Strategic Approaches to Minimize Sudden Cardiac Death in Our Society

2016 KSC Annual Scientific Conference, Gyeongju Plenary Session, Apr 15, 2016, Rm 300C

Sumeet S. Chugh MD
Pauline and Harold Price Professor
Associate Director, Heart Institute
Section Chief, Clinical Cardiac Electrophysiology
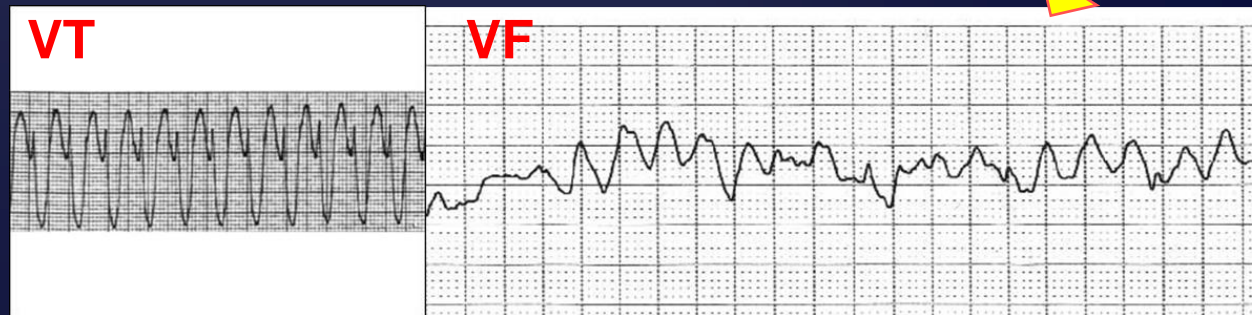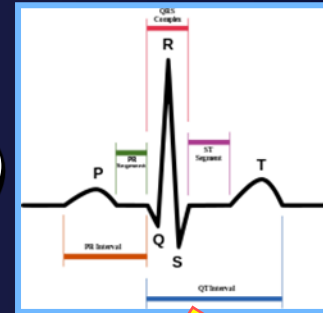**Cedars-Sinai Health System, Los Angeles, CA, USA**

Disclosures

Sudden cardiac death research program funded by NIH, National Heart Lung and Blood Institute Grants:
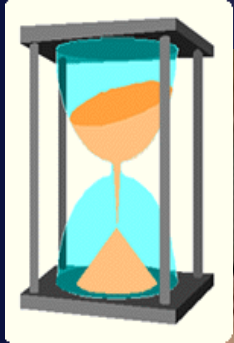
- R01HL122492
- R01HL126938

Sudden cardiac arrest: Sudden unexpected loss of the pulse due to a cardiac cause

- **USA 350,000 SCAs/yr**
- **7 million globally**
- **S Korea: 50,000/yr (140/day)**
- **Unique condition –Death within 10 min of presentation**

VT

VF

PEA

Asystole

Chugh SS, et al. J Am Coll Cardiol 2004; Chugh SS, et al. Prog Cardiovasc Diseases 2008

