Avoidable mortality in old age

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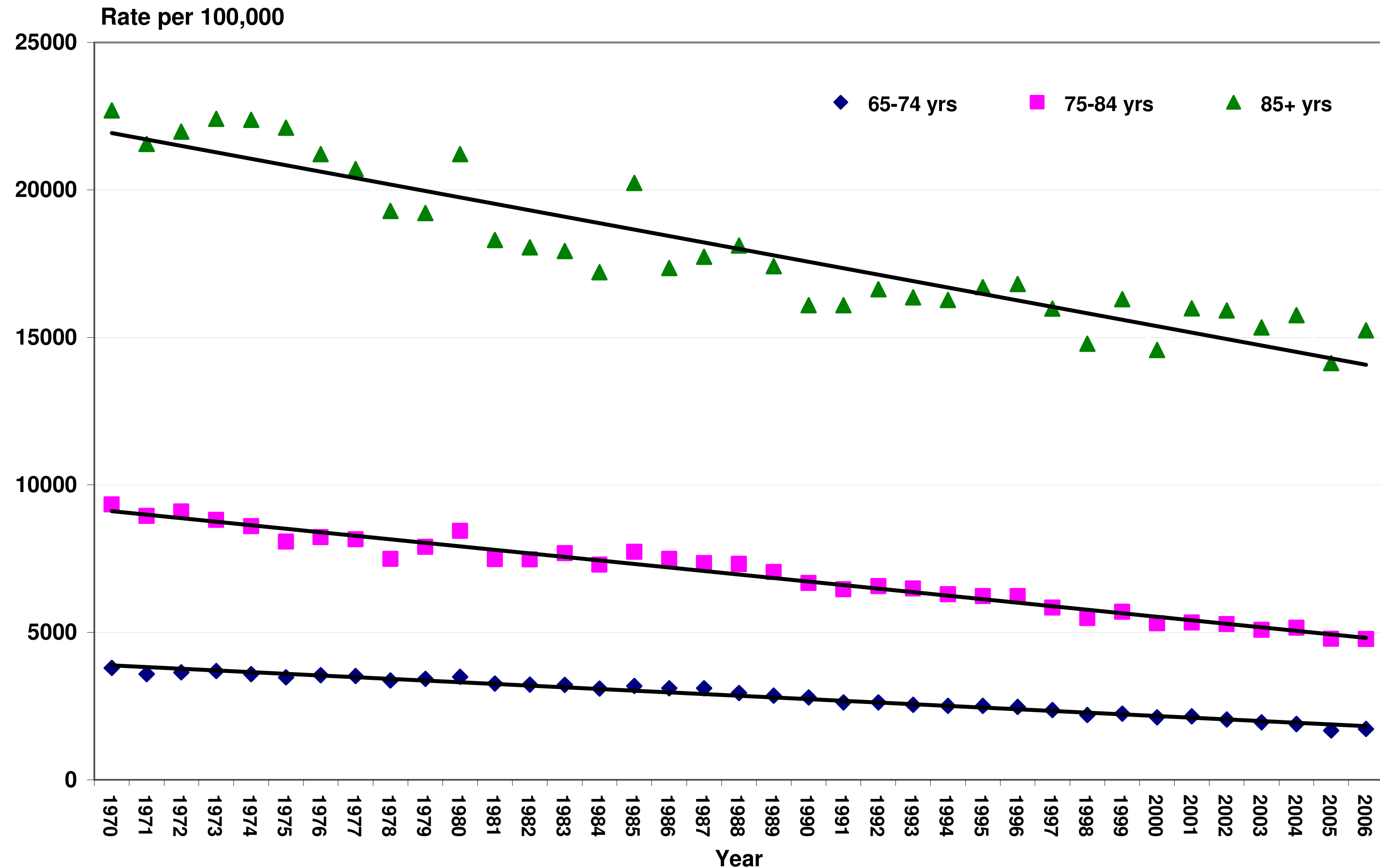
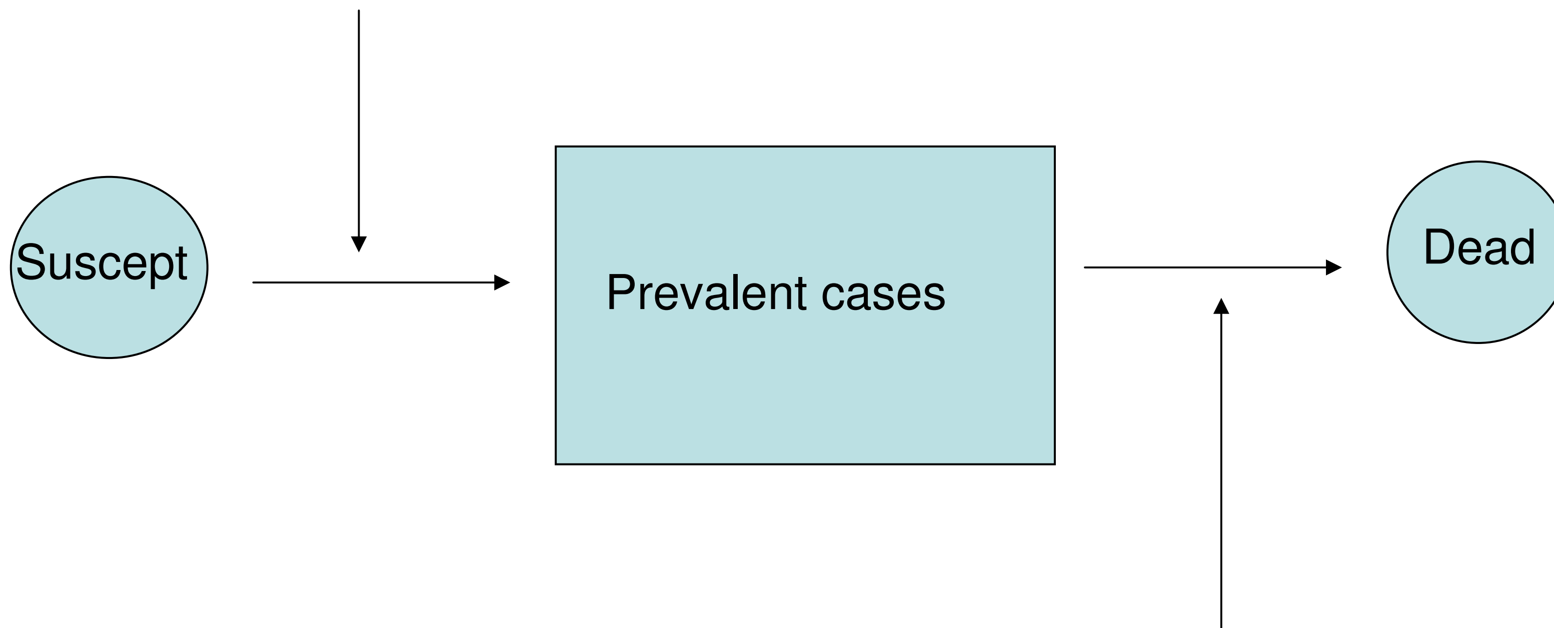
Trends in all cause mortality, New Zealand



