groups. All-time scores were analyzed as change from baseline, with baseline subtracted from the score. A Regression Model was used to compare the two groups for baseline equivalence. Analyses of Variance (ANOVA) were used to examine the differences between groups (hospital based W&E vs. SOC) and time (discharge to 3 months). Matched paired t-tests were used to look at within group improvements from baseline (discharge) to 3 months. The alpha level was adjusted downward and set at ($P<.01$) to control for Type I Error [37].

RESULTS

One hundred and four patients met the criteria for the study and were asked to participate. Of these 104 patients, 99 provided their consent and 5 refused to participate. Thirty-one patients were not taking research related anti-hypertensive and/or anabolic agents such as

Propranolol and Oxandrolone at the time of their participation in the exercise program. The results are based on these 31 patients. Table 2 represents a breakdown of the number of children and parents who completed the CHQ at baseline and at 3 months. Complete data was available for (n=18) children and (n=19) parents/caretaker. Several children and parents/caretakers did not complete the questionnaires at 3 months due to variability with follow up appointments at this acute burn care facility and at the outreach clinics. The CHQ-PF 28 was completed by the parents/caretakers for children (ages 7 to 18) and the CHQ-CF 87 was completed by children (ages 10 to 18).

A total of 31 children (25 males, 6 females) participated in the study. Seventeen children participated in the hospital based W&E program, and 14 children were in the SOC program. Of the study subjects, 30 (97%) were Hispanic/Latino and 1 (3%) was White. The mean age of children at discharge in the hospital based W&E group was 14.07±3.5 years, the mean total body surface area (TBSA) burn was 58%±11.8, and the mean percent 3rd degree burn was 41%±22. The mean age of children at discharge in the SOC group was 13.9±3.1 years, the mean TBSA was 49%±7.8, and the mean percent 3rd degree was 34%±16.0. Children who participated in the hospital based W&E program had larger burns. There were no differences at baseline between the groups in terms of age, TBSA 3rd degree, vertical height, standing weight, and peak exercise cardiopulmonary capacity (VO2 peak) (Table 3). Table 3 also shows the number of patients who received surgery.

As mentioned previously, the CHQ was not normed on children with burns but has demonstrated stable reliability and validity with groups with and without medical conditions. Cronbach's alpha coefficients were obtained to estimate the reliability of the multi-item scales of the CHQ-PF 28 with our sample of pediatric burn survivors. The reliability coefficients were satisfactory for most of the scales. Six of the eight scales had alpha coefficients ≥ 0.70, (physical functioning, family activities, parental-impact time/ emotional, self-esteem and mental health). Two of the eight scales had low alpha coefficients < 0.20, (general health perceptions and general behavior).

A Regression Model was used to compare the two groups for baseline equivalence. Overall, no statistically significant differences were found. However, the groups were not equivalent at baseline with regards to perceived physical functioning. On the CHQ-PF 28 parents with children who participated in the hospital based W&E group reported more difficulty on the role/social physical scale at baseline ($F=8.59$, $P < 0.007$). Similarly, on the CHQ-CF 87, children who participated in the hospital based W&E group perceived more difficulty in their physical functioning at baseline ($F=8.27$, $P < 0.008$). Tables 4 and 5 represent baseline data for parents and children, respectively, and depicts how this sample compared to other groups [29,33].

Analyses of Variance (ANOVA) were used to examine the differences in improvement between groups over time. Overall, statistically significant differences between the groups were not evident with both groups perceiving improvements across time. One significant difference was found between the groups on the CHQ-CF 87 in the area of family cohesion 3 months post-exercise ($F=10.69$, $P < 0.005$). Children who participated in the hospital based W&E program had higher mean scores 3 months post-exercise. Their mean scores increased from 59.3 to 75.0. Children in the SOC program had decreased mean scores at the 3 month time period. Their mean scores decreased from 78.5 to 60.0. It may be that children who return home believed they needed more support to maintain family cohesion during this transition period.

Matched Paired t-tests were done to examine within group improvements from baseline (discharge) to 3 months. On the CHQ-PF 28, statistically significant differences in

improvement were evident for children who participated in the hospital based W&E program in various areas. Parents/caretakers reported significant improvements in their children's functioning post-exercise in the areas of physical functioning, role/social physical, and mental health, as well as on the Physical and Psychosocial Summary Scores. Table 6 represents a summary of these results. On the CHQ-CF 87, statistically significant improvements were reported by children who participated in the hospital based W&E program in the areas of physical functioning and family cohesion post-exercise. Table 7 represents a summary of these results.