EMS Data: USA SCA Survival Stable ≈7%
Key Role for Prediction and Prevention

9-1-1

Early Access — Early CPR — Early Defibrillation — Early Advanced Care

Chain of Survival

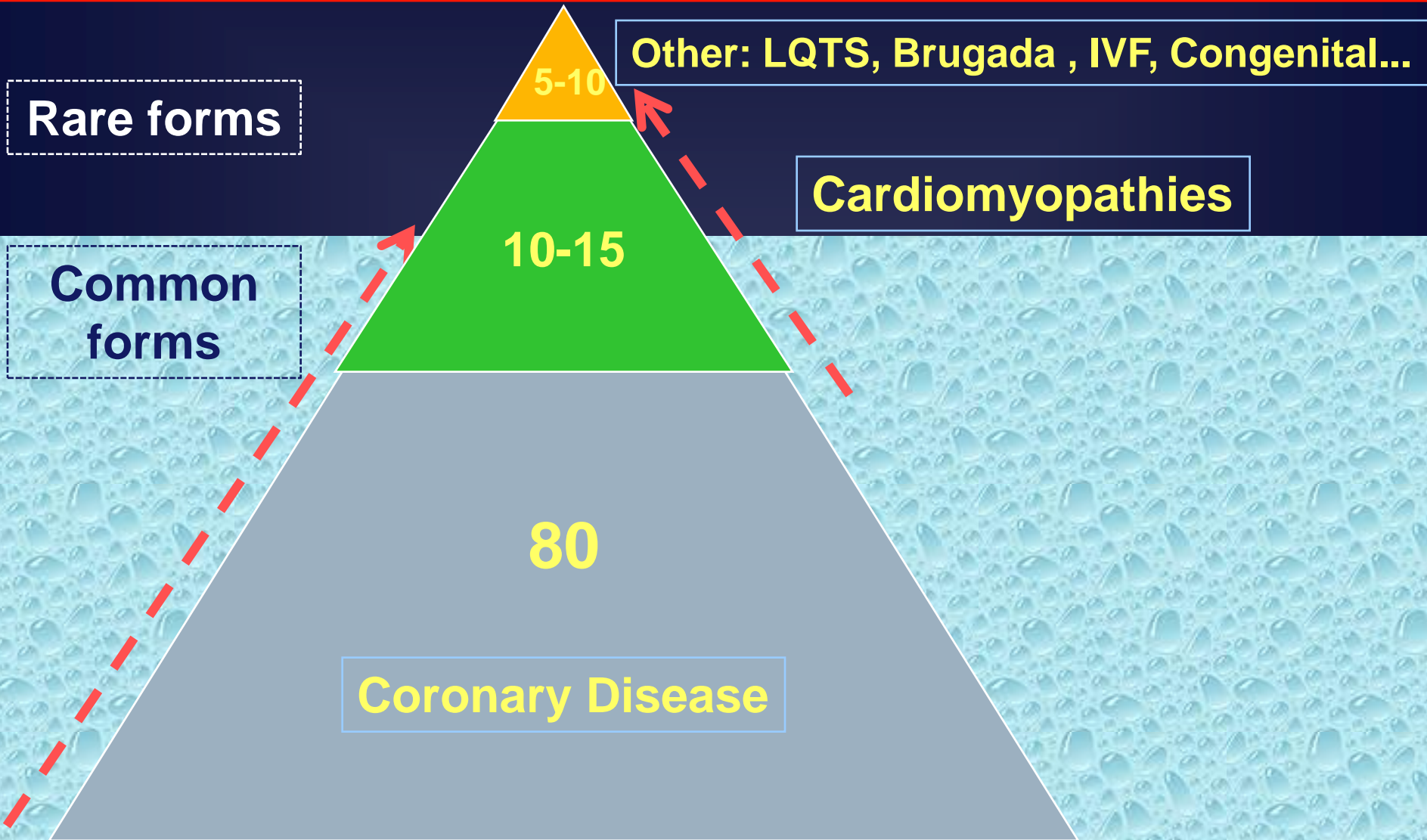Chugh/CSMC

Strategic Approaches to Minimize SCD

LONG TERM: PREDICT & PREVENT

SHORT-TERM : PREDICT & PREVENT

IMMEDIATE RESUSCITATION

- **Causes and risk factors**
- **Community-based Rapid EMS Response**
- **Effective Primary Prevention of SCD**
- **Role of Korean Cardiologist today?**
- **Conclusions and Summary**
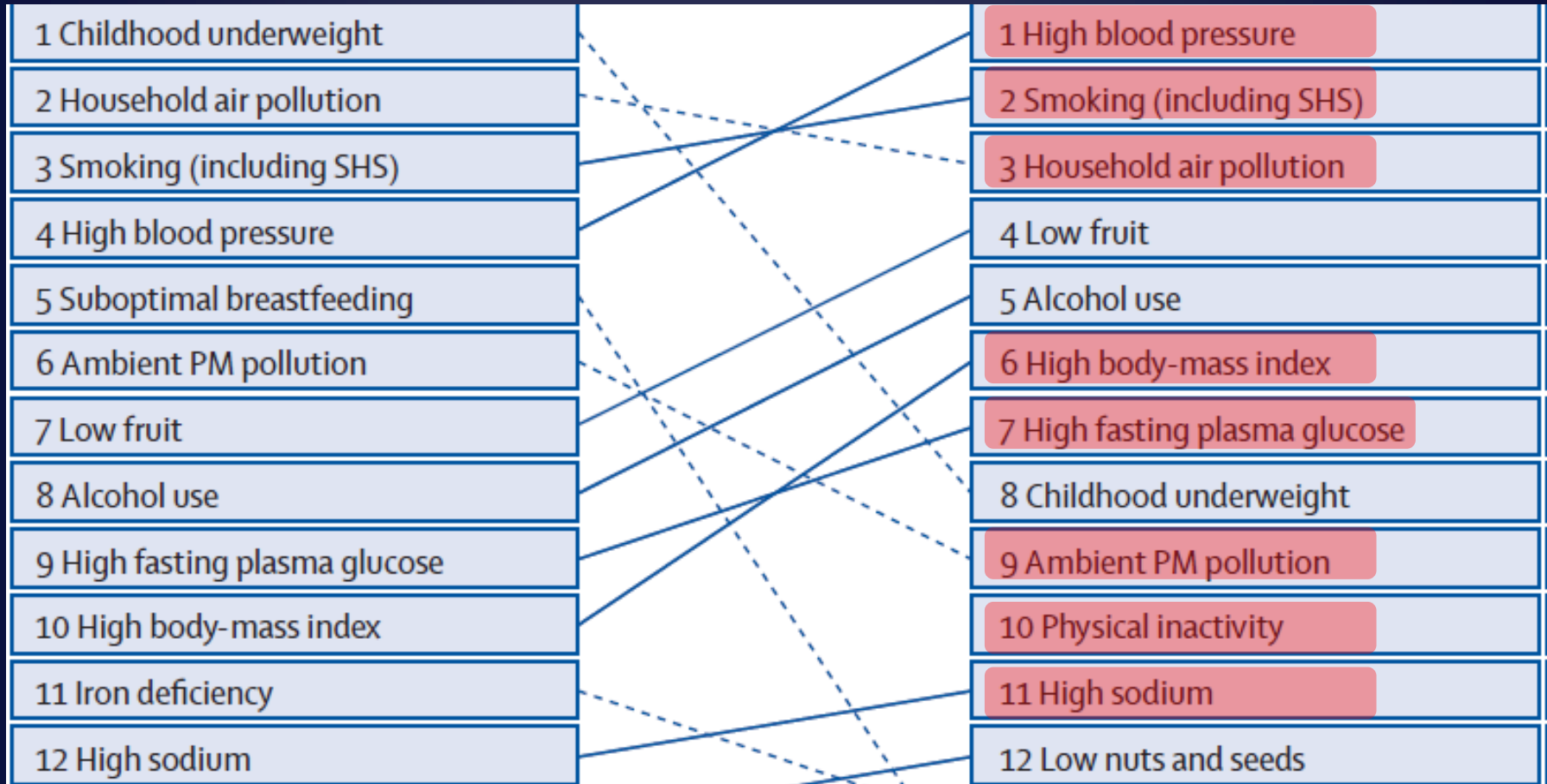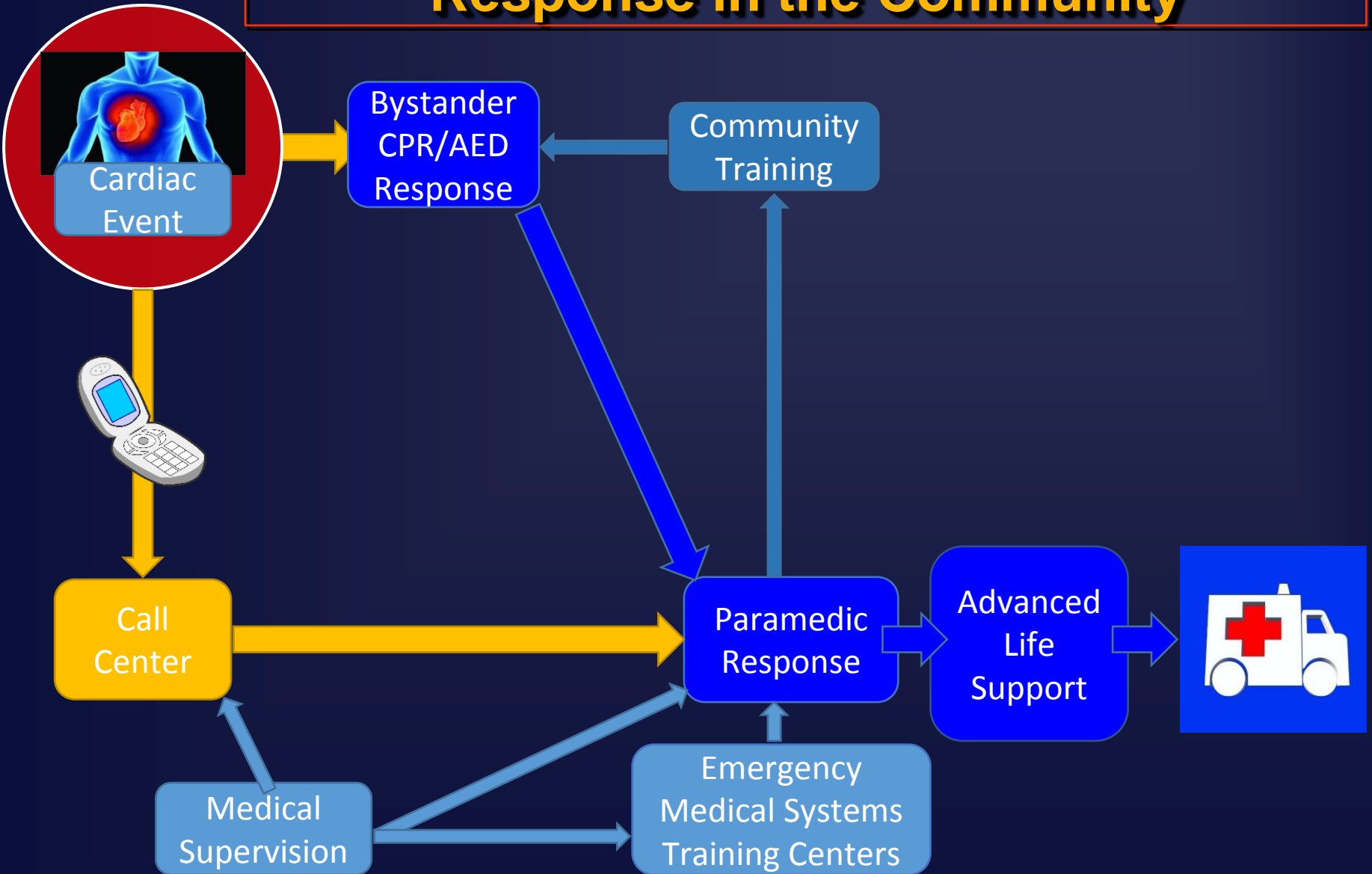
Chugh/CSMC

Etiologies of Sudden Cardiac Death

Other: LQTS, Brugada , IVF, Congenital...

5-10

Rare forms

Cardiomyopathies

10-15

Common forms

80

Coronary Disease

Chugh SS et al. Prog Cardiovasc Diseases 2008.

Global Risk Factor Rankings

1990

1	Childhood underweight
2	Household air pollution
3	Smoking (including SHS)
4	High blood pressure
5	Suboptimal breastfeeding
6	Ambient PM pollution
7	Low fruit
8	Alcohol use
9	High fasting plasma glucose
10	High body-mass index
11	Iron deficiency
12	High sodium

2010

1	High blood pressure
2	Smoking (including SHS)
3	Household air pollution
4	Low fruit
5	Alcohol use
6	High body-mass index
7	High fasting plasma glucose
8	Childhood underweight
9	Ambient PM pollution
10	Physical inactivity
11	High sodium
12	Low nuts and seeds

Lim SS, et al. Lancet 2012; 380: 2224–60

Chugh/CSMC

Coordinated Emergency Medical Response in the Community

Cardiac Event

Bystander CPR/AED Response

Community Training

Call Center

Paramedic Response

Advanced Life Support

Medical Supervision

Emergency Medical Systems Training Centers

Bystander CPR:
Critical Role in Survival
No Need to Support Breathing

- **Bystanders should be trained to recognize cardiac arrests, implement chest compressions**