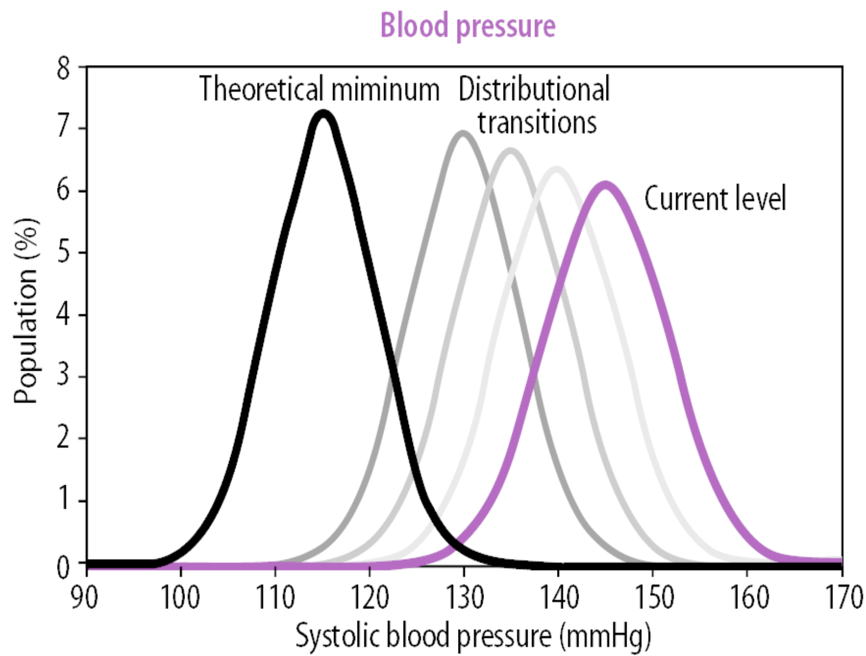
How can deaths in old age be avoided?

Incidence reduction ("preventable" mortality)



Case fatality reduction ("amenable" mortality)

Preventable mortality: concept



$$PIF = \frac{\int_{x=0}^{m} RR(x)P(x) - \int_{x=0}^{m} RR(x)P'(x)}{\int_{x=0}^{m} RR(x)P(x)}$$

$$PAF = 1 - \prod_{i=1}^{n} (1 - PAF_i)$$

Preventable mortality: attributable versus preventable mortality

- Attributable mortality:

  PAF (TMD) x current total mortality

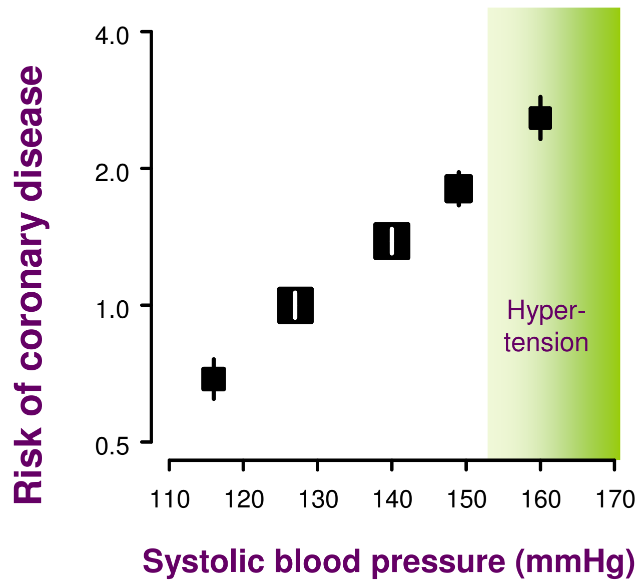
- Preventable mortality:

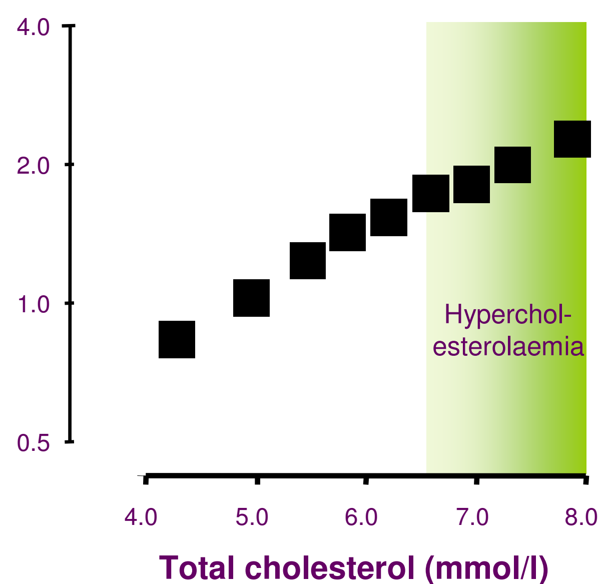
  PAF (EPID) x projected total mortality

