# Singapore's Approaching Tsunami of Cardiovascular Disease

**NMRC**
**Research Symposium**
**7th March 2017**

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# Disclosures

## Affiliation/Financial Relationships

- Grant/Research Support
- Consulting Fees
- Speakers Honoraria

## Institutions/ Companies

- **NMRC**
- **BMRC**
- **NUS**
- **Astra Zeneca**
- **Alere**
- **Roche Diagnostics**
- **Abbott**
- **Thermo Fisher**
- **Critical Diagnostics**
- **Novartis**

National University Heart Centre, Singapore

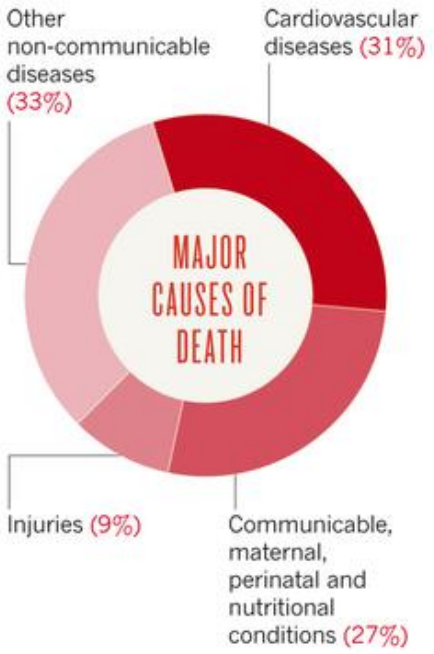
# CVD contribution to Global Burden of Disease

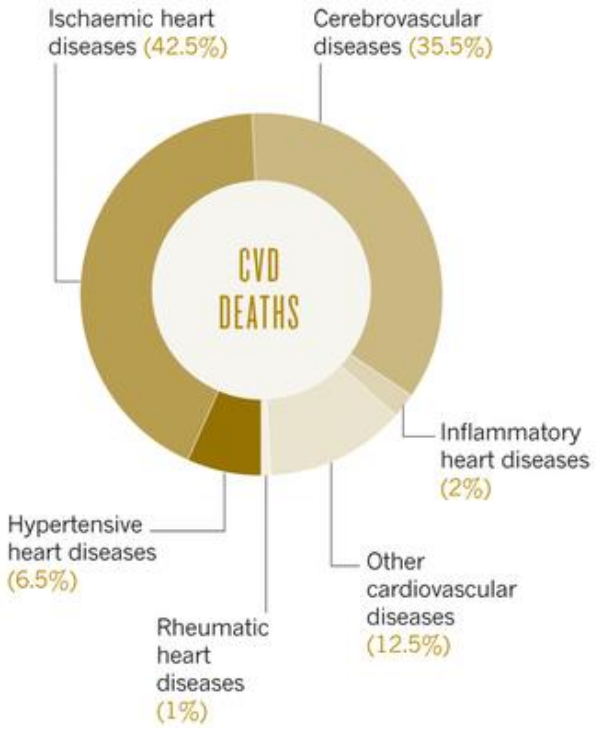
**Number 1**
cause of death globally more people die annually from CVDs than from any other cause.

**17.5 million**
people die each year from CVDs, an estimated 31% of all deaths worldwide.

**80%**
of all CVD deaths are due to heart attacks and strokes

**>75%**
of CVD deaths occur in low-income and middle-income countries.

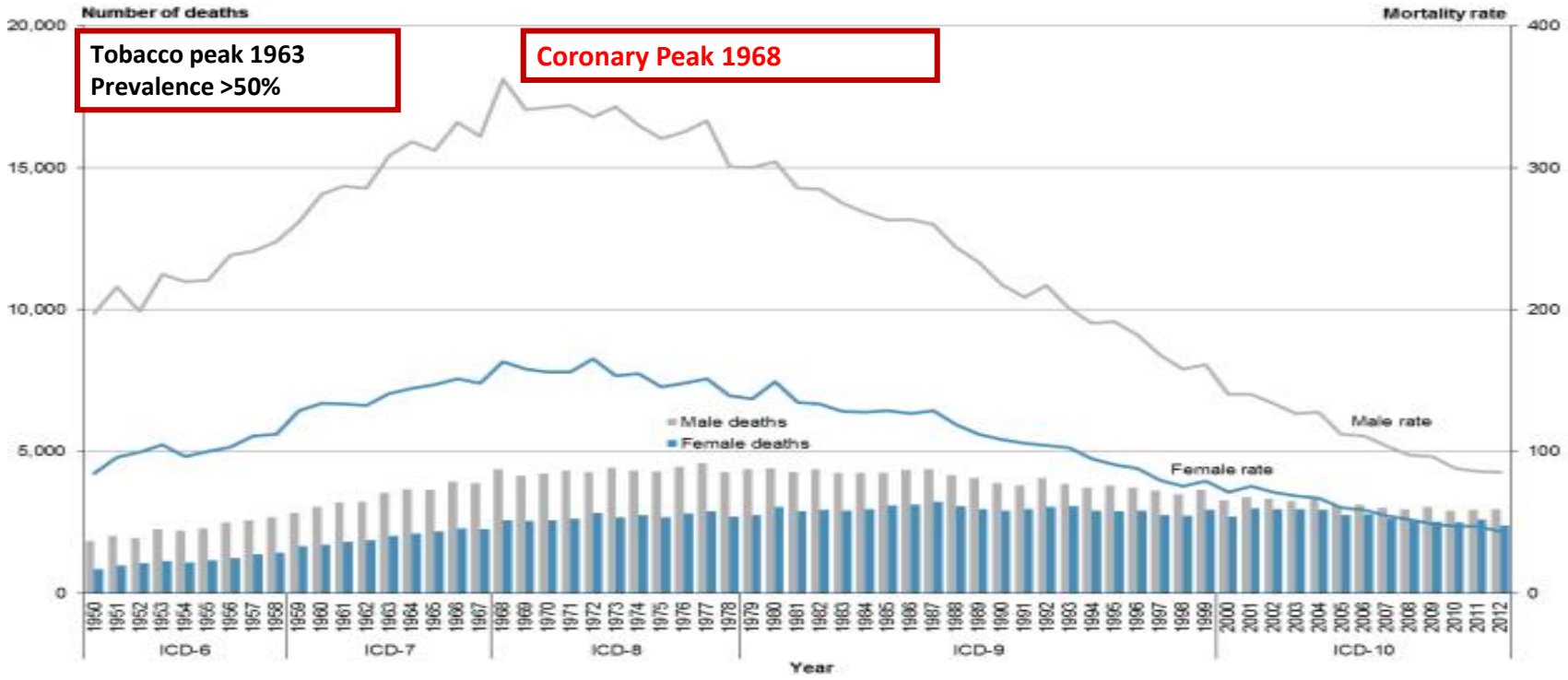



*Nature 2013*

World Health Organization

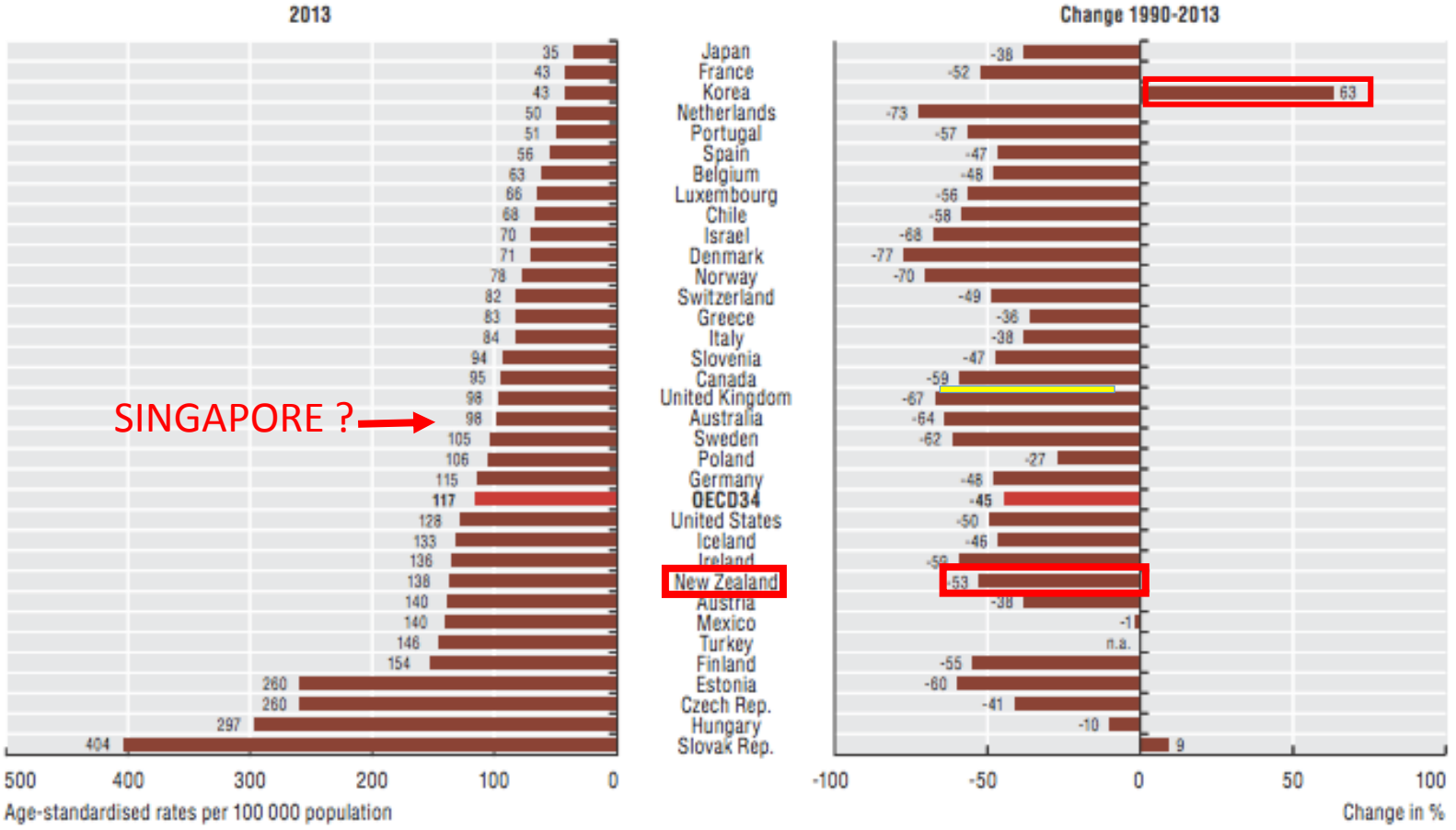
# Numbers and age-standardised mortality rates from ischaemic heart disease, by sex, 1950–2012




Note: rates per 100,000 population, age-standardised to WHO World Standard Population.