American Heart Association 2015

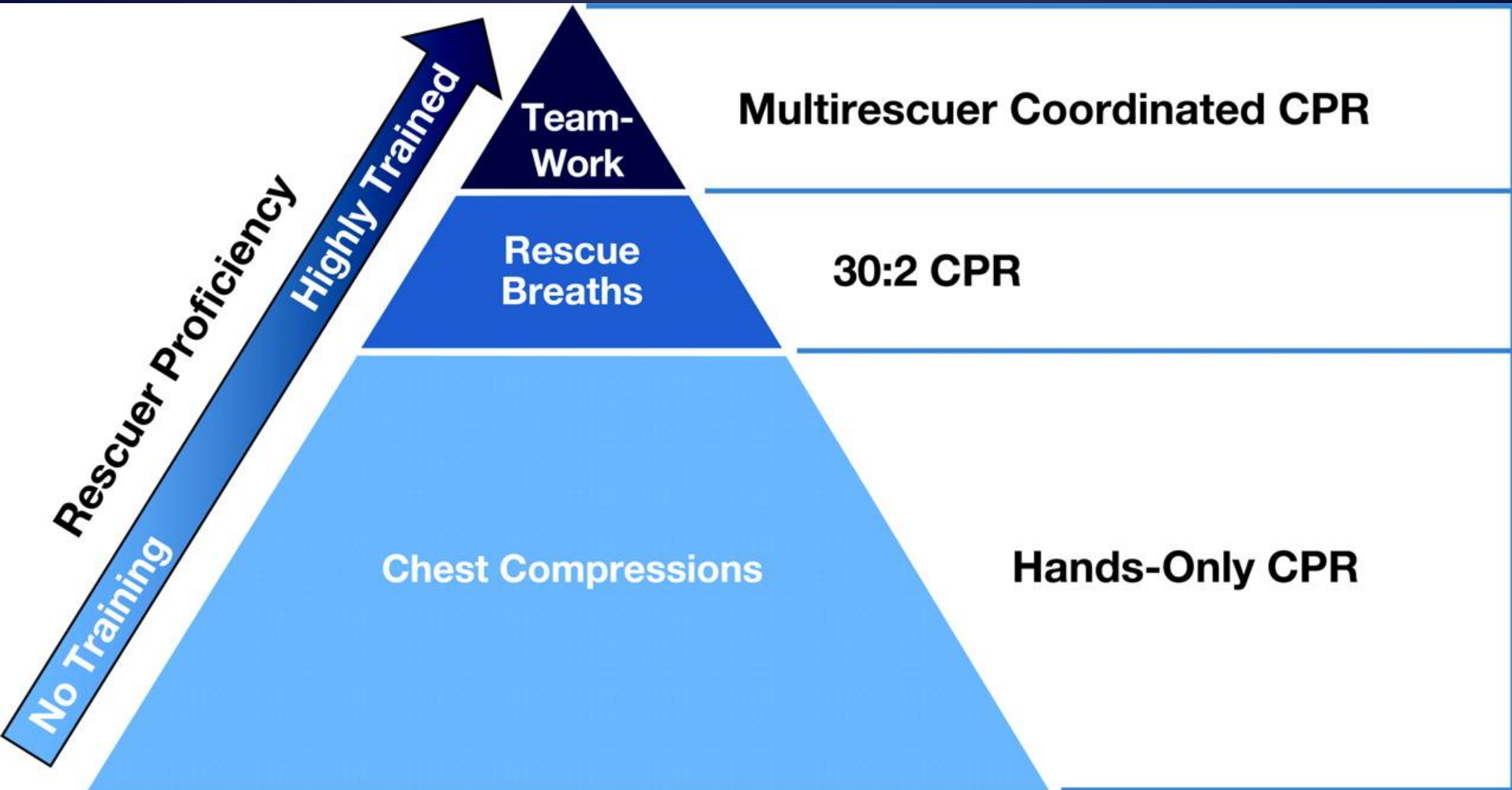# Automated External Defibrillator
Bystanders Can Save Lives

Japan: AED Shocks in 15-40% of Public SCAs
Common Location: Vending Machines
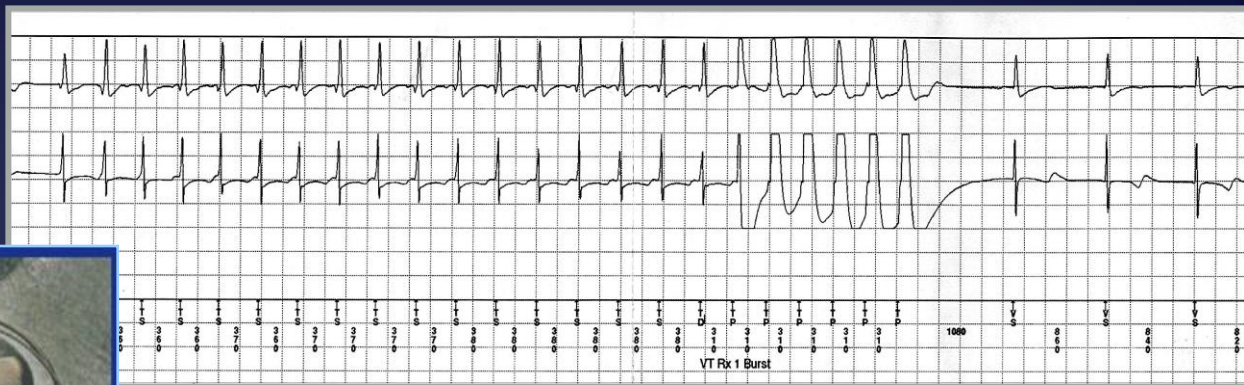
Bystanders Begin
Trained Paramedics Take Over

Rescuer Proficiency
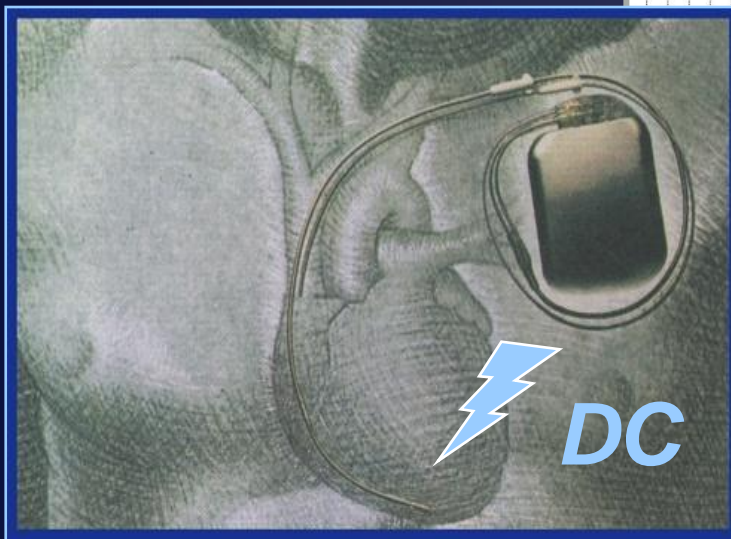
No Training → Highly Trained

Team-Work	**Multirescuer Coordinated CPR**
Rescue Breaths	**30:2 CPR**
Chest Compressions	**Hands-Only CPR**