Additional analyses were done to determine if children who were randomly assigned or allocated into the hospital based W&E program and SOC program differed across time. Sixteen children were randomly assigned (n=7 W&E group, n=9 SOC group) and 15 children were allocated (n=10 W&E group, n=5 SOC group). Overall, no statistically significant differences were found between the groups. However, significant differences were evident between the groups who were allocated in the area of family activities. Patients who were allocated to the SOC group reported improvements with family activities upon their return home, which is to be expected.

Analyses were also done to determine if having surgical interventions and the total number of surgical interventions influenced the psychosocial outcome. The CHQ PF-28 was used for the analyses given that caretakers completed questionnaires for participants in both groups. Not surprisingly, caretakers of patients who participated in the hospital based W&E group reported reduction in their ability to participate in family activities post-exercise due to their children's surgical interventions (Regression Analyses $F=11.42$, $P < 0.0045$). Other results were not statistically significant.

DISCUSSION

To our knowledge this is the first attempt to examine the effects of a comprehensive, structured hospital based W&E program on the perceived quality of life of survivors of large pediatric burns. For many years researchers have focused on examination of psychosocial outcomes of burn survivors. Some studies have used health related quality of life measures while others have used specific measures of behaviors. We know from the literature that the majority of burn survivors achieve optimal outcomes [9,38–41,46] and that some continue to experience difficulties with physical [8,42,43] and/or psychosocial functioning [8,43–45,47]. We also know that physical rehabilitation supplemented with aerobic and a resistance exercise has had positive effects on the recovery of pediatric burn survivors [19, 20].

We hypothesized that pediatric burn survivors who participated in the hospital based W&E program would differ in their quality of life ratings compared to those who were in the SOC program. This hypothesis was not proven. Results revealed that both groups reported improvements in their quality of life from discharge to 3 months and the amount of improvements that occurred between the groups was not different. It is possible that these results were affected by the lack of consistent randomization and the small sample size.

We also hypothesized that participation in a W&E program would positively affect the physical and psychosocial outcome of severely burned pediatric patients as assessed by themselves and their parents. This hypothesis was partially proven in that children who participated in W&E program perceived improvements in their physical functioning and family cohesion post-exercise. Parents/caretakers of children in the W&E group perceived improvements with their children's overall physical and psychosocial functioning. Specifically they reported improvements on the physical functioning, role/social physical and mental health scales of the questionnaire. Children in the SOC group and their parents/

caretakers did not have statistically significant improvements at post-test. These results are clinically relevant in that exercising and good support systems may facilitate physical and psychosocial recovery and well-being after burn injury.

Landgraf (1999) explained that disease impacts parents and their children differently, so it is not uncommon to observe differences in mean scores between them [48]. One can assume this would be consistent with perceptions about burns and impact ratings on outcome questionnaires. In this study, children who remained at the hospital to exercise had larger burns. Parents with children who stayed at this facility to rehabilitate and their children perceived greater physical impairments at baseline. The results from this study revealed that parents/caretakers with children in the W&E group rated their children on the role/social physical scale lower at discharge than those who did not participate, (approximately 27 point difference in mean scores). They perceived more limitations with their children's abilities to participate in activities and school due to their physical health. Similarly, children in the W&E group rated their physical functioning at discharge lower than those who did not participate, (approximately 19 point difference in mean scores). This might account for the perceived variability in improvement in physical functioning reported by the parents and children of the two groups.

With regards to psychosocial functioning, overall the groups were comparable. However, the parents of children in the W&E program noticed statistically significant improvements with their children's mental health post-exercise. This is consistent with the literature that shows that emotional problems related to trauma can be transient and tend to improve with physical recovery and time [2]. All patients in this study received intense psychosocial services from psychologists and child life specialists throughout the recovery process which may have facilitated their emotional recovery.

