

Supplementary Appendix

This appendix has been provided by the authors to give readers additional information about their work.

Supplement to: Katz JN, Brophy RH, Chaisson CE, et al. Surgery versus physical therapy for a meniscal tear and osteoarthritis. *N Engl J Med* 2013;368:1675-84. DOI: [10.1056/NEJMoa1301408](https://doi.org/10.1056/NEJMoa1301408)

Supplementary Materials

"Surgery versus Physical Therapy for Meniscal Tear and Osteoarthritis" by Katz et al.

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Evaluating the impact of missing data on study results and conclusions

At six months, 10.3% of data on the WOMAC physical-function score were missing, with similar amount of missing data in each arm and no association between missingness and baseline characteristics. At 12 months, 14.9% of data were missing with similar amount of missing data across arms.

We performed sensitivity analyses with multiple imputations. For the complete case analysis the difference between means is 2.4 (95% CI -1.8, 6.5) at six months and 0.7 (95% CI -3.5, 4.9) at 12 months. Given small amount of missingness, using Rubin's rule we determined that 5 imputations would provide sufficient efficiency. Using a set of five imputation at six months, we estimated the difference in changes in WOMAC physical-function score improvements across study arms treatments was 3.7 (95 % CI -0.9, 7.1) at six months and 0.8 (95% CI -3.3, 4.9) at 12 months.

In summary, these additional analyses that account for uncertainty due to missing data confirm the robustness of the complete case analysis.

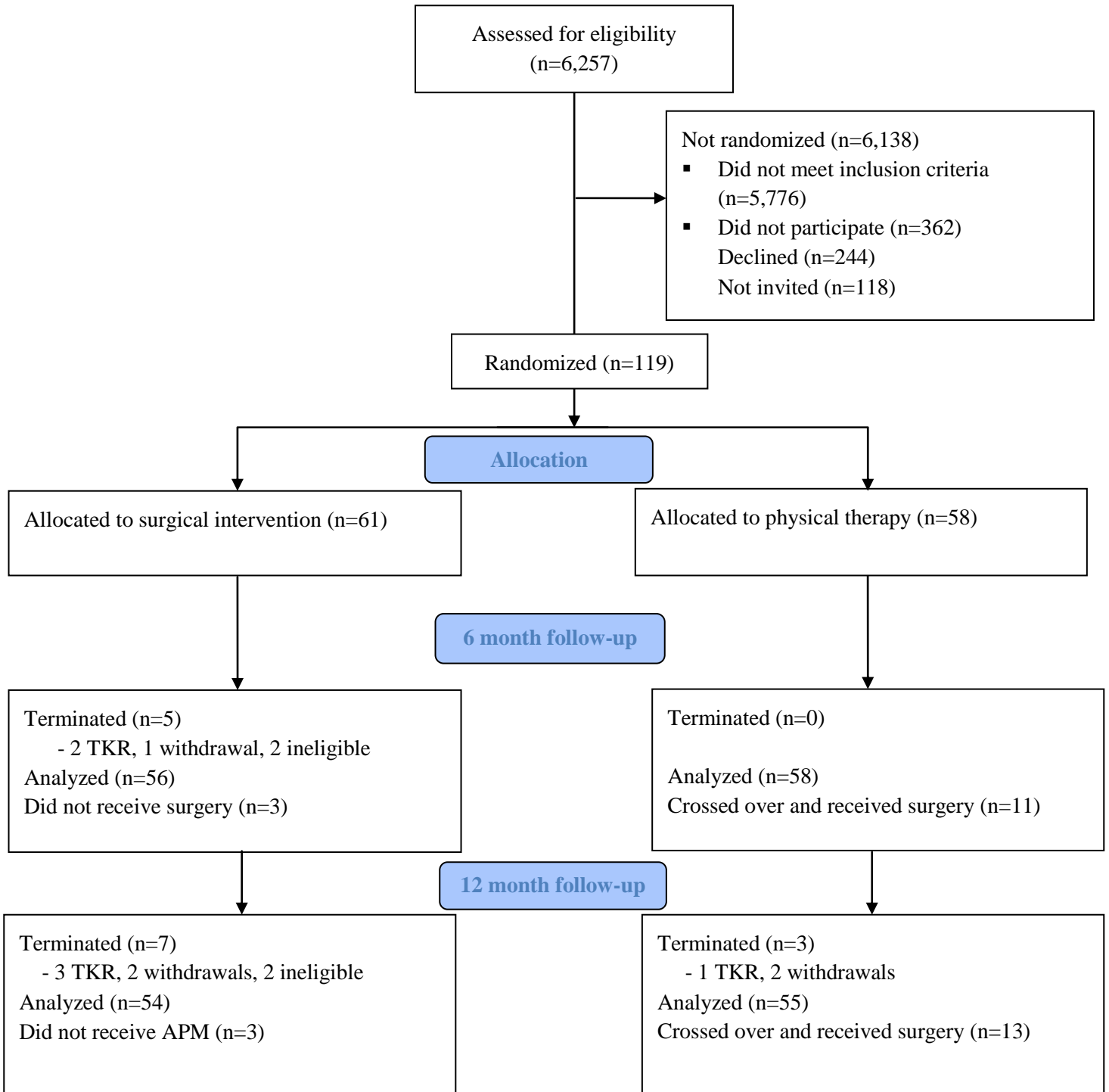
Additional exploratory analysis on the effect of crossover on outcome

