Title Page

Title: Adapted Motivational Interviewing to Promote Exercise in Adolescents with Congenital Heart Disease: A Pilot Trial

Running Head: Physical activity in adolescents with CHD

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Abstract

Purpose: To assess a motivational interviewing (MI) intervention to improve moderate-to-vigorous physical activity (MVPA) in adolescents with congenital heart disease. *Design:* Pilot randomized controlled trial. *Methods:* Intervention participants received one-on-one telephone-based adapted MI sessions over 3 months. Outcomes were acceptability, change mechanisms (stage of change and self-efficacy), and limited-efficacy (PA, fitness and quality of life). *Findings:* 36 (66.7%) patients (50.0% male; 15.1±1.5 years) were randomized. Intervention participants completed 4.2±1.2/6 MI sessions, with no improvements in the high self-efficacy or stage of change observed ($p>0.05$). Overall, participants accumulated 47.24±16.36 minutes of MVPA/day, and had comparable outcomes to healthy peers (except for functional capacity). There was no significant difference in change in any outcome by group. *Conclusions:* The intervention was acceptable, but effectiveness could not be determined due to the nature and size of sample. *Clinical Relevance:* Pediatric cardiac rehabilitation remains the sole effective intervention to increase MVPA in this population.

Key Words: Congenital heart disease, physical activity, motivational interviewing

Introduction and Purpose

Congenital heart disease (CHD) occurs in 1% of all live births.[1]There are now over 120,000 adolescents living with CHD in the United States.[2] Depending on the nature of their defects, adolescents with CHD often have impaired functional health status[3,4] and quality of life (QoL).[5] Evidence demonstrates that exercise training is safe in adolescents with CHD, improving functional capacity and muscle strength,[6,7] leading to improved QoL.[8,9]

Clinical practice guidelines for adolescents with CHD include recommendations for physical activity (PA), at levels that are appropriate for the most common cardiac defects.[10] In general, the recommendations state that adolescents with CHD should be encouraged to be physically active to a similar degree as the general population.[10,11] Thus, the majority of adolescents with CHD are recommended to accumulate 60 minutes of moderate-to-vigorous PA (MVPA) daily.[12]

Despite these clinical recommendations,[10] past reports indicate that adolescents with CHD do not engage in sufficient PA.[13-16] In some cases, degree of PA among CHD patients is lower than that of healthy peers.[13] Limited PA in adolescents with CHD may be attributed to parental over-protection, as well as lack of, or inconsistent, activity advice from healthcare providers.[17,18] This could result in patient uncertainty regarding safe and appropriate activities, and ultimately lead to activity avoidance and sedentariness.

Interventions to improve PA in this population include pediatric cardiac rehabilitation.[7] However, these programs are not widely available, and barriers to participation in such supervised programs including transportation, distance and time can

be insurmountable in adolescents with CHD. One approach to behavior change which does not need to be delivered face-to-face is motivational interviewing (MI).[19] MI takes a non-judgmental, patient-centered approach to evoke, not impose, motivation aimed at resolving ambivalence. A meta-analysis of MI interventions targeting PA showed benefits with modest effect sizes.[20] To date, there has only one been one study that used MI to promote PA in adolescents with CHD,[16] however they offered only one MI session in conjunction with a structured exercise programme. Results showed significant increases in MVPA with intervention, but not amongst control participants.

Considering the context of CHD in adolescence and previously-published systematic reviews of exercise training interventions and PA guidelines for the CHD population,[6,7,10,17] an adapted MI intervention delivered by telephone was developed to promote MVPA. The objectives of this pilot trial were to: (1) evaluate the implementation and acceptability of this adapted MI intervention (i.e., adolescent adherence to sessions, impact on intended change mechanisms of self-efficacy and stage of change), and (2) its' limited-efficacy (i.e., whether a new intervention has the capacity of being successful with intended population in a controlled setting)[21] to improve PA (primary outcome), physical fitness, and QoL.

Methods

Design, Setting and Procedure

This was a pilot randomized controlled trial[21,22] of an adapted MI intervention for adolescents with CHD, devised to increase PA. It was a 12-week trial, with 2 parallel groups (intervention and comparison). The research ethics board for Toronto's Hospital

for Sick Children approved this study (number 1000040503). Parental assent was not required.

The outpatient pediatric cardiology clinic list was screened 1-month prior to upcoming patient appointments between March 2013 and March 2015. Eligible adolescents with CHD were mailed information about the study. Patients were asked to call the study coordinator if they had any questions or if they were interested in participating. An opt-out card was available to send back for those who chose to decline participation.

