SOCIAL INEQUITY & AIR QUALITY IN AOTEAROA

A Preliminary Assessment

STUDY TEAM

Lou Wickham

BE (Chem & Mats)
MEL (Env Law)

Emission
Impossible Ltd

Jayne Metcalfe

BE Hons
ME (Chem & Process)

Emission
Impossible Ltd

Kylie Mason

BSc/BA
MSc (Applied Statistics)

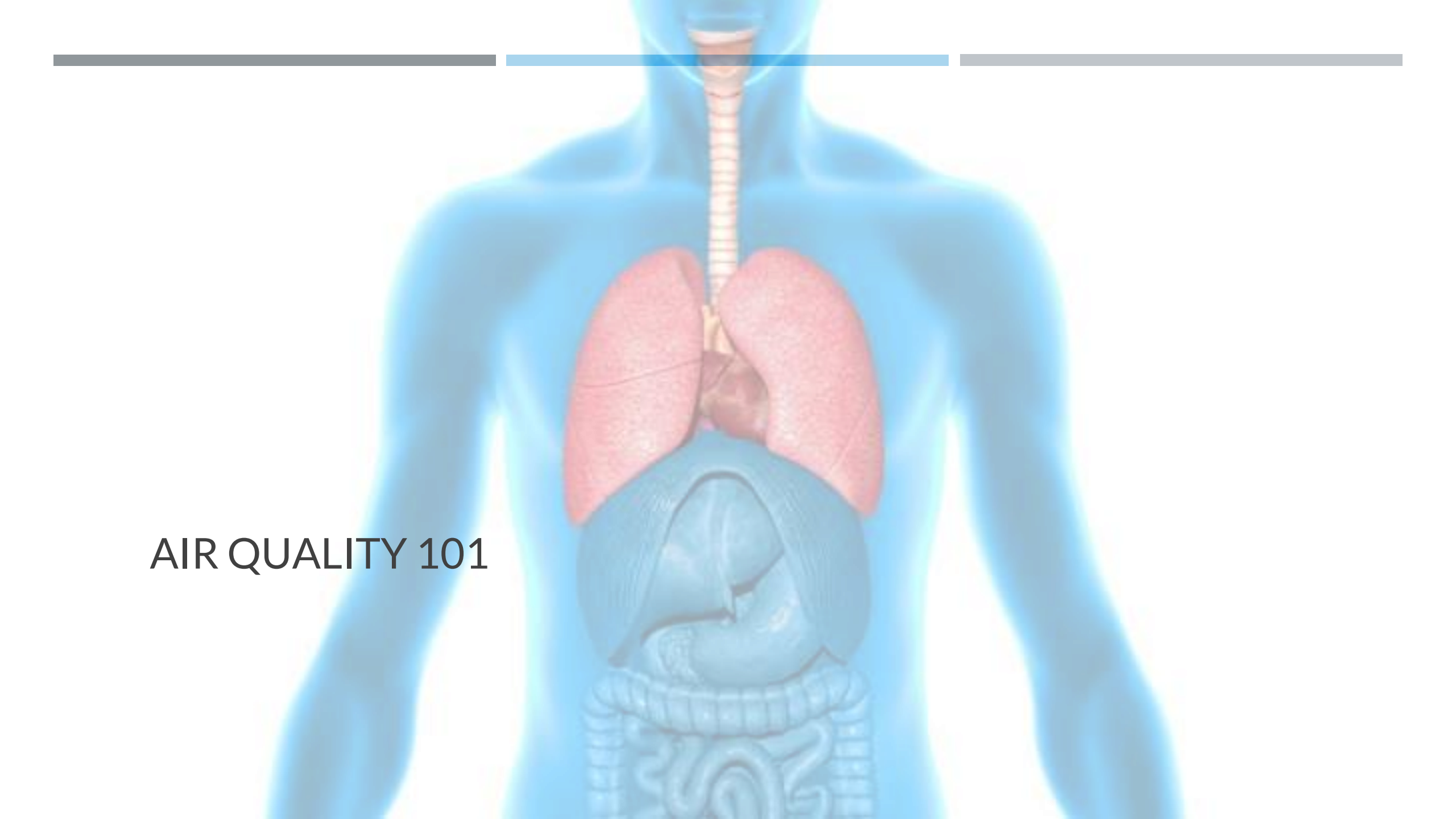
Environmental Health
Intelligence NZ

PRESENTATION OVERVIEW

air quality in NZ

what we did

what we found



AIR QUALITY 101

HOME HEATING ($PM_{2.5}$)