**Overall Heart Disease death rates reduced by more than two-thirds since 1968 in the OECD.**

# IHD Mortality has reduced in most parts of the OECD …not everywhere

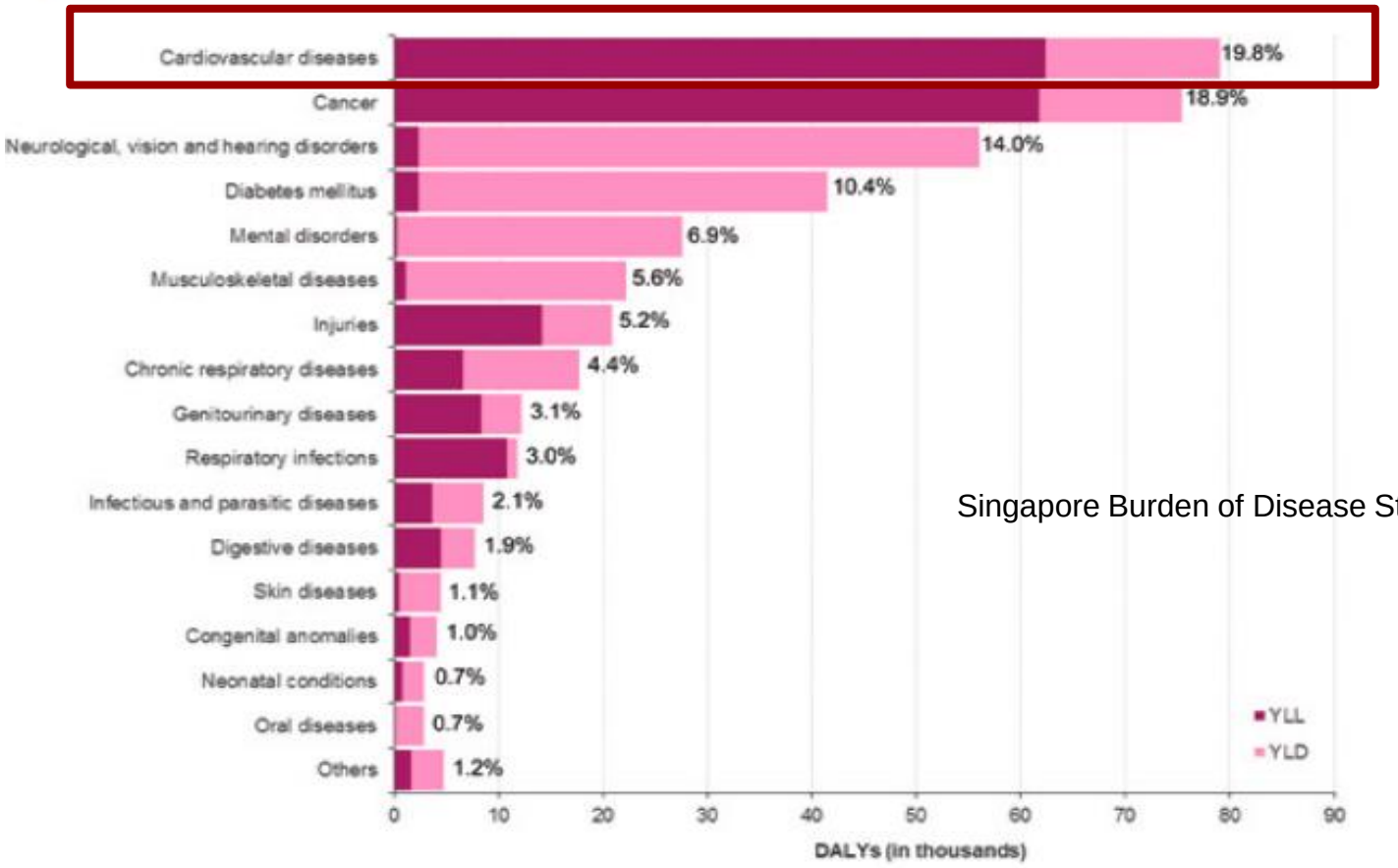



Source: OECD Health Statistics 2015, http://dx.doi.org/10.1787/health-data-en.

StatLink http://dx.doi.org/10.1787/888933280741

# CVD is a Major Local Disease Burden

**Figure 4.11**: YLL, YLD, and DALYs for each broad cause group, Singapore 2010




**CVD 19.8%**

Singapore Burden of Disease Study 2010, MOH

The percentage refers to the proportion of total DALYs contributed by the respective broad cause group.

**Singapore**

Every day, 16 people die from cardiovascular disease (heart disease and stroke) in Singapore. Cardiovascular disease accounted for 29.6% of all deaths in 2015. This means that nearly 1 out of 3 deaths in Singapore, is due to heart disease or stroke.

**PRINCIPAL CAUSES OF DEATHS**

| | 2013 | 2014 | 2015 |
|---|---|---|---|
| Total No. of Deaths | 18,938 | 19,393 | 19,862 |
| % of Total Deaths | | | |
| Ischaemic Heart Disease | 15.5% | 16.0% | 16.7% |
| Cerebrovascular Disease (including stroke) | 8.9% | 8.4% | 6.8% |
| Hypertensive Diseases (including hypertensive heart disease) | 3.1% | 3.6% | 3.9% |
| Other Heart Diseases | 2.0% | 1.9% | 2.2% |
| **Total % of Deaths from Cardiovascular Disease** | **29.5%** | **29.9%** | **29.6%** |
| **Total No. of Deaths from Cardiovascular Disease** | **5,587** | **5,799** | **5,879** |

**Population 5,540,000**
(mid 2015)
**Raw death rates for all CV disease**
**= 106/100,000**
**2013-2015**
**CVD DEATHS ↑ 5.2%**
**POPULATION 2.6%**

SINGAPORE POPULATION


Source: Ministry Of Health

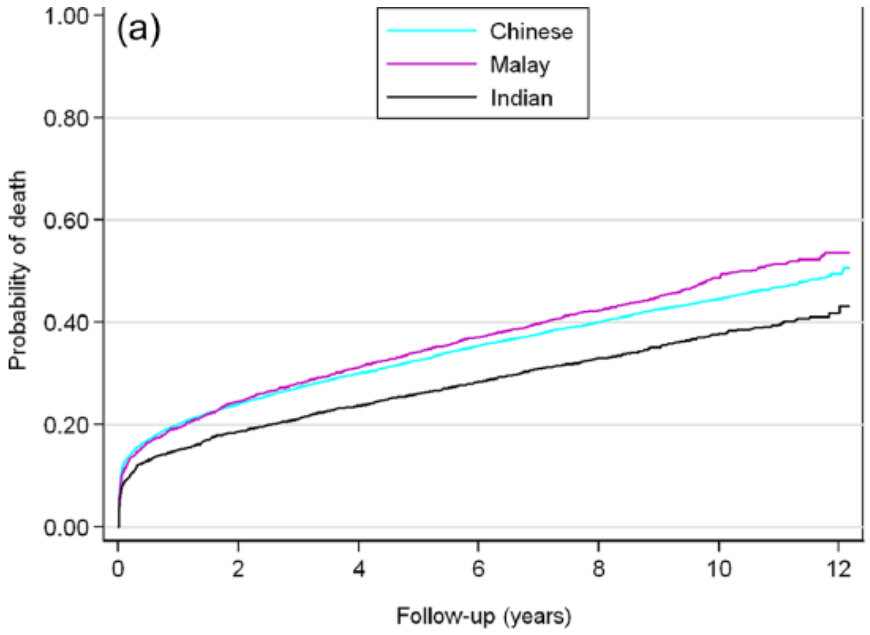
# Characteristics of Patients with Myocardial Infarction

| | Chinese (*n*=10,100) | Malay (*n*=3005) | Indian (*n*=2,046) | *p*-value |
|---|---|---|---|---|
| **Demographic features** | | | | |
| Age (years) | 64 (54–74) | 61 (51, 71) | 58 (49, 70) | <0.001 |
| Male, % | 71.0 | 73.4 | 77.0 | <0.001 |
| **Prior history** | | | | |
| Diabetes, % | 34.6 | 42.0 | 51.0 | <0.001 |
| Hypertension, % | 60.5 | 55.2 | 54.4 | <0.001 |
| Hyperlipidemia, % | 49.6 | 46.3 | 51.9 | 0.001 |
| Current smoking, % | 52.6 | 59.6 | 50.8 | <0.001 |
| Renal failure, % | 6.4 | 7.2 | 4.2 | <0.001 |
| Family history of premature coronary heart disease, % | 11.1 | 14.5 | 21.5 | <0.001 |
| Prior MI, % | 10.5 | 10.9 | 14.8 | <0.001 |
| Prior PCI, % | 4.2 | 3.6 | 8.1 | <0.001 |
| Prior CABG, % | 2.7 | 1.9 | 4.7 | <0.001 |
| Prior cerebrovascular disease, % | 10.5 | 6.2 | 7.2 | <0.001 |
| Peripheral vascular disease, % | 2.6 | 1.8 | 2.8 | 0.037 |