Several factors not accounted for in this study may have impacted the results and require further investigation. The influence of parental well-being on proxy report of children's quality of life was not examined. It may be that parents with children who participated in the W&E program were having more difficulty coping with their children's burns and therefore rated their children's physical functioning worse at time of discharge. It is possible that parents with children in the SOC group were more positive about their children's initial recovery and the opportunity to return home with their children's prescribed written home PT/OT and exercise programs. Waters and colleagues (2001) showed that among school based children and adolescents as health status worsened health concerns increased [32]. Therefore, parental and children's perceptions of health status post-burn may differ at various times throughout the recovery process. In addition, psychosocial factors such as availability of resources at home and the community and social support and acceptance have been discussed in the literature to be predictive of outcome [2,5,9,49,50]. These factors were not examined in this study and merit further investigation.

It is important to note that objective baseline values of physical function such as peak cardiopulmonary exercise capacity was not significantly different (24.6 +/− 3.3 mL of oxygen/kg/minute vs 26.9 +/− 6.5 mL of oxygen/kg/minute for the hospital based W&E group vs the SOC group respectively, $P = 0.32$. Therefore, the lower baseline ratings on the CHQ in the area of physical functioning for those who participated in the W&E program appears to have been influenced by their perceptions at that time. This also supports the argument that except for those children in the randomized design, allocation of subjects was done strictly on the basis of which families could stay or agreed to stay 12 weeks, and that peak cardiopulmonary exercise function was not an initial factor in final outcome.

Research by Pantell and Lewis (1987) revealed that differences in parent-child responses regarding health status may be affected by biases such as the tendency to choose the first answer, agree with the interviewer, limited comprehension of negatively worded items and differences in time perception [51]. Several authors have suggested that responses may be affected by difference in abstract reasoning and/or perceptions [1, 29,30]. Therefore, for this study every effort was made to explain questions to children and families with limited educational backgrounds, those who had difficulty reading, those who had difficulty comprehending negatively worded items, and the Likert scale format. However, unfamiliarity with completing questionnaires and comprehension of questions may have influenced these results.

Limitations

A limitation of the current study is that patients were not consistently randomly assigned to the two groups. In addition, the study had a small sample size and unequal distribution of patients who participated in each group. Patients and parents in the W&E group initially had mean scores that were much lower than those in the SOC group, signifying a greater level of initial distress. Therefore, the amount of improvements that occurred between the groups was not greatly different. Further a single center study with Hispanic patients as the majority may not be representative of other pediatric burn patients. It is unknown if cultural factors influenced the perception of participants when rating physical and psychosocial functioning. It is also possible that the limited educational backgrounds of several parents and lack of experience completing questionnaires may have affected the results.

Future Directions

Future research should incorporate a randomized controlled trial to determine the efficacy of an organized, structured W&E program on quality of life of pediatric burn survivors with massive burns. However, the ethical issue of not offering to all patients the opportunity to have contact with professionals in the rehabilitative field might be an obstacle in conducting such a study. Another future area of study should be to use a combination of burn-specific and general quality of life measures to examine the outcome of pediatric bun survivors who participate in a W&E comprehensive rehabilitation program. The use of various measures seems to be preferred in the literature [6]. Research may also focus on the evaluation of content and methods of administration of home exercise programs and the impact on quality of life. A home exercise program provides additional opportunities for patients to receive family support from immediate and extended family as well as the community and may prove beneficial. In addition to home exercise programs providing opportunities for patient support, it also may be an additional burden for the caregivers. Perhaps using structural components of the W & E program may be beneficial to the home exercise program.

Conclusion

Recovery from a burn injury is complex. The results of this study did not find significant differences between those who participated in the hospital based W&E program and the home based SOC program. The limitations of this study may have contributed to the results. However, past literature has found that participation in a structured physical rehabilitation program is beneficial for burn survivors [19,20,24,25]. Those who participated in the hospital based W&E program perceived both physical and psychosocial benefits. Psychosocial recovery from a burn injury is multifaceted and several factors may have influenced the psychosocial outcome of this study. We advocate the implementation of a structured W&E program as a vital rehabilitation tool due to the past proven physical benefits [19,20,24,25] and to promote psychosocial recovery.