Photo credit: Greater Wellington

ROADS (NO_2)

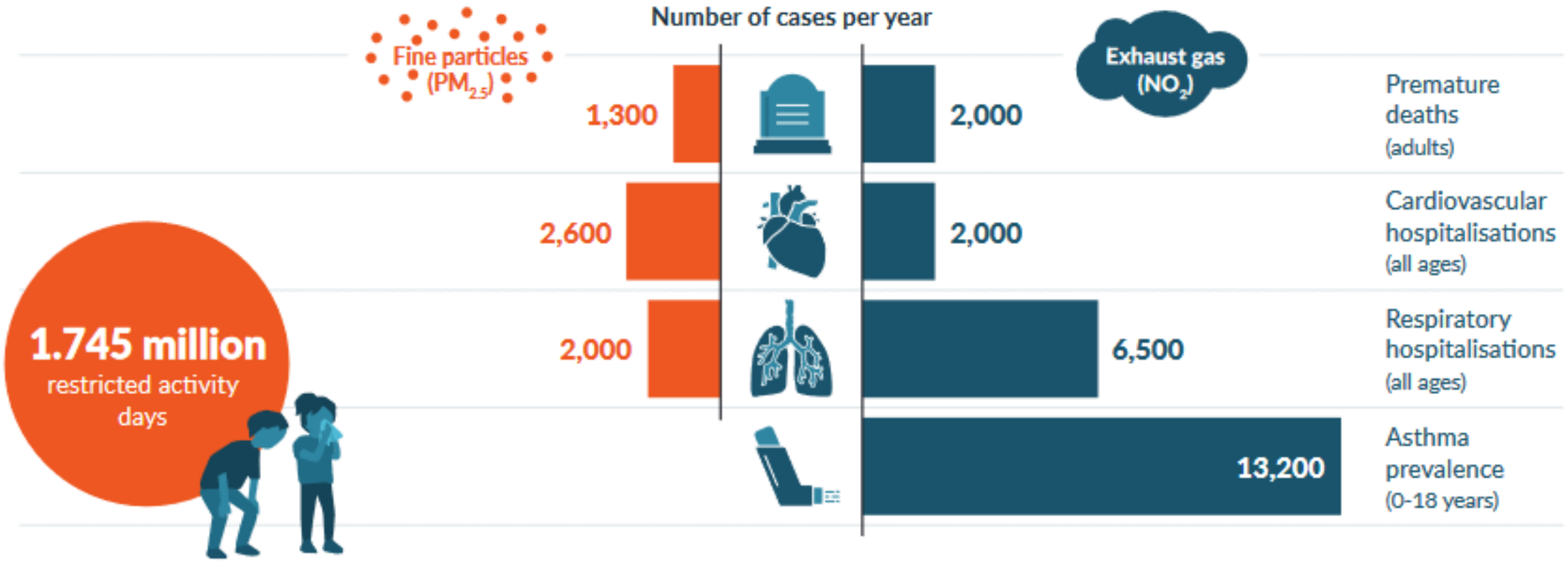
Photo credit: autofile.co.nz

Clean air is a fundamental to life and health
and a basic human right (UN, 2022)

Does population exposure to air pollution, and associated health impacts, vary by socioeconomic deprivation in Aotearoa?