A study coordinator met with patients who did not respond or expressed interest in participating at their scheduled clinical appointments, at which time they were given information about the study and any questions were answered. Informed consent forms were reviewed, and those agreeing to participate signed. An on-site pre-test assessment was then scheduled for a later date.

Randomization & Blinding

Participants were randomly allocated to the intervention or comparison group. An external investigator generated the random allocation sequence, and one of the investigators (A.M.) enrolled and assigned participants to the intervention. A random number generator was used to create blocks of 2 or 4, to achieve 1:1 group randomization within each block by the remote researcher. Assignment was concealed by sealing of tamper-proof, consecutively-numbered envelopes by a researcher remote from the investigators and participants. Participants were assigned the next envelope in sequence.

Participants could not be blinded to group assignment. Study personnel were not blinded to group assignment, with the exception of the exercise physiologist who prepared the individual exercise prescription.

Participants

Adolescents (13-17 years of age) with prior surgical repair of CHD of any type were eligible to participate. Patients who were less than one-year post open-heart surgery, who had exercise contraindication/limitations as identified by the responsible cardiologist (i.e., history of arrhythmias, syncope, hypoxia, pulmonary hypertension), significant cognitive disorders that would hinder the completion of questionnaires and full participation in the MI sessions, or other medical conditions that could influence PA participation were excluded. Because this was a pilot trial,[22] there was no power calculation to determine required sample size to detect a significant difference in the outcomes by group (and hence only limited-efficacy is tested,[21] to inform potential future sample size calculations for a definitive trial).

Study Arms

Comparison - Individualized Exercise Prescription. A Canadian Society of Exercise Physiology-certified Exercise Physiologist (J.S.) prepared a 12-week, individualized exercise prescription for each participant determined by baseline physical fitness (see assessments below), self-reported current activity participation, and any information provided by the participant that could impact exercise prescription (i.e., sport participation, work schedule, religious commitments). The prescription progressively increased in frequency, intensity and duration towards guideline-based PA recommendations for adolescents (60 minutes of daily MVPA).[23] Consideration was also

given to the participant's built environment, previous exercise experience, exercise interests, and personal schedule. A sample exercise prescription for a participant is shown in Appendix 1.

Participants received one telephone call after four weeks and one telephone call after eight weeks by the exercise physiologist to evaluate the need for modification to the prescription. Participants allocated to the comparison group did not receive additional contact beyond these calls.

Intervention: Adapted Motivational Interviewing. In addition to receiving an individualized exercise prescription, participants allocated to the intervention group also participated in adapted MI sessions to explore and resolve ambivalence regarding PA. The intervention was designed to focus on behavior and intrinsic motivation, to be collaborative in delivery, and was aimed at advancing stages of change[24] and increasing exercise self-efficacy. Key MI principles were employed during each session as appropriate, including autonomy, empathy, reflective listening, summaries, and asking open-ended questions.[25] The intervention also took into consideration the participant's life stage as an adolescent, and their growing independence and hence requirement for self-management skills.

The intervention consisted of bi-weekly sessions by telephone over the 3-month period (i.e., 6 sessions). The first session aimed to build rapport with the participant, understand their current views about exercise and general self-reported activity level. The importance of PA in their life and their perceived confidence to change behavior were also assessed, and decisional balance (i.e., advantages and disadvantages of making a change) was explored, as appropriate. Subsequent sessions built on the previous

session(s) with progression towards building a reasonable plan with the participant that would increase their MVPA. Where appropriate and with their permission, information or suggestions were provided to participants regarding exercise techniques based on their progress with the exercise prescription. An outline of the adapted MI sessions is provided in Appendix 2.

The counsellor (A.M.) received training from the MI Network of Trainers (MINT) during a 2-weekend training course. Supervised practice sessions were completed following the training course, where individualized feedback was provided from MI trainers and peers.

Measures

Sociodemographic and clinical characteristics of participants were extracted from medical charts. First, to test the implementation and acceptability of the intervention, the number of completed sessions and the duration of each session were recorded.