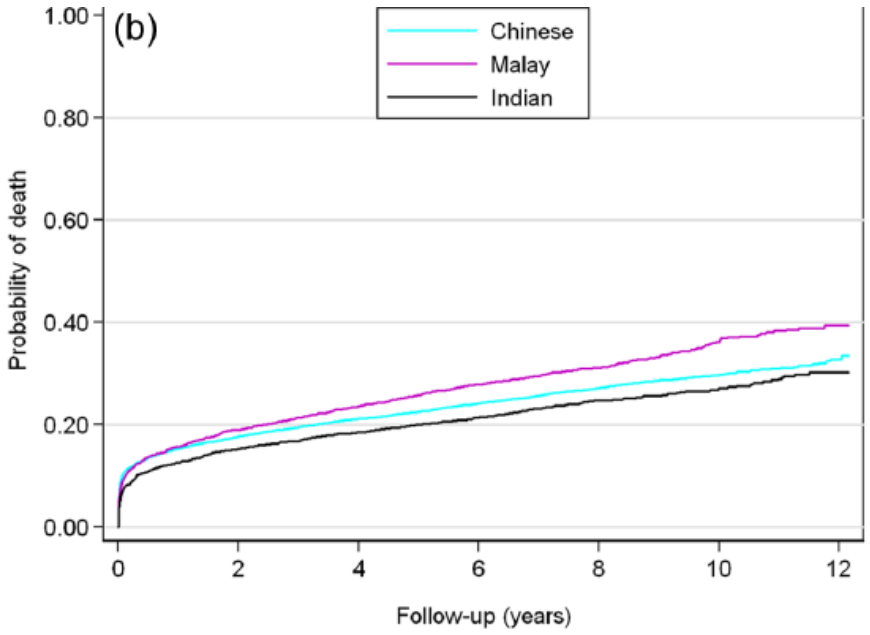
Carvalho, LP et al **Eur Heart J**: Acute CVS Care 2014, Vol. 3(4) 354–362

# AMI: Ethnic differences in mortality

All-cause mortality




CV mortality




Over median follow-up of 7.4 years, 6469 of 15150 (43%) died.

Carvalho LP *Eur Heart J*: Acute Cardiovascular Care 2014; 3: 354–362.

# AMI Outcomes: Singapore versus UK-Belgium

**Despite younger Age of onset (~60y vs 66 yr)) 5 year post MI Mortality is Higher in Singapore Compared with UK-Belgium**

| | Singapore | UK-Belgium |
|---|---|---|
| | 5 Year total no. of death, n=4832/15151 (32%) | 5 year total no. of deaths, n=736/3721 (20%) |
| STEMI | 1768/6843 (26%) | 269/1403 (19%) |
| Non-STEMI | 3064/8308 (37%) | 262/1170 (22%) |

European Heart Journal (2010) 31, 2755–2764
doi:10.1093/eurheartj/ehq326

FASTTRACK
ESC CLINICAL TRIAL UPDATE

## Underestimated and under-recognized: the late consequences of acute coronary syndrome (GRACE UK–Belgian Study)

Keith A.A. Fox[1]*, Kathryn F. Carruthers[1], Donald R. Dunbar[1], Catriona Graham[2], Jonathan R. Manning[1], Herbert De Raedt[3], Ian Buysschaert[4], Diether Lambrechts[5], and Frans Van de Werf[4]

SINGAPORE MYOCARDIAL INFARCTION REGISTRY REPORT NO. 3

# TRENDS IN ACUTE MYOCARDIAL INFARCTION IN SINGAPORE 2007 – 2013

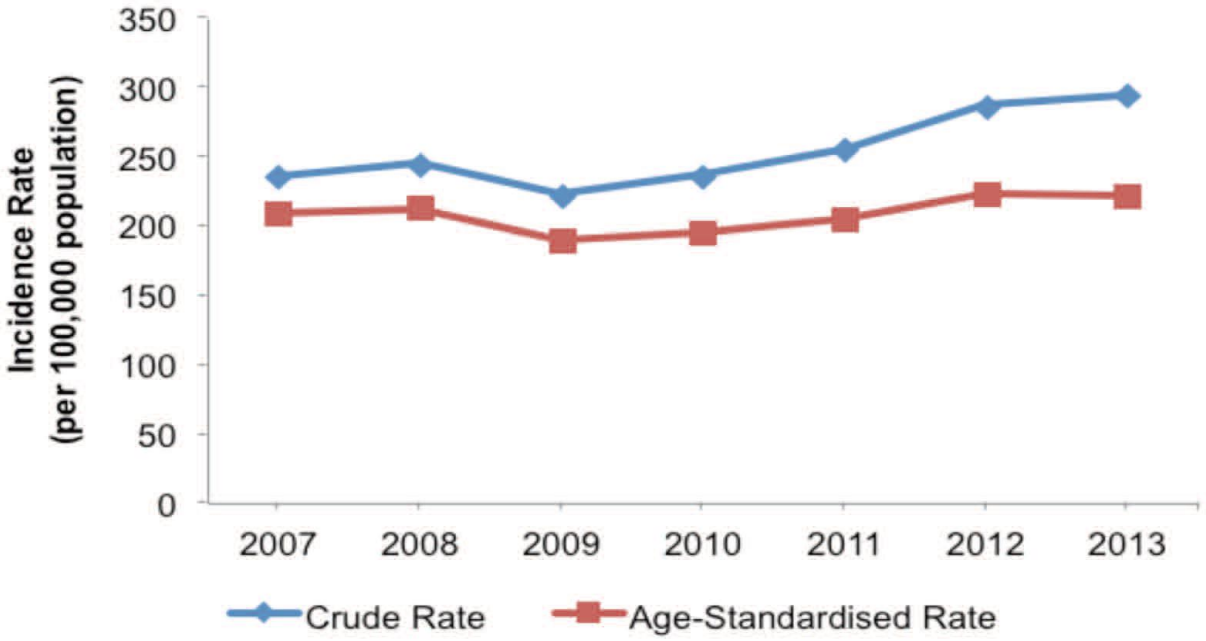
MINISTRY OF HEALTH

SINGAPORE

NATIONAL REGISTRY OF DISEASES OFFICE

**Table 4.1.1 Incidence of AMI Per 100,000 Population (95% CI)**

| Year | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|
| No. of cases | 6817 | 7251 | 6796 | 7344 | 8013 | 9118 | 9463 |
| CR | 234.7 (229.2-240.3) | 244.0 (238.4-249.7) | 221.6 (216.4-226.9) | 235.6 (230.2-241.0) | 254.2 (248.6-259.8) | 285.7 (279.8-291.6) | 293.1 (287.1-299.0) |
| ASR | 208.9 (203.9-214.0) | 212.4 (207.4-217.3) | 189.4 (184.9-194.0) | 194.5 (190.0-199.1) | 204.7 (200.1-209.2) | 223.1 (218.5-227.8) | 221.2 (216.7-225.7) |