AIR POLLUTION FROM CARS KILLING THOUSANDS OF NZERS YEARLY

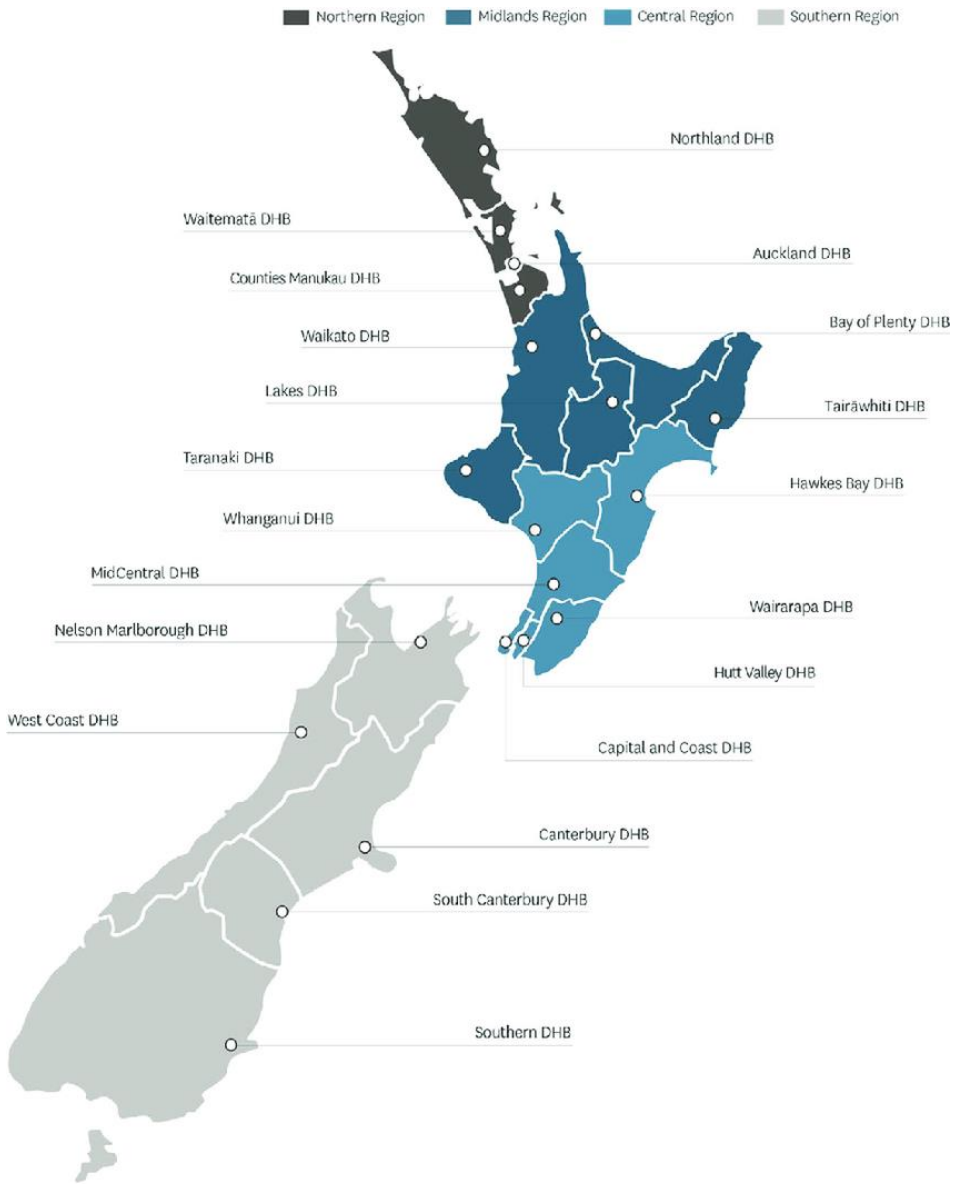
Health and Air Pollution in New Zealand (HAPINZ 3.0)



