using big data to tackle inequalities in vascular diseases

Rod Jackson
Director VIEW research programme
University of Auckland
Mortality trends for all vascular disease: age 35-69 years, New Zealand (Aotearoa)

Male deaths from this cause at age 35-69 years in 2009:
- 1274 (30% of deaths at this age)
- 173 out of every 100 000 males at this age, a rate which was:
  - 36% less than in 2000 (rate: 271)
  - 77% less than in 1975 (rate: 755)
  - 76% less than in 1955 (rate: 711)

Female deaths from this cause at ages 35-69 years in 2009:
- 513 (17% of deaths at this age)
- 70 out of every 100 000 females at this age, a rate which was:
  - 41% less than in 2000 (rate: 119)
  - 79% less than in 1975 (rate: 335)
  - 84% less than in 1955 (rate: 441)
Age-standardised* IHD Death Rates in men aged 35–84yrs, by ethnic group, 2006-2015

Grey et al. NZMJ 2018 (accepted)
**VIEW2020**

**Vascular risk Informatics using Epidemiology & the Web**

**goal:** to reduce inequities in vascular disease outcomes

1. *improve accuracy of vascular risk prediction & target vascular risk management to highest risk people(s)*

2. *monitor trends in inequities in vascular disease risk, risk management & outcomes & provide feedback to clinicians, providers & policymakers*
VIEW 2020 research team

Leadership team:
Rod Jackson (non-Māori director)
Matire Harwood (Māori co-director)
Sue Wells, (Primary care lead)
Andrew Kerr (Secondary care lead)
Dan Exeter (Social determinants lead)
Katrina Poppe (Data ecosystem lead)

Research team:
Corina Grey (PhD student & Pacific lead),
Suneela Mehta (PhD student & South Asian lead),

Patricia Metcalf, Romana Pylypchuk, Jinfeng Zhao, Catherine Choi, Jeff Harrison, Jim Warren, Vicky Cameron, Arier Lee, Rob Doughty, Mark Gahegan
reduce inequities in vascular disease by better targeted management of high-risk people(s) & monitoring outcomes
1. improve accuracy of vascular risk prediction & target vascular risk management to highest risk people(s)
how accurate is a CVD risk prediction algorithm derived from a homogeneous cohort study of white Americans in the 1970s, when applied to a multi-ethnic & socio-economically diverse NZ population in the 21st century?
answering this question requires a large-scale cohort study: PREDICT
PREDICT was designed to:

- Facilitate CVD risk prediction to improve targeting of CVD risk management
& to simultaneously generate new evidence on CVD risk & management

- Electronic medical record
- PREDICT: electronic decision support
- NHI (encrypted)
- VIEW web server
- Patient-specific CVD risk factor profiles
& to simultaneously generate new evidence on CVD risk & management

Patient population

Electronic medical record

NHI

MoH server

PREDICT: electronic decision support

NHI (encrypted)

VIEW web server

patient-specific outcomes: hospital admissions, deaths

patient-specific CVD risk factor profiles
Patient population

Electronic medical record

PREDICT: electronic decision support

VIEW web server

NHI (encrypted)

from MoH to VIEW server

patient-specific outcomes: hospital admissions, deaths

patient-specific CVD risk factor profiles

& to simultaneously generate new evidence on CVD risk & management
& to simultaneously generate new evidence on CVD risk & management

Electronic medical record

Patient population

NHI

VIEW server

PREDICT: electronic decision support

NHI (encrypted)

VIEW web server

PREDICT Cohort Study

patient-specific outcomes: hospital admissions, deaths

patient-specific CVD risk factor profiles
Patient population

Electronic medical record

& to simultaneously generate new evidence on CVD risk & management

NHI

Framingham-based risk algorithm

NHI (encrypted)

patient-specific outcomes: hospital admissions, deaths

patient-specific CVD risk factor profiles

PREDICT: electronic decision support & to simultaneously generate new evidence on CVD risk & management

Electronic medical record

Patient population

Framingham-based risk algorithm

NHI (encrypted)
<table>
<thead>
<tr>
<th></th>
<th>Women</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants; n (% of total cohort)</td>
<td>175,699 (44%)</td>
<td>226,053 (56%)</td>
</tr>
<tr>
<td>Incident CVD events; n (% of sex-specific cohort)(^a)</td>
<td>5,650 (3.2%)</td>
<td>9,736 (4.3%)</td>
</tr>
<tr>
<td>Total person-years observed</td>
<td>743,640</td>
<td>941,881</td>
</tr>
<tr>
<td>Crude incidence of CVD (per 1000 per year)</td>
<td>7.6 (7.4, 7.8)</td>
<td>10.3 (10.1, 10.5)</td>
</tr>
<tr>
<td>Follow-up time in years; mean (SD)</td>
<td>4.2 (2.7)(^b)</td>
<td>4.2 (2.7)(^b)</td>
</tr>
<tr>
<td>People with follow up ≥5 years</td>
<td>58,493 (33%)</td>
<td>72,417 (32%)</td>
</tr>
<tr>
<td>Age in years; mean (SD)</td>
<td>56 (8.9)</td>
<td>51.8 (9.9)</td>
</tr>
</tbody>
</table>

