



OULUN YLIOPISTO
UNIVERSITY of OULU

SYDÄNKUNTOUTUS KANNATTAA

KUNTOUTUSALAN OPINTOPÄIVÄT 15.-16.11.2019

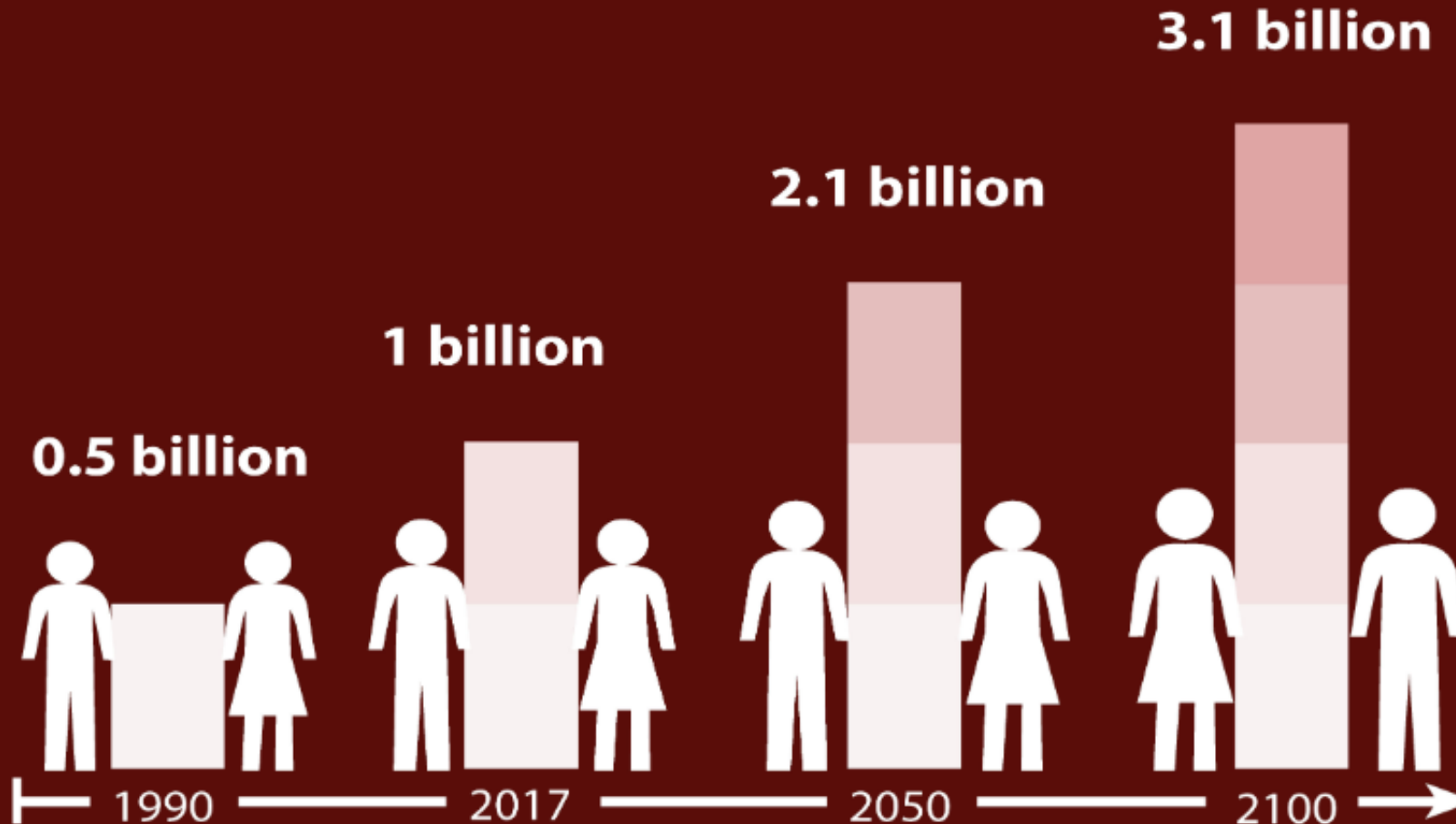
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Oulun Yliopistollinen Sairaala, Oulun Yliopisto,
Kardiologian sydäntoimenpiteiden tutkimusryhmä



Ageing Population

Projected global population aged 60 years or over



Source: United Nations Department of Economic and Social Affairs,
Population Division, *World Population Prospects: The 2017 Revision*
Produced by: United Nations Department of Public Information



14.11.2019

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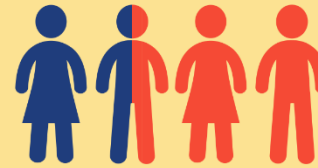


