“using big data to improve vascular risk prediction and better targeted risk management”

VIEW2020

Rod Jackson
VIEW programme
School of Population Health
September 2016

Vascular Informatics using Epidemiology & the Web

VIEW 2020

Vascular risk Informatics using Epidemiology & the Web

***topic**: **Vascular** risk prediction & risk management*

***approach**: **Informatics** – large-scale data linkage*

***science**: **Epidemiology** & Biostatistics*

***data**: **Web**-based clinical tools were developed to generate new clinical data that we link to regional & national routine health data collections*

2020

VIEW team

Rod Jackson, Matire Harwood,

Sue Wells, Andrew Kerr, Dan Exeter,

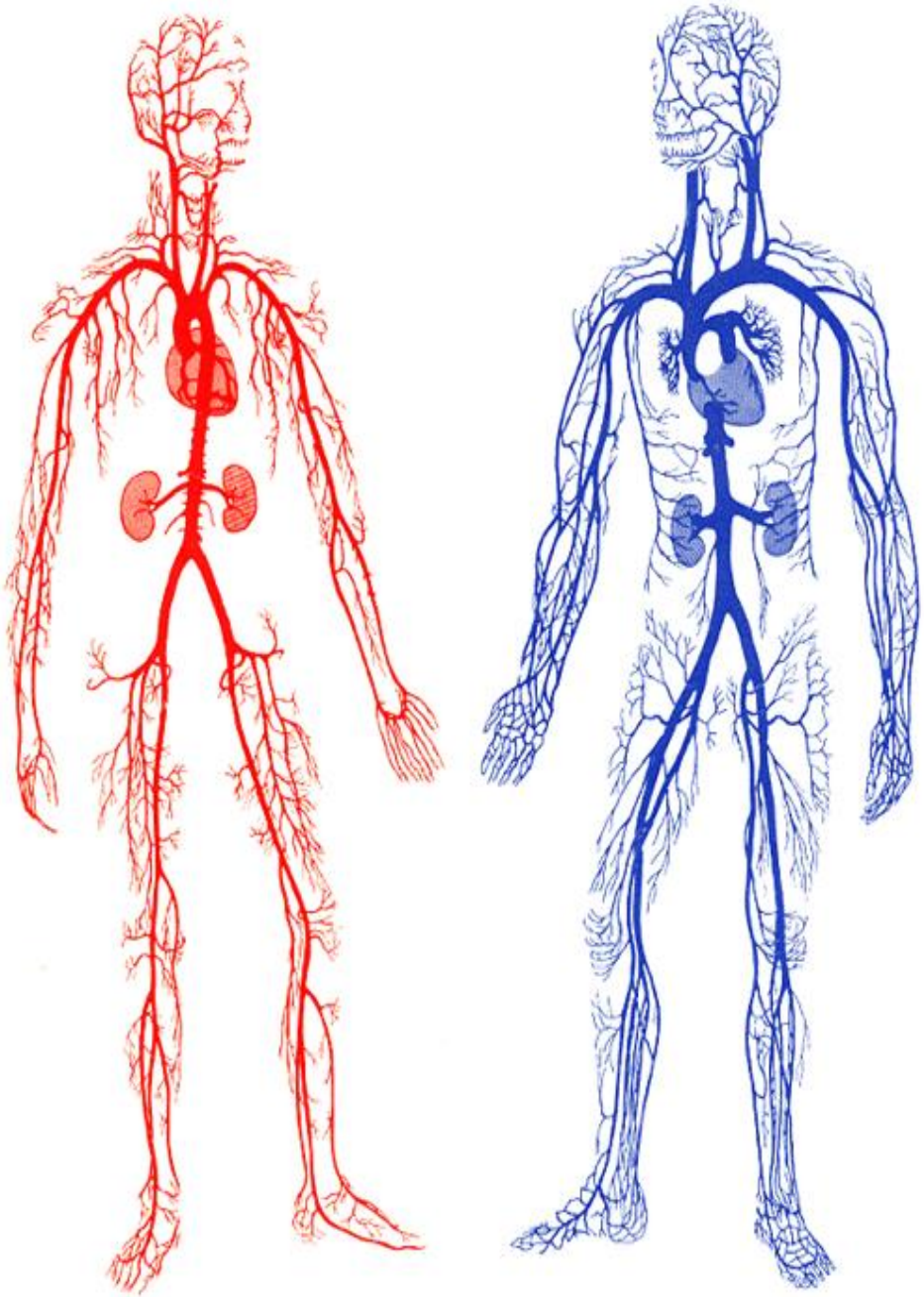
Katrina Poppe, Roger Marshall, Patricia Metcalf,

Jim Warren, Jeff Harrison, Rob Doughty,

Romana Pylypchuk, Corina Grey, Josh Knight, Suneela Mehta, Billy Wu

VIEW goals

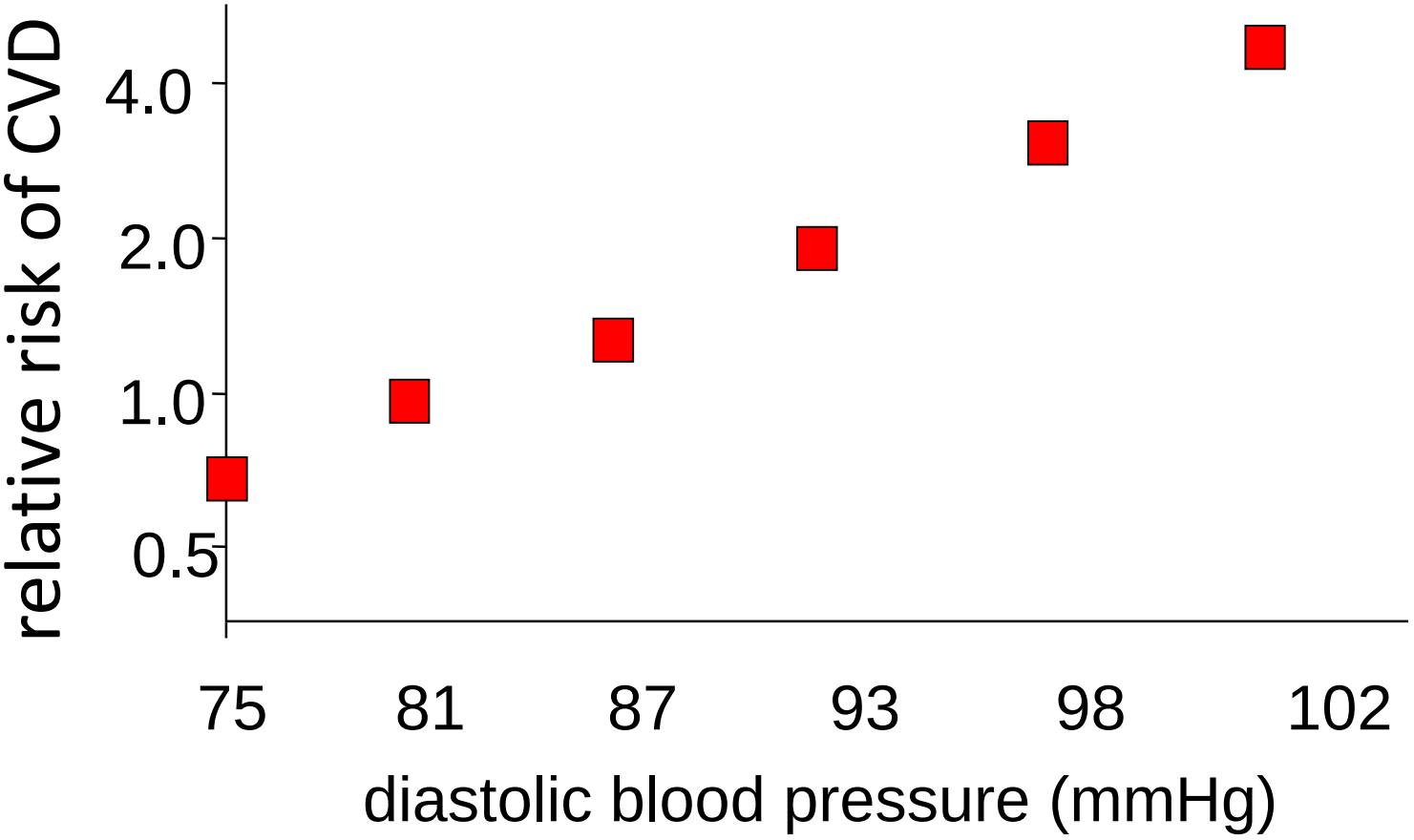
- *more accurate vascular risk prediction*
- *better vascular risk management*
- *reduced inequalities in vascular disease burden*



more accurate vascular risk prediction

traditional approach to vascular risk prediction

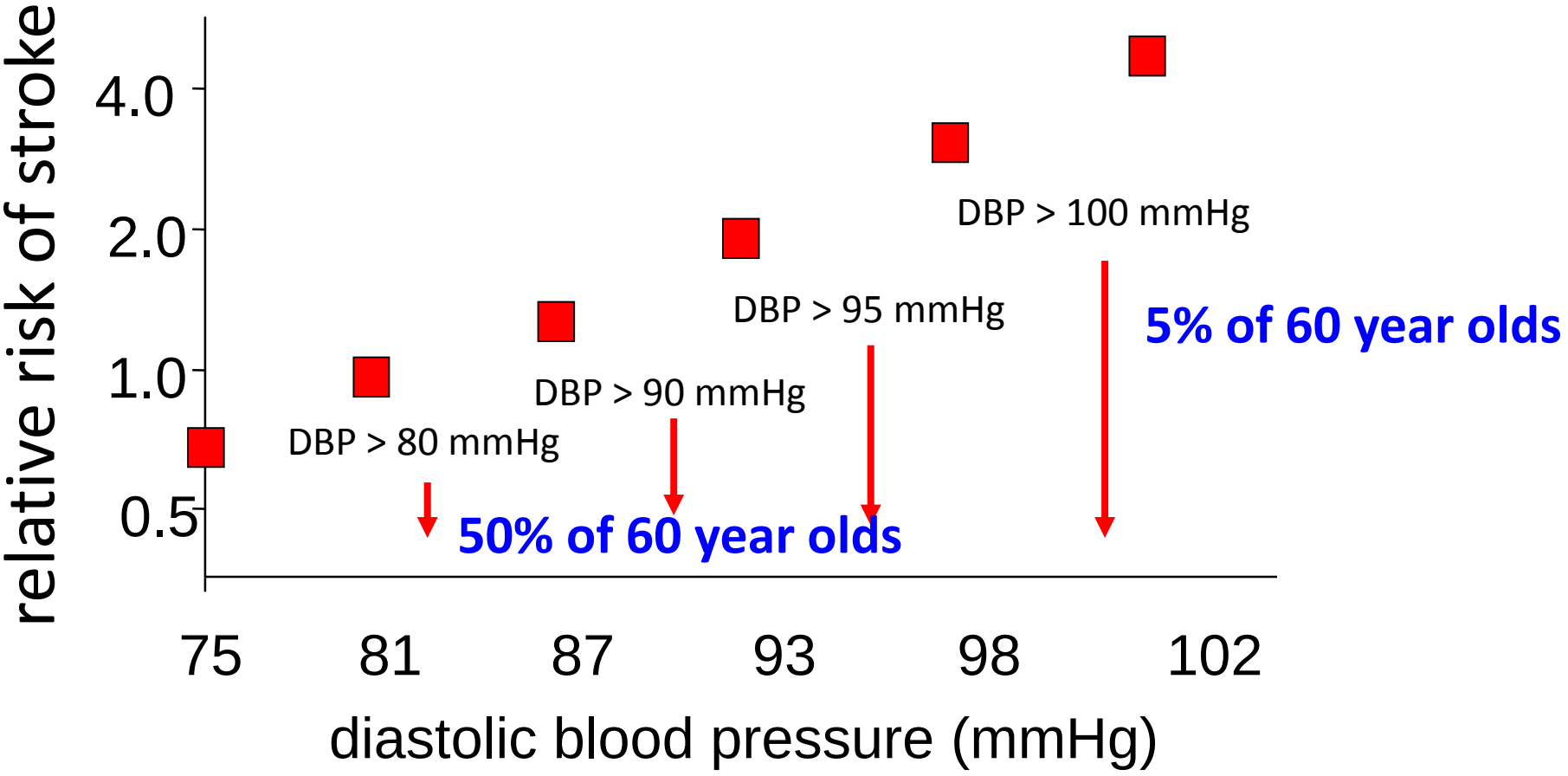
relative risk of CVD by diastolic blood pressure



PSC Lancet 1995;346:1647-53

relative stroke risk and usual Blood Pressure

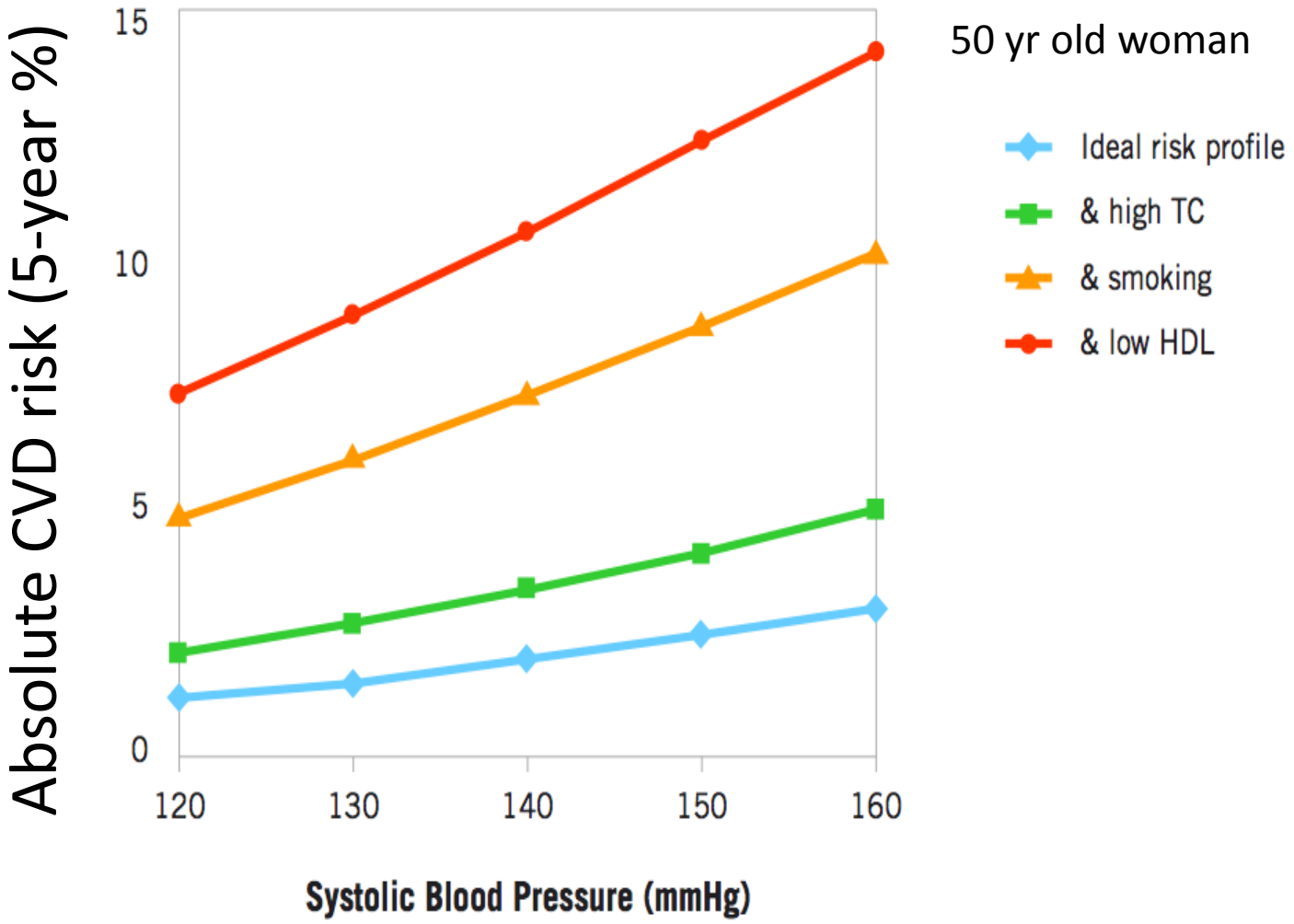
(45 prospective studies: 450,000 people 13,000 events)