**Self-identified ethnicity:**

<table>
<thead>
<tr>
<th></th>
<th>Women</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>European</td>
<td>96,032 (55%)</td>
<td>128,503 (57%)</td>
</tr>
<tr>
<td>Māori</td>
<td>23,853 (14%)</td>
<td>27,573 (12%)</td>
</tr>
<tr>
<td>Pacific</td>
<td>22,537 (13%)</td>
<td>28,073 (12%)</td>
</tr>
<tr>
<td>South Asian</td>
<td>14,188 (8%)</td>
<td>20,232 (9%)</td>
</tr>
<tr>
<td>Chinese/other Asian</td>
<td>19,089 (11%)</td>
<td>21,672 (10%)</td>
</tr>
</tbody>
</table>
## PREDICT cohort baseline characteristics

<table>
<thead>
<tr>
<th>NZ Deprivation quintile:</th>
<th>Women</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (least deprived)</td>
<td>38,523 (22%)</td>
<td>50,379 (22%)</td>
</tr>
<tr>
<td>2</td>
<td>34,230 (20%)</td>
<td>44,609 (20%)</td>
</tr>
<tr>
<td>3</td>
<td>31,808 (18%)</td>
<td>40,684 (18%)</td>
</tr>
<tr>
<td>4</td>
<td>32,626 (19%)</td>
<td>41,553 (18%)</td>
</tr>
<tr>
<td>5 (most deprived)</td>
<td>38,512 (22%)</td>
<td>48,828 (22%)</td>
</tr>
</tbody>
</table>

**Smoking:**

<table>
<thead>
<tr>
<th></th>
<th>Women</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never smoker</td>
<td>129,158 (74%)</td>
<td>149,139 (66%)</td>
</tr>
<tr>
<td>Ex-smoker</td>
<td>24,838 (14%)</td>
<td>39,856 (18%)</td>
</tr>
<tr>
<td>Current smoker</td>
<td>21,703 (12%)</td>
<td>37,058 (16%)</td>
</tr>
</tbody>
</table>

**Family history of premature CVD**

<table>
<thead>
<tr>
<th></th>
<th>Women</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>22,996 (13%)</td>
<td>24,495 (11%)</td>
<td></td>
</tr>
</tbody>
</table>

**Atrial fibrillation**

<table>
<thead>
<tr>
<th></th>
<th>Women</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,777 (1%)</td>
<td>3,680 (1.6%)</td>
<td></td>
</tr>
</tbody>
</table>
### Adjusted HRs: PREDICT models

<table>
<thead>
<tr>
<th></th>
<th>Adjusted hazards ratios (95% CI)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Women</td>
<td>Men</td>
<td></td>
</tr>
<tr>
<td>Age (per year)</td>
<td>1.08 (1.07, 1.08)</td>
<td>1.07 (1.07, 1.07)</td>
<td></td>
</tr>
<tr>
<td>Ethnicity:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>European</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Maori</td>
<td>1.48 (1.37, 1.60)</td>
<td>1.34 (1.26, 1.42)</td>
<td></td>
</tr>
<tr>
<td>Pacific</td>
<td>1.22 (1.12, 1.33)</td>
<td>1.19 (1.12, 1.27)</td>
<td></td>
</tr>
<tr>
<td>South Asian</td>
<td>1.13 (1.00, 1.27)</td>
<td>1.34 (1.24, 1.45)</td>
<td></td>
</tr>
<tr>
<td>Chinese/other Asian</td>
<td>0.75 (0.66, 0.85)</td>
<td>0.67 (0.61, 0.74)</td>
<td></td>
</tr>
<tr>
<td>NZ Deprivation quintile (per 1 quintile)</td>
<td>1.11 (1.09, 1.14)</td>
<td>1.08 (1.07, 1.10)</td>
<td></td>
</tr>
<tr>
<td>Smoking:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-smoker</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Ex-smoker</td>
<td>1.09 (1.01, 1.18)</td>
<td>1.08 (1.02, 1.14)</td>
<td></td>
</tr>
<tr>
<td>Smoker</td>
<td>1.86 (1.73, 2.00)</td>
<td>1.66 (1.57, 1.75)</td>
<td></td>
</tr>
</tbody>
</table>
Framingham predicted 5-year risk versus observed 5-year risk in PREDICT cohort
PREDICT predicted 5-year risk versus in observed 5-year risk in PREDICT cohort
2. monitor trends in inequities in vascular disease risk, risk management & outcomes & provide feedback to clinicians, providers & policymakers
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age 35-69 years, New Zealand (Aotearoa)

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  - 84% less than in 1955 (rate: 441)

