



Automated Telephone-Linked Communication: A Novel Approach To Enhance Long-Term Adherence to Resistance Training Exercise Among People with Knee Osteoarthritis

Kristin Baker
Aileen Ledingham
Michael LaValley
David Felson
Julie Keysor



Center for Enhancing Activity and Participation among Persons with Arthritis (ENACT)



Disclosures

- None



Knee Osteoarthritis Strength Training

- **Knee OA¹**
 - Improve functional limitations, self-efficacy, PA levels
 - Reduce pain
- **Widely recommended²**
 - ACR , OARSI, CDC, AF, DHHS
- **General Population³**
 - Improve body composition, insulin action, bone health, energy metabolism, psychological health
 - 47% of those with arthritis have ≥ 1 Comorbidities⁴



¹Lange et al 2008

²Hochberg et al 2012; Zhang et al 2007; National Public Health Agenda 2010; PA Guidelines 2008

³Warburton et al 2006

⁴Dekker et al 2008

Adherence to Strength Training

- **Physical Activity Guidelines for muscle-strengthening¹**
 - 45-64 yrs. 21%
 - 65-74 yrs. 16%
 - ≥ 75 yrs. 12%
- **3 Large Trials in Knee Osteoarthritis for muscle -strengthening**
 - **Knee Study² Fit and Strong³ Adapt⁴**
 - 40-50% Adherence



1. Health, United States 2012

2. McKnight et al 2010

3. Hughes et al 2006

4. Van Gool et al 2005

Current Approaches to Enhance Exercise Adherence

- **Behavior and social science**
 - Intrinsic – knowledge, attitude, and beliefs
 - Extrinsic – time, social, mode and complexity of exercise and supervision
- **Technology**
 - Promote access to specialist care via phone and internet



¹Gyurcsik et al 2003 and 2009; Carr et al 2001; Marks 2012

²Murray et al 2005



What is Telephone-Linked Communication (TLC)?

- A way to provide health services to patients that complements the delivery of services by physicians and other health professionals.



Ramelson et al., AMIA Sym Proc, 2003

TLC Behavior Interventions

- **Goal: To help individuals learn and use cognitive and behavioral strategies, skills, and techniques that promote healthy behaviors and decrease risk behaviors**
 - Healthy Eating¹
 - Regular Physical Activity²
 - Smoking Cessation³



¹Mosley et al 2001

²King et al. 2003

³Friedman et al 2003

BOOST TLC

- **To develop a dynamic automated telephone calling system, Boston overcoming Osteoarthritis through Strengthening Telephone Linked Communication (BOOST-TLC) to empower and motivate people with knee OA to adhere long-term to resistance training**



Pilot - NARRTC April 18-19 2013

Purpose

- **Describe RCT utilizing BOOST TLC system**
 - Detailed description of the BOOST TLC
- **Provide baseline data on the RCT**
- **Provide data on usage of the BOOST TLC**

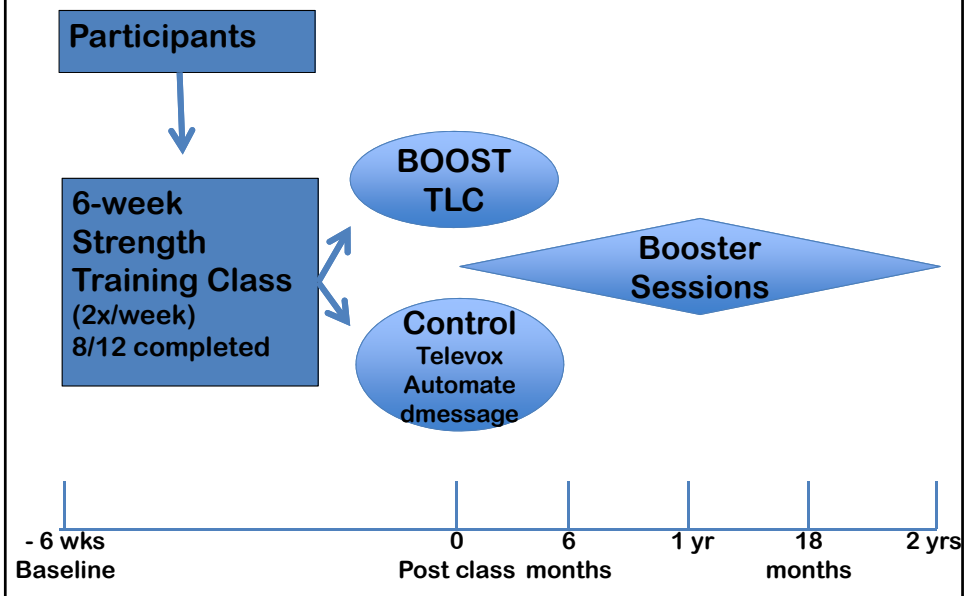


BOOST- TLC RCT Specific Aims

- I. To conduct a randomized trial to determine if, compared to a control group, knee OA participants randomized to TLC will have greater adherence to and participation in exercise over 2 years.
- II. To determine the association of function and pain at 1 and 2 years with adherence to the exercise program at the same time points.



