North Carolina Cardiac Rehab Referral Project

Translating the evidence into practice

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Patient BF

- 73 y/o white man p/w exertional chest pain x 3 weeks. Most prominent episode was while mowing the lawn.

- PMH significant for CAD
  - 2002: CP / + stress → PCI of LAD
  - 2003: CP / + stress → 4v CABG
  - 2008: CP / + stress → PCI of SVG to OM2

Background

- **Medications:**
  - **aspirin**
  - **clopidogrel**
  - **atorvastatin**
  - **metoprolol XL**
  - **NTG**

- **Social**
  - **Married, retired electrician, 11 grandkids**

- **Lifestyle**
  - **“Stays busy” around the house**
  - **Exercise - 15 minutes, 2 times/week**
  - **Quit tobacco in 1982**
  - **Rarely drinks alcohol**

- **BP 147/84. Home BP’s 120s/80s. HR 62 bpm. BMI 23.2 kg/m^2**

- **TC 134, TG 110, HDL-C 43, LDL-C 69**

Tests

- **EKG – NSR with early repolarization**

- **Stress Echo:**
  - **Exercise time on Bruce protocol – 7.7 minutes (10 METs)**
  - **Max HR 136 bpm & BP 179/77**
  - **EKG - > 2 mm ST segment depression in inferolateral leads**
  - **Resting LVEF > 55% and post-exercise LVEF 40%**
  - **LV dilates post-exercise and has hypokinesis in the inferior, lateral, and posterior walls**

Procedure

- Coronary cath
  - LAD – 100% occluded
  - LCX – 80% stenosis
  - RCA – 100% occluded
  - VG to RCA – 100% occluded
  - VG to OM2 – 100% occluded
  - VG to D2 – 90% diffuse disease
  - LIMA to LAD was open

- PCI to LCX with drug eluting stent

Follow-up

- **Still has exertional chest pain.**
- **What's missing ?**

Cardiac Rehabilitation

Evidence Base

Referral Process

Duke Experience

NC statewide initiative ?

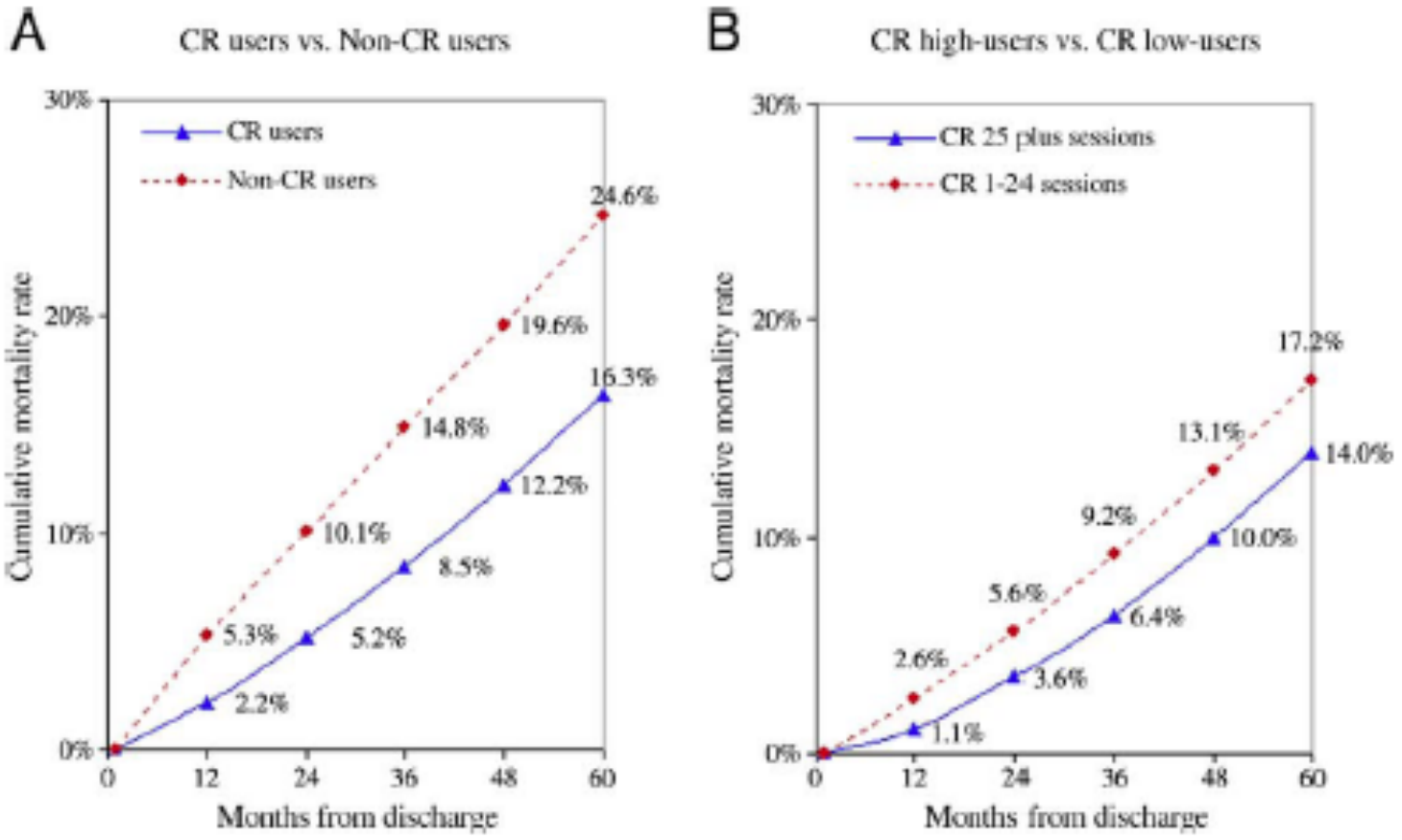
Evidence Base

Meta-analysis of 48 RCTs in CAD

- Analyses up to 2003
- All included exercise training interventions
- > 6 months months follow-up
- 8940 patients
- Compared to usual care, CR had lower rate of mortality with odds ratio 0.80 (95% CI, 0.68 – 0.93)

Taylor AJM 2004

Medicare analysis of > 600,000 pts hospitalized for CAD



Only 12% used cardiac rehab

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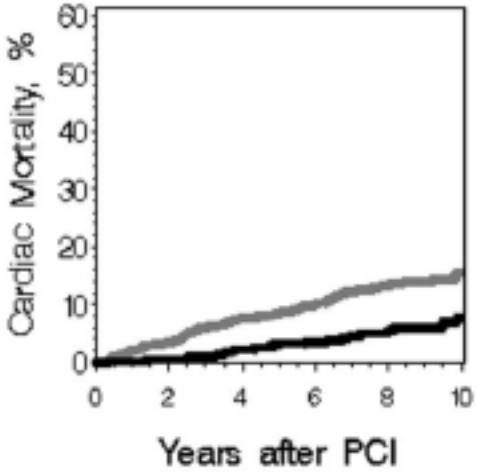
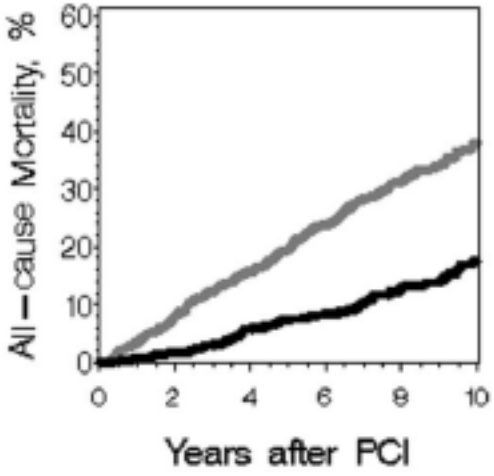
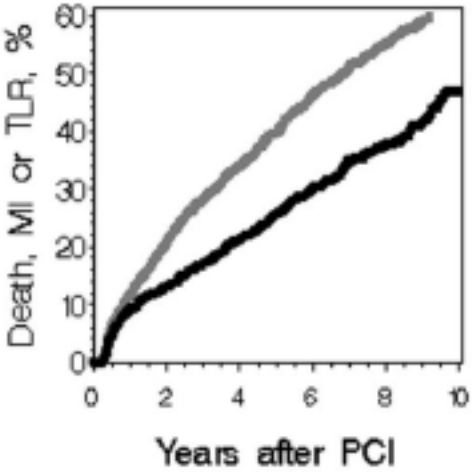
Suaya JACC 2009

Cardiac Rehab Post-PCI







- 2395 consecutive PCI patients in Olmsted County, Minnesota from 1994 – 2008
- Median f/up – 6.3 years

