Aim
To evaluate the association of BMI with mortality and institution of RRT in patients with CKD.

Background
- Dialysis patients who are overweight and obese are reported to have better survival compared with those with lower BMI.
- However, the association of BMI with mortality has not been established in patients with CKD.
- CKD.QLD is a program for surveillance, practice improvement and research in CKD. It is a collaboration of the renal practice network in the adult public health system in the Australian state of Queensland, and with the public health service provider, Queensland Health.
- Enrolment of patients in CKD.QLD is by informed consent. It began in May 2011 at the Royal Brisbane and Women’s Hospital [RBWH] and in June 2011 at the Toowoomba Hospital.
- Events of death without RRT and the institution of RRT were recorded until site censor dates [RBWH July 2015; Toowoomba December 2015].

Methods
- This was a retrospective analysis of pre-terminal CKD patients in public renal specialty practices from two major sites within the CKD.QLD registry.
- Survival time was calculated from time of enrolment to event [death without RRT or RRT] or site censor dates.
- The classical WHO BMI categories were consolidated into the 4 groupings as follows:

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>BMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>&lt;20</td>
</tr>
<tr>
<td>Normal</td>
<td>20 to &lt;25</td>
</tr>
<tr>
<td>Overweight, obese and markedly obese</td>
<td>25 to 40</td>
</tr>
<tr>
<td>Morbidly obese</td>
<td>≥ 40</td>
</tr>
</tbody>
</table>

Notably, those who were overweight, obese and markedly obese were combined into a single category because they had similar survival characteristics.

- Associations of these BMI categories with subsequent death without RRT and with RRT were examined with Kaplan-Meier curves. Cox regression models were also used, adjusting for hospital site, age, sex, CKD stage at enrolment, primary renal disease and co-morbidities.

Results
- There were 2,059 patients with a follow-up time of 4,391 person years.
- Their ages at enrolment ranged from 18 to 98 years, with a median of 69 years.
- BMI ranged from 14.5 to 59.8 with a median of 29.7 kg/m². Fully 80% of the group had a BMI greater than normal.
- 216 patients died without RRT [10%]. Their median age at enrolment was 78 years, and at death was 80 years.
- 151 started RRT [7%]. Their median age at enrolment was 61 years and median age at start of RRT was 63 years.
- Only 15 of the patients who started RRT were aged ≥ 75 years at enrolment.

Death by BMI categories
- Fig 1. In the aggregate cohort, there were 216 deaths. Those who were underweight and normal weight had a higher risk of death.
- Fig 2. However, when examined by age group, in those under 75 years at enrolment BMI was not associated with mortality, among the 86 deaths.
- Fig 3. BMI was associated with mortality only in those ≥ 75 years at enrolment. Mortality was higher in those who were underweight, normal weight or morbidly obese, relative to those with BMIs of 25-39.

RRT by BMI categories.
- BMI categories were not associated with RRT when assessed across the entire cohort.
- Fig 4. There was no significant association of the start of RRT by BMI categories [n=151].
- Fig 5. This applied when only subjects < 75 years were examined and, as shown in Fig 6, also for those with advanced CKD stage [stage 4 and 5] on enrolment.

Conclusions
- 80% of this CKD cohort had a BMI greater than normal.
- Patients with CKD who died without RRT were much older at the time of event than those that commenced RRT [80 vs 63 years].
- Patients with CKD who were underweight, normal or morbidly obese had markedly higher mortality than those with a BMI of 25 to 39. This effect was confined to those ≥ 75 years of age at enrolment.
- Underweight and normal weight in the elderly may be a marker of ill-health and of poor prognosis. It seems intuitive that morbid obesity should also be a predictor of a greater increased risk.
- BMI categories were not associated with the institution of RRT in this cohort.

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Patients by BMI category

<table>
<thead>
<tr>
<th>BMI</th>
<th>#</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;20</td>
<td>70</td>
<td>3</td>
</tr>
<tr>
<td>20-24</td>
<td>361</td>
<td>17</td>
</tr>
<tr>
<td>25-39</td>
<td>1,389</td>
<td>68</td>
</tr>
<tr>
<td>≥ 40</td>
<td>239</td>
<td>12</td>
</tr>
<tr>
<td>2,059</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

Fig 1

Fig 2

Fig 3

Fig 4

Fig 5

Fig 6

Fig 4

Fig 5

Fig 6