ASSET
KIDNEY RESEARCH
HE RAWA RARAUNGA HAUORA MŌ NGĀ TĀNGATA O AOTEAROA

AcceSS and Equity in Transplantation

Project 1: Geographic variation in kidney failure in Aotearoa New Zealand

Johanna Birrell, Angela Webster, Nicholas Cross, Heather Dunckley, Ben Beaglehole, Ian Dittmer, John Irvine, Curtis Walker, Merryn Jones, Melanie Wyld, Kate Wyburn, Nicole De La Mata

Background:

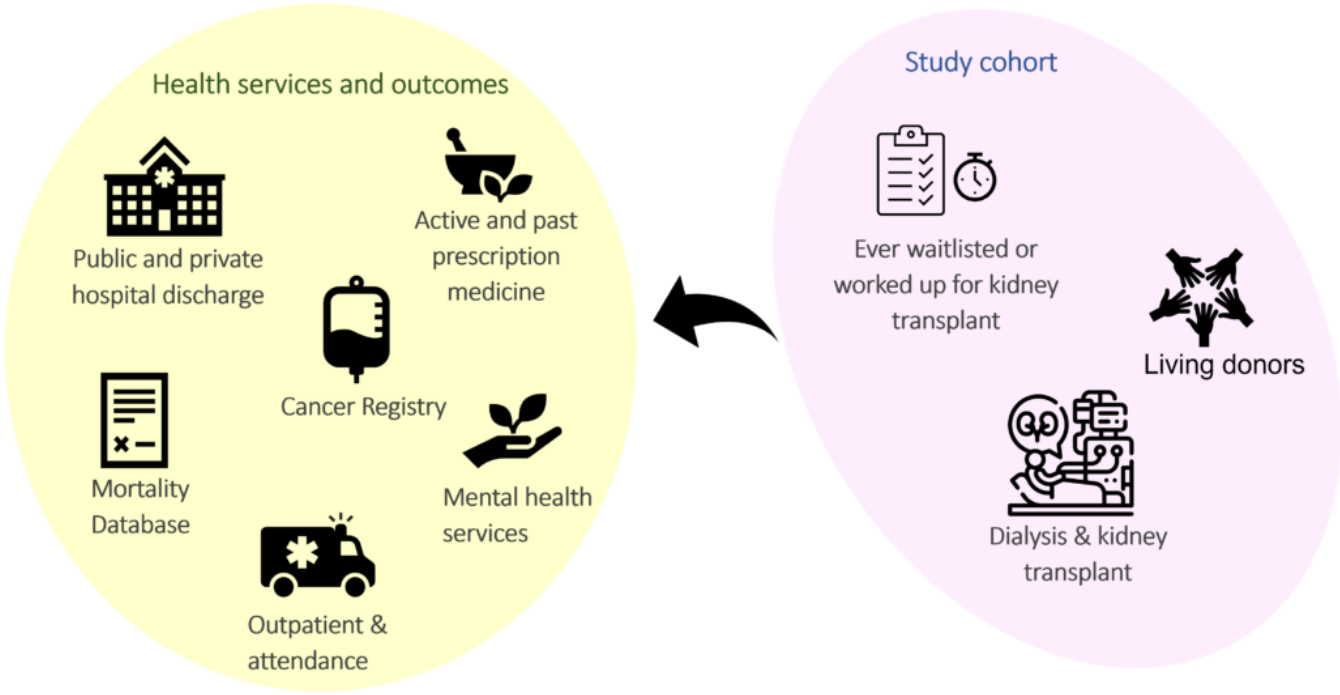
- Transplantation is considered the ideal treatment for most people with kidney failure[1,2]
  - Survival
  - Quality of life
  - Cost-effectiveness, compared to dialysis

- Key Performance Indicator (Australia & New Zealand Society of Nephrology):
  - Proportion of patients aged 2-64 years who are transplanted or “active” on the waiting list **within 6 months** of starting kidney replacement therapy.[3]

Background:

- Te Whatu Ora – Health New Zealand
  - Need for data to guide national resource allocation

- ASSET Linked Data Platform
  - Deterministic data linkage



ASSET KIDNEY RESEARCH
HE RAWA RARAUNGA HAUORA MŌ NGĀ TĀNGATA O AOTEAROA

AcceSS and Equity in Transplantation

Aim:

To describe the epidemiology of kidney failure in Aotearoa New Zealand, and assess the impact of residential location on access to kidney transplantation.

Health services research

Methods

Methods: (1) Data sources

Data linkage

ANZDATA end-stage kidney disease incident patient cohort (New Zealand 2006-2019)

Study cohort (n=7,704)

ANZDATA = Australia and New Zealand Dialysis and Transplant Registry

Data linkage

ANZDATA end-stage kidney disease incident patient cohort (New Zealand 2006-2019)

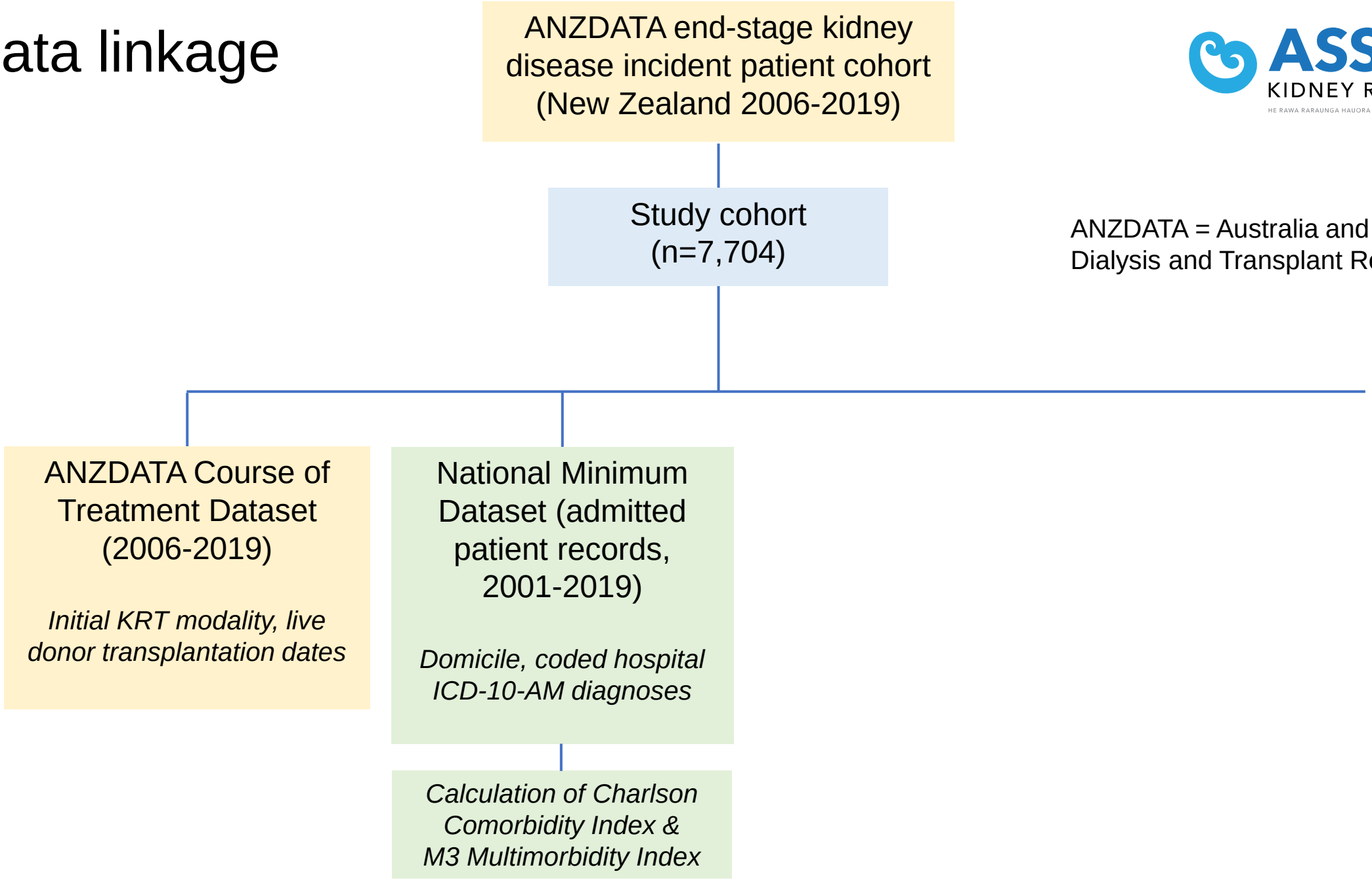
Study cohort (n=7,704)

ANZDATA Course of Treatment Dataset (2006-2019)

Initial KRT modality, live donor transplantation dates

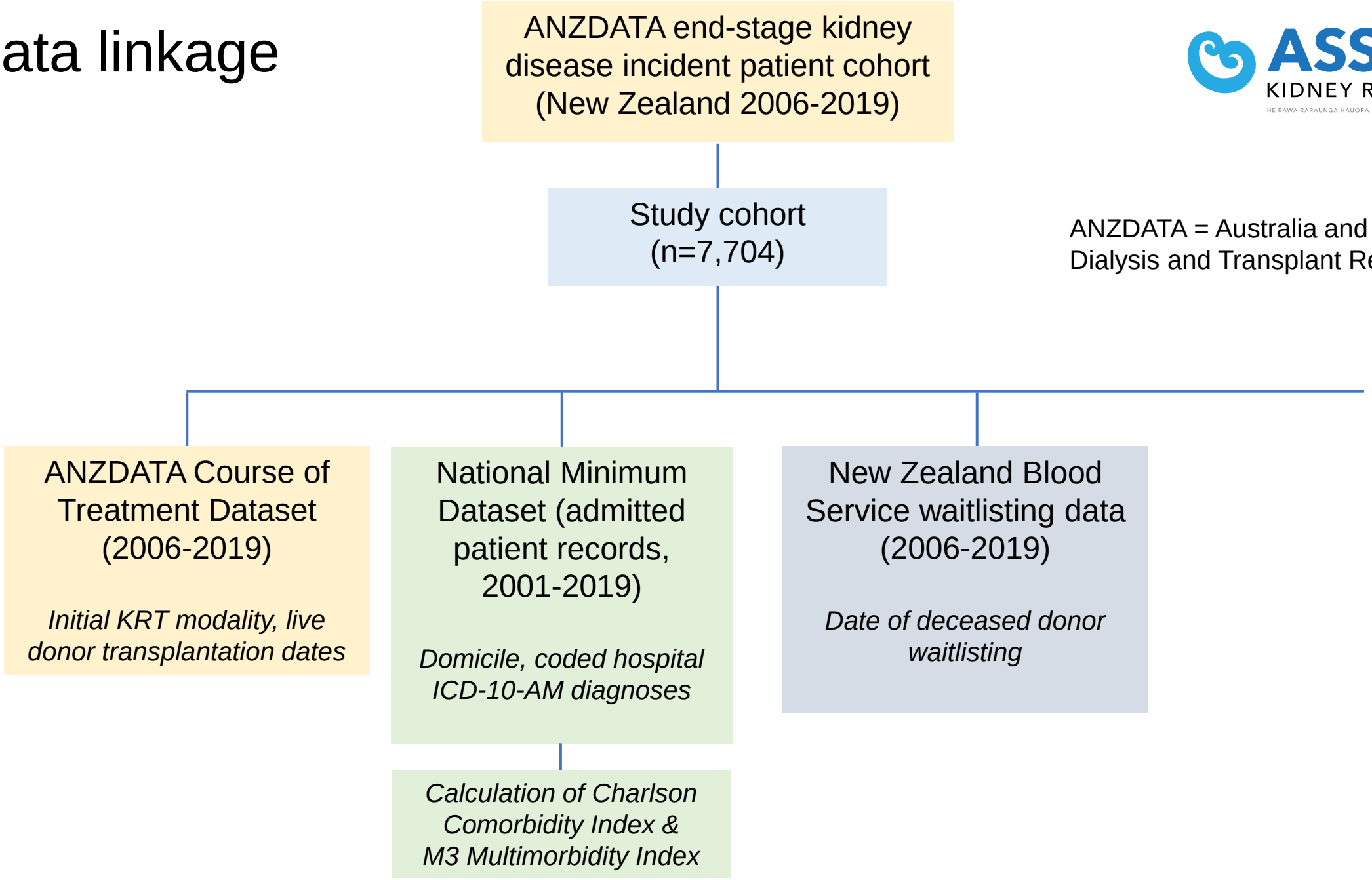
ANZDATA = Australia and New Zealand Dialysis and Transplant Registry

Data linkage



ANZDATA = Australia and New Zealand Dialysis and Transplant Registry

Data linkage



ANZDATA = Australia and New Zealand Dialysis and Transplant Registry

Data linkage

ANZDATA end-stage kidney disease incident patient cohort (New Zealand 2006-2019)

Study cohort (n=7,704)

ANZDATA = Australia and New Zealand Dialysis and Transplant Registry

ANZDATA Course of Treatment Dataset (2006-2019)

Initial KRT modality, live donor transplantation dates

National Minimum Dataset (admitted patient records, 2001-2019)

Domicile, coded hospital ICD-10-AM diagnoses

Calculation of Charlson Comorbidity Index & M3 Multimorbidity Index

New Zealand Blood Service waitlisting data (2006-2019)

Date of deceased donor waitlisting

Domicile mapping files

1. District Health Board (DHB) jurisdictions

2. New Zealand Index of Deprivation

3. Rural-urban Geographic Classification for Health (GCH)

Methods: (2) Descriptive epidemiology

Incidence calculations

- Direct age-standardised incidence
- Population data from Stats NZ[4]
- Case numbers and population data were categorised by:
  - Calendar year
  - 5-year age bands
  - Sex
  - DHB
- World Health Organization Standard Population Distribution.[5]

Methods: (3) Multiple logistic regression

Key outcomes of interest:

1) Deceased donor waitlisting,
2) Live donor transplantation, or
3) Either of 1) or 2)

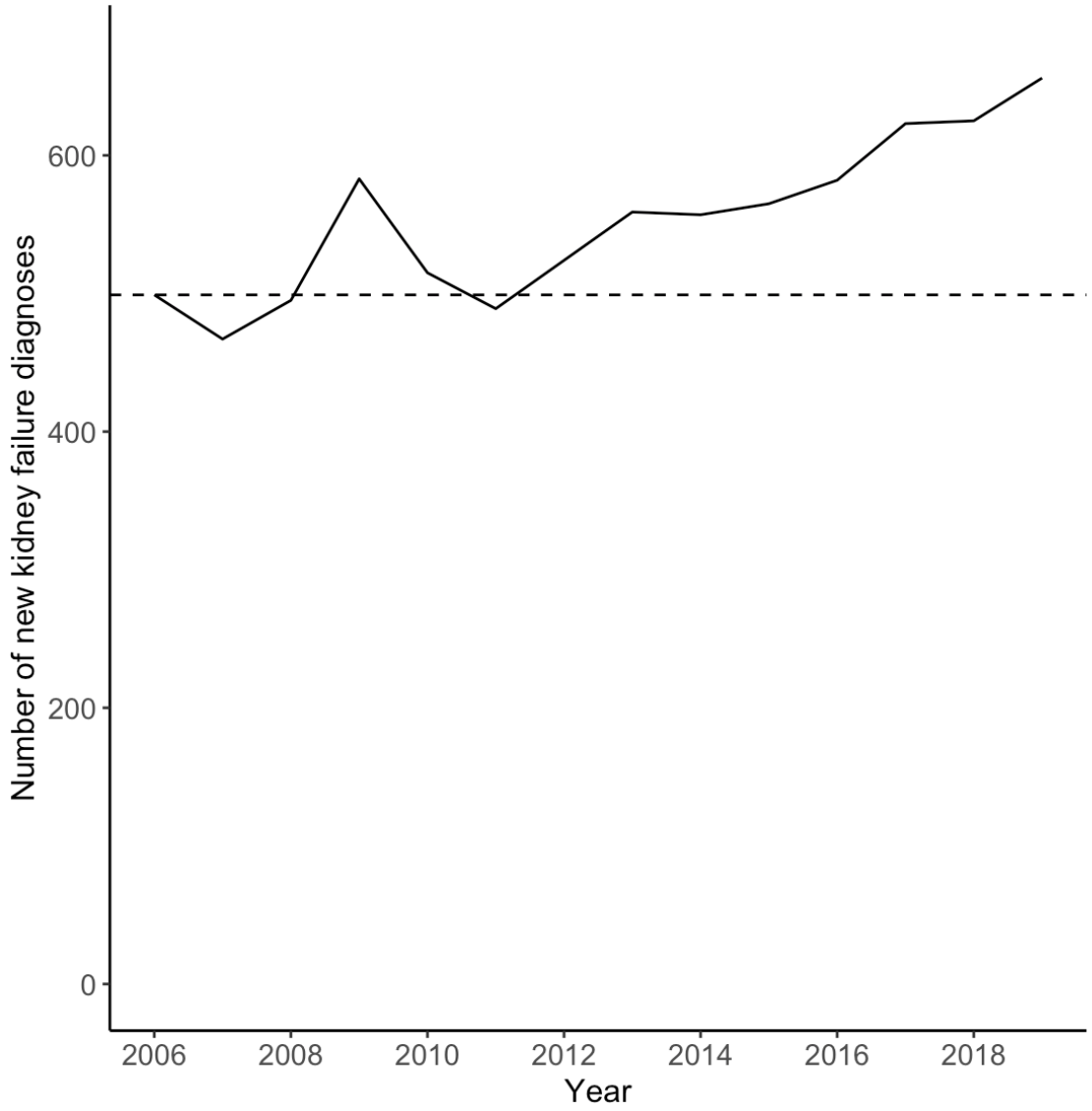
within 6 months after starting KRT (at age 2-64 years).