PSC Lancet 1995;346:1647-53

modern approach to vascular risk prediction

absolute (multivariable) risk of CVD by SBP



modern approach to vascular risk prediction

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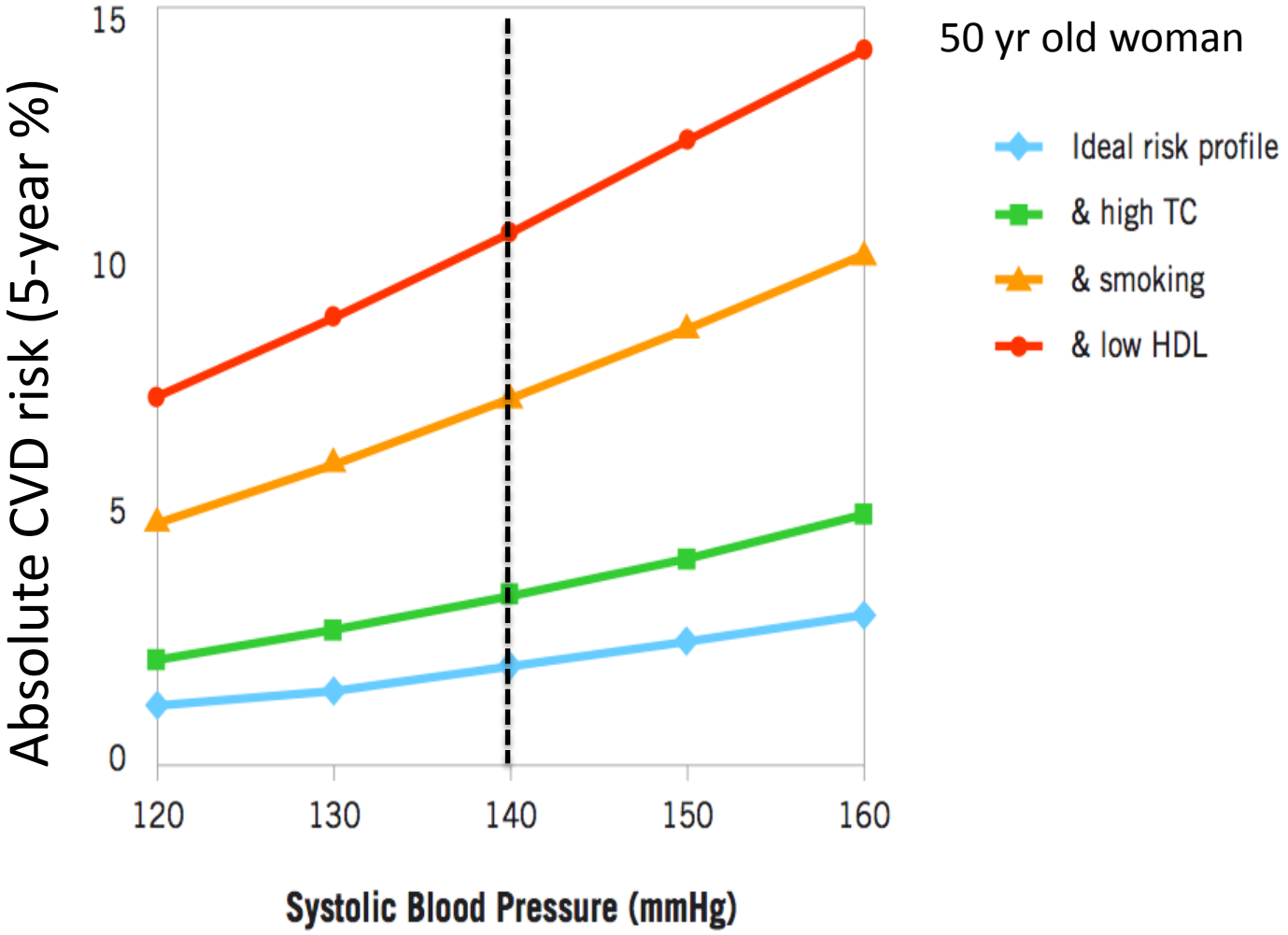
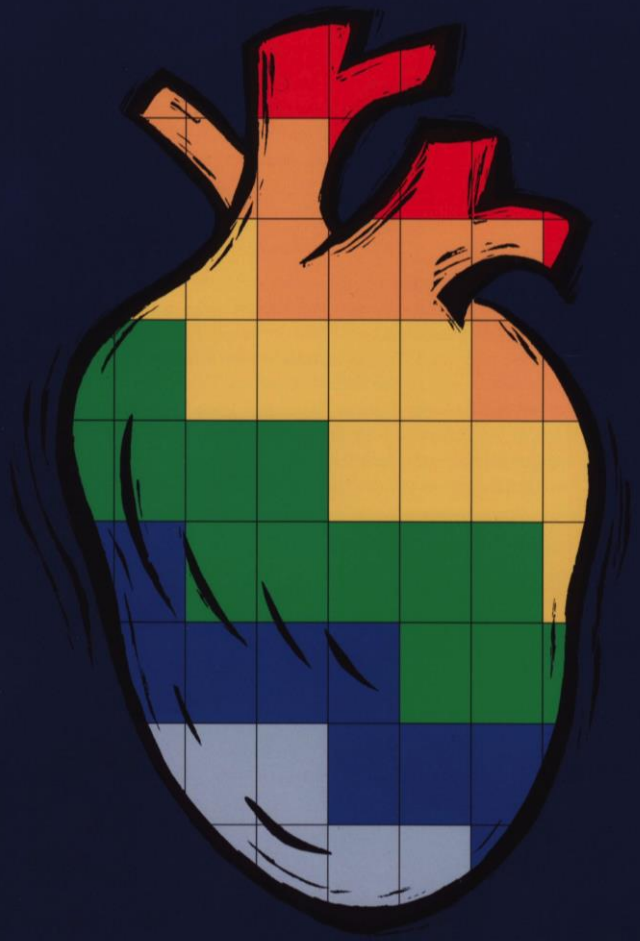


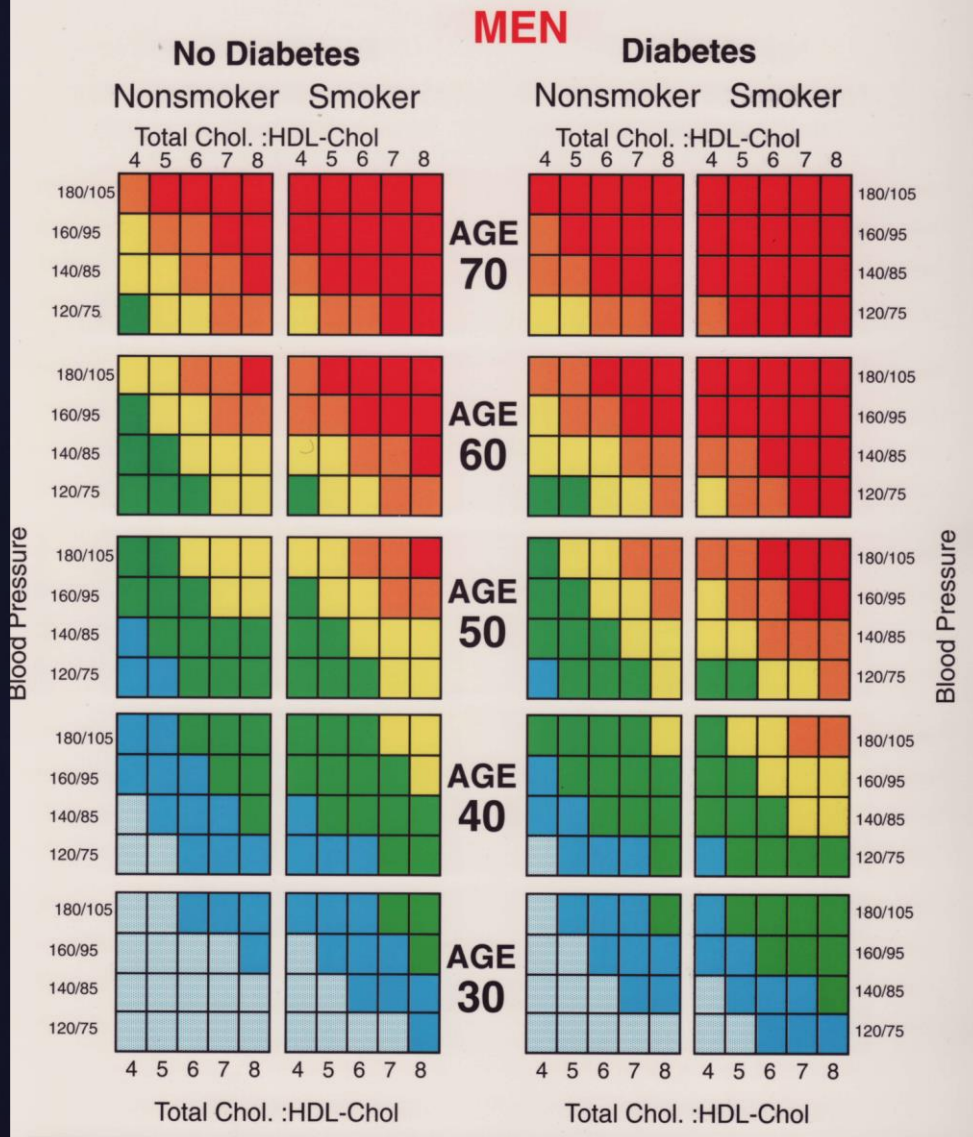
GUIDELINES FOR

THE MANAGEMENT OF MILDLY RAISED BLOOD PRESSURE IN NEW ZEALAND

1992 &1995



MEN



Risk Level Percent chance of cardiovascular event in 5 years		
	Very High	>20%
	High	15-20%
	Moderate	10-15%
	Mild	5-10%
	Low	2.5-5%
	Very Low	<2.5%

How to use the Risk Tables

1. To estimate a person's absolute 5-year risk of a cardiovascular event (newly diagnosed angina, MI, CHD death, stroke or TIA), identify the table relating to person's sex, diabetic status, smoking status and age.
2. Within the table find the cell nearest to the person's blood pressure and TC:HDL-C
3. Compare cell colour with risk level

4. For patients with symptomatic CVD, or familial hypercholesterolaemia. The level of risk should be increased by 1 or 2 categories.

EVIDENCE-BASED
BEST PRACTICE
GUIDELINE

THE ASSESSMENT AND MANAGEMENT OF CARDIOVASCULAR RISK

2003

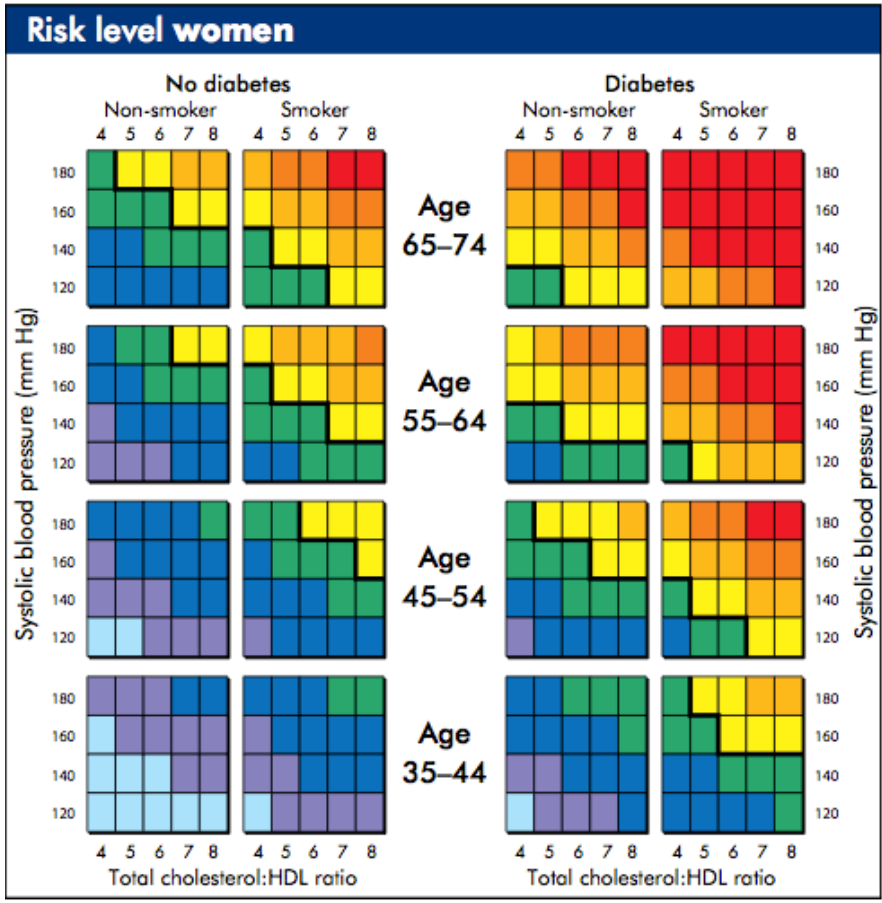
Heart Foundation

STROKE FOUNDATION

MINISTRY OF HEALTH

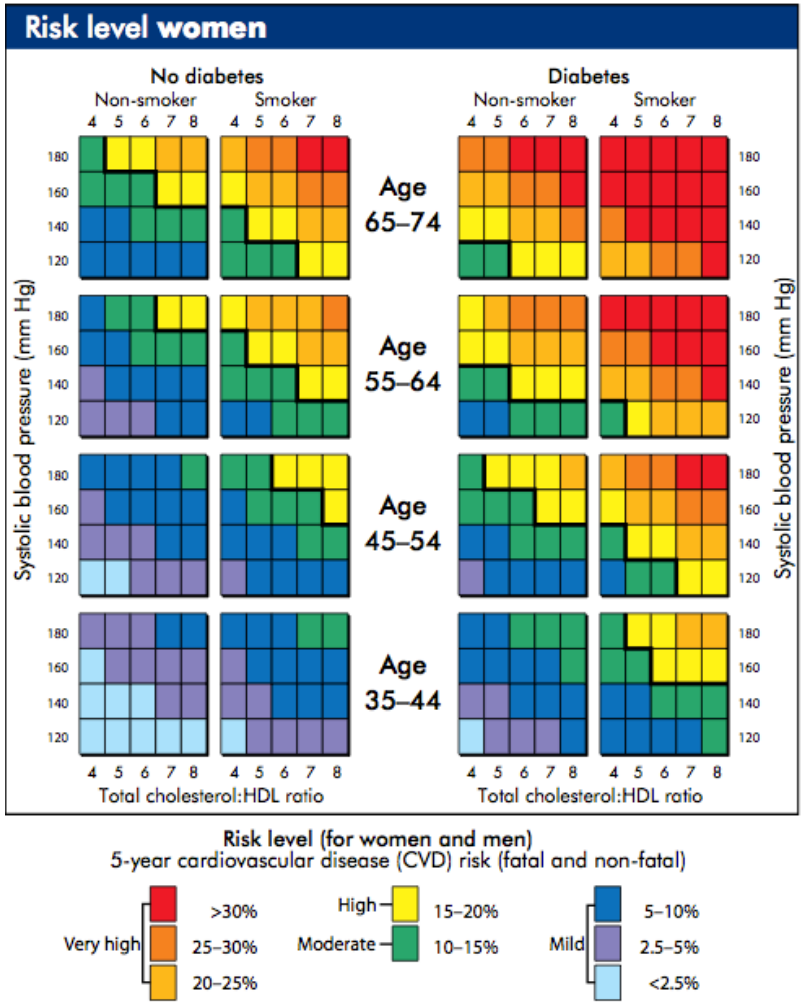
NEW ZEALAND GUIDELINES GROUP

DECEMBER 2003



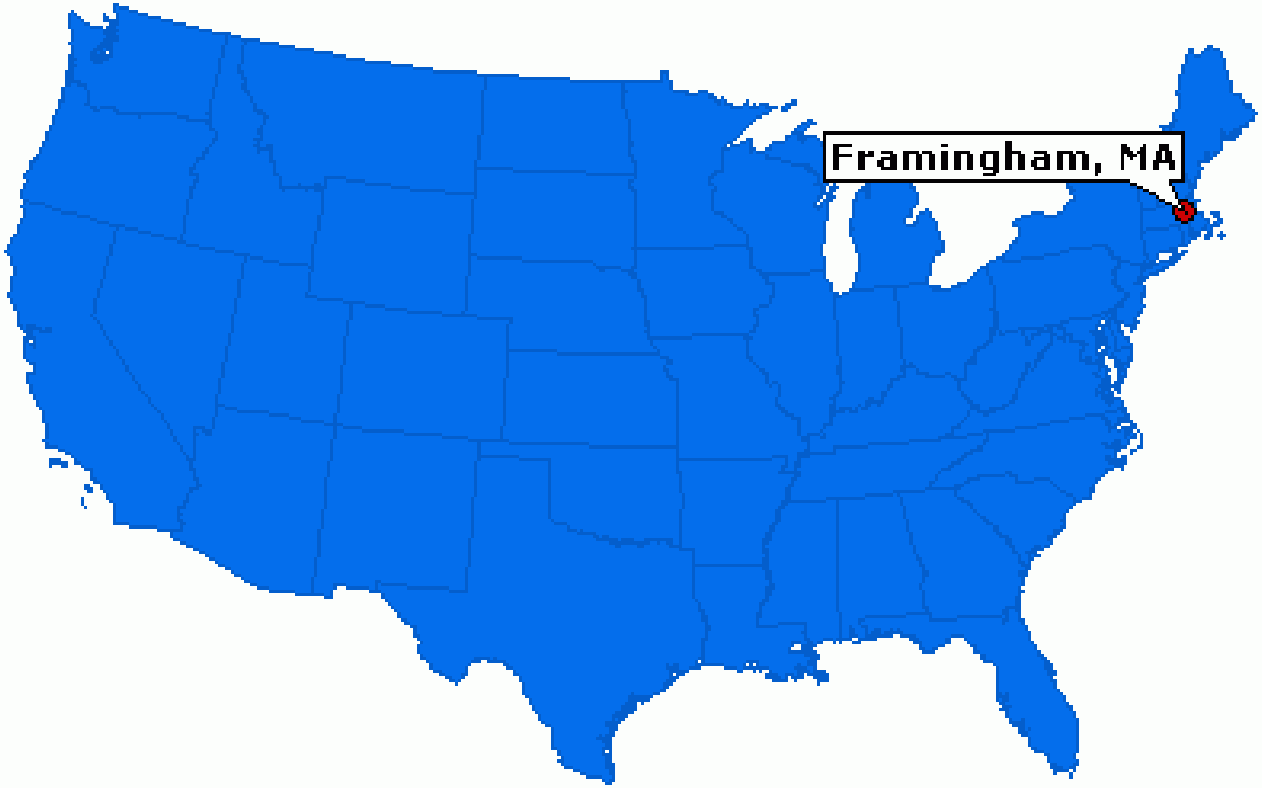
Risk level (for women and men)
5-year cardiovascular disease (CVD) risk (fatal and non-fatal)

Very high	>30%	High	15–20%	Mild	5–10%
	25–30%	Moderate	10–15%		2.5–5%
	20–25%				<2.5%



risk charts derived from 5573 men & women in Framingham Heart Study cohorts between 1968-1975 followed for 12 years