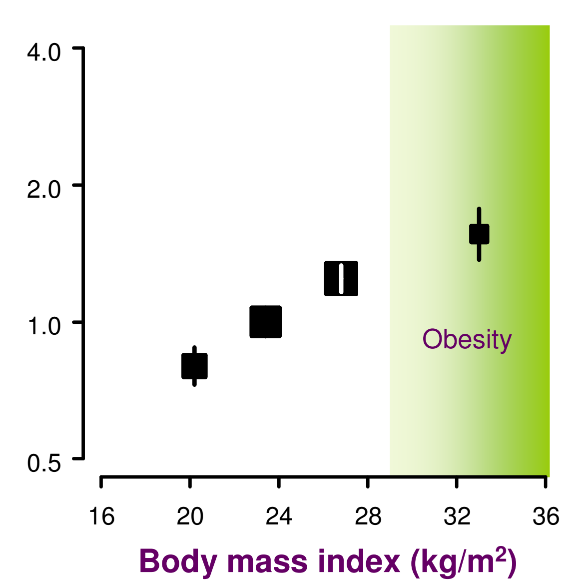
Preventable mortality: data requirements

- Population risk factor distribution (prevalence)
- Counterfactual risk factor distribution (TMD, EPID)
- Hazard function (for all cause or by cause mortality)
- Total all cause or by cause mortality (in age group)
  (current and projected)

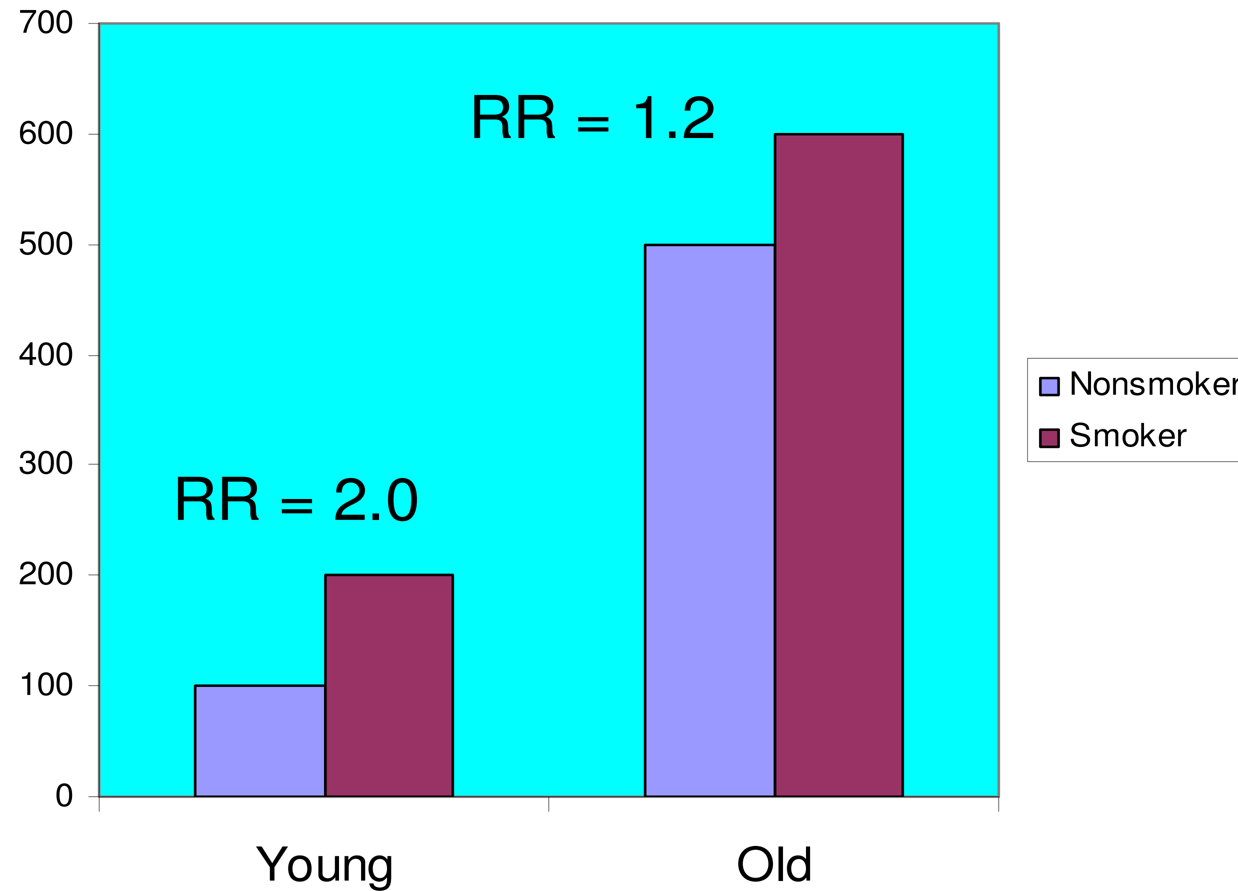
Preventable mortality: hazard functions







Preventable mortality: Why are RRs lower in older than younger adults?



Preventable mortality: mortality attributable to cardiovascular risk factors in New Zealand

SBP		Attributable fraction		Avoidable fraction	
		65-74	**75+**	**65-74**	**75+**
Coronary	**male**	49%	29%	5%	3%
	female	54%	35%	6%	3%
Stroke	**male**	48%	42%	5%	4%
	female	53%	50%	6%	6%

TMD for SBP = 115 mmHg ± 6 mmHg

Attributable fraction for 2006

Avoidable fraction for 2011

Lag = 5 years (2 for risk reversal, 3 for implementation of intervention)

EPID = 16% shift towards TMD (corresponds to a mean decrease of 0.5 mmHg in young adults but 2-3 mmHg in older people)

Amenable mortality: concept

- Deaths that should not have occurred given available health care interventions

- “Untimely and unnecessary deaths, whose occurrence is a warning signal, a sentinel health event, [indicating] that the quality of care might need to be improved”

- “Deaths from those conditions for which variation in mortality rates (over time or across populations) reflects variation in effective coverage of health care”

The ‘Amenable Mortality’ construct: conceptual clarification

- Expert panel
- Selection criteria
- Cross mapping of widely used current lists
- Filtering of consolidated candidate conditions using selection criteria
- Review of draft list by expert panel

Amenable mortality construct: setting the boundary of the health system

- Health system cannot be held accountable for actions of other social systems
- Useful to distinguish preventable from amenable mortality
- So narrow boundary appropriate – health *care* system only
- Intersectoral or population-level interventions not eligible

Amenable mortality construct: explicit identification of intervention

- Amenability is a property of a condition – intervention pair, not of a condition per se
- Necessary to explicitly identify the ‘key’ intervention for each candidate condition
- Sometimes package of interventions rather than single ‘key’ intervention

Amenable mortality construct:
categorical attribution or counterfactual modelling?

