PARIS SUDDEN DEATH
EXPERTISE CENTER

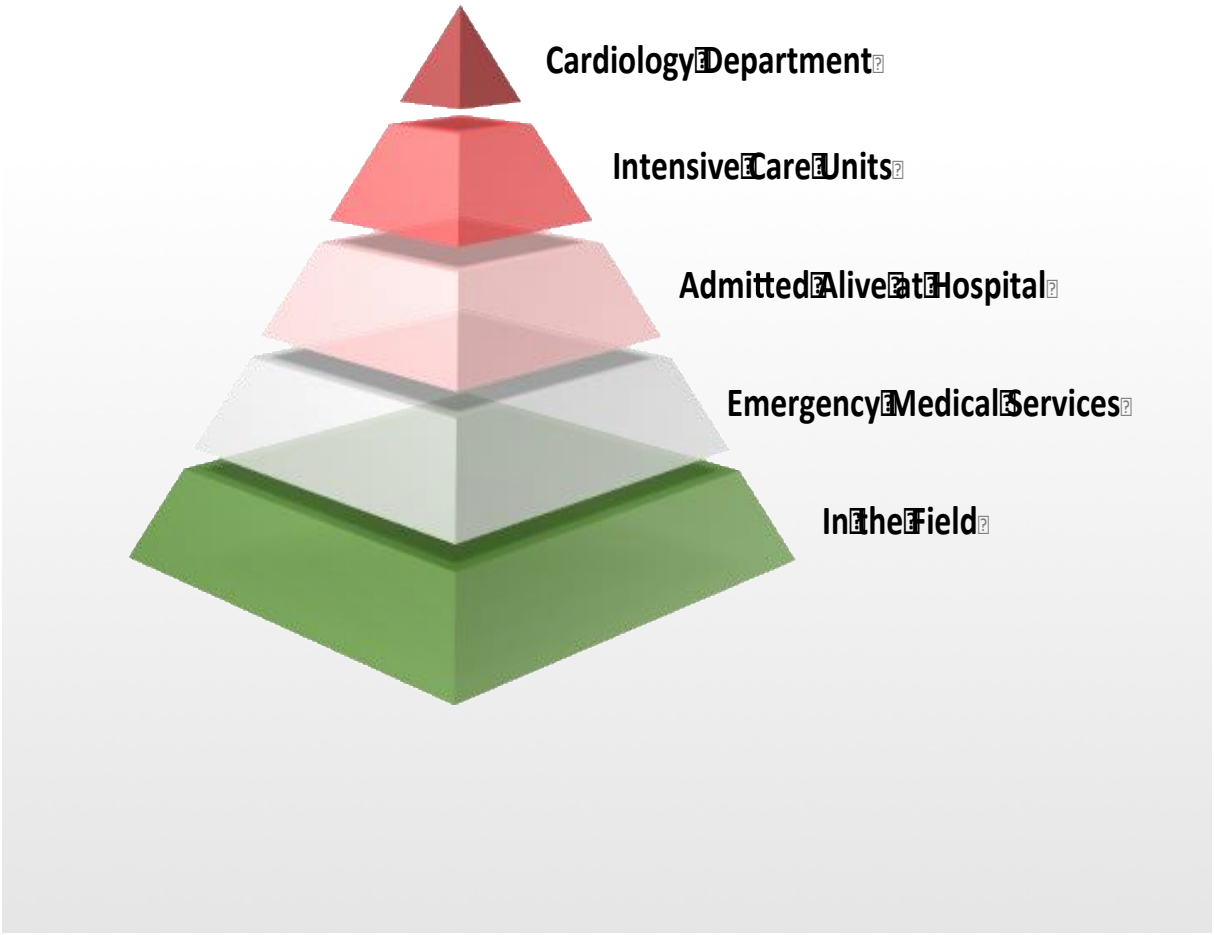
Epidemiologie de la mort subite Necker 2018

Pr Xavier Jouven

CENTRE DE RECHERCHE cardio-vasculaire de Paris
PARCC
HEGP

- No conflict of interest

Different stages, independent conclusions…



SUDDEN DEATH EXPERTISE CENTER

CARE - TEACHING - RESEARCH

AP-HP / HÔPITAL EUROPÉEN GEORGES-POMPIDOU - UNIVERSITÉ PARIS DESCARTES - INSERM

PARIS & suburban area

→3,500 cardiac arrests
→450 admitted to hospital
→150 survivors

- reanimation room
- ICU
- electrophysiology

- MICU
- firefighters

- familial screening
- out-patient clinic and day care ward
- survivors follow-up
- sport related sudden death

- sociology
- ethics
- physiology
- medico-economics assesment
- medico-legal aspect

Training to trainers to BLS for hospital staff

- Sudden death Foundation
- Website

Training for
- physicians
- physiotherapists
- pharmacists

Research U970 INSERM
- epidemiology
- genetics
- physiology

registry

Population : 6.6 million

Telex BSPP traités

de Daniel Jost
sujet **TR: MESSAGE DSA**
pour cems@inserm.fr <cems
étiquettes ADMIS BZ

De : PANT
Envoyé : mardi 24 mai 2011
À : SSSM.Cellules DSA
Objet : MESSAGE DSA

1- COPE 533 837
2- 301
3- 24/05/2011
4- 168 AVENUE JEAN J
5- VSAV PANT
6- 05H12-05H18
7- 29/
8- EVACUEE-UMH AVI
9- DE LA FONTAINE-RE
10- NEANT
11- NEANT
12- 74629 SGT BOIN
13- 2010B589_PANT

Assistance Publique - Hôpitaux de Paris
HOPITAL COCHIN
Réanimation Médicale - Pr J.P. MIRA
27, rue du Faubourg Saint Jacques - 75679 Paris Cedex 14
Accueil : 01-58-41-25-17 ou 25-21
Secrétariat médical : 01-58-41-25-36
Fax : 01-58-41-25-05

COMPTE RENDU D'HOSPITALISATION

Monsieur Carl
Né le
NIP : - NDA :

N° dossier : 11/571
Fait le
Par l'interne :
Chef de Clinique Assistant : Docteur
Senior : Professeur
Secrétaire : ED

Hospitalisation du /2011 au /2011

CORRESPONDANTS :

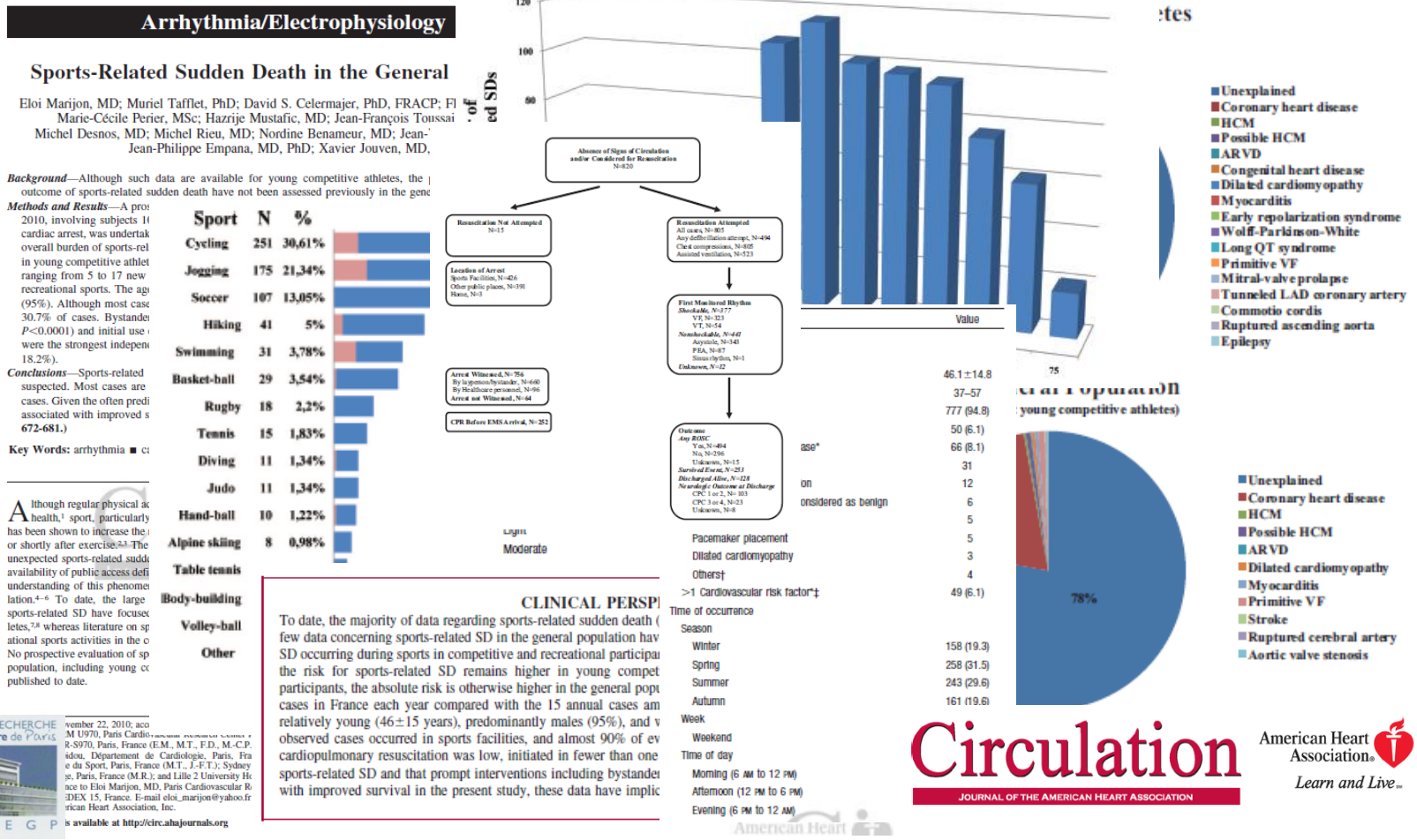
Docteur service de cardiologie, hôpital Cochin
Professeur Michel, Docteurs . service de cardiologie, HEGP
Docteur Unité de Soins Intensifs de Cardiologie, HEGP
Docteur Institut Arthur Vernes, 36 rue Assas, 75006 Paris
SAMU de Paris, SMUR NECKER

Adressé par le SAMU de Paris.