To estimate the effect of crossovers from the nonoperative to the APM arm, we conducted an exploratory analysis and assigned crossover subjects their last score before crossover. We then repeated the primary analysis (analysis of covariance, adjusting for center) of the WOMAC physical-function score at 6 months, using these augmented values for subjects that crossed over between randomization and 6 months. This analysis suggested a 13.0 point improvement in WOMAC physical-function score at 6 months in the PT arm as compared with a 20.9 point improvement in the APM arm.

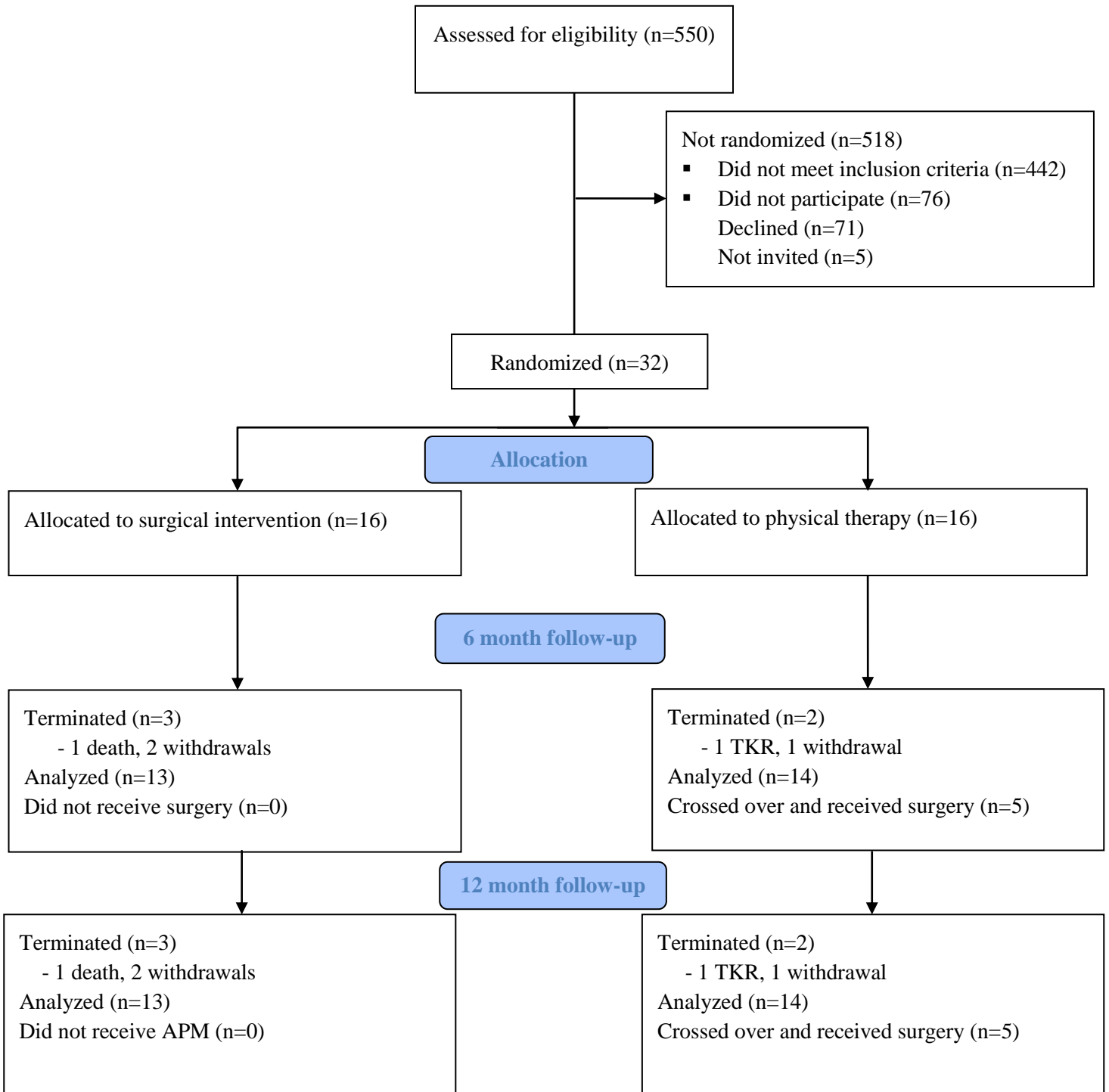
The primary analysis (Table 2) shows an improvement of 18.9 points in the PT arm, which was neither clinically nor statistically significantly different from the improvement in the APM arm. Thus, this exploratory analysis suggests that the similarity in outcomes between the two arms may be explained by additional improvements that subjects that crossed over to APM received from the APM.