Study Design



Participants

- **Community-based sample**
- **N=100**
- **≥ 50 yrs.**
- **Self-report doctor diagnosed knee osteoarthritis**
- **Knee Pain**
 - Knee pain most days in previous month or most months in previous year
 - and/or
 - WOMAC pain subscale score ≥ 4



Intervention

- **Bi-weekly calls for first 6 months**
- **Monthly for 18 months**
- **Individualized exercise program inputted into TLC system (days per week of exercise)**
- **Provides automated individualized feedback on the strength training program**
- **Provides counseling to improve exercise adherence**

Control

- **Monthly Televox phone calls**
- **Automated message to encourage strength training and record progress in the exercise logs.**



Features of TLC

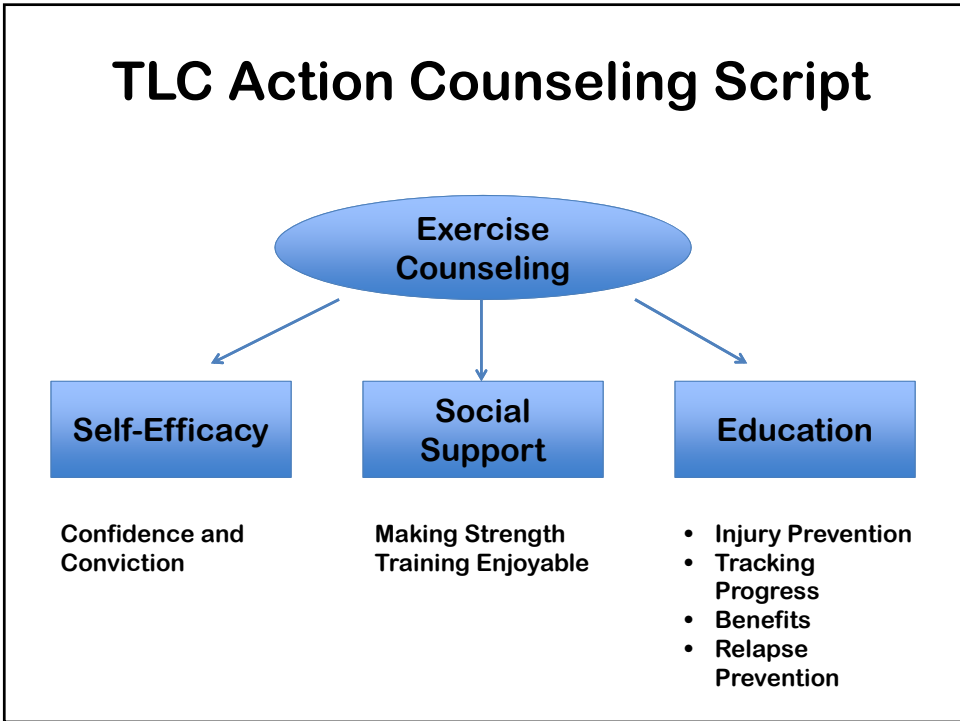
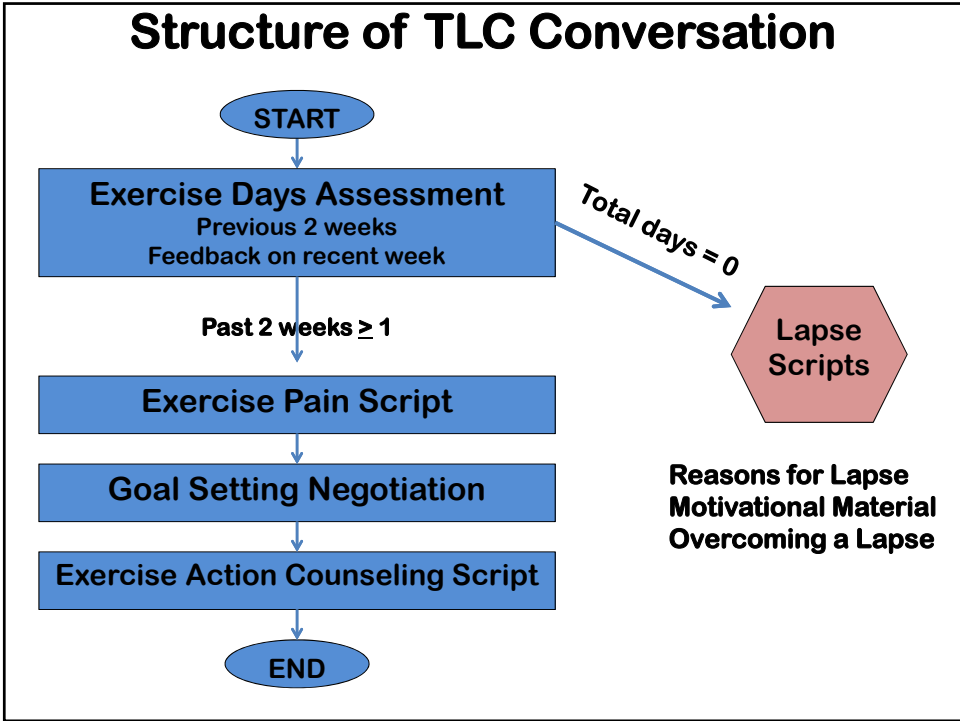
- **TLC systems compatible with**
 - land, portable, or mobile phones from any location
- **Call initiation by TLC (outbound) or by user (inbound)**
- **Digitally recorded human voices**
- **Users communicate with TLC**
 - pressing buttons or
 - speaking
- **Speech recognition technology**
 - “feel” like a natural conversation



