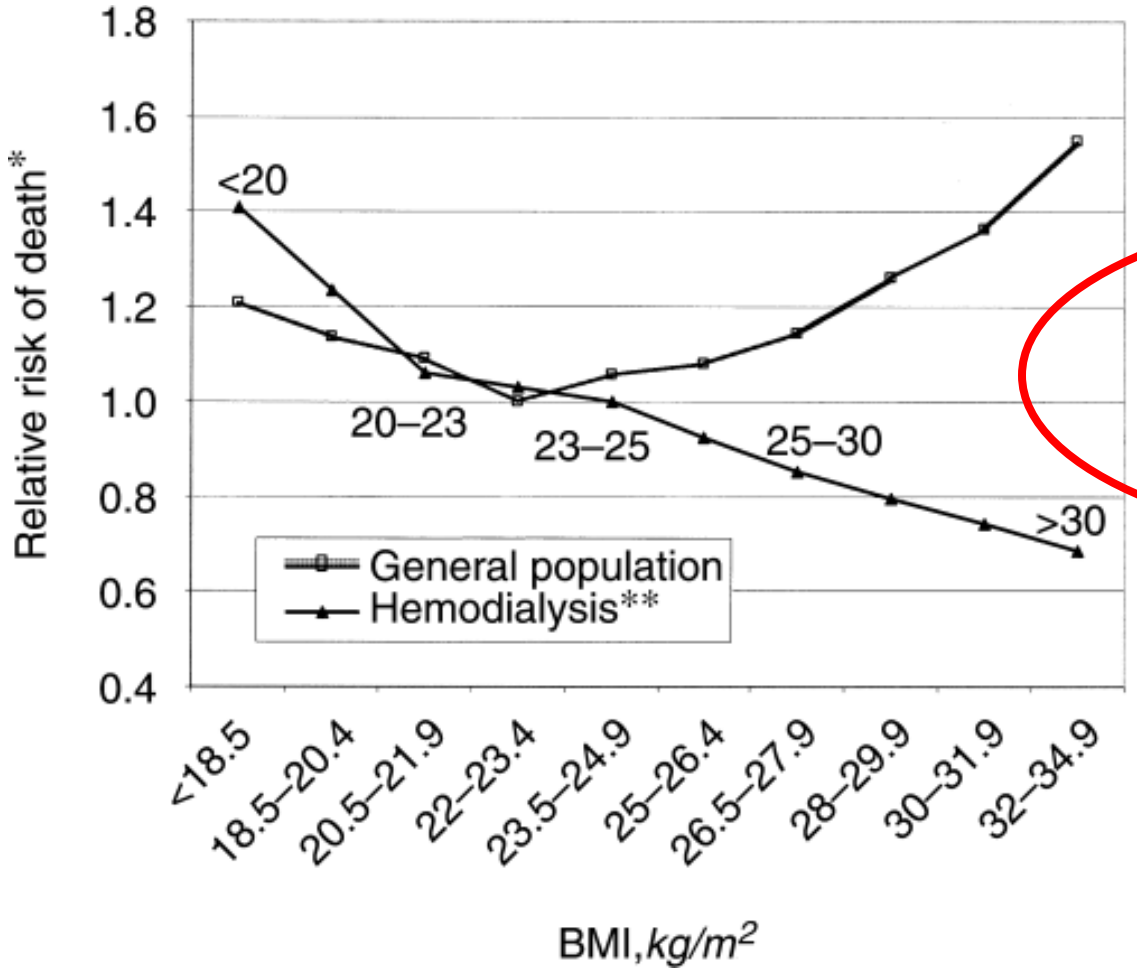
BMI and HD mortality

Stephen McDonald

Why look at BMI

- Relationships between a number of key risk factors and outcomes have been described to differ among the ESKD population
  - In observational and intervention studies
  - “Reverse epidemiology” now an established concept

Original stimulus



The general population data are adopted from Calle et al, *N Engl J Med* 341:1097-1105, 1991 (combined men and women, healthy, nonsmoker). The hemodialysis data are adopted from Leavey et al, *Nephrol Dial Transplant* 16:2386-2394, 2001 (combined data from the United States and Europe) [26]. *Each population has a different follow-up period: 14 years for the general population versus 4 years for hemodialysis patients. **BMI stratifications are different in two populations: X-axis is based on the original graph of the general population and the original hemodialysis BMI subgroup ranges are printed additionally along the hemodialysis curve.