Moreover, to test whether the intervention had the intended mechanistic impact, stage of change and self-efficacy were assessed in all participants at pre- and post-test via self-report survey. The Readiness to Change questionnaire[26] is a 4-item survey that was administered to assess the participant's motivation to change PA. It has been validated in a pediatric sample.[27] Scores range from 0-4, with each value representing the following stages respectively: pre-contemplation, contemplation, preparation, action, and maintenance. The Self-Efficacy Scale for PA[28,29] was also administered,consisting of 9 items. Total scores range from 0-90, with higher scores denoting greater self-efficacy. It has been administered in children[20] and adolescents[29] with CHD with good psychometric performance.

Participants were invited to complete the following outcome assessments at baseline and during their post-test visit: PA, physical fitness indicators, and QoL. Again, these were to test limited-efficacy,[21] to support the decision whether to proceed to a full-scale trial and if yes, potential sample and effect-size estimation.

PA. Participants were provided an Actigraph wGT3X-Plus Triaxial Activity Monitor (Actilife, Pensacola, FL, USA). It has been shown to be valid and reliable using treadmill walking at known speed and a laboratory shaker.[30] The accelerometer was to be worn over the right hip during waking hours for 7 days (2-weekend days and 5 weekdays), except when bathing or swimming. Participants were provided with a log-book to record the dates and times they wore the monitor to substantiate data where ambiguous.

Accelerometer data were included where a minimum of 3 valid (i.e., minimum wear time of 10 hours/day) days of data was received. PA intensity was categorized using cut-point conventions by Evenson and colleagues.[30] (sedentary=0-100 counts per minute [cpm]; light=101-2295 cpm; moderate=2296-4011 cpm; vigorous= ≥4012cpm). Minutes per day were averaged at each intensity, and the mean minutes of MVPA per day computed. The primary endpoint was change in MVPA from pre to post-test.

Physical Fitness Indicators. Anthropometric measures included standing height and body weight (to compute body mass index; BMI=kg/m^2), as well as waist circumference (average of two measurements taken at the narrowest point above the iliac crest).[31] Aerobic fitness was assessed using the validated Modified Canadian Aerobic Fitness Test**.**[32,33]Participants were asked to take alternating steps to a set cadence from an audio cue to estimate oxygen consumption; flexibility (Sit and Reach), muscular strength

(grip strength), and muscular endurance (partial curl-up) were also assessed using standard protocols.[33] This collection of tests was selected as it has been previously administered in a representative sample of healthy adolescents as part of the Canadian Health Measures Survey.[34] Their findings were therefore used as a comparator to interpret the results in this study.

QoL. Global and health-related QoL were assessed via self-report surveys. A Visual Analog Scale (VAS) was administered to assess global QoL. The anchors were 0 to represent 'worst possible QoL' and continued to a value of 100 to represent 'best possible QoL'.[35] Dimensions of health-related QoL were assessed using the 23-item Pediatric QoL Inventory (PedsQL™) Teen (13-18) Report.[36] Scores for items in each of 4 domains (physical, emotional, social, school; range 0-100 for each) were used to calculate total health-related QoL, with higher scores denoting greater QoL.

Statistical Analyses

All statistical analyses were performed using SAS version 9.4 (SAS statistical software, Cary NC). First, to compare pre-test characteristics between the MI and comparison participants to verify equivalence between groups through the randomization, the Fisher's exact test for all categorical variables, Student's t-test assuming unequal variance between samples for continuous variables (Satterthwaite methods) were used. Second, differences between participants who were retained versus lost to follow-up were tested using t-tests or chi-square, as applicable. A similar approach was used to test the differences in participant characteristics between those who had valid accelerometer data at both time points versus those who did not.

Q-Q plots were examined to assess whether the outcome variables were normally distributed. To test the first objective (intervention implementation / acceptability and change mechanism), the mean number of sessions in which the intervention group participated and duration was computed. Change in self-efficacy and stage of change scores from pre- to post-test were tested in the intervention group using paired Student's t-test (or Wilcoxon rank sum if not normally distributed) and chi-square, respectively.

Change in outcomes (PA, fitness, and QoL) were analyzed using paired Student's t-tests (or Wilcoxon rank sum if not normally distributed) within group. Change scores were computed, and differences in each by group were analyzed using independent samples t-tests. Given the number of outcomes assessed, a Bonferroni correction was applied, with a p level of <0.006 considered statistically significant.

Results

Participant flow through the trial is shown in Figure 1. Characteristics of randomized participants at baseline are shown in Table 1. There were no differences observed by group, suggesting successful randomization. The mean BMI was in the "normal" range (between 18.50-24.99).[31] There were no differences between participants who were retained and those who were lost to follow-up by age (t=-0.43, p=0.67), sex (χ^2=0.70, p=0.58), or CHD severity (χ^2=0.35, p=0.58).