10 Common Chronic Conditions for Adults 65+

Quick Facts



80%
have have at
least 1 chronic
condition



68%
have 2 or more
chronic
conditions



Hypertension
(High Blood Pressure)
58%



High Cholesterol
47%



Arthritis
31%



**Ischemic Heart
Disease**
(or Coronary Heart
Disease)
29%



Diabetes
27%



**Chronic Kidney
Disease**
18%



Heart Failure
14%



Depression
14%



**Alzheimer's Disease
and Dementia**
11%

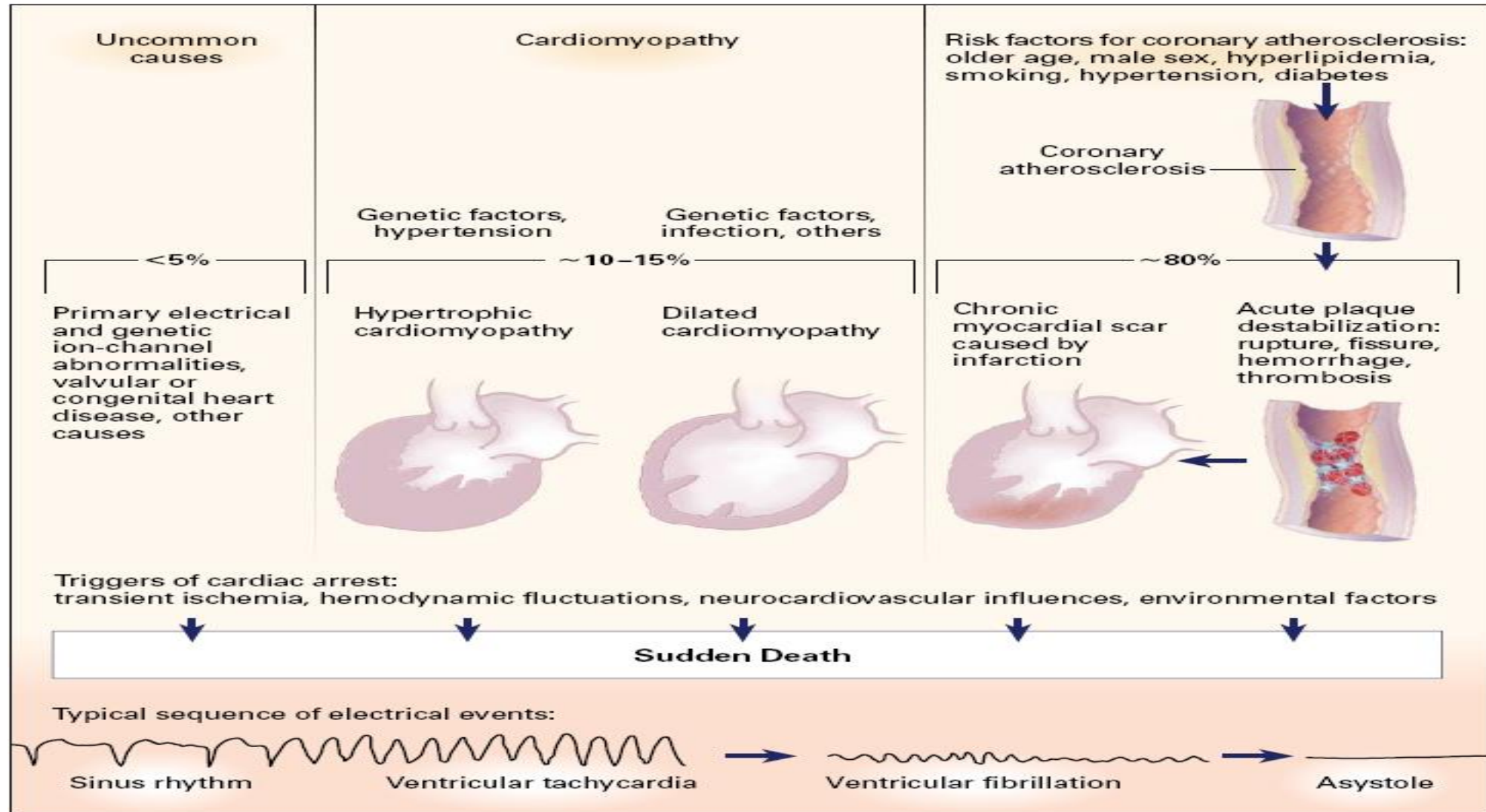


**Chronic Obstructive
Pulmonary Disease**
11%

Source: Centers for Medicare & Medicaid Services, Chronic Conditions Prevalence State/County Table: All Fee-for-Service Beneficiaries, 2015



SYDÄNPERÄISEN ÄKKIKUOLEMAN PATOFYSIOLOGIA



SYDÄNSAIRAUDEN RISKITEKIJÖITÄ

- **Age.** Simply getting older increases your risk of damaged and narrowed arteries.
- **Sex.** Men are generally at greater risk of coronary artery disease. However, the risk for women increases after menopause.
- **Family history.** A family history of heart disease is associated with a higher risk of coronary artery disease, especially if a close relative developed heart disease at an early age. Your risk is highest if your father or a brother was diagnosed with heart disease before age 55 or if your mother or a sister developed it before age 65.
- **Smoking.** People who smoke have a significantly increased risk of heart disease. Exposing others to your secondhand smoke also increases their risk of coronary artery disease.
- **High blood pressure.** Uncontrolled high blood pressure can result in hardening and thickening of your arteries, narrowing the channel through which blood can flow.
- **High blood cholesterol levels.** High levels of cholesterol in your blood can increase the risk of formation of plaque and atherosclerosis. High cholesterol can be caused by a high level of low-density lipoprotein (LDL) cholesterol, known as the "bad" cholesterol. A low level of high-density lipoprotein (HDL) cholesterol, known as the "good" cholesterol, can also contribute to the development of atherosclerosis.
- **Diabetes.** Diabetes is associated with an increased risk of coronary artery disease. Type 2 diabetes and coronary artery disease share similar risk factors, such as obesity and high blood pressure.
- **Overweight or obesity.** Excess weight typically worsens other risk factors.
- **Physical inactivity.** Lack of exercise also is associated with coronary artery disease and some of its risk factors, as well.
- **High stress.** Unrelieved stress in your life may damage your arteries as well as worsen other risk factors for coronary artery disease.
- **Unhealthy diet.** Eating too much food that has high amounts of saturated fat, trans fat, salt and sugar can increase your risk of coronary artery disease.

Sometimes coronary artery disease develops without any classic risk factors. Researchers are studying other possible factors, including:

- **Sleep apnea.** This disorder causes you to repeatedly stop and start breathing while you're sleeping. Sudden drops in blood oxygen levels that occur during sleep apnea increase blood pressure and strain the cardiovascular system, possibly leading to coronary artery disease.
- **High sensitivity C-reactive protein.** High sensitivity C-reactive protein (hs-CRP) is a normal protein that appears in higher amounts when there's inflammation somewhere in your body. High hs-CRP levels may be a risk factor for heart disease. It's thought that as coronary arteries narrow, you'll have more hs-CRP in your blood.
- **High triglycerides.** This is a type of fat (lipid) in your blood. High levels may raise the risk of coronary artery disease, especially for women.
- **Homocysteine.** Homocysteine is an amino acid your body uses to make protein and to build and maintain tissue. But high levels of homocysteine may increase your risk of coronary artery disease.
- **Preeclampsia.** This condition that can develop in women during pregnancy causes high blood pressure and a higher amount of protein in urine. It can lead to a higher risk of heart disease later in life.
- **Alcohol use.** Heavy alcohol use can lead to heart muscle damage. It can also worsen other risk factors of coronary artery disease.
- **Autoimmune diseases.** Conditions such as rheumatoid arthritis and lupus (and other inflammatory rheumatologic conditions) have an increased risk of atherosclerosis.

ALUSTUKSEN SISÄLTÖ

1. **Akuuttihoidosta nopeasti kotiin**
2. Sydäntuntoutuksen sisältö
3. Liikunnan hyödyt sydäntuntoutuksessa
4. Säästetäänkö terveydenhuollon kuluissa?
5. Yhteenveto