MOTIF D'HOSPITALISATION :

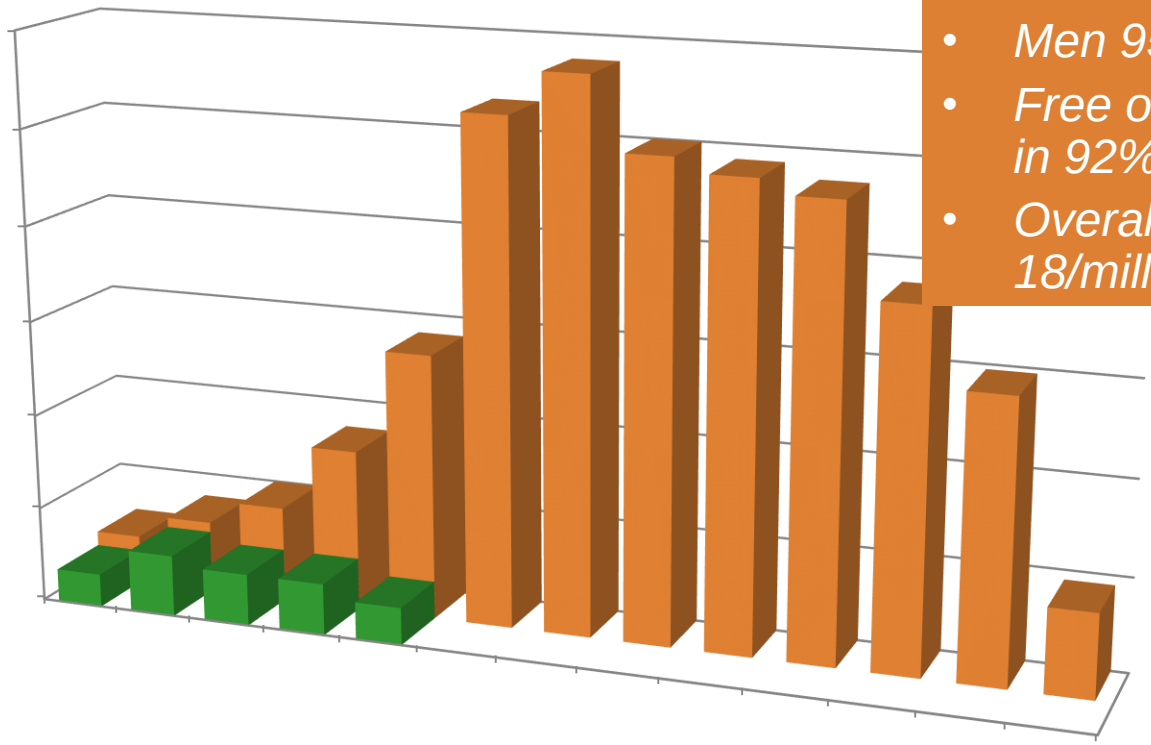
Arrêt cardio-respiratoire extra hospitalier.

Sports Related
Sudden Death in Population



Results (1)

Young Competitive Athletes <5%



- *Mean age 46±15 yrs*
- *Men 95%*
- *Free of known cardiopathy in 92%*
- *Overall incidence 17-18/million/yr*

"Young competitive athletes"

in 48 cases (6%)