Supplementary Figure 1: CONSORT Diagram showing enrollment and follow-up by site

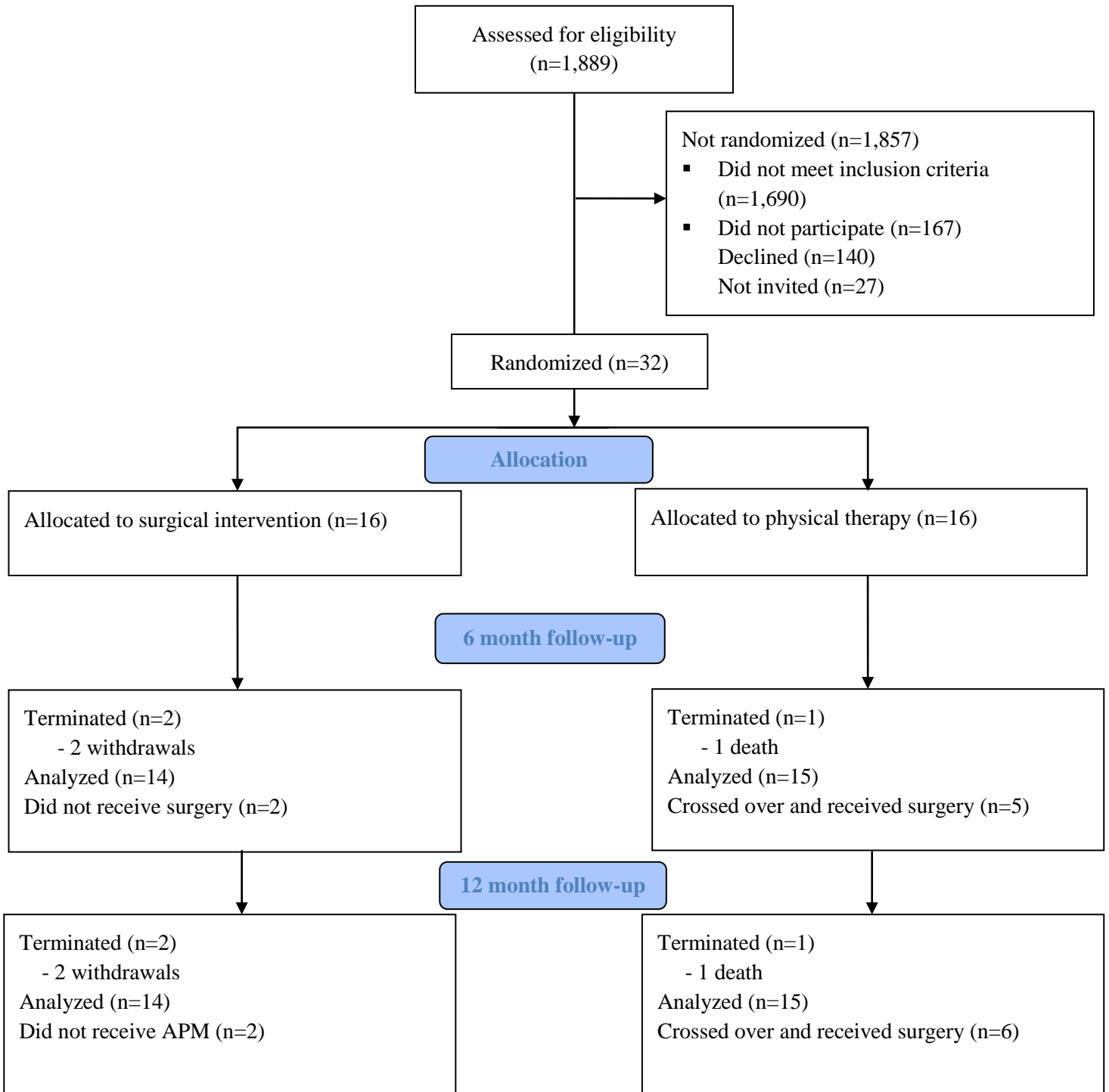
Supplementary Figure 1a: Site A



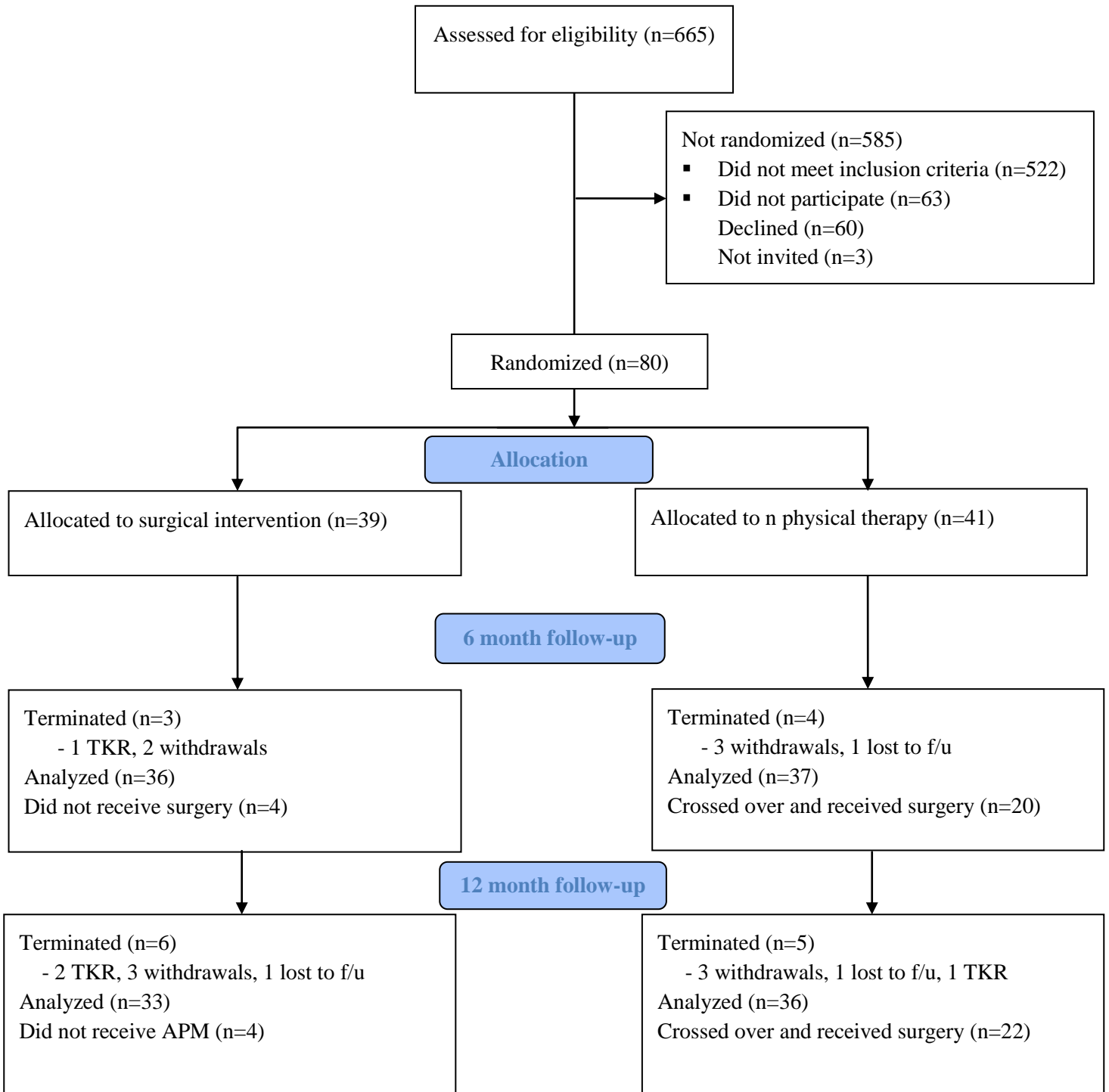
Supplementary Figure 1b: Site B



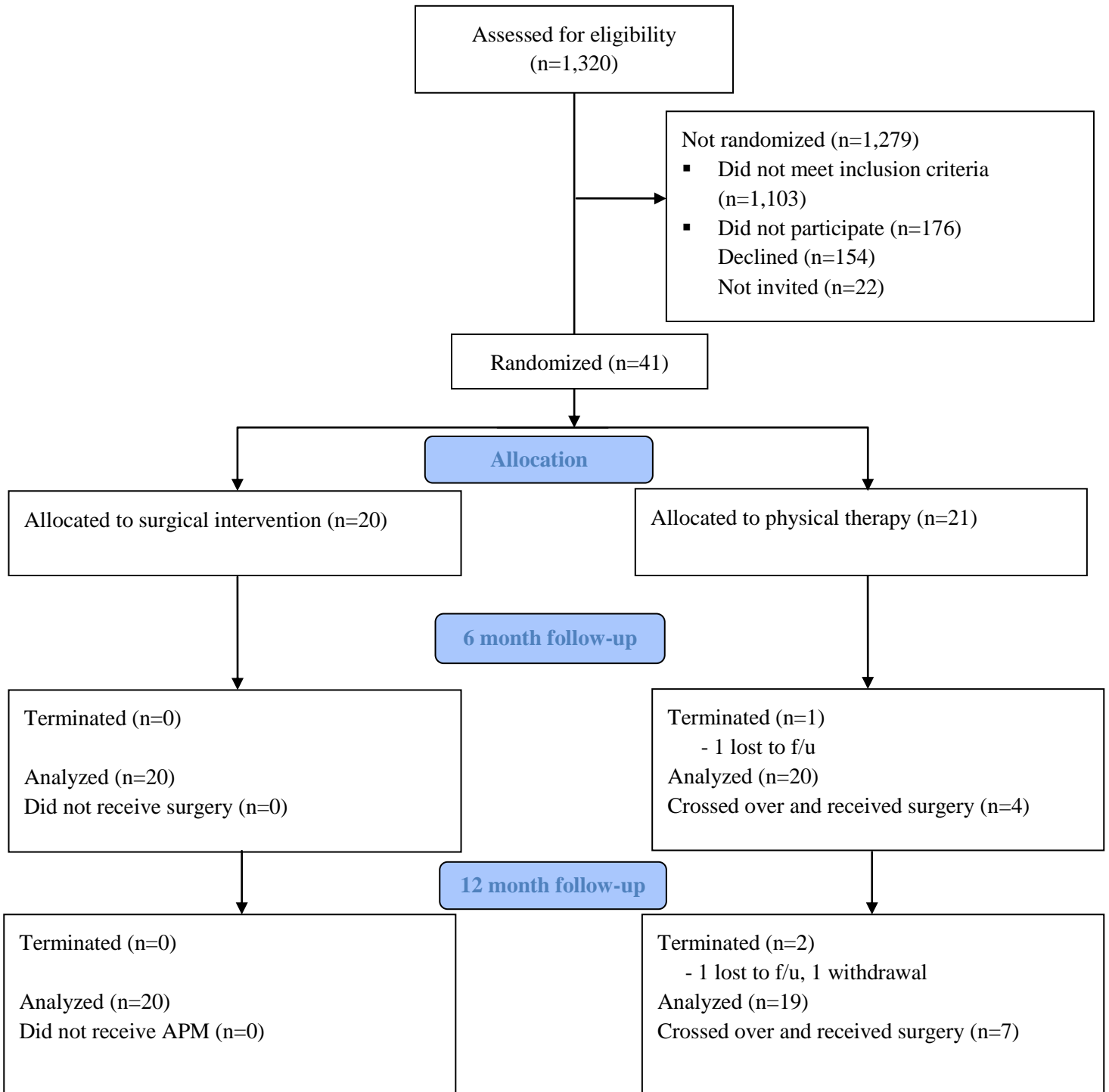
Supplementary Figure 1c: Site C



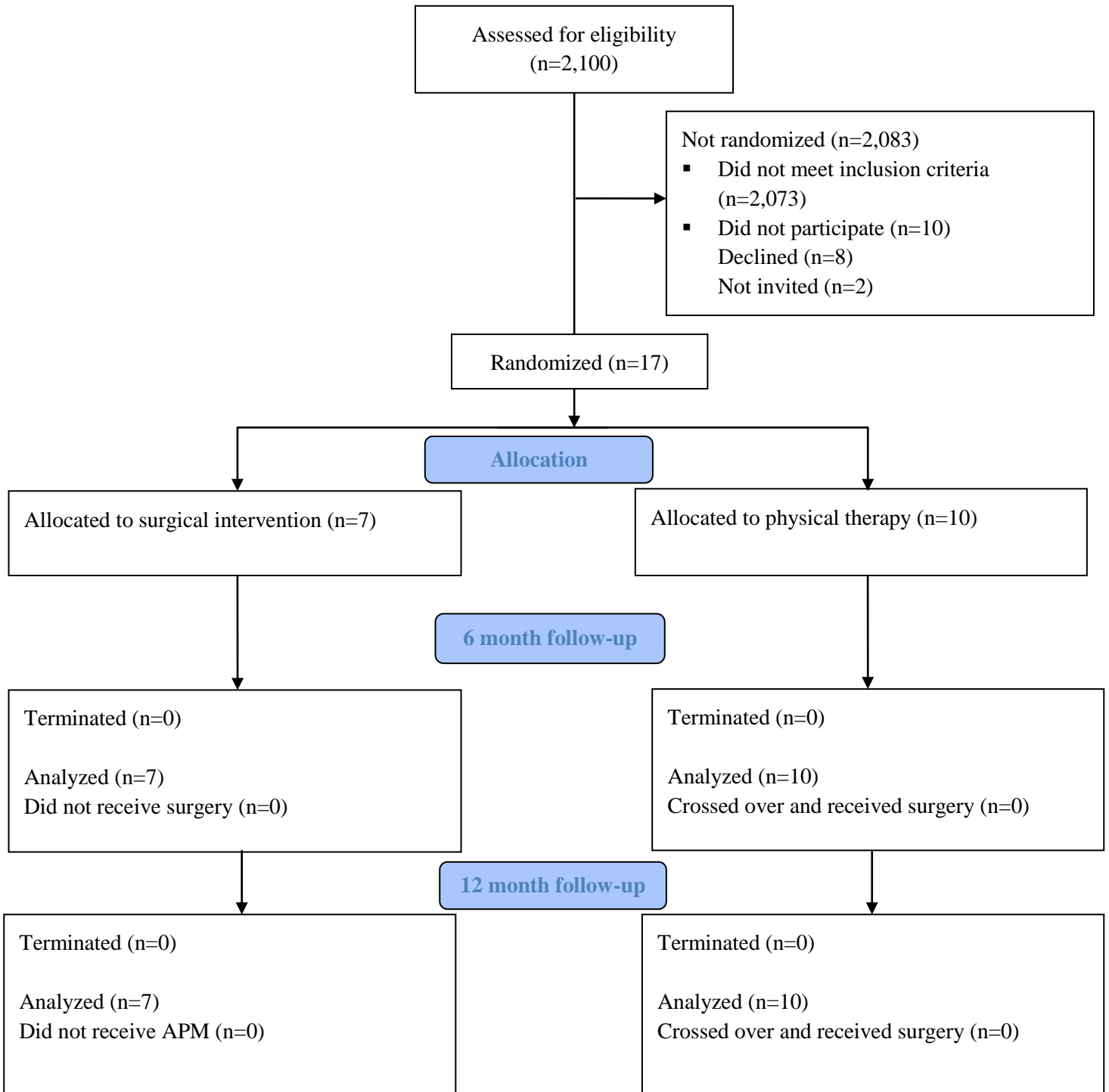
Supplementary Figure 1d: Site D



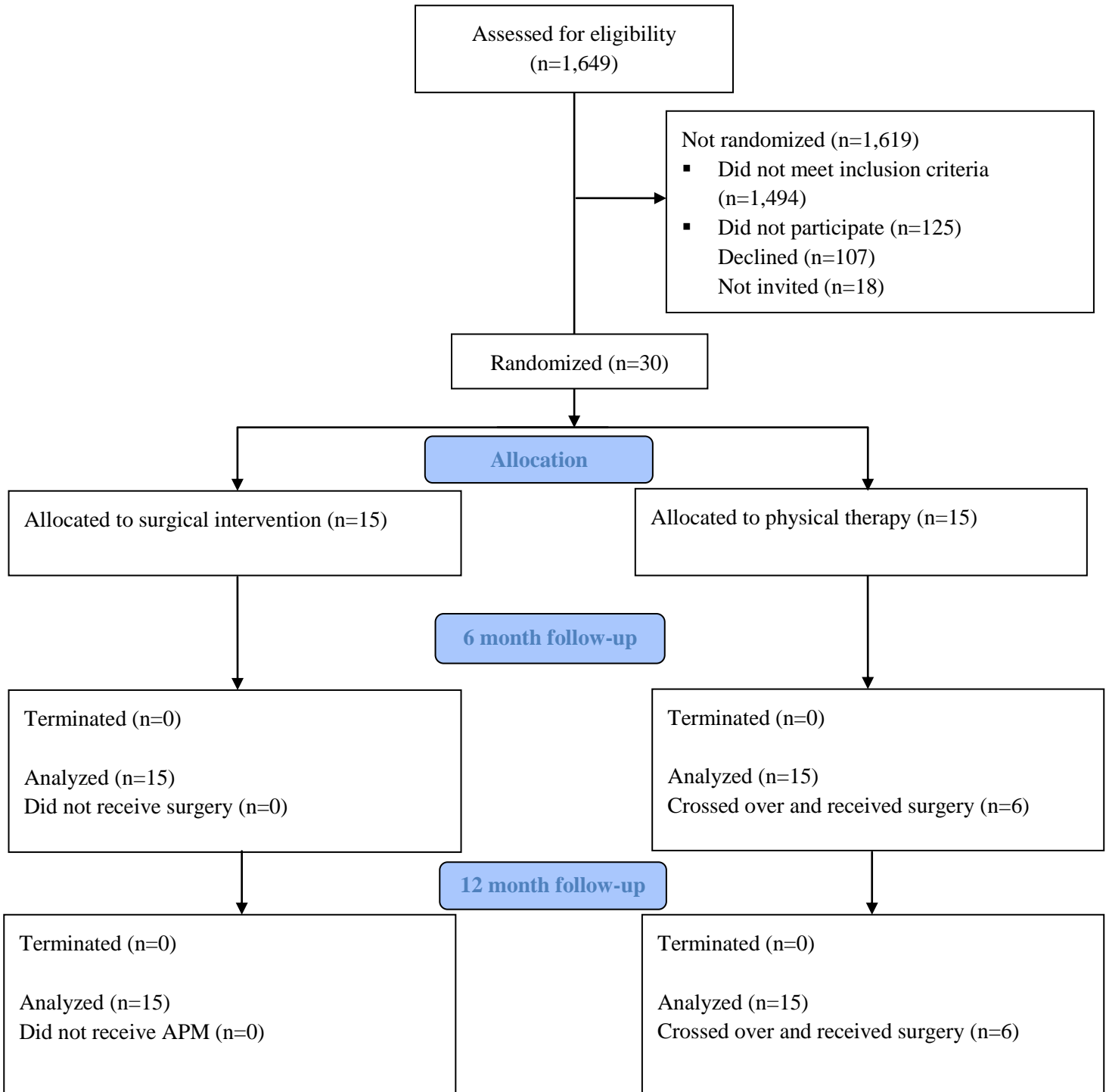
Supplementary Figure 1e: Site E



Supplementary Figure 1f: Site F



Supplementary Figure 1g: Site G



Supplementary Table 1: Entry and Exclusion Criteria for the MeTeOR Trial	
<i>Entry Criteria</i>	<i>Exclusion criteria</i>
<ul style="list-style-type: none"> -Age 45 years or greater -Symptoms for at least four weeks, managed with one or more of: medications, activity limitations or PT -Symptoms consistent with torn meniscus (at least one of the following: clicking, catching, popping, giving way, pain with pivot or torque, pain that is episodic, pain that is acute and localized to one joint line) -Availability of knee radiograph and MRI -Evidence on knee MRI of osteophytes or full-thickness cartilage defect; <i>or</i> plain radiographic evidence of osteophytes or joint space narrowing -Evidence on knee MRI of a meniscal tear that extends to the surface of the meniscus -Willingness to undergo randomization and ability to understand and sign an informed consent document 	<ul style="list-style-type: none"> - Chronically locked knee (e.g. patient cannot flex or extend the knee; a clear indication for APM) - Kellgren-Lawrence Grade 4 - Inflammatory arthritis or clinically symptomatic chondrocalcinosis - Injection with viscosupplementation in past four weeks in index knee - Contraindication to surgery or physical therapy - Bilateral symptomatic meniscal tears - Prior surgery on index knee

Supplementary Table 2: MeTeOR Physical Therapy Intervention Protocol			
Phase I-Acute Phase (1-10 days post-op)			
Goals: Decrease inflammation, Restore A/PROM, Neuromuscular re-education of quadriceps			
Perform at least 8 exercises, 12-15 repetitions, 1-2 sets of the following types of exercises:			
Decrease Inflammation: Retrograde Massage, Cryotherapy E-Stim: NMES or IFC	Manual Therapy: Joint Mobilization Soft Tissue Mobilization Stretching LE Muscles	Open Chain Exercises: Quad Sets SAQ/LAQ/HS Curls Hip-4 way	Closed Chain Exercises: Bicycle, Elliptical, Treadmill, Leg Press, Balance/Proprioception