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APRIL 19, 1952

“ARMCHAIR” TREATMENT OF ACUTE CORONARY THROMBOSIS

Samuel A. Levine, M.D.
and
Bernard Lown, M.D., Boston



SYDÄN- JA VERISUONITAUTIEN KUOLLEISUUDEN KEHITTYMINEN

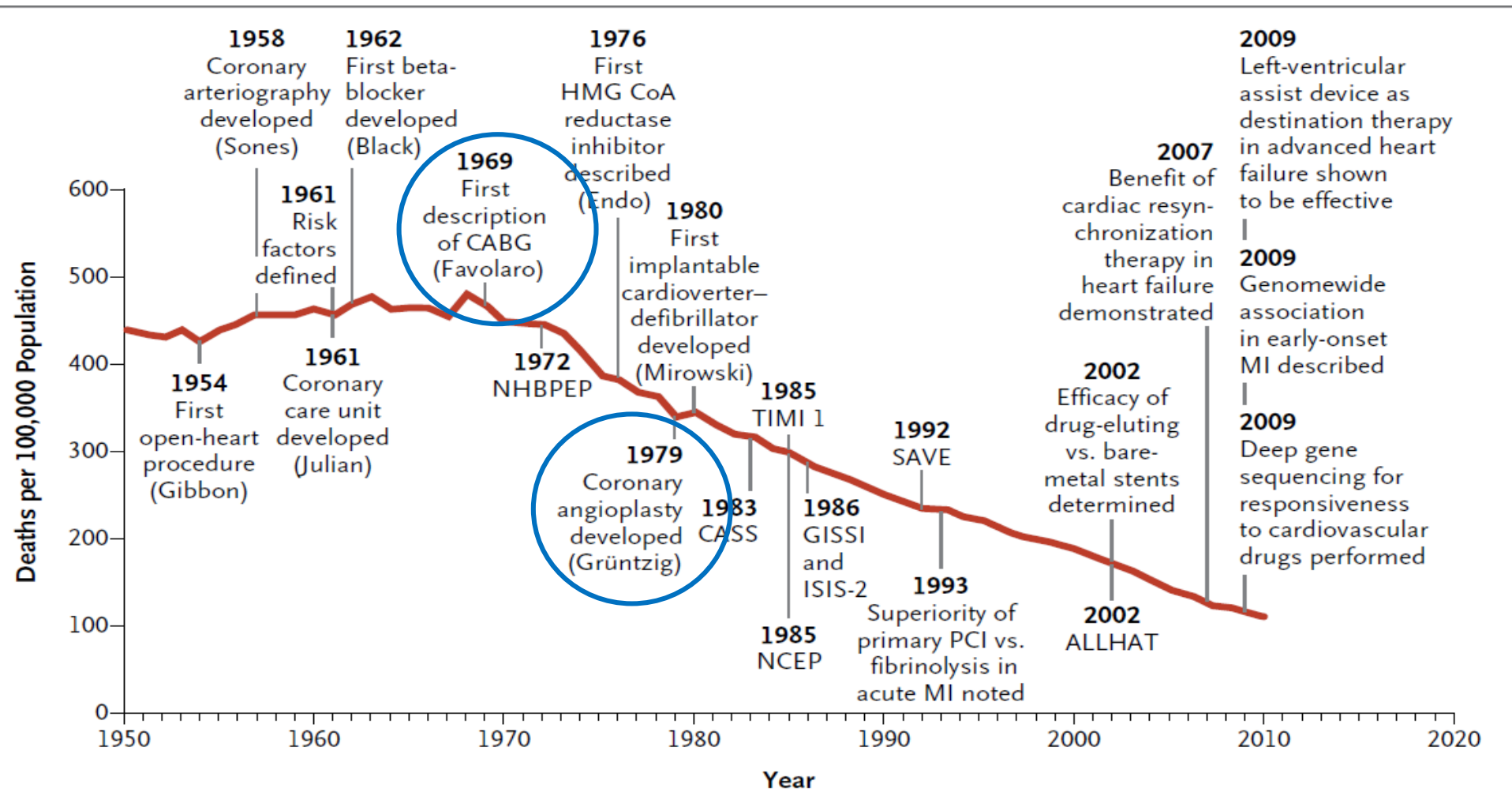
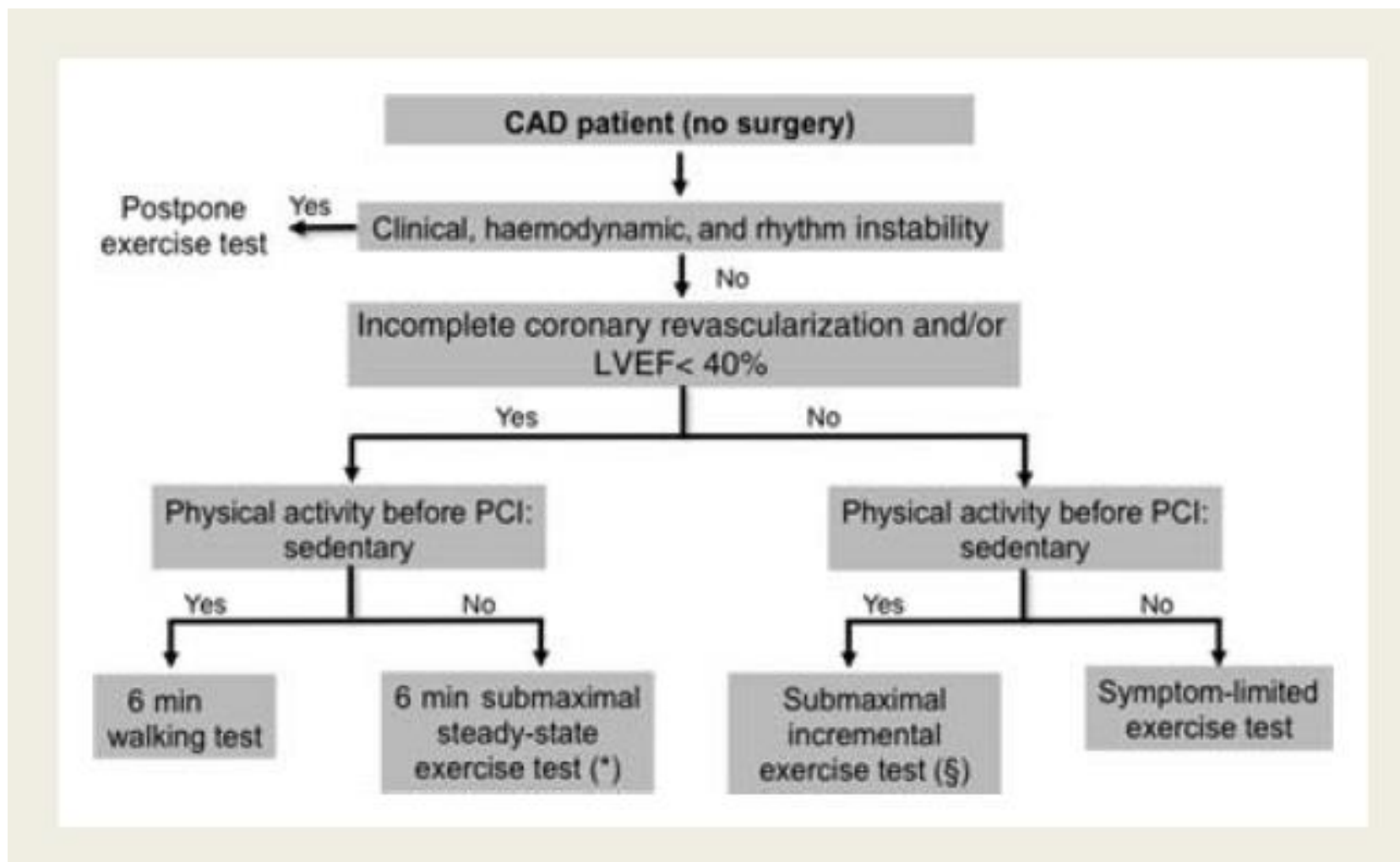


Figure 1. Decline in Deaths from Cardiovascular Disease in Relation to Scientific Advances.