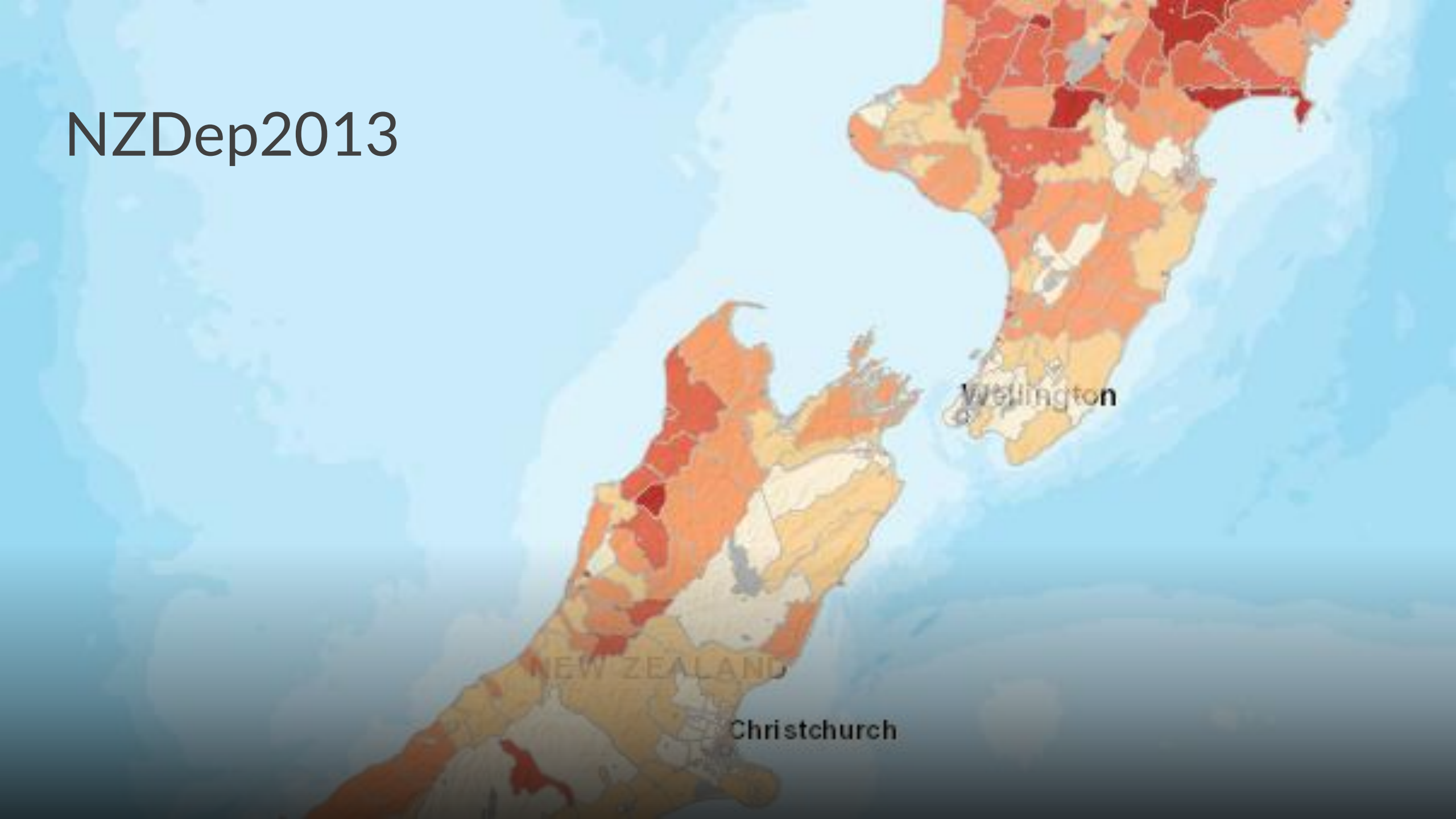
HAPINZ MODEL

https://www.ehinz.ac.nz/projects/hapinz3/explore-publications-and-data/

DHBS OF NZ


Northern Region
Midlands Region
Central Region
Southern Region
Northland DHB
Waitematā DHB
Auckland DHB
Counties Manukau DHB
Bay of Plenty DHB
Waikato DHB
Lakes DHB
Tairāwhiti DHB
Taranaki DHB
Hawkes Bay DHB
Whanganui DHB
MidCentral DHB
Wairarapa DHB
Nelson Marlborough DHB
Hutt Valley DHB
West Coast DHB
Capital and Coast DHB
Canterbury DHB
South Canterbury DHB
Southern DHB