Goel Circ 2009

Cardiac Rehab Post-CABG

Epidemiology and Prevention

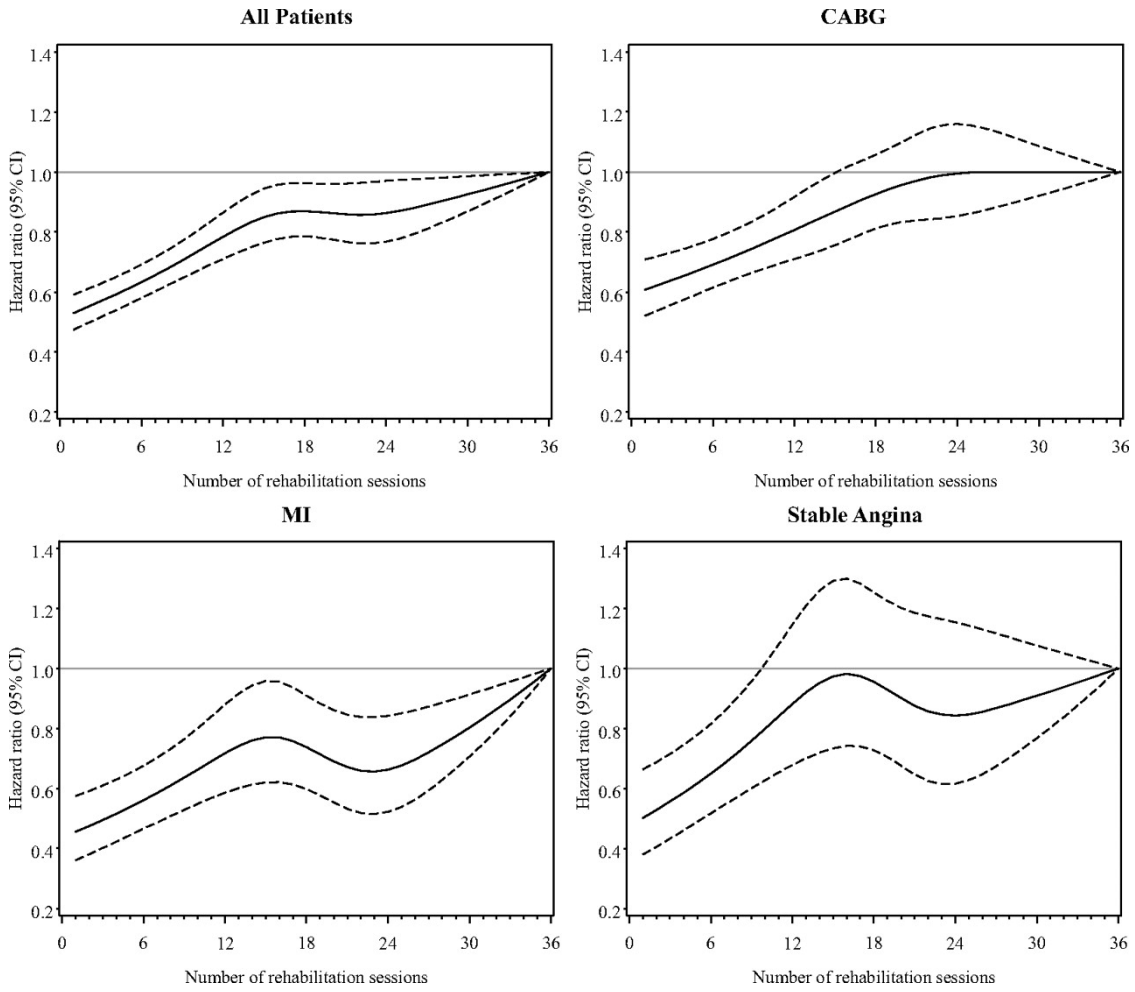
Participation in Cardiac Rehabilitation and Survival After Coronary Artery Bypass Graft Surgery

A Community-Based Study

- CABG patients in Olmsted County, Minnesota from 1996–2007
- 846 patients survived at least 6 months after surgery
- 69% attended cardiac rehab
- 10 year mortality rate 28%
- Cardiac rehab
  - relative risk reduction 46%
  - absolute risk reduction 13%

Pack Circ 2013

Dose response effect of Cardiac Rehab



> 30,000 Medicare patients who attended at least 1 cardiac rehab session from 2000 - 2005

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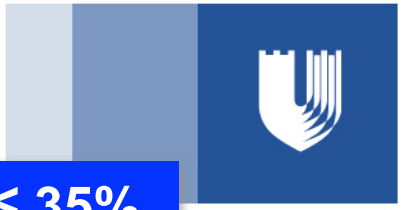
Hammill Circ 2010

HF-ACTION (Heart Failure & Exercise)



Chronic heart failure, NYHA Class II-IV, LVEF ≤ 35%, optimal HF medical therapy, capable of exercising

↓

Pre-randomization CPX and ECHO

↓

Randomization 1:1
(Stratified by center and HF etiology)

Usual Care

Median Follow-up 2.5 years

Exercise Training

Whellan AHJ 2007

HF-ACTION: Effect on Exercise Capacity

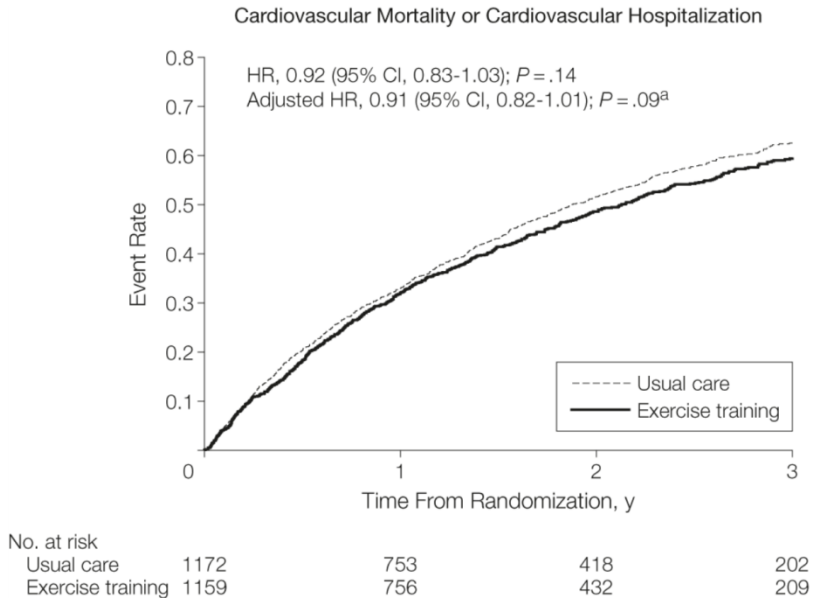
Baseline to 3 months*	Usual Care	Exercise Training	*P*-value
6-minute walk distance (m)	5	20	<0.0001
Change in CPX time (min.)	0.3	1.5	<0.0001
Change in pVO_2 (mL/min/kg)	0.2	0.6	<0.0001

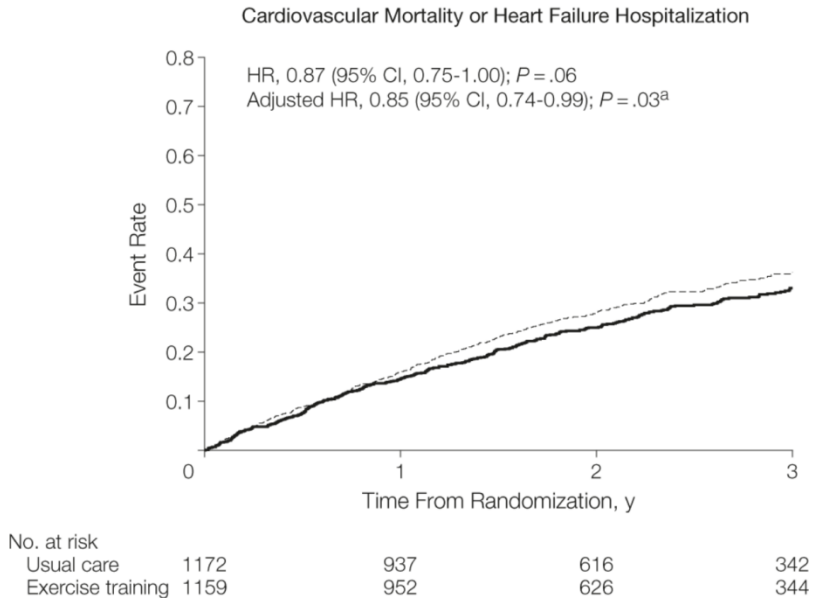
Baseline to 12 months*	Usual Care	Exercise Training	*P*-value
6-minute walk distance (m)	12	13	0.26
Change in CPX time (min.)	0.2	1.5	<0.0001
Change in pVO_2 (mL/min/kg)	0.1	0.7	<0.0001