BMI vs mortality, haemodialysis population vs general population

US data

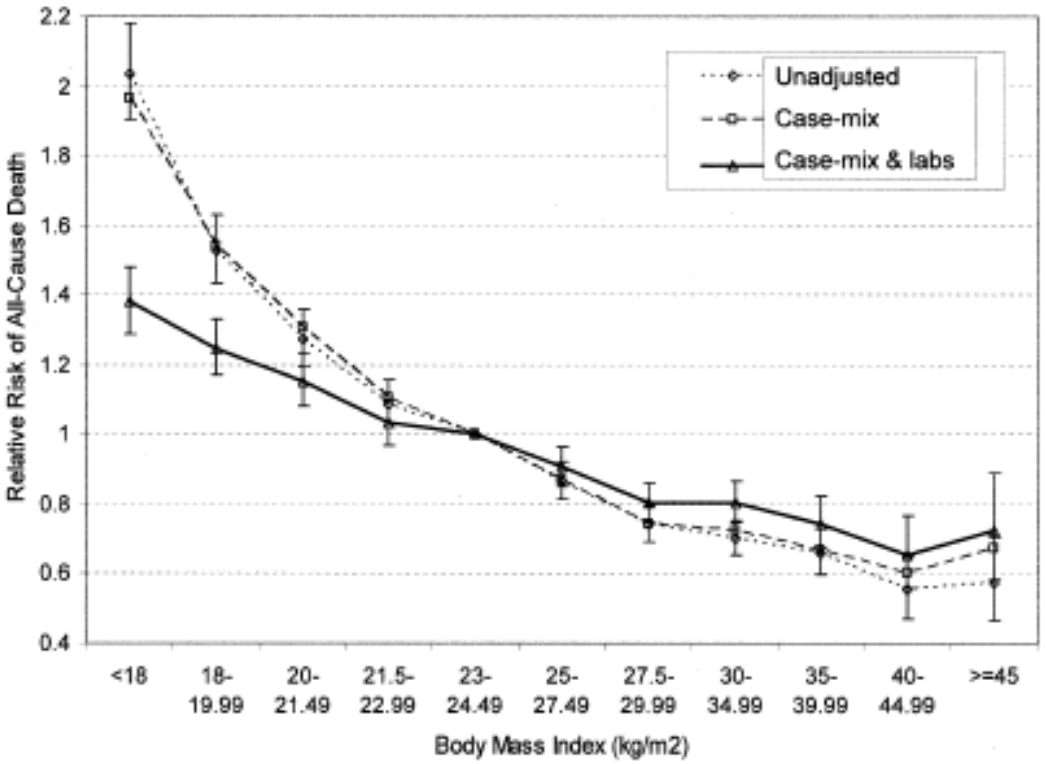
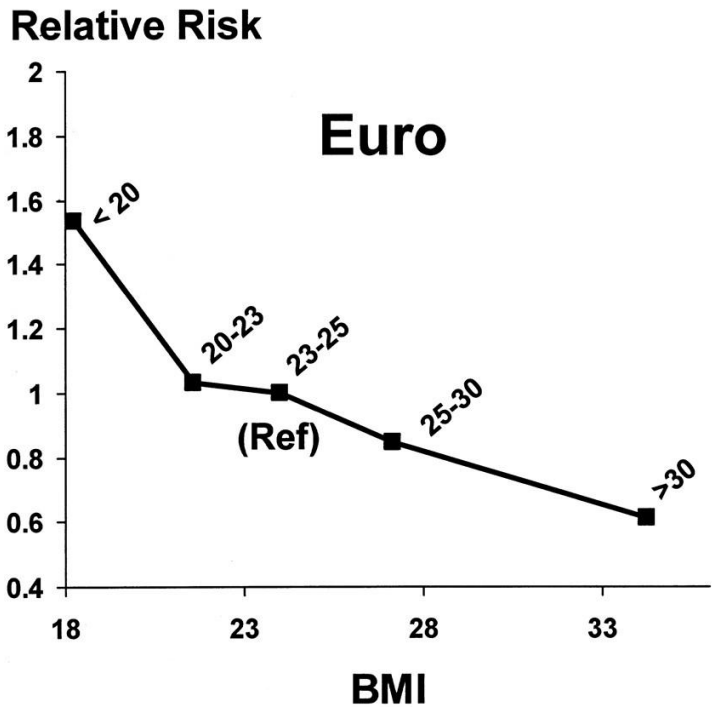
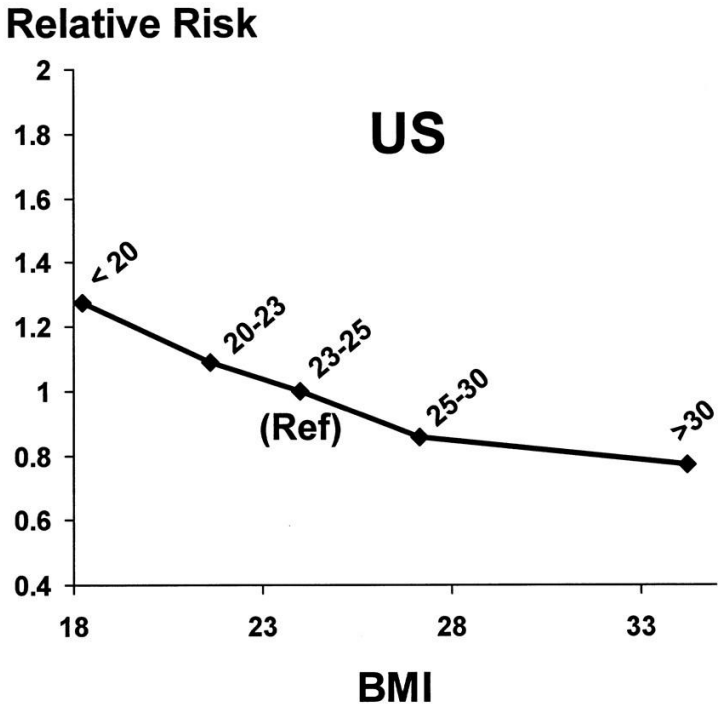


Fig 1. Time-dependent association between BMI and 2-year all-cause mortality in 54,535 MHD patients (95% confidence interval bars are not shown for the case-mix–adjusted group to enable better distinction of confidence intervals for other 2 groups).

Kalantar-Zadeh et al, Am J Kid Dis 2005 46: 489-500

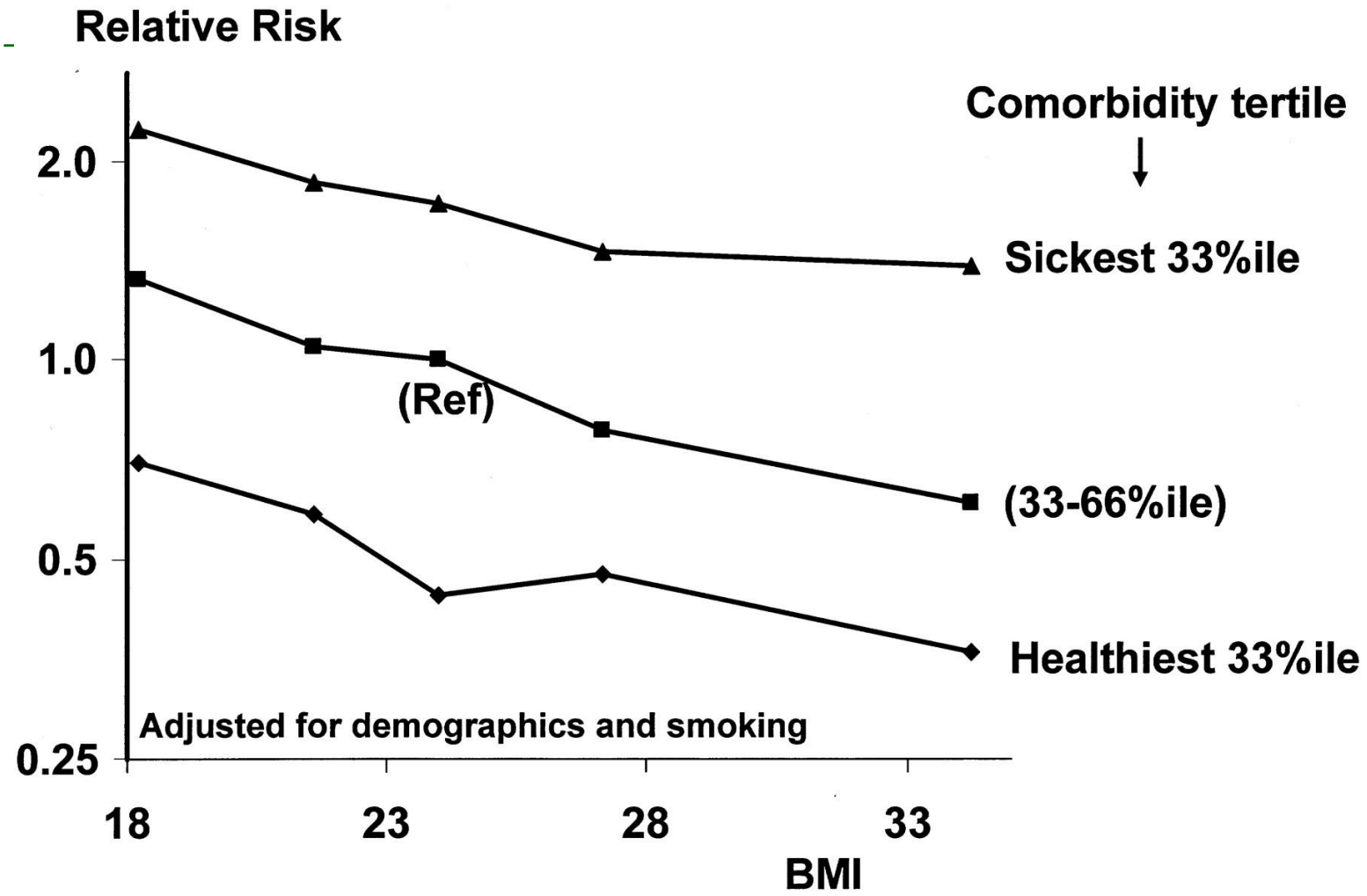
Not just an American phenomenon





Relative mortality risk vs BMI, US and Europe. *Leavey, S. F. et al. Nephrol. Dial. Transplant. 2001 16:2386-2394; doi:10.1093/ndt/16.12.2386*