Travers AH et al. Circulation 2010
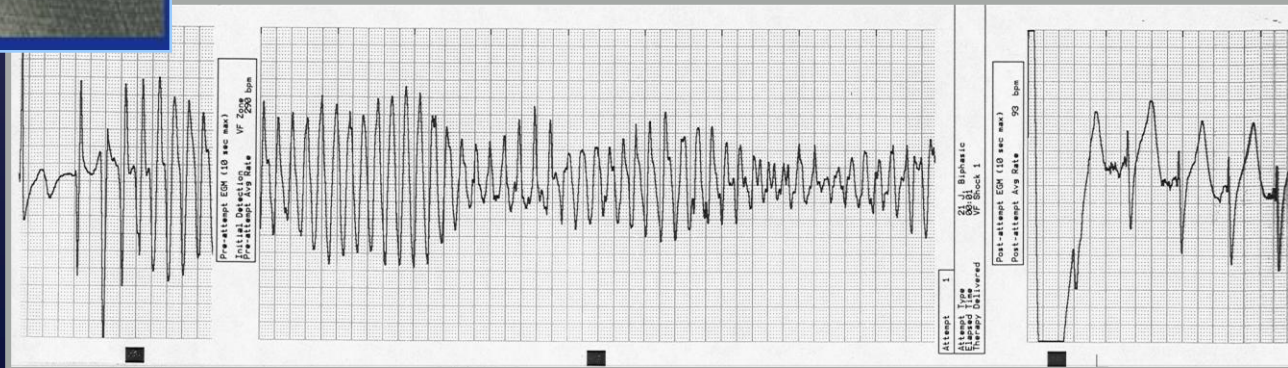
Chugh/CSMC
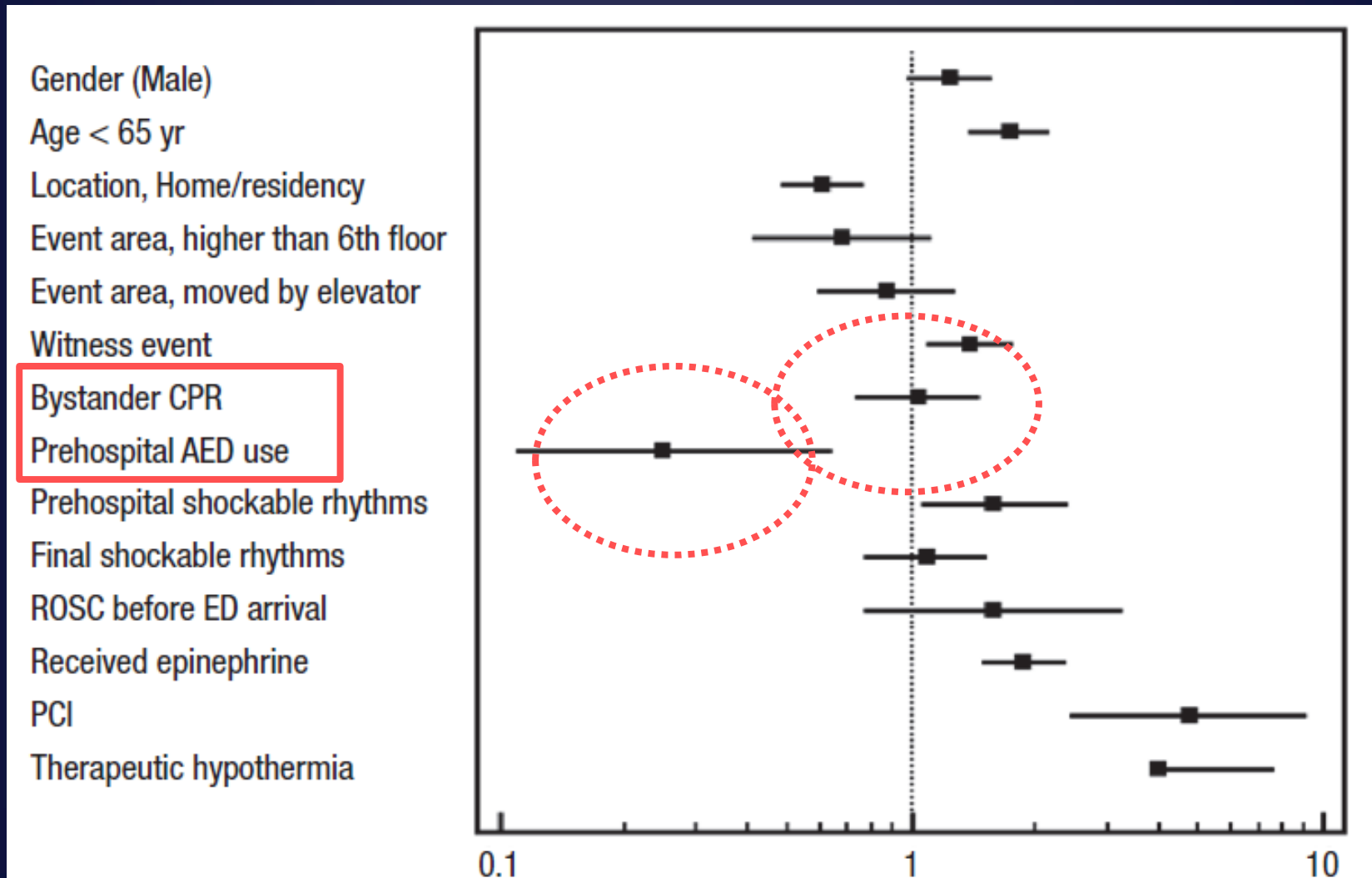
911 too late for >90% →Primary Prevention of SCD
The Implantable Defibrillator (ICD): Shock <10 secs

DC

**Main predictor of SCD risk:
LV ejection fraction <35%**

Chugh/CSMC

12 Randomized Trials (n=8,516), 20% ⇓ Mortality



Figure 2. Effect of implantable cardioverter defibrillator (ICDs) on all-cause mortality in randomized trials.

Study, Year (Reference)	ICD, n/n	Control, n/n	RR (Random) (95% CI)	Weight, %	RR (Random) (95% CI)
Primary prevention programs					
MADIT, 1996 (14)	15/95	39/101		4.05	0.41 (0.24–0.69)
CABG Patch, 1997 (15)	101/446	95/454		10.85	1.08 (0.84–1.39)
CAT, 2002 (17)	13/50	17/54		3.15	0.83 (0.45–1.52)
MADIT II, 2002 (16)	105/742	97/490		10.70	0.71 (0.56–0.92)
AMIOVIRT, 2003 (18)	7/51	9/52		1.55	0.79 (0.32–1.97)
COMPANION, 2004 (19)	105/595	131/617		11.59	0.83 (0.66–1.05)
DEFINITE, 2004 (20)	28/227	40/229		5.22	0.71 (0.45–1.10)
DINAMIT, 2004 (21)	62/332	58/342		8.07	1.10 (0.80–1.52)
SCD-HeFT, 2005 (22)	182/829	244/847		14.74	0.76 (0.65–0.90)
Subtotal	3367	3186		69.93	0.81 (0.69–0.95)
Secondary prevention programs					
AVID, 1997 (23)	80/507	122/509		10.60	0.66 (0.51–0.85)
CIDS, 2000 (24)	83/328	98/331		10.79	0.85 (0.67–1.10)
CASH, 2000 (25)	36/99	84/189		8.68	0.82 (0.60–1.11)
Subtotal	934	1029		30.07	0.77 (0.65–0.91)
Total	4301	4215		100.00	0.80 (0.71–0.90)

0.1 0.2 0.5 1 2 5 10

Favors ICD   Favors Control

Ezekowitz J, et al. Ann Intern Med. 2007;147:251-262

Primary Prevention ICD Based on LVEF
Many Receive ICDs that they do not use
Lifesaving, but cost not sustainable
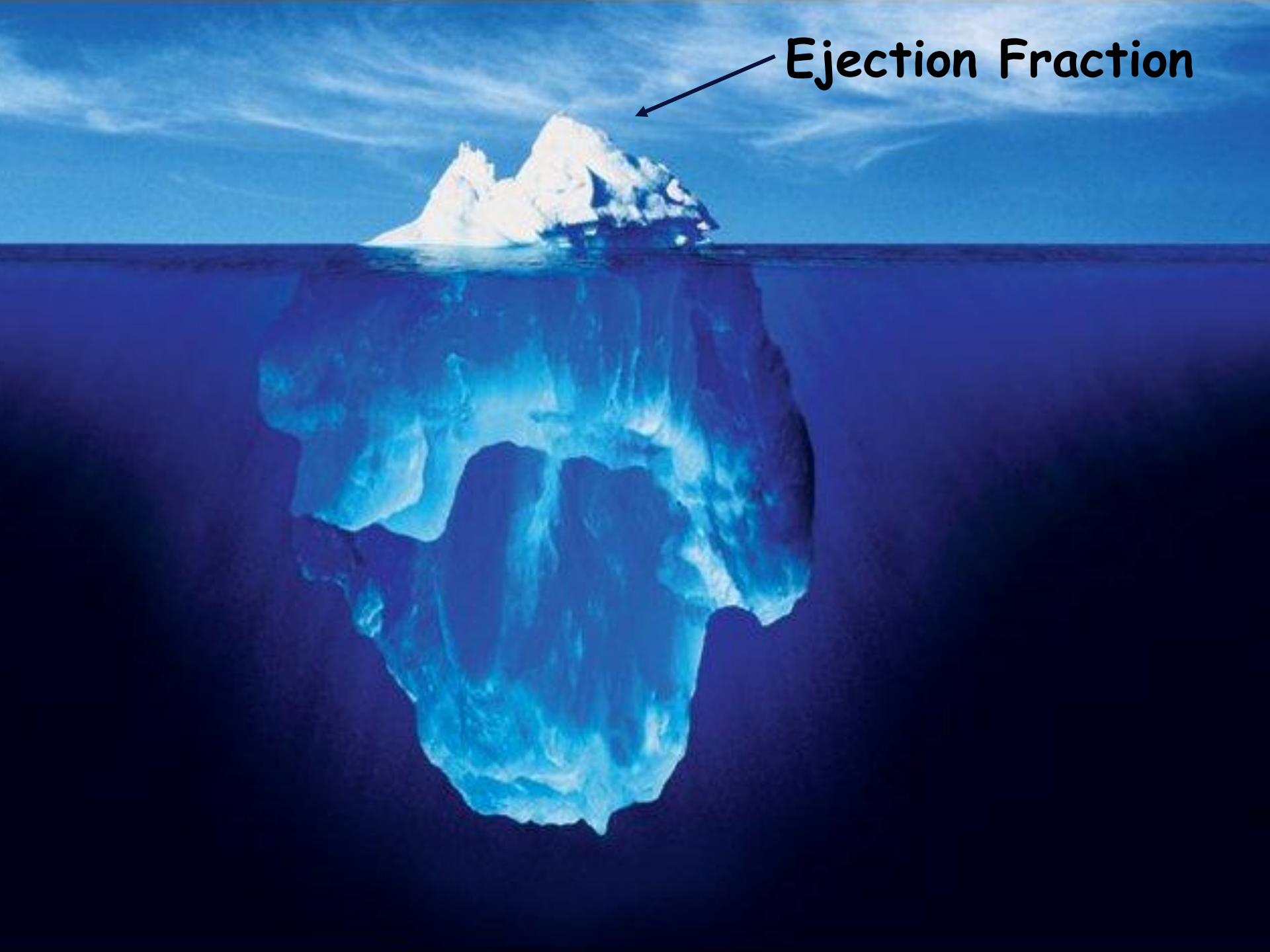