- Categorical attribution implies simplistic notion of causality
- Yet this is the method used to assign COD in the first place (rule based ‘all or nothing’ ICD coding)
- So reasonable to use same logic to further classify COD as amenable or nonamenable
- Differs from counterfactual modelling approach used for preventable mortality
- Note that amenable mortality has property of additive decomposition whereas preventable mortality does not

Amenable mortality construct: lag period

- Amenable mortality intended to serve as indicator of *current*, not future, health system performance
- So lag period must be short (intervention must act quickly)
- Arbitrary threshold of 5 years selected, in keeping with use of 5 year relative survival to define a ‘cure’ in cancer epidemiology
- Most long lag period interventions are intersectoral or population-level interventions anyway

Amenable mortality construct: lead period

- Amenable mortality intended to serve as indicator of *current*, not past, health system performance

- So lead period must be short – only recently introduced interventions should be included

- Arbitrary threshold of 40 years selected (to allow time for dissemination / incremental improvement – “effective coverage”)

- Threshold doesn’t matter much because of ‘rare cause of death’ criterion

Amenable mortality construct: rare causes of death

- Need to avoid clutttering the list with conditions that are ‘avoided’ rather than ‘avoidable’
- Arbitrary threshold: condition must account for >0.1% of all eligible deaths at end of observation period

Amenable mortality construct: extent of mortality reduction

- Evidence of effectiveness must be based on RCTs or major cohort studies
- However, poor state of evidence means that few condition- intervention pairs would make it through this filter if effectiveness threshold set too high eg 50%
- Arbitrary decision made to set the threshold at 30% so as to provide a more comprehensive indicator of health system performance
- 30% threshold does not mean that mortality from the condition must have decreased by >30% over the observation period (because incidence may have increased)

Amenable mortality construct: upper age limit

- Traditionally, deaths at older ages (65+) have been considered ineligible – although in recent years threshold of 75 has been used

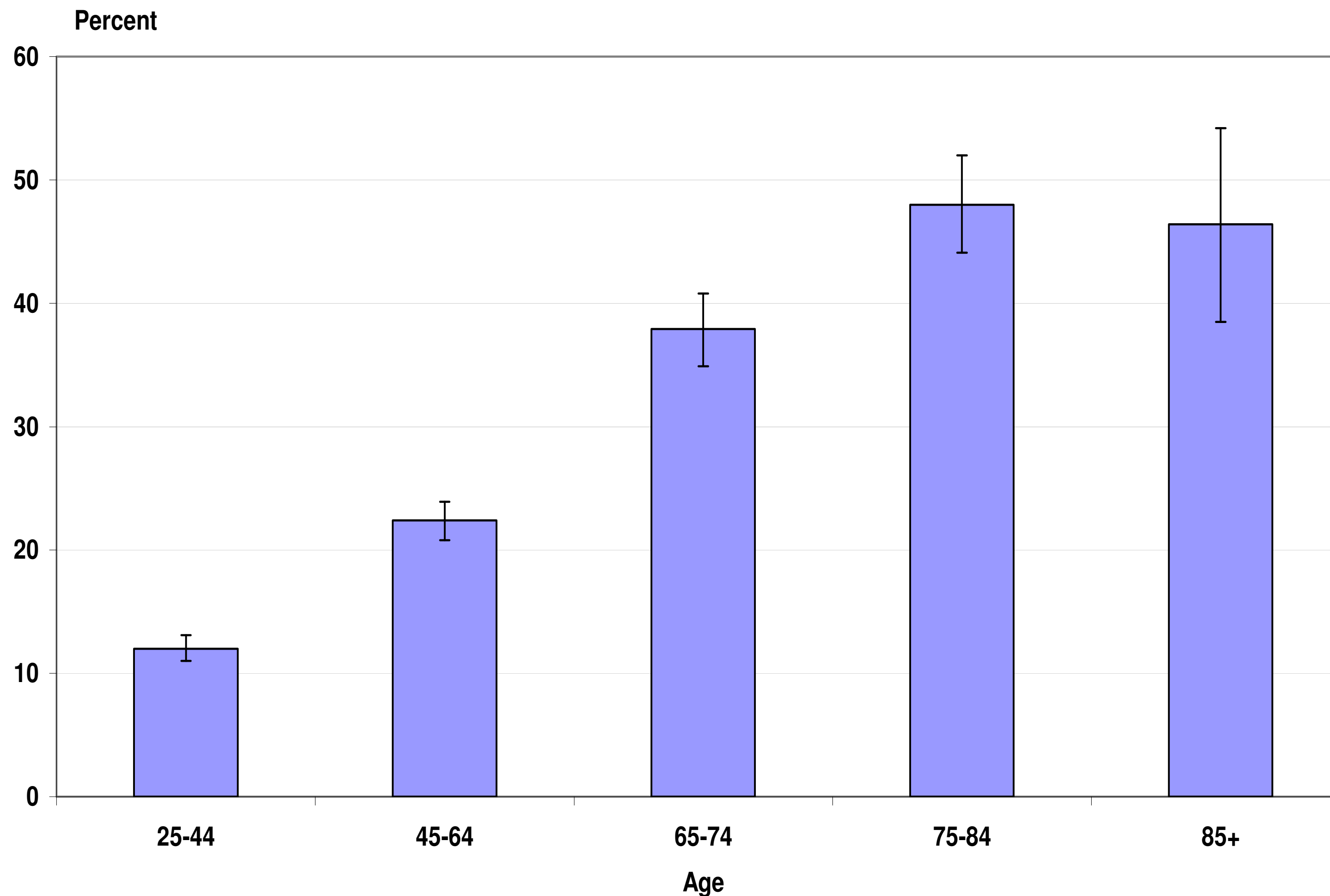
- Epidemiological argument – age limit ageist and also unnecessary once explicit effectiveness criterion (>30%) applied (lack of RCTs will exclude older people anyway)