Degrees of comorbidity



Relative mortality risk vs BMI, for sicker and healthier HD patient subgroups (US and Europe)

Leavey, S. F. et al. Nephrol. Dial. Transplant. 2001 16:2386-2394;
doi:10.1093/ndt/16.12.2386

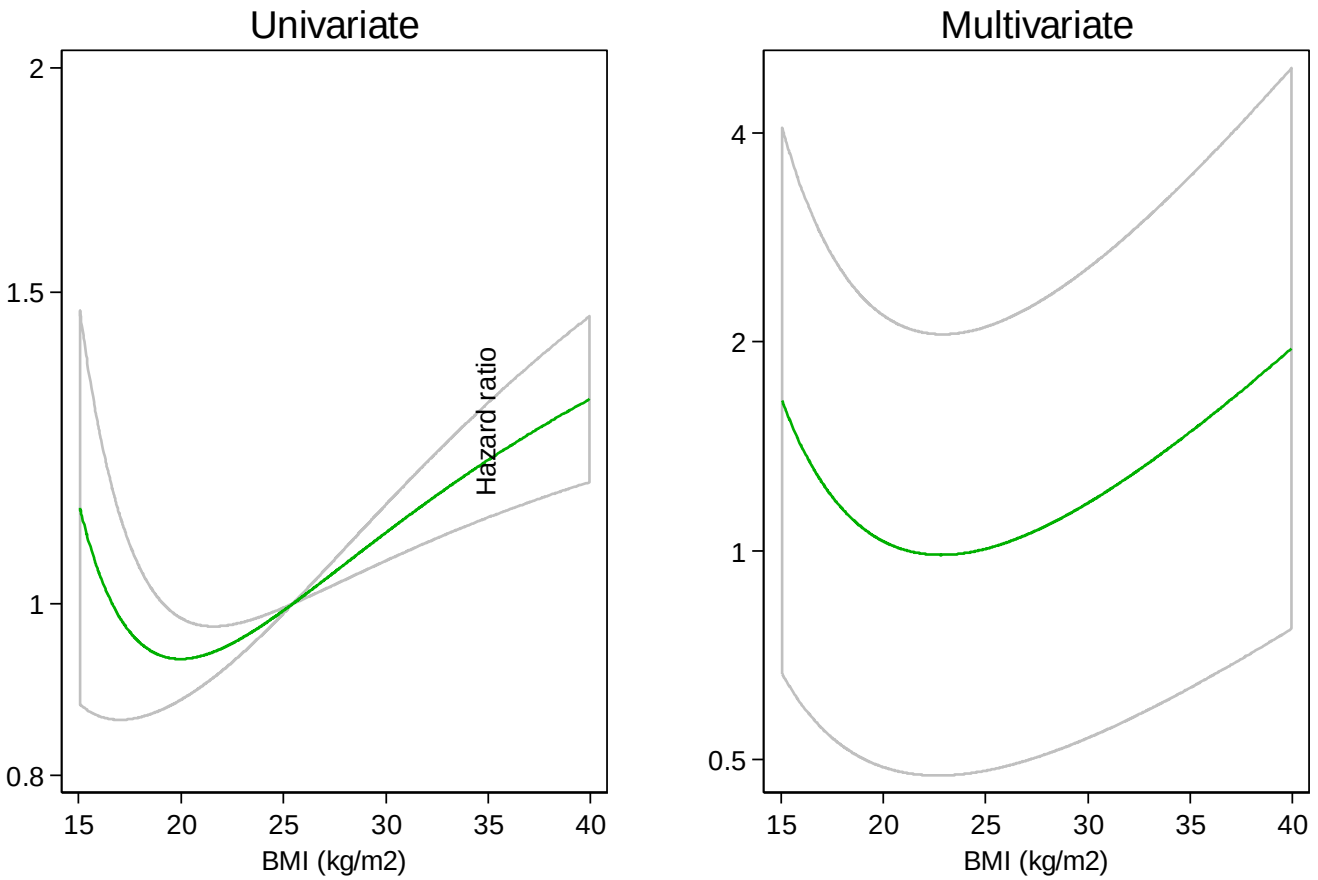
Things are different down under…

Previous BMI studies in ANZDATA

- BMI and outcomes in PD
- BMI and peritonitis rates
- BMI and transplant outcomes
- Weight change and transplant outcomes
- BMI interaction with modality effect