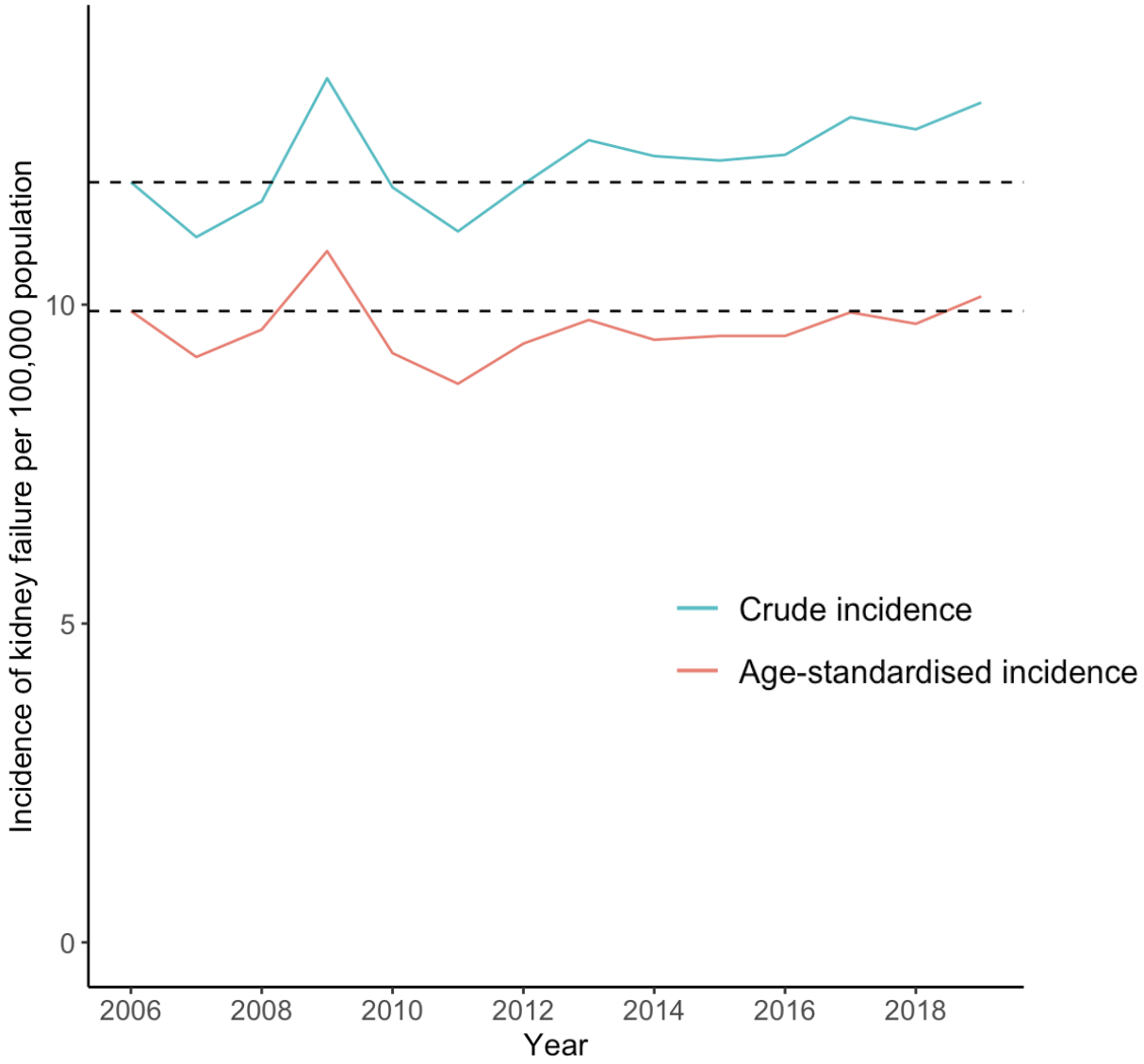
Results

Cohort characteristics

Total number of people starting KRT in NZ, 2006-2019	7,704
Age at KRT start, median (IQR)	58 years (48-68)
Sex	
Male	4,633 (60%)
Female	3,071 (40%)
Ethnicity	
European	2,975 (39%)
Māori	2,380 (31%)
Pacific	1,605 (21%)
Asian	640 (8%)
Other ethnicity	74 (1%)
Rurality (GCH code)	
Urban (U1, U2)	6,271 (81%)
Rural (R1, R2, R3)	1,402 (18%)

Trends in incidence of KRT in New Zealand, 2006-2019

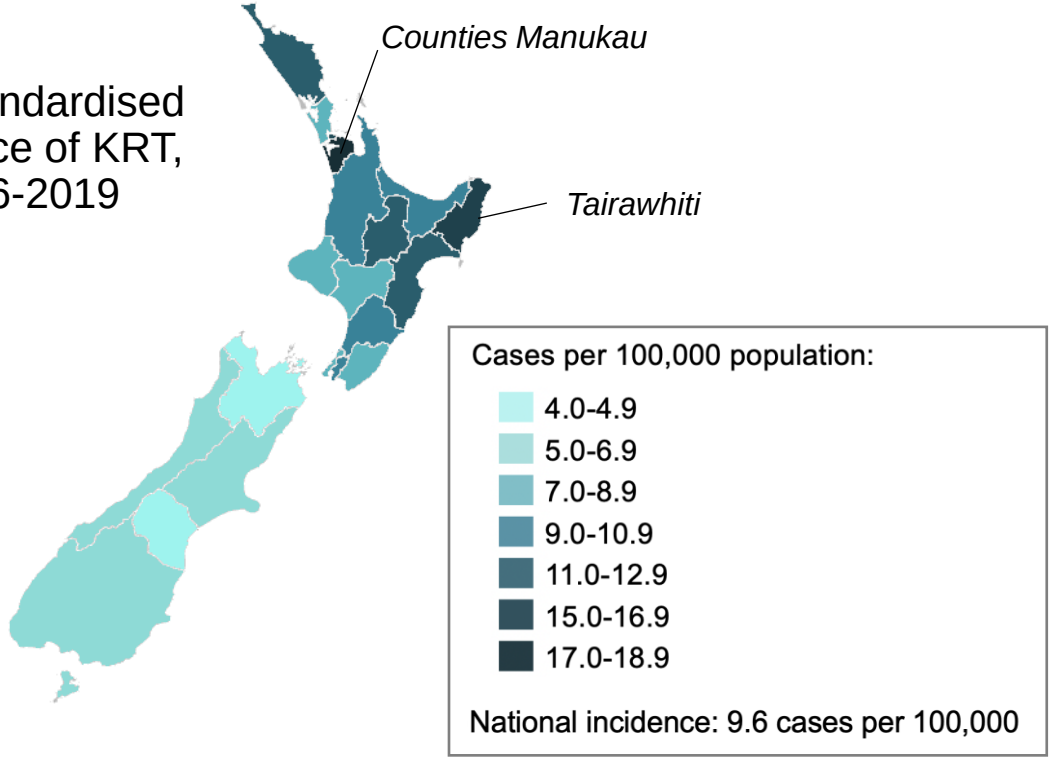




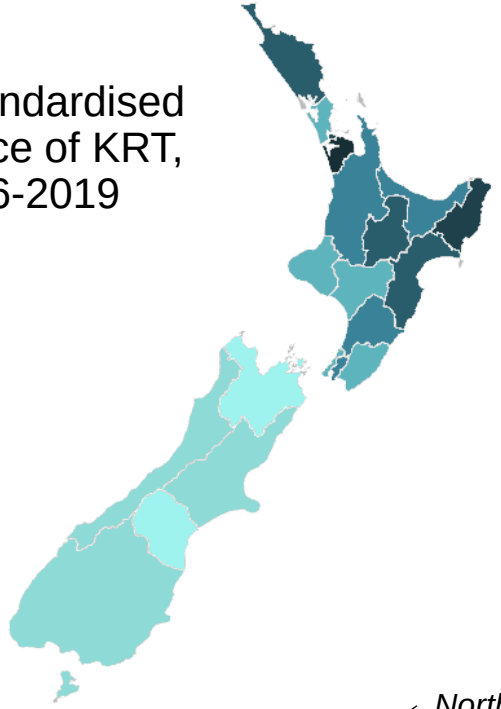
Key findings:

1. The epidemiology of kidney failure and multimorbidity burden is highly variable across Aotearoa New Zealand

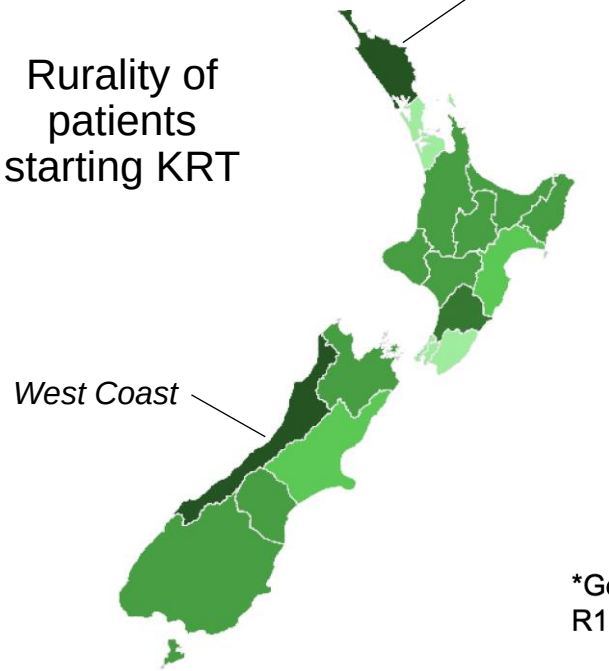
Age-standardised incidence of KRT, 2006-2019



Age-standardised incidence of KRT, 2006-2019



Rurality of patients starting KRT

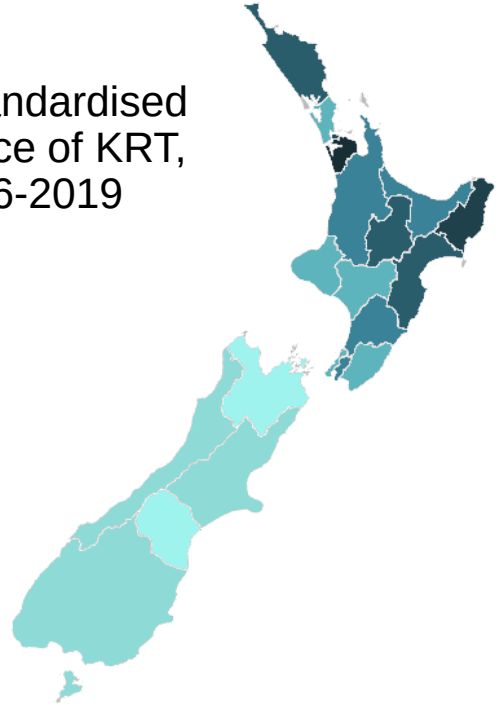


% of patients with a rural address*:

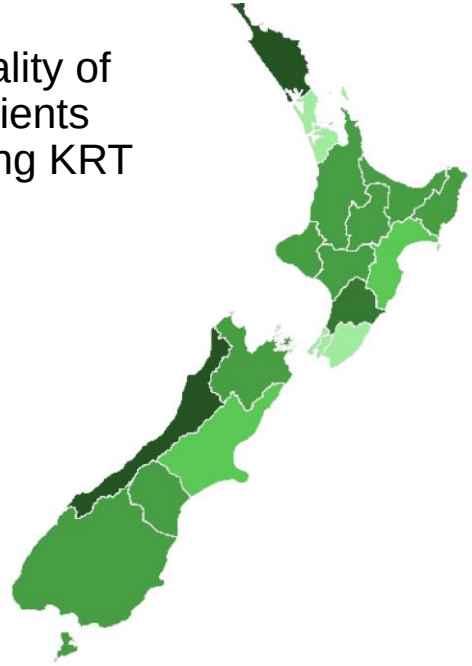
- ≤9%
- 10-19%
- 20-39%
- 40-59%
- ≥60%

*Geographic Classification for Health R1-R3 area, based on domicile

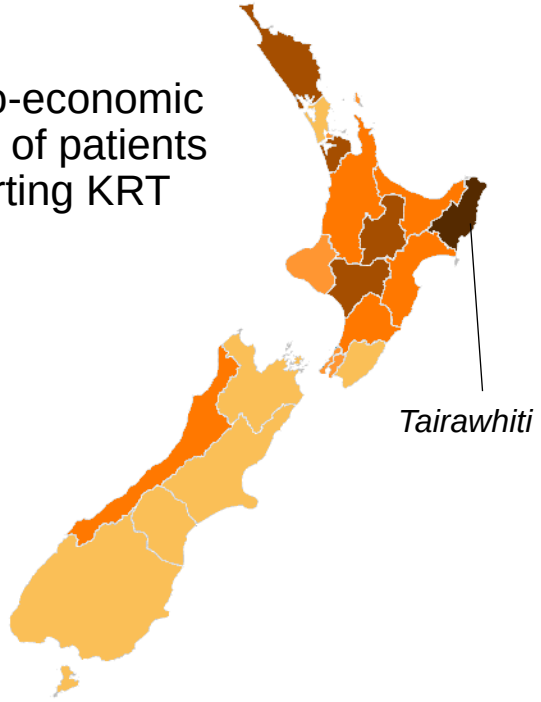
Age-standardised incidence of KRT, 2006-2019



Rurality of patients starting KRT



Socio-economic index of patients starting KRT

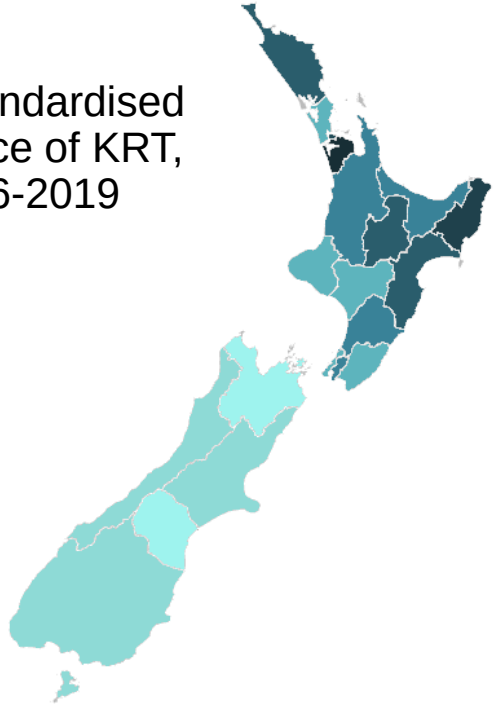


% of patients living in the most disadvantaged socioeconomic quintile*:

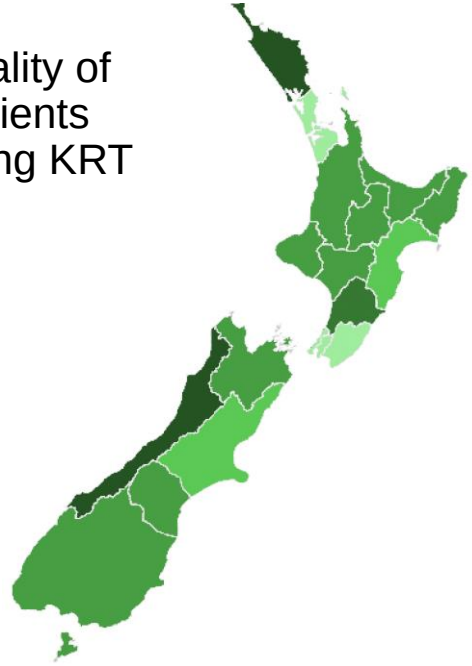
- ≤19%
- 20-39%
- 40-59%
- 60-79%
- ≥80%

*NZDep index of 9-10

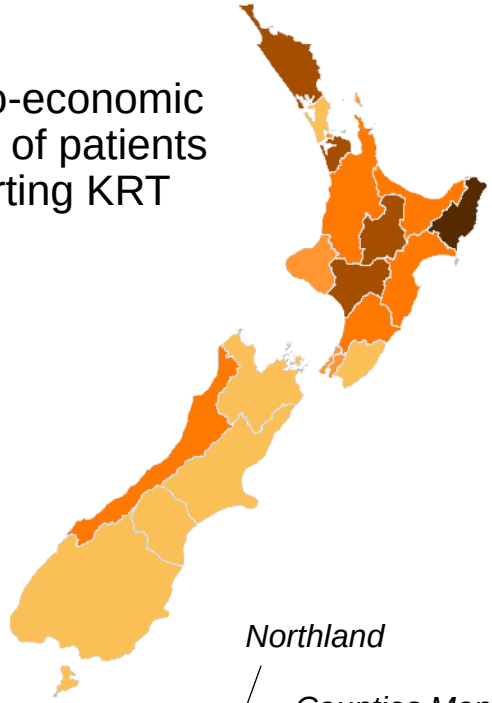
Age-standardised incidence of KRT, 2006-2019