- Policy argument – political impact greater if deaths seen to be *both* unnecessary *and* untimely ("premature" death – fair innings argument)

- Technical argument – COD assignment and coding problematic for deaths at older ages because of comorbidity

- Plus lower quality diagnosis, COD assignment and coding for deaths at older ages independent of comorbidity

Amenable mortality : assigning COD in the face of co-morbidity



Amenable mortality construct: upper age limit

- If argument for upper age limit accepted, what should this threshold be?
- If meant to reflect life expectancy, should it be higher for females than males (eg 80 for males and 85 for females)?
- If based on ‘fair innings’ argument, should it be 85 rather than 75, at least in HICs?
- For the time being we have retained the arbitrary threshold of 75 years (ie only deaths at ages 0-74 years are eligible) – so limiting usefulness of the indicator wrt older age groups

Amenable mortality:
How to set the upper age limit?

- Current period or cohort life expectancy

- Model lifetable

- Fixed limit - <85 for high income countries
  <75 as a global compromise

Amenable mortality: the concept clarified

- Amenable mortality defined by a list of condition – intervention pairs applied to deaths under age 75 years ('premature' deaths)
- To be included on the list, the 'key' intervention must be specified and shown (by RCTs or observational studies) to be capable of reducing mortality from the linked condition by >30% within 5 years of effective coverage
- Furthermore, the intervention must have been introduced within the past 40 years, and the condition must still account for >0.1% of all under 75 deaths
- Note that codelist will require updating every decade or so – which makes time series problematic

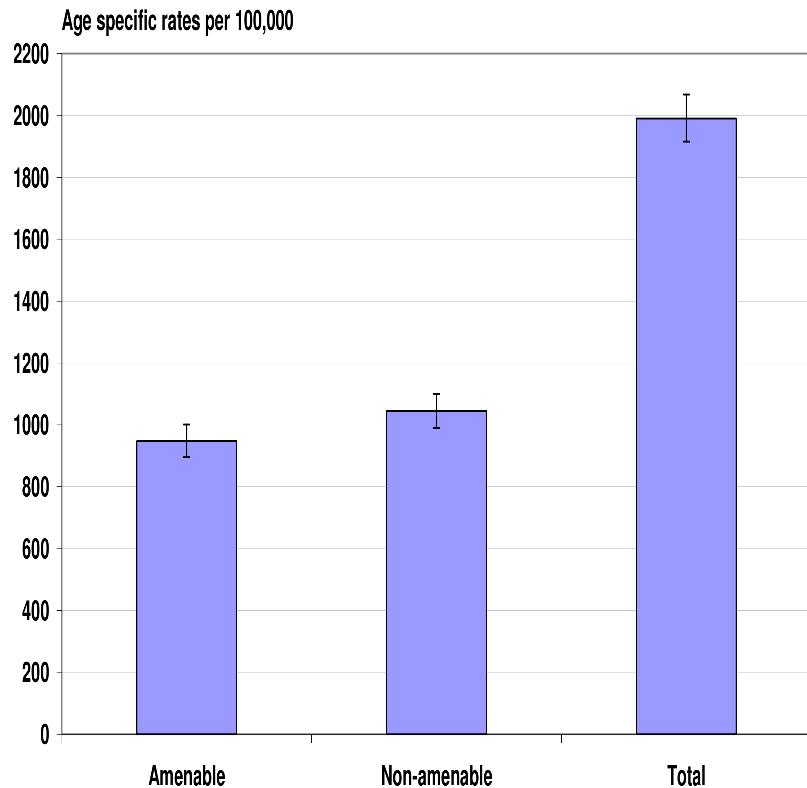
Amenable mortality: current codeset

Group	Condition	ICD-9	ICD-10
CVD & diabetes	Diabetes	250	E10-E14
	Valvular heart disease	391, 394-398, 421.0, 424	I01, I05-I09, I33-I37
	Hypertensive diseases	402-403	I10-I15
	Coronary disease	410-414	I20-I25
	Heart failure	429	I50
	Cerebrovascular diseases	430-438	I60-I69
Other chronic disorders	Renal failure	584-585	N17-N18
	Pulmonary embolism	453	I26
	COPD	491	J42
	Asthma	493	J45-J46
	Peptic ulcer disease	531-532	K25-K26
	Cholelithiasis	574	K80
Injuries	Suicide	E950-E959	X60 –X84
	Road traffic accidents	E812, E814-E815	V01-V79, V87, V89, V99
	Falls (#NOF)	E820	S72
	Burns	E940-E949	T20-T31
	Adverse health care events (subset)	E870-E876	T80-T88

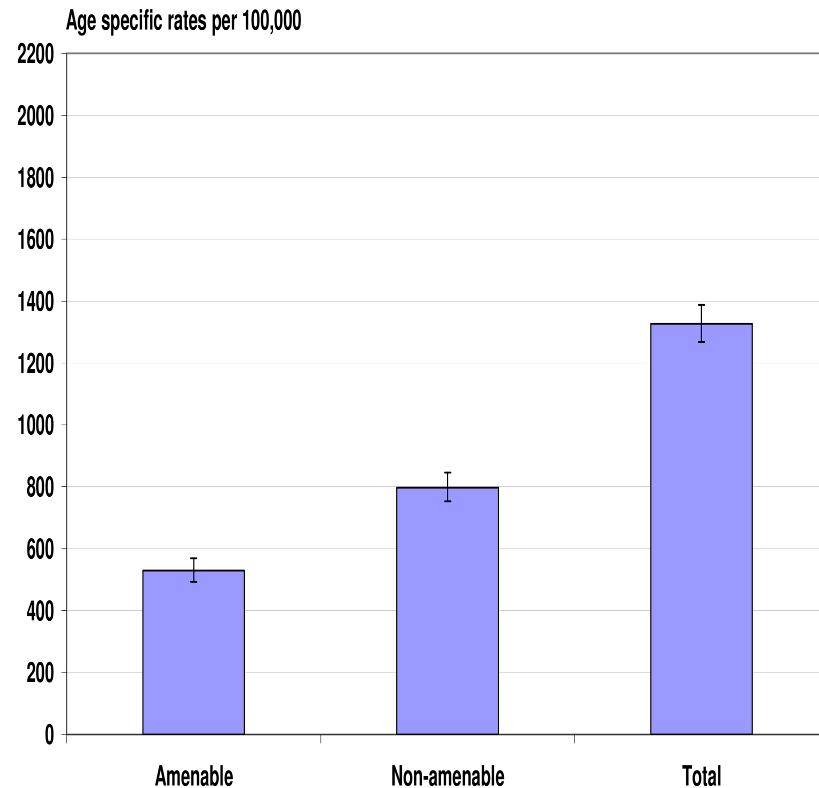
Group		Condition	ICD-9	ICD-10
Infections		Pulmonary tuberculosis	11	A15
		Meningococcal disease	036	A39
		Pneumococcal disease	481, 038.2, 320.1	J13, A40.3, G00.1
		HIV/AIDS	042	B20-B24
Cancers		Stomach	151	C16
		Rectum	154	C19-C21
		Melanoma	172	C43
		Female breast	174	C50
		Cervix	180	C53
		Testis	186	C62
		Prostate	185	C61
		Thyroid	193	C73
		Bone & cartilage	170	C40-C41
		Hodgkins	201	C81
		Acute lymphocytic leukemia	204.0	C91.0