* Complete case analysis

Hammill Circ 2010

HF-ACTION: Effect on CV outcomes





Exercise training was related to 15% reduction in CV mortality or HF hospitalization

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O'Connor JAMA 2009

Baseline Characteristics, Volume of Exercise, and Risk for All-Cause Death or All-Cause Hospitalization After 90 Days

Covariate	*HR (CI)*	χ^2	*p-value*
Peak VO_2 ($mL \cdot kg^{-1} \cdot min^{-1}$)	0.95 (0.93-0.97)	19.2	<0.0001
Exercise Volume (MET-hr/wk)*	0.95 (0.92-0.98)	8.8	0.003
Beck Depression Inventory II Score	1.02 (1.01-1.03)	8.1	0.005
LV Ejection Fraction (%)	0.98 (0.97-1.00)	7.8	0.005
History of Atrial Fibrillation/Flutter	1.33 (1.07-1.64)	6.7	0.010
Beta-Adrenergic Blockade Therapy	0.67 (0.48-0.94)	5.5	0.020
Female Gender	0.77 (0.62-0.96)	5.3	0.022
Statin Therapy	0.83 (0.69-1.00)	4.0	0.045
Resting Heart Rate (min^{-1})	0.99 (0.98-1.00)	3.3	0.068
Non Ischemic Etiology	0.94 (0.77-1.14)	0.4	0.53
Bi-Ventricular Pacemaker	0.95 (0.73-1.25)	0.12	0.73

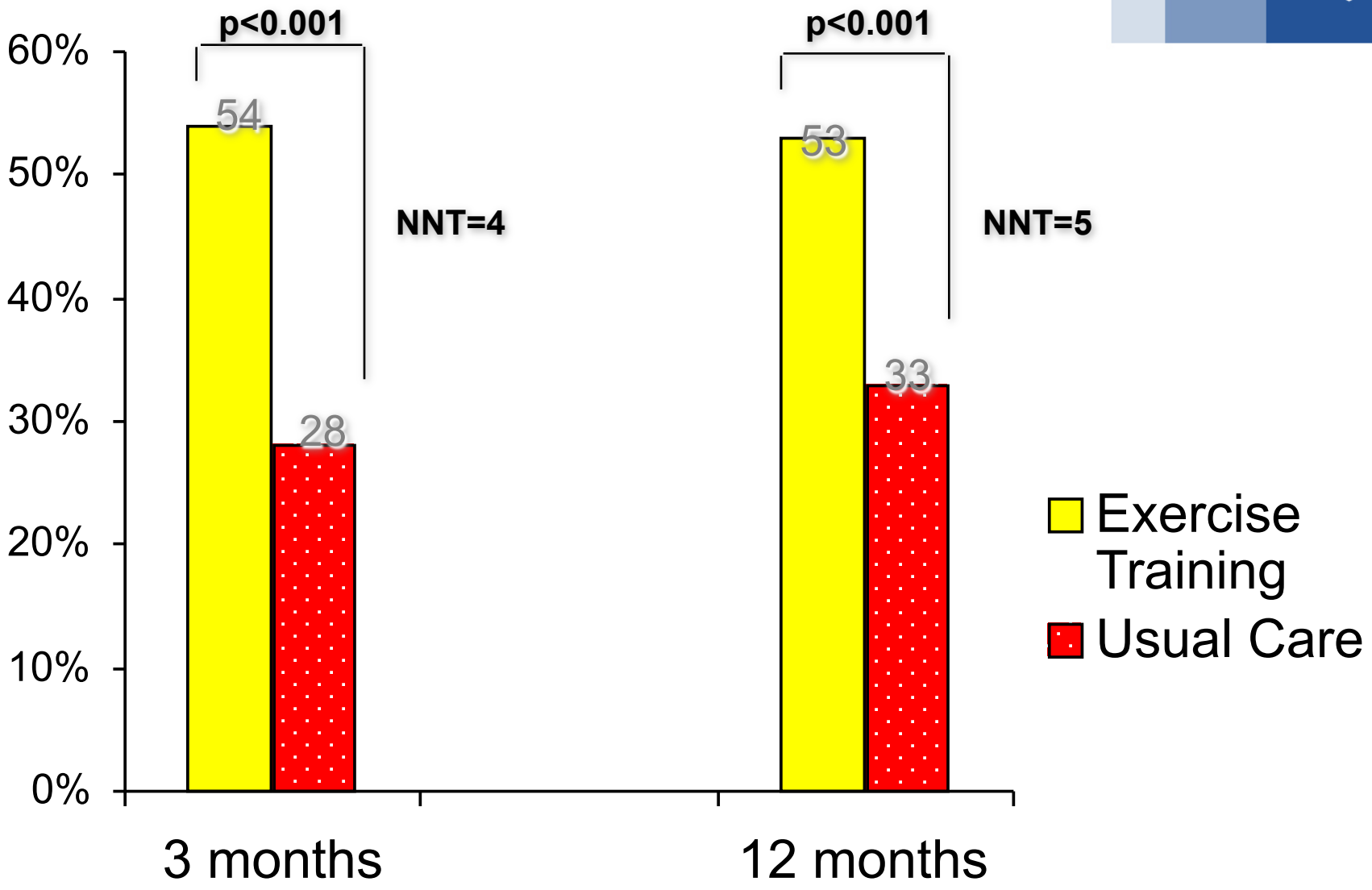
** Median exercise volume performed = ~ 4 MET-hr/wk*

HF-ACTION: Serious adverse events

	Usual Care N=1172	Ex Training N=1159
At least one CV event *	40%	37%
At least one ICD firing	23%	22%
Hospitalized after physical activity	2%	3%
Hospitalized for fracture of hip/pelvis	0.6%	0.3%
Deaths identified as possibly occurring within 3 hours of physical activity	0.4%	0.4%

* Worsening HF, MI, unstable angina, serious adverse arrhythmia, stroke, TIA

HF-ACTION: Effect on Quality of Life



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New indication for HF - CMS

- Early 2013 – AHA, ACC, AACVPR issued a request to expand cardiac rehab to HF.

- Nov 2013 – CMS issued proposal to expand cardiac rehab to pts with HF

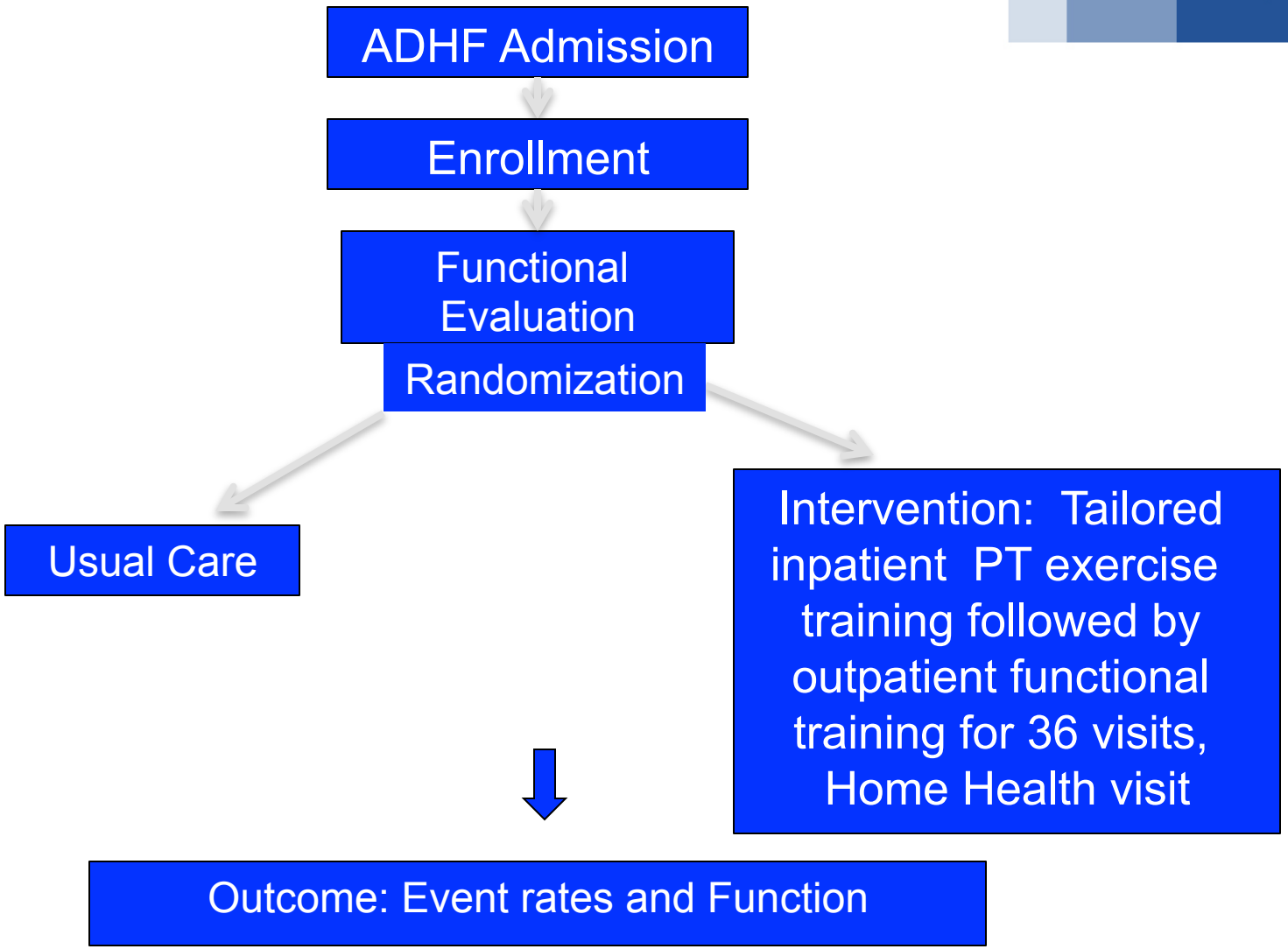
- LVEF ≤ 35% & NYHA class II - IV symptoms despite being on optimal HF therapy for ≥ 6 weeks.