Competitive Setting
A Risk Factor

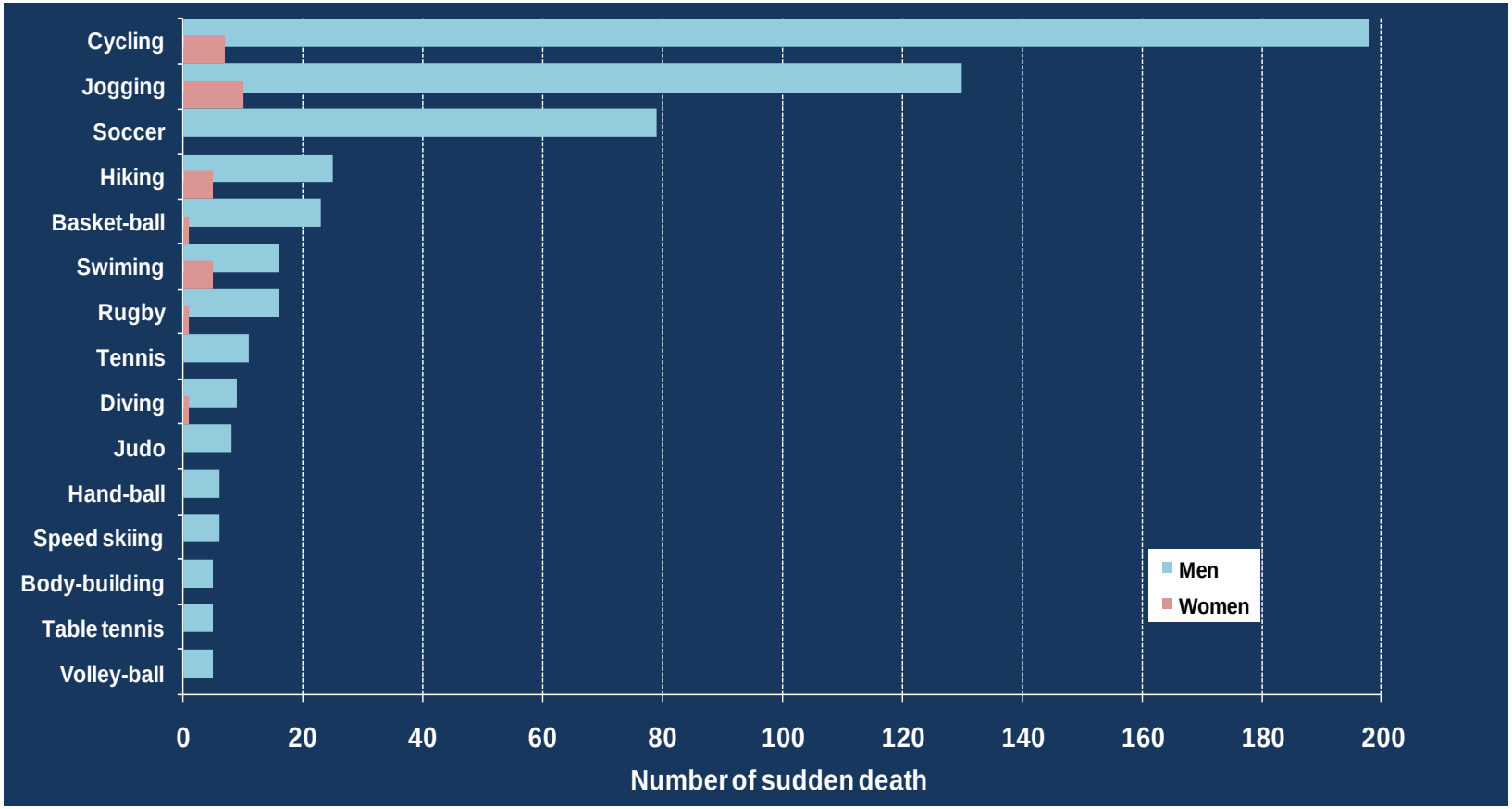
0.94/100,000/yr

0.24/100,000/yr

Among 10-35 year-old population

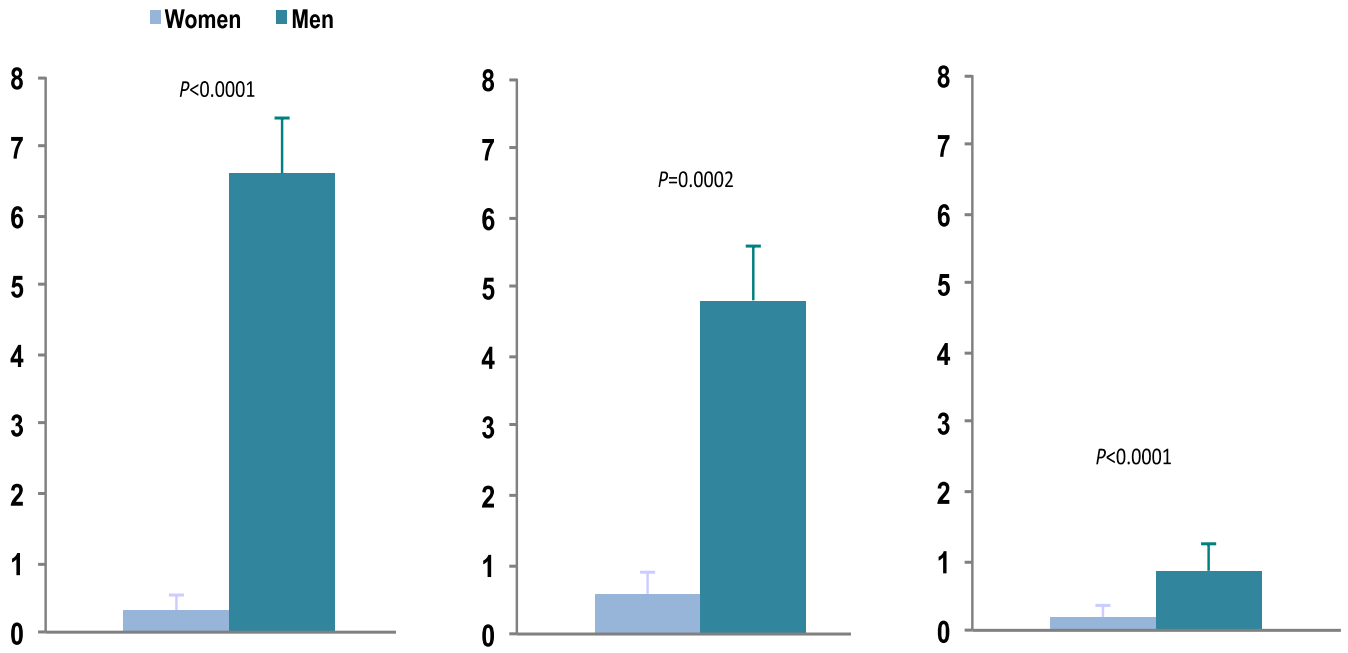
Results (2)

Cycling, Jogging, Soccer



Marijon et al: JAMA 2013

Sport related Sudden death, and sex



	Cycling		Jogging		Swimming	
	Women	Men	Women	Men	Women	Men
N	9	238	13	157	7	18
Incidence per Year per Million of Specific Sport Participants	0.32 (0.11–0.53)	6.61 (5.77–7.45)	0.58 (0.26–0.89)	4.81 (4.06–5.56)	0.19 (0.05–0.34)	0.86 (0.46–1.25)

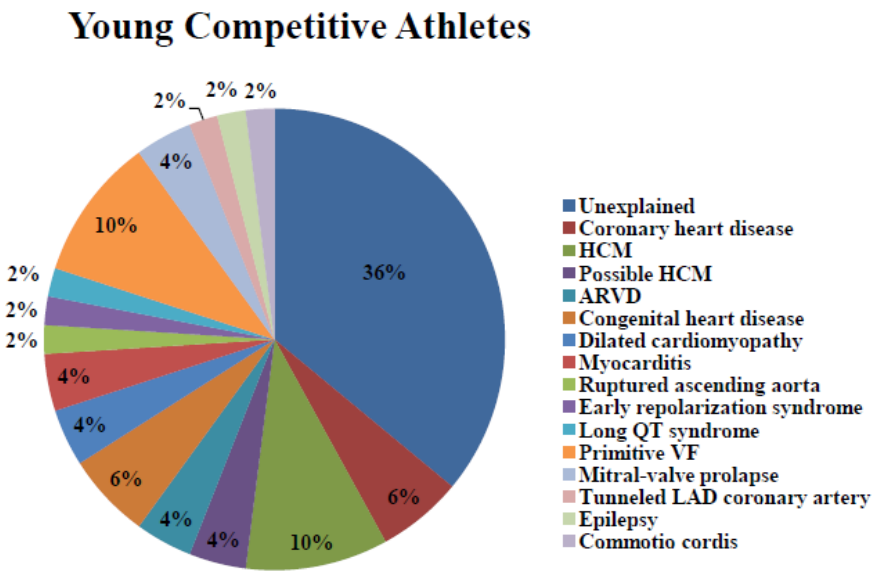
Comparison cylcing vs. swimming:
Women, *P*=0.30
Men, *P*<0.0001

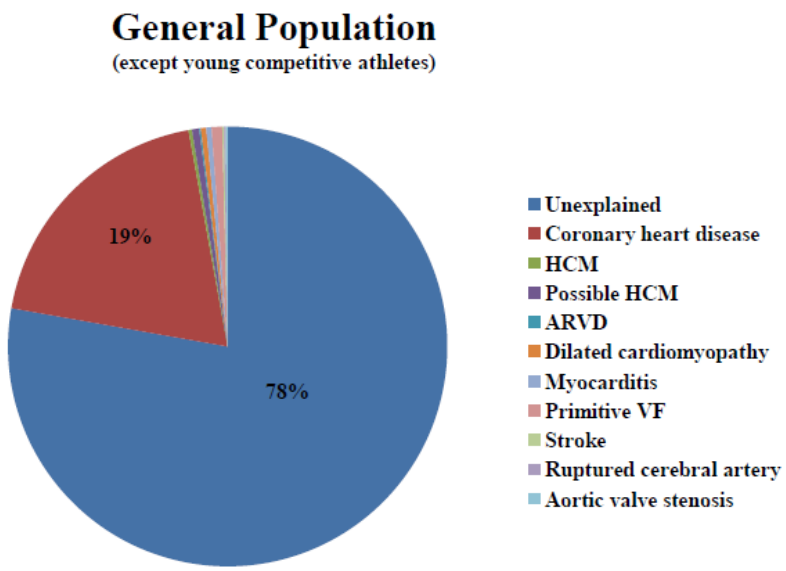
Marijon et al JAMA 2013

Sudden death witnessed >90%
Bystander CPR 30%

99.8% *Presence of Witness* 83.4%

Poor rate of determined causes of death



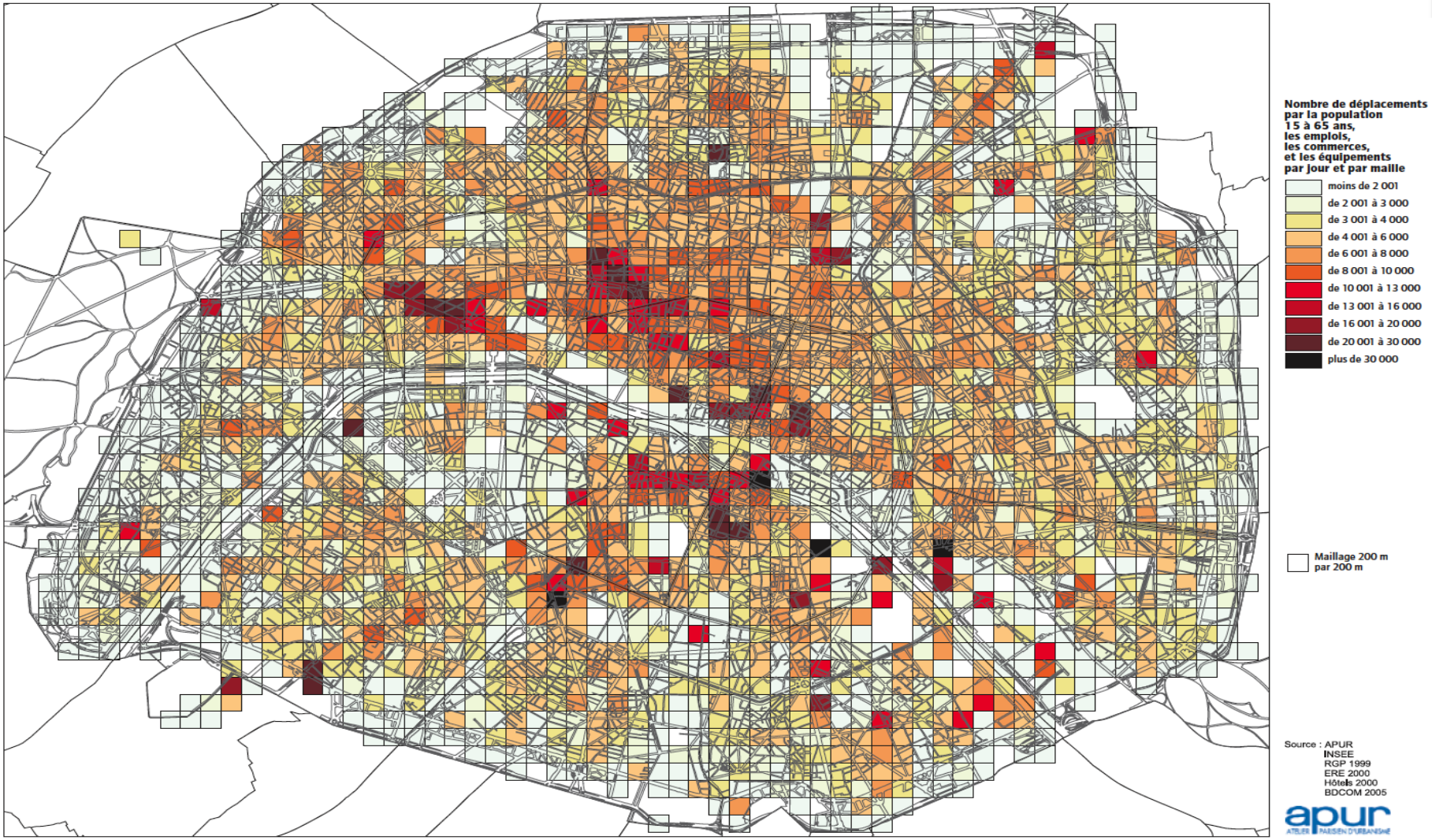


Where do OHCA occur?

