


Secondary Prevention: Lipids, Lifestyle, and the Power of Cardiac Rehab

"Making a second heart attack a never event"


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1

Disclosures

- ❖ No conflicts of interest
- ❖ I am supported by:
 - NHLBI grant #R01 HL156851-01 – Studying the implementation and effectiveness of a hospital-based tobacco treatment team
 - NIA grant #AG077179-01 – Comparing two exercise methods on fitness outcomes in cardiac rehabilitation
 - NHLBI grant #R01HL146884 – Evaluating methods to increase cardiac rehabilitation enrollment among patients with heart failure
 - NHLBI grant #R34 HL156920 – Evaluating a stepped care model for cardiac rehabilitation recruitment and adherence
 - NIA grant # 1R01AG073278-01 - Randomized Trial of Assisted Ambulation to Improve Health Outcomes for Older Medical Inpatients


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73 yo man with stable angina –May 2019

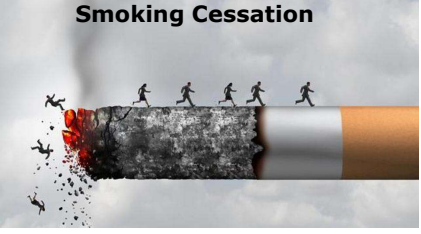
- ❖ Smokes 2 ppd
- ❖ Hypertension: SBP 180-190
- ❖ Hyperlipidemia: LDL 173
- ❖ Cath: 3v-CAD (CTO of RCA, 70% LAD, and 70% LCx)
- ❖ CABG unavailable due to temporary surgeon shortage

❖ What would you do? Where you start? How low do you go? How quickly do you arrange follow up?


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Smoking Cessation



"Giving up smoking is the easiest thing in the world. I know because I've done it thousands of times."
- Mark Twain

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Special Communication
March 10, 2004


Actual Causes of Death in the United States, 2000

Alli H. Mokdad, PhD; James S. Marks, MD, MPH; Donna F. Stroup, PhD, MSc; [et al.](#)
> Author Affiliations
JAMA. 2004;291(10):

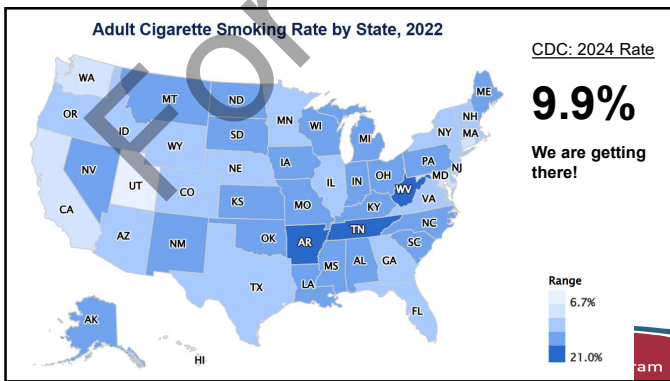
Tobacco is still a problem!

- ❖ #1: Tobacco: 485,000 deaths, (18.1%)
- ❖ #2: Poor diet & physical inactivity: 400,000 (16.6%)
- ❖ #3: Alcohol 85,000 (3.5%)

- ❖ 2016: Opioid overdose – 68K
- ❖ 2020: COVID – 375K

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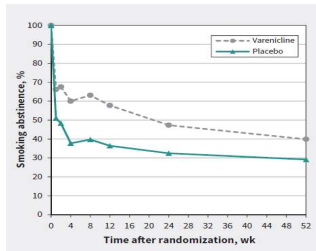
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6

Relapse After Hospitalization

- ❖ Most smokers (80%) want to quit
- ❖ Most (65%) of smokers will relapse
- ❖ Median time to relapse is within 7 days
 - 5% of motivated patients relapse within 1 hour of discharge!
- ❖ Smoking cessation interventions should begin in the hospital