US Data
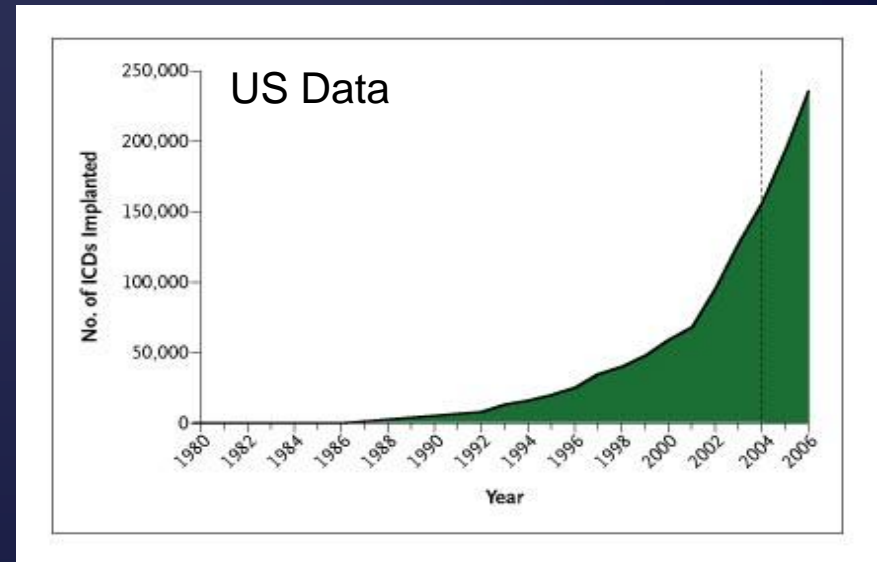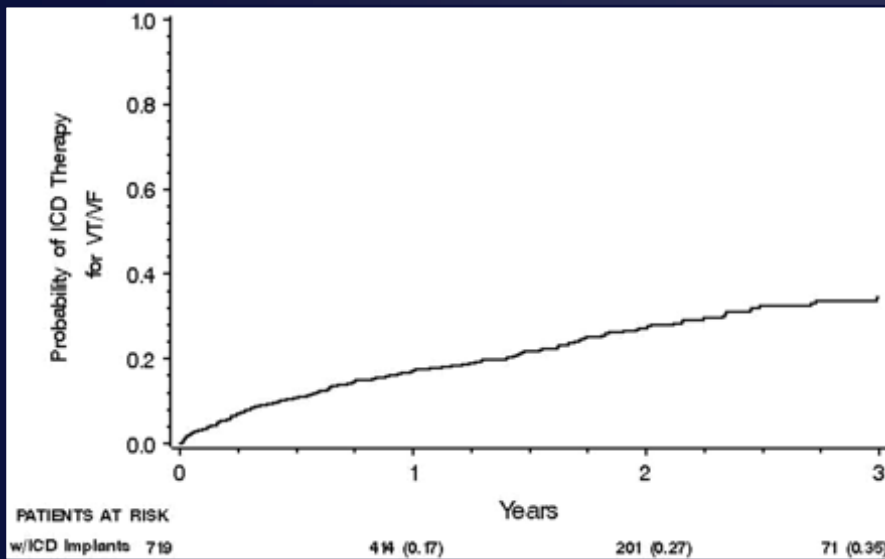
- **Treatments delivered in 20-30% only**
- **Need to treat 20 to save one life**
- **Important to follow guidelines, but also enhance them**

Moss A, et al. Circulation 2004;110:3760-3765
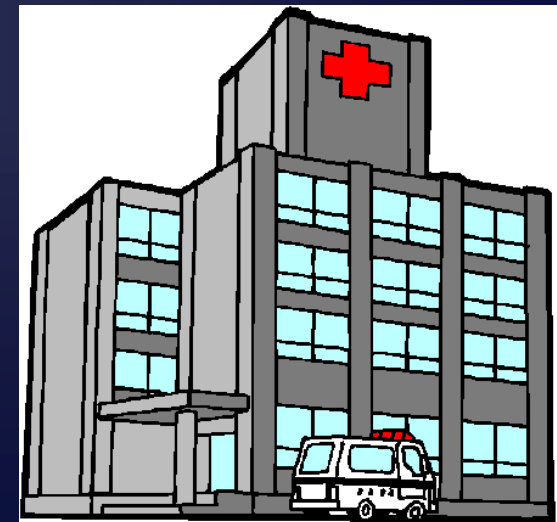
Jauhar & Slotweiner. NEJM 2004;351:2542-44

Ejection Fraction

The Community as SCD Research Lab

SECRET:
EMS-Cardiology
Partnership

P.R.E.S.T.O. Network (Cedars-Sinai, Los Angeles, USA)
PREdiction of Sudden death in mulTi-ethnic cOmmunities

Portland, OR

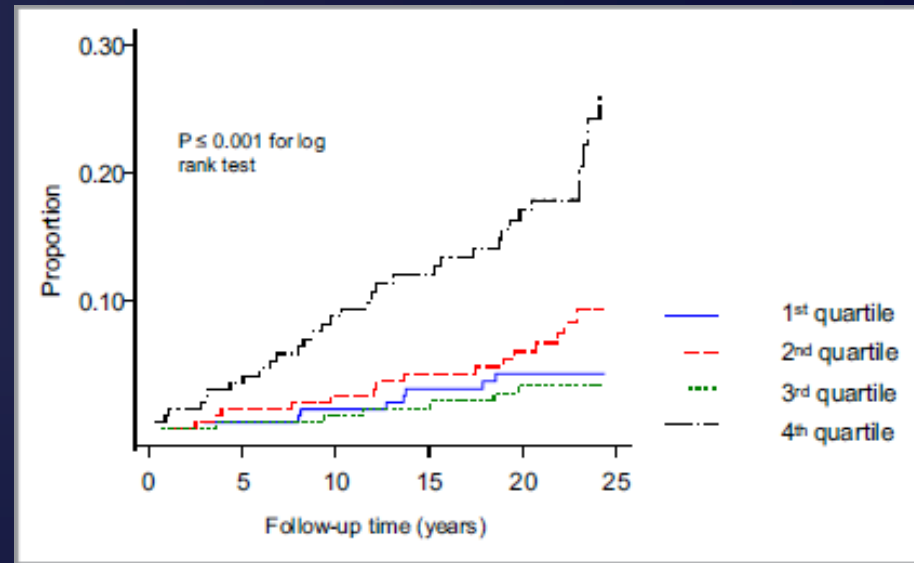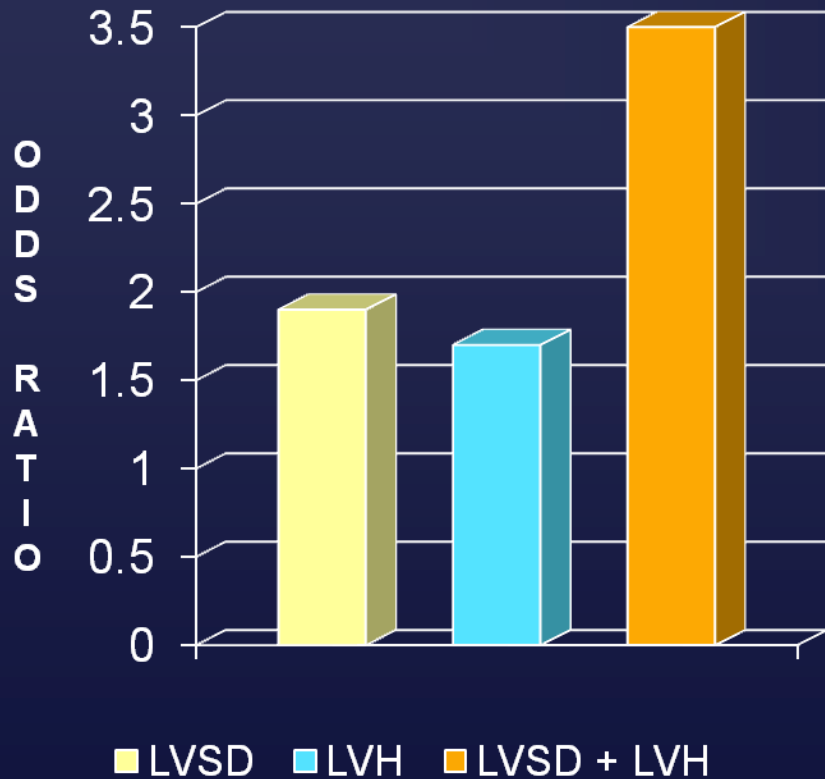≈1 million (15 yr)