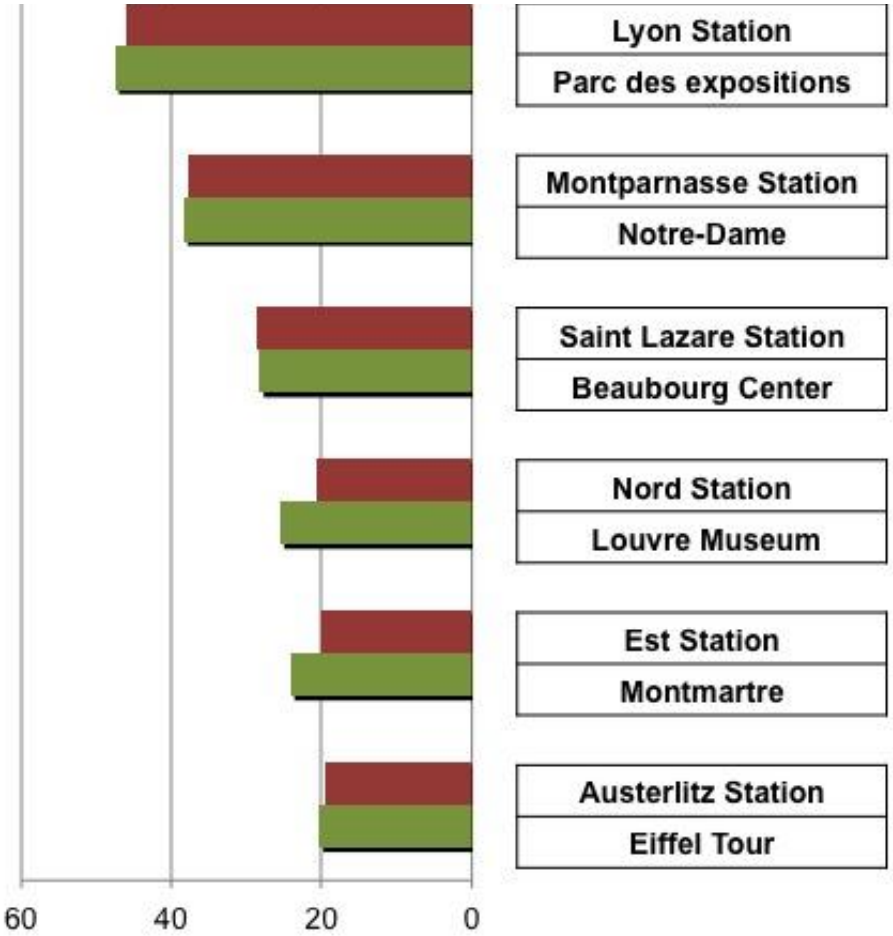
Modèle de Régression Logistique Multinomiale

Flux de personnes: 1.48 (IC95% 1.34-1.63)

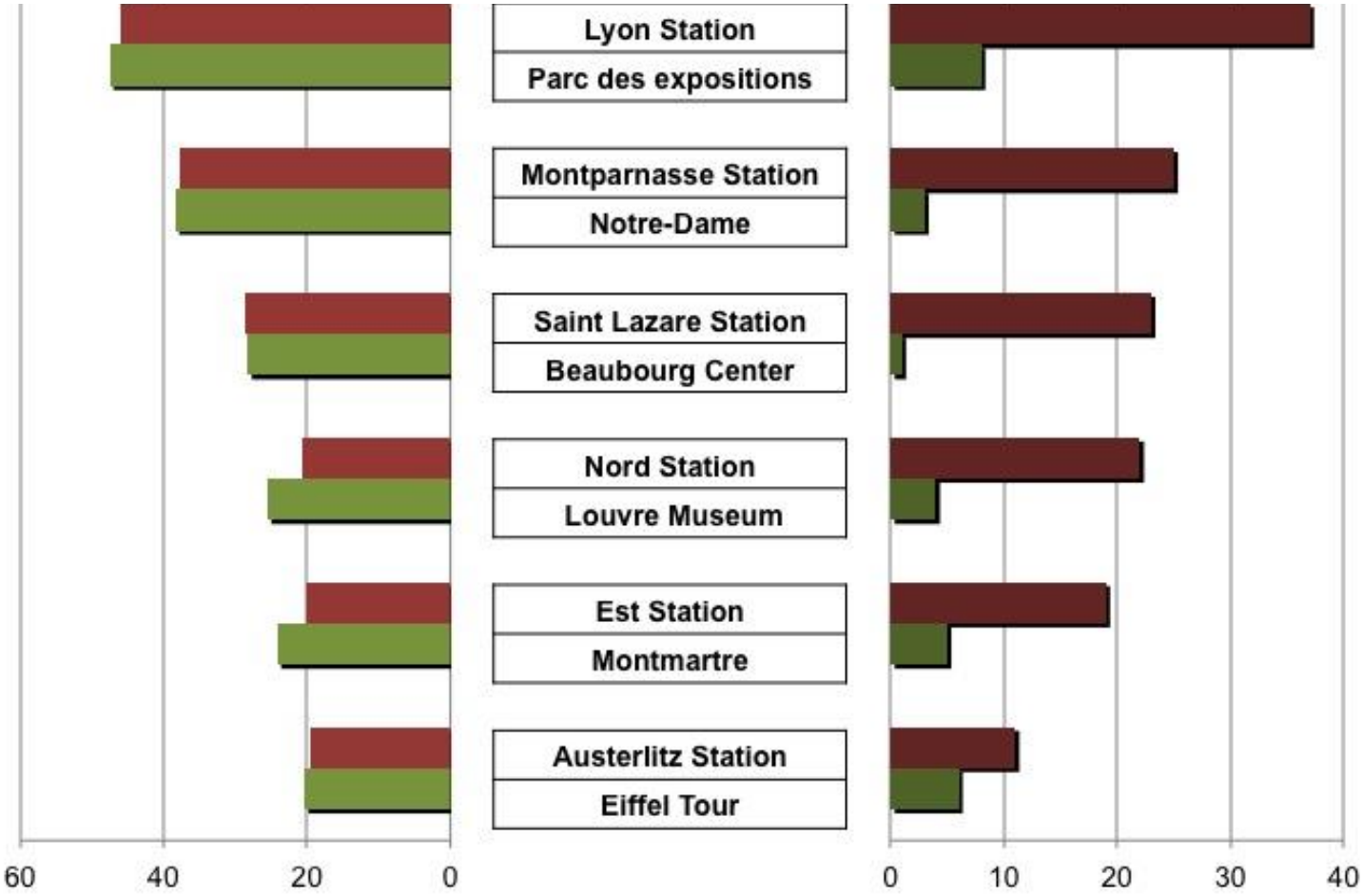
Gares: 3.80 (IC95% 2.66-5.36)