Amenable mortality in 65-74 year olds: New Zealand 2006

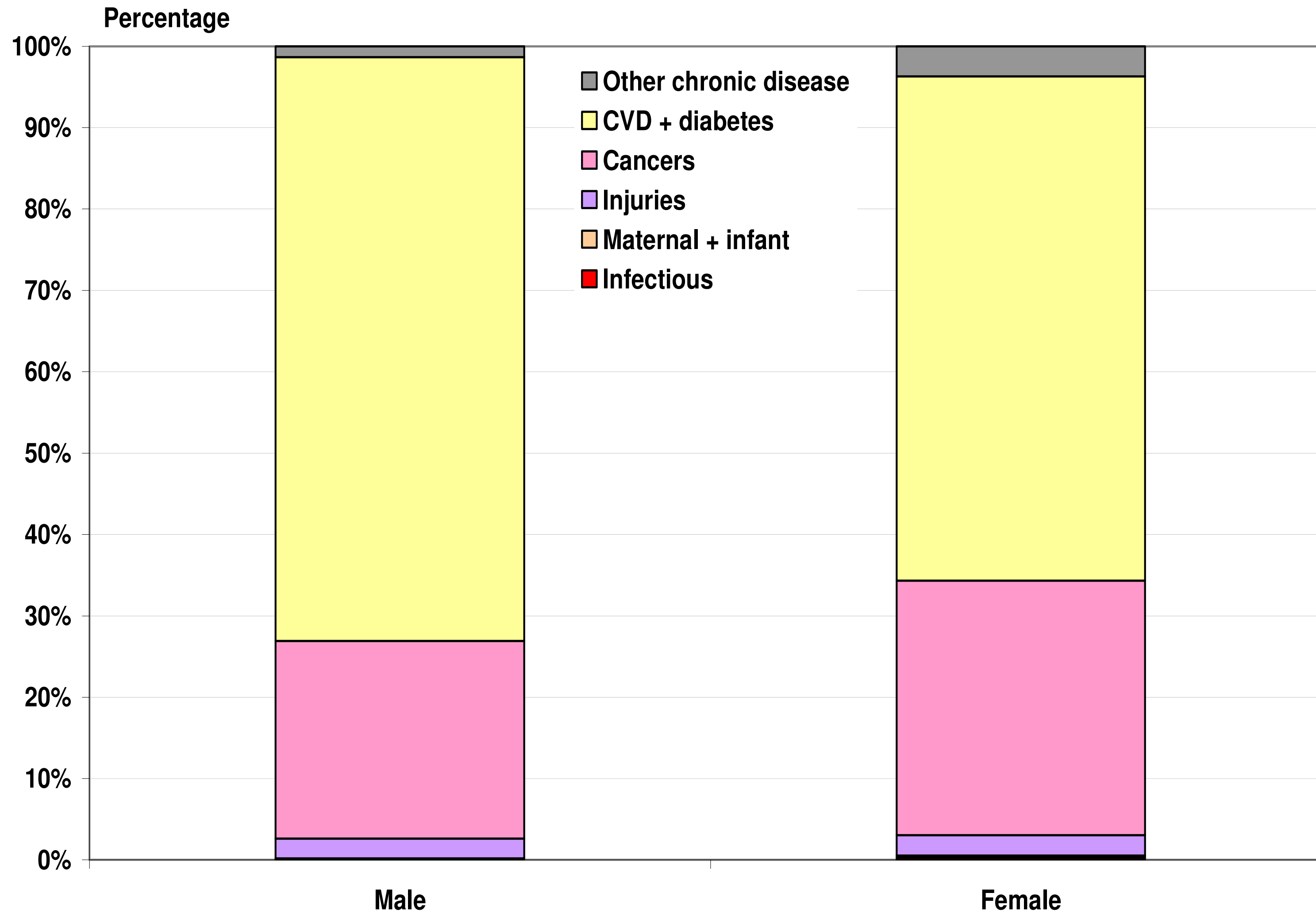
Males



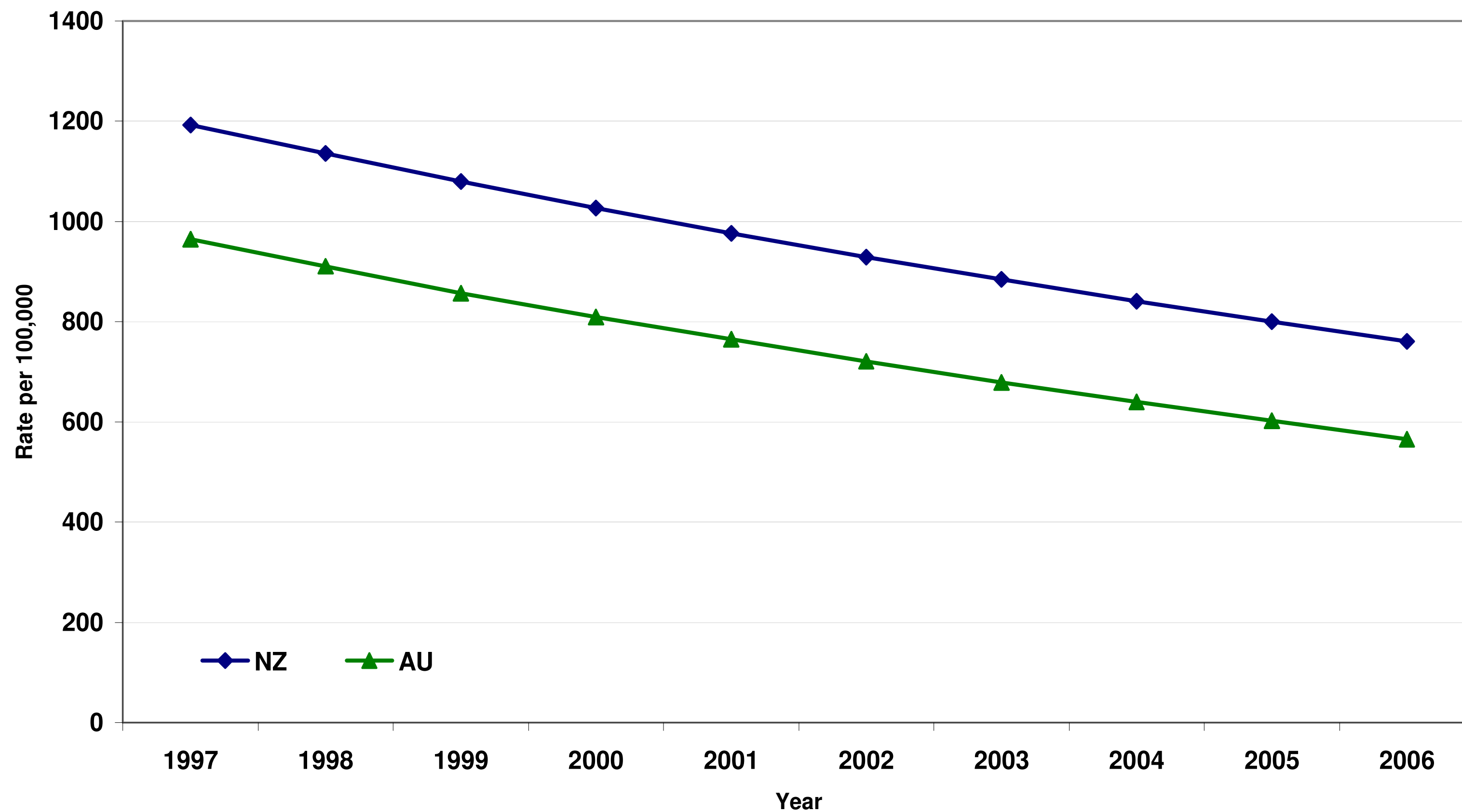