≈850 K (1.5 yr)

Ventura County, CA

Chugh/CSMC

Evidence for Cumulative Effects on SCD Risk
Low EF + ⇑LV Mass are Additive

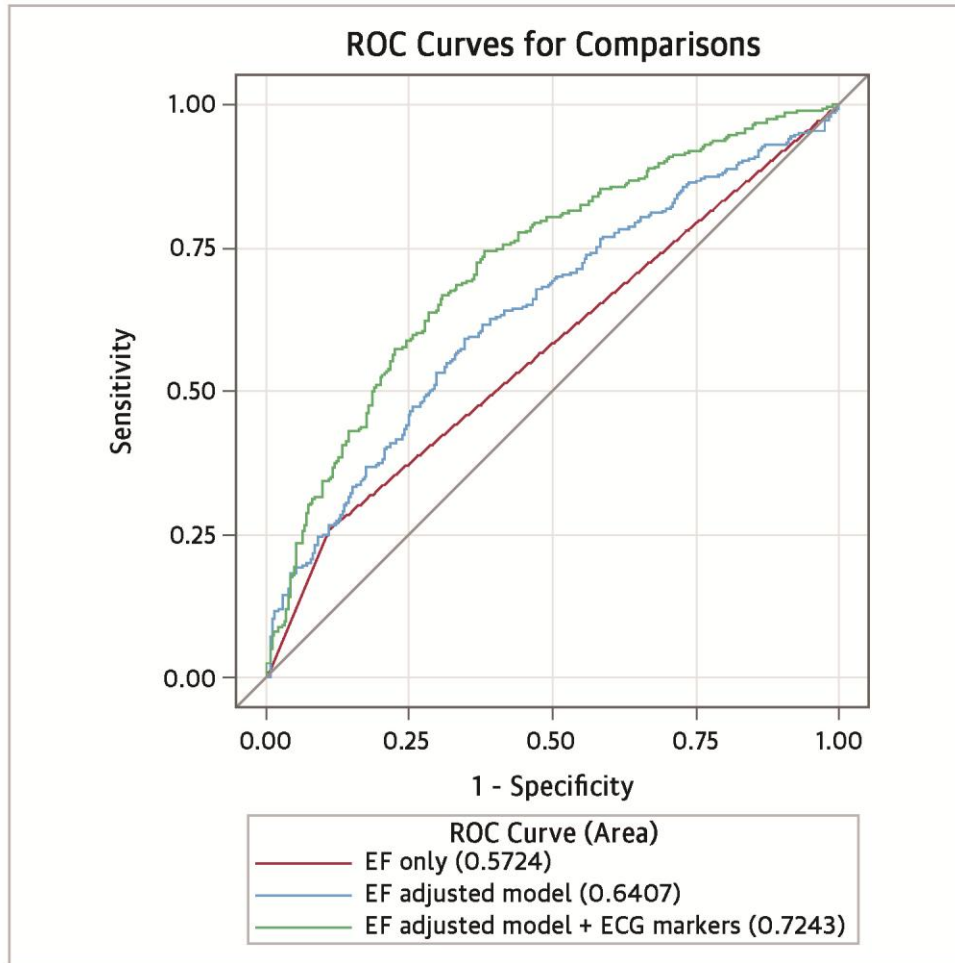# Role of LV Mass Confirmed in Kupio Prospective Cohort

Legend: LVSD, LVH, LVSD + LVH

P ≤ 0.001 for log rank test

1st quartile
2nd quartile
3rd quartile
4th quartile

Independent of Ejection Fraction

Reinier K….Chugh SS.
Heart Rhythm 2011;8:1177–1182

Laukannen JA et al.
JAHA 2014

Chugh/CSMC

EKG Markers and LVEF
Cumulative Effects on SCD Risk

Figure 1

ROC Curves for Comparisons

ROC Curve (Area)
— EF only (0.5724)
— EF adjusted model (0.6407)
— EF adjusted model + ECG markers (0.7243)

- **LVEF**
- **Resting HR**
- **QRSD**
- **JTc**
- **Cstat 0.642 $\Rightarrow$ 0.724**
- **Net re-class ind. ↑ 22.7%**

**Reiner K….Chugh SS
JACC EP 2015 (Press)**

Chugh/CSMC
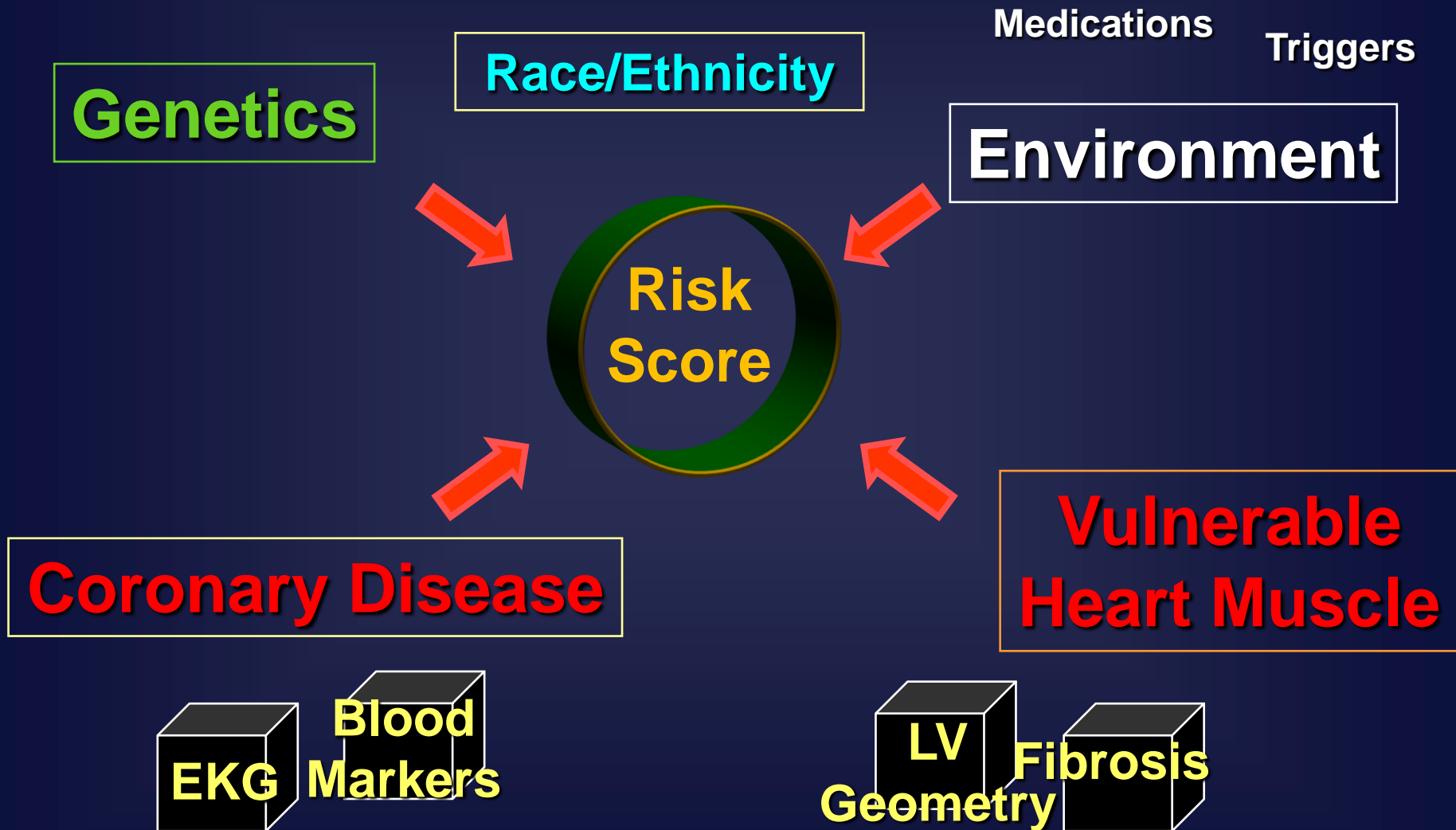
Many Have Warning Symptoms (4 wks)
Short-term Prevention