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Table 1

Description of Exercise Workouts

Cardiopulmonary Workout Program	
Frequency of sessions	3–5 days per week.
Intensity	70–85% of individual peak aerobic capacity ($VO2_{peak}$) or 50–85% of heart rate reserve (HRR). Heart rate and RPE assessed at regular intervals. *
Time or Duration	Approximately 30 minutes (excluding warm-up and cool-down). Can be interval or continuous.
Modality of Exercises	Treadmill, cycle ergometer, elliptical machine, arm ergometer, rowing machine. Walk/Jog or team activities such as soccer, basketball, and kickball.
Progressive Resistance Workout Program	
Frequency of sessions	3 non-consecutive days per week, 1–2 day(s) rest in between
Intensity: Weight/load lifted and repetitions	Week 1: 50–60% of 3RM for 4–10 reps; Weeks 2–6: 70–75% of 3RM for 4–10 reps, Weeks 7–12: 80–85% of 3RM for 8–12 reps. Slow rhythmic speed.
Number of sets	2–3 sets.
Rest interval	Approximate 1 minute between sets.
Modality of Exercises	10 basic resistance exercises using variable resistance machines, free weights, or resistance bands: 5 for upper body, 5 for lower body, plus 1–3 core exercises.
Exercise type	Multi-joint, assistance, and core exercises involving both the upper and lower body.
Order of Exercises	Bench/chest press, leg press or squats, lateral pulldown or row, leg extension, shoulder press, lunges, biceps curl, hamstring curl, triceps extension, toe raises, and core exercises (abdominals, back, or hip/gluteal muscles).

* Talk test method may also be considered in monitoring intensity of aerobic workout sessions [34]

Note: Exercise workouts developed incorporating basic elements of an exercise prescription according to the American College of Sports Medicine recommendations [35–36]. However, all exercise routines should take into consideration patient's age, limitations and modify program to assure safety, increase compliance and mostly fun.

Table 2

CHQ QUESTIONNAIRES COMPLETED

	WELLNESS & EXERCISE GROUP		STANDARD OF CARE GROUP	
	CHILDREN	PARENTS	CHILDREN	PARENTS
Discharge	15	17	13	14
Discharge – 3 Months	15	15	3	4

Table 3

DEMOGRAPHIC CHARACTERISTICS OF PATIENTS

	WELLNESS & EXERCISE GROUP (n = 17)	STANDARD OF CARE GROUP (n = 14)	P VALUE
Gender	15 male/2 female	10 male/4 female	
Age (years)	14.07±3.5	13.9±3.1	0.909
TBSA (%)	58%±11.8	49%±7.8	0.016*
TBSA 3rd degree (%)	41%±22	34%±16	0.347
Height (cm)	153.6±20.2	149.8±18.2	0.59
Weight (kg)	46.3±16.4	44.2±18.7	0.74
Patients who had Surgery			
DC – 3 months	8	0	NA
Total number of Surgeries			
DC – 3 months	10	0	NA
Days from burn to enrollment into study	62.4±26.4	56.8±33.3	0.62
VO_2 peak (mL of O_2/kg/min)	24.6±3.3	26.9±6.5	0.32

Values are expressed as the mean ± SD. TBSA, total body surface area. VO_2 peak, peak exercise oxygen consumption or cardiopulmonary exercise capacity. Exercise and Home, No Exercise groups were similar in age, height, weight, and peak cardiopulmonary exercise capacity. There were no significant differences between the groups in age, TBSA 3rd degree, height, weight, and VO_2 peak. There was a significant difference between the groups in TBSA ($P < 0.05$).

Table 4

BASELINE INFORMATION – CHQ-PF 28

SCALES	W & E GROUP		SOC GROUP		NORMATIVE GROUP
	N	Mean SD	N	Mean SD	Mean SD * Landgraf
Physical Functioning	16	46.5±28.5	13	57.3±24.4	95.0±16.2
Role/Social Emotional/Behavioral	15	64.4±26.6	13	77.0±25.0	92.5±19.1
Role/Social Physical	16	58.3±28.5	14	86.0±21.5	93.7±19.7
Bodily Pain	13	64.6±18.5	13	72.3±15.3	81.3±19.7
General Behavior	17	67.0±17.0	14	69.0±24.4	70.8±18.7
Mental Health	17	60.3±23.5	14	62.5±16.6	79.7±15.5
Self-Esteem	17	72.1±22.2	14	74.0±22.4	80.1±19.1
General Health Perceptions	17	47.0±14.3	14	55.4±20.3	74.0±19.8
Parental Impact Emotional	14	38.4±25.7	12	52.1±24.3	81.3±18.4
Parental Impact Time	17	65.7±25.3	13	65.4±26.8	88.4±20.9
Family Activities	15	63.3±29.3	13	70.2±21.4	91.1±18.9
Family Cohesion	17	69.1±24.0	14	72.9±26.2	72.4±21.6
Change in Health	15	48.0±25.1	13	53.5 ±22.7	
Physical Summary	17	25.7±15.2	14	36.9±9.1	53.2±9.5
Psychosocial Summary	17	41.2 ±8.9	14	42.1±11.3	51.1±9.6

Note:

*The 3rd column compares information provided by Landgraf et al. (1996) about the normative group with the baseline ratings of parents/caretakers in this study [29].