SALON INTERNATIONAL DE L'AGRICULTURE

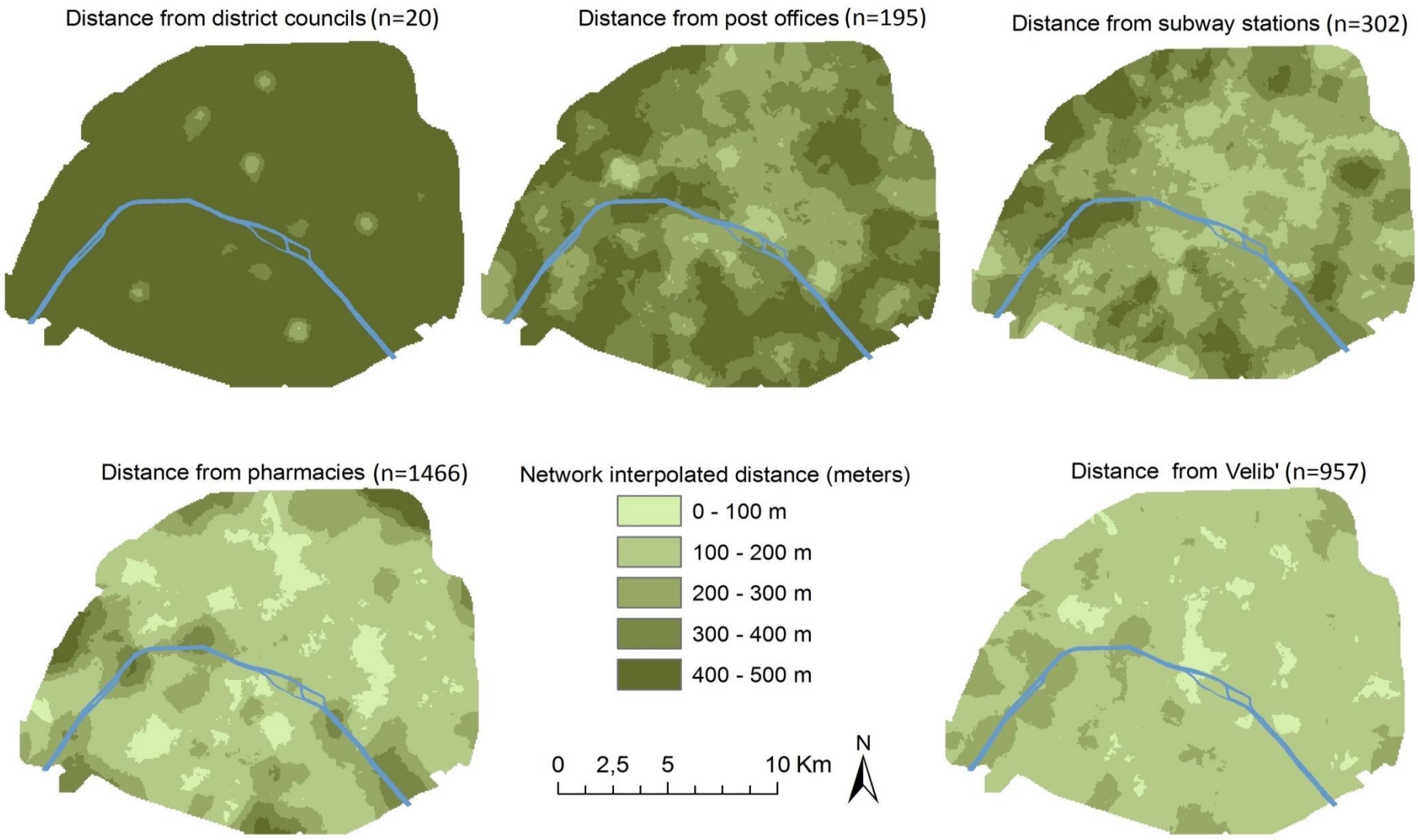

Lyon Station
Parc des expositions
Montparnasse Station
Notre-Dame
Saint Lazare Station
Beaubourg Center
Nord Station
Louvre Museum
Est Station
Montmartre
Austerlitz Station
Eiffel Tour
60
40
20
0
Mean movement per day (thousand)

Circulation
JOURNAL OF THE AMERICAN HEART ASSOCIATION
American Heart Association
Learn and Live



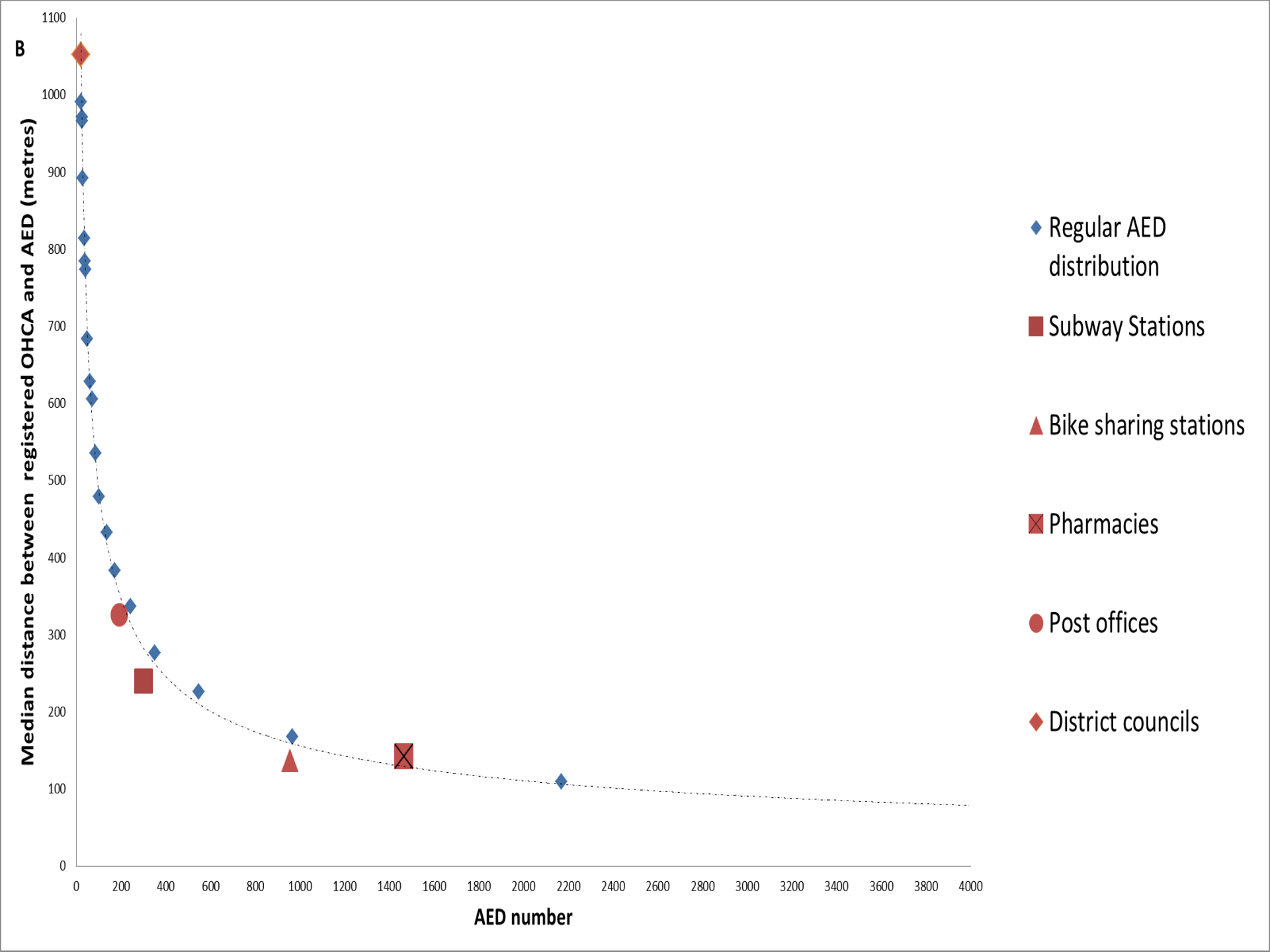
Is there an optimal location for automatic external defibrillators?

- For each scenario of AED deployment, a distance matrix between OHCA locations and the closest AED was calculated, complying Paris road network for real walking distance estimation. The matrix calculation was based on Djikstra's algorithm ($O(|E|+|V|\log|V|)$ where $|E|$ is the number of edges and where $|V|$ is the number of vertices) for finding shortest paths