The number of participants with valid accelerometer data at each assessment point is shown in Figure 1. Overall, there were 11 (61.11%) participants in the intervention group and 12 (66.67%) participants in the comparison group who had valid accelerometer data at both time points for analysis. There was no difference in age (p=0.59) or CHD

severity (p=0.12) among participants with valid accelerometer data and those without or with invalid data; however, significantly more females than males had invalid accelerometer data (χ^2=5.46, p=0.04).

Intervention Implementation/ Acceptability and Change Mechanism

Of the 6 planned sessions, intervention participants completed a mean of 4.20±1.20 sessions. The average duration of the MI sessions was 15.21±4.30 minutes. As shown in Figure 1, 2 (11.2%) dropped out of the intervention, most often citing lack of time.

During MI sessions, participants identified challenges in meeting PA recommendations or goals discussed. Reasons often included personal factors such as spending time with friends or academic priorities (e.g., assignments, exams). Table 2 displays PA self-efficacy and stage of change by time and group. Self-efficacy and stage of change did not differ between groups at pre-test (Wilcoxon rank sum p=0.78; and χ^2=1.72; p=0.66, respectively). Overall, participants reported moderate confidence in being physically active, and most reported being in the maintenance stage at both time points.

There was no significant change observed in the intervention group from pre- to post-test in self-efficacy (t=0.41; p=0.69) or stage category (χ^2=5.81; 0.27; comparison p also n.s.). This disconfirms our hypothesis that the MI intervention would promote greater self-efficacy and advancement through the stages of change.

Outcomes: Limited-Efficacy

Figure 2 displays mean MVPA/week by group and time, with mean minutes of PA per day reported in Table 3 by intensity level. PA was not normally distributed, and

hence Wilcoxon rank sum tests were used. At pre-test, there were no significant differences between groups for time spent in sedentary (p=0.**75**), light (p=0.3**5**), moderate (p=0.2**1**), vigorous (p=0.**7**5), or moderate-to-vigorous (p=0.3**2**) intensity PA, as expected.

The mean MVPA at baseline was 47.24±16.36 minutes per day, corresponding to 78.7% of the daily-recommended amount. Six/24 (25.0%) participants met the 60-minute MVPA recommendation, with the highest value being 77 minutes of MVPA per day obtained at pre-test for one participant. Participants with mild CHD accumulated more MVPA per day than participants with moderate-to-severe CHD at baseline (54.32±15.23 vs. 40.21±14.77 minutes/day, respectively; p=0.03). Females accumulated significantly less MVPA per day than males at baseline (34.70±8.49 vs. 53.55±15.80 minutes/day, respectively; p<0.001).

As shown in Table 3, there were no statistically significant changes in MVPA (or in activity of any intensity) from pre- to post-test within either group, and changes would not be considered clinically meaningful. There was no significant difference in change in MVPA between groups (comparison: 8.40±23.54; Intervention: -13.02±17.37; t=2.11; p=0.05; *r*=-0.11). This disconfirms our hypothesis, and while not significant there was a trend towards lower MVPA with the intervention (likely driven by the trend towards lower vigorous-intensity activity).

Physical fitness indicators are also reported in Table 3. Overall, 8 (22.2%) participants were considered overweight or obese (i.e., BMI >25) at pre-test. With regard to abdominal girth, 4 males (11.1%) were considered at increased or high health risk (i.e., >94cm), while only 1 (2.8%) female was considered at increased health risk (i.e., >80cm).[31] Overall predicted O_2-consumption was low (28.09 ml/kg/min) when compared

to national values for Canadian adolescents without CHD (11-14 years: 51.6 ml/kg/min; 15-19 years: 46.5 ml/kg/min).[36] BMI, waist circumference, flexibility, and grip strength values were comparable to healthy adolescents.[33]

There was no difference at pre-test between groups for any fitness indicator. As shown in Table 3, there were no significant changes in any physical fitness indicator from pre- to post-test in either group. Furthermore, there were no differences between groups for change in waist circumference (t=-0.29; p=0.77), BMI (t=0.53; p=0.60), vertical jump (t=0.71; p=0.48), oxygen consumption (t=0.38; p=0.71), hand-grip (t=0.59; p=0.56), sit-and-reach (t=1.25; p=0.23), or partial curl-up (t=0.58; p=0.57).