SYDÄNINFARKTIPOTILAS KOTIUTUU SAIRAALASTA NOPEASTI



“Stable CAD and post elective PCI: Symptom-limited exercise testing can be safely performed the day after routine PCI, but scarcely performed.”

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Physical Activity and Structured Exercise for Patients With Stable Ischemic Heart Disease

“Exercise was recently described as “A MIRACLE DRUG” that can benefit every part of the body and substantially extend lifespan.”



SYDÄNKUNTOUKSEN AVAINTEKIJÄT

Table I Key elements of cardiac rehabilitation programmes

Tools	Follow-up measures
• Exercise training • Education • Diet	• Cardiorespiratory fitness • Physiological measures • Symptoms
• Psychological support • Lifestyle modifications • Social support • Relaxation therapy	• Quality of life • Healthcare costs • Hospitalization • Morbidity and mortality



ELÄMÄNTAPAMUUTOKSEN TAVOITTEET SYDÄNKUNTOUTUKSESSA



ARKIAKTIIVISUUTTA JA LIIKUNTAHARJOITTELUA



European Heart Journal (2010) **31**, 1967–1976
doi:10.1093/eurheartj/ehq236

POSITION PAPER

Secondary prevention through cardiac rehabilitation: physical activity counselling and exercise training

Key components of the position paper from the Cardiac Rehabilitation Section of the European Association of Cardiovascular Prevention and Rehabilitation

“Many of the risk factor improvements occurring in CR can be mediated through exercise training programmes. This call-for-action paper presents the key components of a CR programme: physical activity counselling and exercise training.”



LIIKUNTALÄÄKERESEPTI

General guideline for training:

Endurance training

Frequency	≥5 d/wk
Intensity	55%–90% maximum predicted HR* or 40%–80% $\dot{V}O_{2\max}$ or HR reserve RPE 12–16
Modality	Walking, treadmill, cycling, etc
Duration	30–60 min

Resistance training

Frequency	2–3 d/wk
Intensity	50%–80% of 1-RM or RPE 12–16 1–3 sets of 8–15 repetitions per exercise
Modality	Lower extremity: leg extensions, leg curls, leg press. Upper extremity: bench press, lateral pulldowns, biceps curl, triceps extension
Duration	30–45 min

HR indicates heart rate; maximum predicted HR=(220–age); RPE, rating of perceived exertion; and 1-RM, single-repetition maximal lift.

*The HR range recommendation assumes that the individual is not taking β -adrenergic-blocking medications. Modified from Shephard and Balady.^{491a}

Guideline for cardiac patients:

Endurance training

Frequency	≥5 d/wk
Intensity	55%–90% maximum predicted HR* or 40%–80% $\dot{V}O_{2\max}$ or HR reserve RPE 12–16
Modality	Walking, treadmill, cycling, etc
Duration	30–60 min

Resistance training

Frequency	2–3 d/wk
Intensity	40%–60% of 1-RM or RPE 12–16 1–3 sets of 10–15 reps
Modality	Lower extremity: leg extensions, leg curls, leg press. Upper extremity: bench press, lateral pulldowns, biceps curl, triceps extension
Duration	30–45 min

HR indicates heart rate; maximum predicted HR=(220–age); RPE, rating of perceived exertion; and 1-RM, single-repetition maximal lift.

*The HR range recommendation assumes that the individual is not taking β -adrenergic-blocking medications. Modified from Shephard and Balady.^{491a}



INDIKAATIOT SYDÄNKUNTOUTUKSEEN

Coronary artery bypass grafting

Myocardial infarction in the past 12 months

Percutaneous coronary angioplasty or intervention

Chronic stable angina

Heart valve repair or replacement

Heart failure (must fit all 3 criteria)

New York Heart Association class II–IV

Left ventricular ejection fraction $\leq 35\%$

Stable on medical therapy without hospitalization or planned procedure in past 6 weeks

Heart or heart and lung transplant

Peripheral artery disease



NOPEA ALOITUS SAIRAALASTA PÄÄSYN JÄLKEEN

Uncomplicated myocardial infarction, percutaneous coronary intervention (patients with normal or mildly reduced left ventricular ejection fraction)	Within 14 days of event
Minimally invasive open-heart surgery	Within 4 weeks
Heart surgery involving sternotomy	After 6 weeks



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ORIGINAL INVESTIGATIONS

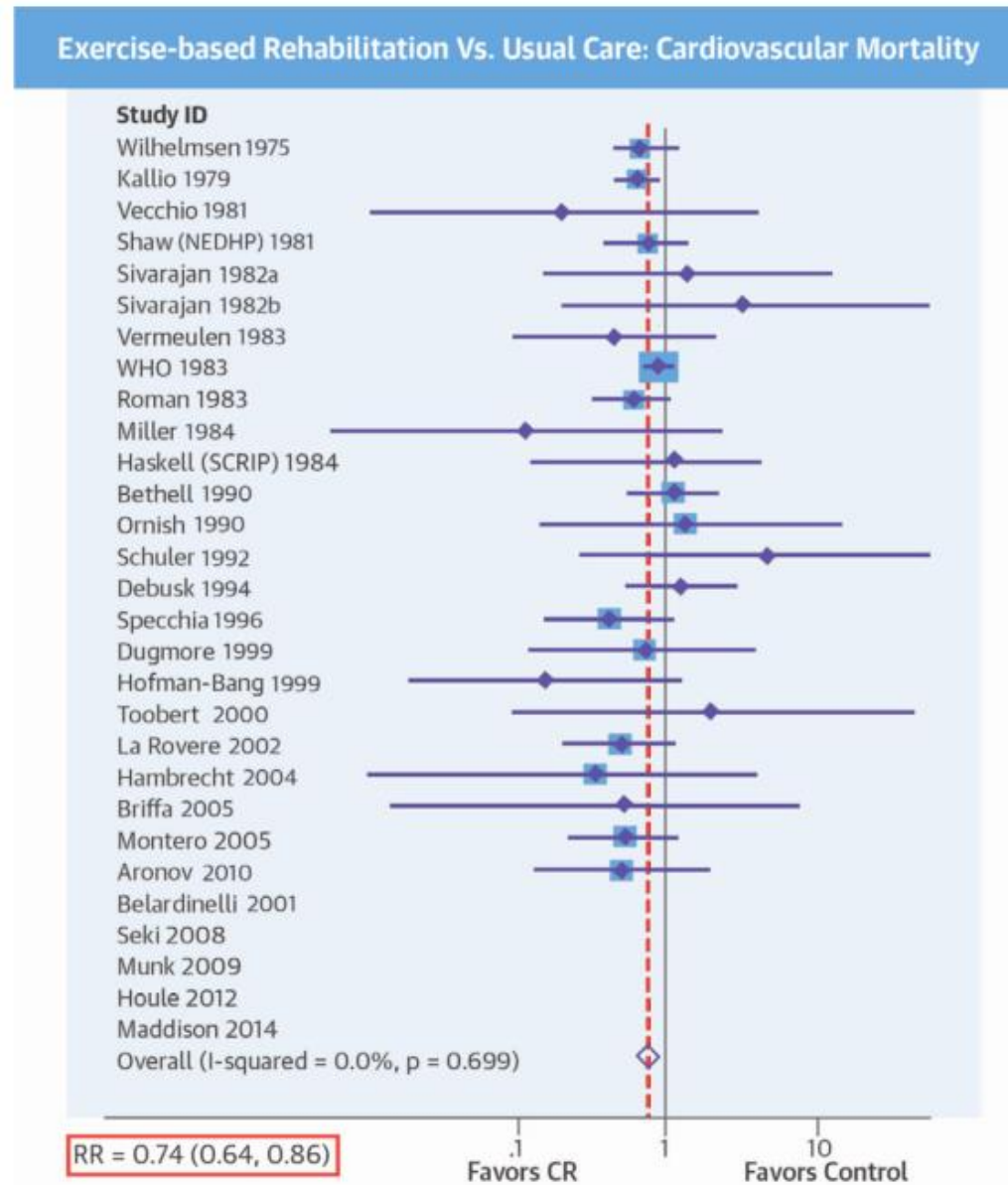
Exercise-Based Cardiac Rehabilitation for Coronary Heart Disease