Rurality of patients starting KRT



Socio-economic index of patients starting KRT

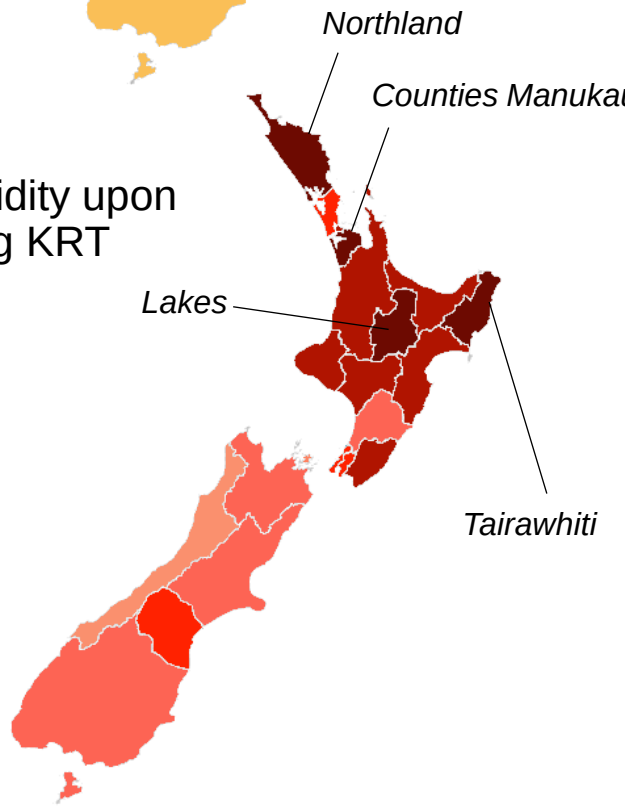


Multimorbidity upon starting KRT

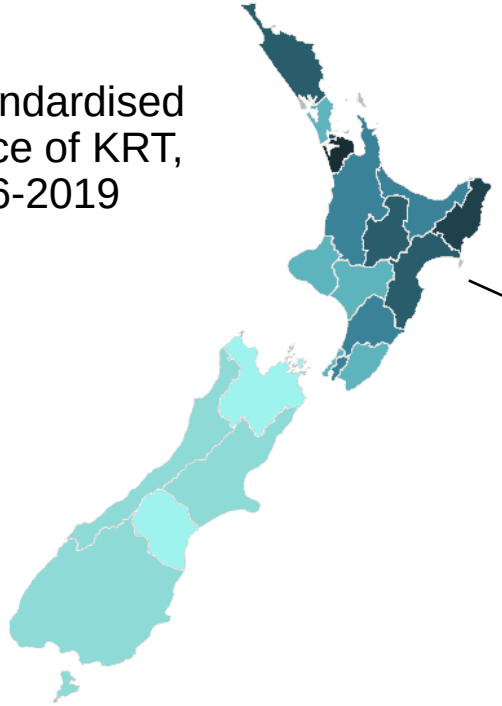
% of patients with a Charlson Comorbidity Index ≥2*:

- 30-39%
- 40-49%
- 50-59%
- 60-69%
- 70-79%

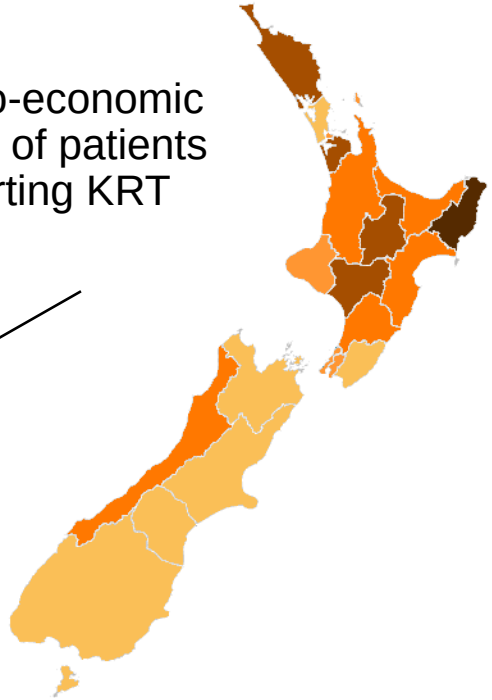
*Estimated 10-year survival ≤ 53%

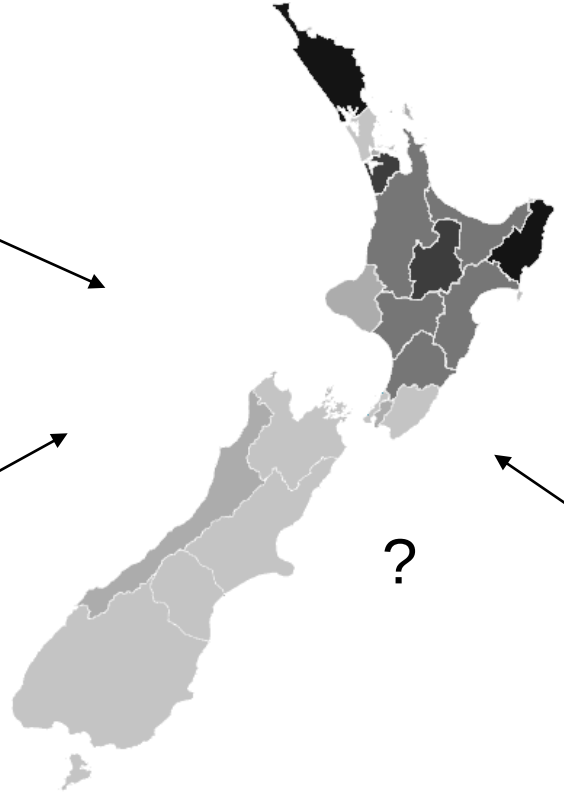


Age-standardised incidence of KRT, 2006-2019



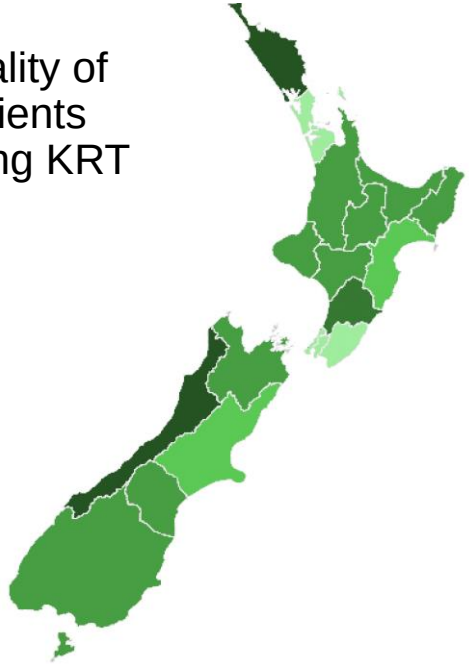
Socio-economic index of patients starting KRT



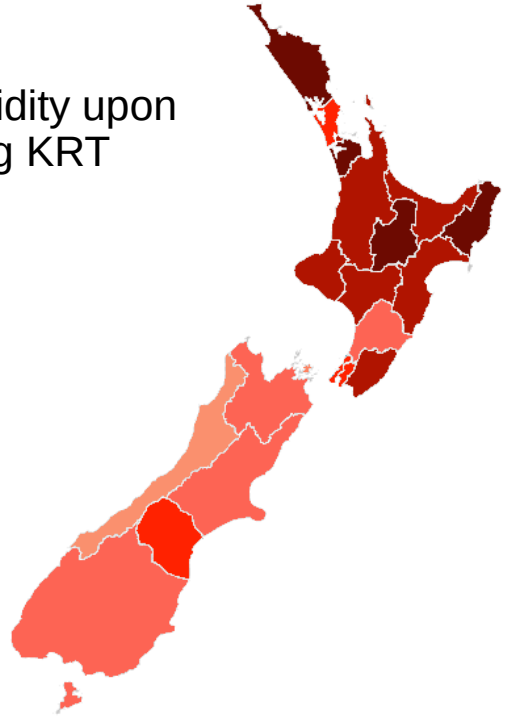


?

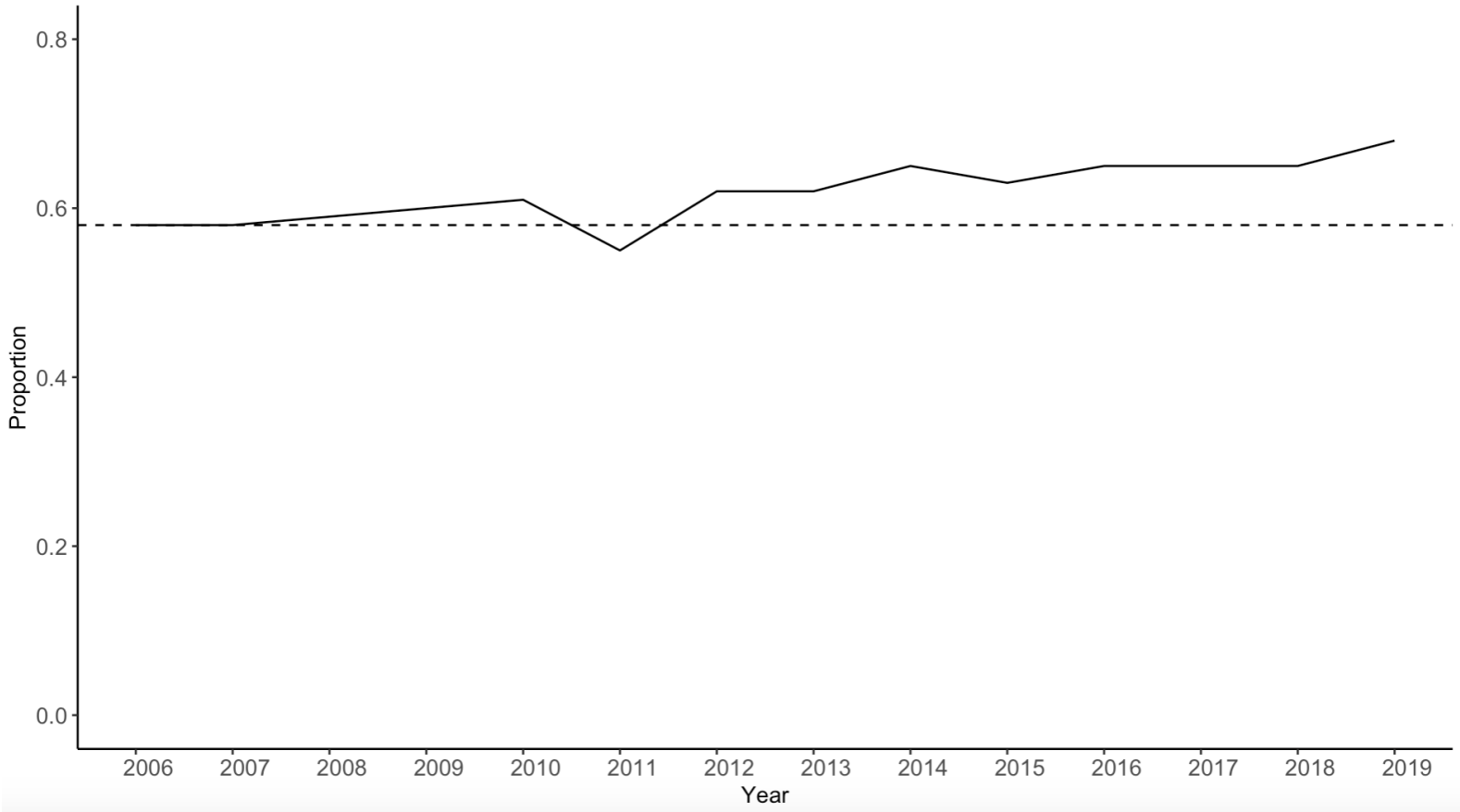
Rurality of patients starting KRT



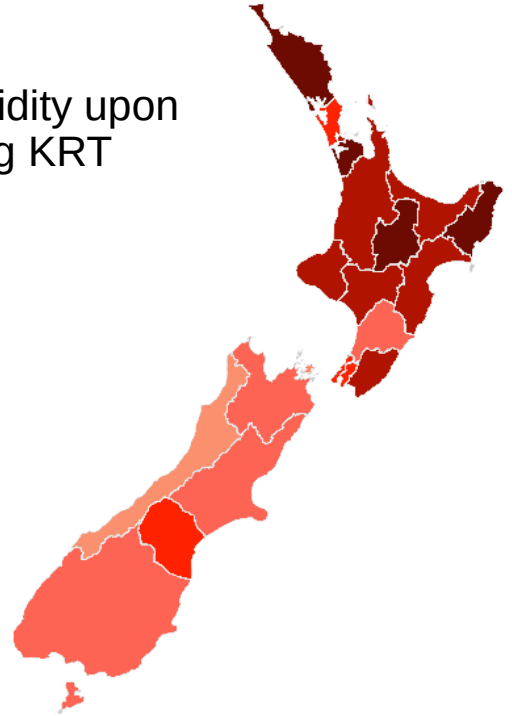
Multimorbidity upon starting KRT



Proportion of people starting KRT with Charlson Comorbidity Index ≥2*: trend over study period (2006-2019)



Multimorbidity upon starting KRT



*Estimated 10-year survival of ≤ 53%

Key findings:

2. Living in a non-transplanting region is independently associated with disadvantage in accessing kidney transplantation