Finally, participants reported overall positive psychosocial outcomes at baseline. There were no significant differences at pre-test between groups in global (t=-0.32; p=0.75) or health-related QoL (t=-0.30, p=0.76). There were no significant changes in QoL domains from pre- to post-test in either group (Table 3). Furthermore, there were no differences for global QoL (t=0.57; p=0.58) or total health-related QoL (t=0.47; p=0.64).

Discussion

It is well-established that PA is associated with improved functional status and positive psychosocial outcomes in healthy adolescents[37] and those with CHD,[9] although some mixed findings are reported.[38] This study tested the acceptability, implementation and limited-efficacy of a theory-based intervention to improve MVPA in adolescents with CHD. The intervention was fairly-well received with only a 10% dropout and 70% adherence to sessions. While not powered to observe an impact on outcomes, results did not support the intervention. However, this study is one of few that assessed functional fitness among other objective indicators in adolescents with CHD. The MVPA and

physical fitness of patients in this study were comparable to that of healthy peers,[39] except functional capacity was quite low and one-quarter of participants were overweight or obese.

In regards to the intervention, while the sample size for this pilot study was small, the adapted MI intervention had no discernible impact on stage of change or self-efficacy for PA as intended, and hence not surprisingly had no impact on outcomes (and in fact may have tended to have a negative impact on vigorous-intensity PA). The lack of impact of this intervention could be attributed to several factors, including the high degree of PA and exercise self-efficacy at baseline and that most participants were in the maintenance phase (i.e., selection bias), the adaptation of MI, intervention delivery via telephone rather than in-person, or characteristics of the sole counsellor. Patients may have not considered the intervention to be important, as they engaged PA levels similar to healthy peers at baseline,[36] which was almost 80% of recommended levels.[12] which was almost 80% of recommended levels. Finally, the provision of an exercise prescription and 2 calls with the exercise physiologist in the comparison group may have diminished any intervention effect; the intervention itself as delivered was a total of 60 minutes only over and above these 2 calls (4/6 [67%] planned calls at 15 minutes each on average). The optimal intervention approach (i.e., method of delivery, number of sessions) for inactive adolescents with CHD remains unknown and should be explored in future studies.

In regards to MVPA, the average minutes of MVPA per day of patients with CHD in this study was comparable to published values of healthy children (53 minutes of MVPA for males and 47 minutes of MVPA for females aged 15-19 years old).[39] While the sample in this study may have been more active than the average adolescent with

CHD as they were interested in an exercise study, these results corroborate that adolescents with CHD may not be less active than their healthy peers.[13] Voss and colleagues assessed PA via accelerometry among patients with various CHD defects (n=90, 8-19 years old) and comparably reported 42.6 minutes of MVPA per day.[40] In a study conducted by McCrindle and colleagues of patients (N=108; 7-18 years old) with complex CHD, 38% of patients met current PA recommendations.[15] However, it was curious that although MVPA and other fitness indicators were consistent with healthy peers, functional capacity was much lower. It should be tested whether this finding is robust, and if so future research is needed regarding the effectiveness and mode of the PA in which adolescents with CHD engage.

With regards to time spent in sedentary activity, patients in this study also accumulated relatively similar sedentary minutes as their healthy peers (590 minutes/day vs. 554 minutes/day).[39]This sedentary behavior, representing approximately 74% of their time, was also similar to that reported in patients with CHD (70%).[40]

This study demonstrated favorable psychosocial health among adolescents with CHD. Patients were confident they could be physically active and reported relatively high QoL. The high proportion of patients with simple CHD may have contributed to the high values, and collectively contribute to the high PA participation observed in our study.

Pediatric cardiac rehabilitation should continue to serve as an important venue to promote PA in children and adolescents with CHD. The beneficial effects of such programs on exercise capacity, psychosocial outcomes, and PA have been reviewed previously.[7] Serious adverse events have not been encountered. Perhaps by intervening earlier in this population and over a longer period of time, with those who have lower PA

and self-efficacy, lifelong PA habits can be ingrained, resulting in better physical and psychosocial outcomes. Unfortunately, there are few such programs available; perhaps broader delivery could be achieved by offering home-based services as is available in adult programs.[41] This could also address some of the barriers to adhering to the intervention and MVPA reported by participants in this study.

Physical therapists are well-positionsed to deliver pediatric cardiac rehabilitation programs, as well as provide exercise and behavior change interventions, given their in-depth understanding of chronic conditions like CHD. Furthermore, community-based physical therapists may be integral to support home-based programs and delivery of behavioural interventions like MI for CHD patients where they cannot readily access a center.