Riley, JCRP 2018; Calvicchi et al. Am J Cardiol. 2011;108:804-808; CMAJ March 2018

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Inpatient Smoking Cessation

- ❖ Urges to smoke are much lower in the hospital
 - "I won't have a problem when I get home"
 - "I'm not having withdrawal"
 - "I already quit."
- ❖ In truth, withdrawal peaks around 1-2 weeks after smoking cessation, usually well after hospital discharge.
 - Withdrawal can be seen in the hospital
 - Irritable, cranky, easily frustrated, can't concentrate, yelling, grumpy
 - Withdrawal is a strong risk factor for leaving AMA

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Cessation Meds after ACS

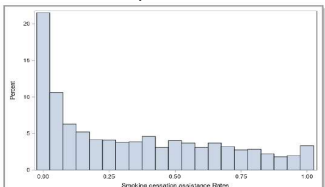
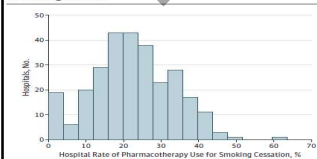
In Hospital

- ❖ Only 22% of patients get meds of any kind
- ❖ Hospital-dependent

After Hospital

- ❖ Only 7.0% got either varenicline or bupropion
- ❖ Clinician-dependent

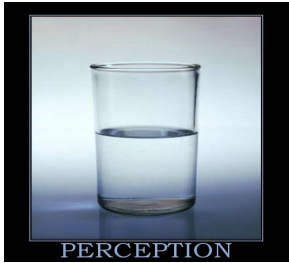
Figure. Variation Among Hospitals in Use of Pharmacotherapy for Smoking Cessation



Pack et al, JAMA-IM 2017; Pagitipadi JAMA-Card 2017; Sardana, JAHA, 2019

9

Meds: Do they Work?



- ❖ Most smokers fail when trying to quit
- ❖ Medications double to triple the quit rates
- ❖ From my perspective, the glass is half-full

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Medications

- ❖ "Pharmacotherapy ... should be encouraged for virtually all daily smokers."
- ❖ First line medications:
 - Varenicline
 - Patch and ad-lib NRT
- ❖ Ideal:
 - Varenicline + patch + lozenge
- ❖ Always send refills!

ACC Consensus Statement, JACC 2018

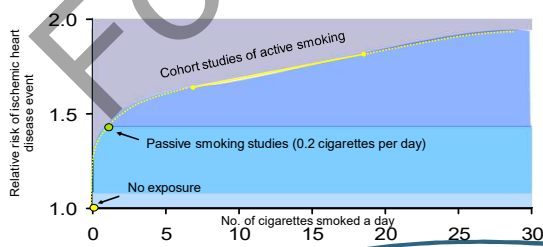
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Optimal prescribing practices

- Less effective**
- Low-dose nicotine patch (7, 14 mg) or gum (2mg)
 - 4 weeks of use
 - Stopping medications with lapse
- Effective**
- Nicotine patch, adequately dosed (21 to 42 mg)
 - Nicotine gum (4mg), lozenge (4mg), or inhaler
 - Bupropion SR
 - Continuing medication use even with lapses
- More Effective**
- Varenicline
 - Combination NRT (e.g. patch + gum, patch + lozenge)
 - Bupropion + NRT
 - 3 months of use
- Most Effective**
- Varenicline + adequately dosed patch (21 to 42 mg)
 - Varenicline + combination NRT
 - Varenicline + bupropion
 - 6 months of use

11

Need for Complete Abstinence "Not a single puff"



Pechacek TF, Babb S. BMJ. 2004 Apr 24;328(7446):980-3.

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“Tobacco use presents a rare confluence of circumstances:

- a highly significant health threat.
- a disinclination among clinicians to intervene consistently, and
- the presence of effective interventions.

Indeed, it is difficult to identify any other condition that presents such a mix of lethality, prevalence, and neglect, despite effective and readily available interventions.”