CMS.gov
Centers for Medicare & Medicaid Services

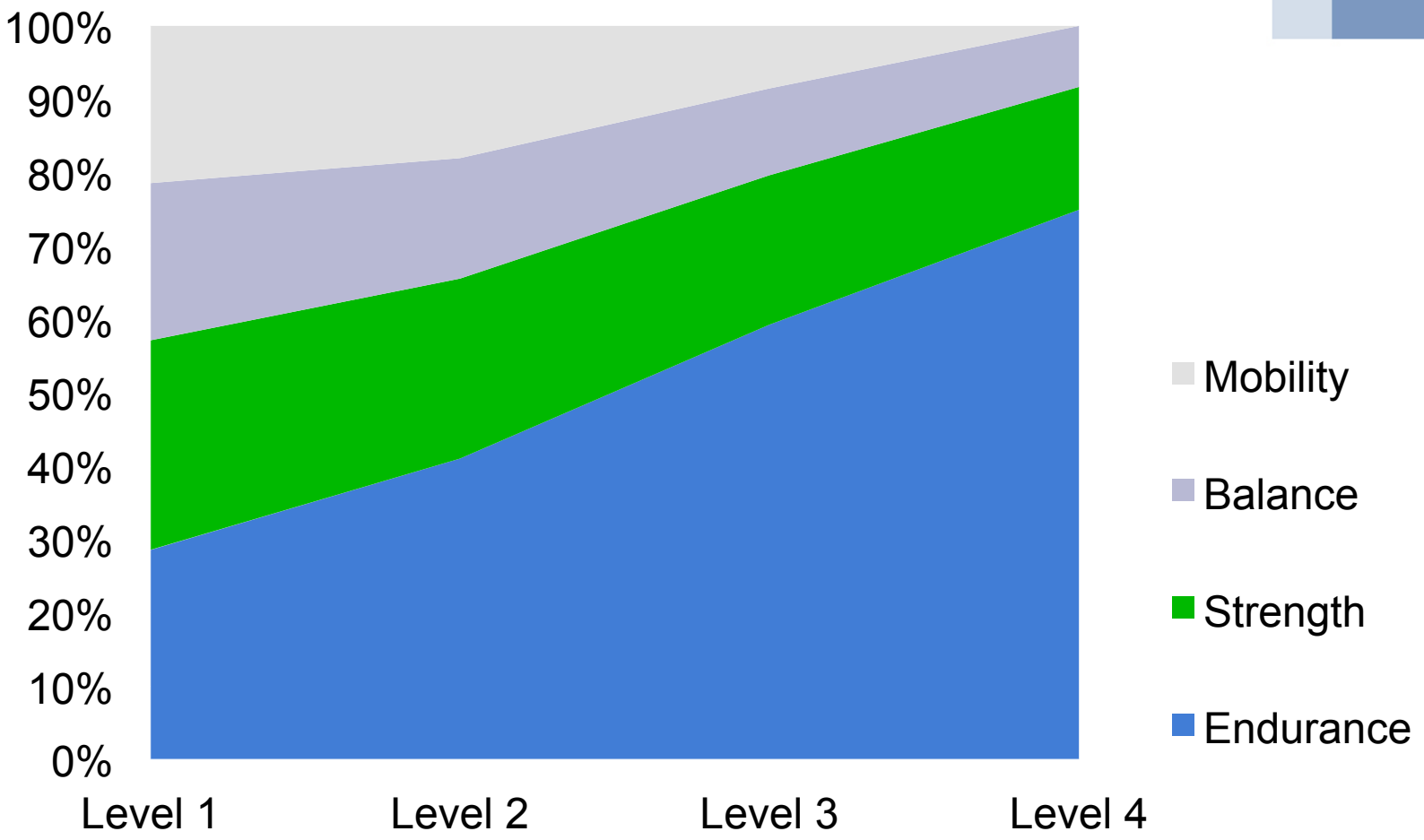
REHAB-HF Pilot Study

- Rehabilitation and Exercise Training after Hospitalization: Assessing Benefit in Heart Failure

REHAB HF – Pilot study



REHAB HF – Pilot study



Example of relative composition of REHAB HF multi-domain rehabilitation intervention as percent of exercise time as functional performance improves

REHAB HF – Pilot study

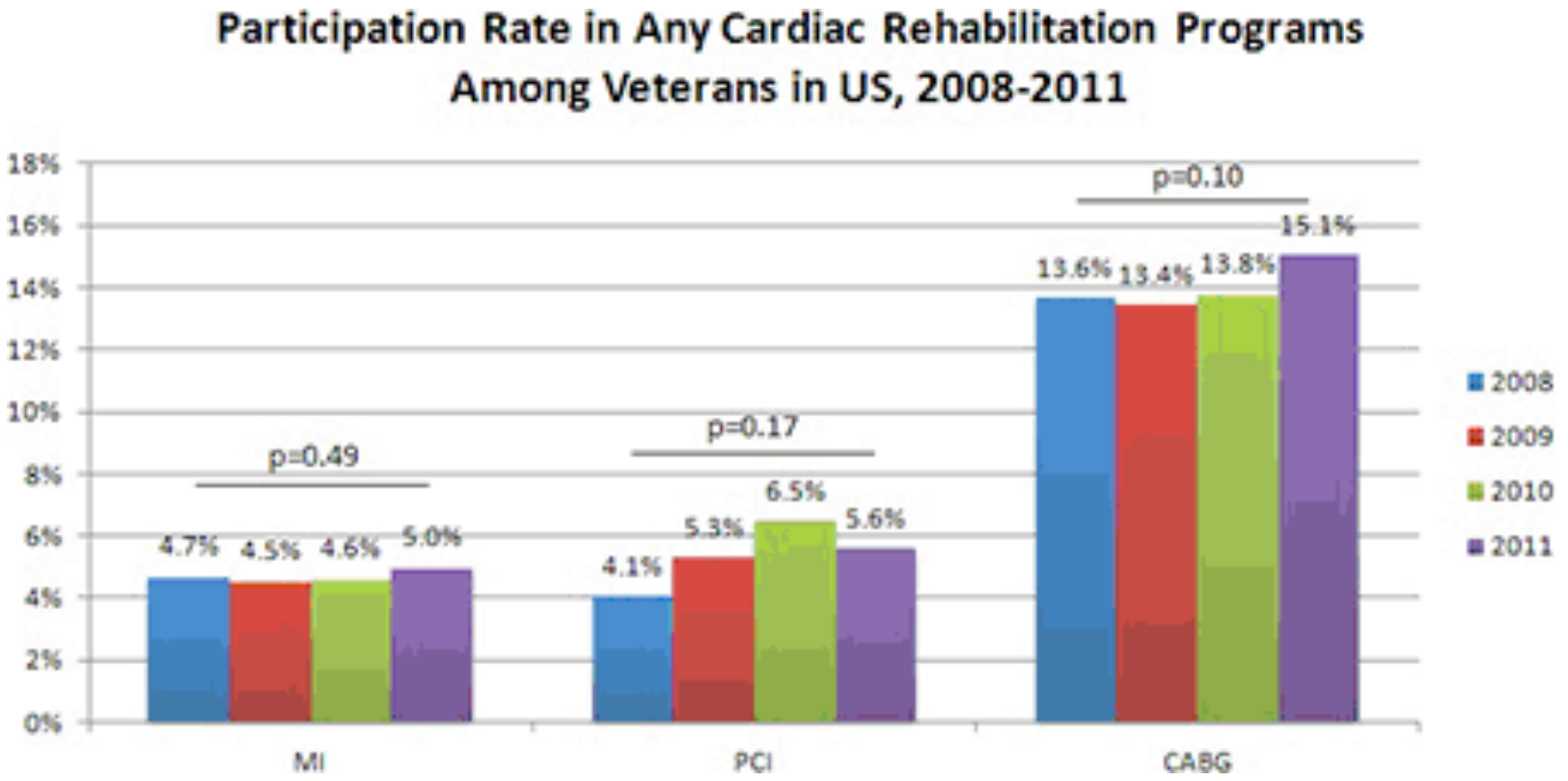
- 27 pts enrolled in 32 weeks
- Mean age 72 yrs (range 60-98)
- 59% women, 56% AA
- 41% HFPEF (mean LVEF 37%)
- Average # of co-morbidities 5.1
- 30% had a hospitalization w/in prior 6 months
- Average length of index hospitalization – 5 days