Caution is warranted when interpreting these results. First with regard to generalizability, this study was limited to a single institution. Also related to generalizability limits, is that the sample was an active group already in the "maintenance" stage. Due to this selection bias, it is warranted that the intervention is tested in an adequately-powered inactive cohort before conclusions on efficacy are drawn.

Second and related, given this was a pilot study, the sample was small and the lack of intervention effect could be due to low power. The sample size was also reduced due to low retention. This may have introduced bias, particularly considering there were fewer females with valid accelerometer data than males.

Third, with regard to design, the outcome assessor was not blind to condition, and this may have biased the results. Fourth, with regard to analysis, they were not

undertaken on the basis of intention-to-treat. However, with regard to limitations 3 and 4, given the lack of demonstrated intervention effect, these are not a major concern.

In conclusion, this pilot study suggests adapted MI was acceptable to adolescents with CHD, given the low 10% dropout rate and 70% adherence to sessions. However, whether it is an effective approach to improving PA among adolescents with CHD cannot be known, due to the nature (i.e., those who are physically active, confident in their activity, and have good QoL) and size of the sample. Despite engaging in a fair degree of MVPA (~80% of guideline-recommended levels), patients nevertheless had reduced functional capacity and one-quarter were overweight or obese.

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Figure Legends

Figure 1. Participant flow diagram displaying participant numbers by group and completion of study measures.

PA: physical activity assessment by accelerometer.

Figure 2. Mean moderate-to-vigorous physical activity at pre-test and post-test by trial arm, N=23.

Notes: Guideline recommendation is 60 minutes per day. No significant differences by time or group ($p>.05$). This figure represents the maximum and minimum values (top and bottom whiskers, respectively), the IQR (the main box), and median values (horizontal line within the box).

