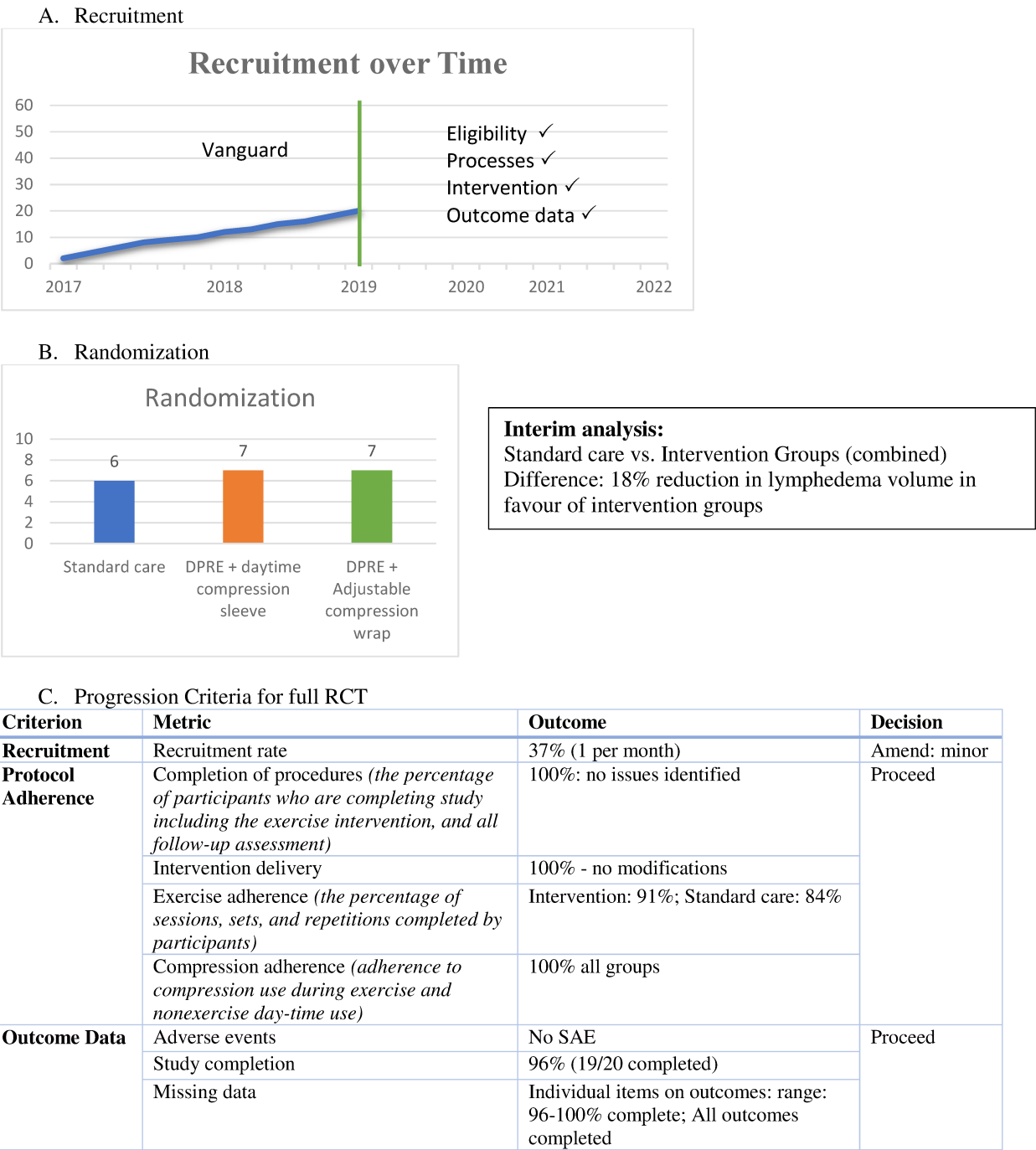


Supplementary Materials

Appendix 1: Vanguard Phase: Summary of Progress



Supplementary Materials

Table S1: Exercise principles

Components	Principles	Benefits
Decongestive exercise sequence ¹⁻³	Follow a sequence from proximal to distal	- Enhance lymph drainage from the edematous area through the use of the skeletal-muscle contraction to promote venous and lymphatic return w
Resistance exercise ^{4,5}	Overload, progression, and specificity	- Improve lymphedema symptoms - Improve muscle strength, and quality of life
Compression ⁶⁻⁸	Enhancement of muscle pump	Improve long-term control of the lymphedema

Table S2: Exercise protocol

	Weight machines and free weights	Resistance Band (RB)*
Exercise	<ul style="list-style-type: none"> • Upper limb: Shoulder shrugs, chest press, seated row, lateral raise, biceps curls, triceps pulldown, wrist curl, reverse wrist curl, handgrip • Lower limb: Leg press, leg curl 	
Initial/starting weight	<ul style="list-style-type: none"> • Upper limb: 1RM: 30-35% RPE: 2-3 (mild) • Lower limb: 1RM: 60% RPE: 4-5 <p>- The intensity will be adjusted by adding/removing weight.</p>	<ul style="list-style-type: none"> • Upper limb: RPE: 2-3 (mild) • Lower limb: RPE: 4-5 <p>-The intensity will be adjusted by tension first and then by RB strength (color).</p>
Progression**		
• Intensity	<ul style="list-style-type: none"> • Upper limb: -Weight will be increased by 5% of the 1 RM (weekly) -RPE: 3-5 (mild to moderate) • Lower limb: -Weight will be increased by 5-10% of the 1 RM (weekly) -RPE: 5-6 (moderate) 	<ul style="list-style-type: none"> • Upper limb: -RB intensity will be increased by band tension, or band strength (color, or combining two RB. -RPE: 3-5 (mild to moderate) • Lower limb: -RB intensity will be increased by band tension first and then by RB strength (color, or combining two RB. -RPE: 5-6 (moderate)