REHAB HF – Pilot study

- All-cause rehospitalizations were reduced by 51% in the intervention vs. usual care (1.1 vs. 2.3 per patient; p=0.07)
- All-cause rehospitalization days were also reduced (5.3 ± 6.1 vs. 14.7 ± 8.9; p=0.03)
- Rehospitalizations for HF were reduced by 61% (0.67 vs. 1.71, p=0.10)
- The change in the SPPB score explained 52% of the reduction in all-cause rehospitalizations.

Referral Process

Cardiac rehab utilization



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Schopfer AHA Poster 2013

Cardiac rehab utilization

- Only 14-35% of MI survivors participate in CR
- Only 31% participate in CR after CABG
- No only do more referrals need to be made but they also need to be more effective.

Suaya Circ 2007
CDC MMWR 2008

Cardiac Rehab Barriers

- **Physician**
  - Referrals are not performed or delayed
  - Perception of low patient willingness to participate
  - Low knowledge of evidence base
  - Over-reliance on physician referrals

- **Health System**
  - Services are seen to be territorial
  - Poor CR capacity (time and space)
  - Lack of renumeration for referral
  - High co-pays

- **Patient**
  - Limited knowledge of services
  - Referral difficult to attain
  - Competing demands – work and family
  - Patient's belief system

Referral Strategies

- Usual care
- Liaison
- Automated order
- Combined strategy

- Prospective study
- 2635 inpatients with CAD
- 11 hospitals in Canada

Table 4. GEE Analysis of Cardiac Rehabilitation (CR) Referral and Enrollment Rates by Referral Strategy[a]

Variable	OR (95% CI) Unadjusted	Adjusted
CR referral		
Liaison only	3.06 (2.26-4.16)	3.35 (1.54-7.29)
Automatic only	5.05 (3.71-6.87)	3.27 (1.52-7.04)
Combined automatic and liaison	12.64 (8.83-18.08)	8.41 (3.57-19.85)
Usual	1 [Reference]	1 [Reference]
CR enrollment		
Liaison only	2.49 (1.82-3.41)	2.60 (1.20-5.62)
Automatic only	3.57 (2.62-4.87)	2.35 (1.10-4.99)
Combined automatic and liaison	6.40 (4.60-8.88)	4.45 (1.98-10.00)
Usual	1 [Reference]	1 [Reference]

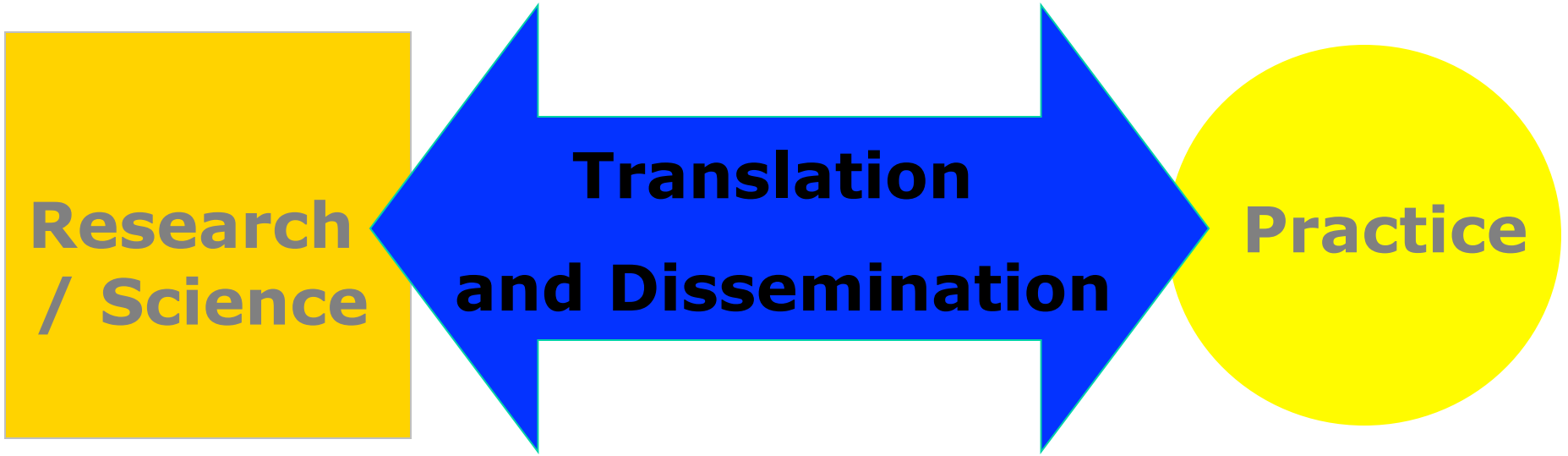
Grace Arch Intern Med 2011

Health Services and Outcomes Research

An Early Appointment to Outpatient Cardiac Rehabilitation at Hospital Discharge Improves Attendance at Orientation

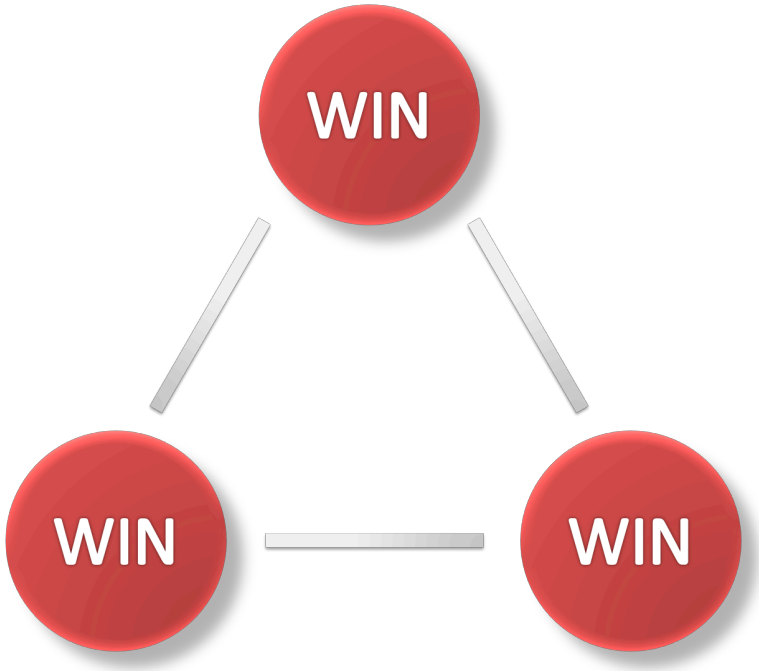
A Randomized, Single-Blind, Controlled Trial

- Randomized, single-blind, controlled study
- 148 inpatients with nonsurgical qualifying diagnosis for cardiac rehab
- CR appt within 10 days (early) vs. 35 days (standard)
- Early appt – CR attendance rate 77%
- Standard appt – CR attendance rate 59%