Progression Criteria to Phase II			
Patient must meet 3 of the 4 criteria: Knee A/PROM ≥ 115 degrees, Moderate to minimal effusion, Knee Pain $\leq 4/10$, Muscle Strength $\geq 3/5$			
Phase II-Subacute Phase (10 days-4 weeks post-op)			
Goals: Restore muscle strength and endurance, re-establish full and pain free AROM, gradual return to functional activities, minimize gait deviations			
Perform at least 8 exercises, 12-15 repetitions, 1-2 sets of the following types of exercises:			
Decrease Inflammation: Retrograde Massage Cryotherapy E-Stim: NMES or IFC	Manual Therapy: Joint Mobilization Soft Tissue Mobilization Stretching LE Muscles	Open Chain Exercises: Add more Concentric/Eccentric Hip/Knee progressive resistive exercises, ROM	Closed Chain Exercises: Resisted terminal knee extension, modified mini squats, step up/down progressions, toe raises, functional and agility training
Progression Criteria to Phase III			
Patient must meet 4 of the 5 criteria: Knee A/PROM ≥ 125 degrees, Normal Joint Play, Minimal effusion, Knee Pain $\leq 2/10$, Muscle Strength $\geq 5/5$			
Phase III-Advanced Activity Phase (4-7 weeks post-op)			
Goals: Enhance Muscle Strength and Endurance, Maintain full ROM, Return to sports/functional activities			
Perform at least 8 exercises, 12-15 repetitions, 1-2 sets of the following types of exercises:			
Continued stretching program	Continued PRE therapeutic exercises program	Emphasis on closed chain program with progression to dynamic single leg stance, plyometrics, running, and sport specificity training	

A/PROM: Active/Passive range of motion

NMES: Neuromuscular electrical stimulation

IFC: Interferential current

SAQ/LAQ/HS: Short arc quadriceps/ Long arc quadriceps/Hamstrings

E-Stim: Electrical stimulation

LE: Lower extremity

Supplementary Table 3: Improvement in WOMAC Physical-function Score stratified by Kellgren-Lawrence Radiographic Grade and Study Arm

KL Grade	N	Arm	Mean change in WOMAC Function	95% CI
0-2	90	APM	21.9	18.1, 25.7
0-2	98	PT	17.2	13.5, 20.8
3	40	APM	19.0	13.3, 24.7
3	35	PT	21.9	15.8, 27.9

APM: arthroscopic partial meniscectomy

PT: Physical Therapy

MeTeOR Data Safety Monitoring Board

The Data Safety Monitoring Board was appointed by the National Institute of Arthritis, Musculoskeletal and Skin Diseases (NIAMS).

Members included:

Patrick Heagerty, Ph.D., Chair

John-Paul Rue, M.D., Safety Officer

Arnold Postlethwaite, M.D.

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