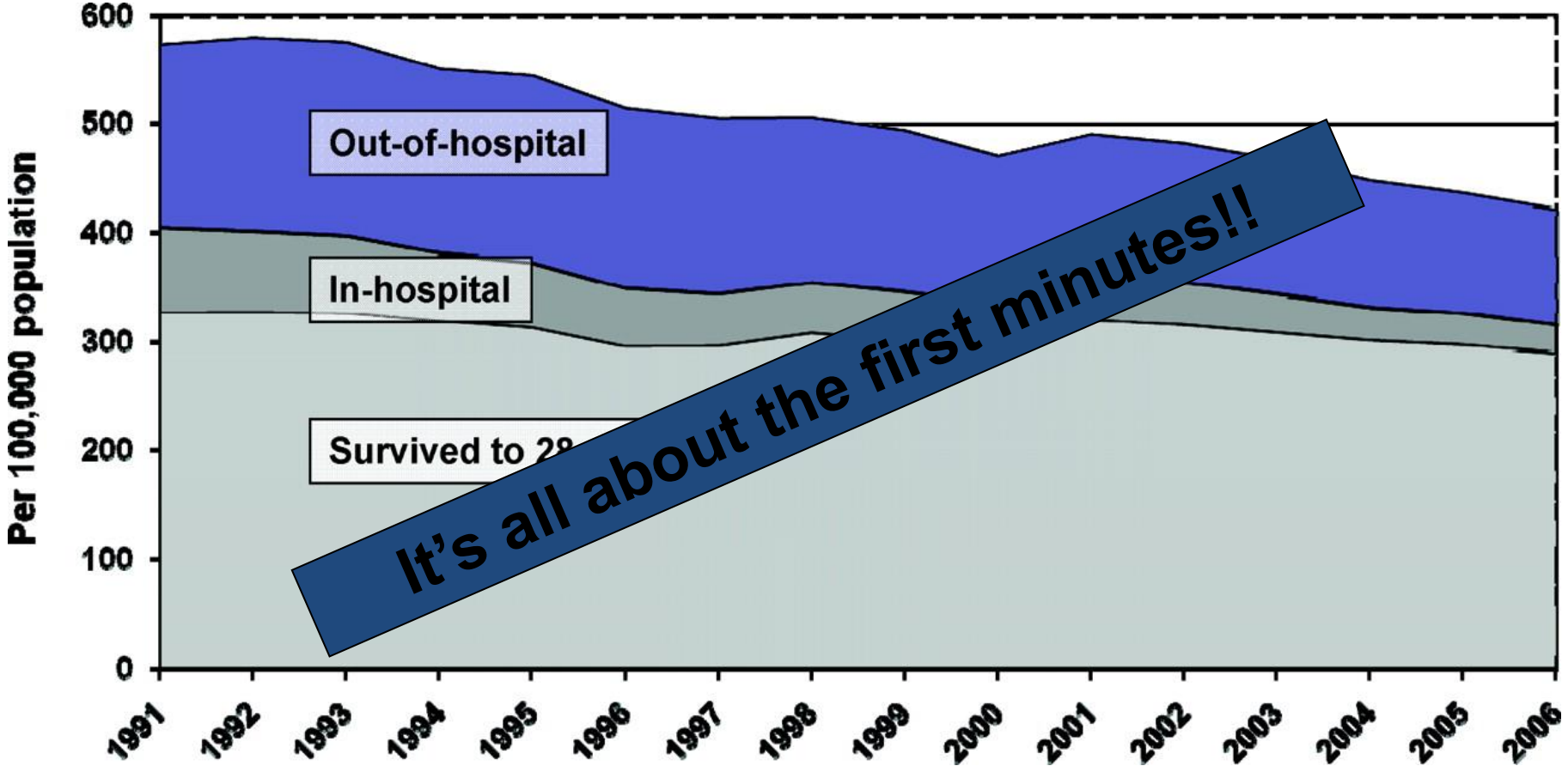
Dahan B et al Resussitation 2016

- Is there an optimal number for automatic external defibrillators in a given city ?


B
Median distance between registered OHCA and AED (metres)
AED number
0
100
200
300
400
500
600
700
800
900
1000
1100
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
3400
3600
3800
4000
Regular AED distribution
Subway Stations
Bike sharing stations
Pharmacies
Post offices
District councils

Is it possible to identify subjects with acute SCA minutes before their OHCA?

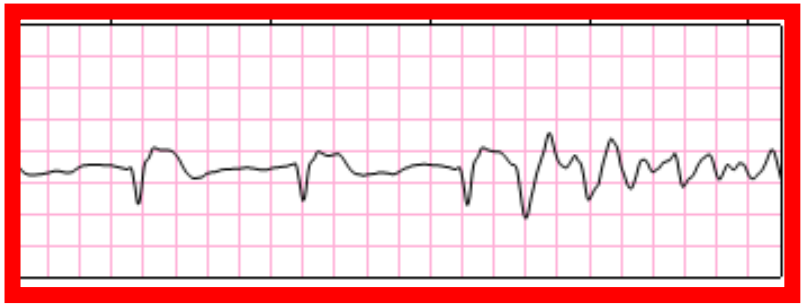
BAckground



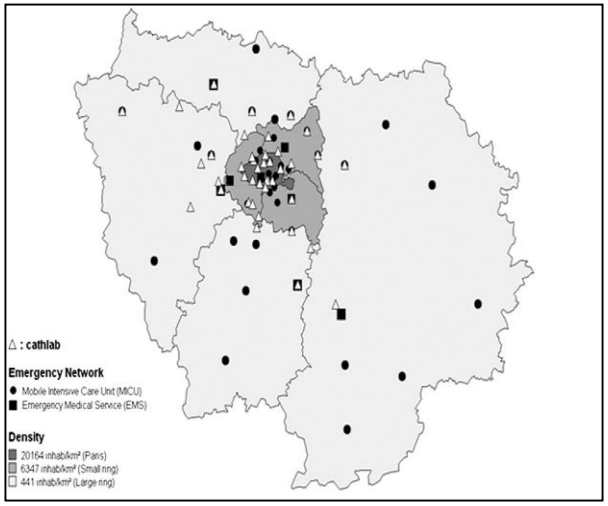
Myocardial infarction, Sweden (1991-2006)

Dudas et al. Circulation 2011

Background



DATA SOURCE: e-MUST REGISTRY



Les registres de cardiologie de l'ARS Île-de-France

e-MUST et CARDIO-ARSIF

THE e-MUST REGISTRY

- Created in 2003 by the ARSIF (Agence Régionale de Santé d'Ile de France)
- Enrolls all out-of-hospital STEMI patients managed by the EMS in the Greater Paris Area

- Inclusion criteria:
  - Patient alive at EMS arrival
  - Chest pain > 20mn, but < 24h
  - Persisting despite nitrates
  - ST segment elevation ≥ 2mm in 2 adjacent leads or new LBB

THE e-MUST REGISTRY

Data collection:

- Standardized questionnaire since 2006
- Data collected on the phone by the EMS dispatcher
- Completed on site by the EMS physician.
- In-hospital follow up and outcome obtained in the following days through a systematic phone call to the admitting hospital

THE e-MUST REGISTRY

Data management:

- Entered in a computerized database in each dispatch center
- Sent every four months to the registry services of the ARSIF.
- An independent random external audit of 11% of the files held yearly in order to ensure completeness and reliability.
- Analyzed at the Cardiovascular Epidemiology unit (U970) of the National Institute of Research (INSERM)

STUDY POPULATIONS

<table>
<tr><td colspan="2">e-MUST Population
Jan 2006 - Dec 2010
N=8112</td><td>Haute-Savoie Population
Jan 2005 - Jan 2012
N=606</td></tr>
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(2/3)
N=5353</td><td>Validation sample
(1/3)
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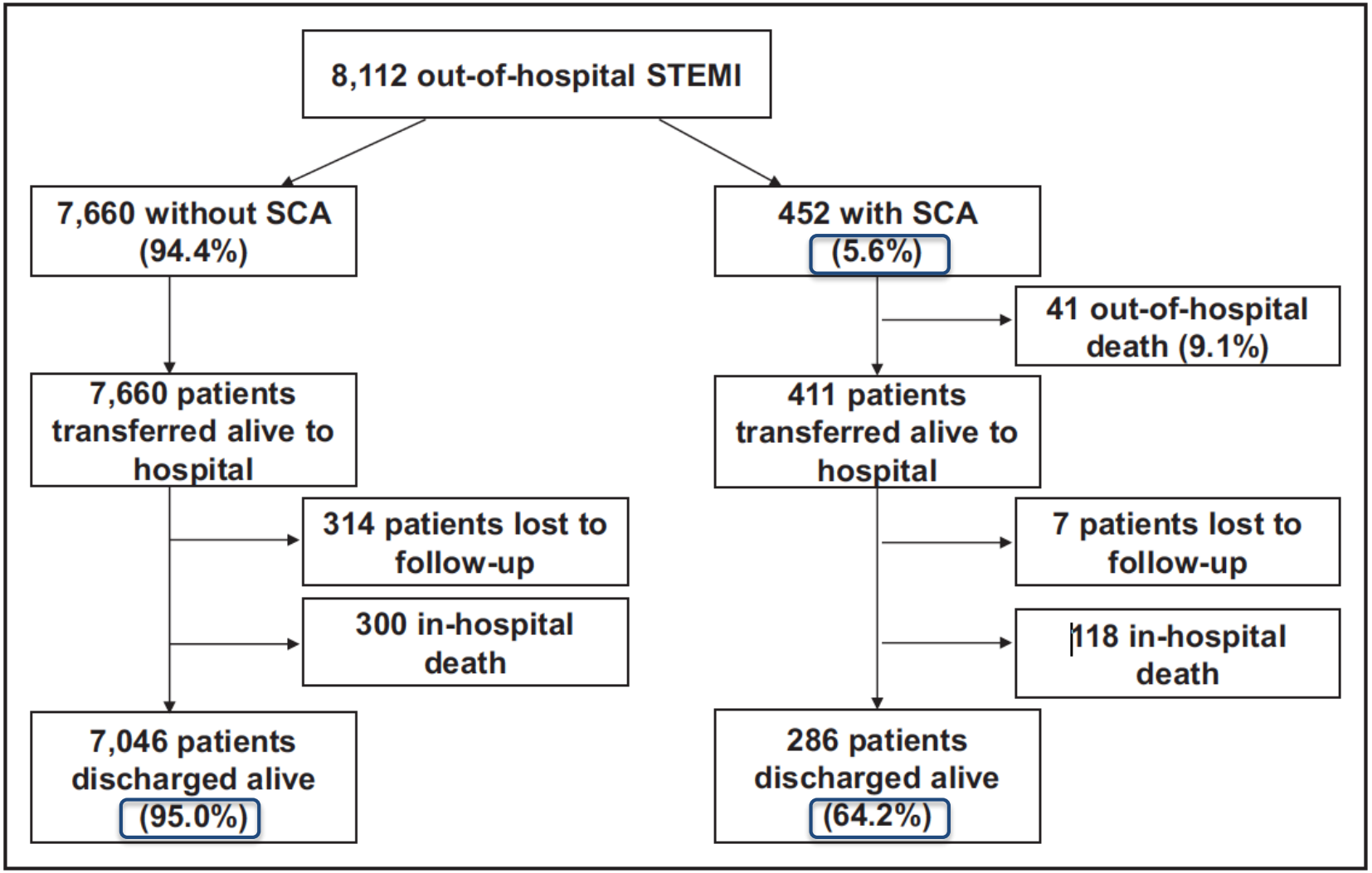
FLOWCHART