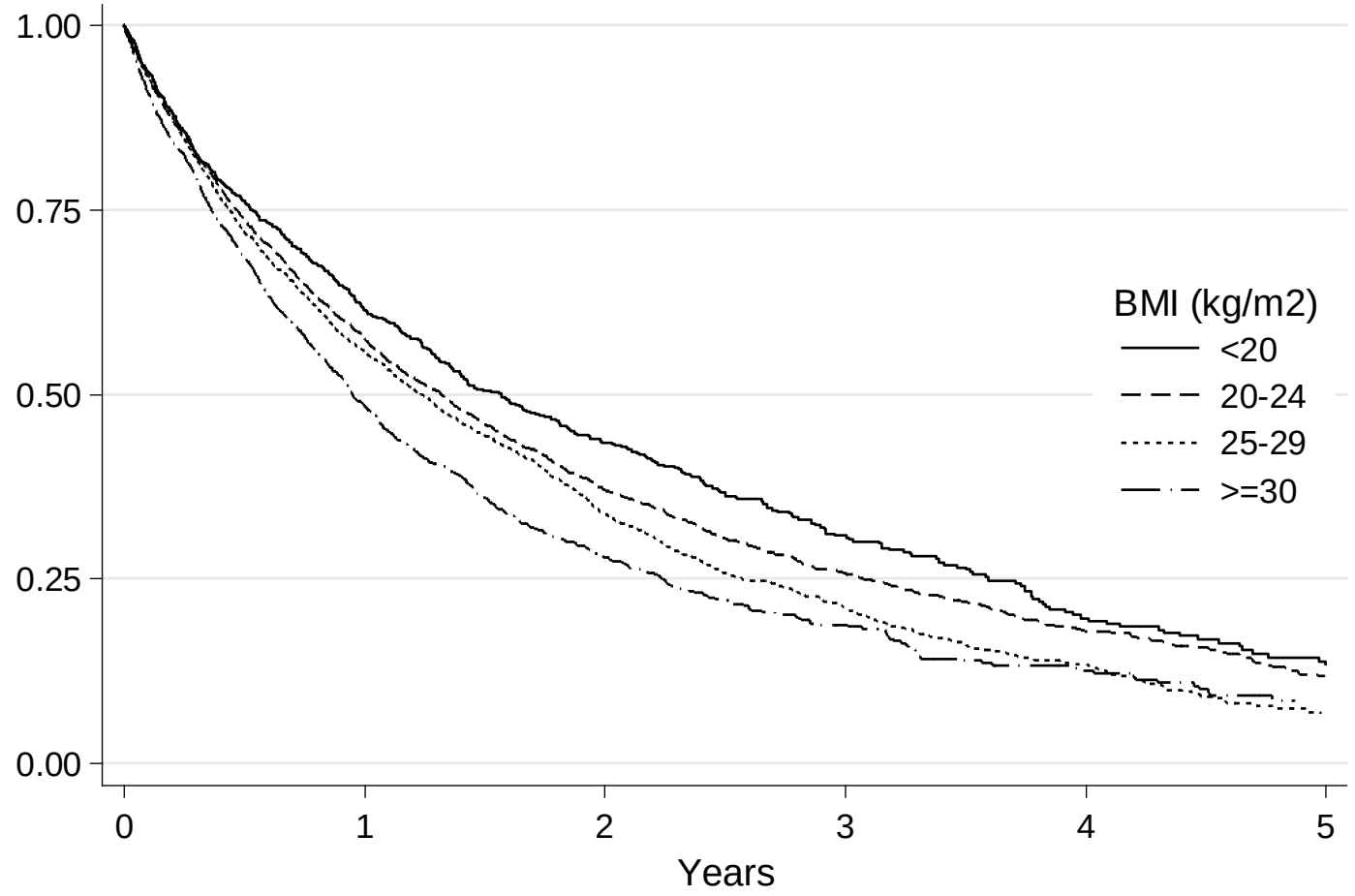
BMI and mortality during PD

Patient mortality



McDonald , Collins, Johnson, J Am Soc Nephrol 2003 14: 2894-901

BMI and risk of peritonitis



McDonald, Collins, Rumpsfeld & Johnson, Perit Dial Internat 2004 24:340-346

BMI and graft outcome

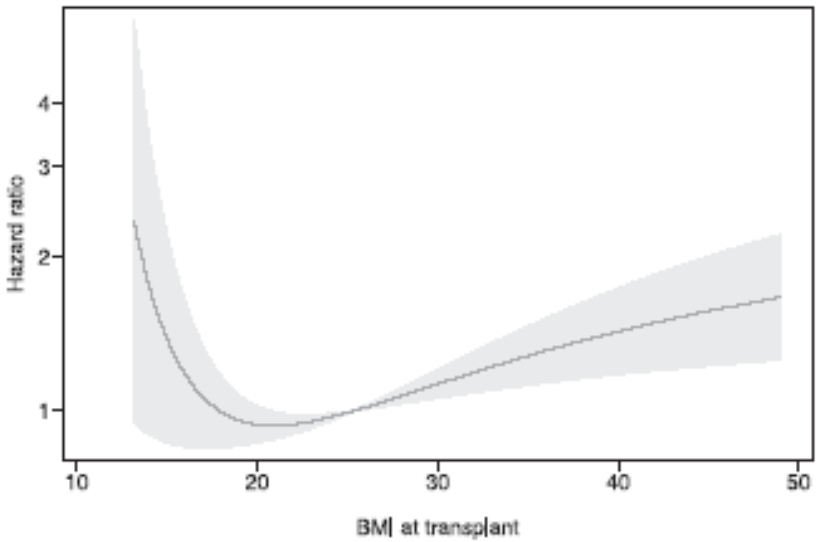


FIGURE 1. Univariate relationship between hazard for graft loss (mean ± 95% confidence intervals) and BMI at transplant.

TABLE 2. Univariate and multivariate hazard ratios for graft loss, death-censored graft loss, and patient death

	Univariate HR	Multivariate HR
Graft loss	N = 5684 (1429)[a]	N = 5552 (1380)[a]
Underweight	1.35 (1.05, 1.74)[b]	1.34 (1.03, 1.75)[a]
Normal	1	1
Overweight	1.12 (0.99, 1.26)	1.04 (0.92, 1.18)
Obese	1.26 (1.09, 1.47)[c]	1.10 (0.94, 1.29)
Death-censored graft loss (%)	N = 5684 (906)[a]	N = 5552 (870)[a]
Underweight	1.46 (1.08, 1.97)[b]	1.27 (0.93, 1.74)
Normal	1	1
Overweight	1.04 (0.90, 1.21)	1.10 (0.94, 1.29)
Obese	1.16 (0.96, 1.41)	1.16 (0.95, 1.42)
Patient death (%)	N = 5682 (827)[a]	N = 5552 (799)[a]
Underweight	1.17 (0.82, 1.67)	1.38 (0.95, 2.01)
Normal	1	1
Overweight	1.24 (1.06, 1.45)[c]	0.95 (0.81, 1.11)
Obese	1.51 (1.24, 1.83)[c]	1.02 (0.83, 1.25)

[a] N = number of patients (number of events).
[b] $P<0.05$.
[c] $P<0.01$.

Chang & McDonald, Transplantation 2007 84: 981-7

Weight change and graft survival

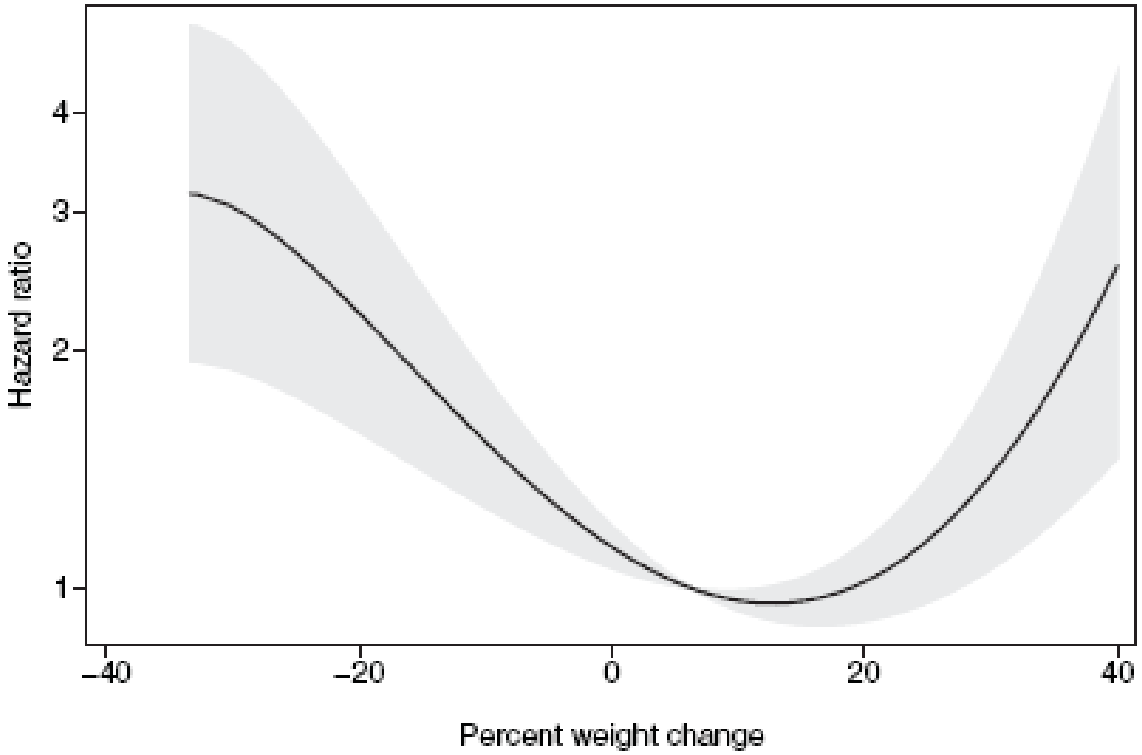


FIGURE 1. Association between year 1 percentage weight change and risks of graft loss.