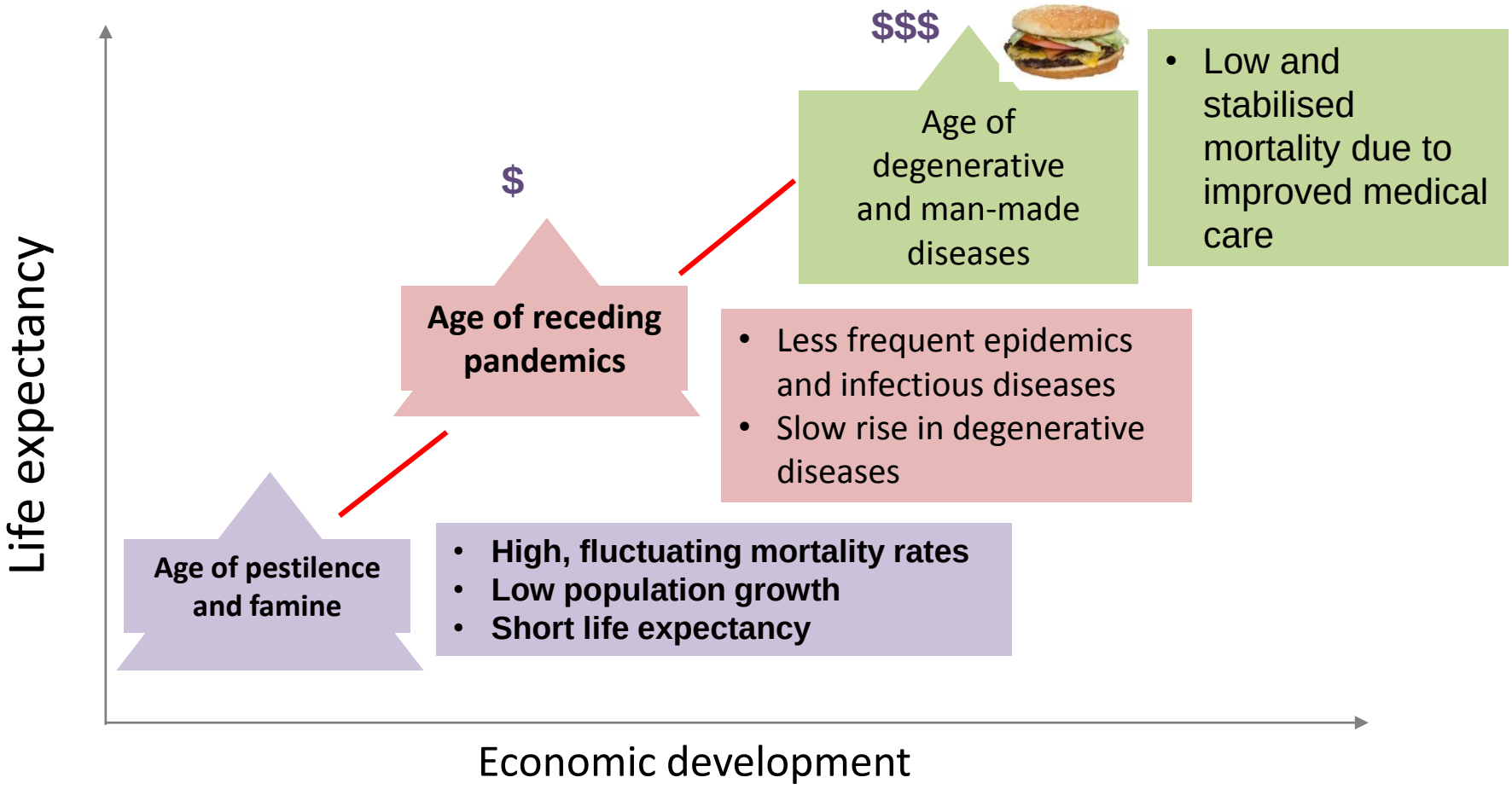

MoH Singapore 2016

## Table 4.1.3 Age-Specific Incidence Rate of AMI Per 100,000 Population

| Age Group | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|
| **15-19** | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 |
| **20-24** | 0.0 | 1.3 | 0.0 | 1.2 | 1.2 | 1.5 | 1.1 |
| **25-29** | 3.9 | 2.7 | 4.4 | 3.3 | 3.8 | 4.3 | 3.9 |
| **30-34** | 8.5 | 9.0 | 9.4 | 8.4 | 8.7 | 10.8 | 12.1 |
| **35-39** | 30.5 | 31.2 | 26.5 | 28.8 | 31.6 | 34.1 | 34.0 |
| **40-44** | 72.9 | 71.5 | 71.6 | 70.4 | 69.4 | 74.8 | 84.8 |
| **45-49** | 149.0 | 130.5 | 131.8 | 141.5 | 153.1 | 153.9 | 155.9 |
| **50-54** | 230.0 | 240.3 | 219.2 | 247.1 | 223.3 | 267.4 | 269.4 |
| **55-59** | 321.4 | 334.4 | 316.3 | 327.3 | 325.5 | 362.8 | 357.3 |
| **60-64** | 476.8 | 513.1 | 462.6 | 424.2 | 483.4 | 536.2 | 485.6 |
| **65-69** | 711.8 | 715.9 | 621.3 | 602.0 | 691.3 | 744.8 | 718.3 |
| **70-74** | 1090.3 | 1080.0 | 947.4 | 978.4 | 986.0 | 1078.5 | 1054.0 |
| **75-79** | 1573.9 | 1606.1 | 1472.4 | 1413.2 | 1539.6 | 1606.5 | 1578.7 |
| **80-84** | 2126.6 | 2331.4 | 1844.1 | 2025.1 | 2132.7 | 2301.6 | 2333.3 |
| **85+** | 3044.4 | 2992.5 | 2465.7 | 2925.2 | 3000.0 | 3250.7 | 3548.7 |

MoH Singapore 2016

# Omran's Epidemiological Transition Theory



PLOS ONE

RESEARCH ARTICLE

# Ethnicity Modifies Associations between Cardiovascular Risk Factors and Disease Severity in Parallel Dutch and Singapore Coronary Cohorts

**Crystel M. Gijsberts[1,2], Aruni Seneviratna[3], Leonardo P. de Carvalho[3], Hester M. den Ruijter[1], Puwalani Vidanapthirana[4], Vitaly Sorokin[4], Pieter Stella[5], Pierfrancesco Agostoni[5], Folkert W. Asselbergs[5,6,7], A. Mark Richards[3,8], Adrian F. Low[3], Chi-Hang Lee[3], Huay Cheem Tan[3], Imo E. Hoefer[1], Gerard Pasterkamp[1], Dominique P. V. de Kleijn[1,2,4,8]*, Mark Y. Chan[3,8]**

**1** Laboratory of Experimental Cardiology, University Medical Center Utrecht, Utrecht, The Netherlands, **2** The Netherlands Heart Institute (ICIN), Utrecht, The Netherlands, **3** Cardiac Department, National University Heart Centre, National University Hospital, Singapore, Singapore, **4** Department of Surgery, Yong Loo Lin School of Medicine, National University of Singapore, Singapore, Singapore, **5** Cardiology Department, University Medical Center Utrecht, Utrecht, The Netherlands, **6** Durrer Center for Cardiogenetic Research, ICIN-Netherlands Heart Institute, Utrecht, The Netherlands, **7** Institute of Cardiovascular Science, faculty of Population Health Sciences, University College London, London, United Kingdom, **8** Cardiovascular Research Institute (CVRI), National University Heart Centre (NUHCS), National University





**Citation:** Gijsberts CM, Seneviratna A, de Carvalho

# Stable CAD: Singapore versus Dutch

| | Caucasian | Chinese | Indian | Malay | p-value |
|---|---|---|---|---|---|
| **Stable CAD patients** | | | | | |
| N | 150 | 150 | 150 | 150 | |
| Males (%) | 83.3 | 81.3 | 77.3 | 78.0 | 0.52 |
| Age (years, mean ± sd) | 63.7±10.5 | 62.0±8.8 | 56.8±9.5 | 57.7±10.0 | <0.001 |
| BMI (kg/m$^2$, mean ± sd) | 28.0±4.4 | 26.5±4.8 | 27.4±5.1 | 29.2±4.9 | <0.001 |
| Diabetes (%) | 23.5 | 36.0 | 58.0 | 52.7 | <0.001 |
| Hypertension (%) | 64.0 | 78.0 | 69.3 | 71.3 | 0.06 |
| Dyslipidemia (%) | 57.2 | 77.3 | 78.0 | 75.3 | <0.001 |
| Current smoker (%) | 24.6 | 28.8 | 40.0 | 47.0 | 0.013* |
| Previous PCI (%) | 46.7 | 20.7 | 30.7 | 20.1 | <0.001 |
| Previous ACS (%) | 33.3 | 17.4 | 26.8 | 18.0 | 0.002 |
| CVA/TIA (%) | 8.1 | 10.0 | 8.0 | 8.7 | 0.92 |
| Peripheral arterial disease (%) | 10.7 | 2.7 | 3.3 | 2.0 | <0.001 |
| Renal failure (%) | 4.7 | 7.3 | 6.7 | 6.7 | 0.80 |
| Anti platelet (%) | 94.0 | 68.0 | 54.0 | 59.3 | <0.001 |
| Statin (%) | 86.0 | 73.3 | 65.3 | 60.7 | <0.001 |
| Beta blocker (%) | 74.7 | 40.0 | 47.3 | 52.7 | <0.001 |
| RAAS (%) | 54.7 | 42.7 | 41.3 | 42.7 | 0.07 |

PLoS One. 2015 Jul 6;10(7):e0132278

# Singapore patients Younger but more Multi-vessel Disease than Dutch

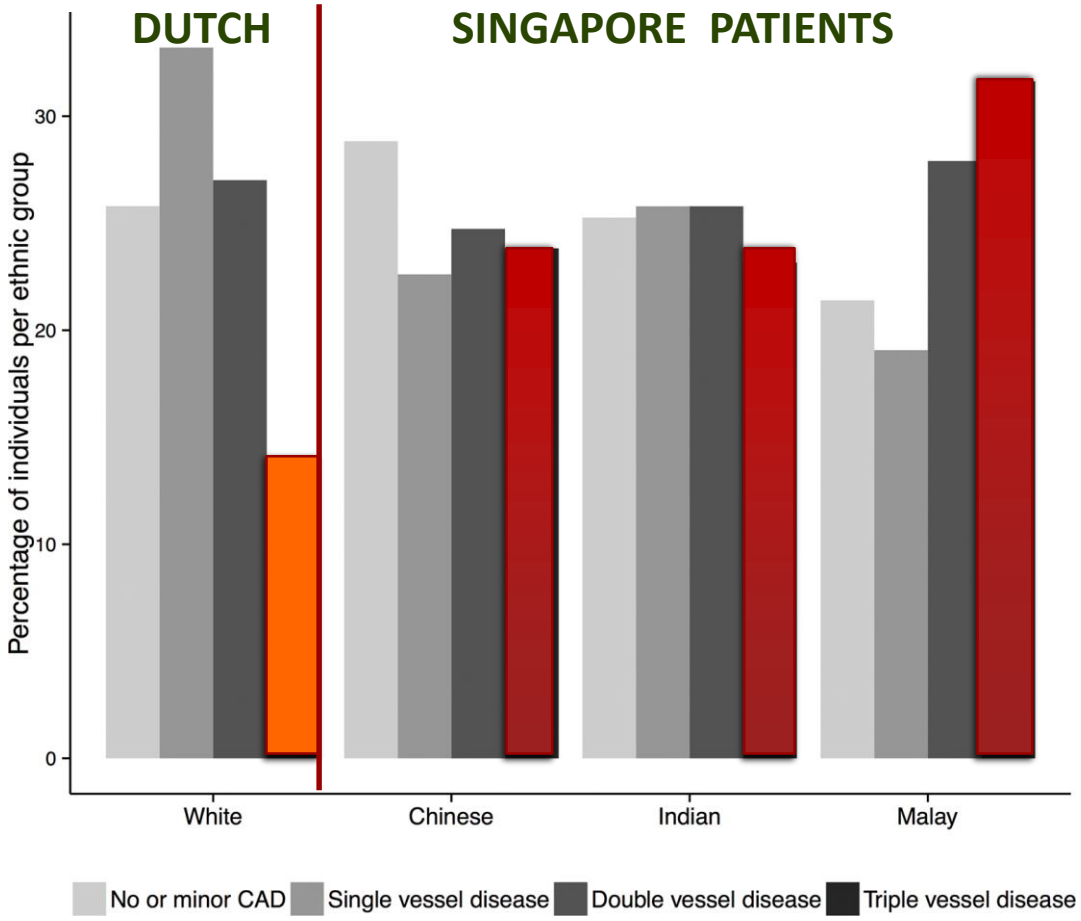



**Fig 1. Severity of CAD by ethnicity.** Bar chart depicting the distribution of CAD severity as the percentage of the total number of individuals per ethnic group. Triple vessel disease is significantly more common among Chinese, Indians and Malays than among Whites ($p < 0.001$).