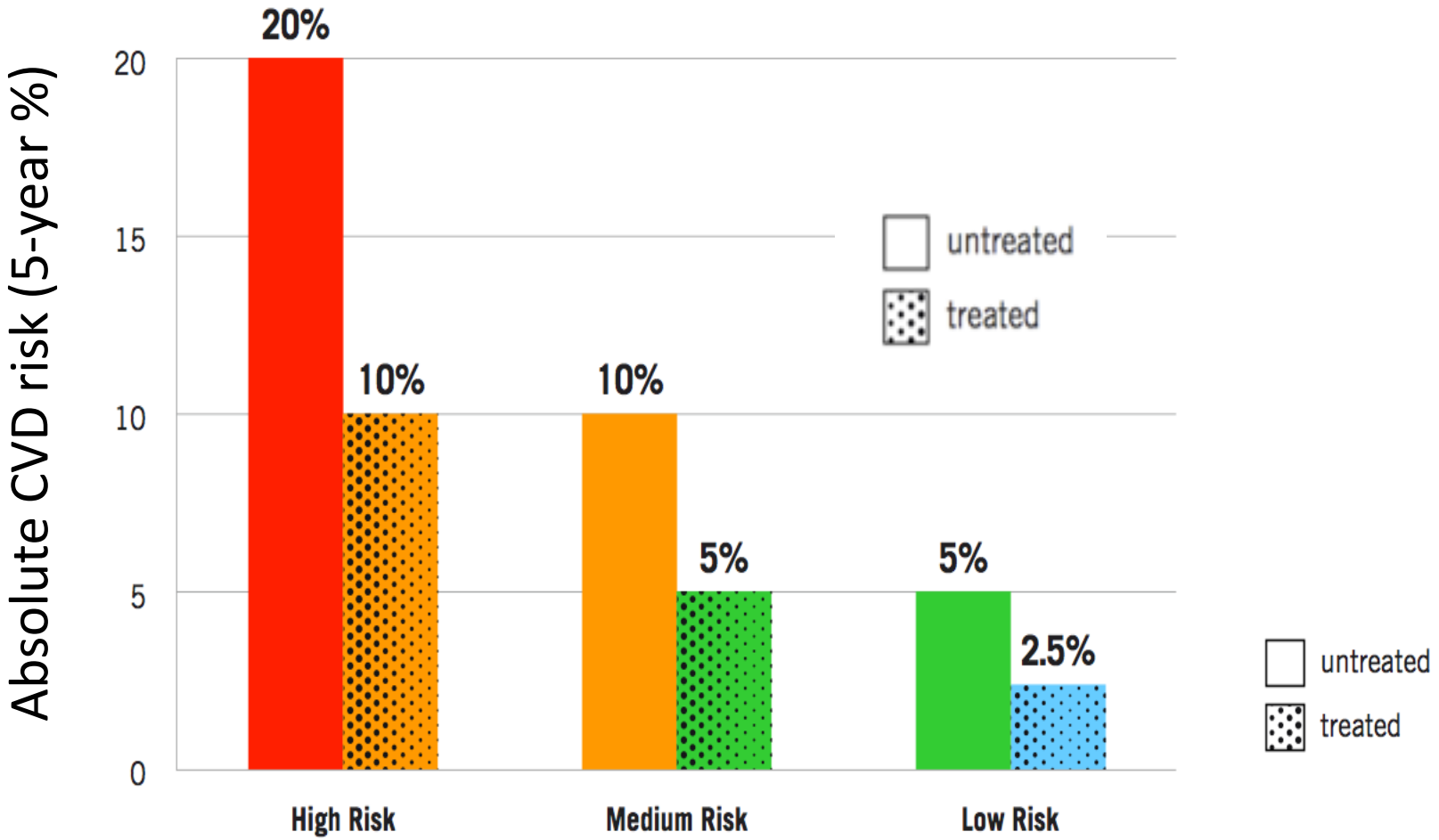
how relevant is a US CVD risk prediction study from the 1970s to a multiethnic NZ populations in the 21st century?



more accurate vascular risk prediction

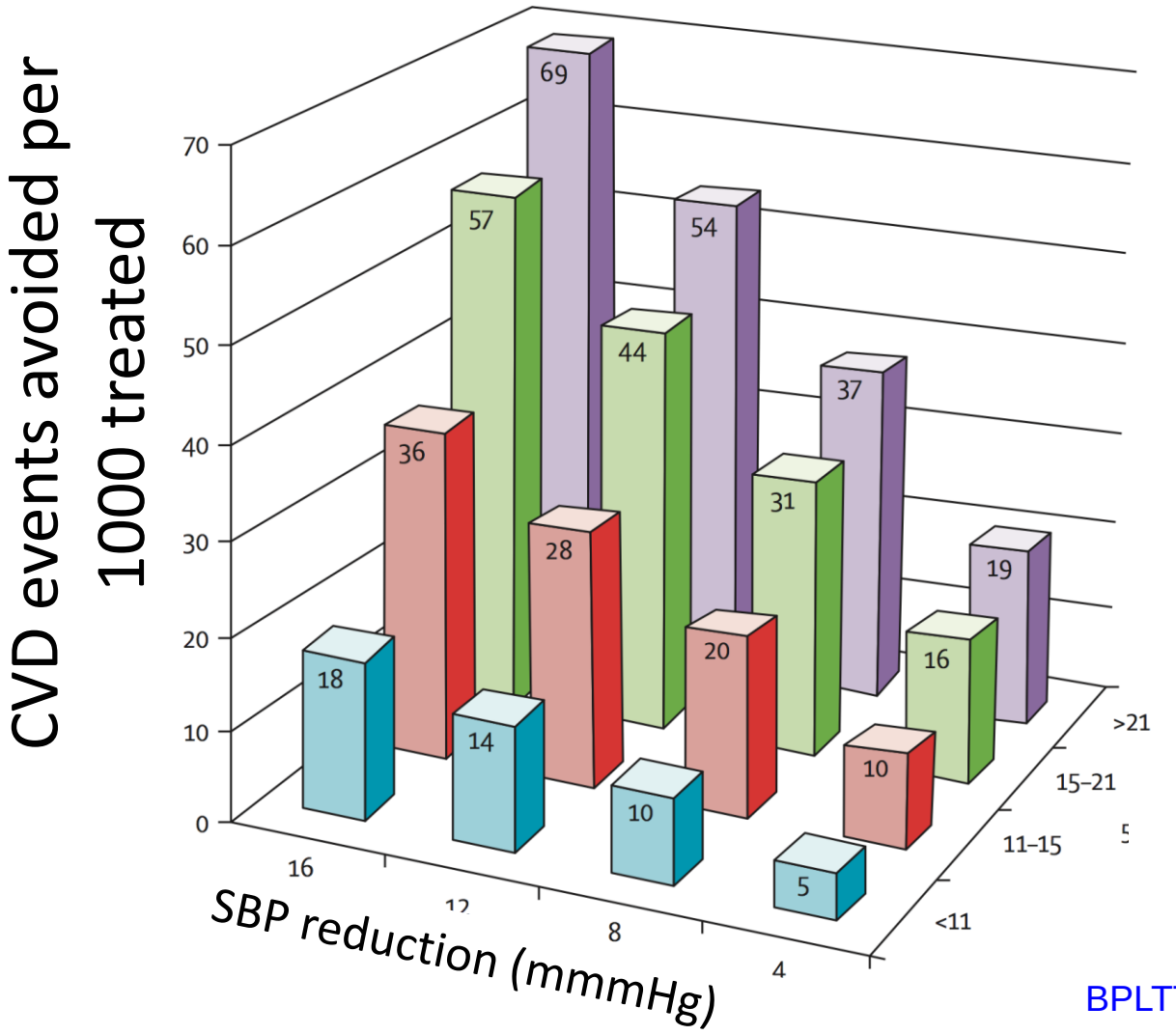
better vascular risk management

better risk management: the higher the risk the greater the treatment benefit



cost-effective treatment depends on targeting higher risk patients

CVD events prevented per 1000 treated by baseline combined risk and extent of systolic blood pressure-lowering



BPLTTC. Lancet 2014; 384: 591–98

THE NEW ZEALAND MEDICAL JOURNAL
Vol 118 No 1223 ISSN 1175 8716 NZMJ 7 October 2005

Cardiovascular medications in primary care: treatment gaps and targeting by absolute risk

Natasha Rafter, Jennie Connor, Jason Hall, Rod Jackson, Isobel Martin, Varsha Parag, Stephen Vander Hoorn, Anthony Rodgers

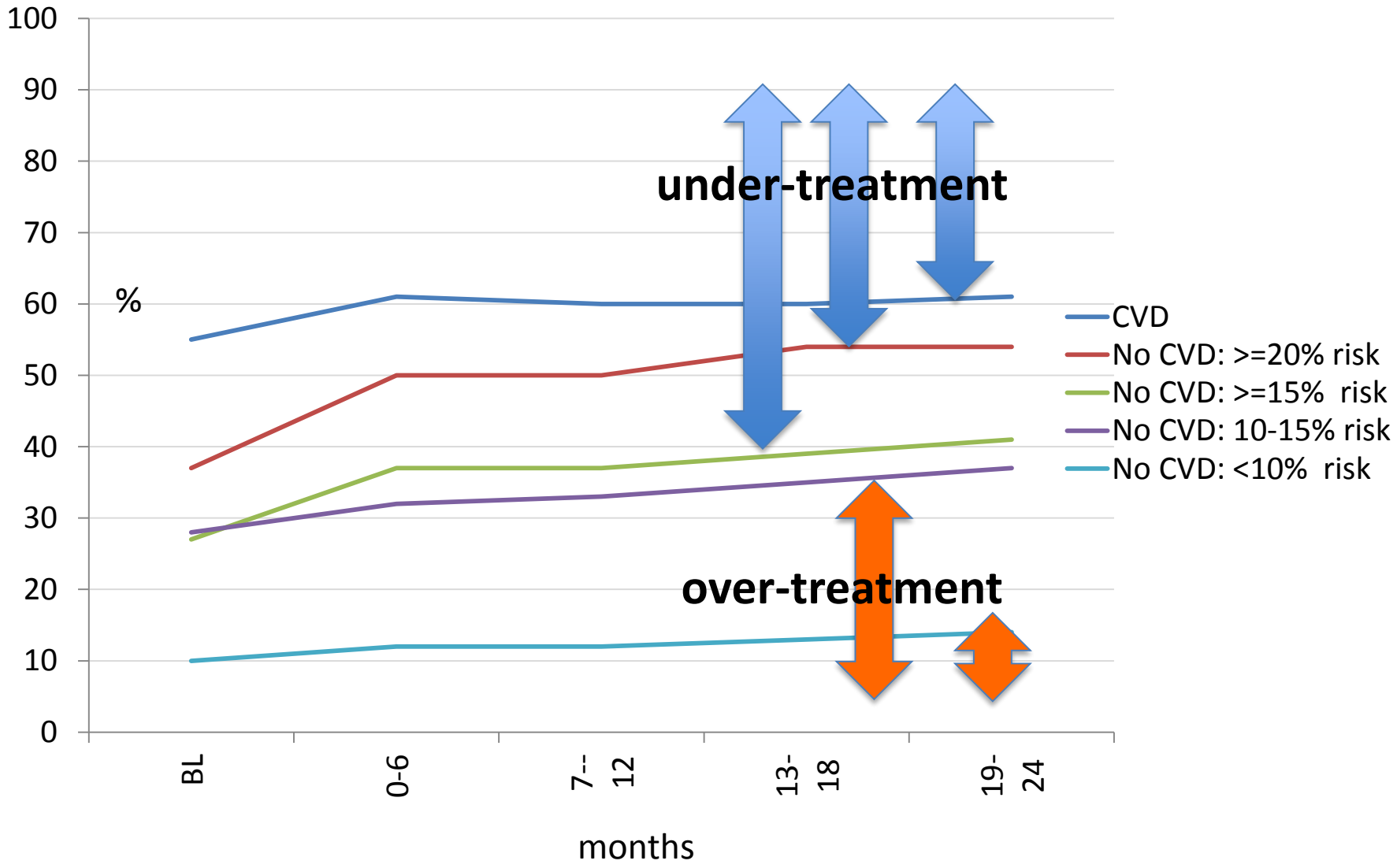
Methods Demographic, risk factor, and prescribing data from the Dunedin Royal New Zealand College of General Practitioners Research Unit database were analysed. The data set consisted of 25,384 individuals, men aged at least 45 years and women at least 55 years, who consulted a doctor in 2000 in a practice which supplied electronic clinical notes. People with congestive heart failure were excluded. Five-year risk of a cardiovascular event was estimated using a history of vascular disease or the Framingham risk equation, and correlated with prescribed medications.

better vascular risk management

Results Cardiovascular risk could be estimated for only one-third of the study population due to missing risk factor information. Data were largely unavailable on antiplatelet agents and so lipid lowering and blood pressure lowering medications were used to assess the "treatment gap". This combination was prescribed to only 28% of those with documented cardiovascular disease. For the remainder without a history of disease and for whom 5-year absolute risk of cardiovascular disease could be estimated, prescription of combination therapy ranged from 8% in the lowest risk group (<5% 5-year risk) to 14-16% in the other risk categories.

better vascular risk management

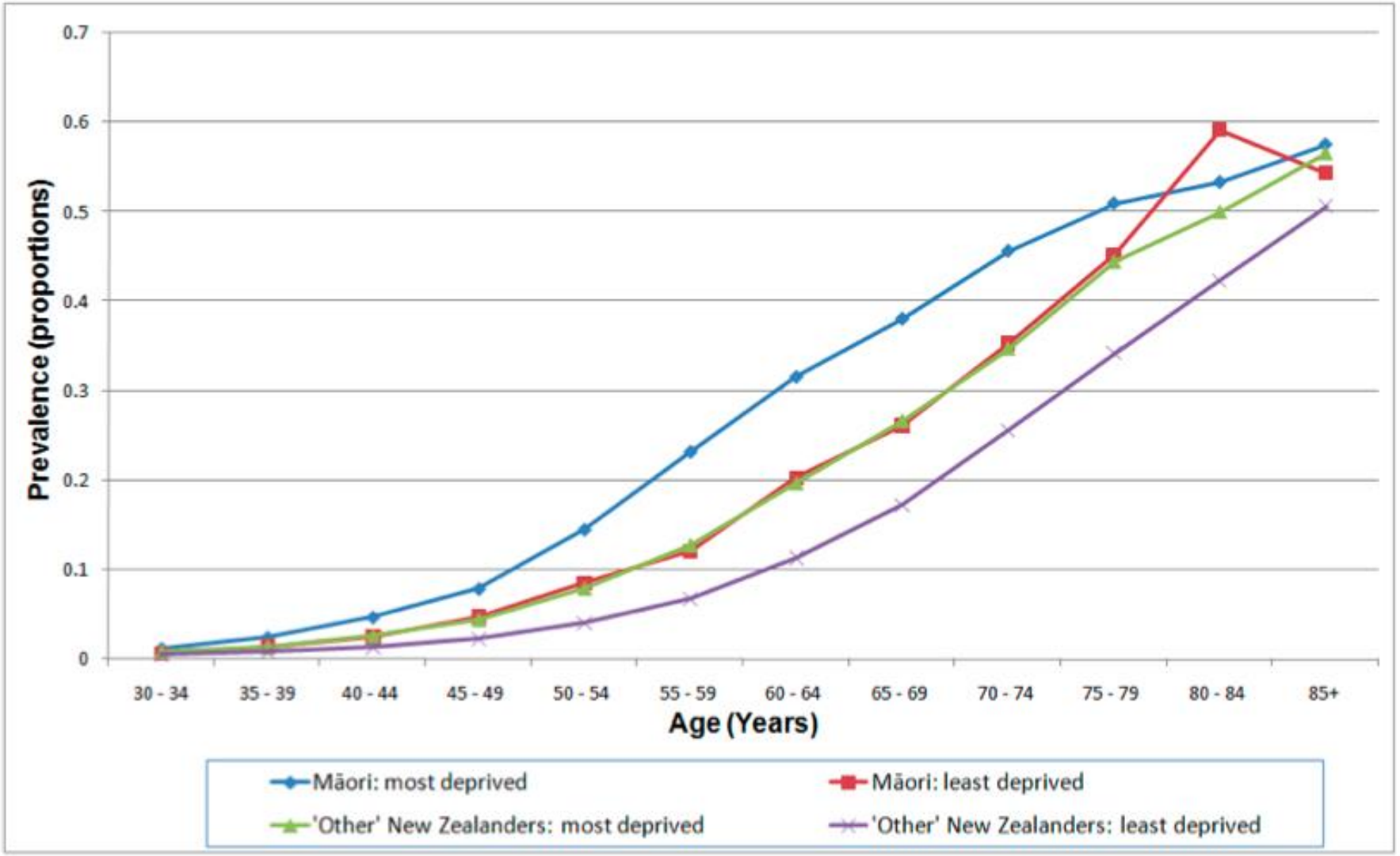
vascular risk management: Auckland 2006-9



Mehta et al. Eur J Prevent Cardiol. 2014;21:192–202

reducing inequalities in vascular disease burden

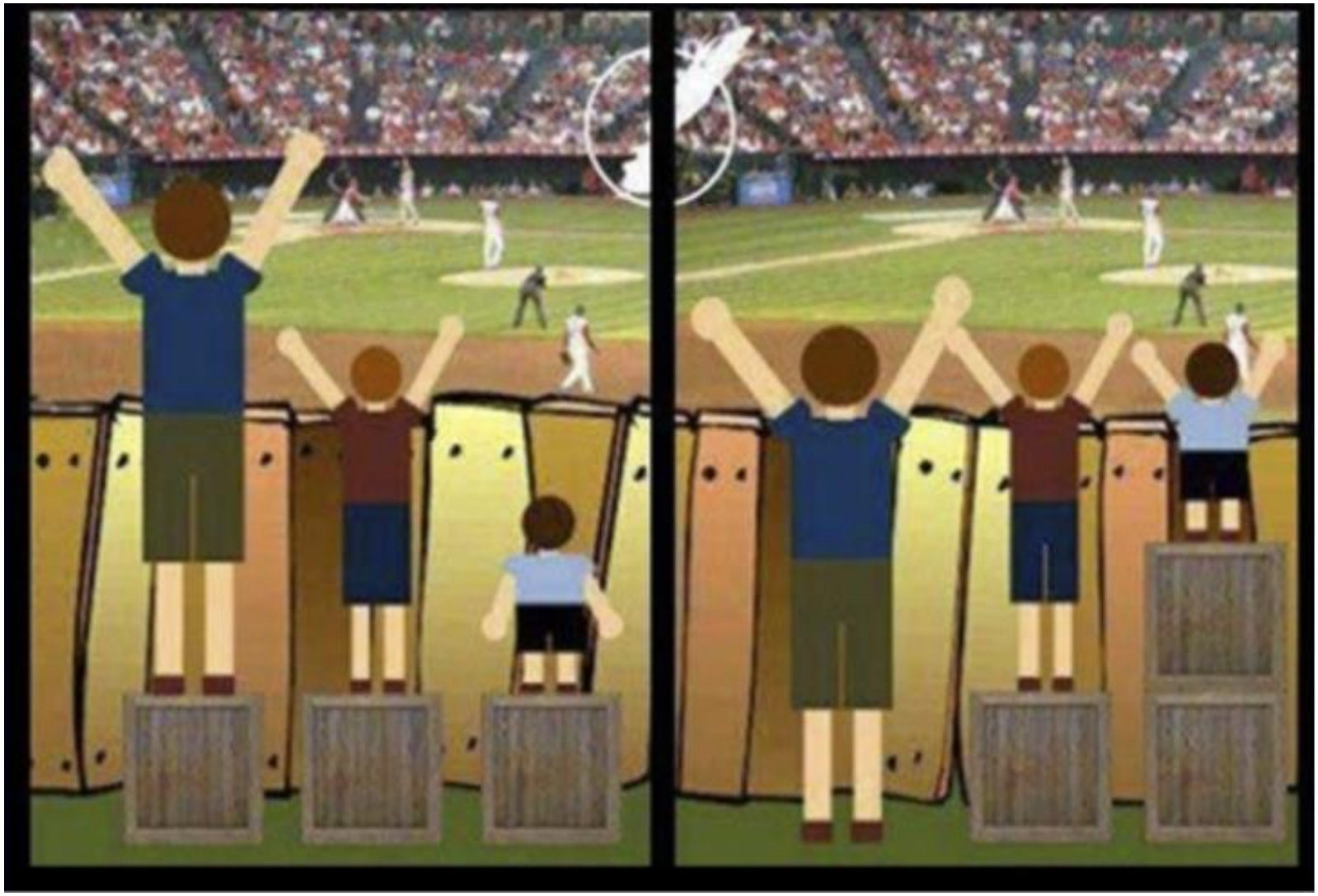
inequalities in vascular risk burden: comparison of least/most deprived* Māori & Pakeha