ASSET KIDNEY RESEARCH
HE RAWA RARAUNGA HAUORA MŌ NGĀ TĀNGATA O AOTEAROA

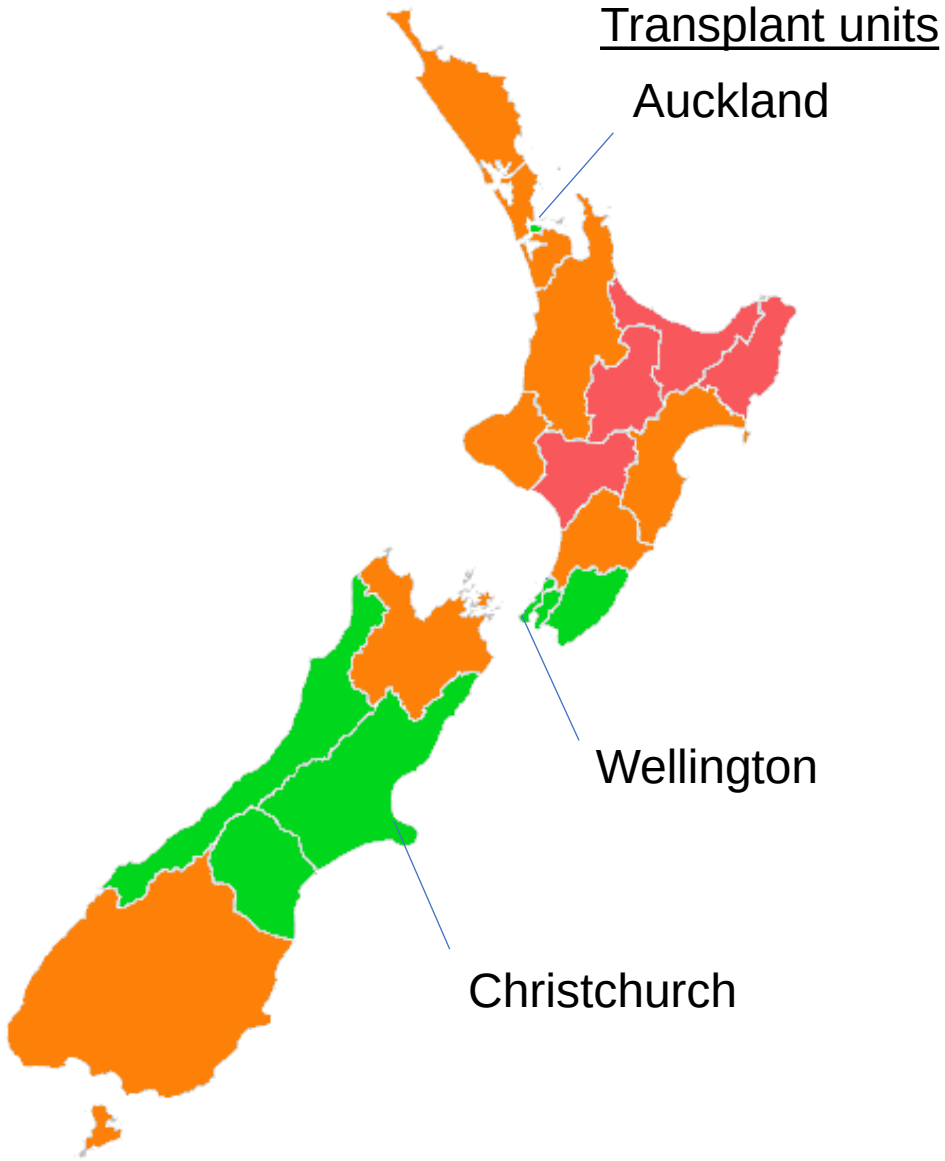
AcceSS and Equity in Transplantation

Region categories

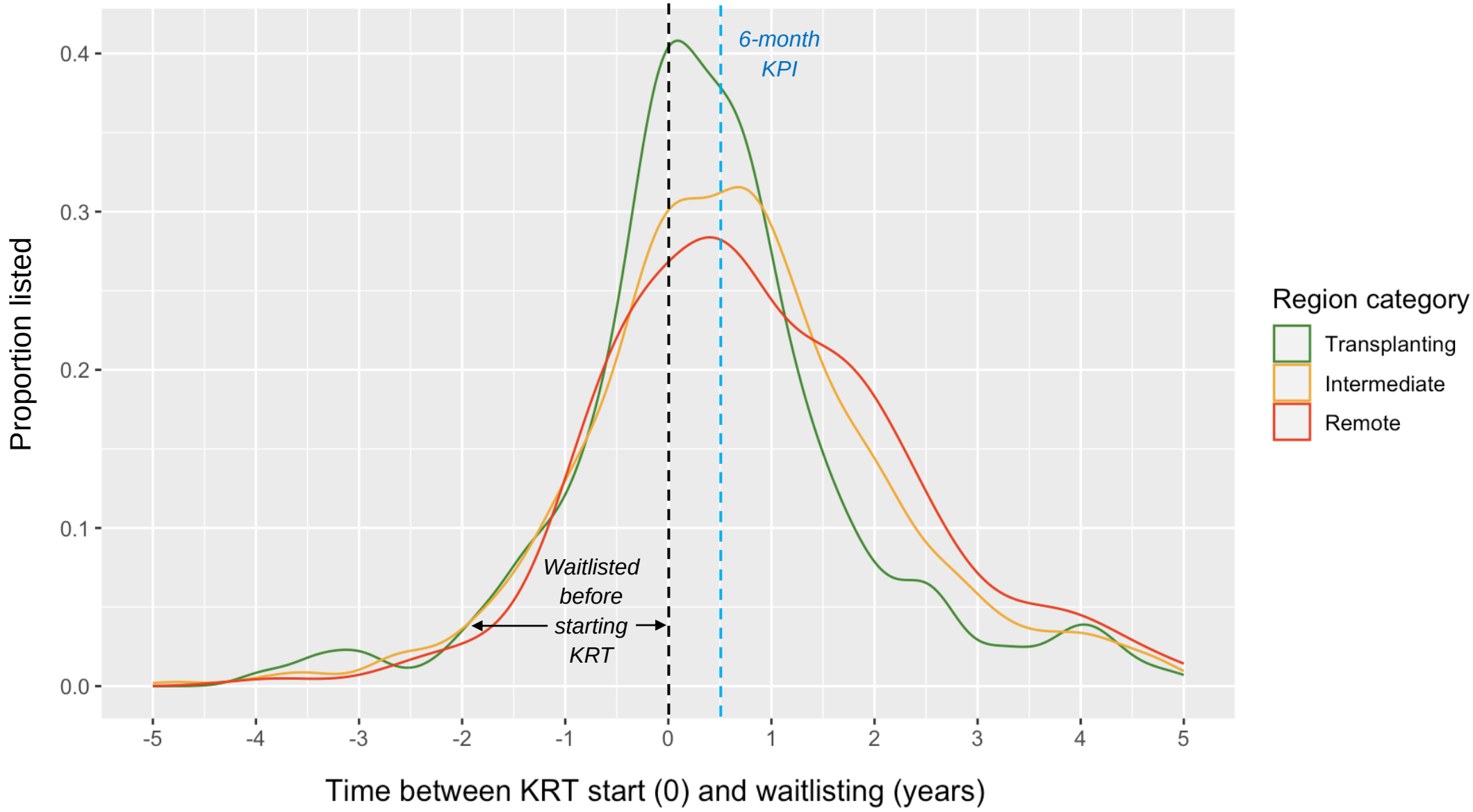
‘*Transplanting regions*’ = District Health Boards (DHBs) containing a transplant unit, or adjacent to and staffed by a transplanting DHB throughout the study period.

‘*Intermediate regions*’ = DHBs with on-site nephrologists that refer patients directly to a transplant unit or received visiting transplant unit staff.

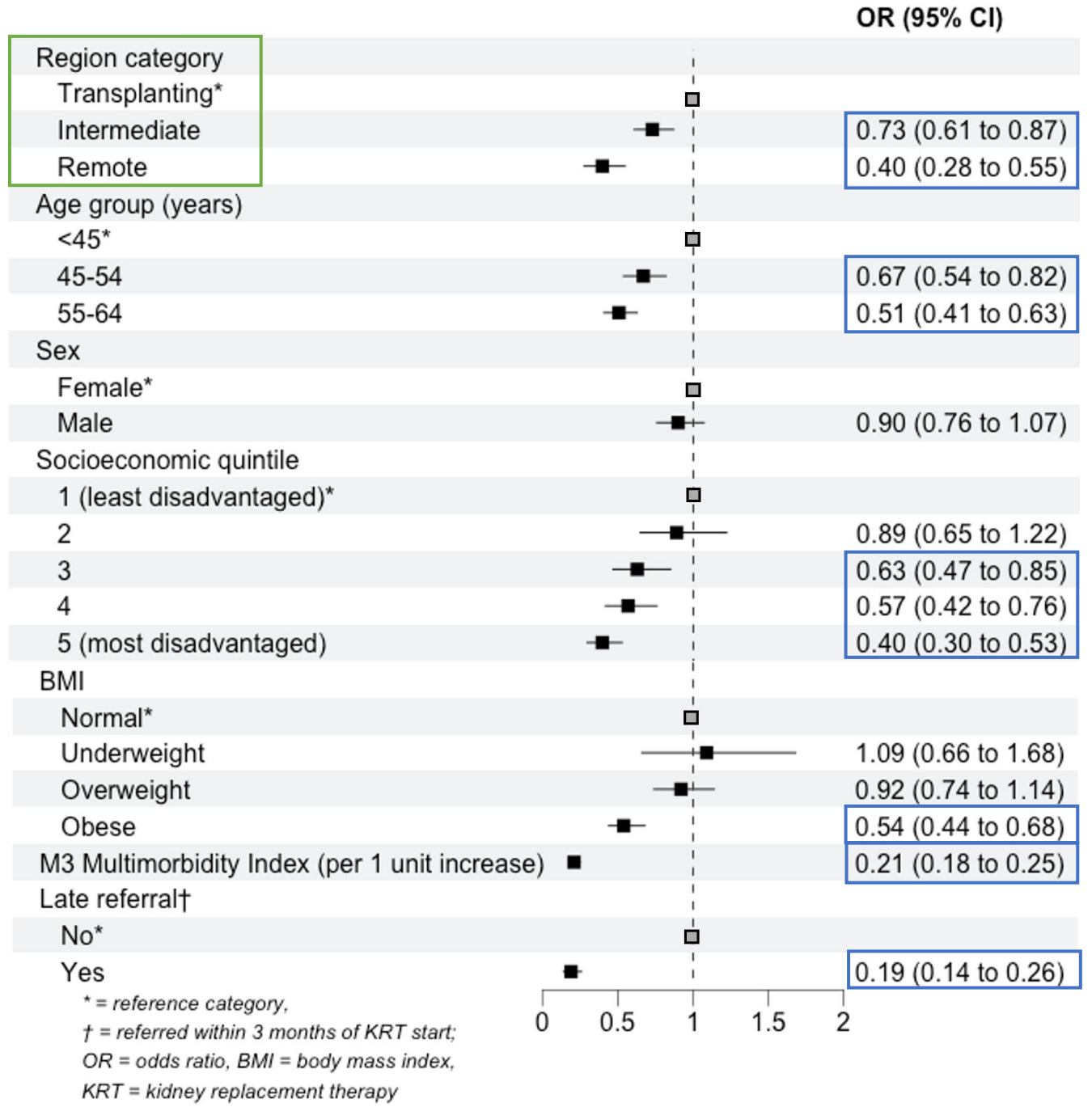
‘*Remote regions*’ = DHBs in which patients require referral to another DHB for nephrology review, followed by a second referral to a transplant unit.



Time between starting KRT and deceased-donor transplant waitlisting (years), by region category in NZ, 2016-2019



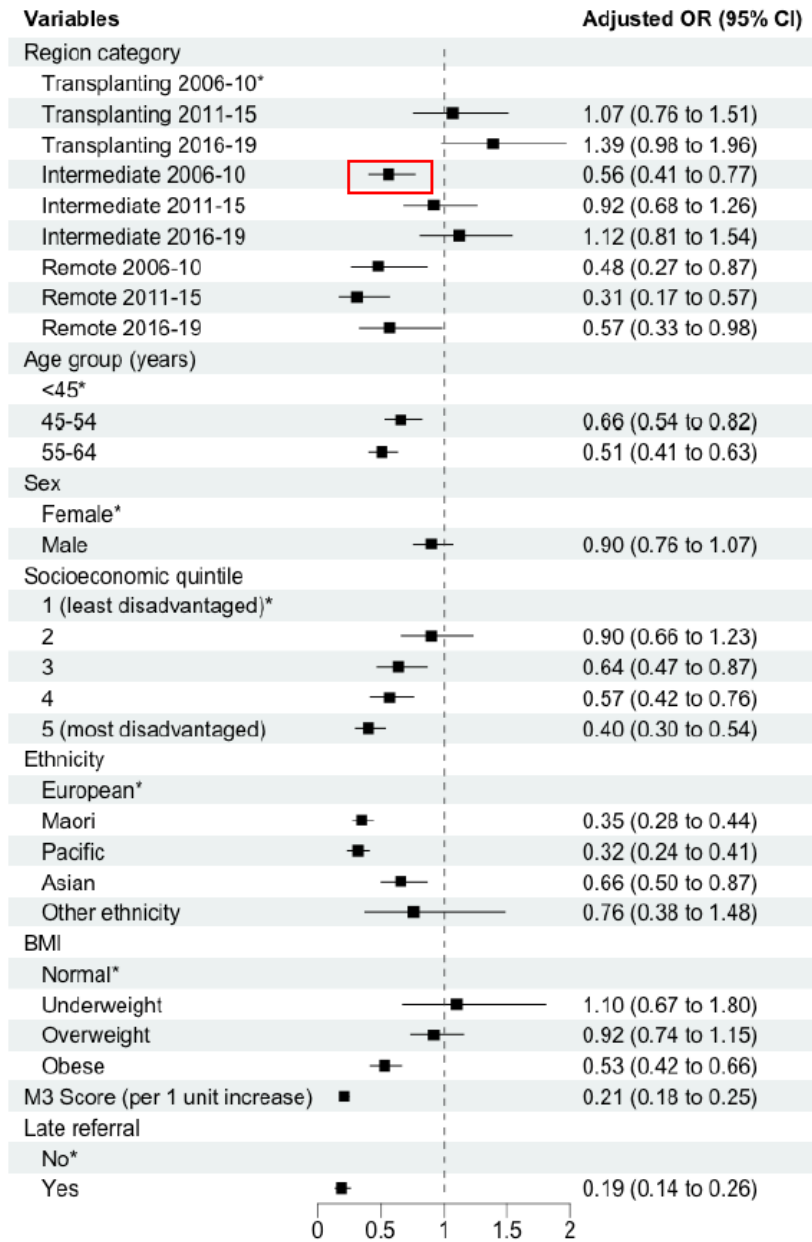
Multiple logistic regression analysis: waitlisting or live donor transplantation by **6 months** after starting KRT



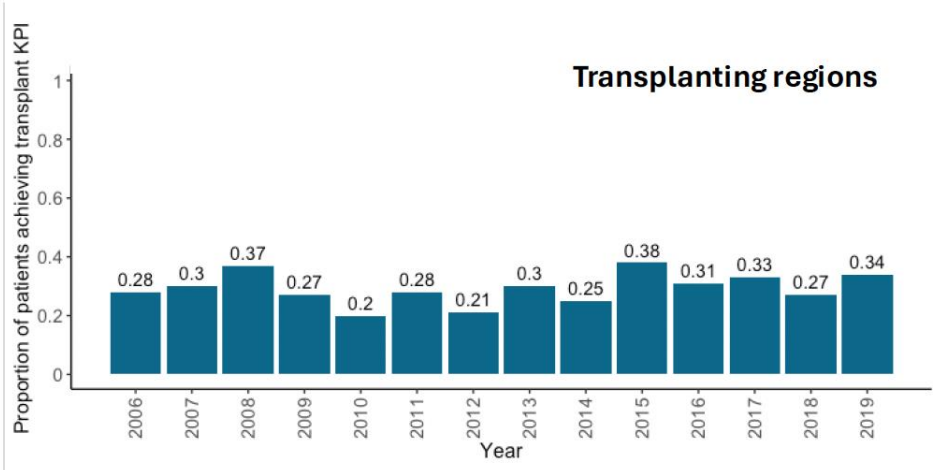
Note: ethnicity was also included in this model

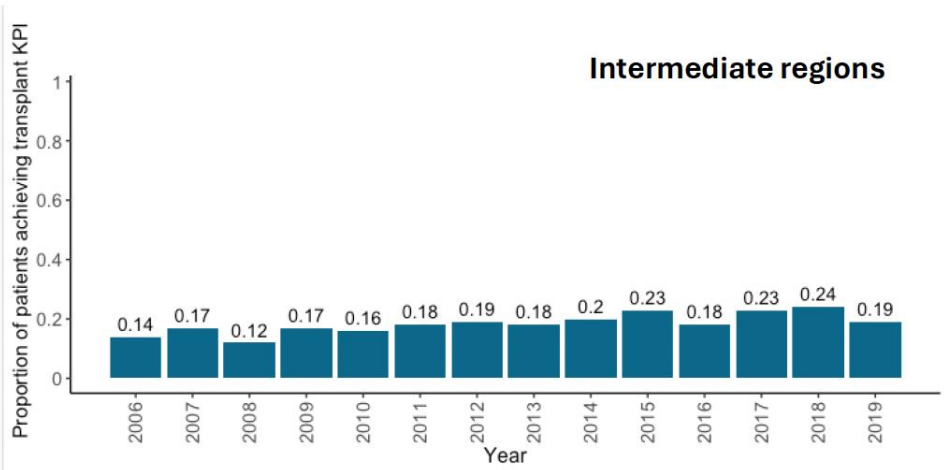
With interaction term (change over time)

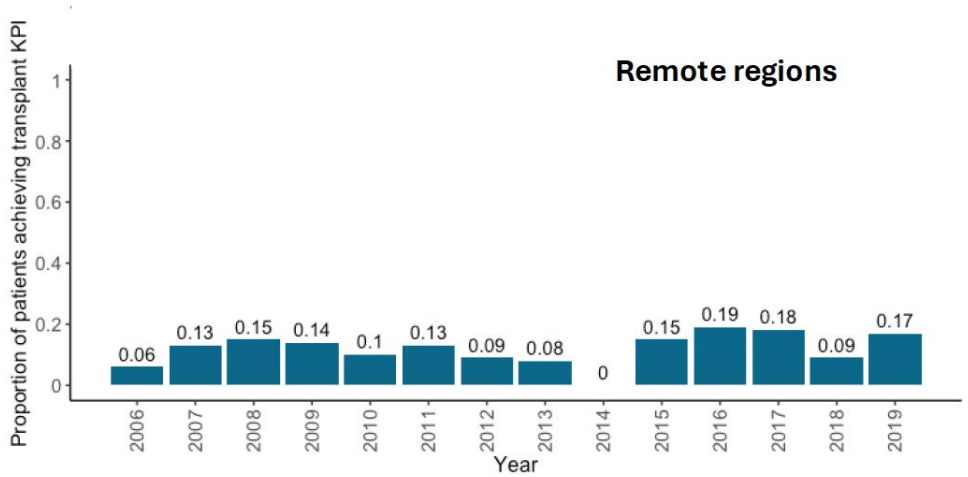
***With* interaction term (between region category and year category):**



Trend in proportion of patients waitlisted or transplanted within 6 months of starting KRT, New Zealand, 2006-19







KRT = kidney replacement therapy; KPI = key performance indicator.
Note: includes patients aged 2-64 years.