Females



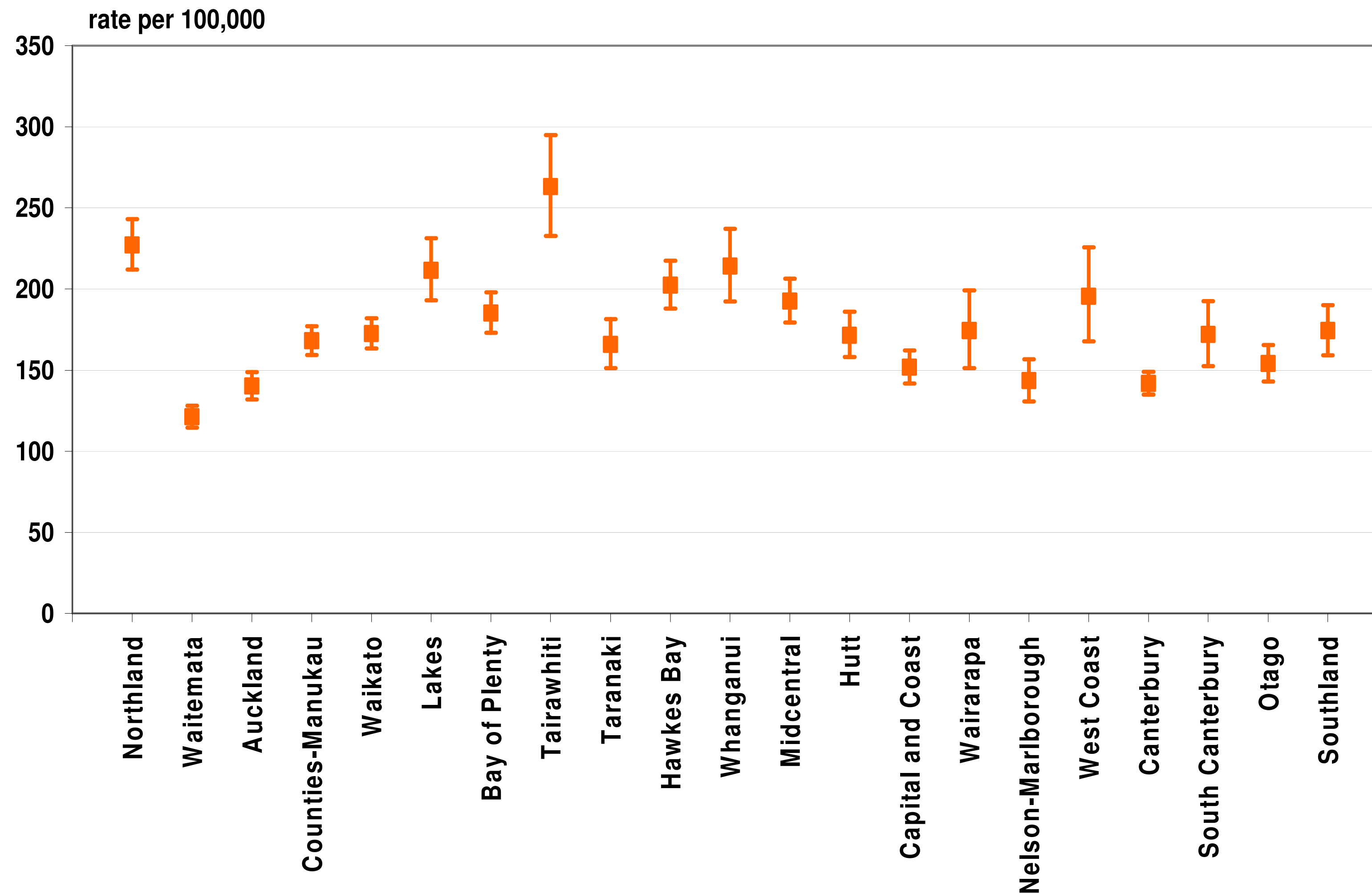
Amenable mortality: causal structure at age 65-74, New Zealand 2006