Chang & McDonald, Transplantation, 2008 85:1443-9

Interaction with BMI: HD and PD are different

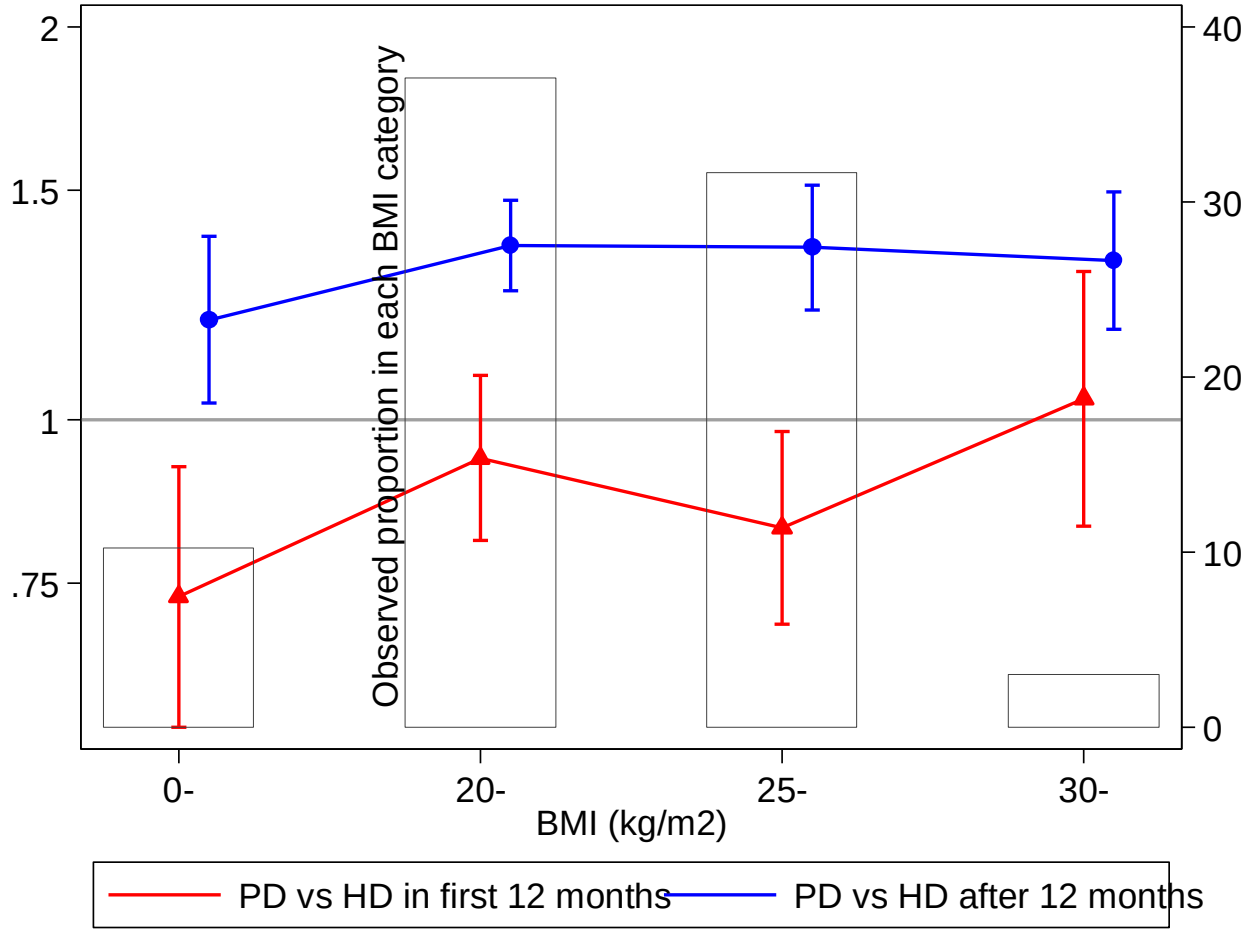


Figure 2. Hazard ratio for mortality during PD vs during HD, by modality at 90 days, stratified by BMI at RRT start. Also shown is the proportion of the cohort in each BMI category. McDonald, Marshall, Johnson & Polkinghorne, J Am Soc Nephrol 2008 In Press

Why should HD differ?

- PD includes exposure to glucose containing fluids
- Different energy “budget” with HD
  - Haemodynamic instability
  - Temperature challenges
- Different patient selection
  - In Australia and NZ, PD group are older, more likely to have comorbidities etc