Michael Fiore – 2008 Guidelines


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- ❖ Cath: 3v-CAD (CTO of RCA, 70% LAD, and 70% LCx)
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❖ What would you do? Where you start? How low do you go? How quickly do you arrange follow up?


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Lancet – 2002 - Hypertension

- ❖ 1 million previously health adults
- ❖ Ages 40-89 years old
- ❖ 61 prospective observational trials included
- ❖ 12.7 million person/years at risk
- ❖ 56,000 vascular deaths
- ❖ 66,000 other deaths

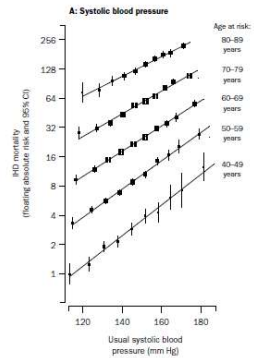
PSC Secretariate, *Lancet* Dec 2002, 360

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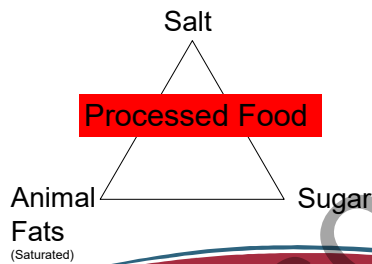
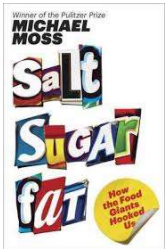
High Blood Pressure

- ❖ Risk **doubles** at 140/90 mmHg
- ❖ Most important risk for stroke
- ❖ No basement: goal <115 mmHg
- ❖ US guidelines now allow targeting a BP of <120 mmHg



16

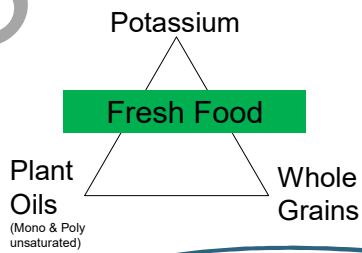
Dietary Axis of Evil



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Healthy Diet



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Mediterranean/DASH Diet

- ❖ Fish 2 times per week
- ❖ Red meat < 1 month
- ❖ Lots of fruits and vegetables
- ❖ Lots of legumes, nuts, whole grain
- ❖ Olive oil regularly



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DASH- Sodium

- ❖ 412 participants, 56% Women, 57% African American
- ❖ Randomized to 6 groups:
 - DASH diet or control diet
 - 50, 100, or 150 mmol/day sodium
 - After 2 week run-in on control diet, participants rotated through the three sodium levels in a cross-over design, for 30 days each

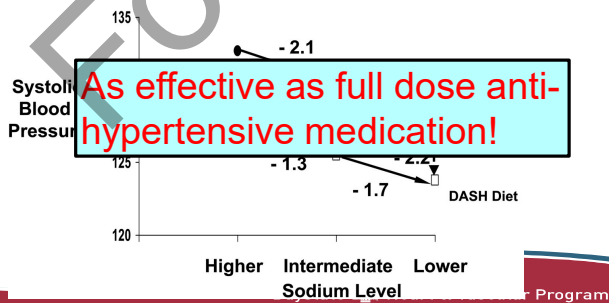


Sacks et al, NEJM Jan 2001

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DASH – Sodium Diet



21

Three Keys

- ❖ **Question:** How long does it take a typical patient with hypertension to get an anti-hypertensive medication started and/or up-titrated?
- ❖ Days, weeks, months, years?

TARGET:BP™



- ❖ Measure accurately
- ❖ Partner with patients
- ❖ **Act rapidly**

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Anti-Hypertensive Intensification

- ❖ 215 pt with DM2
 - BP > 140/90 mmHg
 - **13%** of visits increased medications
 - 6 months between visits (!)
- ❖ 221,519 pts - Kaiser CA
 - BP > 140/90 mmHg
 - **29%** had medication increase
 - Less likely when older, DM
 - More likely with team care
 - 6 months to achieve control (!)