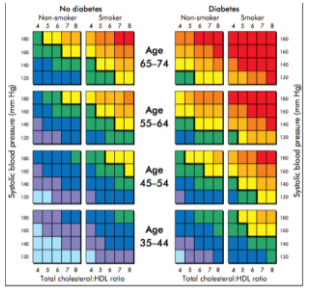
* socioeconomic deprivation based on NZdep

Chan et al. NZMJ 2008. 121:1285/3341

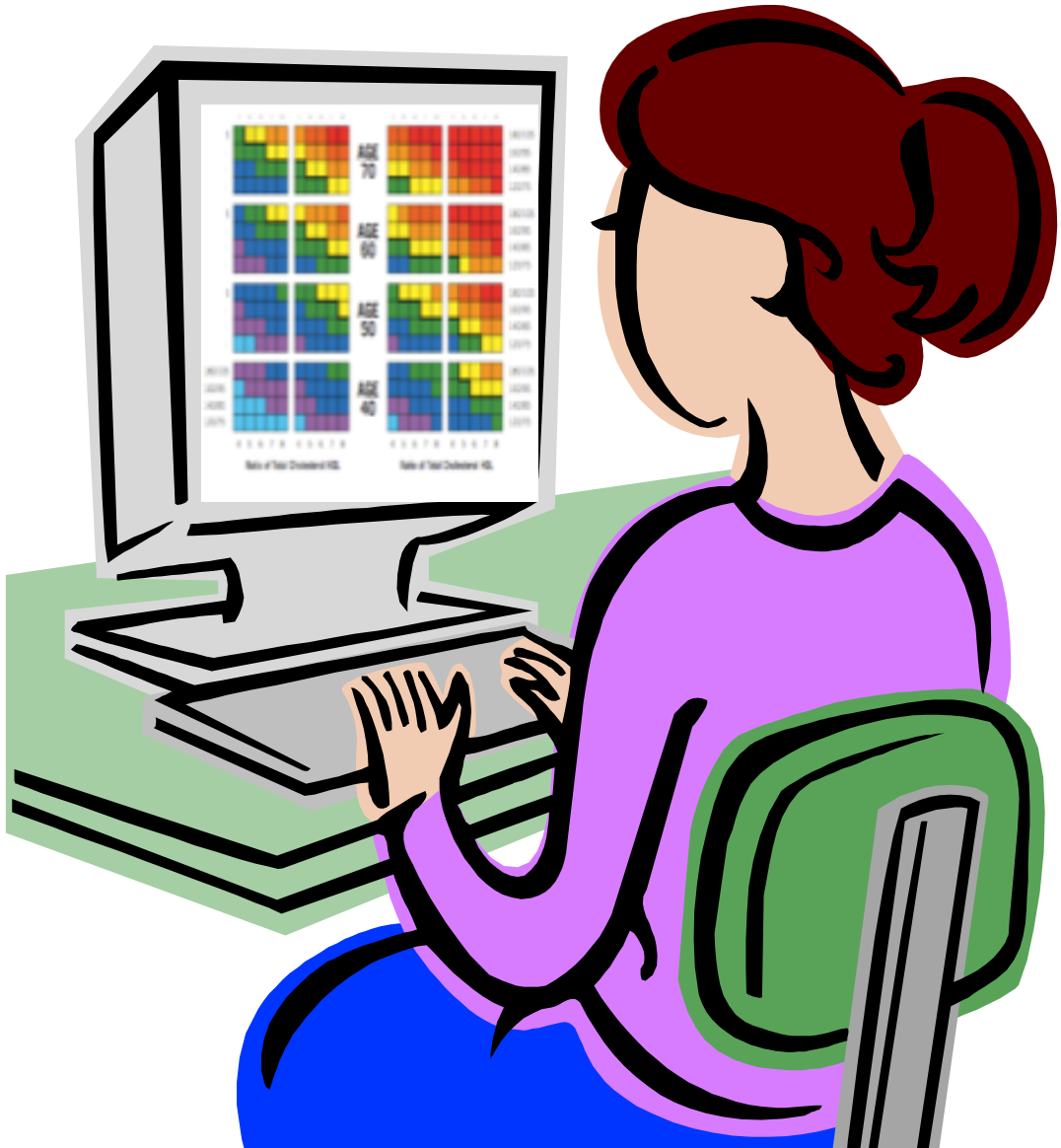
reducing inequalities by better targeting of high vascular risk individuals & populations



using big data to improve CVD risk prediction



PREDICT in PHOs: electronic decision support for CVD risk prediction & management



2002

Risk Assessment:

This page was made specifically for **Joe Bloggs *(ABC1235)***: 09-Aug-2006 10:37 hrs

Estimated risk of having a CVD event in the next 5 years: 18%

Estimated risk level: 5-year CV risk (fatal and non-fatal)	**Estimated Benefits: NNT for 5 years to prevent one event** (CVD events prevented per 100 people treated for 5 years)		
	1 intervention (25% risk reduction)	**2 interventions (45% risk reduction)**	**3 interventions (55% risk reduction)**
18%	22 (4.5 per 100)	12 (8.1 per 100)	10 (9.9 per 100)

Based on the conservative estimate that each intervention: aspirin, blood pressure treatment (lowering systolic blood pressure by 10 mm Hg) or lipid modification (lowering LDL-C by 20%) reduces CV risk by about 25% over 5 years.

CVD risk has been moved up one risk category (5%), as cardiovascular risk may be underestimated in the Framingham risk equation; based on:

- family history of premature coronary heart disease or ischaemic stroke in a first-degree male relative before the age of 55 years or a first-degree female relative before the age of 65 years
- Maori or Pacific ethnicity or people from the Indian subcontinent
- metabolic syndrome

Cardiovascular Disease: Baseline Risk and Treatment Benefit

NO DIABETES

(With a 5% upward risk adjustment applied)

Nonsmoker | Smoker

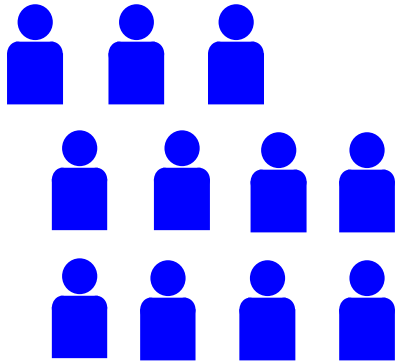
Ratio of Total Cholesterol:HDL

Risk Level

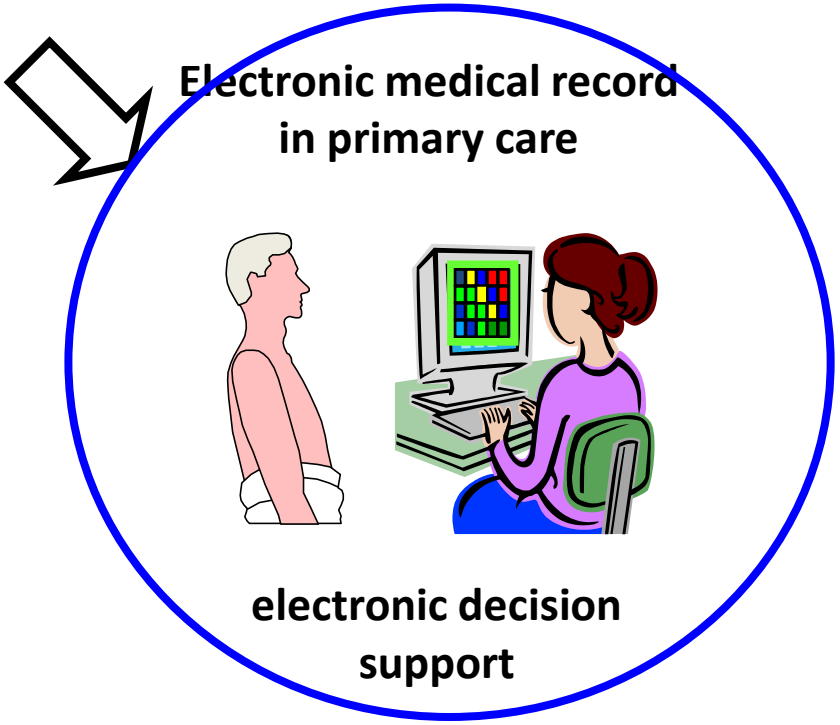
5 year CVD risk (non-fatal and fatal)

	>30%	**High**	15-20%		5-10%
Very High	25-30%	**Moderate**	10-15%	**Mild**	2.5-5%
	20-25%				<2.5%

PREDICT was designed to:

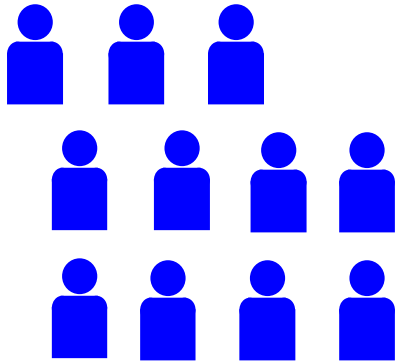


Patient population



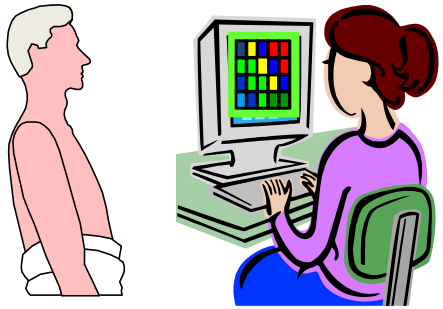
get current best evidence on risk & management into clinical practice

& to simultaneously generate new evidence from clinical practice



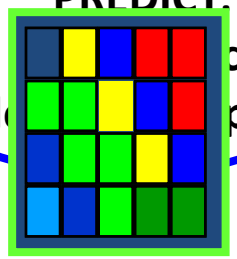
Patient population

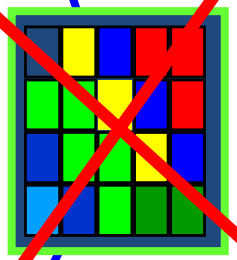
Electronic medical record in primary care



PREDICT:

d c port





NHI

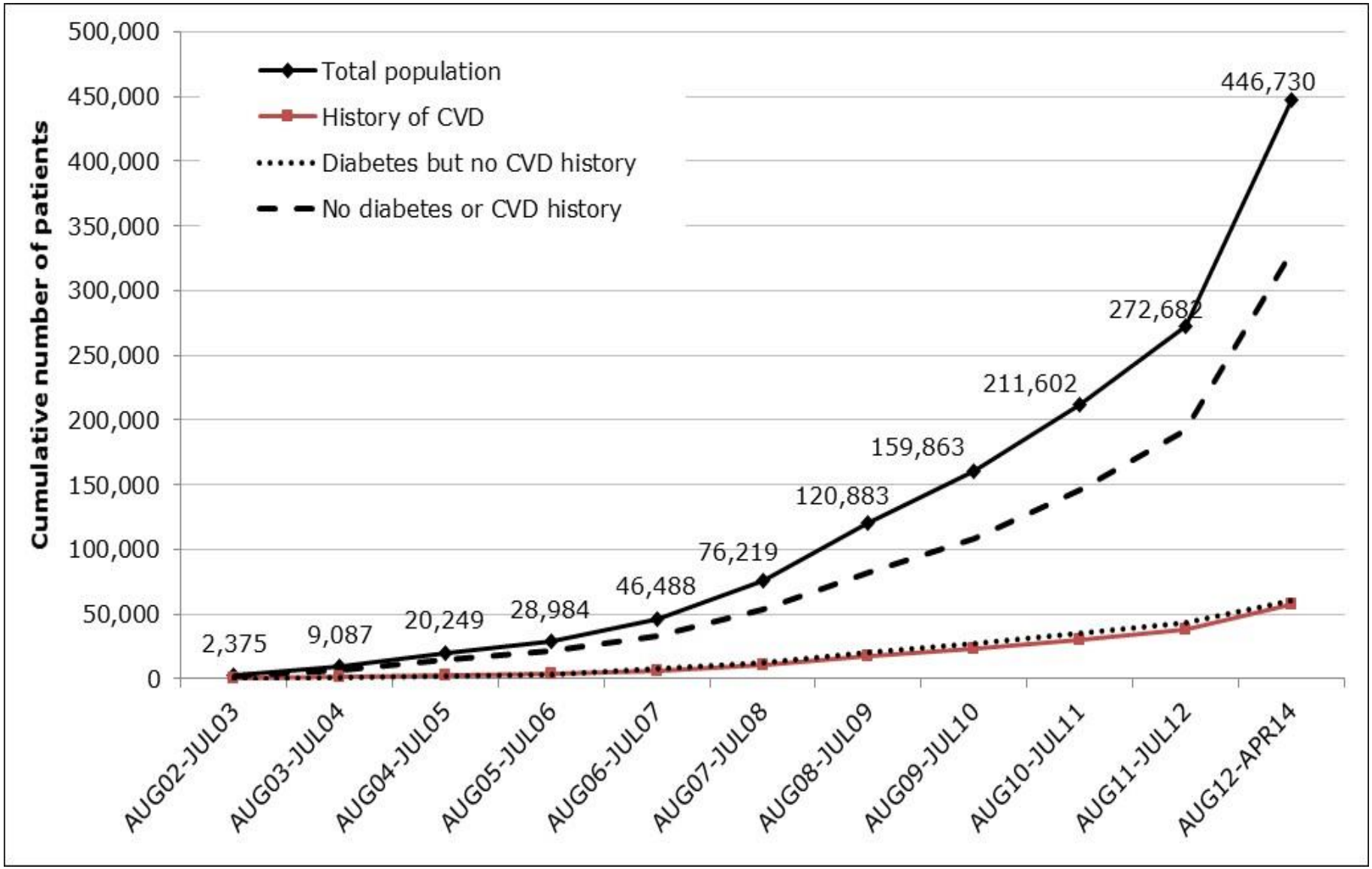
NHI

patient-specific outcomes: hospital admissions, deaths

patient-specific CVD risk factor profiles

encrypted NHI

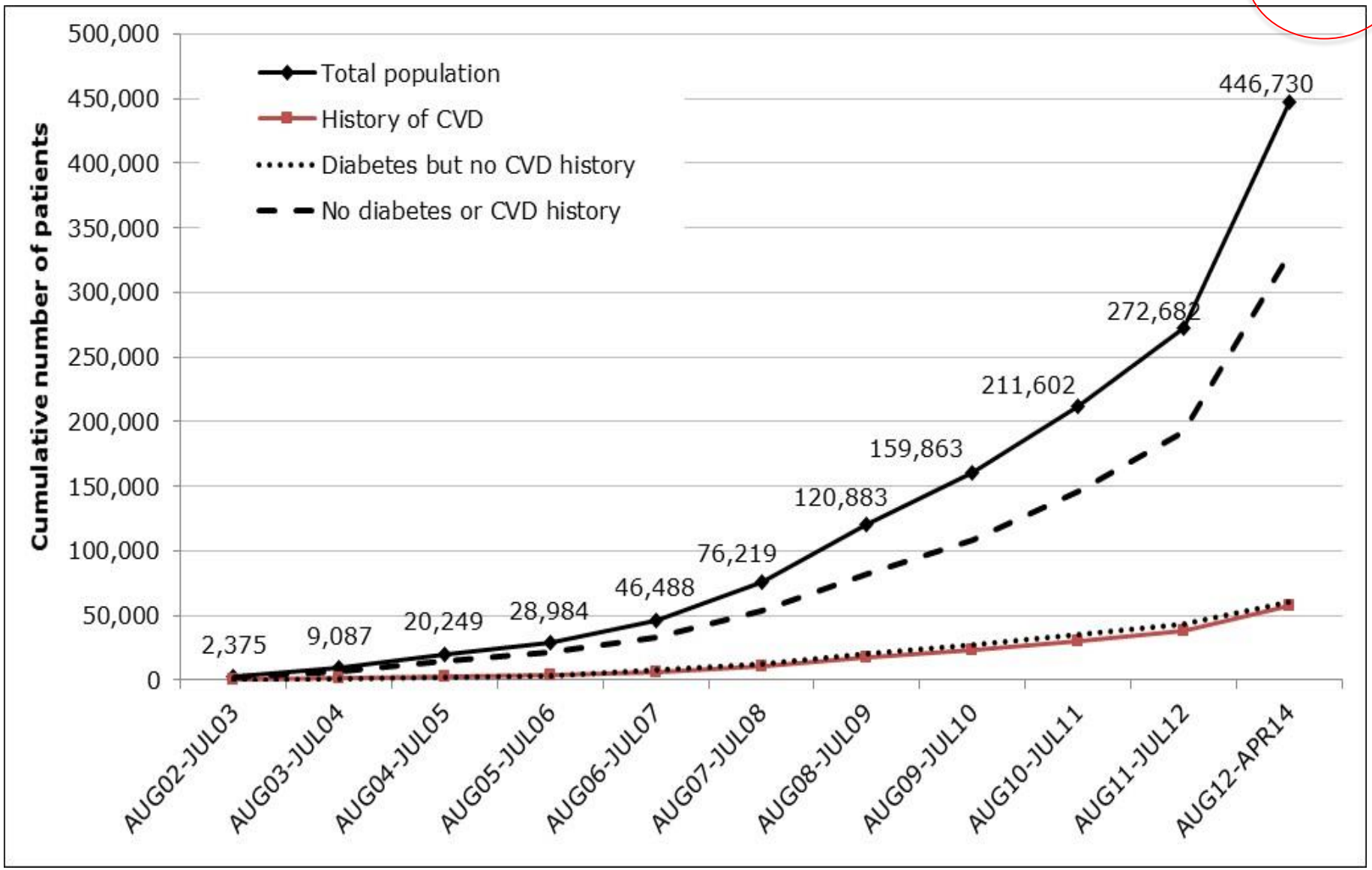
PREDICT recruitment 2002-14



Updated from Wells et al. IJE 2015

PREDICT recruitment 2002-14

now 500,000



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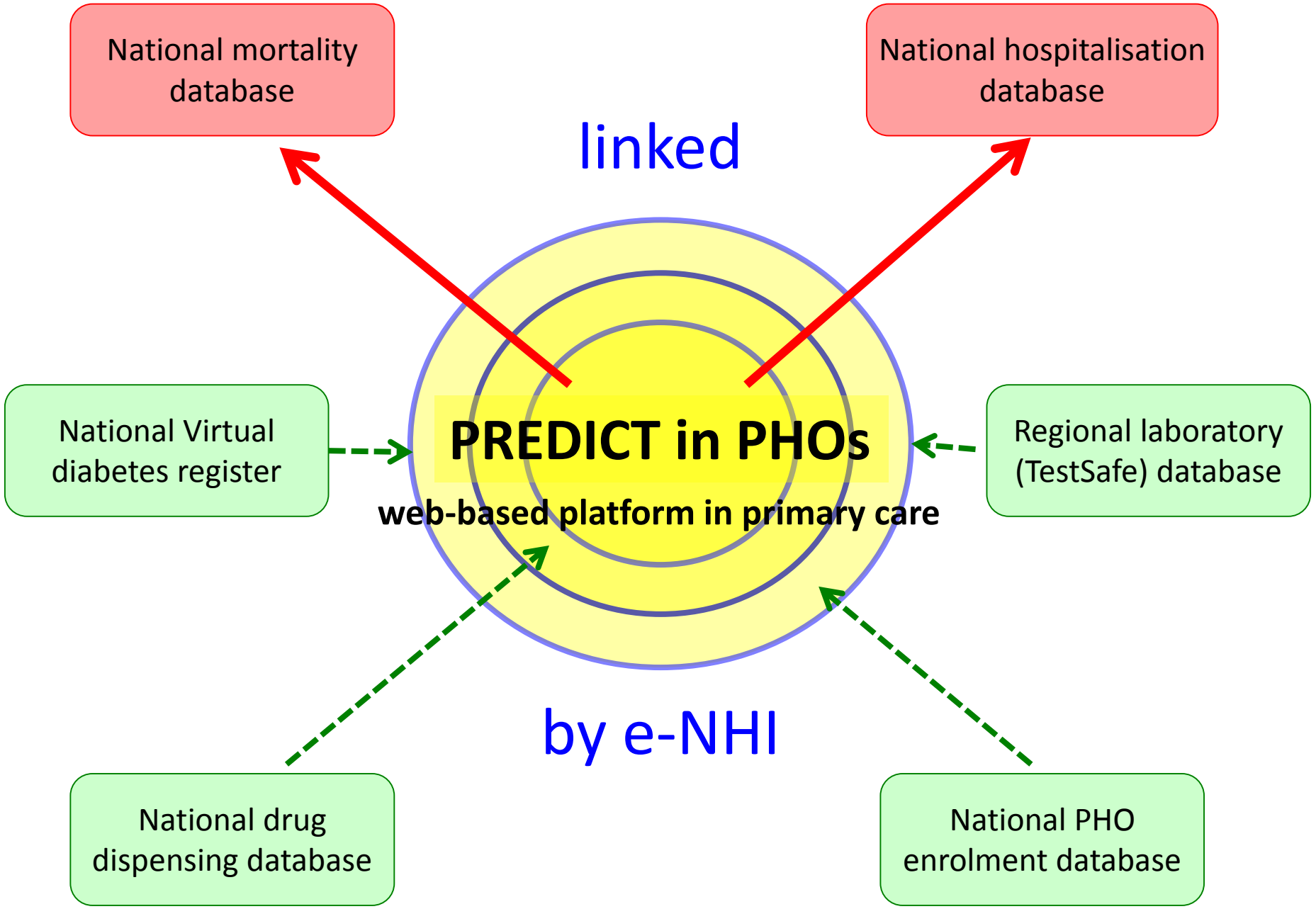
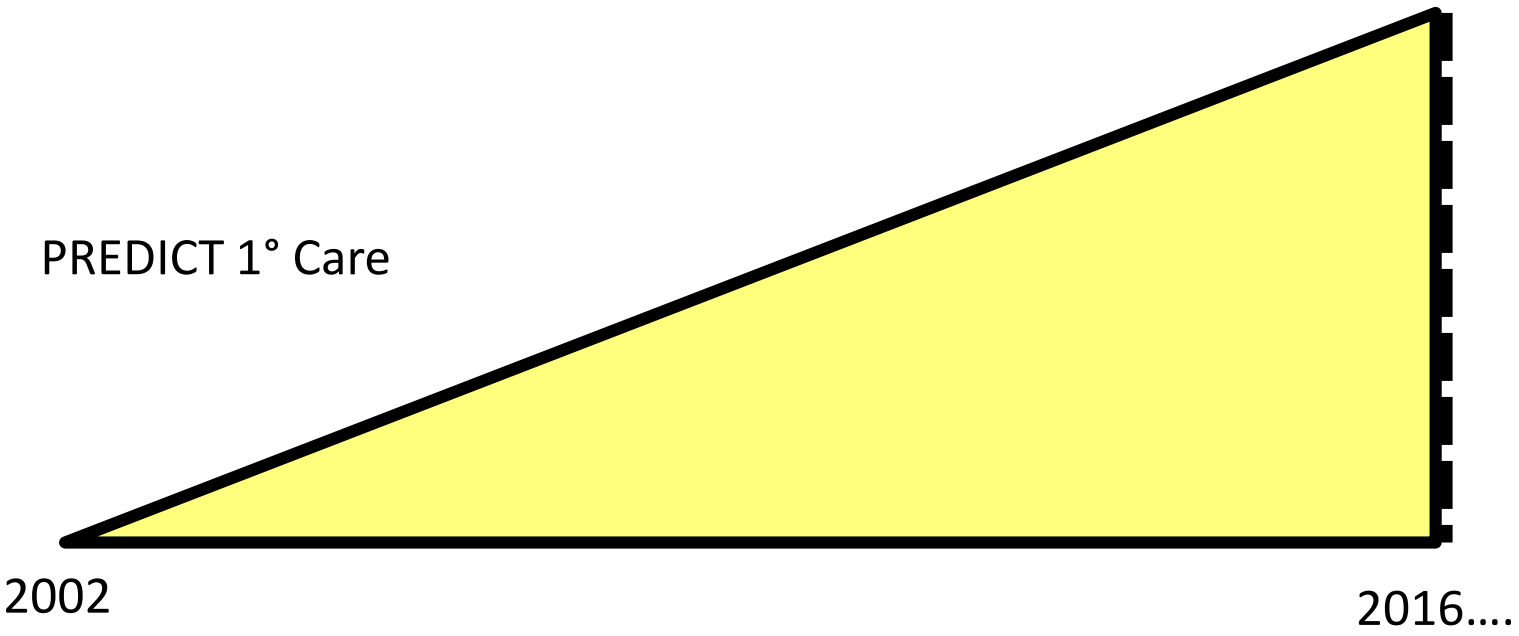
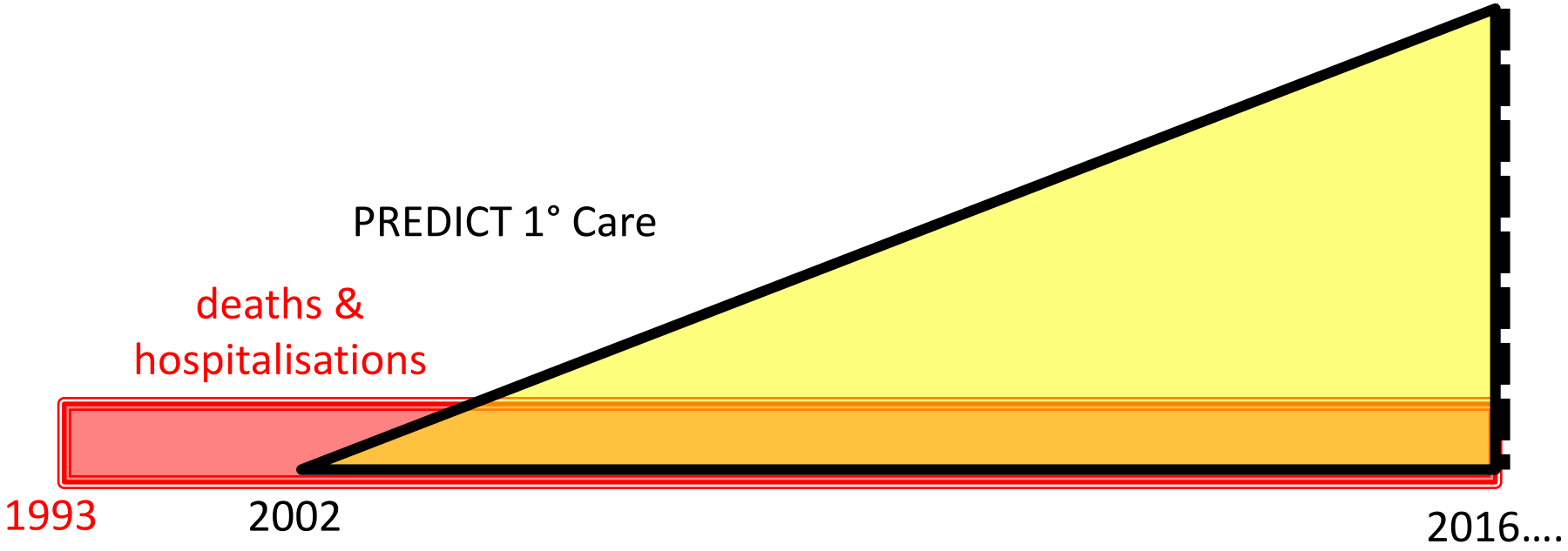

National mortality database
National hospitalisation database
linked
National Virtual diabetes register
PREDICT in PHOs
web-based platform in primary care
Regional laboratory (TestSafe) database
by e-NHI
National drug dispensing database
National PHO enrolment database

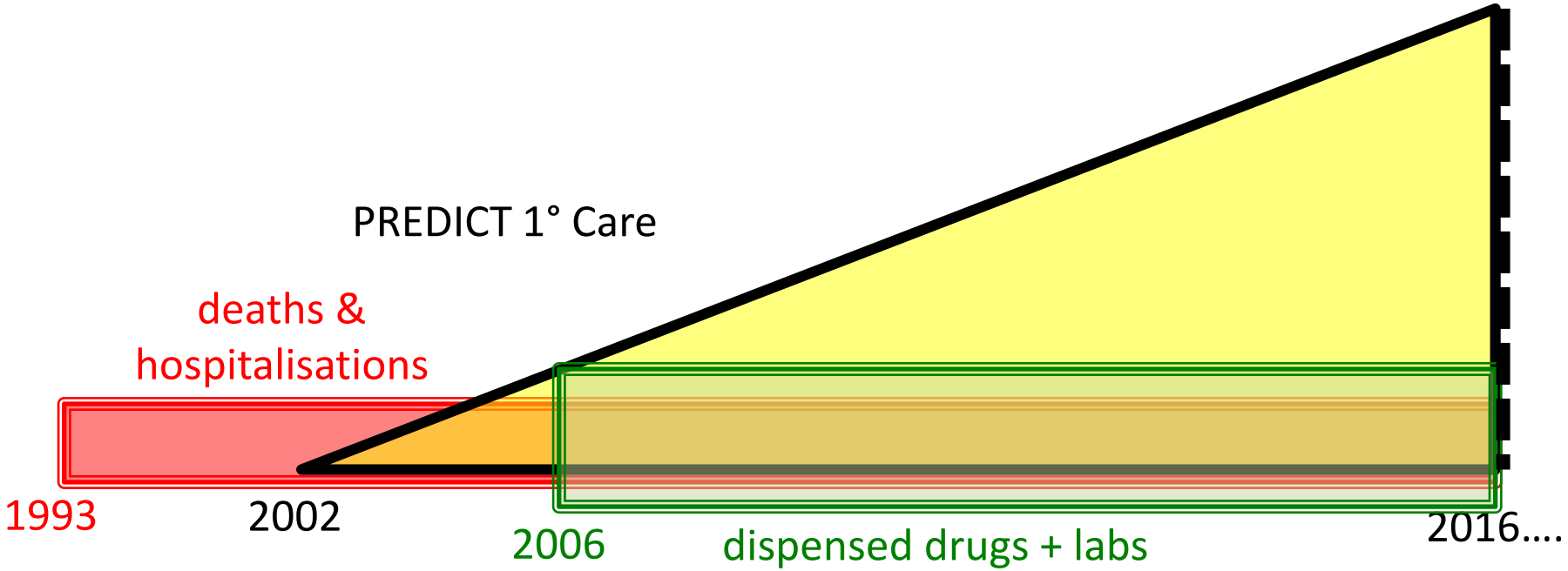
PREDICT: Predicting Cardiovascular Disease Risk In Primary Care



- PREDICT integrated into electronic health record systems of ≈ 35% NZ GPs

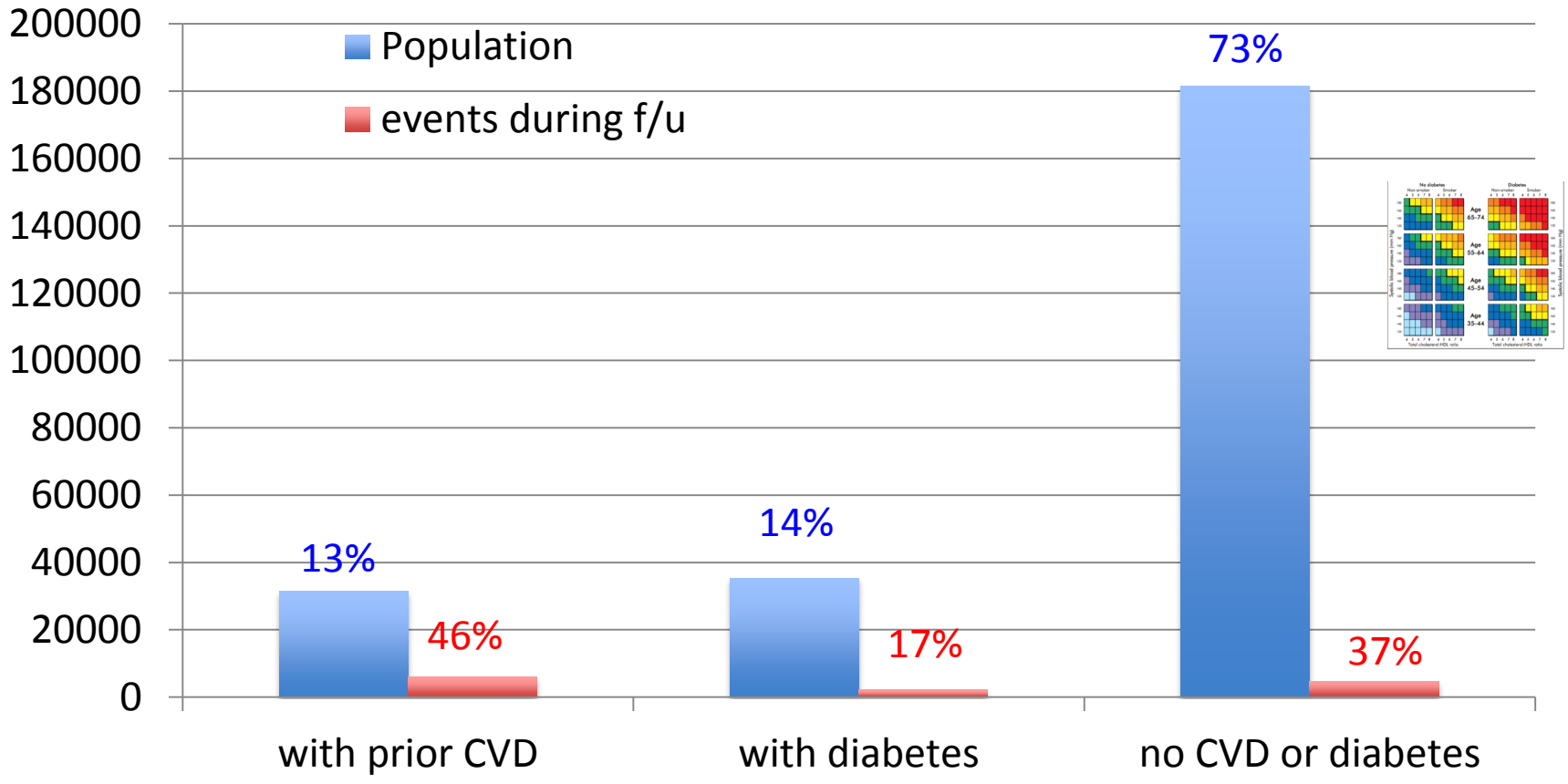


- link cohort to national hospitalisations & mortality databases biannually



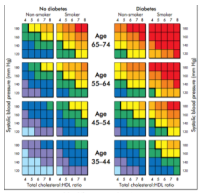
- from 2006 linked national drug dispensing and laboratory database (1° care risk management)

CVD events during follow-up in PREDICT population 30-74 years, by clinical history