8,112 out-of-hospital STEMI
7,660 without SCA (94.4%)
452 with SCA (5.6%)
41 out-of-hospital death (9.1%)
7,660 patients transferred alive to hospital
411 patients transferred alive to hospital
314 patients lost to follow-up
7 patients lost to follow-up
300 in-hospital death
118 in-hospital death
7,046 patients discharged alive (95.0%)
286 patients discharged alive (64.2%)

PATIENTS' CHARACTERISTICS

	N	All patients N=8,112	Without SCA N=7,660	With SCA N=452	P*
Age	8,070				
Median (IQR)		60 (51-73)	60 (51-73)	57 (48-68)	<0.0001
Male, n (%)	8,095	6,322 (78.1)	5,964 (78.0)	358 (79.4)	0.5
Risk factors	7,924				
Past history of CAD, n (%)		1,505 (19.0)	1,429 (19.0)	76 (17.0)	0.3
Familial CAD history, n (%)		1,470 (18.5)	1,398 (18.7)	72 (16.1)	0.2
Current smoking, n (%)		4,188 (52.8)	3,960 (53.0)	228 (51.1)	0.4
Diabetes, n (%)		1,195 (15.1)	1,154 (15.4)	41 (9.2)	<0.0001
Hypertension, n (%)		3,166 (40.0)	3,031 (40.5)	135 (30.3)	<0.0001
Dyslipidemia, n (%)		2,826 (35.7)	2,684 (35.9)	142 (31.8)	0.08
Obesity, n (%)		1,963 (24.8)	1,889 (25.3)	74 (16.6)	<0.0001
Shortness of breath, n (%)	7,752	281 (3.6)	202 (2.7)	79 (19.4)	<0.0001
Chest pain onset-to-call delay	7,924	60 (26-165)	63 (27-170)	34 (12-78)	<0.0001
Call to EMS arrival delay	7,959	20 (14-28)	20 (14-28)	18 (13-28)	0.03

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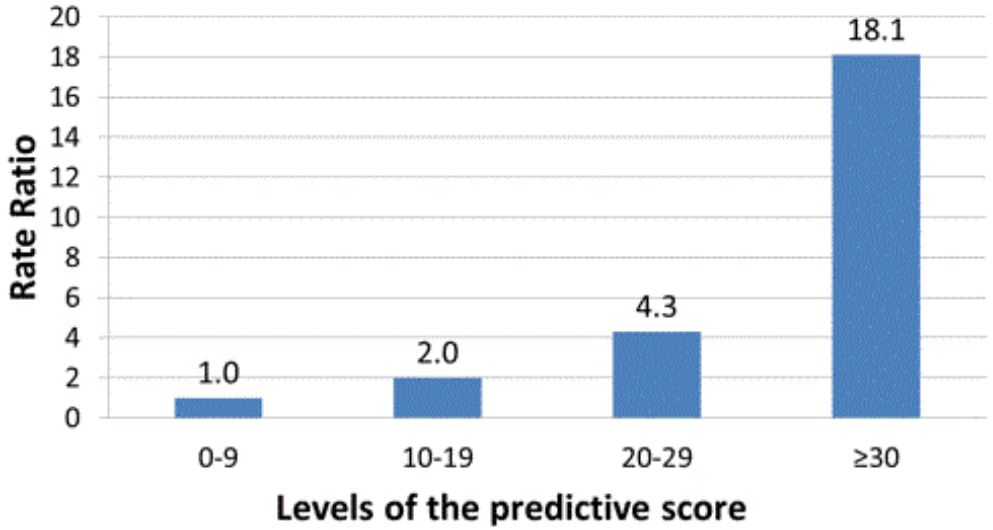
SCORE CREATION

	OR	95% CI	*P*-value	*β*-Coef	Score
Age					
> 70 years	1				**0**
61-70 years	1.4	[0.9 - 2.1]	0.1	0.3	**3**
51-60 years	1.5	[1.0 - 2.2]	0.04	0.4	**4**
41-50 years	2.1	[1.4 - 3.1]	<0.0001	0.7	**7**
≤ 40 years	2.5	[1.5 - 4.4]	<0.0001	0.9	**9**
Diabetes					
Yes	1				
No	1.6	[1			
Obesity					
Yes	1				
No	1.7	[1			
Shortness of breath					
Absent	1				
Present	10.5	[7.			
Time from the chest pain onset to the c					
> 120 minutes	1				
61 – 120 minutes	1.7	[1.1 - 2.7]	0.02	0.5	**5**
31 – 60 minutes	2.3	[1.5 - 3.4]	<0.0001	0.8	**8**
≤ 30 minutes	2.8	[1.9 - 4.0]	<0.0001	1.0	**10**

Score	OR (95%CI)	Score
Age <40yo	2.5 (1.5-4.4	9
No diabetes	1.6 (1.0-2.6)	5
No obesity	10.5 (7.1-15.4)	5
Delay ≤30min	2.8 (1.9-4.0)	10
Heart Failure	10.5 (7.1-15.4)	23
TOTAL		/52

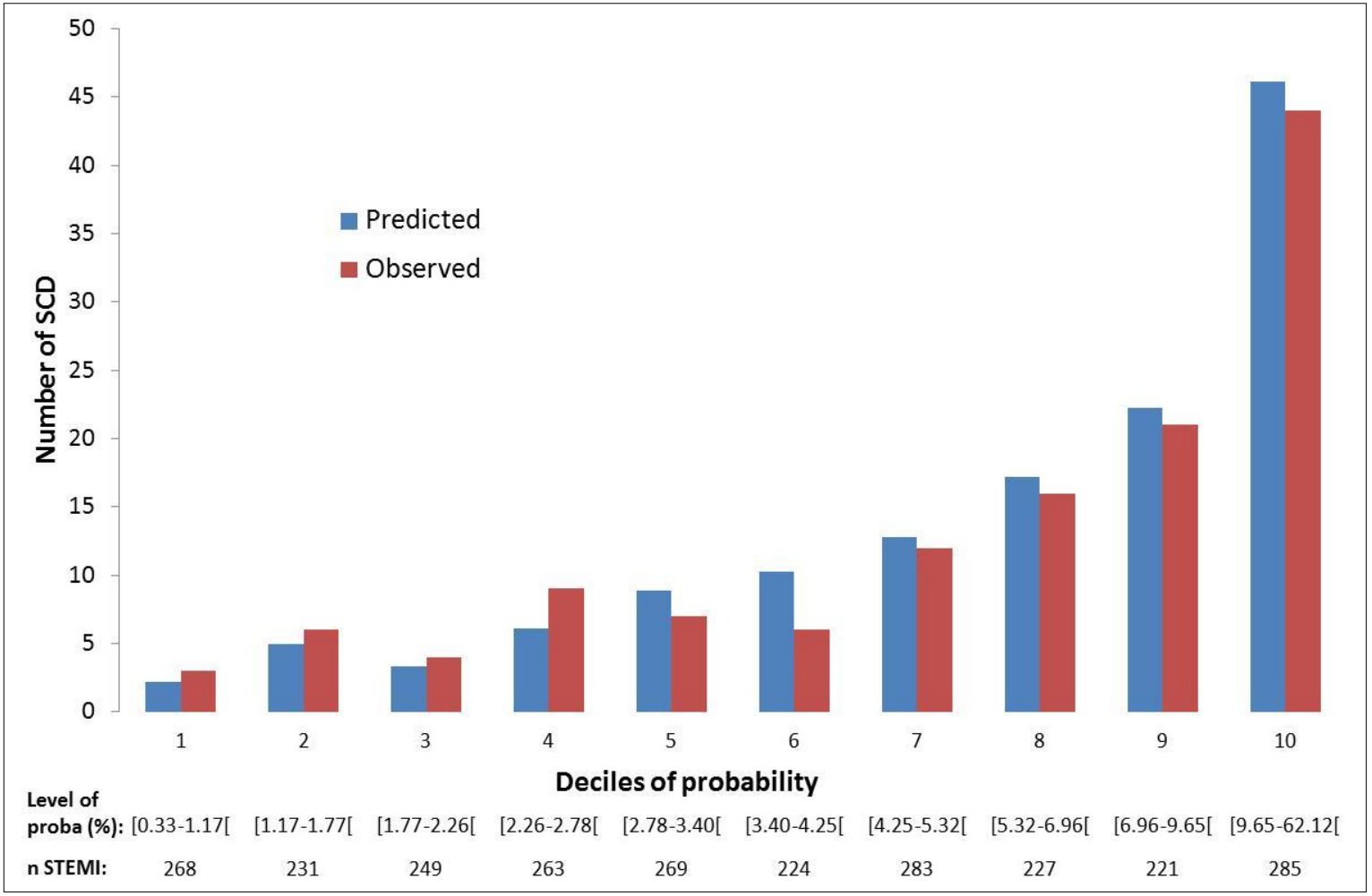
RISK ACCORDING TO SCORE LEVEL



n:	748	3793	2642	239
% of SCA:	1.6	3.2	6.9	28.9

Score	**≥10**	**≥20**	**≥30**
Sensitivity	96.9%	65.4%	18.0%
Specificity	10.5%	62.6%	97.6%
Positive likelihood ratio	1.08	1.75	7.44
Negative likelihood ratio	0.30	0.55	0.84