Bolen et al, GJIM 2008; J. An et al., GJIM 2025

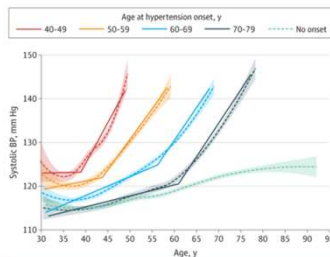
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Early BP Inflection Point:

Why <120 mmHg Matters

- ❖ Framingham Heart Study
 - SBP remains flat until ~120–125 mmHg, then rises sharply.
 - Shows rapid slope increase once above ~125 mmHg.
- ❖ China Health and Nutrition
 - Lower inflection point:
 - SBP: 112–118 mmHg
 - Slopes of SBP rise:
 - Before: ~0.4–0.7 mmHg/yr
 - After: 1.9–3.2 mmHg/yr



JAMA Cardiol 2018, JAHA 2023 Liu et al.

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Clinical Topics Latest in Cardiology Education and Meetings Tools and Practice Support My ACC

Cover Story | Collaborative Care a Critical Piece in the Hypertension Puzzle

Feb 02, 2024

Cardiology Magazine

Save to Lib

Elevated blood pressure (BP) is a modifiable risk factor for cardiovascular disease. Yet controlling hypertension and death and disability from cardiovascular disease has been challenging. Hypertension affects nearly 1 billion adults in the U.S., based on guideline definition of a systolic BP of 130 mm Hg on two separate occasions. About one in four adults has uncontrolled hypertension, and many are unaware they even have it. With so much on the line for patients and providers, collaborative care is a critical piece in the hypertension puzzle.

Figure: Effectiveness of Team-Based Strategies For Systolic BP Control

Strategy	Reduction in Systolic BP (mm Hg)
Team-based care (nonphysician titration)	-6.5
Team-based care (physician titration)	-5.5
Multilevel without team-based care	-4.5
Health coaching	-3.5
Home BP monitoring	-2.5

Data are from Mills KT, Ohtani KM, Shen W, et al. *Ann Intern Med* 2018;168:110-20. Table design informed by ChartGPT.

Corner | Heart Month supports Health Promotion | Collaborative Care a Piece in the Hypertension Puzzle

25

Rapid Follow Up & Team Based Care

Follow-Up After Initial BP Evaluation and Initiation of Antihypertensive Therapy

4. Adults with uncontrolled hypertension placed on new or intensified medical therapy should have follow-up evaluations for medication adherence and response to treatment at monthly intervals until control is achieved.¹⁴⁻¹⁵

Health Information Technology

5. For adults with uncontrolled hypertension, health information technology (HIT) by synchronous (eg, phone, video call) or asynchronous (eg, text, e-mail) communication is beneficial in improving BP control, access to care, and adherence to standards of care and should be incorporated in the management of hypertension, including the titration of BP medications.¹⁶⁻¹⁷

Team-Based Care

1. For adults with uncontrolled hypertension, a team-based care approach is recommended to achieve and maintain BP control.¹⁸

2. For adults with uncontrolled hypertension, an evidence-based care plan utilizing NPPs, and team-based care that is responsive to addressing adverse SDOH, is recommended to achieve and maintain BP control.¹⁸

Framework in Clinical Practice to Improve Hypertension Control

3. For adults with uncontrolled hypertension, an integrated treatment model that includes accurate BP measurement, prompt treatment, patient engagement, and ongoing review of NPPs is recommended to improve BP control.¹⁸

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26

73 yo man with stable angina –May 2019

- Smokes 2 ppd day
- Hypertension: SBP 180-190
- Hyperlipidemia: LDL 173
- Cath: 3v-CAD (CTO of RCA, 70% LAD, and 70% LCx)
- CABG unavailable due to temporary surgeon shortage

What would you do? Where you start? How low do you go? How quickly do you arrange follow up?