Created: 17 May 2013, 4:34 pm
Males & females, ages 35-69 years
Vascular diseases
New Zealand

www.mortality-trends.org
creating national cohorts:
VARIANZ
(Health Service Utilisation cohorts)
National mortality database
National hospitalisation database
National drug dispensing database
National PHO enrolment database
Regional laboratory (TestSafe) database
National Virtual diabetes register

linked
by e-NHI

PREDICT
web-based platform in primary care
National mortality database

National hospitalisation database

National drug dispensing database

National PHO enrolment database

Regional laboratory (TestSafe) database

National Virtual diabetes register

linked

web-based platform in hospitals

by e-NHI

ANZACS-QI
linked

National mortality database

National hospitalisation database

National Virtual diabetes register

Regional laboratory (TestSafe) database

National drug dispensing database

National PHO enrolment database

routine health databases

by e-NHI
VARIANZ (VAascular Risk In Adult NZ’ders)

linked by e-NHI

- National mortality database
- National hospitalisation database
- National Virtual diabetes register
- Regional laboratory (TestSafe) database
- National drug dispensing database
- National PHO enrolment database
Age-standardised IHD Death Rates in women & men aged 35–84y, by prior IHD status, 2005–2015

Grey et al. Heart 2018; 104:51–7
Age-standardised* IHD Death Rates in men aged 35–84yrs, by ethnic group, 2006–2015

Grey et al. NZMJ 2018 (accepted)
Age-standardised* IHD Death Rates in women (L) & men (R) aged 35–84y, by NZ Dep, 2006–2015
Effect of age, gender, ethnicity, socioeconomic status and region on dispensing of CVD secondary prevention medication in New Zealand: The Atlas of Health Care Variation CVD cohort (VIEW-1)

Andrew Kerr, Dan Exeter, Grant Hanham, Corina Grey, Jinfeng Zhao, Tania Riddell, Mildred Lee, Rod Jackson, Sue Wells
Adequate maintenance of triple therapy
Development and validation of alternative cardiovascular risk-prediction equations for population health planning: a routine health data linkage study of 1.7 million New Zealanders

Suneela Mehta, Rod Jackson, Romana Pylypchuk, Sue Wells & Andrew Kerr
VARIANZ predicted 5-year risk versus in observed 5-year risk in VARIANZ cohort
National mortality database
National hospitalisation database
National drug dispensing database
National PHO enrolment database
Regional laboratory (TestSafe) database
Census databases
Arrival/departure databases
Education databases
Taxation databases
Social services databases
Justice databases
National Virtual diabetes register

linked

VARIANZ-IDI

by e-NHI
Constructing whole of population cohorts for health and social research using the New Zealand Integrated Data Infrastructure

Jinfeng Zhao,¹ Sheree Gibb,² Rod Jackson,¹ Suneela Mehta¹ and Daniel J. Exeter¹

_Aust NZ J Public Health._ 2018; Online; doi: 10.1111/1753-6405.12781
<table>
<thead>
<tr>
<th>Distribution</th>
<th>IDI (N)</th>
<th>IDI (%)</th>
<th>HSU (N)</th>
<th>HSU (%)</th>
<th>Census (N)</th>
<th>Census (%)</th>
<th>IDI-HSU (%)</th>
<th>IDI-Census (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>4,414,287</td>
<td>100</td>
<td>4,266,789</td>
<td>100</td>
<td>4,242,051</td>
<td>100</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>2,172,804</td>
<td>49</td>
<td>2,063,709</td>
<td>48</td>
<td>2,064,018</td>
<td>49</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Female</td>
<td>2,241,483</td>
<td>51</td>
<td>2,202,120</td>
<td>52</td>
<td>2,178,030</td>
<td>51</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Prioritised ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Māori</td>
<td>700,941</td>
<td>16</td>
<td>551,895</td>
<td>13</td>
<td>598,602</td>
<td>14</td>
<td>21</td>
<td>15</td>
</tr>
<tr>
<td>Pacific</td>
<td>288,249</td>
<td>7</td>
<td>274,005</td>
<td>6</td>
<td>244,158</td>
<td>6</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Asian</td>
<td>482,670</td>
<td>11</td>
<td>354,516</td>
<td>8</td>
<td>457,167</td>
<td>11</td>
<td>27</td>
<td>5</td>
</tr>
<tr>
<td>Indian</td>
<td>163,287</td>
<td>4</td>
<td>113,412</td>
<td>3</td>
<td>151,809</td>
<td>4</td>
<td>31</td>
<td>7</td>
</tr>
<tr>
<td>Chinese</td>
<td>157,872</td>
<td>4</td>
<td>120,465</td>
<td>3</td>
<td>161,769</td>
<td>4</td>
<td>24</td>
<td>-2</td>
</tr>
<tr>
<td>Other Asian</td>
<td>161,508</td>
<td>4</td>
<td>120,642</td>
<td>3</td>
<td>143,589</td>
<td>3</td>
<td>25</td>
<td>11</td>
</tr>
<tr>
<td>All Other</td>
<td>2,942,430</td>
<td>67</td>
<td>3,086,376</td>
<td>72</td>
<td>2,711,472</td>
<td>64</td>
<td>-5</td>
<td>8</td>
</tr>
</tbody>
</table>
reduce inequities in vascular disease by better targeted management of high-risk people(s) & monitoring outcomes
thank you