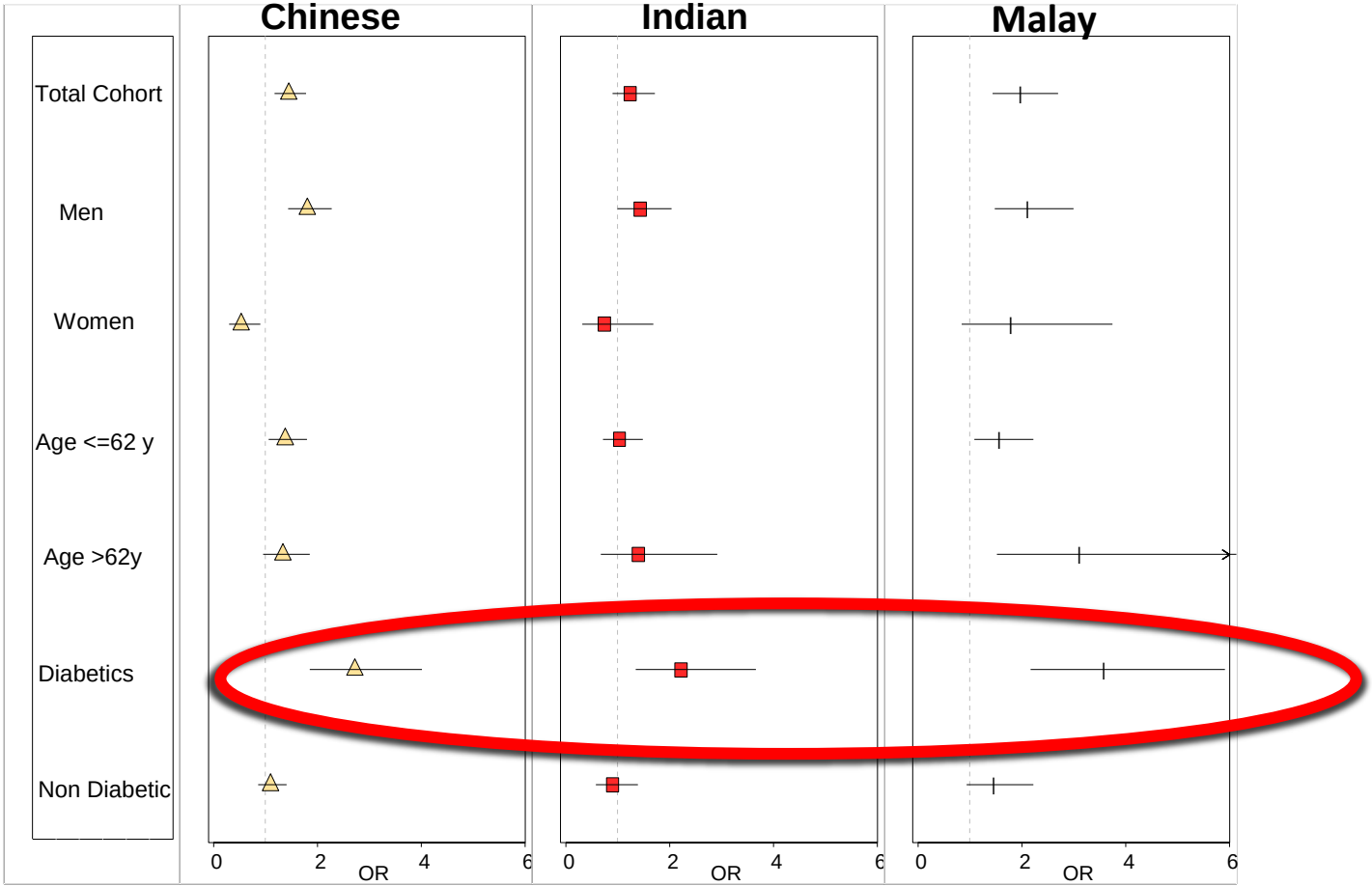
doi:10.1371/journal.pone.0132278.g001

PLoS One. 2015 Jul 6;10(7):e0132278

# Relative Severity of Coronary Artery Disease by Ethnicity

Odds ratios of Chinese, Indian and Malay ethnicity for the severity of CAD relative to Caucasian.

**Gijsberts et al**
***PLoS ONE***
**2015**



# IMproving reModeling in ACute myocardial infarction Using Live and Asynchronous Telemedicine (IMMACULATE )

Principal Investigator: Mark Chan
Study Chairman: A. Mark Richards
Project Lead: Poh Sock Cheng
Telemedicine lead: Karen Koh

# Study Sites

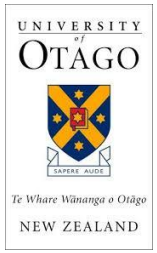
National University Hospital


Tan Tock Seng Hospital


**Changi General Hospital**

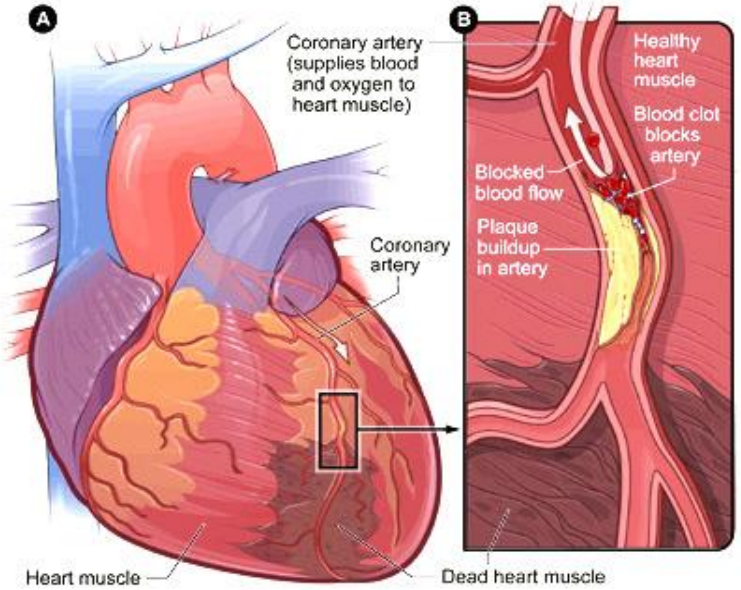

**Sarawak General Hospital Heart Centre, Malaysia**

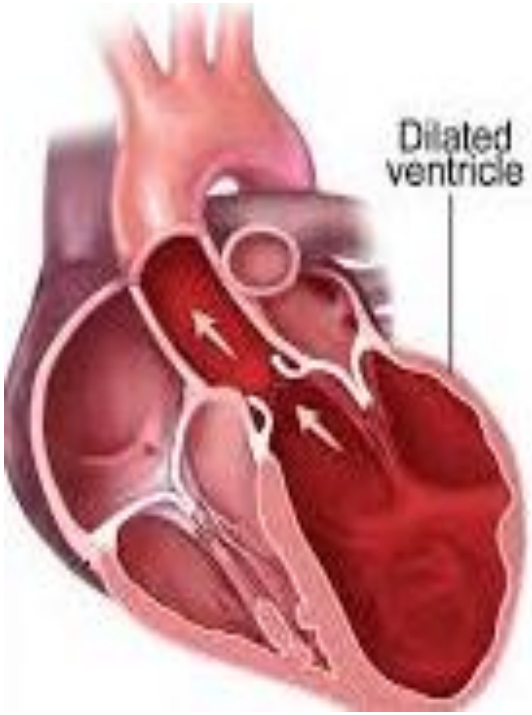

**Christchurch Heart Institute, New Zealand**

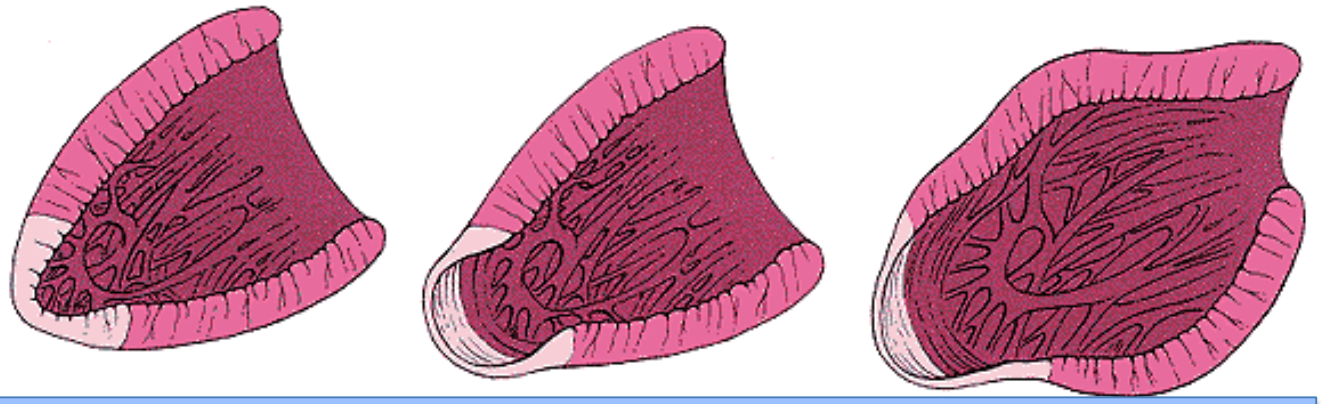




**26/07/2016**

# Acute Myocardial Infarction



**Hours** **Days** **Months**

# Aims of IMMACULATE

post-MI LV remodeling program:

- 1. Multicentre registry of patients hospitalised for **acute myocardial infarction (AMI)** with:-
  -Serial cardiac imaging
  -Serial blood sampling to identify biomarkers and therapeutic targets for post-MI ventricular remodeling and heart failure.