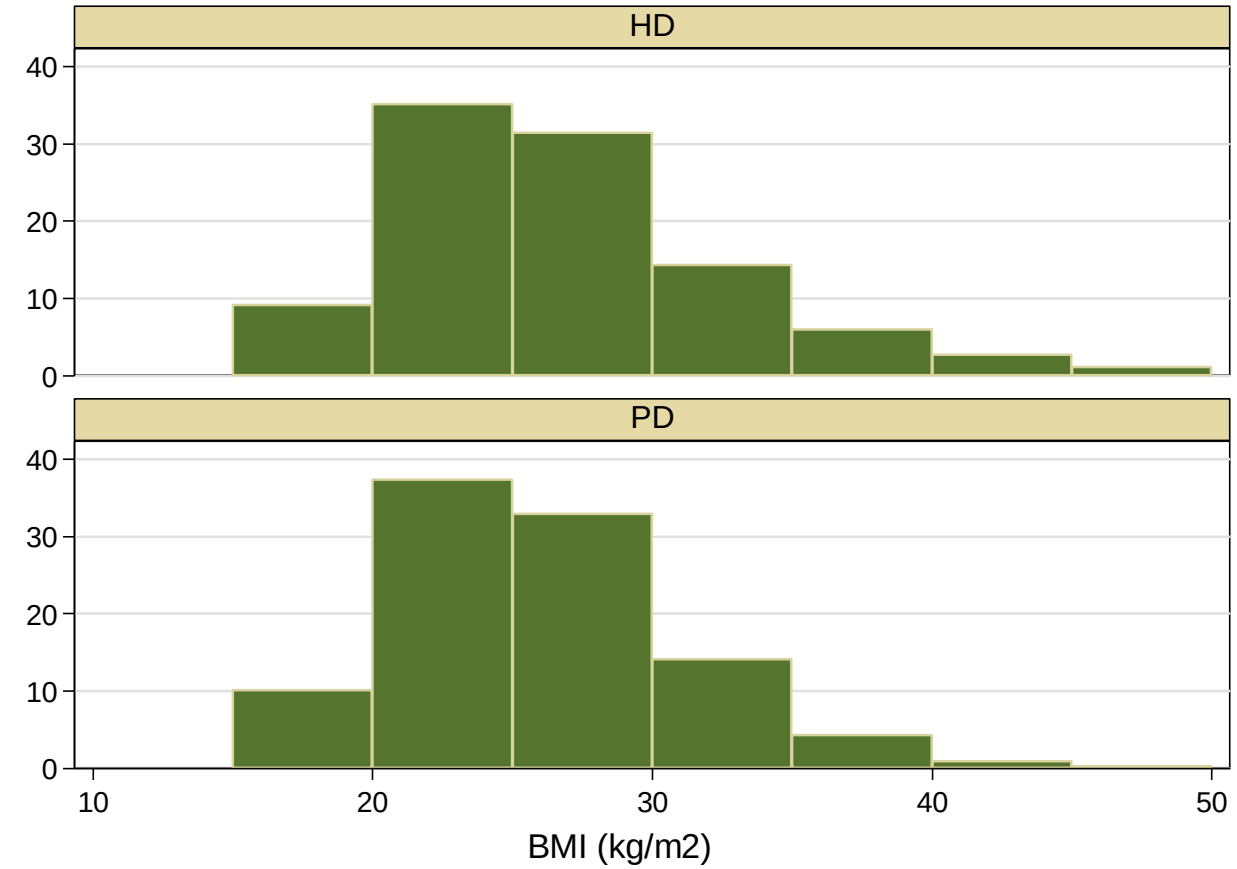
Methods

- All people 15 years or older who started RRT in Australia or New Zealand from 1991 to 2006 were included,
  - BMI between 15 and 50 at RRT start.
- All HD modalities included together
- Confounders
  - Comorbidities
    - Coronary artery disease
    - Chronic lung disease
    - Diabetes
    - Peripheral vascular disease
    - Cerebrovascular disease
  - Indigenous racial origin
  - Vintage
  - Age
  - Gender
  - Late referral

Statistics

- Mortality outcomes examined in three periods
  - HD modality at start of each period compared
  - 0-89 days (n=21313),
  - 90-365 days (n=16482) and
  - 366+ days (n=12893) after RRT start.
  - Censored for transplantation