Cochrane Systematic Review and Meta-Analysis

Lindsey Anderson, PhD,* Neil Oldridge, PhD,† David R. Thompson, PhD,‡ Ann-Dorthe Zwisler, MD,§
Karen Rees, PhD,|| Nicole Martin, MA,¶ Rod S. Taylor, PhD*



SYDÄN- JA VERISUONITAUTIKUOLLEISUUS



UUSI SAIRAALAKÄYNTI

Exercise-based Rehabilitation Vs. Usual Care: Hospitalization

Study ID

Shaw (NEDHP) 1981

Lewin 1992

Haskell 1994

Engblom 1996

Hofman-Bang 1999

Belardinelli 2001

VHSG 2003

Hambrecht 2004

Yu 2004

Briffa 2005

Giallauria 2008

Zwisler 2008

Reid 2011

Mutwalli 2012

Maddison 2014

Overall (I-squared = 34.5%, p = 0.099)

RR = 0.82 (0.70, 0.96)

.1 Favors CR

10 Favors Control

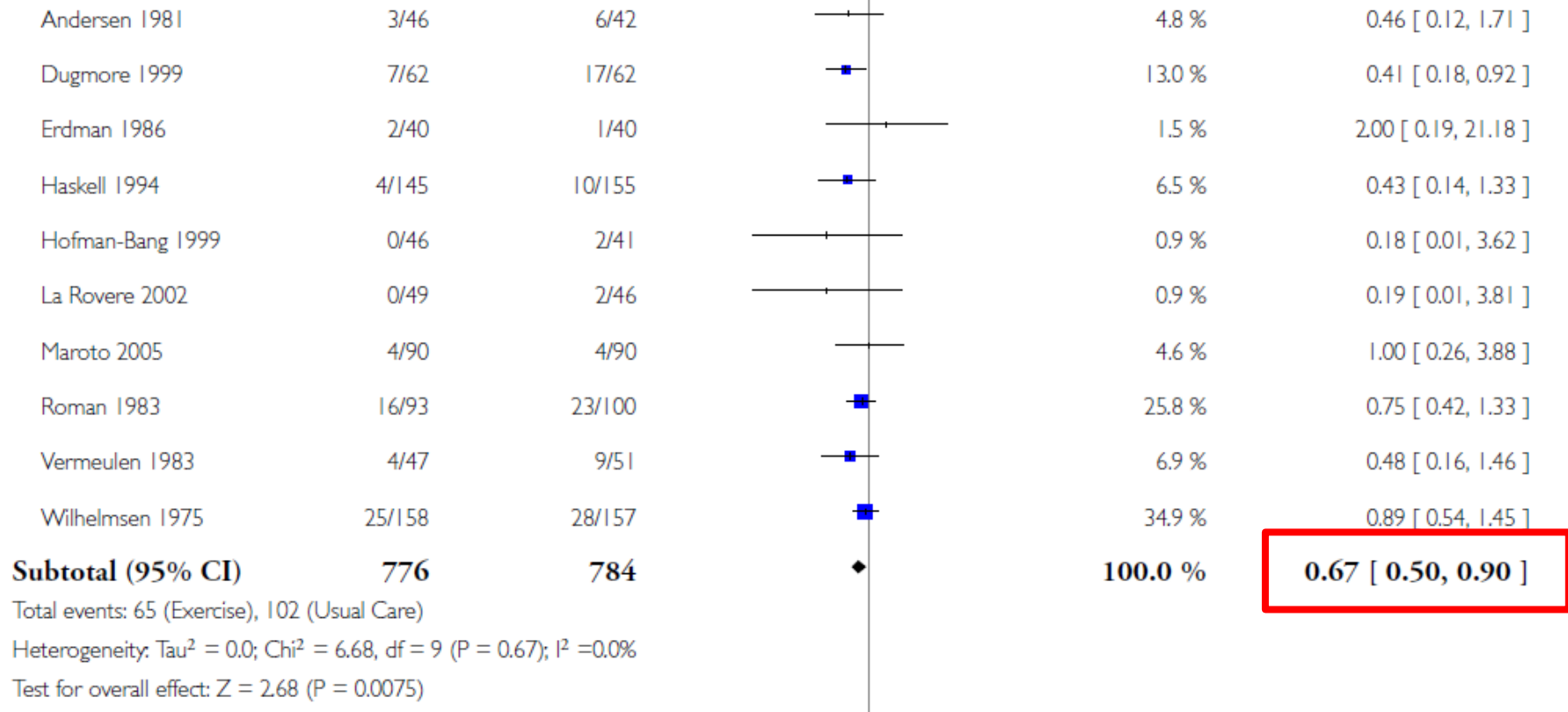
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NÄKYYKÖ HYÖTY VIELÄ MYÖHEMMIN (CV-KUOLLEISUUS)? SEURANTA PIDEMPI KUIN 3 VUOTTA

3 Follow-up of longer than 3 years





ESC

European Society
of Cardiology

European Heart Journal (2018) 00, 1–8

doi:10.1093/eurheartj/ehy417

CLINICAL RESEARCH

Coronary artery disease

Impact of ambulatory cardiac rehabilitation on cardiovascular outcomes: a long-term follow-up study