PREDICTED VS. OBSERVED SCA RATE



- Clinical implications:

    1. Understanding potential factors associated with pre-hospital SCA

    2. Help in STEMI patients' optimal dispatching and management

    3. More important role in the future?

- Limitations:

    1. Not applicable on patients who present immediate SCA

    2. Generalization to all acute coronary syndromes not tested

    3. Could probably have been improved with SCA-specific risk factors

Circulation

ORIGINAL RESEARCH ARTICLE

Identifying Patients at Risk for Prehospital Sudden Cardiac Arrest at the Early Phase of Myocardial Infarction

The e-MUST Study (Evaluation en Médecine d'Urgence des Stratégies Thérapeutiques des infarctus du myocarde)

Nicole Karam, Sophie Bataille, Eloi Marijon, Olivier Giovannetti, Muriel Tafflet, Dominique Savary, Hakim Benamer, Christophe Caussin, Philippe Garot, Jean-Michel Juliard, Virginie Pires, Thévy Boche, François Dupas, Gaelle Le Bail, Lionel Lamhaut, François Laborne, Hugues Lefort, Mireille Mapouata, Frederic Lapostolle, Christian Spaulding, Jean-Philippe Empana, Xavier Jouven, Yves Lambert and For the e-MUST Study Investigators

PREHOSPITAL CARE REPORT

OR - Multnomah

Case #: 4016275 County Run #: Pt # 1 of 1 Unit ID: 333 Date: 8/5/2011

DISPATCH INFORMATION

Time Received:	14:39:07			Incident Location:	
Time Dispatched:	14:39:14	Time To Hosp:	15:00:27	153 SE 84TH AVE , PORT, OR	
Time Enroute:	14:39:36	Time At Hosp:	15:06:39	Initial Mode:	CODE 3
Time On Scene:	14:41:49			Final Mode:	CODE 3
Time at Pt Side:	14:42:22	Time Cleared:		ALS Assessment:	AMR EMT-P

First in: ALS Ambulance

Nature of Call: CH1 Chest Pain_Discom >1 prob

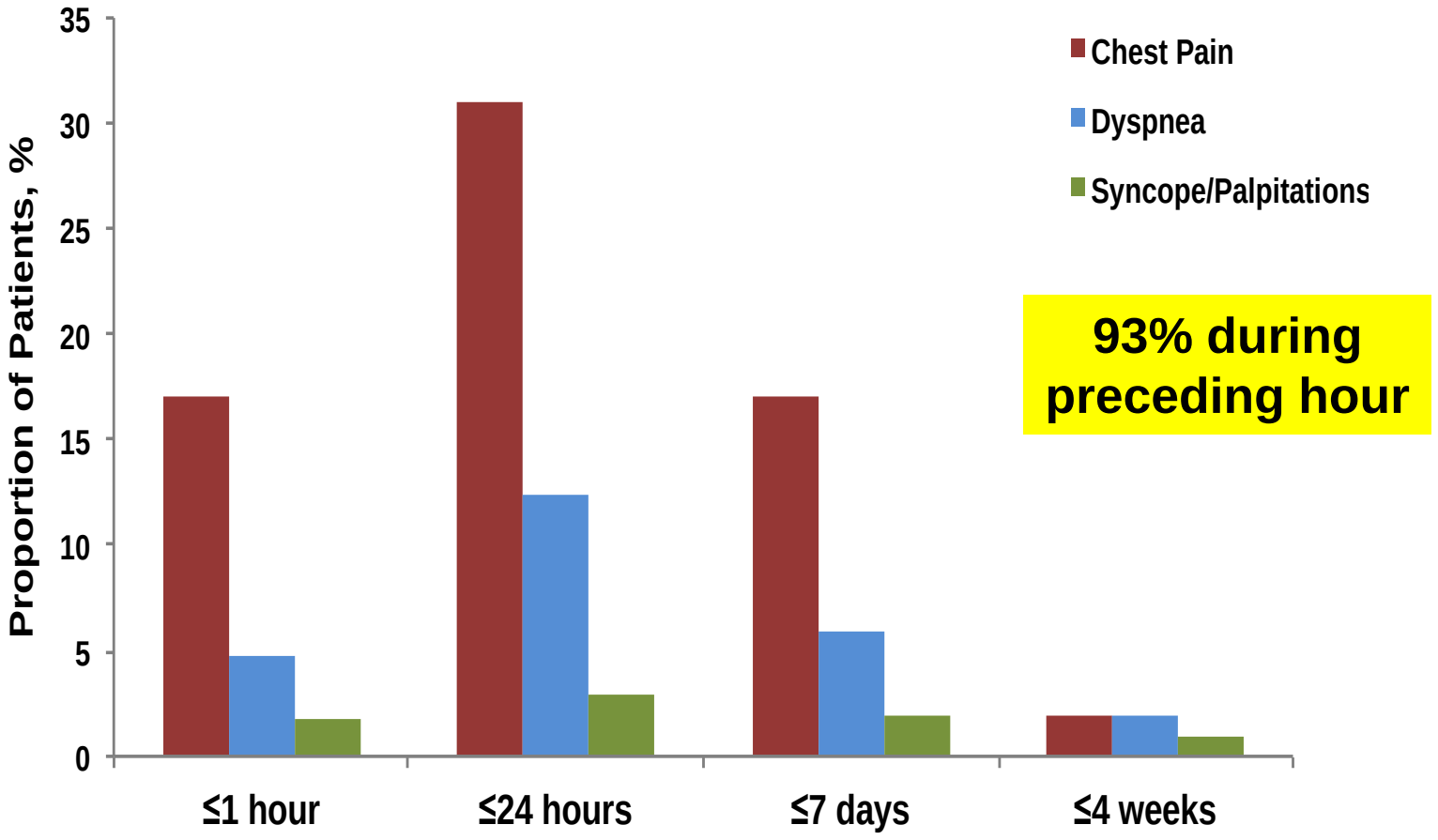
PATIENT DEMOGRAPHICS

☐ Age Estimated

Name:	chaverria, eduardo	D.O.B.:	04/05/1956	Age: 55 years	Months: Days:
Address:	153 SE 84TH AVE ,	Ethnicity:	Unknown	Sex: Male	Weight: 100 Kg
City, State, Zip:	PORT, OR 97233	Physician:		Triage Tag :	
Phone :	(503) 285-4419	Employer:			
SSN:	000-00-0000	Responsible Party:	chaverria, eduardo	Phone:	(503) 285-4419

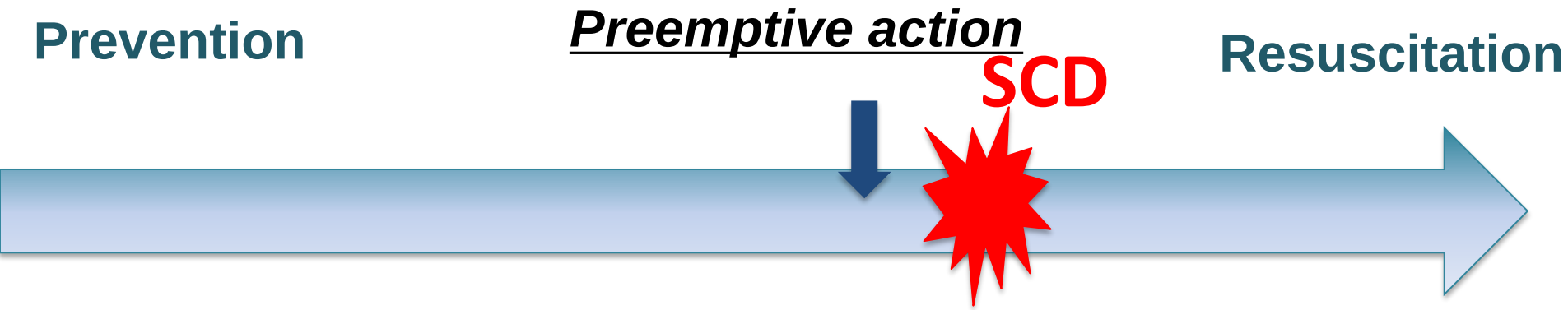
NARRATIVE

50% have symptoms before



Marijon E …….. Chugh S . Ann Int Med 2015

Predicting SCD minutes prior to its occurrence in STEMI pts



ask for
-Bystander assistance
-neighbour,
-Identify closest location AED
-EMS +++
-Dispatcher instructions

Karam et al Circulation 2016

Near-term prevention