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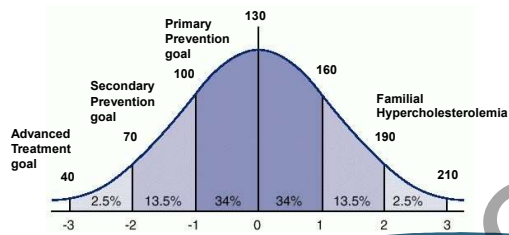
Question: Where did the 2001 ATP III recommendation of an LDL cholesterol treatment goal of <100 mg/dL come from?

- A. Nice round number
- B. Mouse models of disease
- C. Population norms
- D. Biologic norms

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28

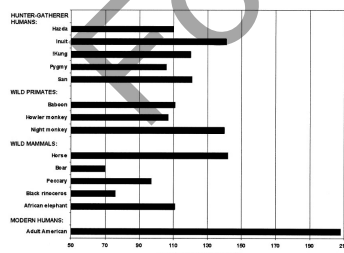
LDL Cholesterol
US Population Average, Mean ±SD



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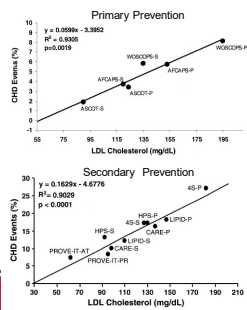
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Biologic Normal Cholesterol



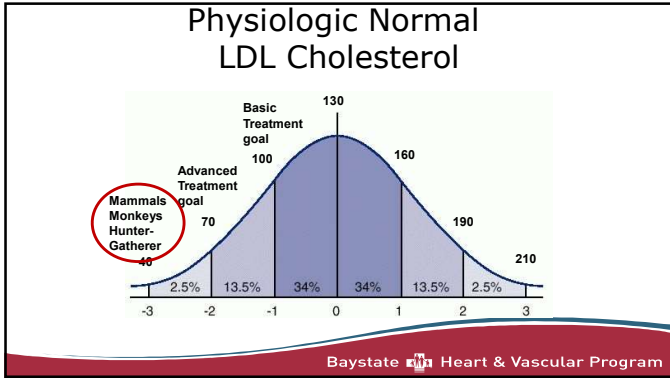
O'Keefe et al, JACC 2004 43 (11): 2146

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30



31

Question: Is Atherosclerosis Reversible?

- ❖ Yes
- ❖ No
- ❖ Maybe so?
- ❖ Multiple studies using IVUS at time of PCI
- ❖ Follow up 1-2 years later
- ❖ Correlates with treatment

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32

73 yo man with stable angina –May 2019

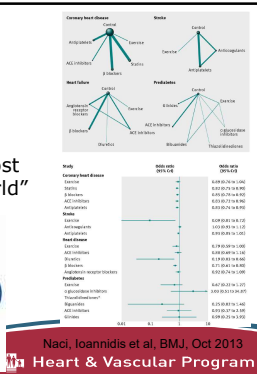
- ❖ 2 ppd smoker
- ❖ Underweight: BMI 18
- ❖ Hypertension: SBP 180-190
- ❖ Hyperlipidemia: LDL 173
- ❖ Cath: 3v-CAD (CTO of RCA, 70% LAD, and 70% LCx)
- ❖ CABG unavailable due to temporary surgeon shortage
 - **Cardiac Rehabilitation!**

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Benefits of Exercise

- ❖ Cornerstone of cardiac rehabilitation
- ❖ Low Tech – Powerful Medicine!
- ❖ "If the benefits of exercise could be contained in a pill, it would be the most widely prescribed medicine in the world"



34

Eligible Diagnoses for Cardiac Rehabilitation

- ❖ Within 6-12 months of:
 - Coronary artery bypass graft surgery
 - Heart valve replacement/repair
 - Myocardial infarction
 - Percutaneous coronary intervention
 - Heart transplant
 - Stable angina
 - Heart Failure, NYHA Class II-IV
 - Medicare, EF ≤ 35%
 - Other insurances vary, including HFpEF