- 2. Registry-based randomised trial comparing ventricular remodeling among patients with AMI and elevated NT-pro-B-type natriuretic peptide receiving **comprehensive telemedicine-guided post-MI treatment** (remote intensive management) vs. standard non-telemedicine guided treatment.

# Post-MI Remodeling REGISTRY

1200 STEMI and NSTEMI patient with anterior or large inferior MI undergone primary PCI from 5 hospitals

NT-proBNP>300pg/ml
regardless of LVEF

## Registry-based Randomised Trial

**Nurse-led physician supported (NLPS)**
**Remote intensive titration of ACE/ARB and BB**

***versus***

**STANDARD CARE**

STEMI/NSTEMI with NT-proBNP> 300pg/ml

## Control Group

Standard Care
N = 150

## Intervention group

Telehealth Mx
N = 150

CMR (5-10D post MI)

Standard Care :-
Cardiac rehab X 12 sessions, smoking cessation, face-to-face cardiologist review 1, 6 and 12 months*

Standard care + 6 month intervention program. Telehealth drug titration weekly (first 2 months) then Telehealth review every 2 weeks (next 4 months)

CMR (6M)

NTproBNP

6-mo readmission (ALTRA)

Platelet reactivity (TICA)

MR-PET (Cardiac efficiency)

QOL and cost effectiveness

# IMMACULATE Registry

- NUH, TTSH, CGH, Sarawak, Christchurch
- 911 enrolled as of Dec 2016
- 91 dropouts

# IMMACULATE RRCT

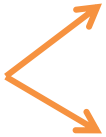
- NUH, TTSH
- 177 consented
- 76 NT-proBNP screen failures
- 101 randomized as of Jan 2017

# Post-MI Remodeling Registry

| Echocardiography characteristics | Adverse | Reverse |
|---|---|---|
| Median Baseline EDV (ml) | 92 | 102 |
| Median Baseline ESV (ml) | 40 | 46 |
| Median Baseline EF % | 52 | 51 |
| Median 6-month EDV (ml) | 116 | 86 |
| Median 6-month ESV (ml) | 57 | 36 |
| Median 6-month EF % | 49 | 56 |

## Endpoints

| | |
|---|---|
| **Adverse Remodeling** | **26.2%** |
| Reverse Remodeling | 25.5% |



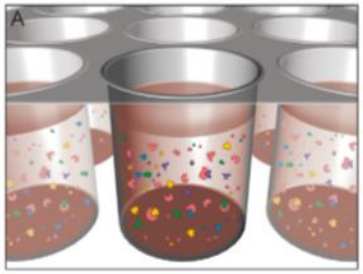
STEMI 27.5%

NSTEMI 22.6%

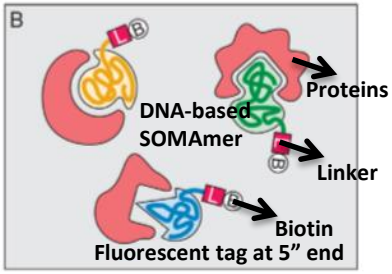
**Adverse = increase in left ventricular ESV of 15% over 6 months**
**Reverse = decrease in left ventricular ESV of 15% over 6 months**

SomaLogic

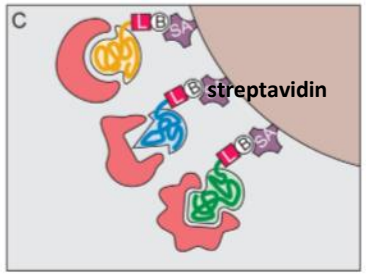
SOMAmer (Slow Off-rate Modified Aptamer) protein-binding reagent consists of **unique short DNA sequence** that incorporates **chemically modified bases** to mimic amino acid side chains and **a 5'- fluorescent tag** for use in the SOMAscan assay.



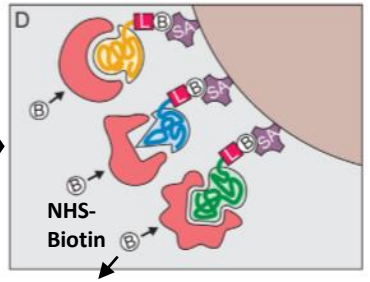

SOMAmers and samples are mixed in 96-well microwell plates and allowed to bind.



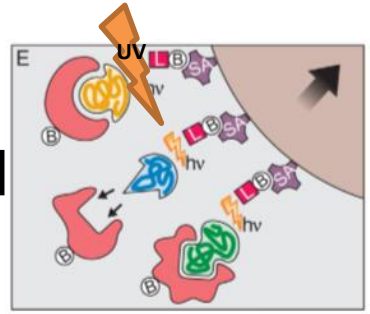

**SOMAmer-protein binding**: DNA-based SOMAmer molecules bind to specific protein. SOMAmers contain biotin (B), a photo-cleavable linker (L) and a fluorescent tag at the 5" end.



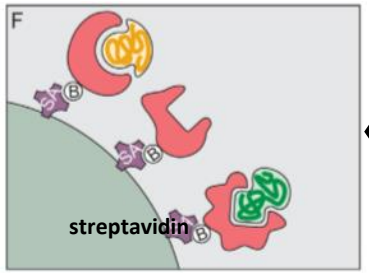

SOMAmers are captured onto a bead coated with **streptavidin** (SA) which binds biotin.



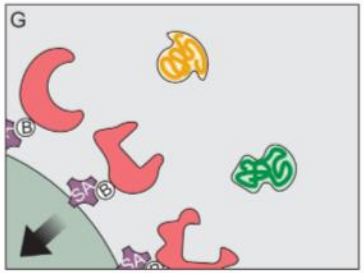

Proteins are tagged with NHS-biotin.



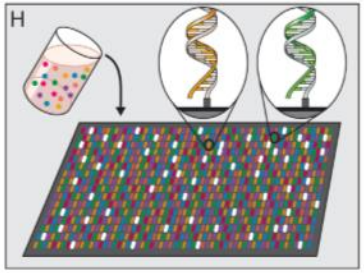

UV light cleaves the linker and SOMAmer-protein complexes are released from beads. Samples are challenged with anionic competitor (dextran sulfate). Non-cognate complexes (blue SOMAmer) preferentially dissociate.




SOMAmer-protein complexes are captured onto **new avidin coated beads** by protein biotin tag.




SOMAmers are released from complexes into solution at high pH




Remaining SOMAmers are quantified by **hybridization** to microarray containing single-stranded DNA probes complementary to SOMAmer DNA sequence, which form a double-stranded helix. **Hybridized SOMAmers are detected by fluorescent tags when the array is scanned.**

# Proteomics of post-MI remodelling

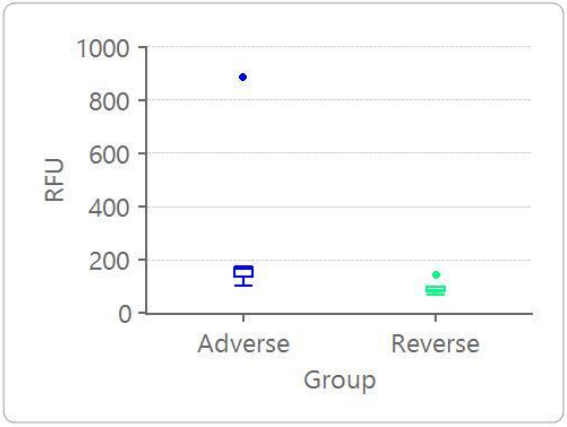
Pilot study (n=24);

- 12 adverse post MI remodelling (% change ESV > 15%)
- 12 reverse post MI remodelling (% change ESV > -15%)

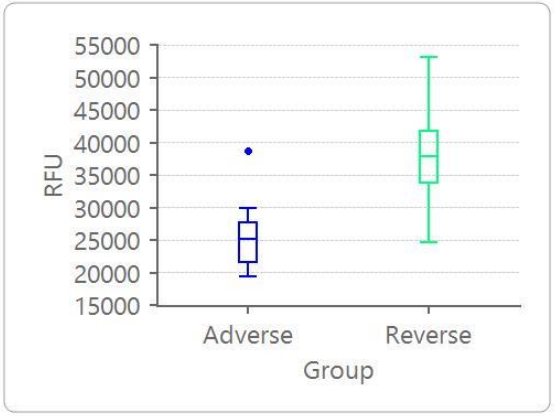
- The SOMAscan® 1.3k Assay (SOMAlogic, Boulder, CO) was used for hypothesis-free biomarker discovery 1,310 proteins measured simultaneously in 150 microliters of EDTA plasma (collected 30 days after MI)

- 191 proteins with P<0.05 and 48 proteins with p<0.01 and 5 proteins with P<0.001