Figures

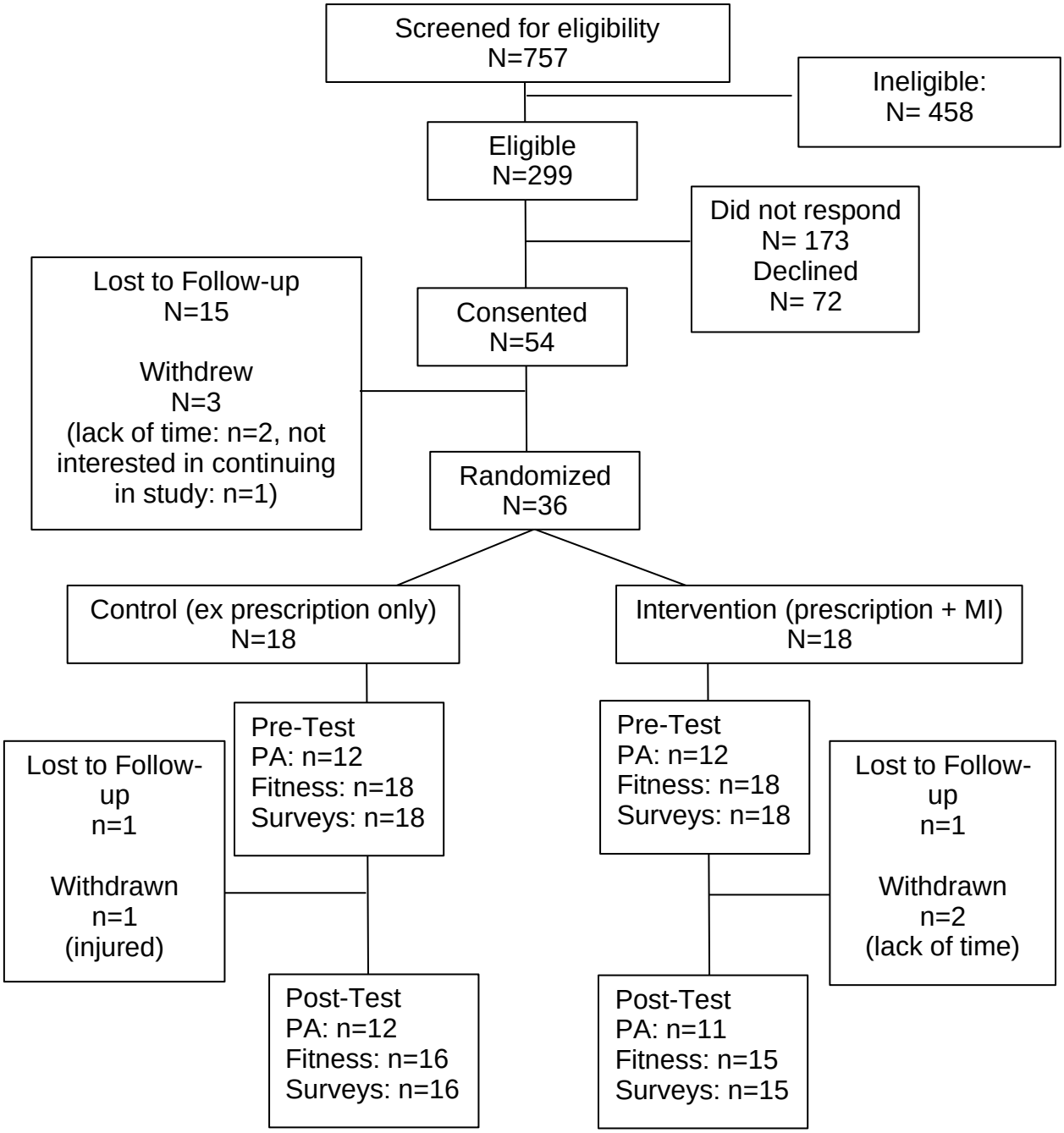

Figure 1. Participant flow diagram displaying participant numbers by group and completion of study measures.
PA: physical activity assessment by accelerometer; ex.: exercise; MI:motivational interviewing.

Tables

Table 1: Sociodemographic and clinical characteristics of participants at baseline, overall and by group (N=36)

Characteristic	Group		Total N=36
	Comparison n=18	Adapted Motivational Interviewing n=18	
Sociodemographic			
Age, years (mean ± SD)	14.48±1.56	15.28±1.53	15.03±1.54
Sex, n (%)			
Male	7 (38.8%)	11 (61.1%)	18 (50.0%)
Clinical			
Congenital Defect, n (% yes)			
Mild	8 (44.4%)	10 (55.5%)	18 (50.0%)
Ventricular septal defect	6 (33.3%)	7 (38.8%)	13 (36.1%)
Atrial septal defect	2 (11.1%)	2 (11.1%)	4 (11.1%)
Aortic stenosis	0 (0.0%)	1 (5.5%)	1 (2.8%)
Moderate	5 (27.7%)	2 (11.1%)	7 (19.4%)
Coarctation of the aorta	2 (11.1%)	2 (11.1%)	4 (11.1%)
Tetralogy of Fallot	3 (16.6%)	0 (0.0%)	3 (8.3%)
Severe	4 (11.1%)	6 (33.3%)	10 (27.8%)
Transposition of the great arteries	1 (5.5%)	3 (16.6%)	4 (11.1%)
Fontan	2 (22.2%)	1 (5.5%)	3 (8.3%)
Pulmonary atresia	0 (0.0%)	1 (5.5%)	1 (2.8%)
Truncus arteriosus	1 (5.5%)	0 (0.0%)	1 (2.8%)
Hypoplastic left heart syndrome	0 (0.0%)	1 (5.5%)	1 (2.8%)
Missing	1 (5.5%)	0 (0.0%)	1 (2.8%)
Weight, kg (mean±SD)	60.44±14.38	60.07±19.06	60.26±16.64
Height, cm (mean±SD)	165.99±8.09	164.77±10.34	165.38±9.17

SD refers to standard deviation.

Note: there were no significant differences by group.

Table 2: Intervention Mechanisms - Physical Activity Self-Efficacy and Stage of Change by time and by group (N=36)

	Group					
	Comparison n=18 (50%)			Adapted Motivational Interviewing n=18 (50%)		
	PRE	**POST**	**p**	**PRE**	**POST**	**p**
Self-efficacy, mean±SD	30.24±5.03	30.31±3.55	0.96	31.00±4.61	30.27±5.76	0.69
Stages of Change*			0.15			0.27
Stage 1, n (%)	0 (0.0%)	0 (0.0%)		0 (0.0%)	1 (2.8%)	
Stage 2, n (%)	2 (5.6%)	0 (0.0%)		1 (2.8%)	0 (0.0%)	
Stage 3, n (%)	4 (11.1%)	1 (2.8%)		2 (5.6%)	0 (0.0%)	
Stage 4, n (%)	2 (5.6%)	1 (2.8%)		2 (5.6%)	0 (0.0%)	
Stage 5, n (%)	9 (25.0%)	14 (38.9%)		13 (36.1%)	14 (38.9%)	

SD refers to standard deviation.