**Sara Doimo¹, Enrico Fabris^{1*}, Massimo Piepoli², Giulia Barbati³,
Francesco Antonini-Canterin⁴, Guglielmo Bernardi⁵, Patrizia Maras¹, and
Gianfranco Sinagra¹**

¹Cardiovascular Department, Azienda Sanitaria Universitaria Integrata, University of Trieste, Via Pietro Valdoni n. 7, 34149 Trieste, Italy; ²Heart Failure Unit, Cardiac Department, Guglielmo da Saliceto Hospital, Piacenza, Italy; ³Biostatistics Unit, Department of Medical Sciences, University of Trieste, Italy; ⁴Cardiovascular Rehabilitation, Ospedale Riabilitativo di Alta Specializzazione, Motta di Livenza, Italy; and ⁵Division of Cardiology, "Santa Maria degli Angeli" Hospital, Pordenone, ASS5, Italy

Received 24 October 2017; revised 3 January 2018; editorial decision 7 June 2018; accepted 20 July 2018



14.11.2019



PÄÄTETAPAHTUMIA VÄHEMMÄN KUNTOUTUSRYHMÄSSÄ 5 VUODEN SEURANNAN JÄLKEEN

“The composite outcome of hospitalizations for cardiovascular causes and cardiovascular mortality were lower in CR group compared to no-CR group (**18% vs. 30%, $P < 0.001$**) and was driven by lower hospitalizations for cardiovascular causes (**15% vs. 27%, $P < 0.001$**).”

“This study showed, in a real-world population, the positive effects of ambulatory CR program in improving clinical outcomes and highlights the importance of a spread use of CR in order to reduce cardiovascular hospitalizations and cardiovascular mortality during a long-term follow-up.”

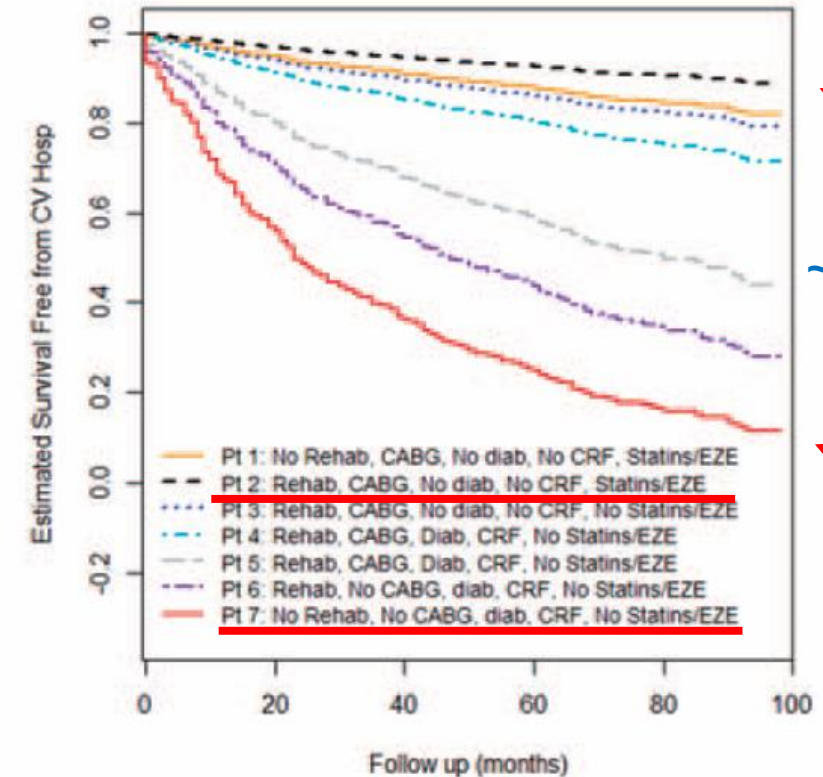


Figure 1 Estimated survival curves from the Cox model. The curves are estimated for patients having the median ejection fraction (56%) of the population. CABG, coronary artery bypass graft; CRF, chronic renal failure; Diab, diabetes; EZE, ezetimibe; Rehab, cardiac rehabilitation.



MILLÄ MEKANISMEILLA HYÖTY SYNTYY?

TABLE 1 Potential Cardioprotective Effects of Increased Lifestyle Activity, Structured Exercise, and/or Improved Cardiorespiratory Fitness

Anti-inflammatory	Reduced plasma level of C-reactive protein, which is a biomarker of inflammation (10)
Antithrombotic	Decreased platelet aggregation (11) Enhanced fibrinolysis activity (12)
Antiarrhythmic	Improved cardiac autonomic function (13,14) Increased vagal tone and decreased sympathetic activity (14)
Antiatherogenic	Improvement in established ASCVD risk factors Improved endothelial function due to increased blood flow and shear stress on arterial walls (15,16) Enhanced synthesis and release of nitric oxide, which is responsible for the inhibition of processes involved in atherogenesis (15)
Improved ASCVD risk factors	Decrease in total cholesterol, LDL-C, and triglycerides (17) Increase in HDL-C levels (17) Reduced blood pressure (18) Increased insulin sensitivity (19) Weight reduction (19)
Anti-ischemic	Improved myocardial perfusion (20) Raised ischemic threshold (11) Ischemic preconditioning of the myocardium (21)

ASCVD = atherosclerotic cardiovascular disease; HDL-C = high-density lipoprotein cholesterol; LDL-C = low-density lipoprotein cholesterol.



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ECLINM-00125; No of Pages 15

EClinicalMedicine xxx (xxxx) xxx



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journal homepage: <https://www.journals.elsevier.com/eclinicalmedicine>

EClinicalMedicine

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Cardiac Rehabilitation Availability and Density around the Globe☆

Interpretation: CR is available in only half of countries globally. Where offered, capacity is grossly insufficient, such that most patients will not derive the benefits associated with participation.

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ECLINM-00124; No of Pages 11

EClinicalMedicine xxx (xxxx) xxx



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EClinicalMedicine

Published by THE LANCET

Nature of Cardiac Rehabilitation Around the Globe

Interpretation: This first-ever survey of CR around the globe suggests CR quality is high. However, there is significant regional variation, which could impact patient outcomes.