• Volume	2 X 10, 2X12, 2X15 (then increase resistance and drop number of repetitions)	
• Rest intervals	2 min	
• Velocity	Slow to moderate with breathing (two seconds concentric, four seconds eccentric)	
• Frequency	2Xwk	

* Adopted training protocols from (Colado and Triplett, 2008)⁹. Each participant will be provided with 1.5-2 meter of 3- levels RB. Each band will be marked with reference points (10cm) to control the intensity. The band reference values provided by (Uchida et. al 2016)¹⁰ will be used to estimate the starting RB color.

**The exercise will be progressed in the second week, first by increasing the number of repetitions, and then by increasing the intensity. The RPE will be used to quantify the exercise intensity and to inform the progression of exercise resistance. The exercises will be tailored based on the lymphedema symptoms for each participant.

Supplementary Materials

Table S3: Exercise monitoring

<i>Symptoms</i>	<i>Response</i>
<i>Exacerbation of lymphedema symptoms (tension, tightness, heaviness, pain, or increased swelling)</i>	<ul style="list-style-type: none"> • Participant will be monitored and examined by lymphedema therapist • Exercise intensity will be reduced by decreasing the number of repetitions and/or resistance
<i>Worsening of fatigue</i>	<ul style="list-style-type: none"> • Exercise intensity will be reduced by decreasing the number of repetitions

Table 4: The percentage change in arm lymphedema calculation formula

<i>Lymphedema absolute volume (LAV)</i>	<i>LAV=affected volume – unaffected volume (mls)</i>
<i>Absolute change in excess volume (mls)</i>	<i>LAV (baseline) – LAV (12-weeks)</i>
<i>Lymphedema relative volume (LRV) change</i>	<i>(1) LAV baseline – LAV 12-weeks</i> <i>(2) LAV at baseline</i> $\frac{(1)}{(2)} \times 100$

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