Key findings:

3. People of Māori or Pacific ethnicity were also independently disadvantaged in waitlisting and live donor transplantation

Multiple logistic regression analysis: **ethnicity comparison**

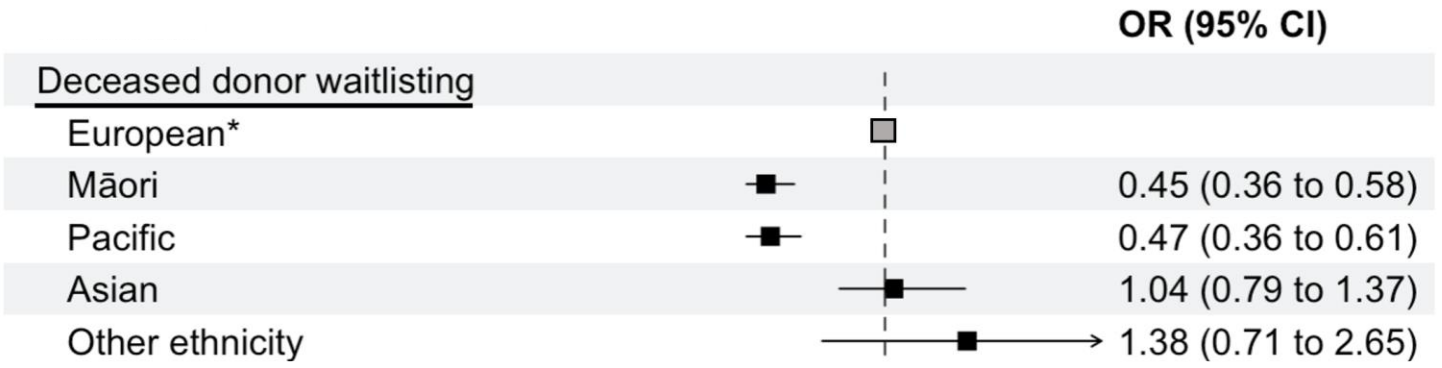
Outcomes:
Waitlisting / live donor transplantation by **6 months** after starting KRT

Adjusted for:

- Region category (transplanting / intermediate / remote)
- Age
- Sex
- Socioeconomic quintile
- Body mass index
- M3 Multimorbidity Score
- Late referral

Multiple logistic regression analysis: **ethnicity comparison**

Outcomes:
Waitlisting / live donor transplantation by **6 months** after starting KRT



Adjusted for:

- Region category (transplanting / intermediate / remote)
- Age
- Sex
- Socioeconomic quintile
- Body mass index
- M3 Multimorbidity Score
- Late referral

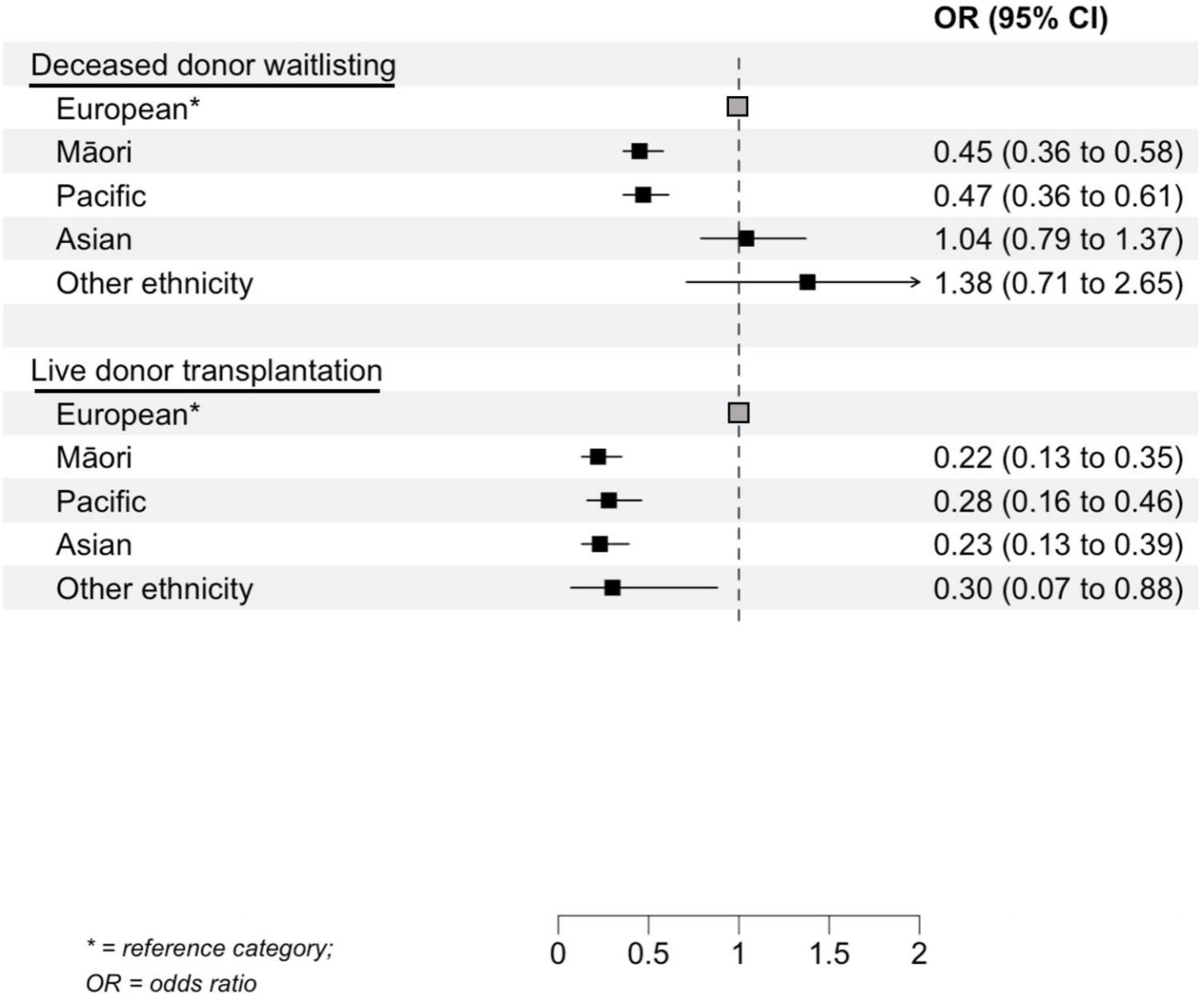
** = reference category;*
OR = odds ratio

Multiple logistic regression analysis: **ethnicity comparison**

Outcomes:
Waitlisting / live donor transplantation by **6 months** after starting KRT

Adjusted for:

- Region category (transplanting / intermediate / remote)
- Age
- Sex
- Socioeconomic quintile
- Body mass index
- M3 Multimorbidity Score
- Late referral



** = reference category;*
OR = odds ratio

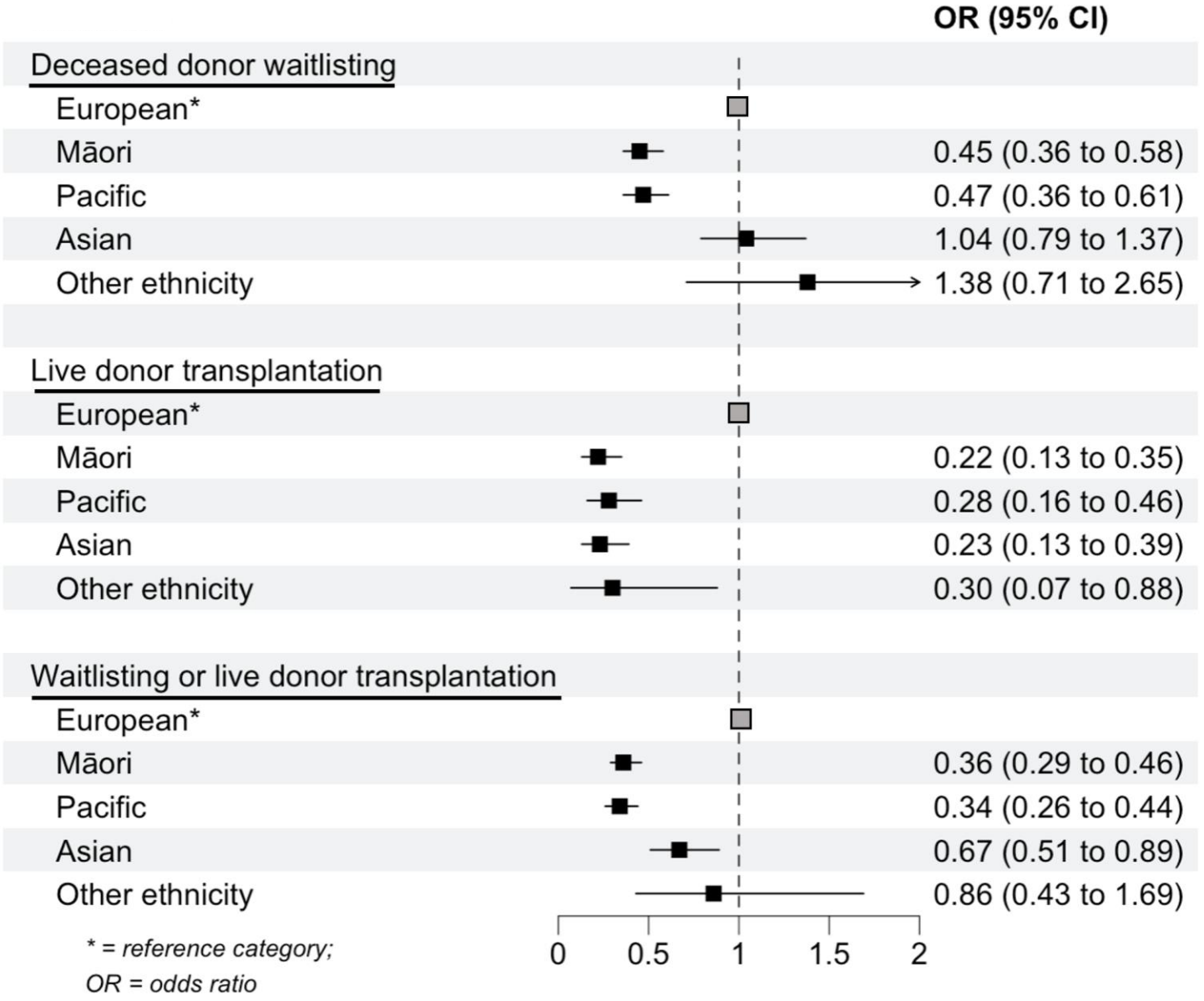
ASSET KIDNEY RESEARCH
HE RAWA RARAUNGA HAUORA MŌ NGĀ TĀNGATA O AOTEAROA

AcceSS and Equity in Transplantation

Multiple logistic regression analysis: **ethnicity comparison**

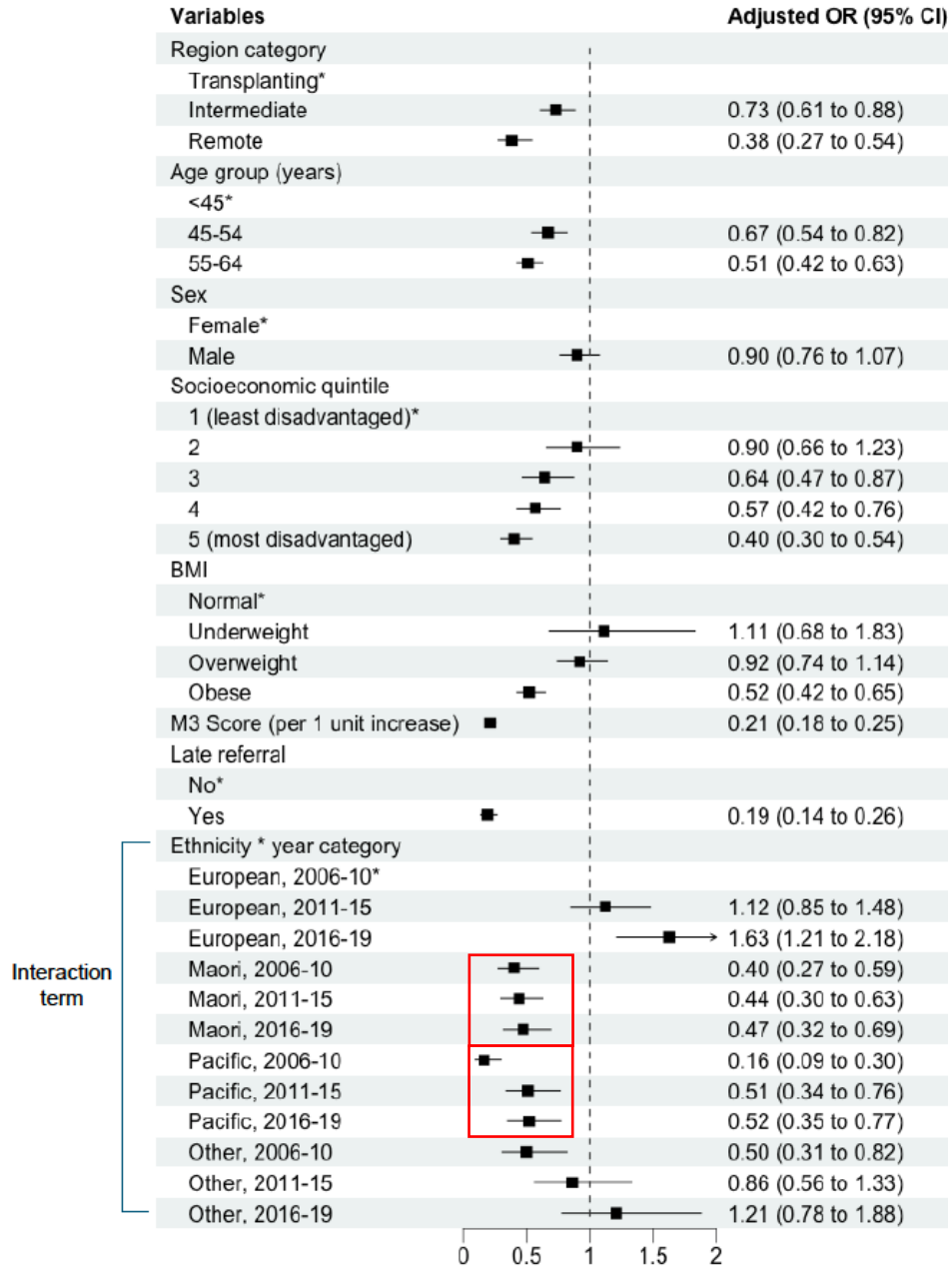
Outcomes:
Waitlisting / live donor transplantation by **6 months** after starting KRT

Adjusted for:
- Region category (transplanting / intermediate / remote)
- Age
- Sex
- Socioeconomic quintile
- Body mass index
- M3 Multimorbidity Score
- Late referral



With interaction term (change over time)

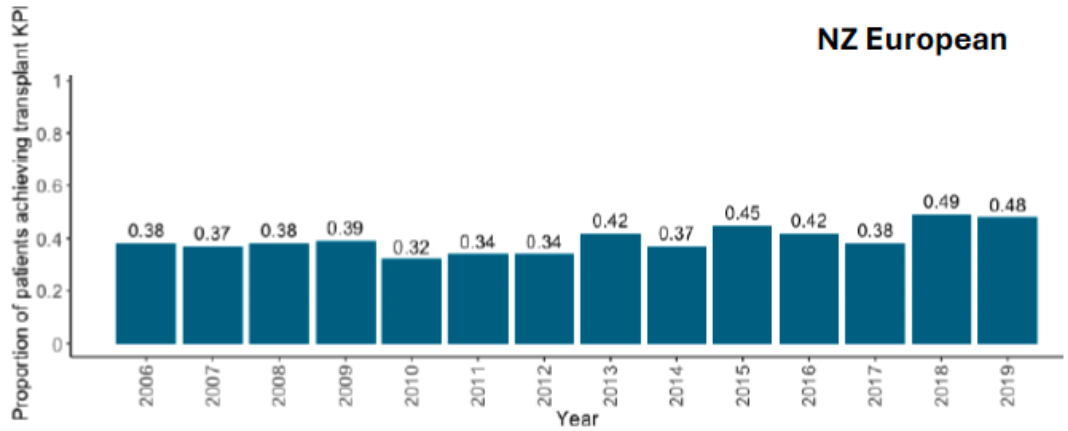
With interaction term (between ethnicity and year category):

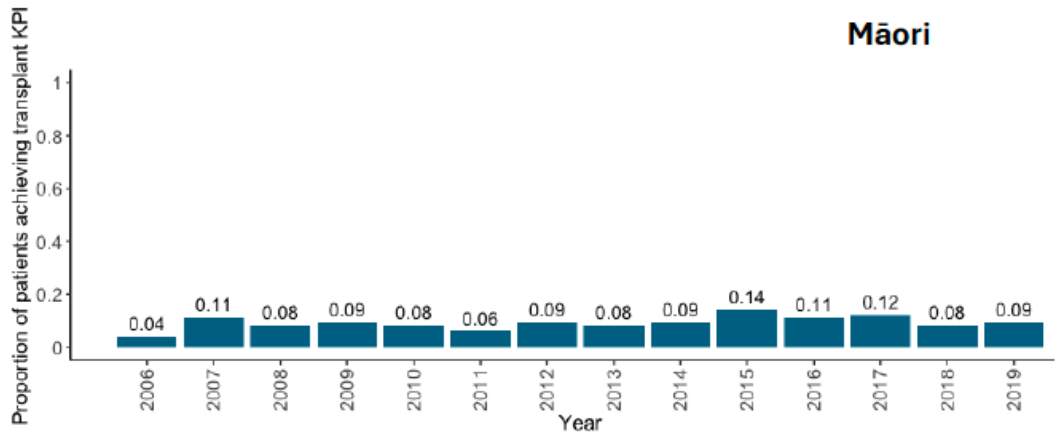


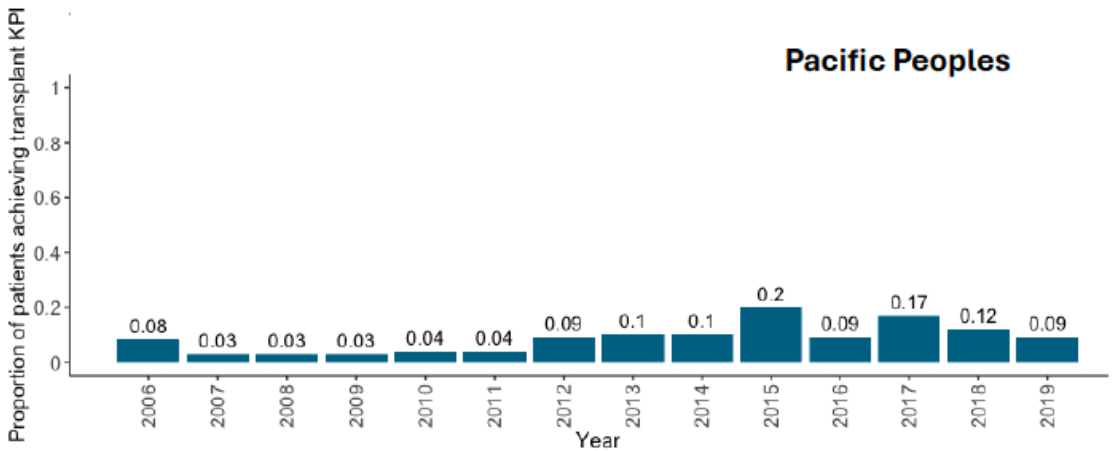
* = reference category

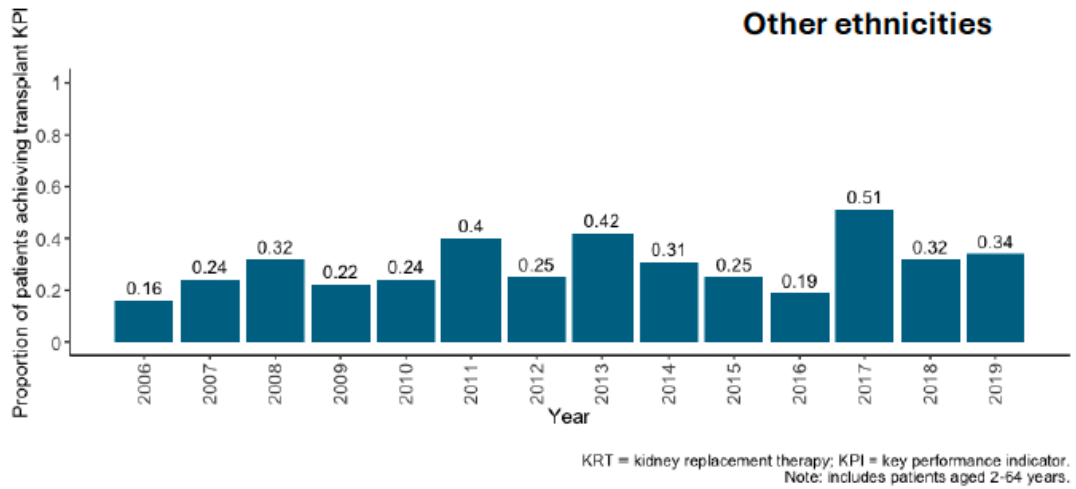
p value for interaction term (ethnicity) x (year category) = **0.046**