Table 5

BASELINE INFORMATION – CHQ-CF 87

SCALES	W & E GROUP		SOC GROUP		SCHOOL BASED GROUP
	N	Mean SD	N	Mean SD	Mean SD * Raat
Physical Functioning	14	59.7±21.3	13	79.2±12.4	96.8±5.4
Role/Social Emotional	15	80.0±23.5	13	83.8±21.1	92.3±16.8
Role/Social Behavioral	14	82.5±24.5	13	88.0±13.2	91.4±13.7
Role/Social Physical	14	73.0±32.2	13	81.2±18.3	96.5±11.6
Bodily Pain	14	46.4±22.1	13	63.8±23.0	78.2±19.5
General Behavior	15	72.1±14.0	13	82.1±13.0	83.6±10.2
Mental Health	15	65.3±16.2	13	69.2±10.0	78.2±13.0
Self-Esteem	15	68.4±11.7	13	78.3±14.8	75.4±12.5
General Health Perceptions	15	56.0±11.6	13	62.3±15.2	74.6±15.9
Family Activities	15	71.7±22.6	13	77.0±22.3	
Family Cohesion	15	59.3±25.0	13	78.5±25.6	75.7±23.1
Change in Health	14	2.6±1.2	13	2.5±0.9	

Note:

*The 3rd column compares information provided by Raat et al. (2002) on school children with baseline data of children in this study [33].

Table 6

WITHIN GROUP CHANGES FROM BASELINE– 3 MONTHS ON THE CHQ-PF 28

	W & E GROUP			SOC GROUP		
Scales - Time	**N**	**Difference Means**	**t**	**N**	**Difference Means**	**t**
Physical Functioning	13	30.0	4.2*	4	19.4	1.5
Role Emotional/Behavioral	13	23.1	2.6	4	8.3	1.0
Role Physical	14	26.2	3.7*	4	−8.3	−1.0
Bodily Pain	11	12.7	3.1	4	----	----
General Behavior	15	6.4	1.8	4	−6.6	−2.9
Mental Health	15	15.0	4.0*	4	12.5	2.3
Self-Esteem	15	0.8	0.1	4	14.6	1.7
General Health Perceptions	15	4.8	1.1	4	3.1	0.4
Parental Impact – Emotional	12	18.8	2.1	3	−4.2	−1.0
Parental Impact – Time	14	7.1	1.3	4	16.7	1.0
Family Activities	14	7.1	0.8	4	3.1	1.0
Family Cohesion	15	0.0	0.0	4	−6.3	−1.0
Change in Health	12	1.7	0.2	3	28.3	1.8
Physical Summary Measures	15	14.6	4.7*	4	2.8	0.6
Psychosocial Summary Measures	15	6.6	3.1*	4	4.5	1.8

Significance

* $P \leq 0.01$

Table 7

WITHIN GROUP CHANGES FROM BASELINE– 3 MONTHS ON THE CHQ-CF 87

	W & E GROUP			SOC GROUP		
Scales - Time	**N**	**Difference Means**	**t**	**N**	**Difference Means**	**t**
Physical Functioning	13	22.2	3.3*	3	6.2	0.9
Role/Social Emotional	13	0.9	0.1	3	−22.2	−1.3
Role/Social Behavioral	12	−4.6	−0.5	3	−14.8	−1.5
Role/Social Physical	13	5.1	0.4	3	−11.1	−1.0
Bodily Pain	13	14.6	2.2	3	13.3	4.0
General Behavior	14	4.8	1.2	3	1.1	0.2
Mental Health	14	5.9	1.5	3	−0.6	−0.4
Self-Esteem	14	3.3	0.8	3	−4.9	−0.7
General Health Perceptions	14	2.5	0.8	3	−2.8	−0.6
Family Activities	14	−0.3	−0.1	3	8.3	0.2
Family Cohesion	13	18.8	3.9*	3	−16.7	−2.0
Change in Health	12	0.0	0.0	3	0.3	0.5

Significance

* $P \leq 0.01$