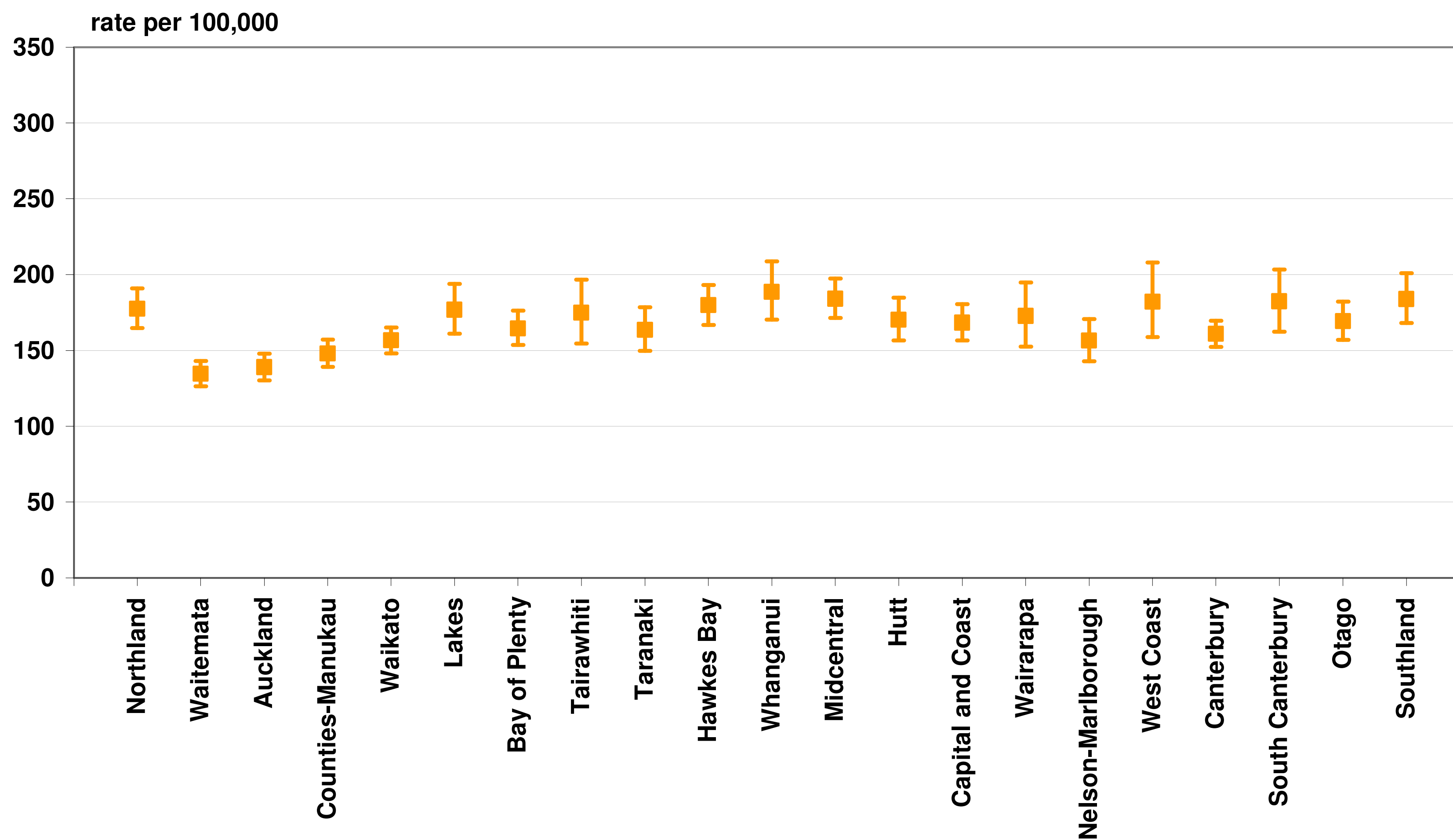
Amenable mortality in old age: trans Tasman comparison, 1997-2006



Amenable mortality :NZ health districts, 2006 (age and sex adjusted)



Amenable mortality :NZ health districts, 2006 (age, sex, ethnicity and deprivation adjusted)



Measuring avoidable mortality at older ages in low/mid income countries

- Preventable mortality
  - identify key risk / protective factors
  - monitor prevalences via survey
  - use hazard ratios for all cause mortality (from WHO)
  - mortality projections from national statistical office
  - run policy-relevant intervention scenarios (with sensitivity analysis)

Measuring avoidable mortality at older ages in low/mid income countries

- Amenable deaths
  - restrict to <75 yrs of age ?
  - adopt 'NZ' definition & codelist ?
  - assess whether COD coding quality sufficient (redistribute garbage codes) ?

- Reality is that poor quality COD data, and current lack of standardisation of the metric, may limit usefulness of this indicator in the short term

Does the ‘amenable mortality’ construct translate well for older ages?

- Traditionally, older people have been excluded
- Yet data quality (COD assignment and coding) has improved in recent years, as has evidence for effectiveness of interventions in older people
- Co-morbidity could (possibly) be dealt with by multiple COD coding (followed by appropriate statistical analysis), so better estimating contribution of different diseases to old age mortality
- At present, more an area for further research than routine monitoring – especially wrt 85+ age group
- Extension of upper age limit to 85 yrs, or dropping it altogether, warrants serious consideration