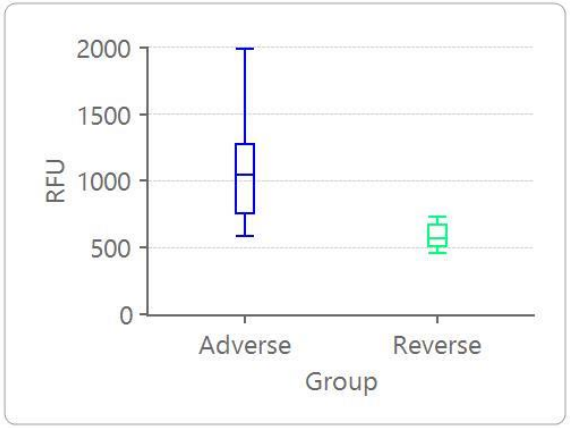
Angiopoietin-2 **P=8.61E-05**




Myokinase, human **P=0.0003**




ANP **P=0.0003**



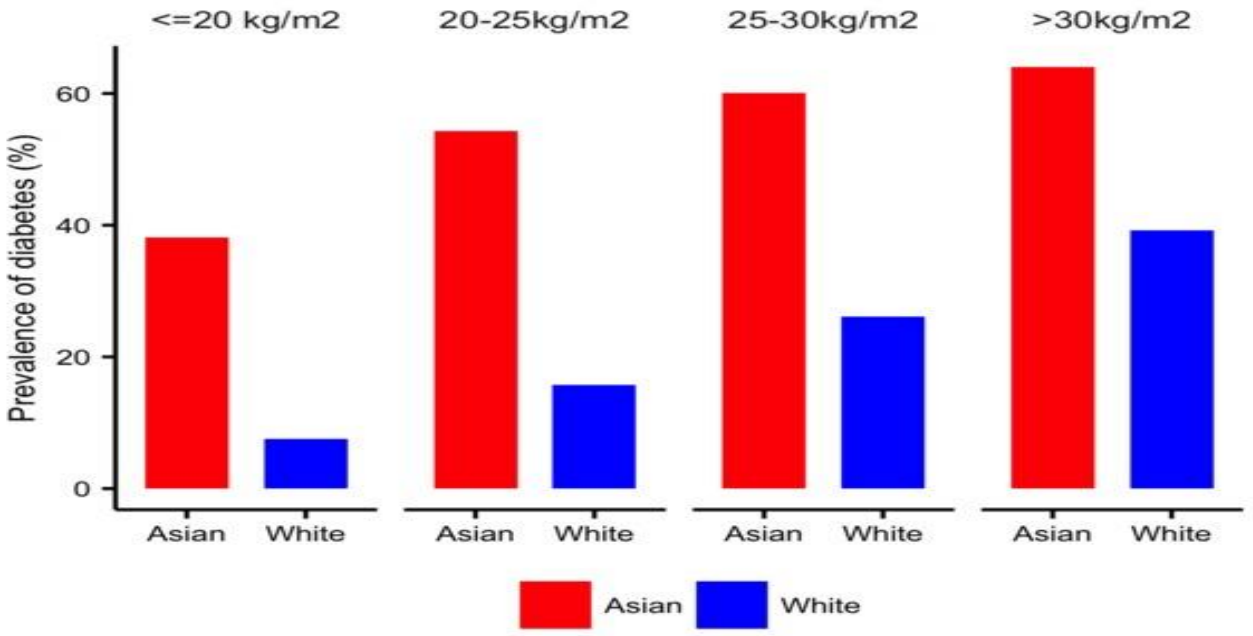
# Is Singapore facing cardiovascular Catastrophe ?

## Comparison of HF in Singapore and Sweden

***Methods*** Two contemporary population-based HF cohorts were compared:

1) Singapore n=1,002, 62 [54-70] yr, 76% men, 19.5% obese
2) Sweden n=19,537, 77 [68-84] yr, 60% men, 24.8% obese

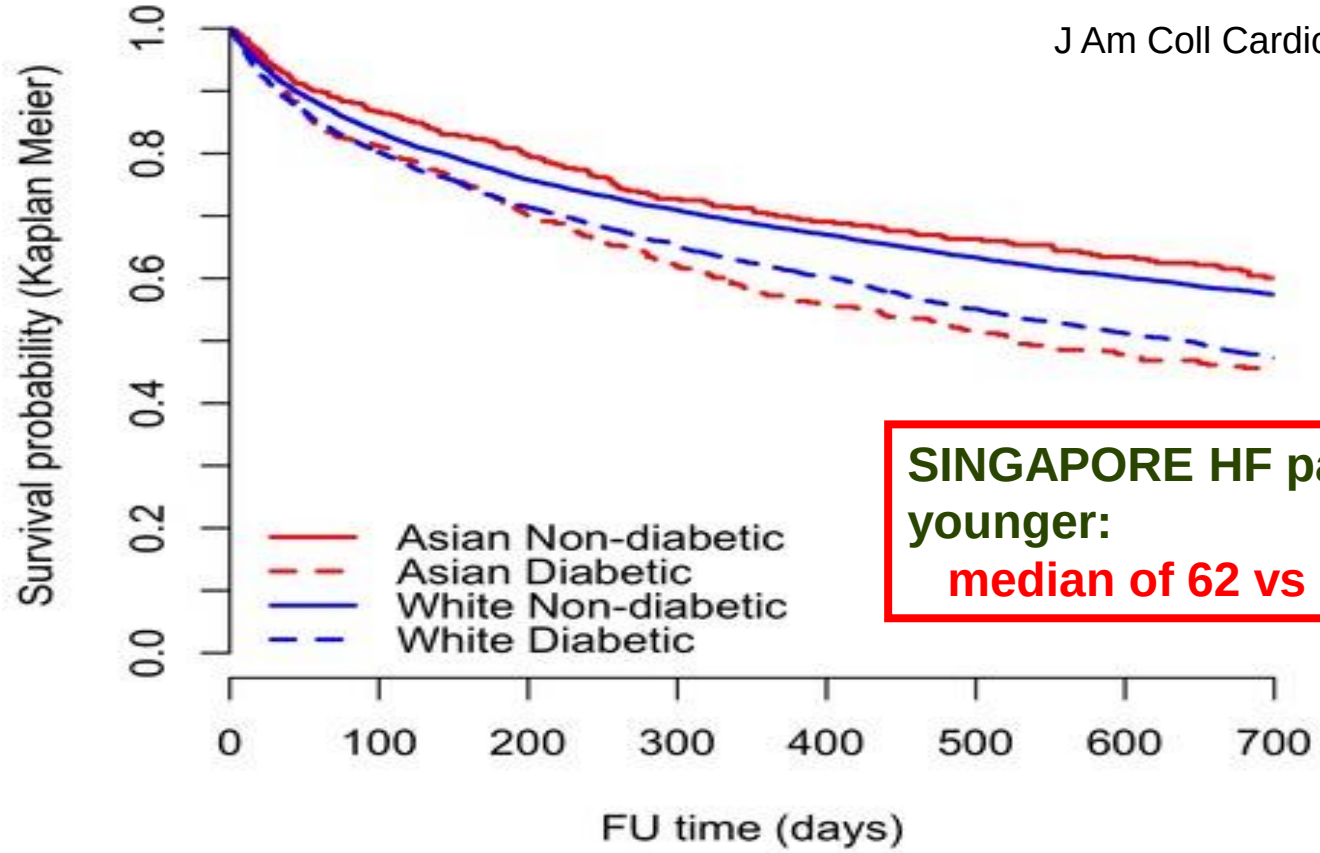
**DIABETES**




J Am Coll Cardiol: Heart Failure 2016

# Heart Failure and Survival in Singapore and Sweden

J Am Coll Cardiol: Heart Failure 2016




**SINGAPORE HF patients are younger:**
**median of 62 vs 77 years**

**Number of patients at risk**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Asians** | 1001 | 806 | 705 | 630 | 479 | 423 | 396 | 334 |
| **Whites** | 19537 | 14809 | 12250 | 10224 | 8407 | 6674 | 5341 | 3884 |

# Is Singapore facing cardiovascular Catastrophe ?

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1) Singapore n=1,002, 62 [54-70] yr, 76% men, 19.5% obese
2) Sweden n=19,537, 77 [68-84] yr, 60% men, 24.8% obese

***Results***

Diabetes was present in 569 (57%) Asians versus 4680 (24%) Whites ($p<0.001$).

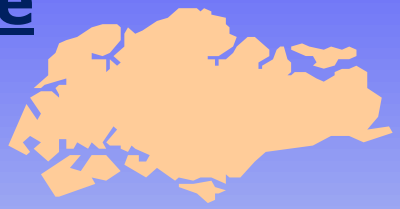
Diabetes was more strongly associated with increased HF hospitalization and all cause mortality in :-
Asians (adjusted HR 1.50, 95% CI 1.21-1.87) than
Whites (HR 1.29, 95% CI 1.22-1.36) ($p=0.045$).

***Conclusions*** Diabetes was > TWO-fold more common in Southeast Asian compared to White HF patients, in spite of younger age and less obesity, and more strongly associated with poor outcomes in Asians than Whites.