Continued: Features of TLC

- **Interaction is designed to resemble a typical conversation between a health counselor and a patient/client**
- **Rules determine which sound files to play based on logic applied at each step of the conversation**
- **Data collected on user utilized to personalize the conversation**
- **Data can be provided to users and health professionals to summarize progress**
- **Alerts can be generated and sent by phone, email, or fax**





TLC Action Counseling Script Example

There are five common reasons why active people stop strength training or exercising: an illness or injury, being chronically tired, going on vacation, exercise is boring and unsupportive friends and family. What would you do in these situations? Give it some thought and figure out how you would eventually return to your regular strength training routine. That way, you'll be prepared.

Would you like to hear more about being chronically tired? Please say yes or no.



Study Outcomes


- **Primary: Adherence to Strength Training**
 - Self-report exercise logs
 - Recall past week at data collection time points
- **Secondary:**
 - **Self-report pain and physical function¹**
 - WOMAC
 - PROMIS
 - OA CAT
 - **Observed physical function**
 - Timed up and Go, chair stand, and stair climb
 - Muscle Strength and Power – Isokinetic



¹Bellamy et al 1988; Cella et al 2007; Jette et al 2009


BOOST Baseline Demographics n=84	
Gender N (%)	
Male	14 (17)
Female	70 (83)
Race and Ethnicity N (%)	
White	52 (62)
Black	21 (25)
Hispanic	2 (2)
Asian	3 (3)
Other	6 (6)
Age (years)	66 (7.2)
BMI	30.4 (6.7)
WOMAC mean (sd)	
Pain (0-20)	7.0 (3.5)
Physical function (0-68)	20.2 (3.5)
Observed physical function	
Timed up and go (seconds)	8.3 (1.8)
Chair stand x 5	16.0 (4.6)
Comorbidities N (%)	
Heart disease	9 (11%)
Chronic respiratory conditions	14 (17%)
Diabetes	11 (13%)
Hypertension	40 (48%)

Center for Enhancing Activity and Participation among Persons with Arthritis (ENACT)



Data on TLC

- **Participants receiving TLC intervention \geq 6 months**
 - 50% have connected all possible TLC calls
 - 50% range 31-85% of possible TLC calls
- **Majority of calls are complete**
 - Average time on call 6:43
 - Incomplete calls average 3:25



Conclusions

- **Boost Participants**
 - **Connecting with TLC**
 - **Engaging with TLC**
 - **Carrying out the TLC calls to completion**



Acknowledgements

- **National Institute on Disability and Rehabilitation Research (NIDRR), Arthritis Rehabilitation Research and Training Center Grant H133B100003**
- **Arthritis Foundation Arthritis Investigator Award**
- **Study Staff: Faye Cochrane, Inbar Hanouna, Jon Dibello, Kelly Pesanelli**
- **Study participants**