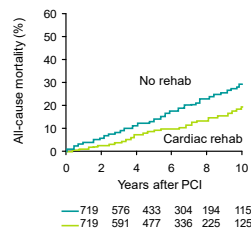
❖ **Don't forget:**
Supervised
Exercise Training
for Peripheral
Arterial Disease
(SET-PAD)

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Mortality Impact Post-PCI

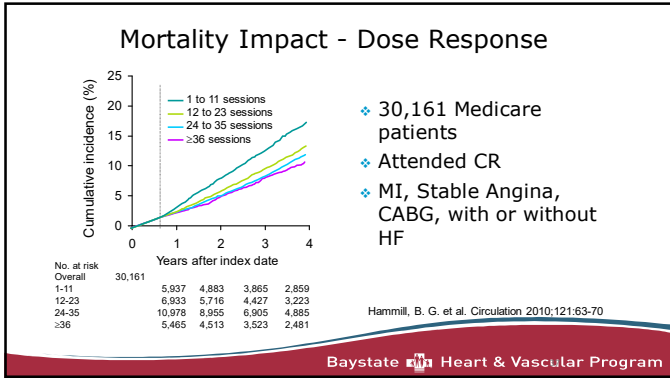
- ❖ 1438 patients undergoing PCI
- ❖ CR vs. No CR
- ❖ 5-year death rates 45% lower for CR participants
- ❖ Benefits regardless of concurrent MI



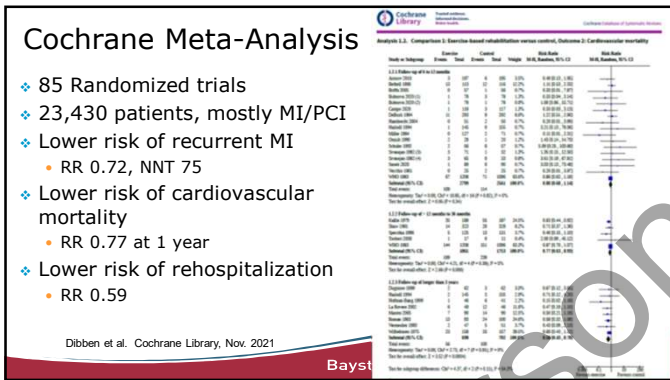
Goel, et al. Circulation. 2011;123:2344-52