Greatest Unmet Need in CR

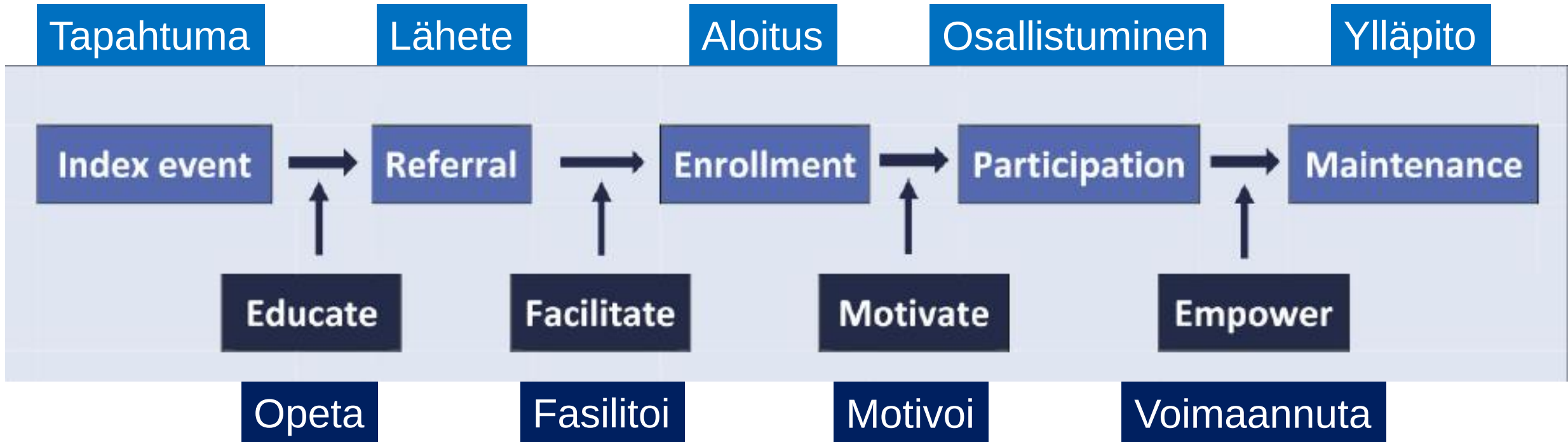
Country	# IHD pt spots needed / yr
India	3,304,474
China	3,034,003
Russia	1,222,142
Pakistan	616,146
Brazil	523,662
Ukraine*	519,761
All LMICs	14,766,930

¹⁶ *country has no CR

YORK U

Suomi 25,677

MITEN POTILAS SITOUTETAAN?



ALUSTUKSEN SISÄLTÖ

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THIS IS
FINE, I CAN
SEE ALL THE
EVIDENCE I
NEED FROM
HERE



winnett

COST-EFFECTIVENESS

EFFECTIVENESS

EFFICACY

COCHRANE LADDER of EVIDENCE

Is it
worth it?

Does it work
in practice?

Can it
work?

THE ROCK CARLING FELLOWSHIP

1971

EFFECTIVENESS AND EFFICIENCY

RANDOM REFLECTIONS ON
HEALTH SERVICES

A. L. Cochrane
CBE, FRCP
Director
MRC Epidemiology Unit
Cardiff

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OPEN ACCESS

Cost-effectiveness of cardiac rehabilitation: a systematic review

Gemma E Shields,¹ Adrian Wells,^{2,3} Patrick Doherty,⁴ Anthony Heagerty,⁵
Deborah Buck,¹ Linda M Davies¹

This systematic review of studies evaluates the cost-effectiveness of CR in the modern era, providing a fresh evidence base for policy-makers.

Evidence suggests that CR is cost-effective, especially with exercise as a component.

However, research is needed to determine the most cost-effective design of CR.



HUR älykuntosali, Verve Oulu

1. Leg Press

2. Chest Press

3. Back extension 4. Abdomen

5. Push up 6. Pull down

7. Twist left 8. Twist right

9. Dip 10. Shrug

11. Leg extension 12. Leg curl

Warm-up and cool-down



TERVEYDENHUOLLON KUSTANNUKSISSA SÄÄSTETÄÄN

Description of resource	Rehabilitation		Usual care	
	Mean (without imputation; <i>n</i> = 78)	Mean (with imputation; <i>n</i> = 109)	Mean (without imputation; <i>n</i> = 70)	Mean (with imputation; <i>n</i> = 95)
Primary health care costs (€)	346	357	418	483
Secondary health care costs (€)	814	1162	2142	2479
Occupational health care service costs (€)	117	126	69	65
Exercise-based cardiac rehabilitation costs (€)	375	299	0	0
Total average cost per patient (€)	1652	1944	2629	3027
Incremental cost (€)*	−865 (−1765 to −119)	−1103 (−2249 to −49)		
Average utility at the baseline	0.917	0.908	0.897	0.900
Average change in 15D utility	−0.008	0.013	−0.020	−0.012
Baseline-adjusted mean QALYs at 12 months†	0.909	0.922	0.878	0.885
Adjusted incremental QALYs gained‡	0.037 (0.028–0.047)	0.045 (0.023–0.077)		
ICER	Dominant option‡	Dominant option‡		

*Means and 95% CIs are estimated using non-parametric bootstrapping.

†QALYs adjusted for baseline 15D utility using regression-based adjustment; R, rehabilitation; UC, usual care; QALY, quality-adjusted life year; ICER, incremental cost-effectiveness ratio.

‡Intervention is less costly and more effective.