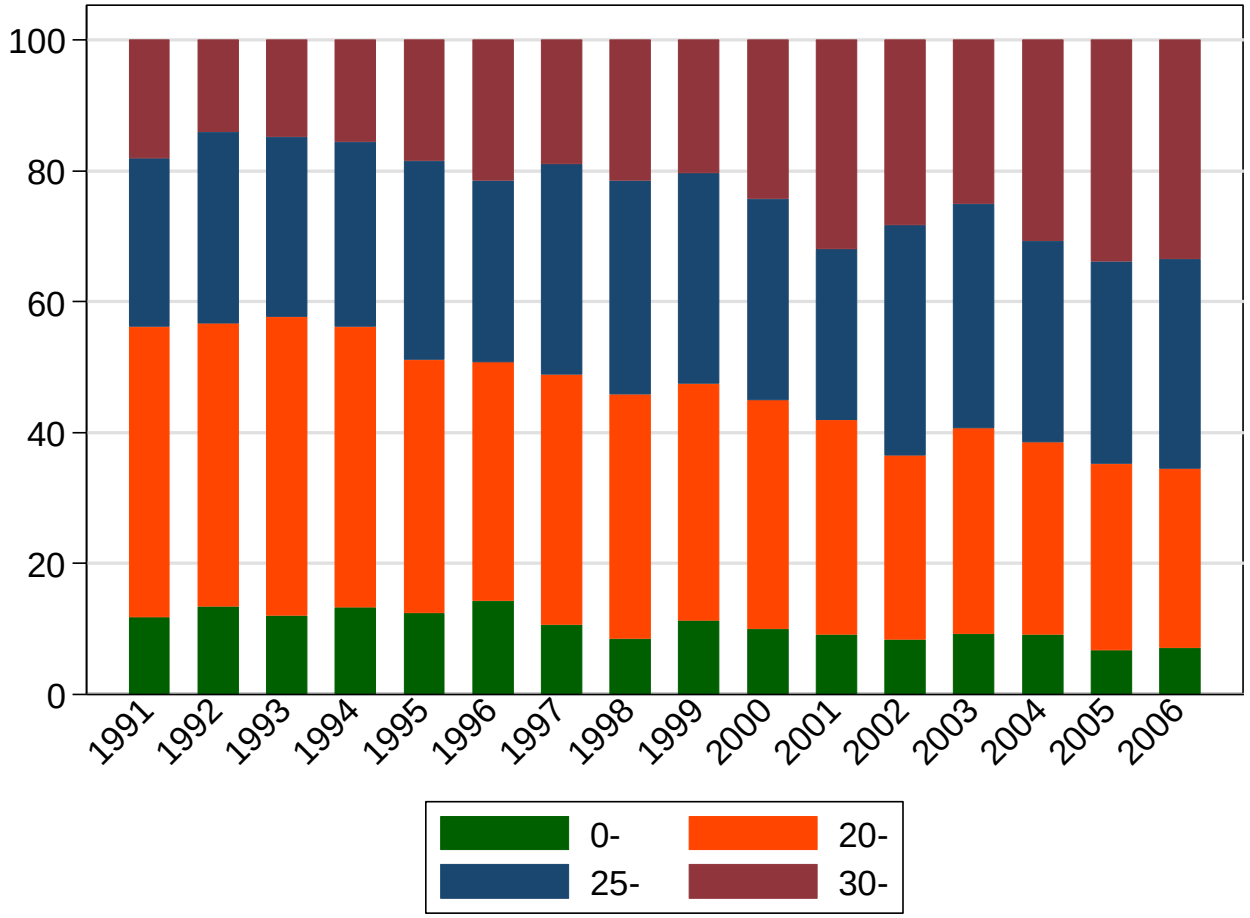
Baseline observations



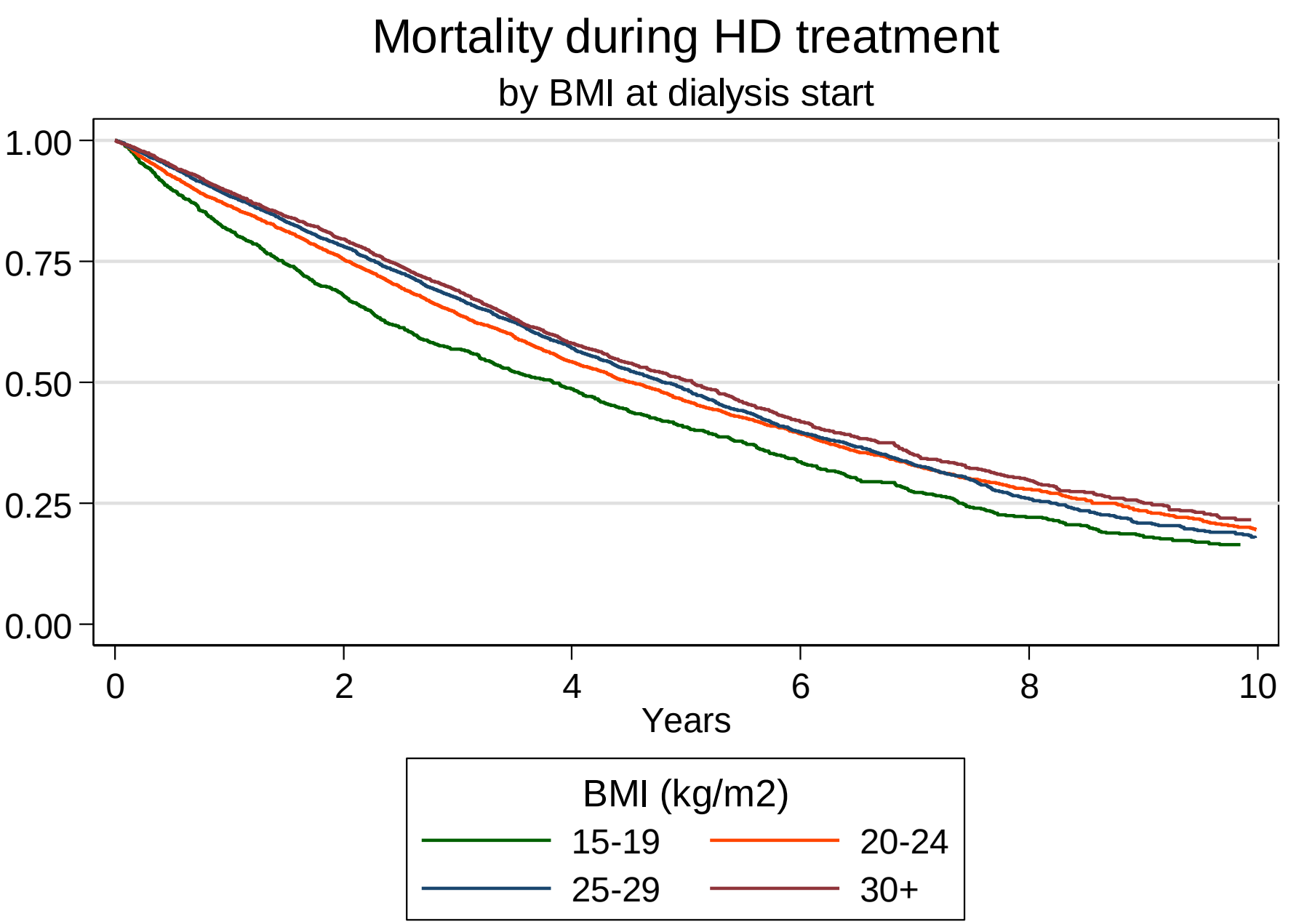
Graphs by Modality at 90 days

Baseline BMI was similar between the 2 groups: mean 26.8 (HD) vs 25.9 (PD), p<0.001