2002-2012

new 1° prevention risk scores
Romana Pylypchuk (PhD), Sue Wells & Rod Jackson

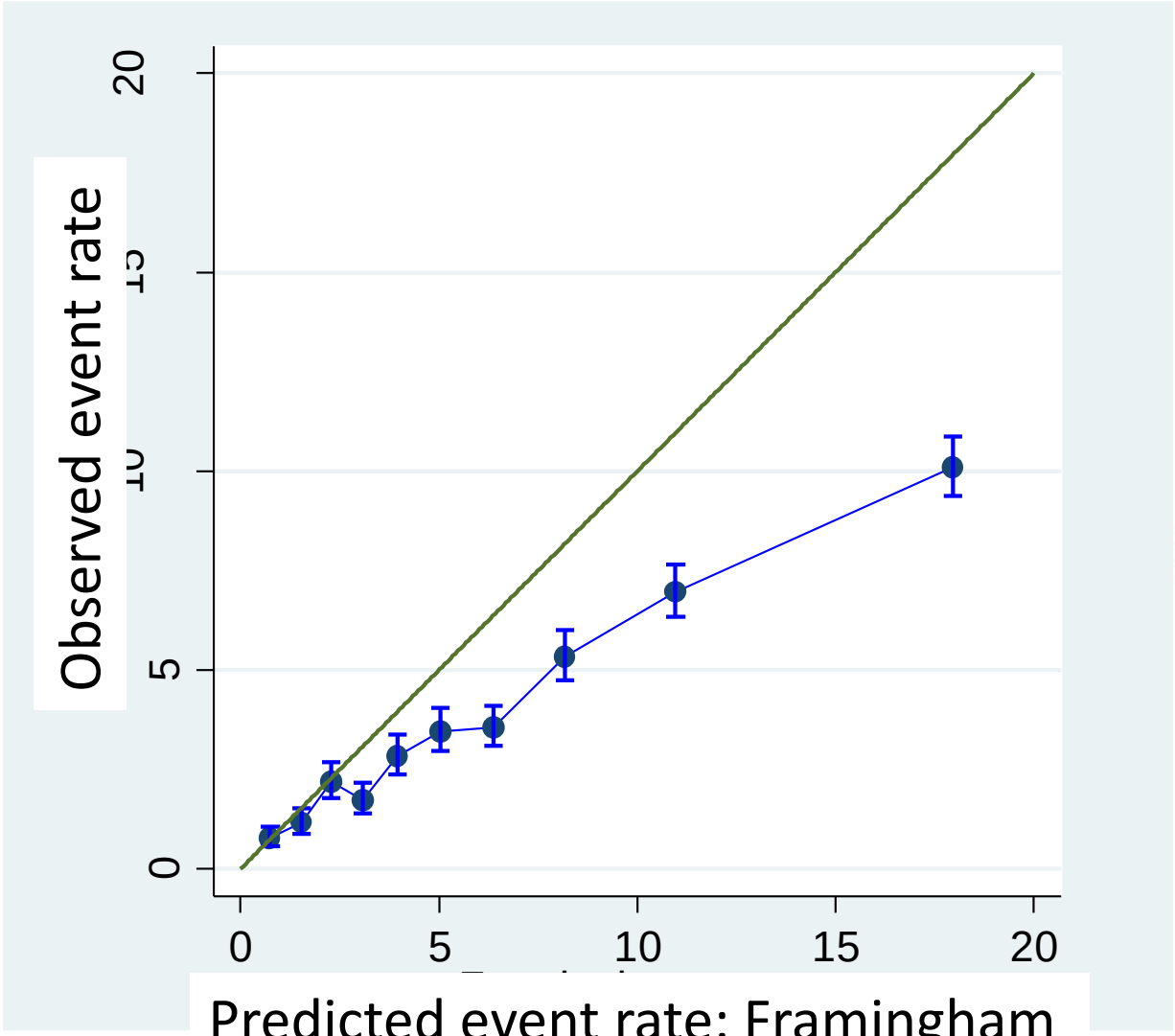


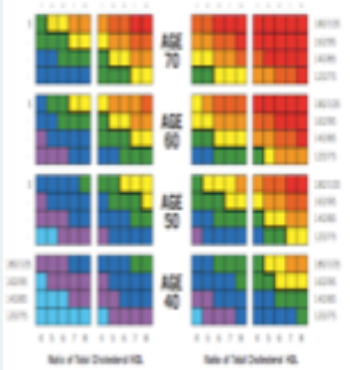
1° prevention cohort by ethnicity aged 30-74 years: 2002-2012

	Men	Women
Total (205,274)	**114,463**	**90,811**
European/other	74,002	57,757
Maori	14,142	12,583
Pacific	16,372	13,490
Indian	9,947	6,981

with no hx of CVD, renal disease or AF

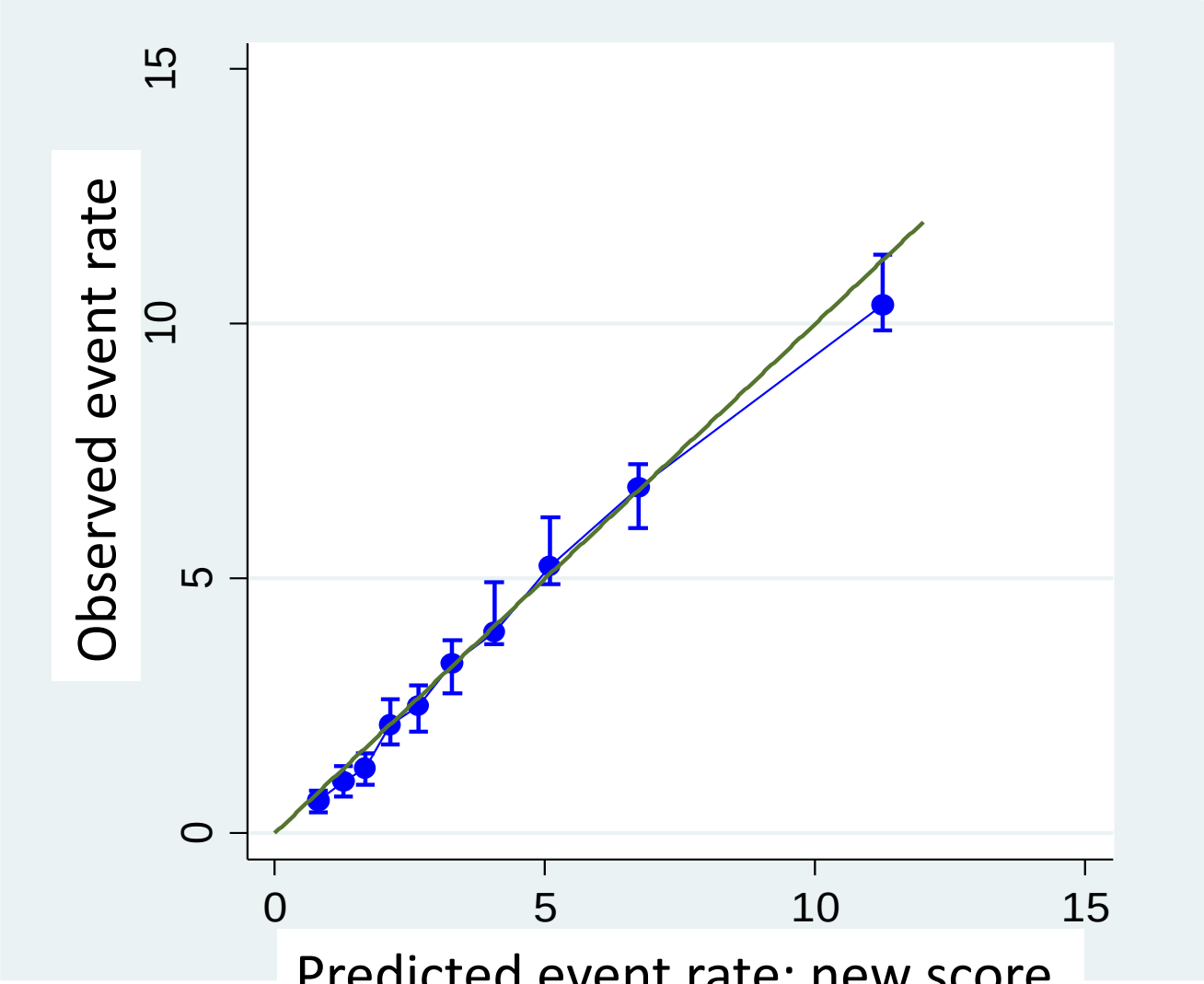
observed vs predicted risk: Framingham score





1° prevention score

observed vs predicted risk: PREDICT score

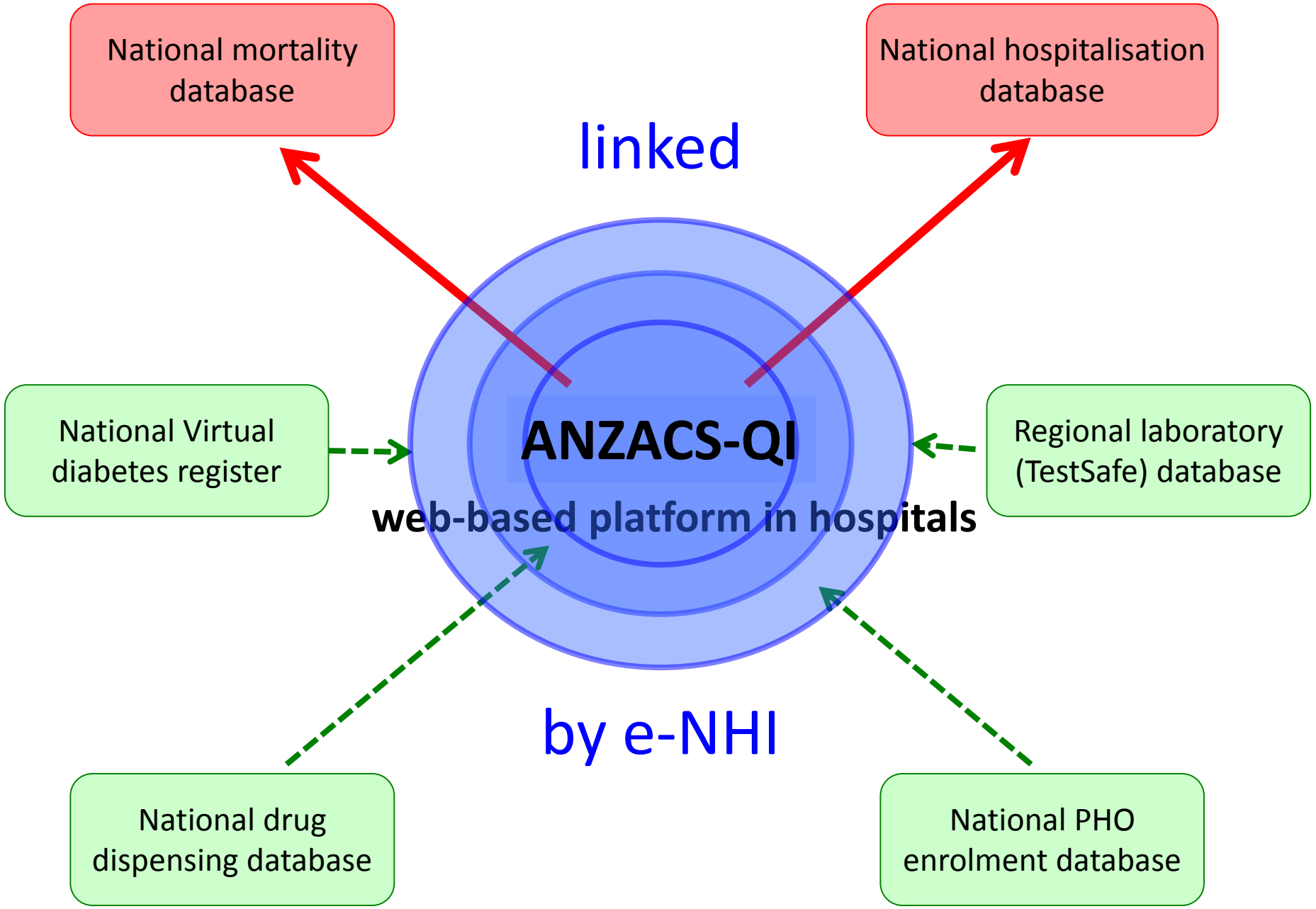


1° prevention score

ANZACS-QI

All NZ Acute Coronary Syndrome - Quality Improvement Programme

Andrew Kerr, Corina Grey


National mortality database
National hospitalisation database
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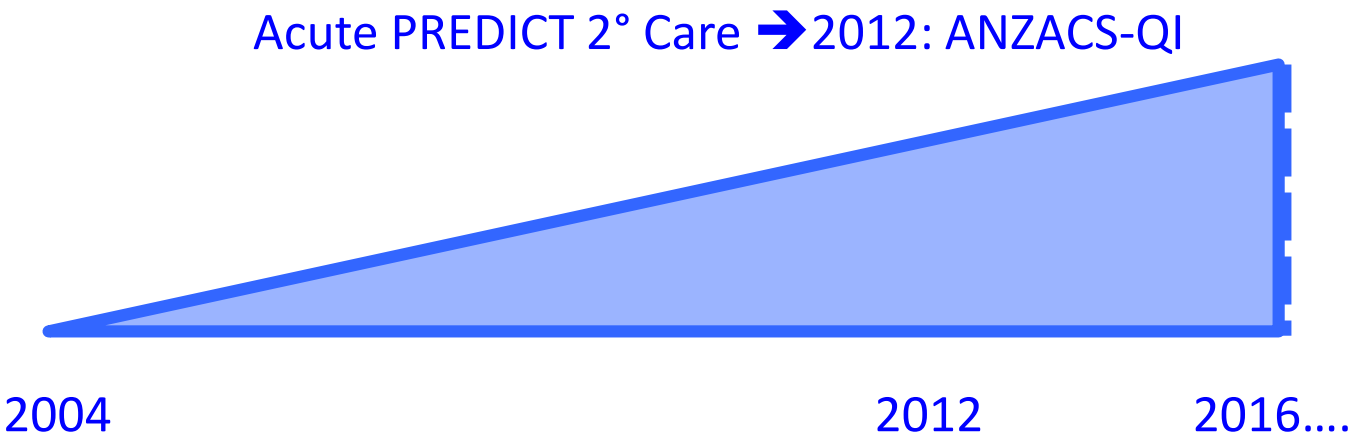
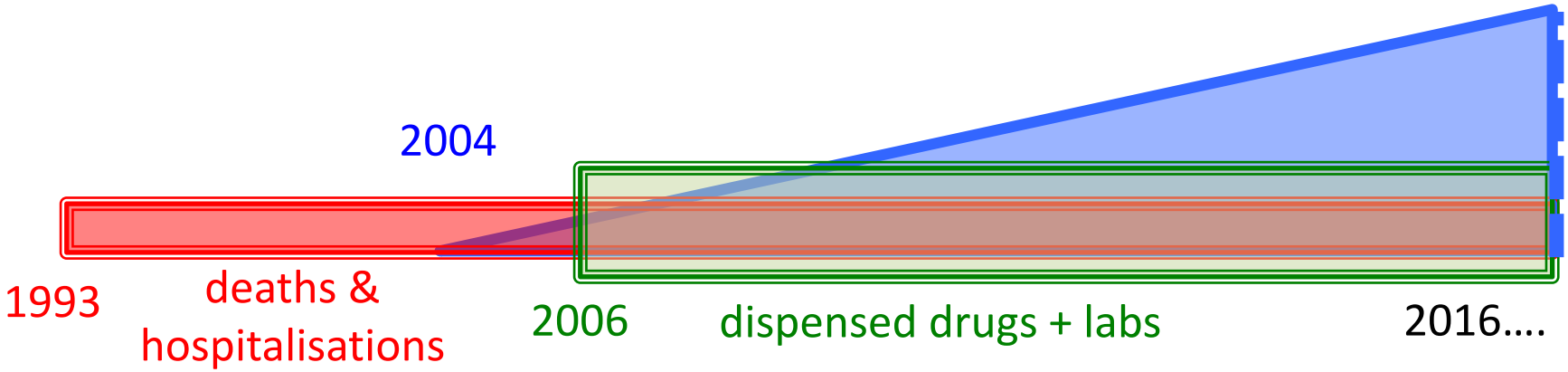
ANZACS-QI
web-based platform in hospitals
Regional laboratory (TestSafe) database
by e-NHI
National drug dispensing database
National PHO enrolment database

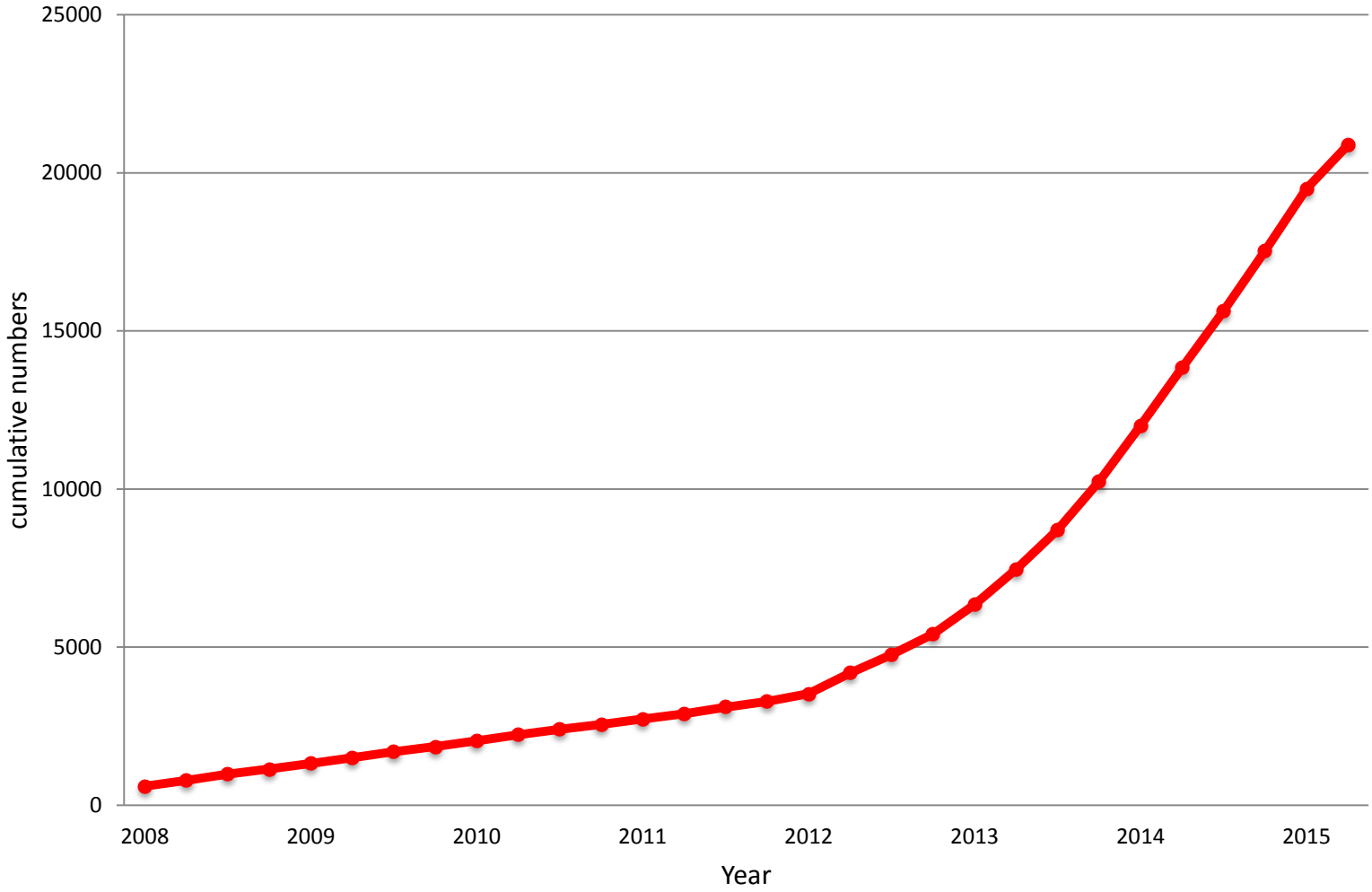
ANZACS-QI: All NZ Acute Coronary Syndrome-Quality Improvement

- web-based CVD risk factor/diagnostic/management/patient flow data collection system in hospitals
- started in 2004 in MMH as 'Acute PREDICT', expanded to Waikato in 2005
- 'morphed' into ANZACS in 2012
- now includes acute coronary hospitalisations in every NZ hospital & all coronary procedures in NZ
- copies of patients' data are recorded on a secure web server
- ≈ 30,000 patients risk assessed 2007-2015




2004
1993
deaths &
hospitalisations
2006
dispensed drugs + labs
2016….