Trend in proportion of patients waitlisted or transplanted within 6 months of starting KRT, New Zealand 2006-19 – by ethnicity group (unadjusted)





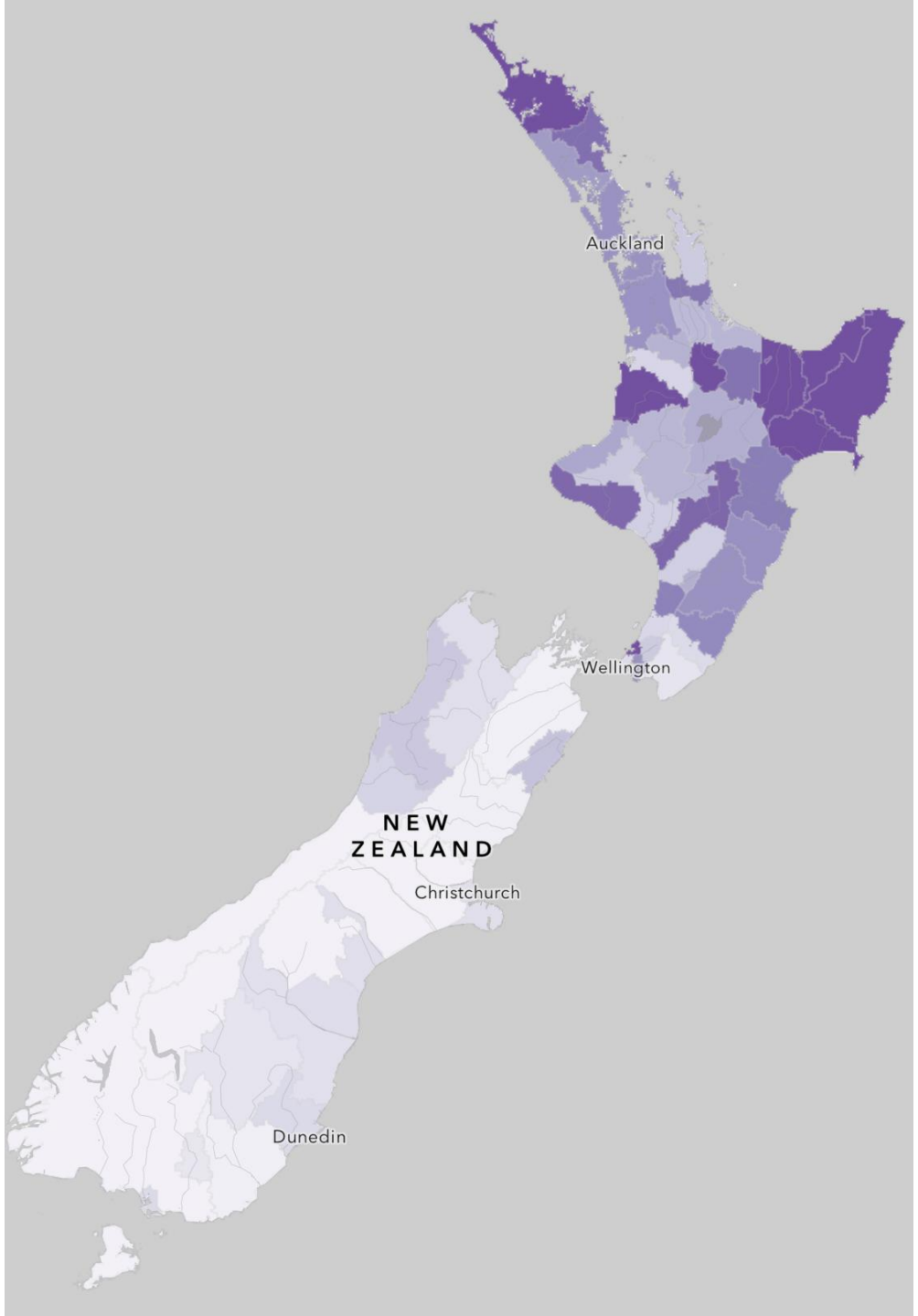


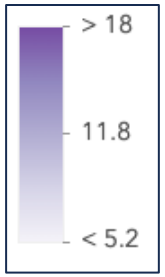


KRT = kidney replacement therapy; KPI = key performance indicator.
Note: includes patients aged 2-64 years.

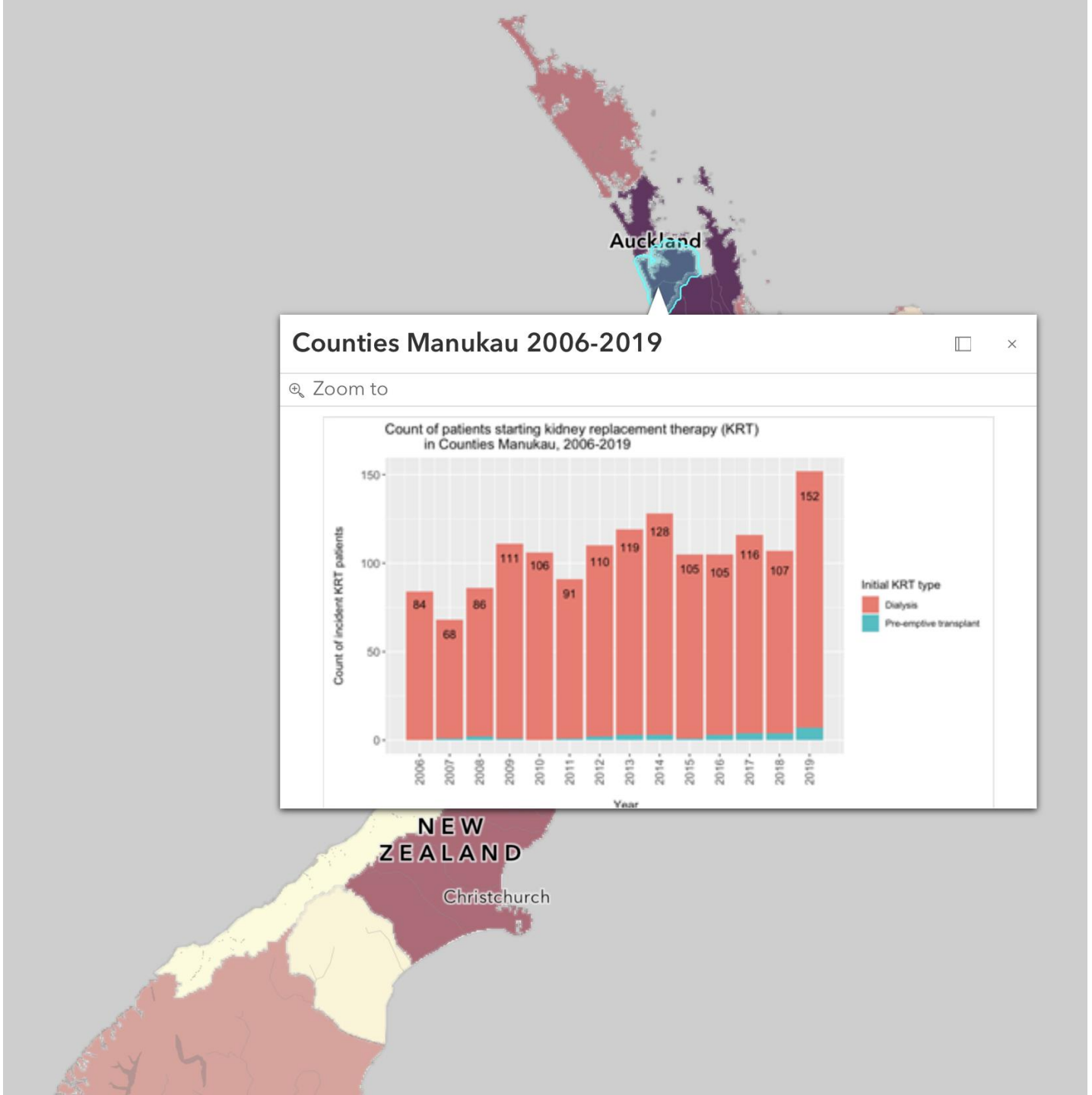
Geo-spatial mapping

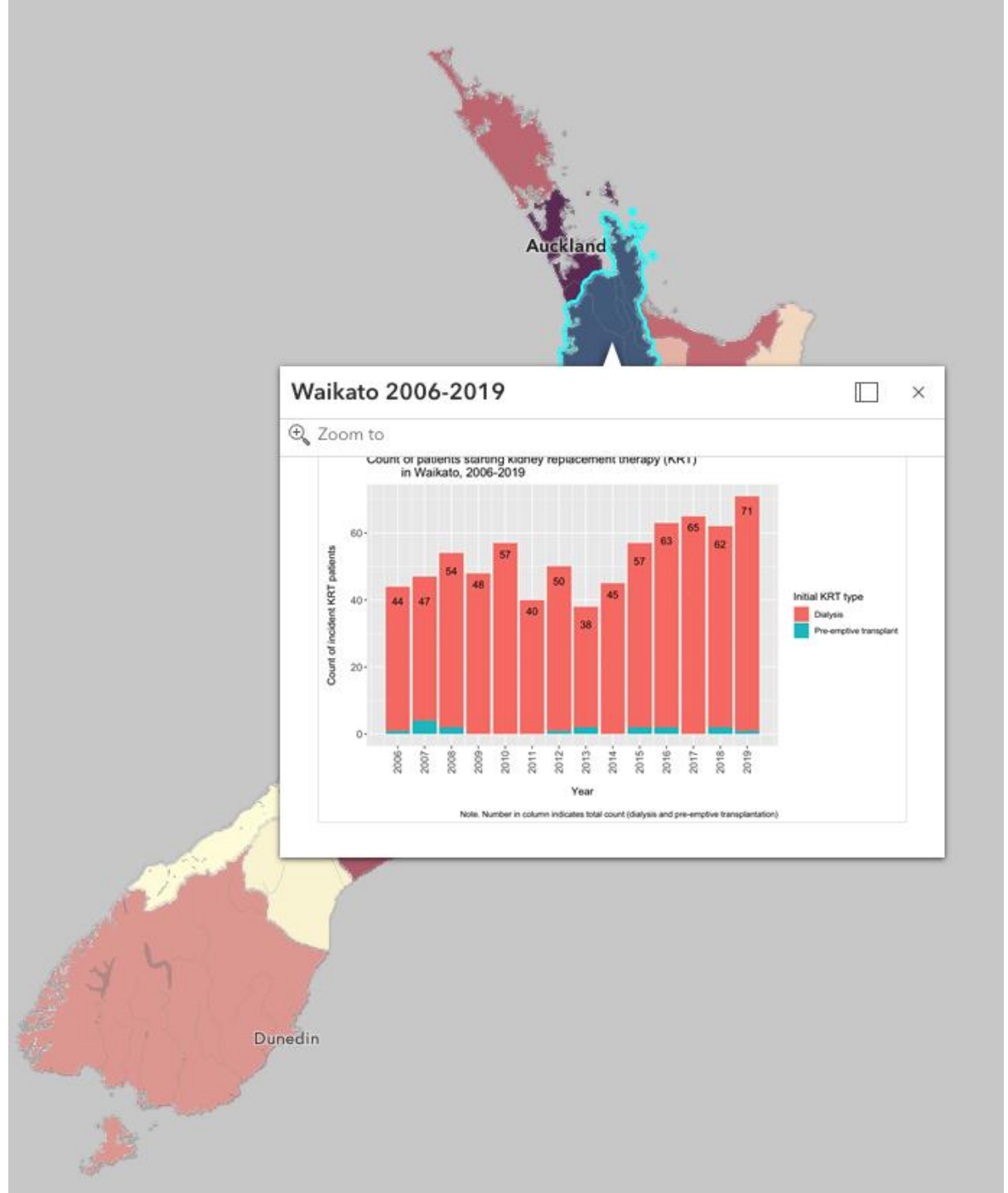
Incidence of KRT, by Territorial Authority, 2006-2019 (per 100,000 population)