*Stage 1=pre-contemplation; Stage 2=contemplation; Stage 3=preparation; Stage 4=action; Stage 5=maintenance

Note: no significant differences in change between groups; t=-0.47; p=0.78 for self-efficacy, and χ^2=1.72; p=0.66 for mean stage of change.

Table 3: Limited-Efficacy- Physical Activity, Physical Fitness, and Quality of Life by group and time (N=23)

	Group					
	Comparison n=12 (66.7%)*			Adapted Motivational Interviewing n=11 (61.1%)*		
	PRE	**POST**	**p**	**PRE**	**POST**	**p**
Physical Activity (mean±SD)						
Intensity (minutes per day)						
Sedentary	590.59±49.36	561.50±63.85	0.22	593.27±68.28	569.70±51.66	0.89
Light	163.11±33.17	179.20±16.47	0.15	178.92±39.48	160.5±65.10	0.42
Moderate	29.15±12.98	33.73±11.84	0.38	34.41±10.17	30.63±12.24	0.43
Vigorous	15.04±8.27	19.99±13.19	0.28	16.73±9.71	9.26±7.03	0.05
MVPA †	44.19±16.56	53.73±22.61	0.25	50.34±16.24	38.49±15.88	0.09
≥60 mins/day (n, %)	2 (16.7%)	5 (41.7%)	0.37	3 (27.3%)	1 (9.1%)	0.32
Physical Fitness (mean±SD)						
BMI (kg/m^2)	21.93±5.08	22.04±5.27	0.95	21.81±5.13	22.02±4.83	0.91
Waist Circumference (cm)	74.84±12.77	74.30±12.89	0.90	74.34±12.58	74.70±11.60	0.93
O_2-consumption (ml/mg/min)	26.51±4.64	26.66±4.35	0.92	29.76±4.76	30.16±7.72	0.82
Flexibility (cm)	22.73±11.97	24.06±11.83	0.75	20.67±11.12	20.02±10.82	0.87
Muscular Endurance (#)	22.00±5.81	20.43±8.58	0.56	20.82±6.99	22.71±3.32	0.36

Grip Strength (lbs)	59.75±12.36	64.00±14.14	0.37	66.20±19.84	69.07±18.66	0.69
Quality of Life (mean±SD)						
HRQoL physical	83.46±8.40	81.64±8.98	0.55	83.33±10.98	84.17±11.23	0.83
HRQoL emotional	69.71±22.81	72.19±16.12	0.72	80.00±15.53	81.67±16.33	0.77
HRQoL social	89.71±13.86	87.19±10.32	0.56	86.11±11.95	85.33±13.16	0.86
HRQoL school	75.59±13.79	73.13±13.65	0.61	74.17±12.04	73.00±14.74	0.80
HRQoL Total	80.12±11.55	78.94±9.60	0.75	81.22±9.90	81.45±10.23	0.94

SD refers to standard deviation; MVPA moderate to vigorous physical activity; BMI body mass index; HRQoL health-related quality of life.

*percentage of participants with valid accelerometer data

†guideline recommendation is 60 minutes /day.

Appendix 1: Example of an individualized exercise program created for a participant.

Date	# of sessions/week	Type of Activity	Time/Duration	Intensity
May 1 – June 1	5	Walking with mother	45 min	65% (130 bpm)
	5	Walking to subway	20 min	65% (130 bpm)
	2	Exercise Video	20 min	85% (170 bpm)
June 1 – July 1	6	Walking with mother		
	3	Exercise Video	20 min	85% (170 bpm)
July 1 – August 1	7	Walking – with hills/stairs if possible	45 min	65% (130 bpm) to 85% (170 bpm)
	5	Local fitness club (teen program)	30 min	85% (170 bpm)
	2	Exercise Video	20 min	85% (170 bpm)
	4	Swimming	30 min	65% (130 bpm)
Heart Rate: find pulse and count # of beats in a 10s period				

Appendix 2 Outline of bi-weekly MI session.

Step 1	Establish Rapport
Step 2	Gathering information on activity participation
Step 3	Assess Motivation (Readiness Ruler and Confidence Ruler)
Step 4	Elicit barriers, concerns, and change talk
Step 5	Summary and affirm
Step 6	Review plan and weekly goals
Step 7	Schedule next session