Number of Patients

Presence of Symptoms Prior to SCA

Legend: Chest Pain, Dyspnea, Syncope/Palpitations

Survival to Hospital Discharge, %

911 Call / No 911 Call

Any Symptoms | Chest Pain
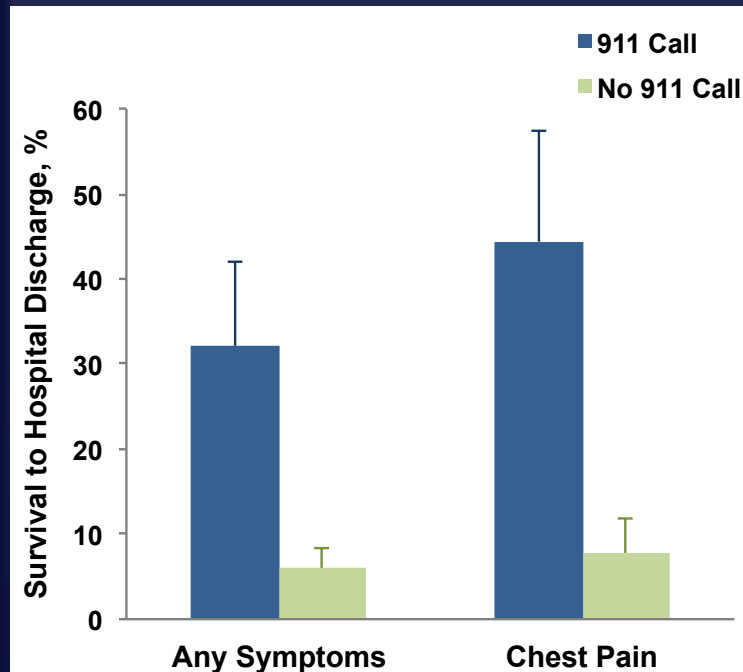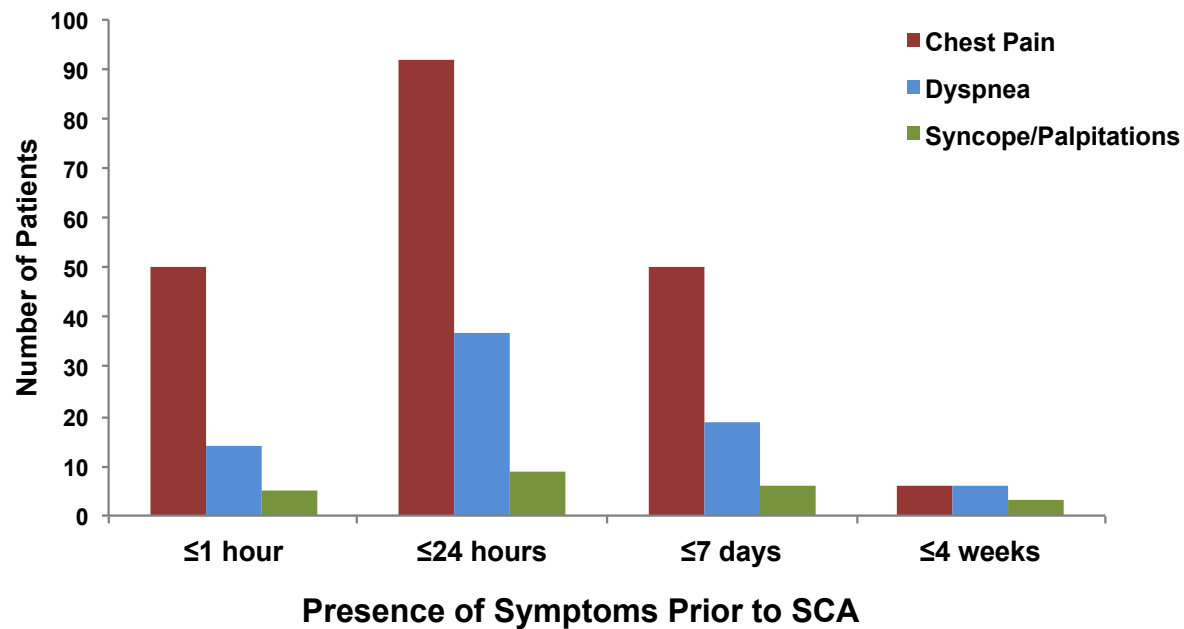
- N=839, middle age (35-65)
- 430 (51%) had symptoms
- 50% men, 53% women
- Symptoms neglected- survival 6%
- 911 called- survival 32.1% (>5-fold)
- New Window of Opportunity