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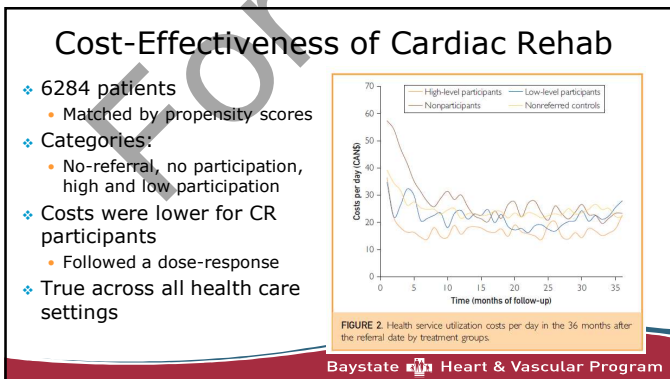
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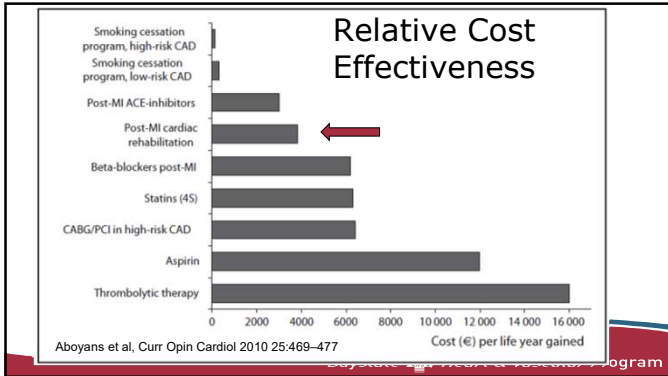
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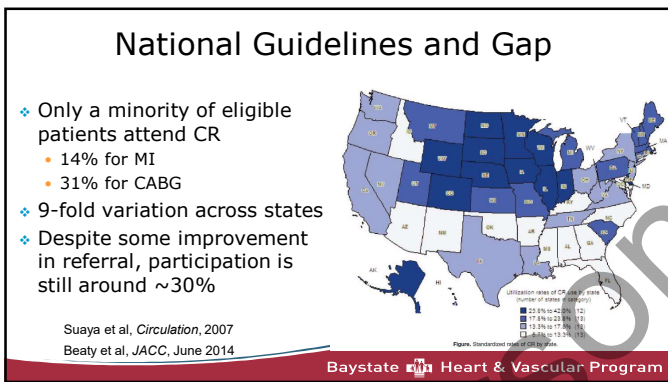
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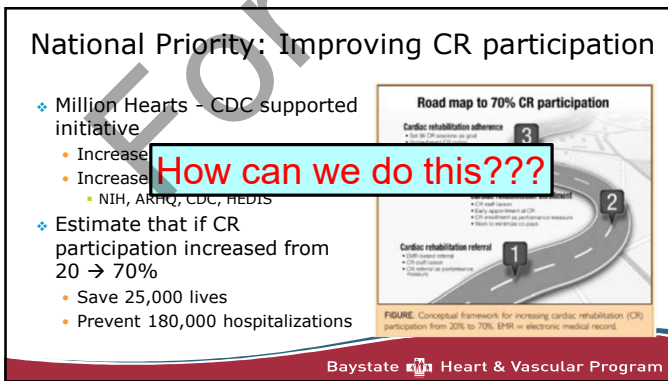
39



40



41



42

Systematic Referral - Opt Out

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Liaisons

❖ Face to face meeting prior to hospital discharge

- 1 EXPLAIN WHAT CR IS
- 2 CR BENEFITS
- 3 POSITIVE ENDORSEMENT
- 4 PROCESS TO ENROLL
- 5 WELCOME QUESTIONS
- 6 DISCUSS ANY BARRIERS
- 7 PROVIDE PATIENT HANDOUT

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Make Appointments before Hospital Discharge

- ❖ February - April 2019
- ❖ Chart Review (not randomized)
 - Referred to Baystate CR program
 - Appointment prior to discharge (yes/no)
- ❖ 229 patients
 - 171 (75%) appointment
 - 160 (70%) attended CR
- ❖ OR 61 (24 to 156), $p < 0.001$

Attended Cardiac Rehab (%)

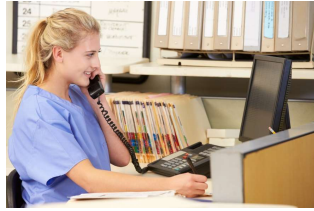
Appointment Status	Attended Cardiac Rehab (%)
Appointment	~75%
No Appointment	~10%

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Nurse Telephone Reminder

- ❖ 3536 patients after CABG, all referred
- ❖ Nurse telephone reminder vs. usual care
- ❖ 78% vs 50% attendance, $p < 0.001$



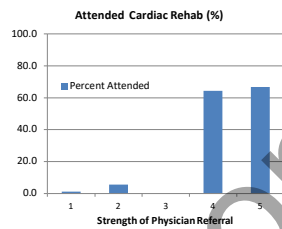
Harkness et al, *Heart Lung*, May-June 2005; 34 (3): 179