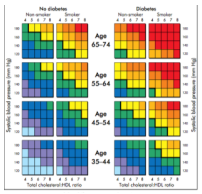
ANZACS-QI recruitment 2002-15

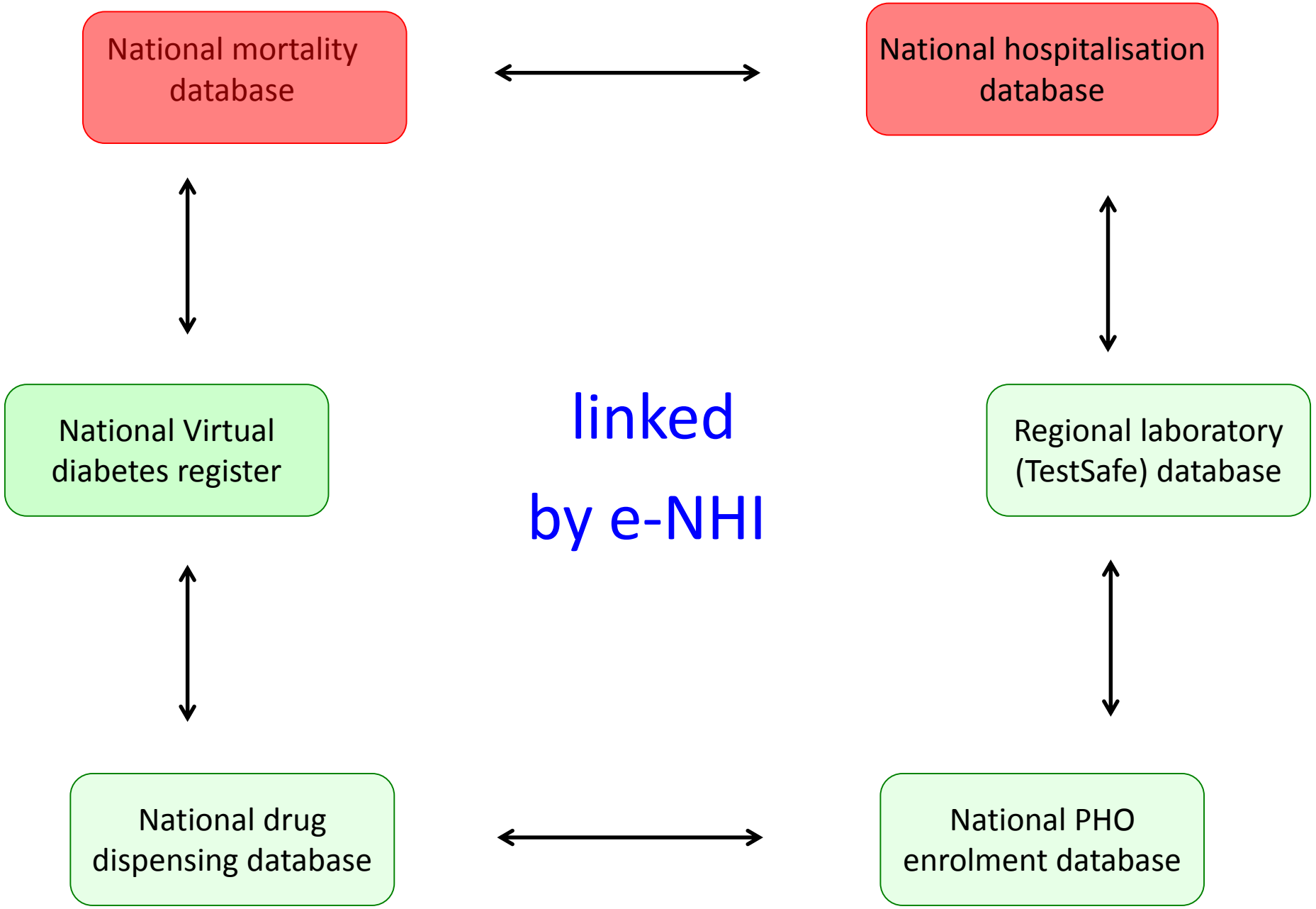


Kerr et al. NZMJ (accepted)

developing low information vascular risk scores for informing national policy

Suneela Mehta (PhD)

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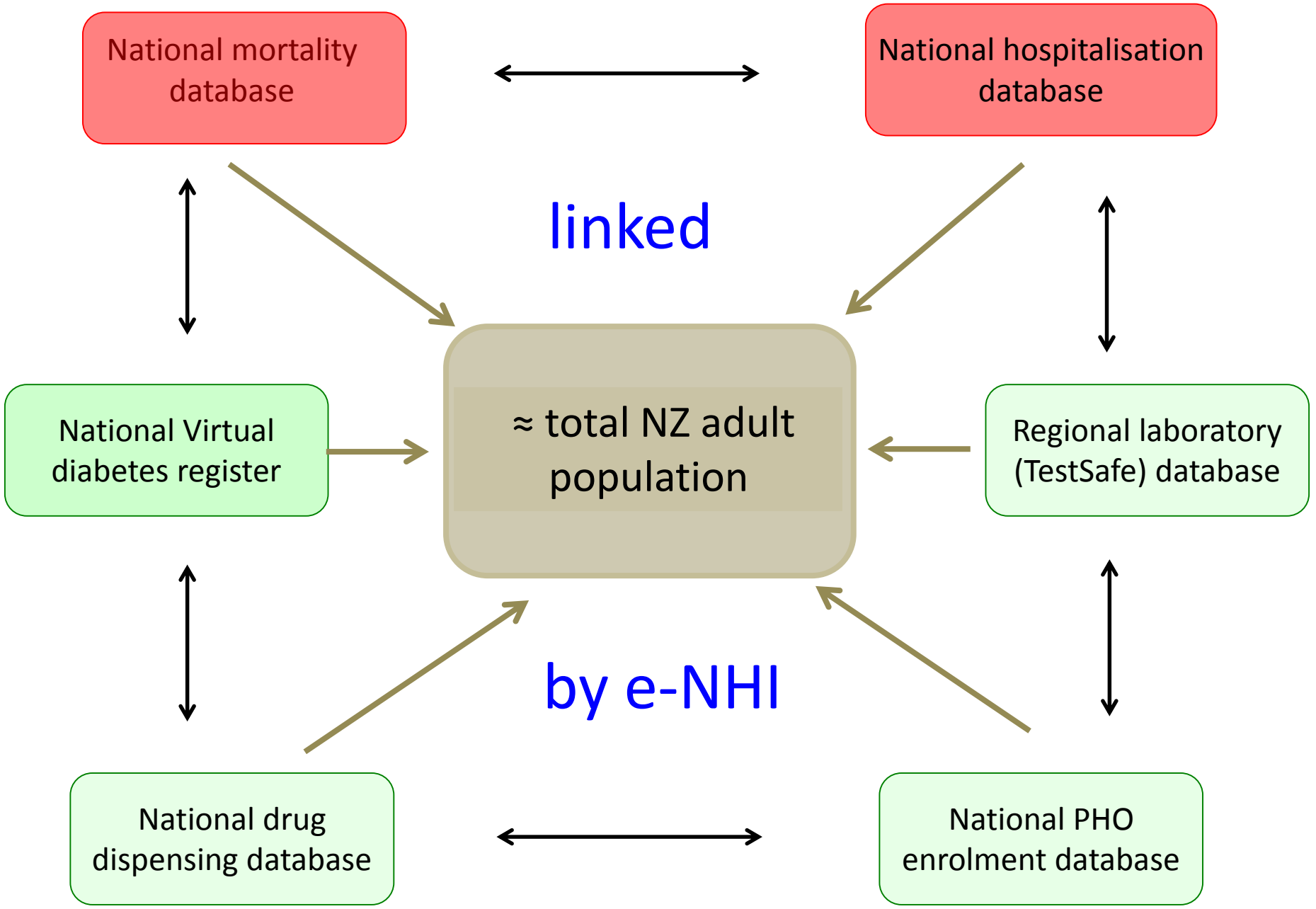
National mortality database
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≈ total NZ adult population
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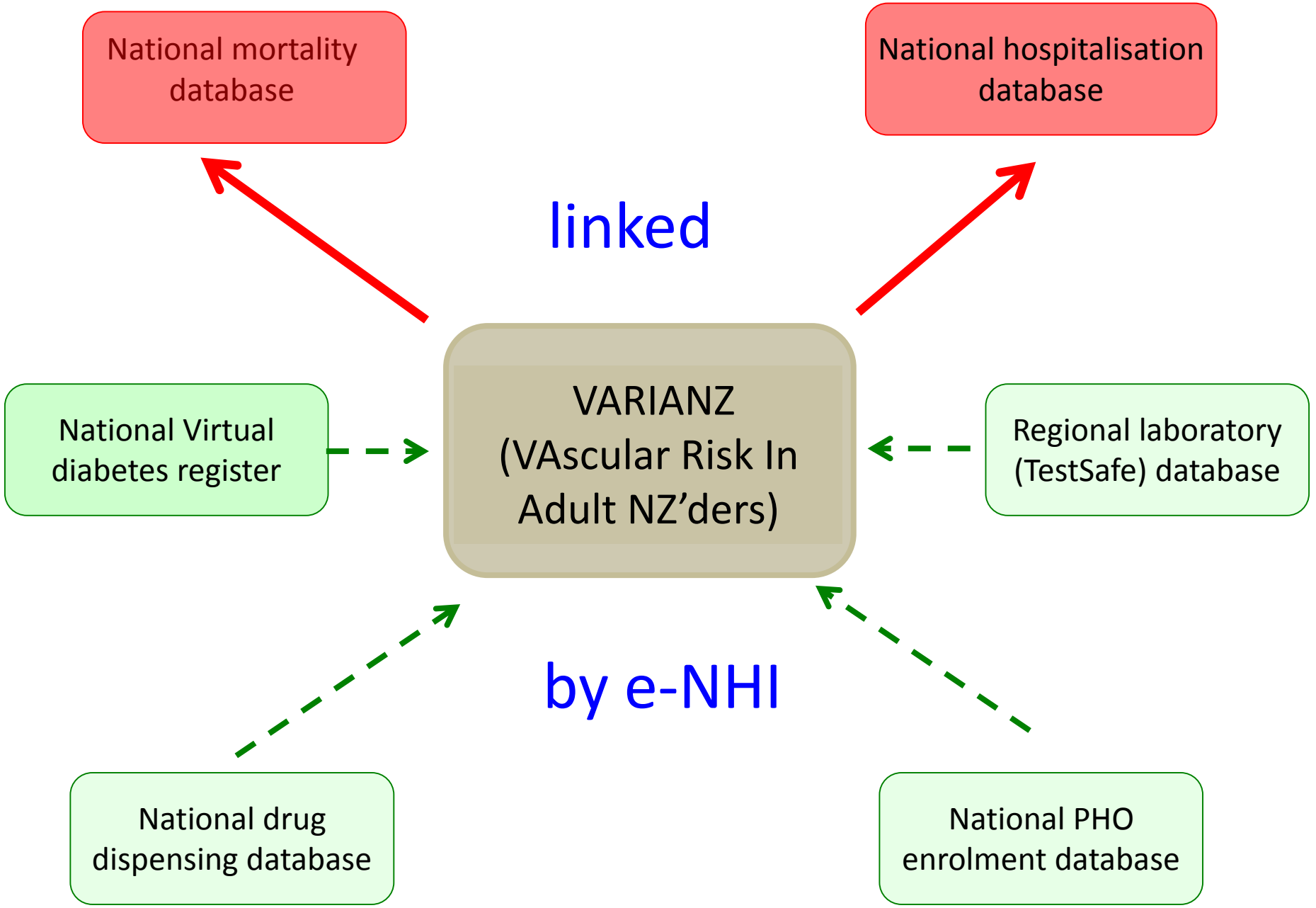
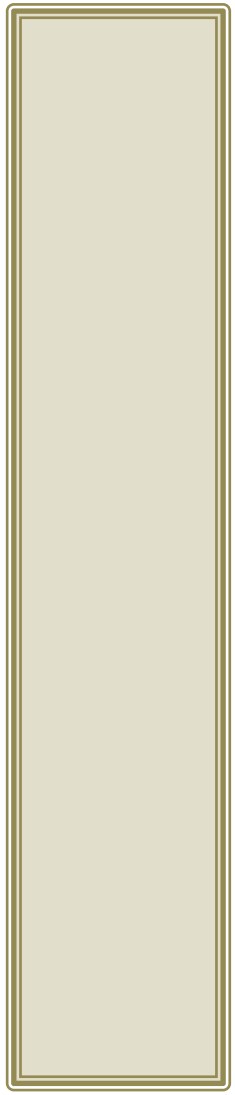
National drug dispensing database
National PHO enrolment database


National mortality database
National hospitalisation database
linked
National Virtual diabetes register
VARIANZ (VAscular Risk In Adult NZ'ders)
Regional laboratory (TestSafe) database
by e-NHI
National drug dispensing database
National PHO enrolment database

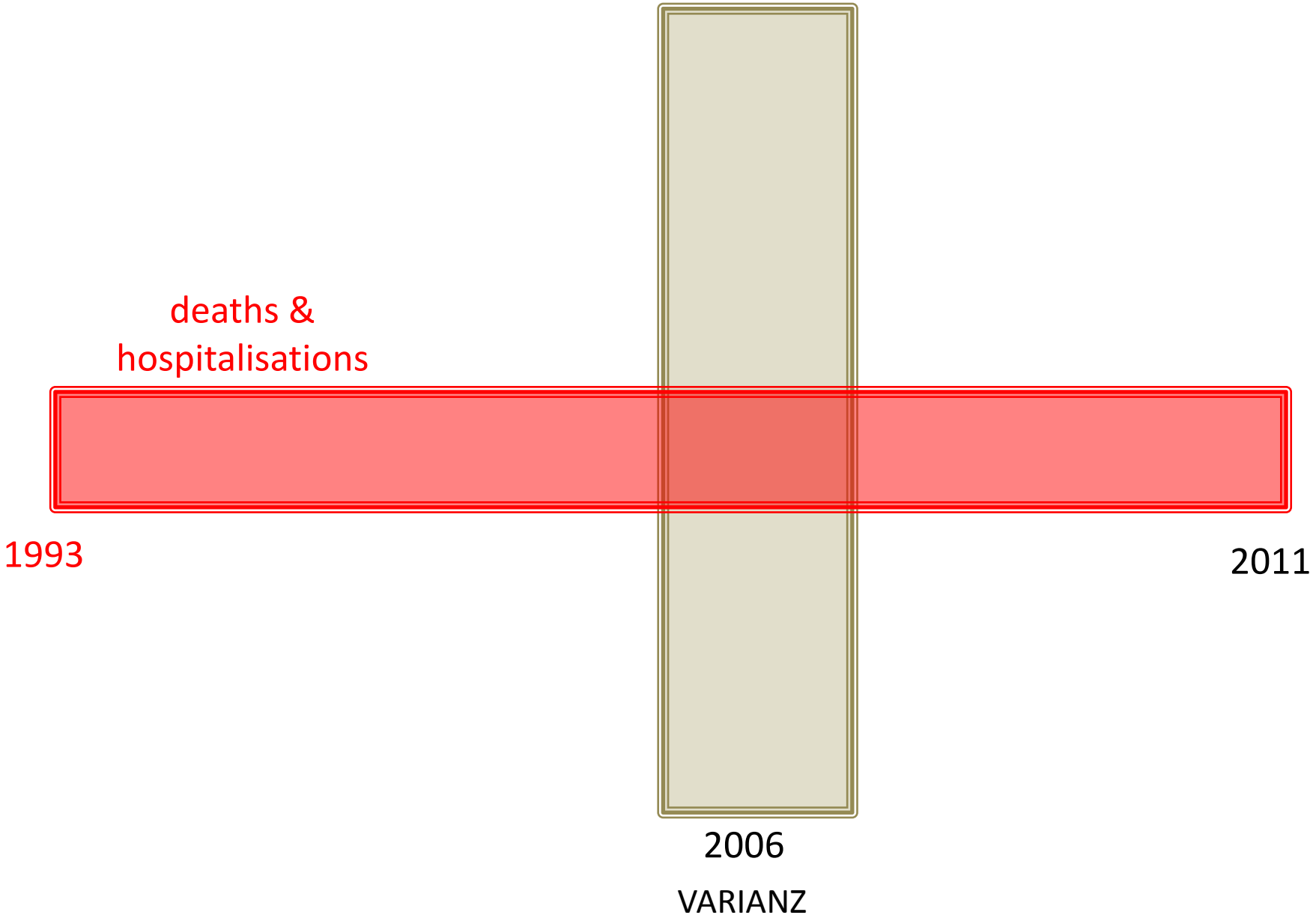
VARIANZ-2006: Vascular Risk In Adult New Zealanders-2006 Cohort

- includes: mortality, hospitalisations, drugs dispensed, community lab tests performed, Virtual diabetes register, PHO enrolments
- NHI linked records considered sufficiently complete since 2006
- Can be compared to 2006 Census