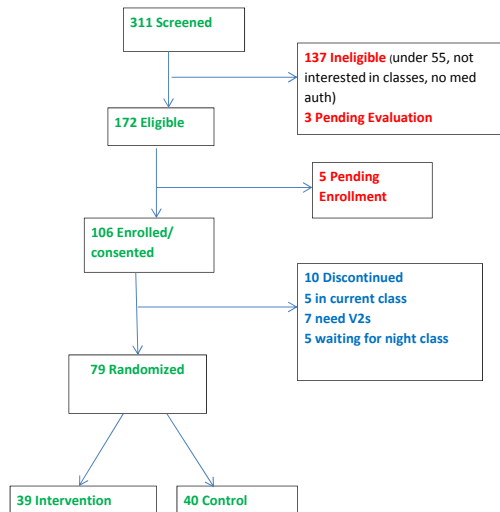
Adherence to Strength Training

- **Multidimensional Intervention for Early Osteoarthritis of the Knee (“Knee Study”)**
 - 2 years
 - Compliance less than 40% in strength training over 18 months
- **Fit and Strong**
 - 1 year
 - 55.6% increase from baseline decline in control group 50% attrition in exercise greater in control
- **ADAPT Trial**
 - 18 months
 - 55% adherence at 18 months

Arthritis Care Res (Hoboken). 2010 January 15; 62(1): 45–53
Gerontologist. 2006 Dec;46(6):801-14
Arthritis & Rheumatism (Arthritis Care & Research) Vol. 53, No. 1, February 15, 2005, pp 24-32



BOOST – Participant Flow Chart



Pilot: Study design

- Participants recruited from South Boston Neighborhood Center and Senior Center
- 6-week exercise class (2 times per week)
- Participants enrolled to the TLC intervention for 3 months following the exercise class.



Pilot: Participants

- N=11 participants
- Adults 55+ with knee OA and WOMAC pain score ≥ 4 or knee pain most days in previous month or most months in previous year



Pilot: TLC Intervention

- Bi-weekly counseling calls by TLC for 3 months
- Individualized exercise program inputted into TLC system (days per week of exercise)
- Goal attainment review
- Goal setting review
- Counseling



Pilot: Assessments

- **Pre and post the 6-week exercise class**
 - Western Ontario and McMaster Universities Osteoarthritis Index (*WOMAC*) for knee pain and physical function
 - Get up and Go time
 - 10 chair stand time
- **Post 3-month TLC intervention**
 - Qualitative data on TLC and strength training class



Pilot: Results-Demographics

- **Gender**
 - Female = 9
 - Male = 2
- **Age**
 - Mean 70,
 - Range 55-83 years
- **WOMAC pain (0-20)**
 - Mean 6.4
 - Range 2-13



Pilot: Results-Quantitative

Question	Pre Exercise class	Post class
WOMAC pain (0-20)	6.4+/- 3.8	5.4 +/- 2.6
WOMAC function (0-68)	17.6 +/- 9.8	15.4 +/- 9.4
TUG (seconds)	9.9 +/- 2.7	9.0 +/- 3.2
*Chair stand x10	36.0 +/- 9.9	25.1 +/- 5.0

Lower scores reflect less pain and better function



Pilot: Results-Qualitative

Attitudes towards TLC System

Variable (score range)	Mean (range)
Usability (1-5)	3.4 (2-4)
Helpfulness (1-5)	3.0 (1-4)
Motivation to strength train (1-5)	3.3 (3-4)
Confidence to adhere (1-5)	4.4 (4-5)

Higher numbers are more favorable



Results: Qualitative Comments

Positive Comments

- “A reminder should be doing exercises”
- “Keep moving”
- “Exposure to exercise that helped me”
- “You can’t improve on perfection can you?”

Negative Comments

- “Too much information – needs to be simpler”
- “Make it cleaner – more to point”



Pros and Cons of TLC Health Behavior Interventions

PROS

- Access
- Reach
- Cost
- Frequency of Contact
- Continuity of Care
- Anonymity
- Interpersonal Nature
- Fidelity
- Dose Measurement

CONS

- Impermanence
- Limits of Tailoring
- Rigidity of Intervention



Analytics

- Powered to detect 35% difference in adherence across groups
- Hypothesis 1:
 - Dichotomous Adherence: Fisher's exact test and logistic regression modeling
 - Continuous measure of adherence: Multiple linear regression modeling with data translations to normalize the distributions.
- Hypothesis 2: Logistic and multiple linear regression modeling to test hypothesized associations.