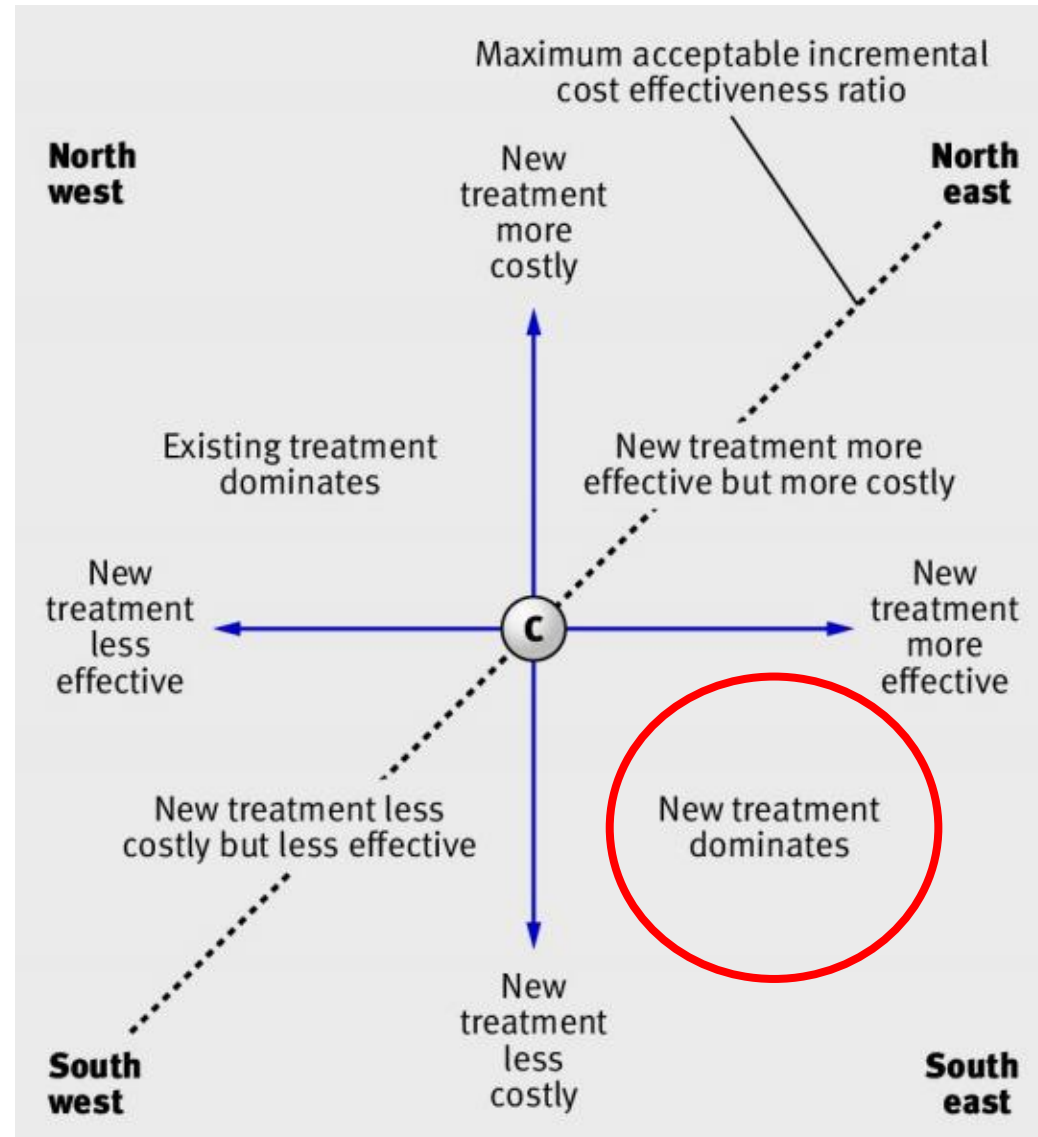
**Säästö
37%**

14.11.2019

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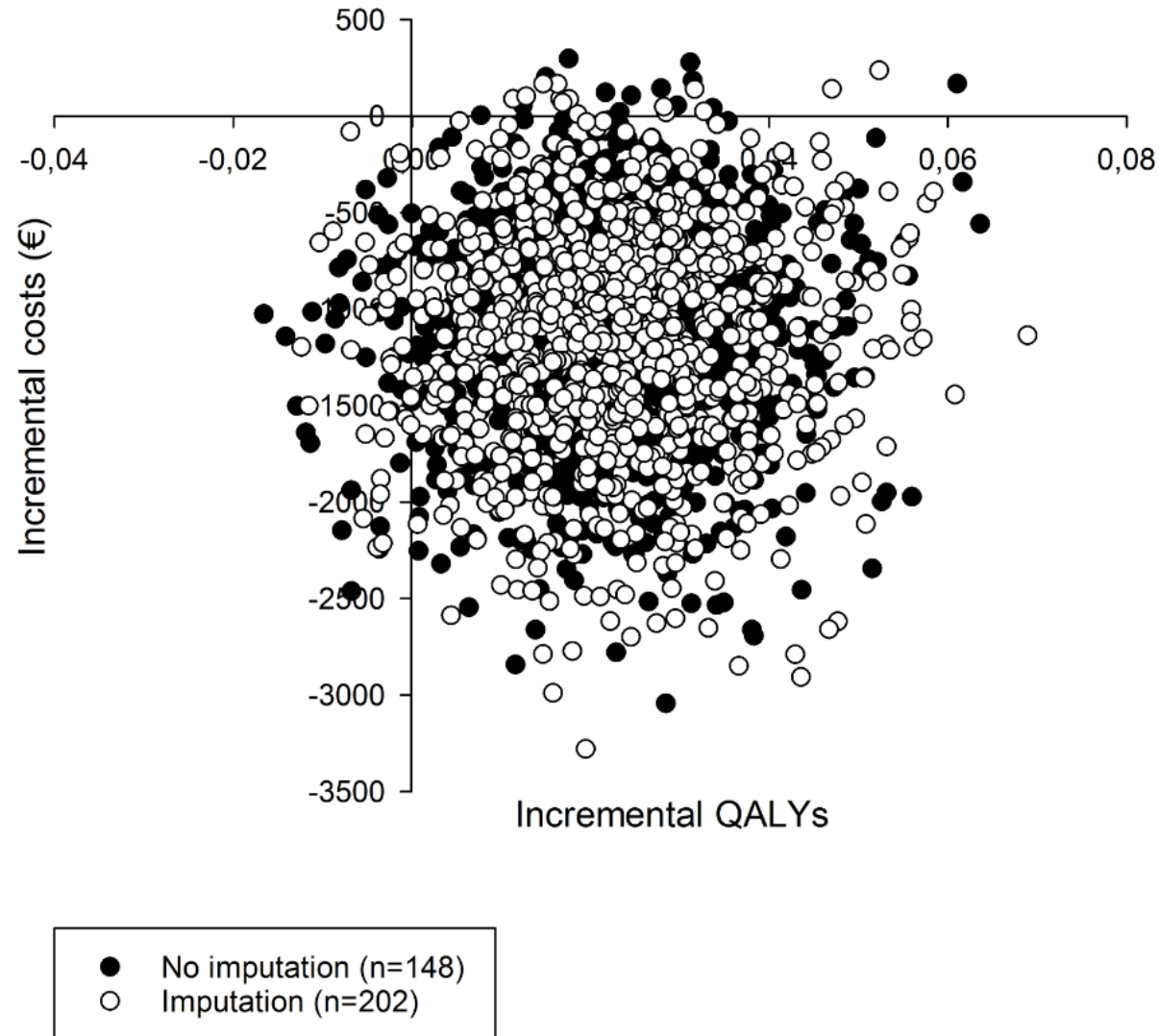


KUSTANNUSVAIKUTTAVUUSTASO



14.11.2019

LIKUNNALLINEN SYDÄNKUNTOUTUS ON KUSTANNUSVAIKUTTAVA JA TEHOKAS HOITO



**An incremental
cost-effectiveness ratio:
- €24 511/QALYs.**



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TECHNICAL ADVANCE

Open Access

Good safety practice in a randomized controlled trial (CadColdEx) involving increased cardiac workload in patients with coronary artery disease



Tiina M. Ikäheimo^{1,2*} , Miia Länsitie^{1,2}, Rasmus Valtonen^{1,2}, Heidi E. Hintsala^{1,2}, Niilo Rytö^{1,2}, Juha Perkiömäki³,
Matti Mäntysaari⁴, Arto J. Hautala⁵ and Jouni J. K. Jaakkola^{1,2}

YHTEENVETO

Säännöllinen arjen fyysinen aktiivisuus ja liikuntaharjoittelu muodostavat sydänekuntoutuksen tukipilarin.

Älytekniologian käyttö voi auttaa liikuntaan motivoinnista ja sen jalkauttamisessa arkeen tarjoten myös kustannusvaikuttavan hyvän hoidon jatkumon sydänpotilaille.

KIITOS!