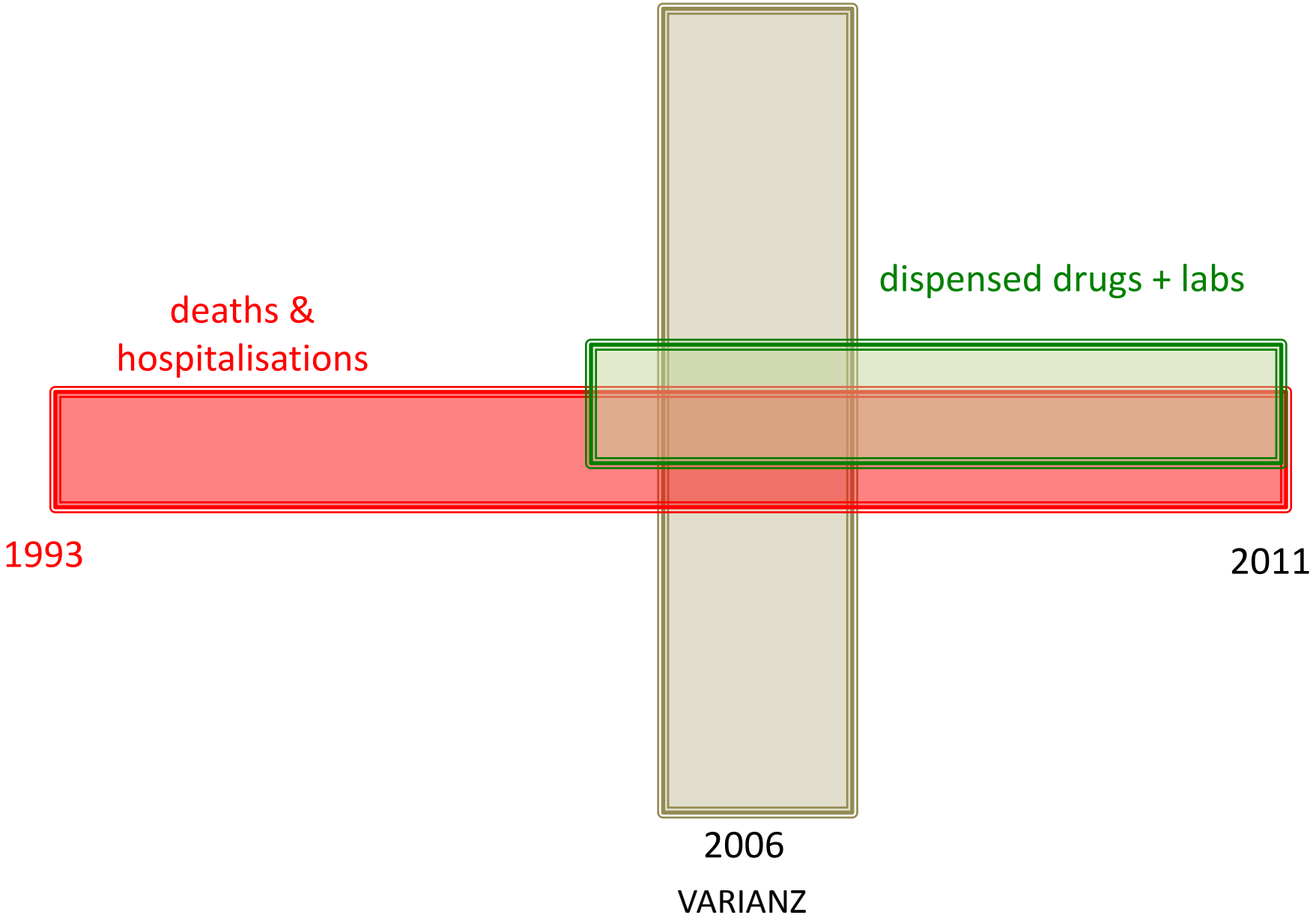


2006

VARIANZ-2006: for 5 year risk prediction



VARIANZ-2006: for 5 year risk prediction & risk management



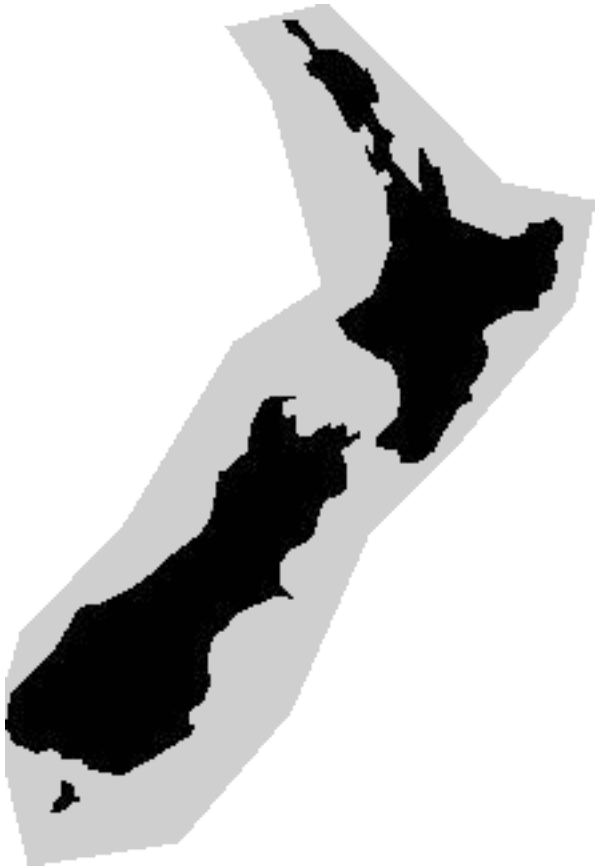
VARIANZ-2006 and the 2006 Census

Demographic	VARIANZ 2006 Population n(%)	2006 NZ Census Population n(%)	Difference n(% Census)
Total	2 543 577	2 982 720	439 143 (15%)
Male	1 140 283 (45%)	1 433 980 (48%)	293 697 (20%)
Female	1 403 155 (55%)	1 548 760 (52%)	145 605 (9%)
Age:			
20-34 years	652 170 (26%)	837 560 (28%)	185 390 (22%)
35-44 years	521 108 (20%)	635 050 (21%)	113 942 (18%)
45-54 years	486 247 (19%)	568 810 (19%)	82 563 (15%)
55-64 years	389 470 (15%)	429 670 (14%)	40 200 (9%)
65-74 years	263 268 (10%)	275 700 (9%)	12 432 (5%)
75-84 years	172 720 (7%)	177 780 (6%)	5 060 (3%)
85 years and over	58 594 (2%)	58 140 (2%)	-454 (0%)
Ethnicity:			
Māori	260 871 (10%)	343 050 (12%)	82 765 (24%)
Pacific	127 141 (5%)	147 740 (5%)	23 480 (16%)
Asian	160 188 (6%)	278 265 (9%)	121 483 (44%)
Chinese	56 325 (2%)	121 110 (4%)	65 738 (54%)
Indian	55 115 (2%)	80 609 (3%)	26 884 (33%)
Other	1 995 377 (79%)	2 213 280 (74%)	224 757 (10%)

2006 VARIANZ cohort by CVD history 35-74 years

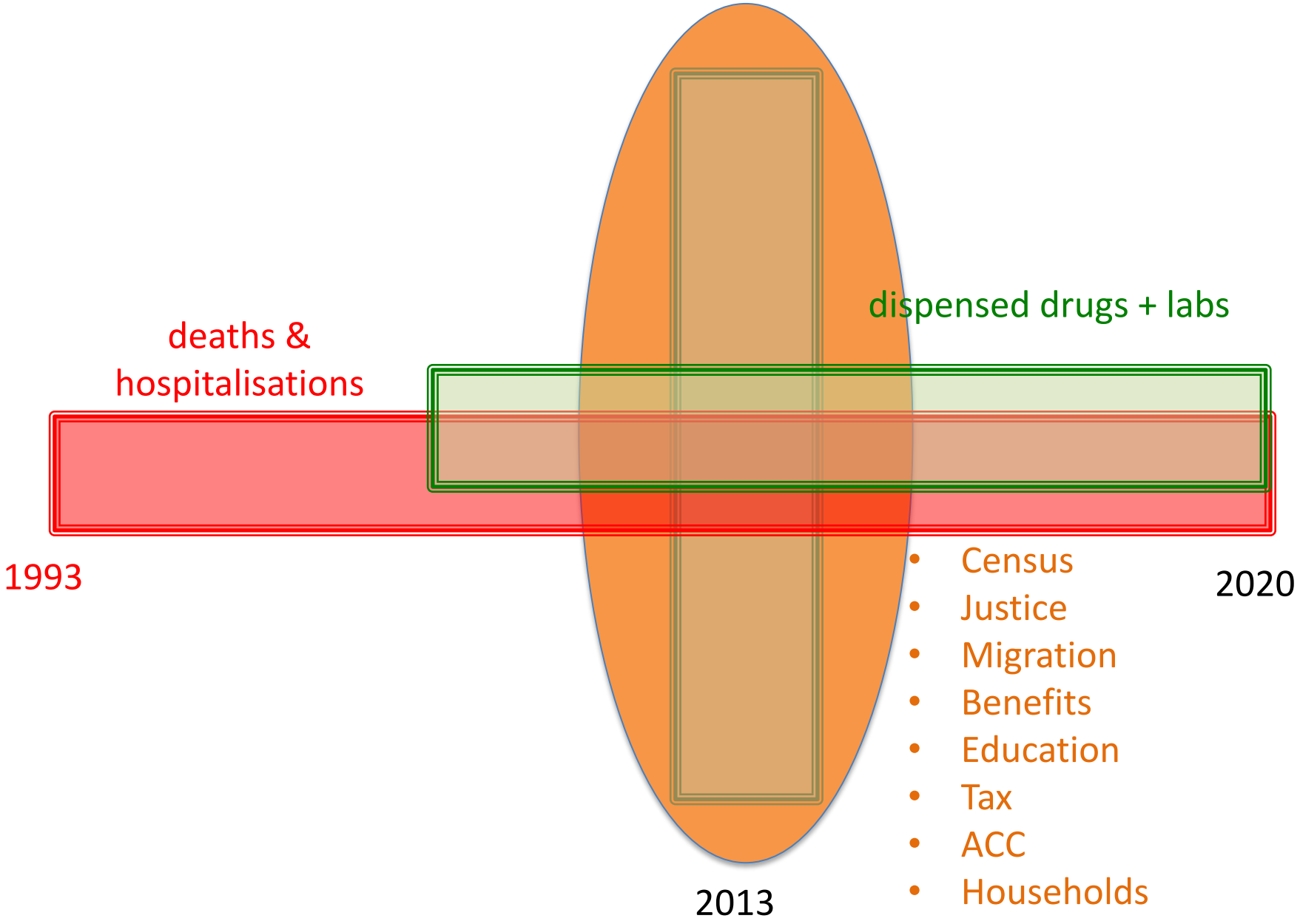
	No hx CVD	Hx CVD
Total (1,878,994)	**1,758,572**	**120,422**
AF	13,358 (1%)	17,172 (14%)
Diabetes	86,750 (5%)	26,161 (22%)
Lipid Lowering Rx	165,875 (9%)	72,254 (60%)
BP Lowering Rx	299,676 (17%)	86,285 (72%)
CVD events:5y f/u	65,239 (4%)	41,913 (35%)

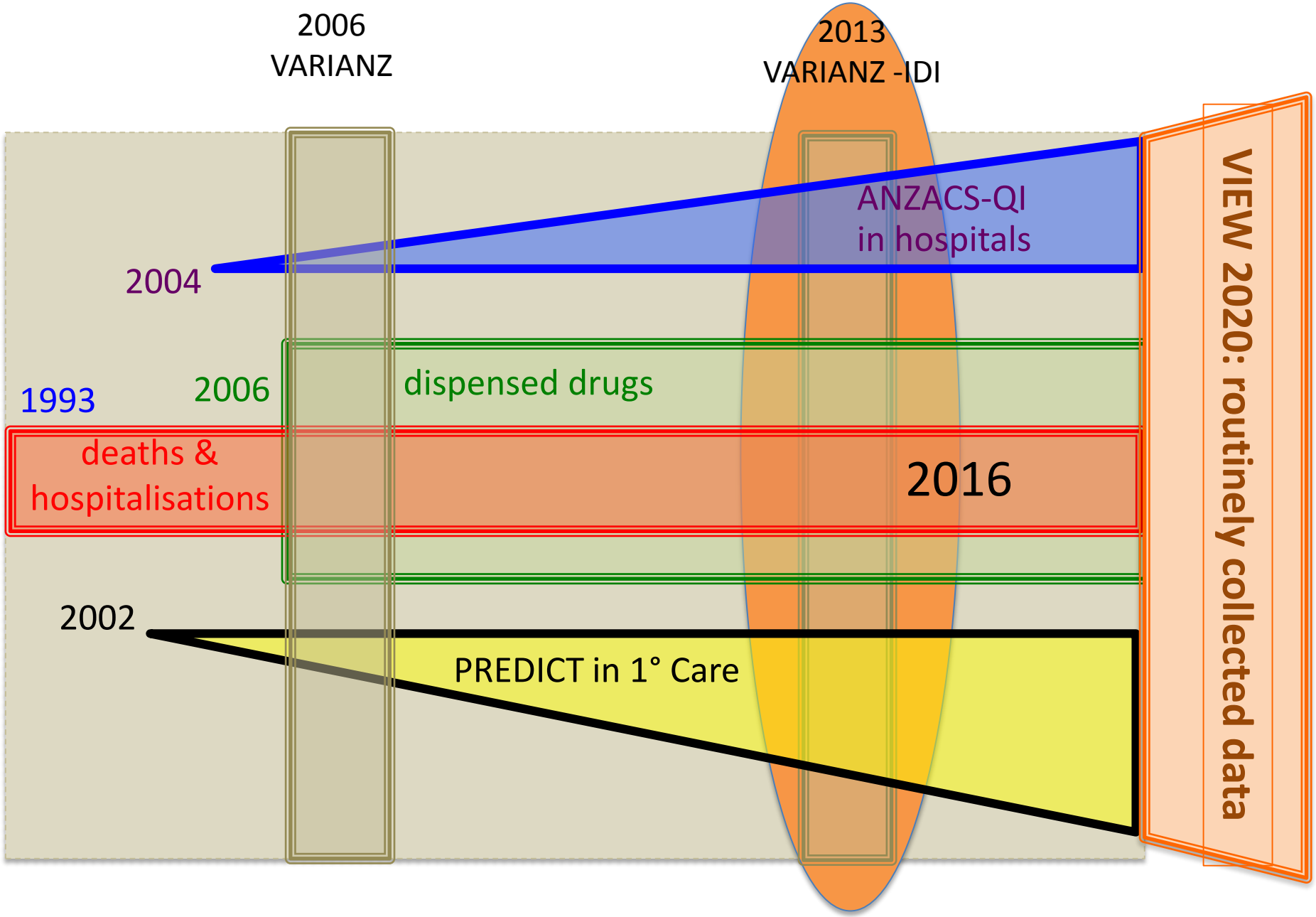
applying the VARIANZ-2006-11 risk score

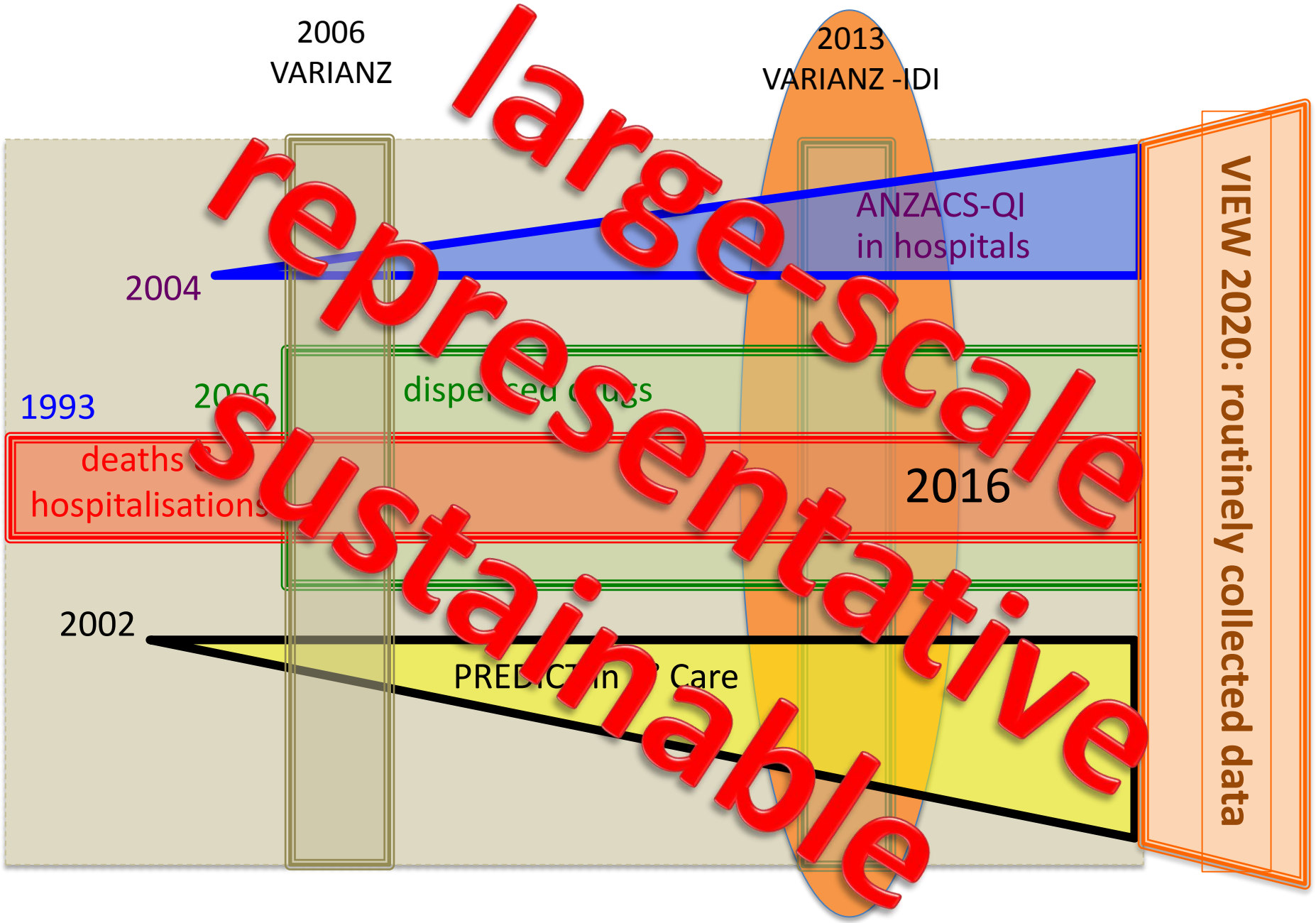


give every adult NZ’der a vascular risk score
only using routinely collected data

proposed VARIANZ IDI (Integrated Data Infrastructure) 2013/2018




2006
VARIANZ
2013
VARIANZ -IDI
ANZACS-QI
in hospitals
2004
1993
2006
dispensed drugs
deaths &
hospitalisations
2016
2002
PREDICT in 1° Care
VIEW 2020: routinely collected data


2006
VARIANZ
2013
VARIANZ -IDI
large-scale
representative
sustainable
ANZACS-QI
in hospitals
2004
1993
2006
dispensed drugs
deaths
hospitalisations
2016
2002
PREDICT
Care
VIEW 2020: routinely collected data