Research / Science
Translation and Dissemination
Practice

Develop customized referral strategies which engage all vested parties

- Patient
- Physician
- Health System



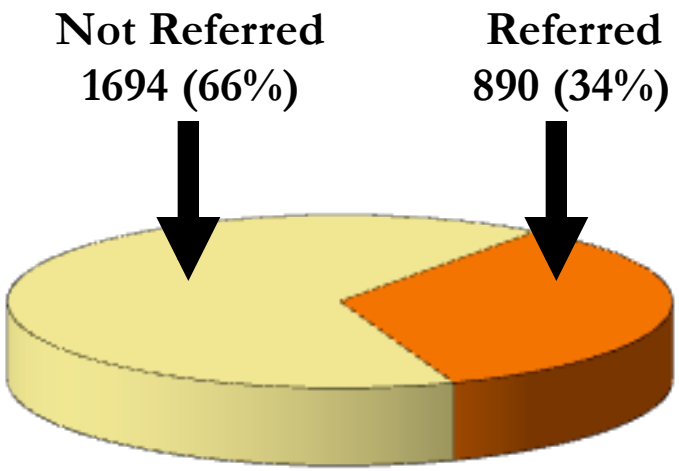
Duke Experience

Duke Cardiac Rehab

Duke Cardiac Rehab

Cardiac Rehab Referral Challenges

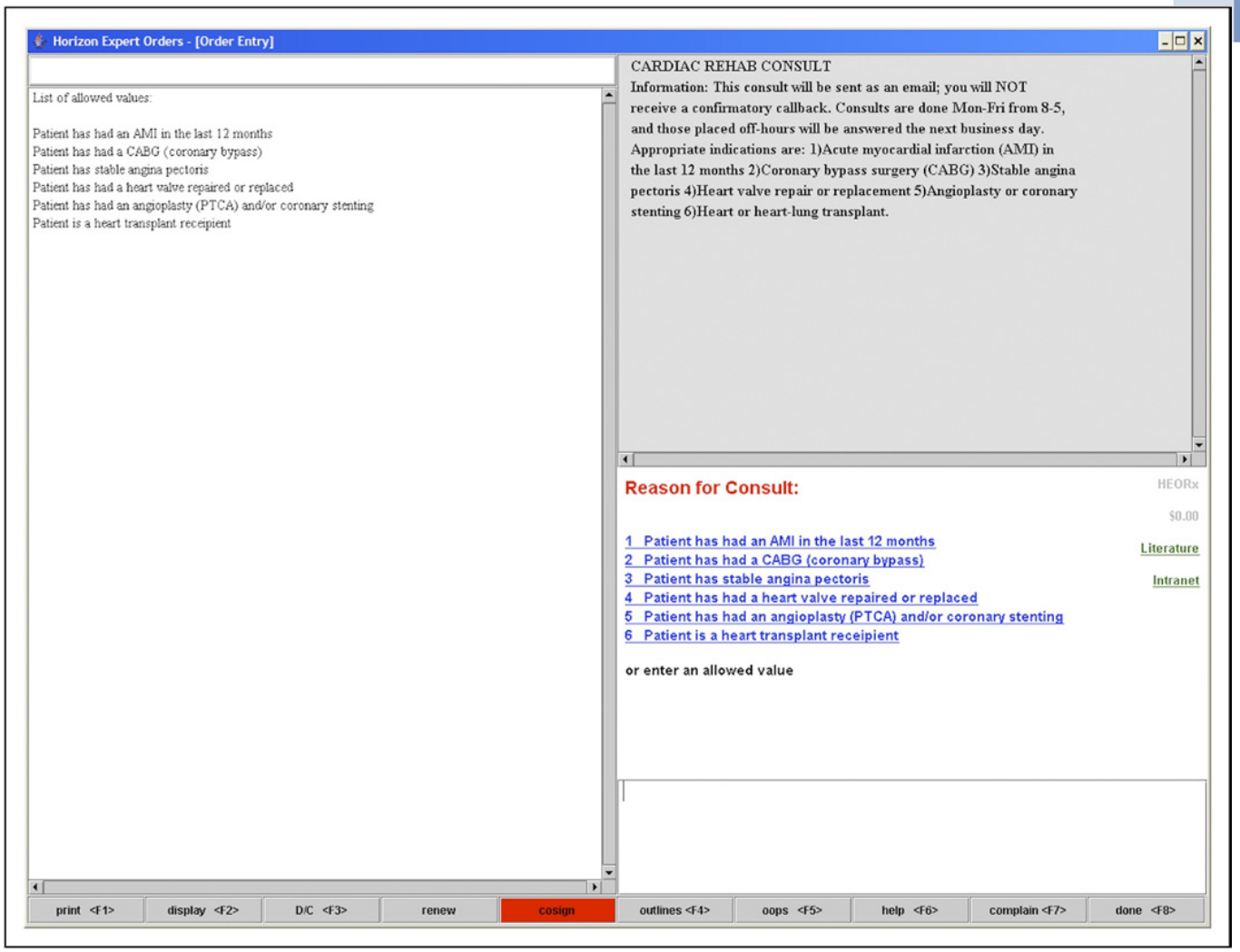
N = 2584 CR Eligible Patients from CV Hospitalizations spanning Aug 2007 – Jul 2008



Cardiac rehab staff started losing its presence in the hospital due to lack of resources

Patel AJM 2011

Duke Automated Referral Strategy



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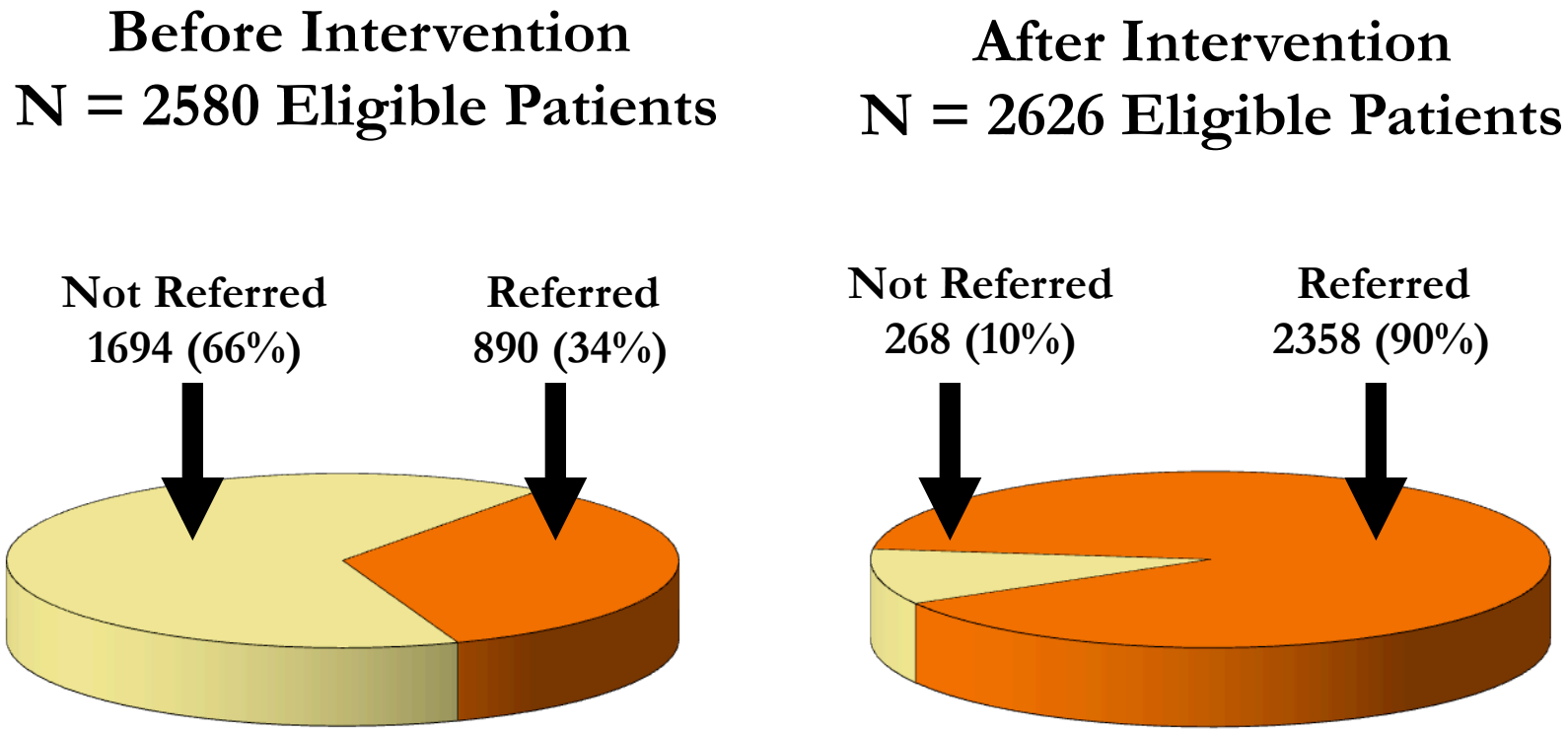
Patel AJM 2011