**PEOPLE / SHOP Study**
**NZ and Singapore**

# Combined Outcome Study

| | New Zealand | Singapore |
|---|---|---|
| **Population** | 4.6m | 5.5m |
| Density n/km$^2$ | 7.8 | 7,829 |
| **Land area** | 268,000km$^2$ | 740km$^2$ |
| **GDP** | 174,000m | 293,000m |
| **Unemployment** | 5.6% | 3.0% |
| **Life Expectancy** | 80.6yrs | 82.1yrs |



**Ethnicity**


| | | | |
|---|---|---|---|
| **NZ Euro** | **67%** | **Chinese** | **74%** |
| **Māori** | **15%** | **Malay** | **13%** |
| **Asian** | **10%** | **Indian** | **9.2%** |
| **Pacific** | **7%** | | |

European Journal of Heart Failure (2016)
doi:10.1002/ejhf.612

# Superior performance of N-terminal pro brain natriuretic peptide for diagnosis of acute decompensated heart failure in an Asian compared with a Western setting

**Irwani Ibrahim[1,2], Win Sen Kuan[1,2], Chris Frampton[3], Richard Troughton[3], Oi Wah Liew[4,5], Jenny Pek Ching Chong[4,5], Siew Pang Chan[4,5], Li Ling Tan[4,5], Wei Qin Lin[4,5], Chris J. Pemberton[3], Shirley Beng Suat Ooi[1,2], and A. Mark Richards[3,4,5]***

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*Received 20 March 2016; revised 1 June 2016; accepted 9 June 2016*

# Is Singapore facing cardiovascular Catastrophe ?

| BREATHLESS PATIENTS ATTENDING THE EMERGENCY DEPARTMENT | | | | |
|---|---|---|---|---|
| | | COUNTRY | | |
| | | Singapore n=606 | NZ n=500 | P-value |
| AGE (yr) | Mean | **55.1** | **70.6** | <0.001 |
| | (SD) | 15.2 | 13.0 | |
| BMI (kg/m2) | Mean | 27.4 | 27.3 | 0.806 |
| | (SD) | 6.9 | 7.5 | |
| Sa O2 (%) | Mean | 97.3 | 94.4 | <0.001 |
| | (SD) | 3 | 6 | |
| eGFR | Mean | 82.4 | 61.2 | <0.001 |
| (ml/min/1.73 m2) | (SD) | 29.3 | 20.7 | |

**Ibrahim et al *Eur J heart Fail* 2016**

# Is Singapore facing cardiovascular Catastrophe ?

## Breathless People with a Diagnosis of Acute Heart Failure

| | | COUNTRY | | |
|---|---|---|---|---|
| | | Singapore n=148 | NZ n=180 | P-value |
| AGE (years) | Mean | **62.0** | **75.4** | **P<0.001** |
| | (SD) | 11.5 | 11.4 | |
| BMI (kg/m2) | Mean | **28.4** | **27.5** | **0.277** |
| | (SD) | 7.4 | 6.8 | |
| Sa O 2 (%0 | Mean | **96.3** | **94.1** | **<0.001** |
| | Std. Deviation | 3.8 | 6.0 | |
| eGFR (ml/min/1.73m 2) | Mean | **63.9** | **53.9** | **<0.001** |
| | Std. Deviation | 27.7 | 18.8 | |

Acute heart Failure cases In the Emergency Department are not the same in Singapore & New Zealand

**Ibrahim et al *Eur J Heart Fail* 2016**

# Is Singapore facing cardiovascular Catastrophe ?

**Breathless People with a Diagnosis of Acute Heart Failure**

| | COUNTRY | | | | |
|---|---|---|---|---|---|
| | Singapore (N=148) | | NZ (N=180) | | |
| | Count | % | Count | % | P-value |
| Gender (F) | 40 | 27.0% | 64 | 35.6% | 0.099 |
| **COPD** | **10** | **6.8%** | **46** | **26.0%** | **<0.001** |
| CHF | 60 | 40.5% | 89 | 50.6% | 0.071 |
| **TOBACCO** | **46** | **31.1%** | **16** | **8.9%** | **<0.001** |
| **PND** | **74** | **51.4%** | **110** | **63.6%** | **0.028** |
| **ELEVJVP** | **54** | **37.2%** | **115** | **67.6%** | **<0.001** |
| **DIABETES** | **80** | **54.1%** | **43** | **24.2%** | **<0.001** |
| **HYPERLIPIDEMIA** | **85** | **57.4%** | **79** | **46.2%** | **0.045** |
| **DYSPREST** | **95** | **65.5%** | **138** | **77.1%** | **0.021** |
| **ECGAFIB** | **33** | **22.3%** | **64** | **44.1%** | **<0.001** |
| **ECGLBBB** | **7** | **4.7%** | **18** | **13.3%** | **0.011** |

Acute heart Failure cases In the Emergency Department are not the same in Singapore & New Zealand

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**2016**


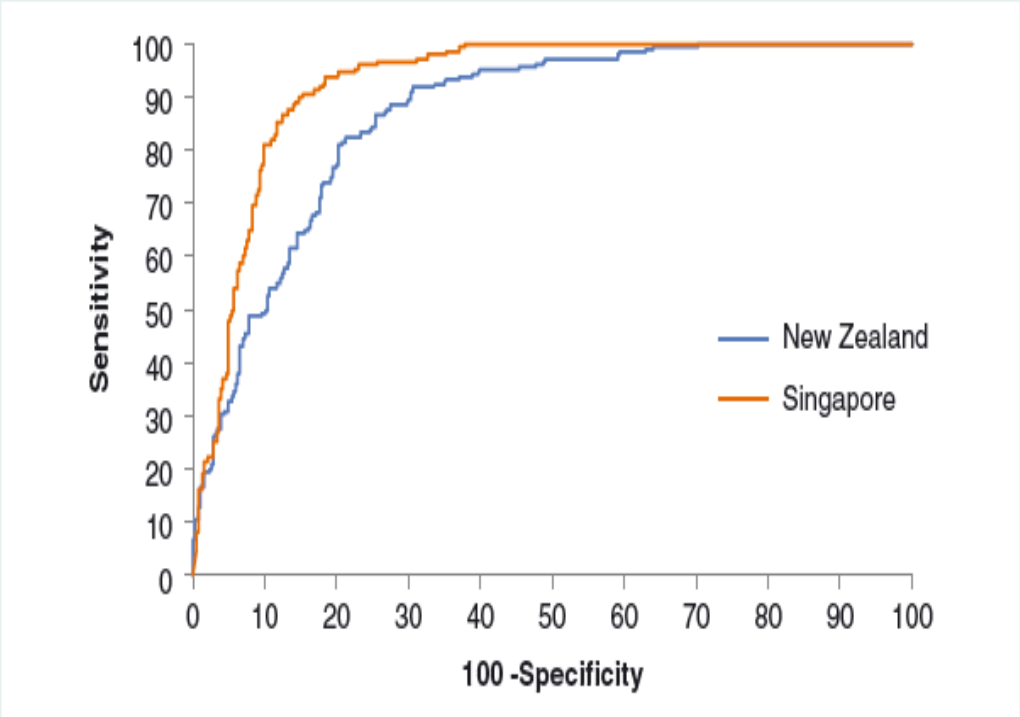


**Figure 1** Receiver operating characteristic curves for discrimination of acute decompensated heart failure. Areas under the curve for Singapore (0.926) and New Zealand (0.866) differ significantly ($P = 0.012$).

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**2016**

Diagnostic Test Performance of NT-proBNP for Diagnosis of Acute Heart Failure

**Single threshold (300pg/ml)**

| Singapore | | | |
|---|---|---|---|
| | NTPBNP | | |
| Diagnosis | <= 300.00 | 300.01+ | Total |
| No | 334 | 124 | 458 |
| Yes | 5 | 143 | 148 |
| Total | 339 | 267 | 606 |
| | Estimate | LL | UL |
| Sensitivity | 96.62 | 92.29 | 98.89 |
| Specificity | **72.93** | 68.61 | 76.94 |
| PPV | 53.56 | 47.38 | 59.66 |
| NPV | 98.53 | 96.59 | 99.52 |
| Accuracy | **78.71%** | | |

| Christchurch | | | |
|---|---|---|---|
| | NTPBNP | | |
| Diagnosis | <= 300.00 | 300.01+ | Total |
| No | 135 | 185 | 320 |
| Yes | 5 | 175 | 180 |
| Total | 140 | 360 | 500 |
| | Estimate | LL | UL |
| Sensitivity | 97.22 | 93.64 | 99.09 |
| Specificity | **42.19** | 36.71 | 47.81 |
| PPV | 48.61 | 43.34 | 53.91 |
| NPV | 96.43 | 91.86 | 98.83 |
| Accuracy | **62.00%** | | |

**Age adjusted thresholds**
<50 years >450pg/ml
50-75 yr >900pg/ml
>75 years >1800pg/ml

| Singapore | | | |
|---|---|---|---|
| | NTPBNP | | |
| Diagnosis | Below | Above | Total |
| No | 393 | 65 | 458 |
| Yes | 17 | 131 | 148 |
| Total | 410 | 196 | 606 |
| | Estimate | LL | UL |
| Sensitivity | 88.51 | 82.25 | 93.16 |
| Specificity | **85.81** | 82.27 | 88.87 |
| PPV | 66.84 | 59.77 | 73.38 |
| NPV | 95.85 | 93.44 | 97.57 |
| Accuracy | **86.47%** | | |

| Christchurch | | | |
|---|---|---|---|
| | NTPBNP | | |
| Diagnosis | Below | Above | Total |
| No | 228 | 92 | 320 |
| Yes | 21 | 159 | 180 |
| Total | 249 | 251 | 500 |
| | Estimate | LL | UL |
| Sensitivity | 88.33 | 82.72 | 92.63 |
| Specificity | **71.25** | 65.95 | 76.15 |
| PPV | 63.35 | 57.06 | 69.32 |
| NPV | 91.57 | 87.40 | 94.70 |
| Accuracy | **77.40%** | | |

Ibrahim et al Eur J heart fail 2016

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2. Mark Chan, Carolyn Lam, Dominique de Kleijn.

3. NMRC Singapore.



4. NUS, NUHS.

4. New Zealand HRC and Heart Foundation.

## CONCLUSIONS

- Myocardial Infarction occurs early in Singapore.
- Outcomes may be worse than in the West.
- Incidence in younger (30-60 years) age groups appears to be rising.
- Risk factors including Diabetes and Hypertension are highly prevalent within the AMI population. Disease for given burden of risk is worse than in the west.
- Heart Failure …a key consequent morbidity after AMI occurs early and is characterized by high prevalence of diabetes and worse outcomes.
- Research in to the burden of risk leading to AMI and the biology and medical management post-AMI warrant research and development of effective interventional strategies.

National University
Heart Centre, Singapore