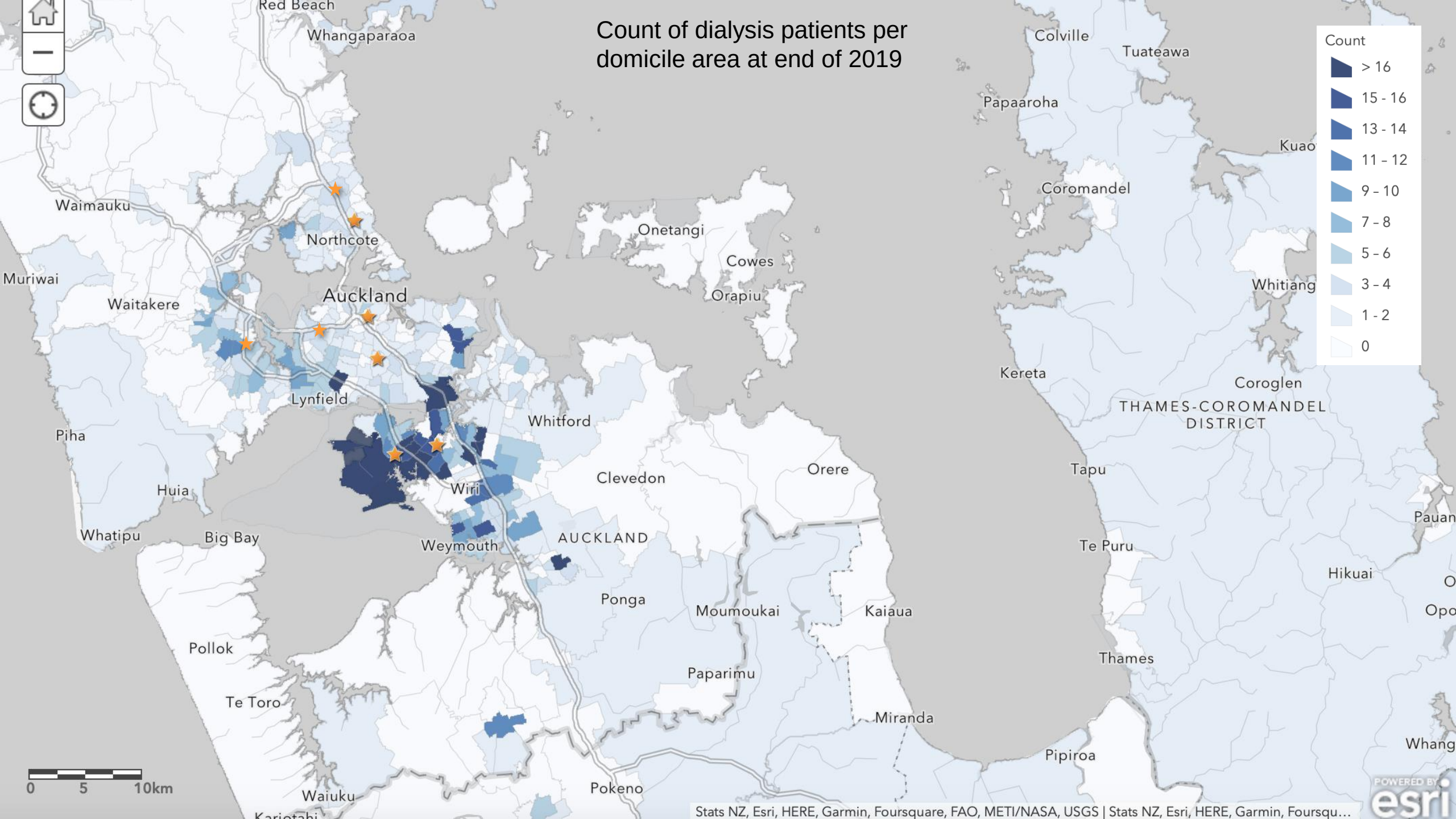


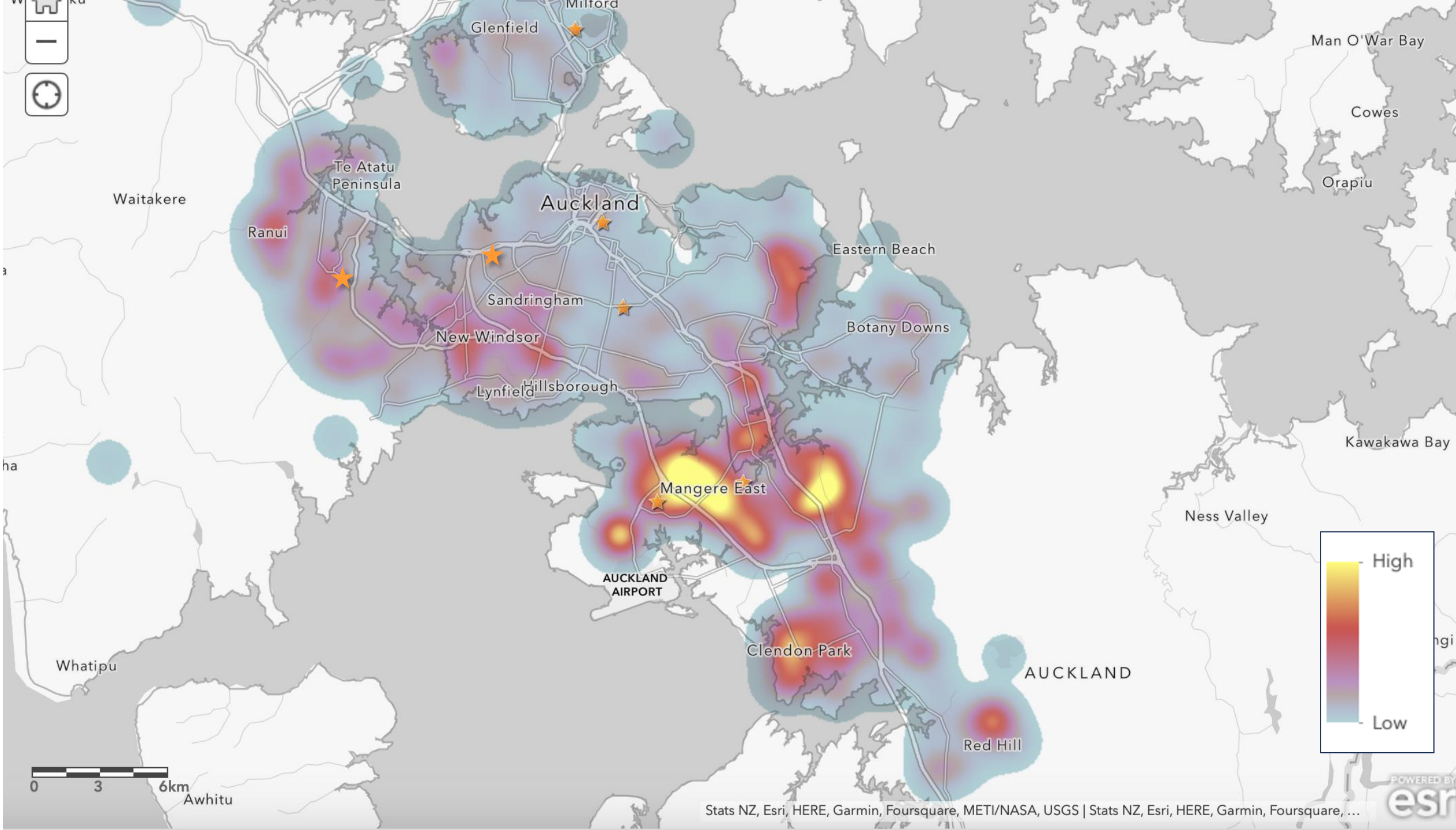


Count of patients starting KRT, by District Health Board, 2006-2019




Auckland
Waikato 2006-2019
Zoom to
Count of patients starting kidney replacement therapy (KRT) in Waikato, 2006-2019
Count of incident KRT patients
0
20
40
60
44
47
54
48
57
40
50
38
45
57
63
65
62
71
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
Year
Initial KRT type
Dialysis
Pre-emptive transplant
Note. Number in column indicates total count (dialysis and pre-emptive transplantation)
Dunedin

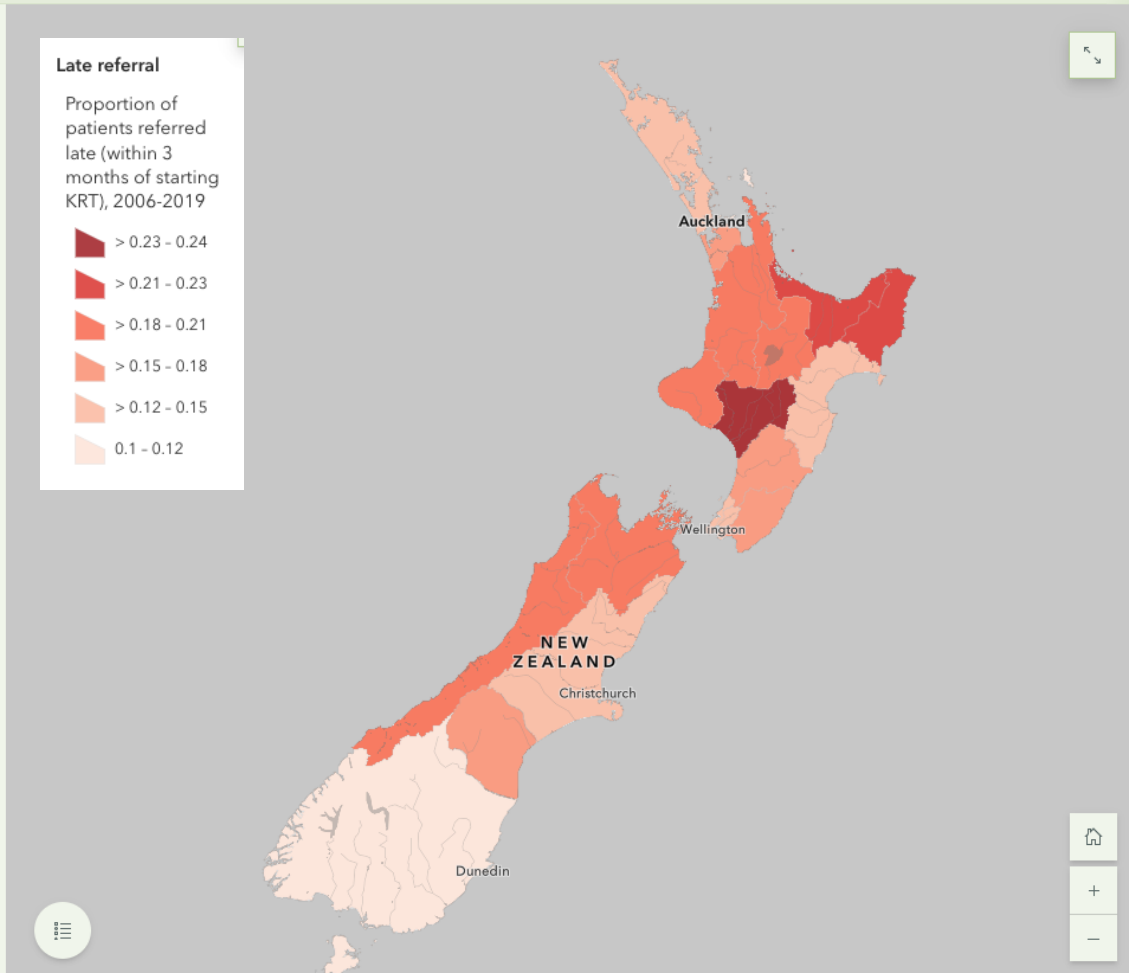

Count of dialysis patients per domicile area at end of 2019
Count
> 16
15 - 16
13 - 14
11 - 12
9 - 10
7 - 8
5 - 6
3 - 4
1 - 2
0
Red Beach
Whangaparaoa
Colville
Tuateawa
Papaaroha
Kuao
Coromandel
Waimauku
Onetangi
Cowes
Orapiu
Northcote
Muriwai
Auckland
Waitakere
Whitiang
Kereta
Coroglen
THAMES-COROMANDEL DISTRICT
Lynfield
Whitford
Piha
Clevedon
Orere
Tapu
Huia
Wiri
Whatipu
Big Bay
Weymouth
AUCKLAND
Te Puru
Hikuai
Ponga
Moumoukai
Kaiaua
Pollok
Thames
Paparimu
Te Toro
Miranda
Pipiroa
Pokeno
Waiuku
0 5 10km
Stats NZ, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS | Stats NZ, Esri, HERE, Garmin, Foursqu…
POWERED BY esri


Milford
Glenfield
Man O'War Bay
Cowes
Orapiu
Te Atatu
Peninsula
Waitakere
Auckland
Ranui
Eastern Beach
Sandringham
Botany Downs
New Windsor
Lynfield
Hillsborough
Kawakawa Bay
Mangere East
Ness Valley
AUCKLAND
AIRPORT
Clendon Park
AUCKLAND
Whatipu
Red Hill
Awhitu
High
Low
0
3
6km
Stats NZ, Esri, HERE, Garmin, Foursquare, METI/NASA, USGS | Stats NZ, Esri, HERE, Garmin, Foursquare, …

Late referral

ANZDATA captures whether patients were referred to a nephrology service at a late stage (**within 3 months of starting KRT**).

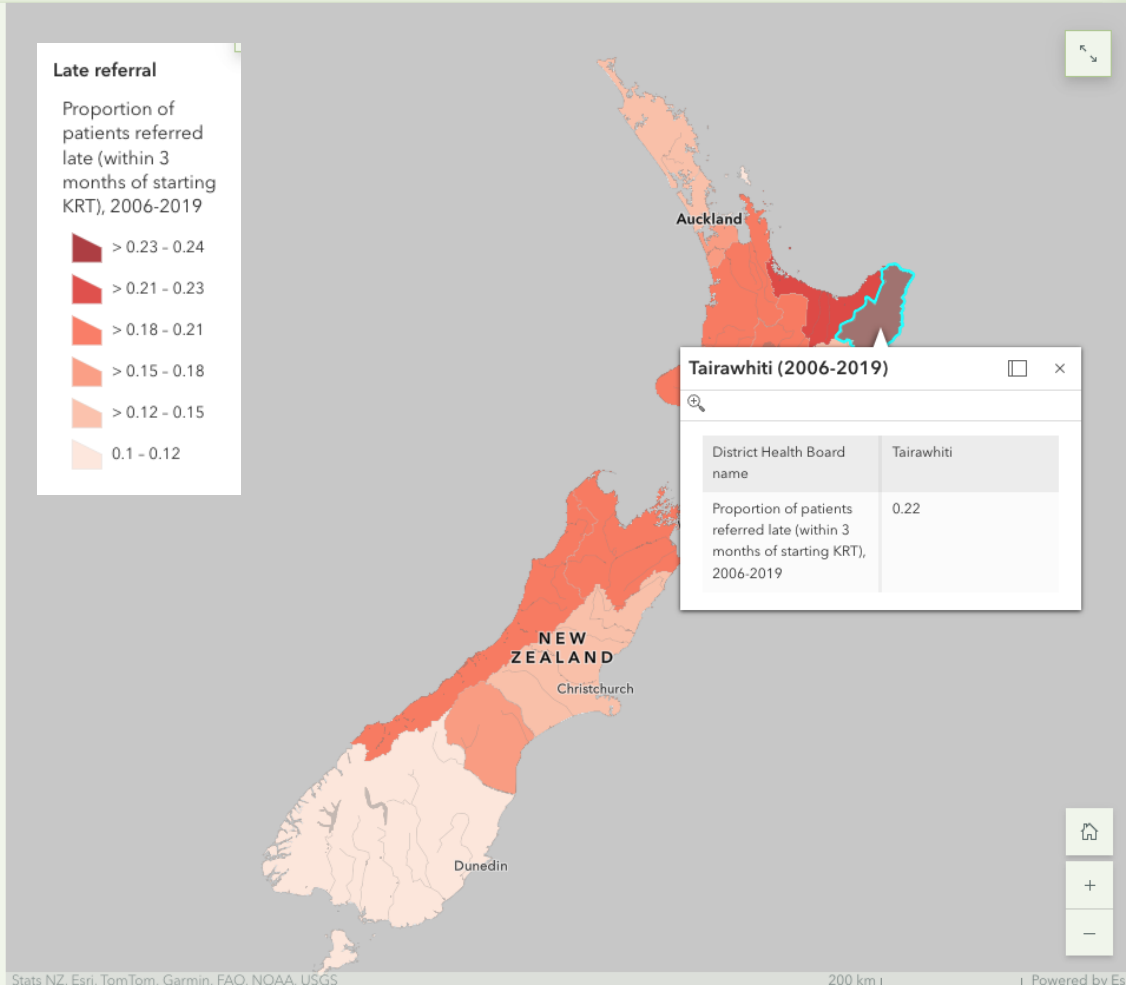
Rates of late referral are shown in this interactive map, ranging from 10% (in ⊕ Auckland DHB) to 24% (in ⊕ Whanganui DHB).

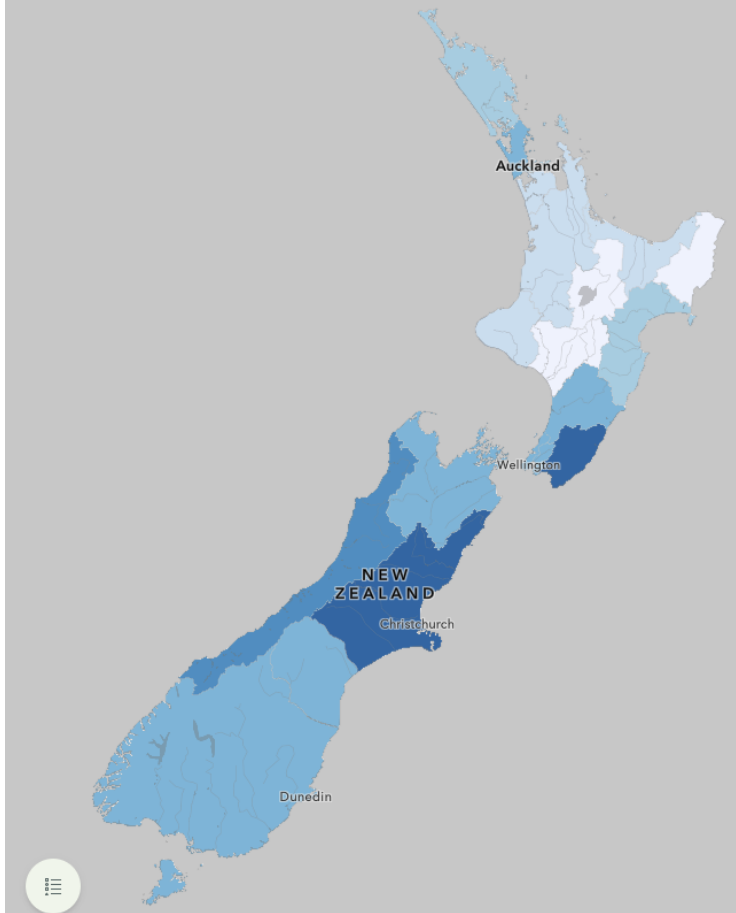


Late referral

ANZDATA captures whether patients were referred to a nephrology service at a late stage (**within 3 months of starting KRT**).

Rates of late referral are shown in this interactive map, ranging from 10% (in ⊕ Auckland DHB) to 24% (in ⊕ Whanganui DHB).