Duke Automated Referral Strategy



Patel AJM 2011

Develop customized referral strategies which engage all vested parties

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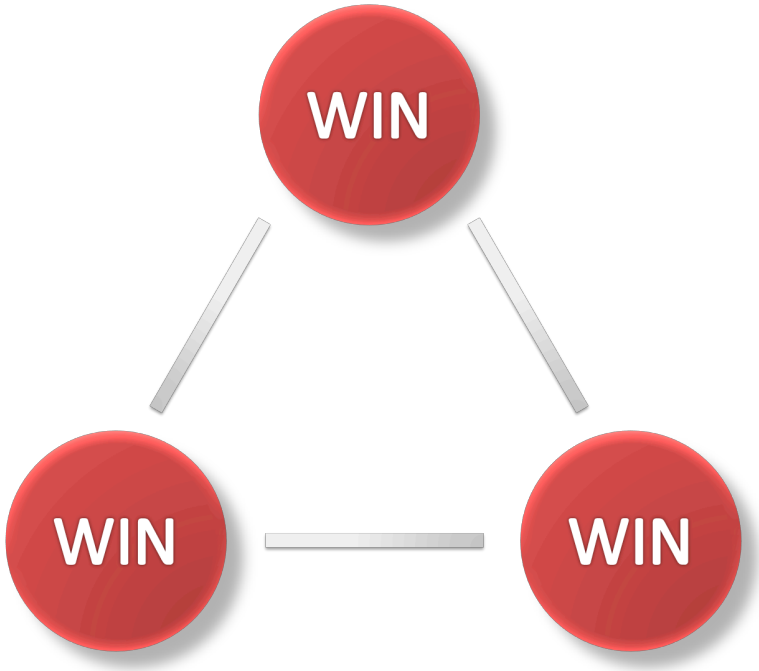
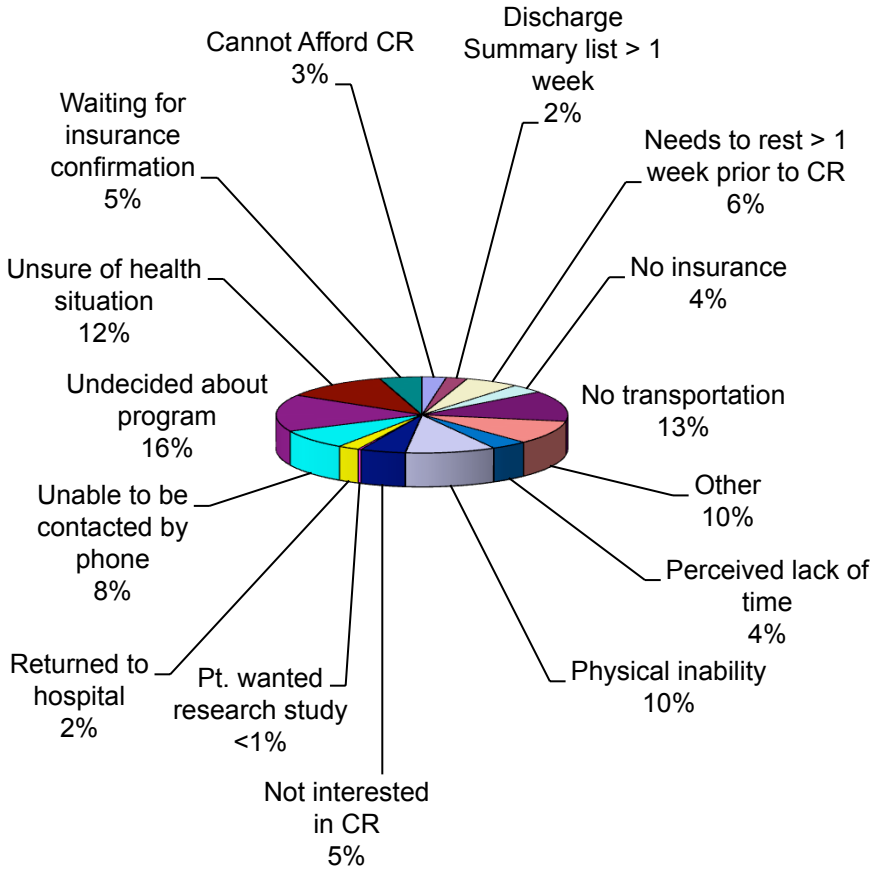


Duke patients reported reasons for not enrolling in cardiac rehab

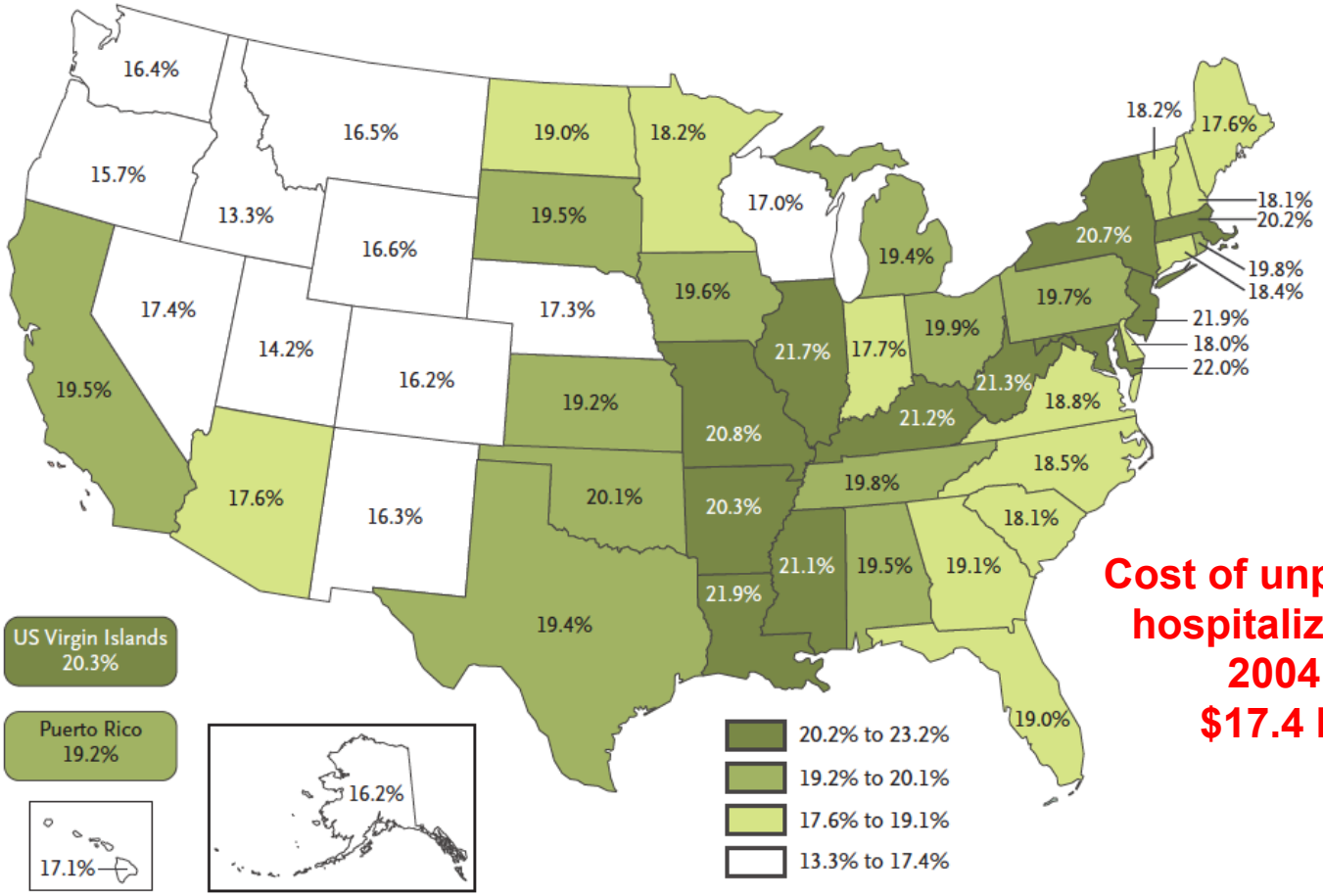


Engaging Patients : Testimonials

- Duke developed a video with the American College of Cardiology giving the patient perspective on cardiac rehab.
- Three testimonials from 3 diverse patients
- Can be found on the NCCRA or the ACC website
- Meant to be used as a resource for all programs

Health System in an Evolving Financial Model

Example - 30-Day Rehospitalizations



Cost of unplanned re-hospitalizations in 2004 was $17.4 billion

Jencks NEJM 2009

Engaging the Health System

- **Showcase the potential of cardiac rehab to improve quality of care, patient outcomes, patient experience and to reduce costs**

- **Key Partners:**
  - **Hospital Administration**
  - **Physicians**
  - **Cardiac rehab staff**
  - **EMR**
  - **Case managers / social workers**
  - **Schedulers**
  - **Financial counselors**