Marijon E…..Chugh SS. Annals of Internal Med 2015

Approaches to SCD Prevention
A Role for Short-Term Prevention

LONG TERM: PREDICT & PREVENT

Cumulative risk score

Early identification by screening

Treatment with ICD or other primary prevention modality

SHORT-TERM : PREDICT & PREVENT

Sub-acute warning patterns/monitoring

Symptoms days-weeks in advance of the SCD

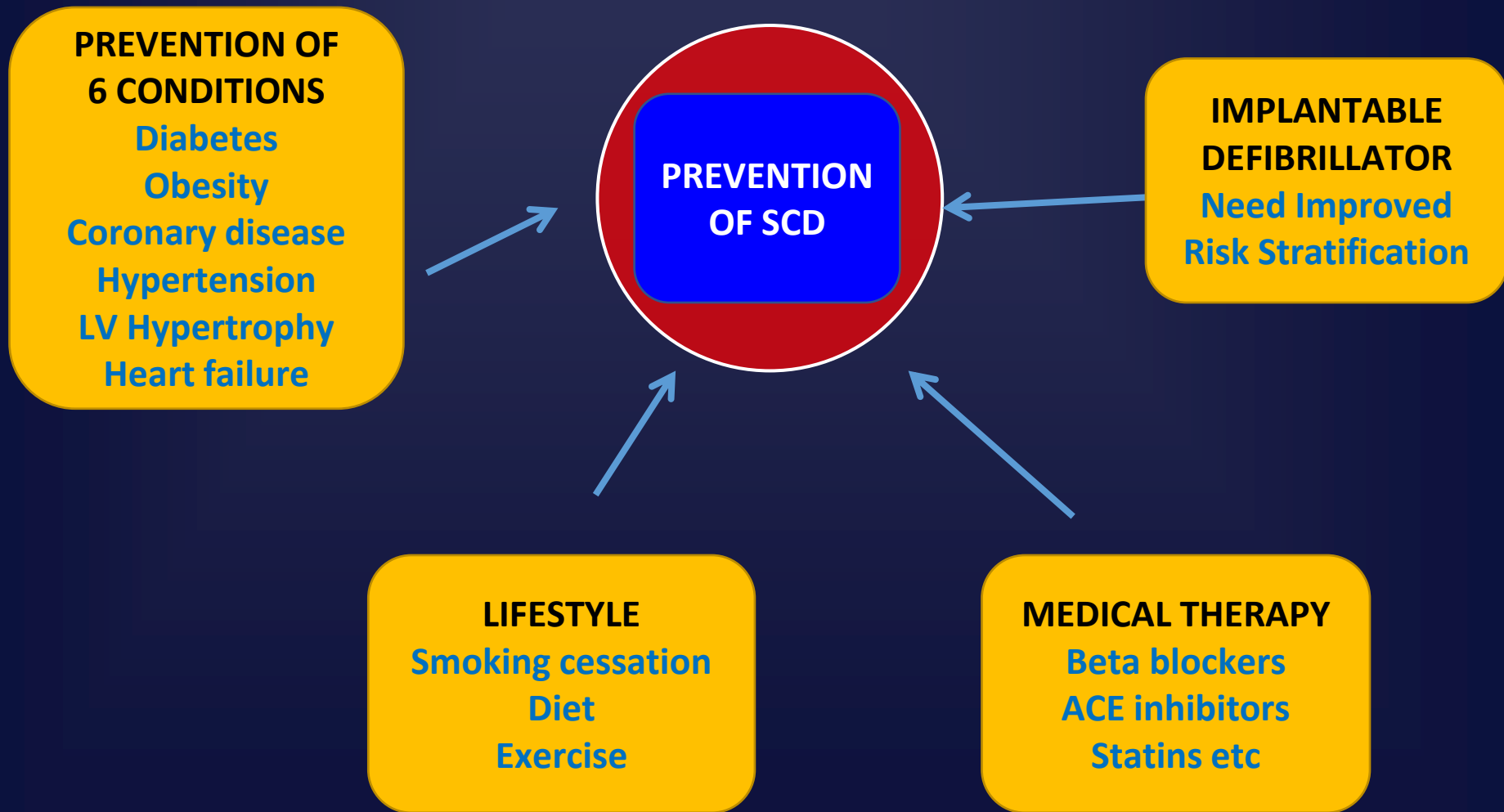Potential to intervene and prevent SCD

IMMEDIATE RESUSCITATION

Assessment of Burden

Community involved (By CPR)

Enhancing ACLS

Early access to advanced care

Chugh/CSMC

S. Korea: Air Pollution Associated with SCA
Seoul, 2006-2013, N=21,509 (Role for Govt. Policy)
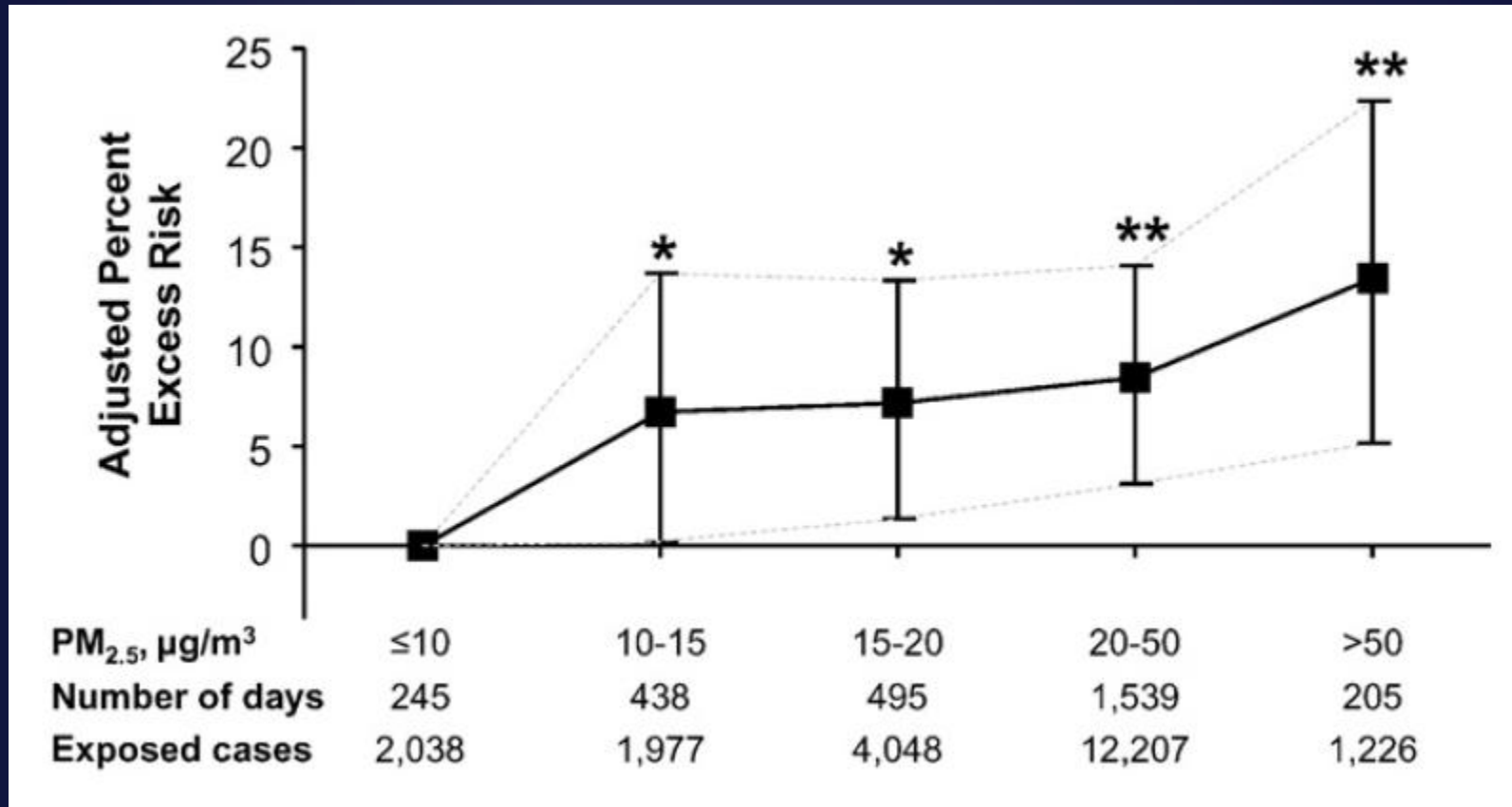
- **Those with conventional cardiac risk factors more susceptible**

Kang, Si-Hyuck et al. Int J Cardiol 2016

Chugh/CSMC

Opportunities for SCD Primary Prevention By the Korean Cardiologist

PREVENTION OF 6 CONDITIONS
Diabetes
Obesity
Coronary disease
Hypertension
LV Hypertrophy
Heart failure

PREVENTION OF SCD

IMPLANTABLE DEFIBRILLATOR
Need Improved
Risk Stratification

LIFESTYLE
Smoking cessation
Diet
Exercise

MEDICAL THERAPY
Beta blockers
ACE inhibitors
Statins etc

Strategic Approaches to Minimize SCD

- **Large public health burden, likely to increase**
  - **Korea: 50,000 SCDs/yr → MAKE SCD REPORTABLE**
  - **Critical importance of prevention**
- **Several causes, but largely coronary disease**
- **Community based emergency response**
  - **Chain of survival, bystander CPR, AED**
  - **Community-specific factors leading to policy change like pollution prevention (EMS-CARDIOLOGY PARTNERSHIP)**
- **Primary Prevention: ICD useful, need better selection**
  - **Cumulative risk score will be needed (EMS-CARDIOLOGY)**
  - **New paradigm: Short term prevention for warning signs**
- **Goals for Korean Cardiologist: Prevent 6 conditions:**
  - **Diabetes, Obesity, Coronary disease,**
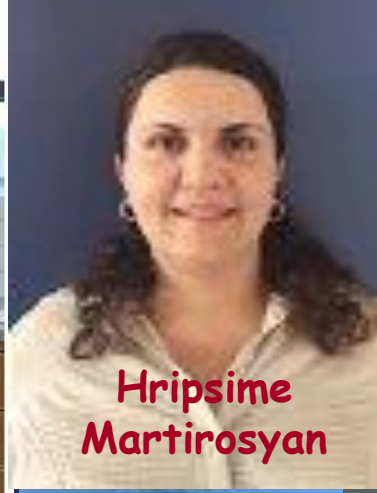 - **Hypertension, Hypertrophy, Heart failure**

DOC3H

Kyndaron Reinier

Audrey Uy-Evanado

Ron Mariani

Hripsime Martirosyan

Daniel Perez

Carmen Teodorescu

Adriana Huertas

Aapo Aro

Reshmy Sandeep

Jo Ayala

Sharon Mariani

Priya Chugh

Arrhythmia Research Lab Cedars-Sinai Los Angeles

Sandeep Nair

Arayik Sargasyan

QUESTIONS?

Sumeet.Chugh@cshs.org