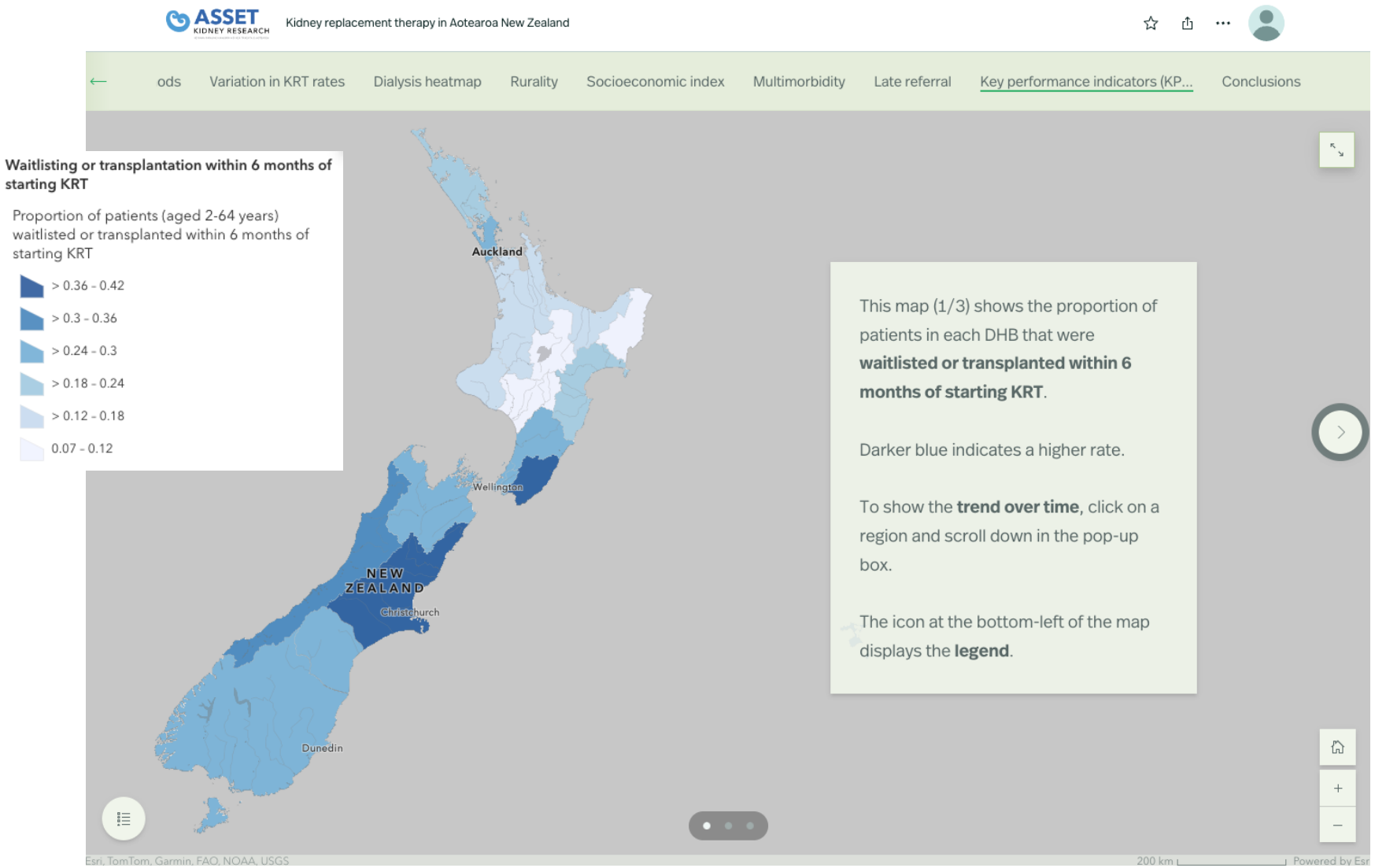


This map (1/3) shows the proportion of patients in each DHB that were **waitlisted or transplanted within 6 months of starting KRT**.

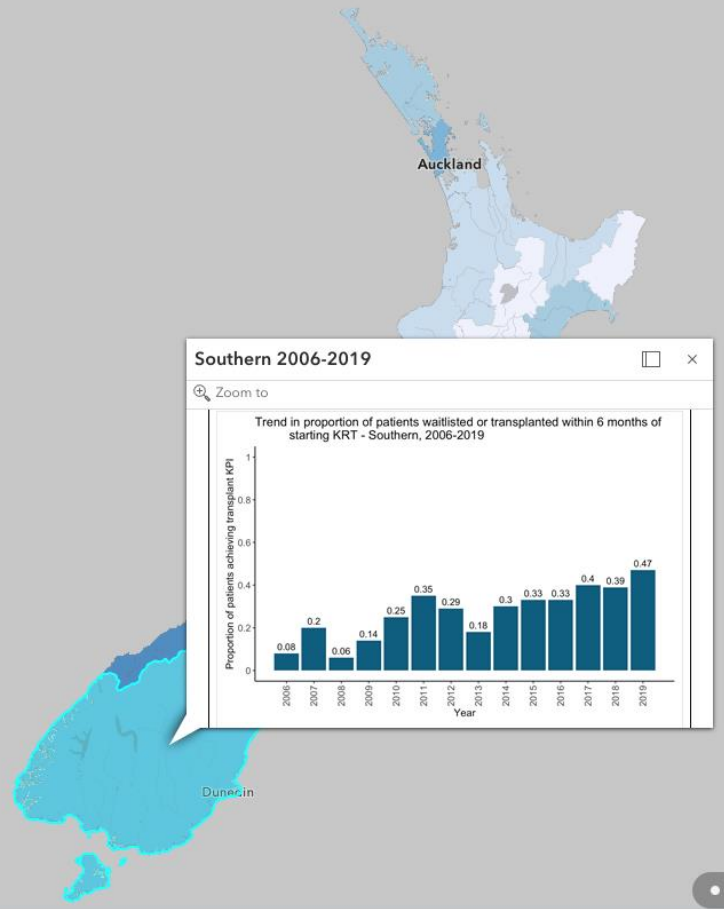
Darker blue indicates a higher rate.

To show the **trend over time**, click on a region and scroll down in the pop-up box.

The icon at the bottom-left of the map displays the **legend**.


ASSET KIDNEY RESEARCH
Kidney replacement therapy in Aotearoa New Zealand
ods
Variation in KRT rates
Dialysis heatmap
Rurality
Socioeconomic index
Multimorbidity
Late referral
Key performance indicators (KP...
Conclusions
Waitlisting or transplantation within 6 months of starting KRT
Proportion of patients (aged 2-64 years) waitlisted or transplanted within 6 months of starting KRT
> 0.36 - 0.42
> 0.3 - 0.36
> 0.24 - 0.3
> 0.18 - 0.24
> 0.12 - 0.18
0.07 - 0.12
Auckland
Wellington
NEW ZEALAND
Christchurch
Dunedin
This map (1/3) shows the proportion of patients in each DHB that were **waitlisted or transplanted within 6 months of starting KRT**.
Darker blue indicates a higher rate.
To show the **trend over time**, click on a region and scroll down in the pop-up box.
The icon at the bottom-left of the map displays the **legend**.
Esri, TomTom, Garmin, FAO, NOAA, USGS
200 km
Powered by Esri

ASSET KIDNEY RESEARCH | Kidney replacement therapy in Aotearoa New Zealand

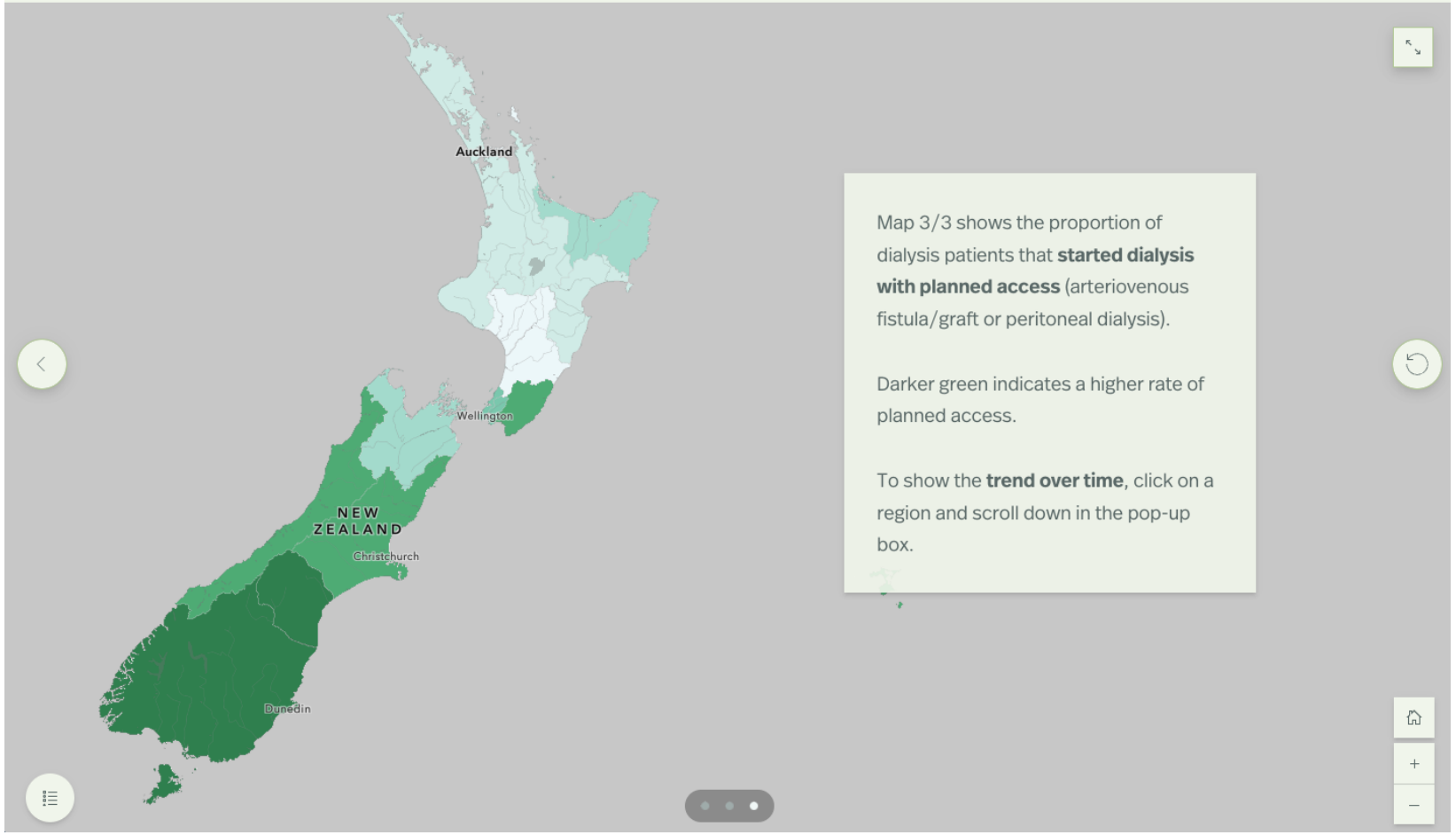


This map (1/3) shows the proportion of patients in each DHB that were **waitlisted or transplanted within 6 months of starting KRT**.

Darker blue indicates a higher rate.

To show the **trend over time**, click on a region and scroll down in the pop-up box.

The icon at the bottom-left of the map displays the **legend**.



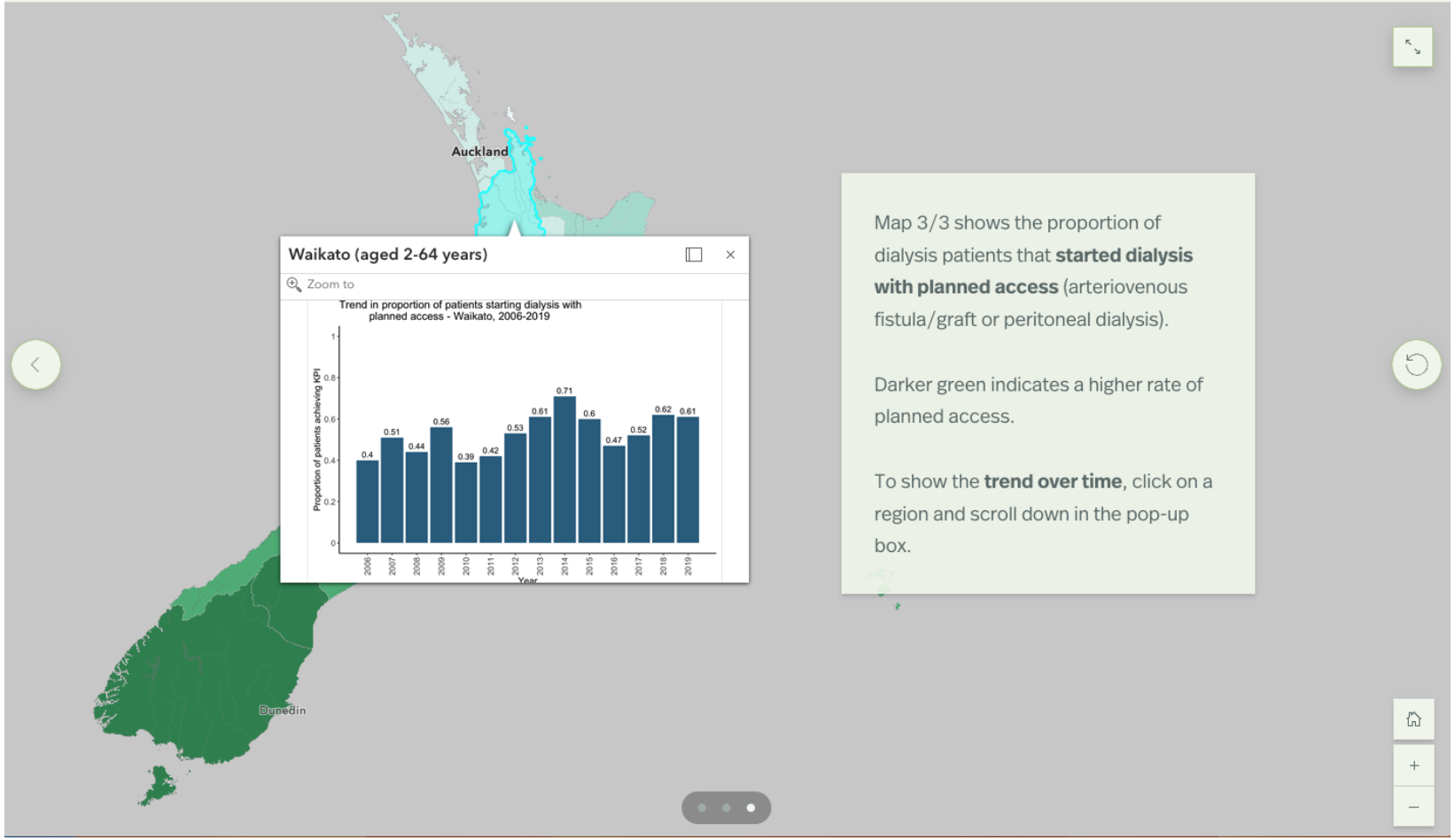
Map 3/3 shows the proportion of dialysis patients that **started dialysis with planned access** (arteriovenous fistula/graft or peritoneal dialysis).

Darker green indicates a higher rate of planned access.

To show the **trend over time**, click on a region and scroll down in the pop-up box.

ASSET KIDNEY RESEARCH

Kidney replacement therapy in Aotearoa New Zealand



Map 3/3 shows the proportion of dialysis patients that **started dialysis with planned access** (arteriovenous fistula/graft or peritoneal dialysis).

Darker green indicates a higher rate of planned access.

To show the **trend over time**, click on a region and scroll down in the pop-up box.

Key findings:

1. The epidemiology of kidney failure and multimorbidity burden is highly variable across Aotearoa New Zealand

2. Living in a non-transplanting region was independently associated with disadvantage in accessing kidney transplantation

3. People of Māori or Pacific ethnicity were also independently disadvantaged in waitlisting and live donor transplantation.

References:

1. Wong G, Howard K, Chapman JR, Chadban S, Cross N, Tong A, et al. Comparative survival and economic benefits of deceased donor kidney transplantation and dialysis in people with varying ages and co-morbidities. PLoS One. 2012; 7(1):e29591.

2. Tonelli M, Wiebe N, Knoll G, Bello A, Browne S, Jadhav D, et al. Systematic Review: Kidney Transplantation Compared With Dialysis in Clinically Relevant Outcomes. American Journal of Transplantation. 2011; 11(10):2093–109.

3. ANZSN Key Performance Indicator (KPI) Working Group. A Nephrology KPI Program for Australia and Aotearoa New Zealand - Report of the Key Performance Indicator Working Group. Nov 2020.

4. Stats NZ. Subnational population estimates (DHB, DHB constituency), by age and sex, at 30 June 1996-2022 (2015 boundaries), 2023.

5. Ahmad OB, Boschi-Pinto C., Lopez AD, Murray CJL, Lozano R, Inoue M. Age standardization of rates: a new WHO standard, in GPE Discussion Paper Series*: No.31*. 2001, EIP/GPE/EBD. World Health Organization.

Acknowledgements:



- **Research supervisors**: Dr Nicole De La Mata, Prof Angela Webster, Dr Nick Cross
- **ASSET Team**: Dr Ben Beaglehole, Dr Ian Dittmer, Dr John Irvine, Mr John Kearns, Dr Curtis Walker, Dr Heather Dunckley, Ms Merryn Jones, A/Prof Patrick Kelly, Prof Kate Wyburn, Ms Rachel Cutting, Dr Melanie Wyld
- **The Ross Bailey Nephrology Trust**
- Human Research Council Activation Grant 2 HRC 20/1225 (ASSET Project)
- Prof Tim Driscoll, University of Sydney School of Public Health (Public Health Training Supervisor)
- A/Prof James Stanley, Prof Diana Sarfati, A/Prof Jason Gurney - Multimorbidity project, University of Otago - Wellington (M3 Multimorbidity Index R code)
- Mr James Hedley, University of Sydney (adapted Charlson Comorbidity Index R Code)
- Mr Ray Wibrow, Digital Enablement / Pūnaha Tōrire, Te Matau a Māui Hawke's Bay
- University of Otago – Rural-urban classification for NZ health research and policy