Duke Post-CAD Hospitalization Care

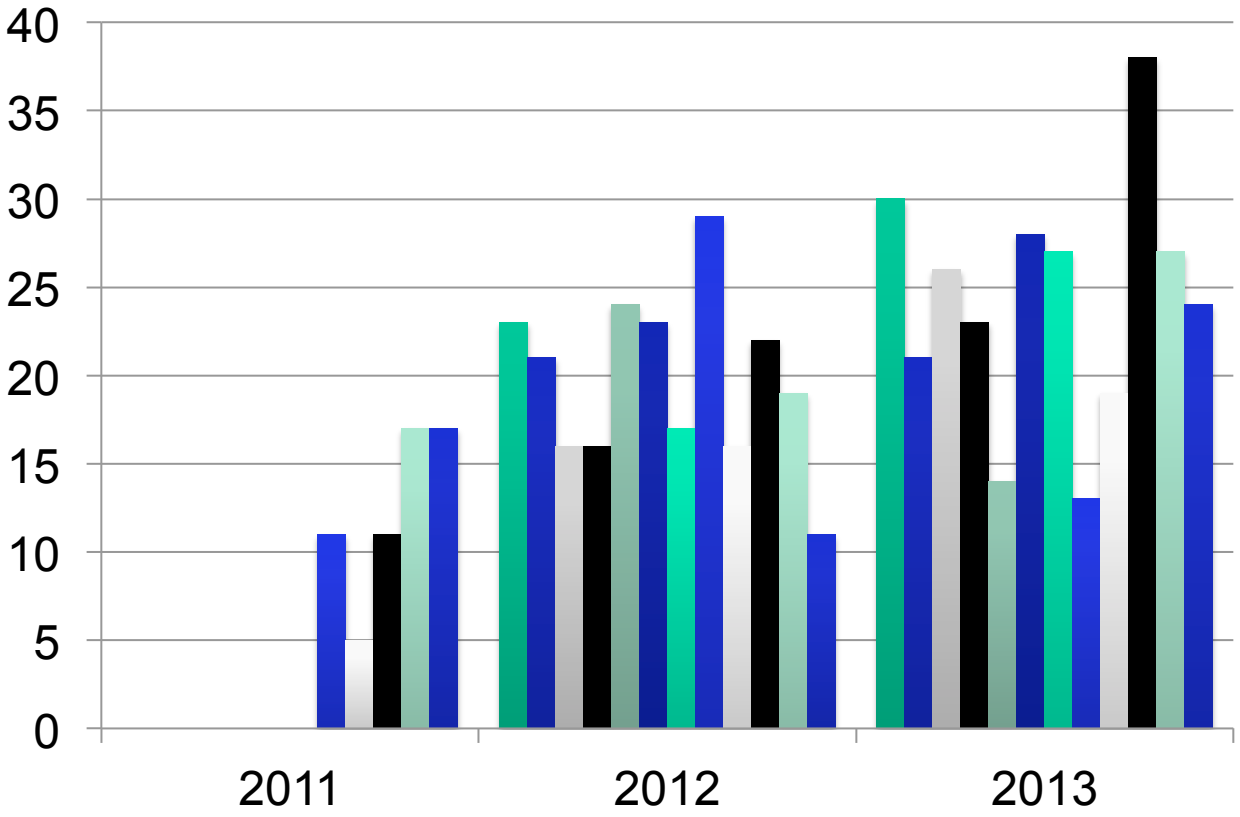
	72 Hours	7 Days	30 Days	45 Days	60 Days	90 Days
RN Phone Call	Review symptoms, medications, solicit questions, verify follow up visit scheduled		Review symptoms, medications, solicit questions, verify follow up visit scheduled		Review symptoms, medications, solicit questions, verify follow up visit scheduled	Review symptoms, medications, solicit questions, verify follow up visit scheduled
Provider Visit		**PCP or Cardiologist:** Review symptoms, medications, solicit questions	**Cardiologist or PCP (provider not seen at 7 days):** Review symptoms, medications, solicit questions	**Cardiologist:** Review symptoms, medications, solicit questions		
Cardiac Rehab	**Cardiac Rehabilitation** **12-week Comprehensive Lifestyle-based Prevention Program** **(Physicians, Nurses, Nutritionists, Exercise physiologists, Health Psychologists)**					

Patient BF

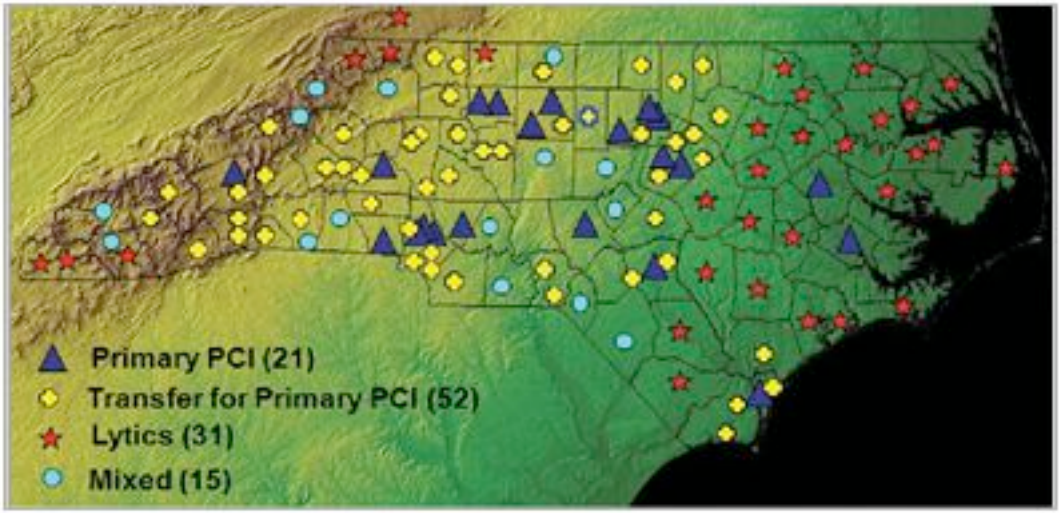
- 73 y/o white man s/p PCI of LCX with DES
- PCI – Day 0
- Hospital discharge – Day 1
- Post-PCI clinic visit – Day 8
- CR orientation – Day 11
- Completed 36 sessions
- CR graduation – Day 130
- No chest pain!

Duke Cardiac Rehab Utilization

New patients enrolled



What about patients who do not live in Durham county?



NC statewide initiative ?

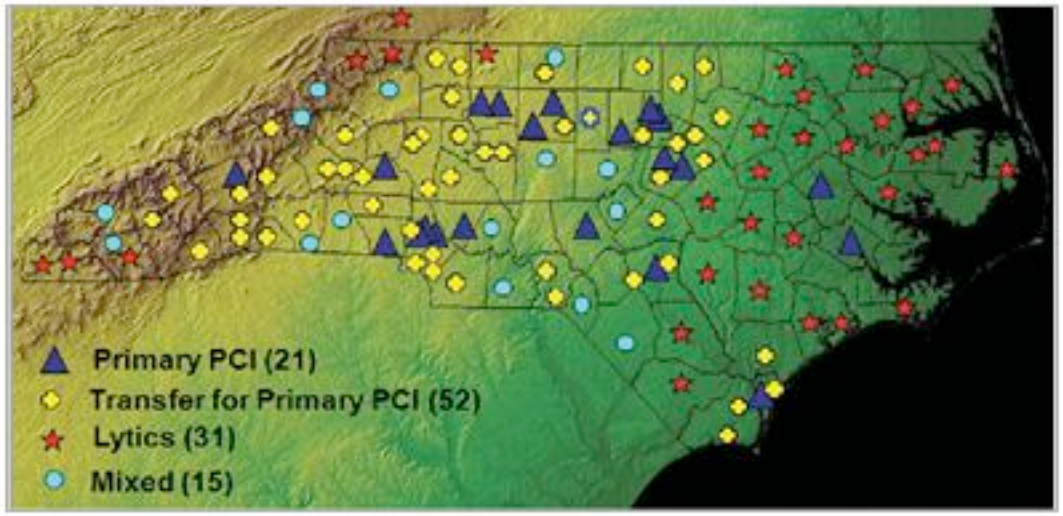
STEMI in North Carolina

- There is now decades of data supporting rapid reperfusion therapy for ST elevation MI in the US.

- Healthcare system still has serious problems providing reperfusion to all eligible patients in a timely fashion.

RACE project

- **R** eperfusion of
- **A** cute MI in
- **C** arolina
- **E** mergency Depts



RACE project in NC

- Collaborative efforts
  - EMS
  - Physicians
  - Nurses
  - Hospital Administrators
  - Payors
  - Industry partners
- 122 hospitals in 6 regions of NC
- Main outcomes tracked
  - Rates of re-perfusion
  - Time to treatment

A BIG Thanks to NCCRA Think Tank !!!

- Betty Matteson
- Debbie Scotten
- Karen Craig
- Claudia Gollop
- Katie Flanagan

NC statewide initiative for cardiac rehab utilization ?