BMI change over time

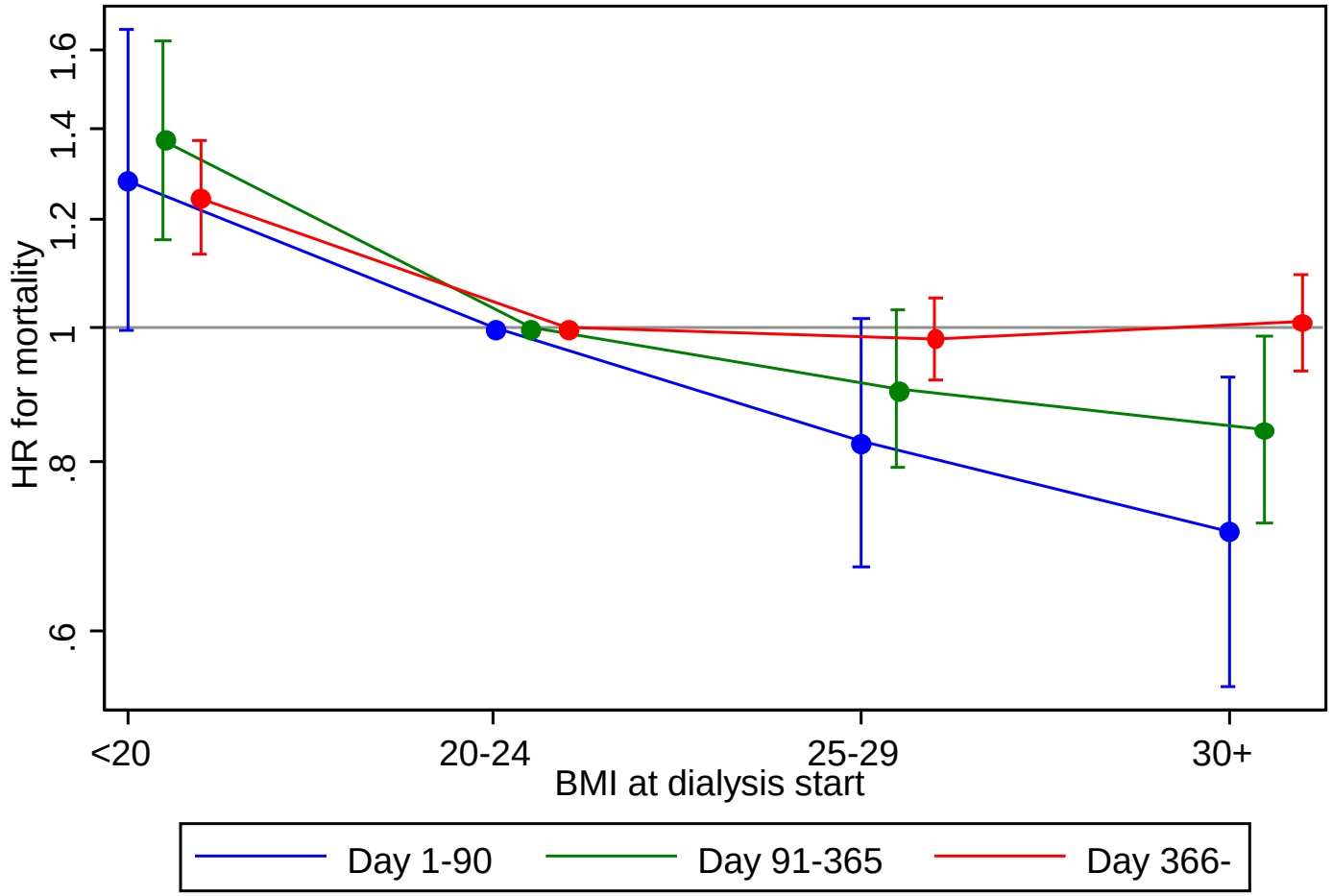


BMI (at RRT start) among those who were receiving HD at 90 days



Mortality during HD treatment – "as treated" analysis

Mortality by baseline BMI

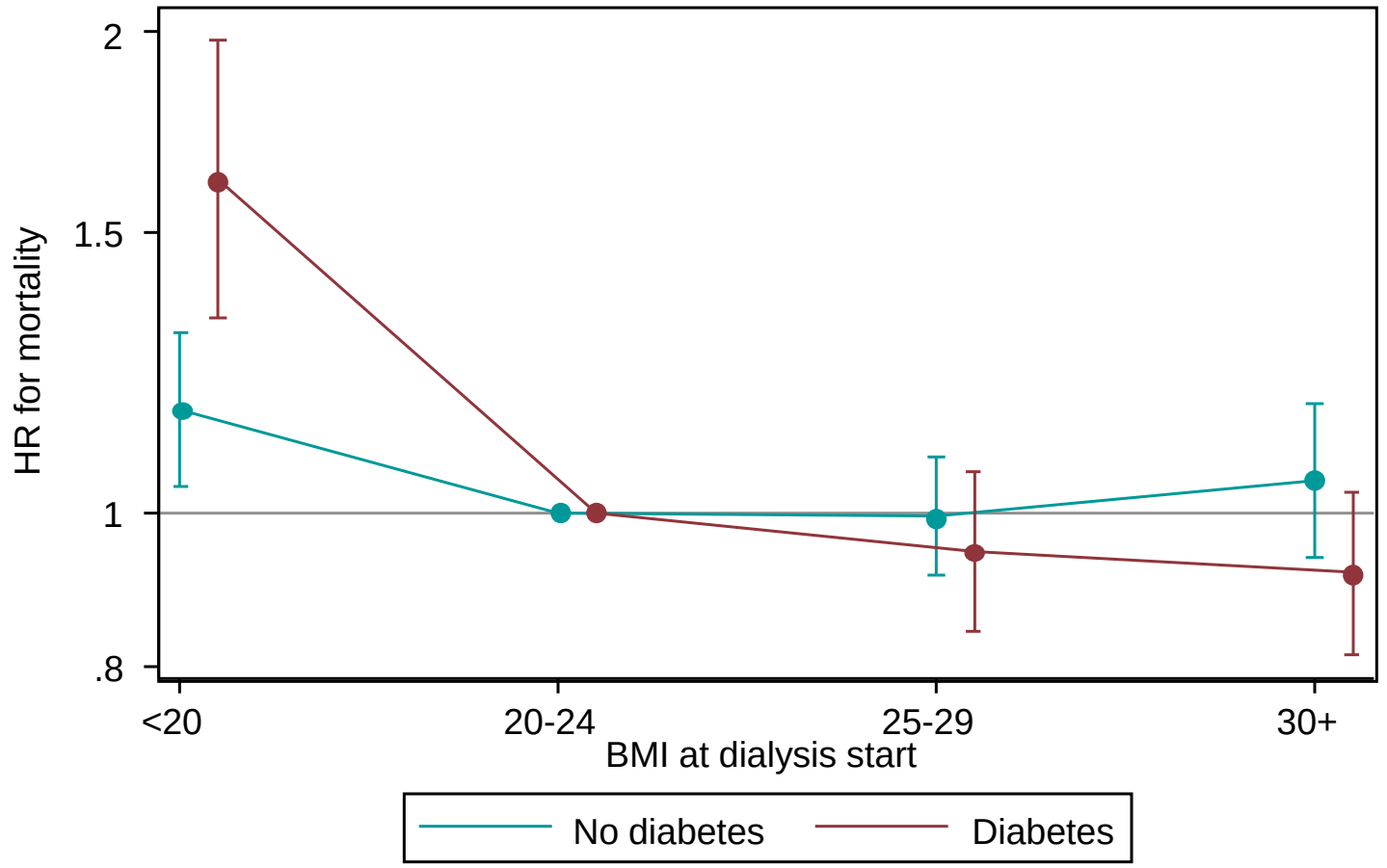


ANZDATA, all HD Australia and NZ to end 2006, multivariate analysis. P<0.001 for variation over BMI in each category

Interactions

- No interaction between diabetes and BMI
  - For 1-90 day outcomes or for 90-366 day outcomes
  - For 366+ day outcomes, the relationship does vary
    - Predominantly due to different risk associated with underweight, not overweight

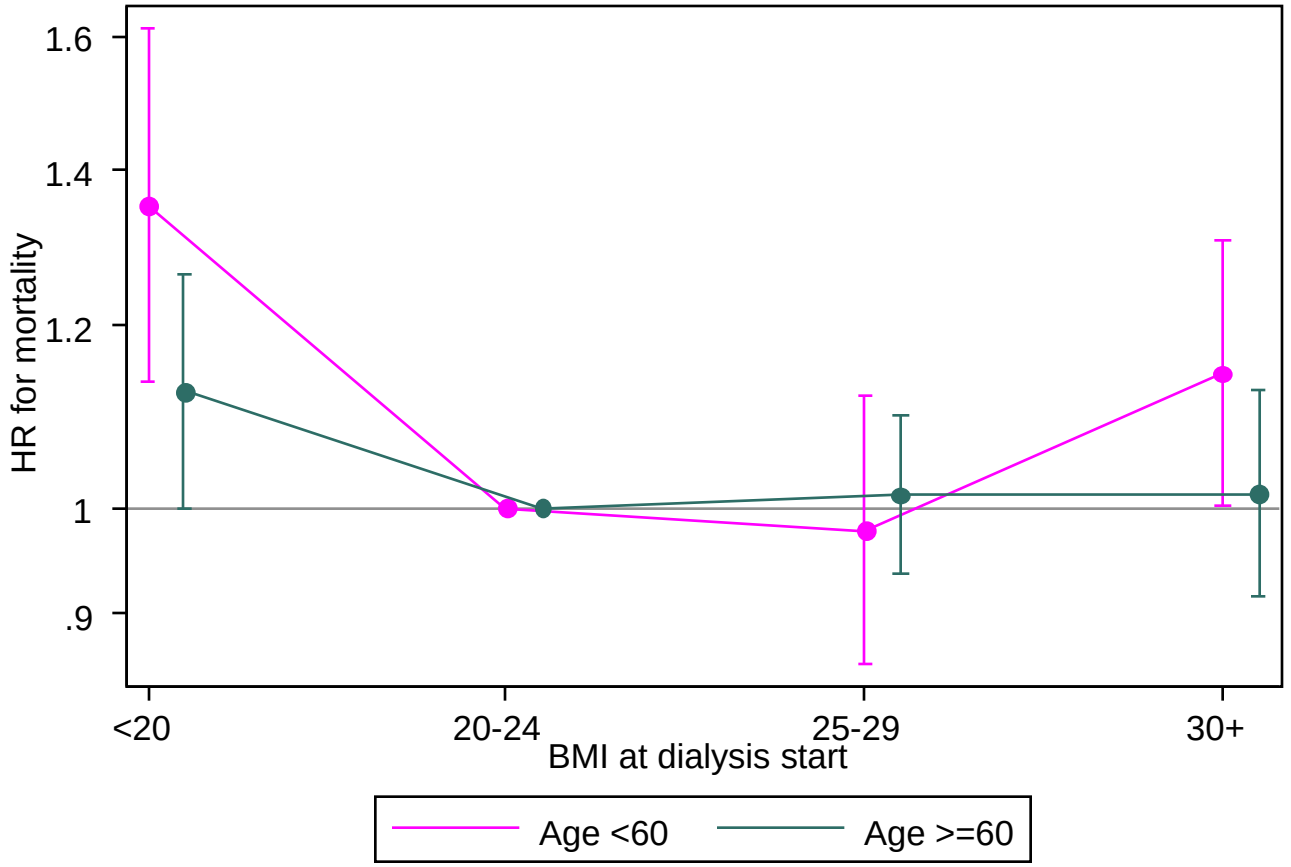
BMI and diabetes after 1 year



Outcomes from 1 year

ANZDATA, all HD at 1 year, Australia and NZ to end 2006, multivariate analysis

BMI by age at RRT start



ANZDATA, all HD Australia and NZ to end 2006, multivariate analysis

Mortality after 366 days by BMI at dialysis start. Adjusted for comorbidities P=0.03 for interaction

Discussion

- Relationship between BMI and mortality risk is a complex one
- Varies with
  - Time
  - Age
  - Diabetes (and other comorbidities)
- Lower risk groups and younger groups show a more “normal” BMI-mortality relationship
  - Variation elsewhere
    - Some reports show comorbidity makes no difference

Thank you