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Physician Endorsement of CR

- ❖ The strength of the physician referral is a **key predictor** of attendance at CR
 - Ranked "strength of physician referral" from 1 to 5, 5 being the highest
- ❖ Has been reproduced in multiple studies



Ades et al, *Archives Int. Med*, 1992
Grace et al, *Archives Int Med*, 2010
Grace et al, *Eur J Card Rehabil* Oct 2008

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Summary: How to Improve CR Use

- ❖ Systematic referral
 - Opt out > Opt in > Routine "paper" referral
- ❖ Liaison-facilitated referral
 - Inpatient cardiac rehabilitation, navigators, liaisons
 - Maps, contact information, encouragement
- ❖ Early appointments to CR
 - Eliminate restrictive policies
- ❖ Reminder phone calls
- ❖ Increase strength of physician referral

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73 yo man with stable angina –May 2019

- ❖ Started on
 - atorvastatin 40 mg;
 - metoprolol 50 mg XL
- ❖ Referred for Prehabilitation in CR



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49

Prehabilitation

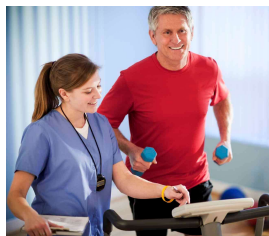
- ❖ Hypertensive (184/76), 1 mm ST depression with walking
 - Prescribed Amlodipine 5 mg and Chlorthalidone 12.5 mg
 - 1 week later: Increased to Amlodipine 10 mg; Chlorthalidone 25 mg
 - CR provided weekly feedback on symptoms and blood pressure
- ❖ Visited with dietician, increased protein, began to gain weight
- ❖ Saw tobacco treatment specialist, started varenicline and nicotine lozenge
- ❖ Attended 8 sessions
- ❖ Exercise capacity: 2.4 → 3.2 METs

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CABG and Rehabilitation

- ❖ 5 weeks later, pre-op BP was 132/60
- ❖ Underwent 3v CABG
- ❖ 5-day length of stay (short)
 - no complications from surgery
- ❖ Cardiac rehabilitation – 3 weeks later
 - Adherent to his medications
 - Chest pain free
 - Normal blood pressure
 - Smoke free
 - 36 sessions!
 - Exercise capacity: 2.6 → 4.5 METs

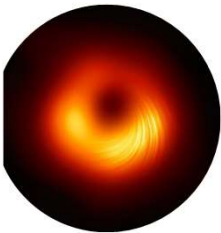



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Black Box of Cardiac Rehab

- ❖ Many providers have little to no idea what happens in cardiac rehabilitation
 - Take a tour, Ask your patients, Ask questions!
- ❖ We get 36 sessions with your patients
 - Education, tobacco, nutrition, medication adherence, strength training, exercise
 - Symptom evaluation, early warning
- ❖ We have a lot of data
 - Exercise tolerance, symptoms, heart rates
 - Resting blood pressure, telemetry strips
- ❖ Collaborate with your program!



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Long-Term Disease Management of Patients With Coronary Disease by Cardiac Rehabilitation Program Staff

- ❖ 503 patients s/p MI and attended CR
- ❖ Attended disease management program
 - Optimal Treatment
 - 90% on statins, LDL 91
 - BP 129 mmHg
- ❖ Over 3 years
 - All-cause mortality **1.9%**
 - Age matched control group, no CAD: **1.6%**
- ❖ We are getting there! 😊


Squires et al, JCRP 2008; 28: 180-186

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Take Home Points

- ❖ Secondary Prevention works!
 - Atherosclerosis is (somewhat) reversible
 - An LDL <55 mg/dL is biologically normal
- ❖ Smoking is still a major problem
 - Always prescribe medications for smoking cessation!
- ❖ Titrate anti-hypertensive medications quickly
 - Team based care is best
 - Aim for a BP of <120 mmHg when possible
- ❖ Always refer to cardiac rehab
 - What you say (or don't) really matters!

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54

“Making a second heart attack a never event”

Questions?

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