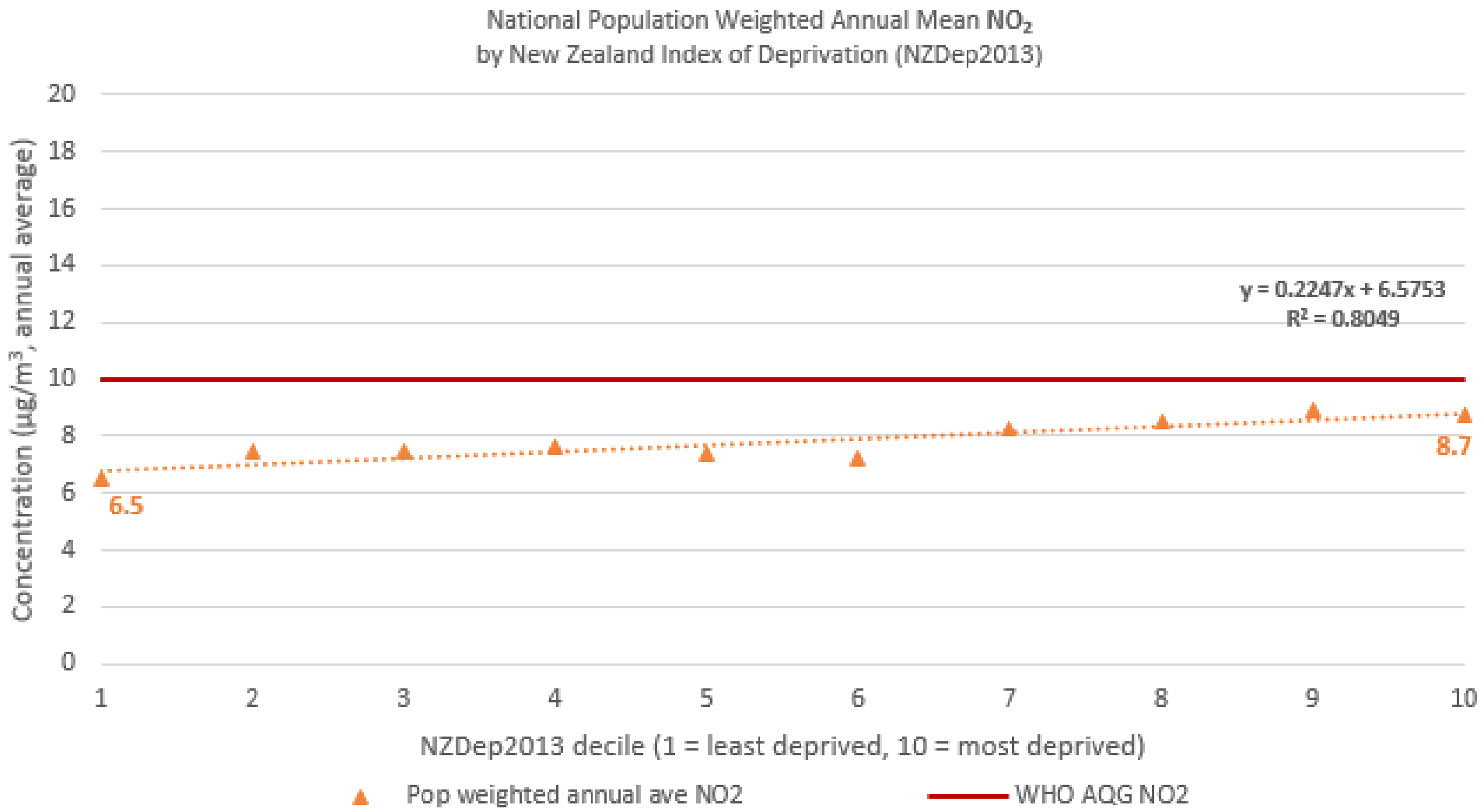
NZDep2013



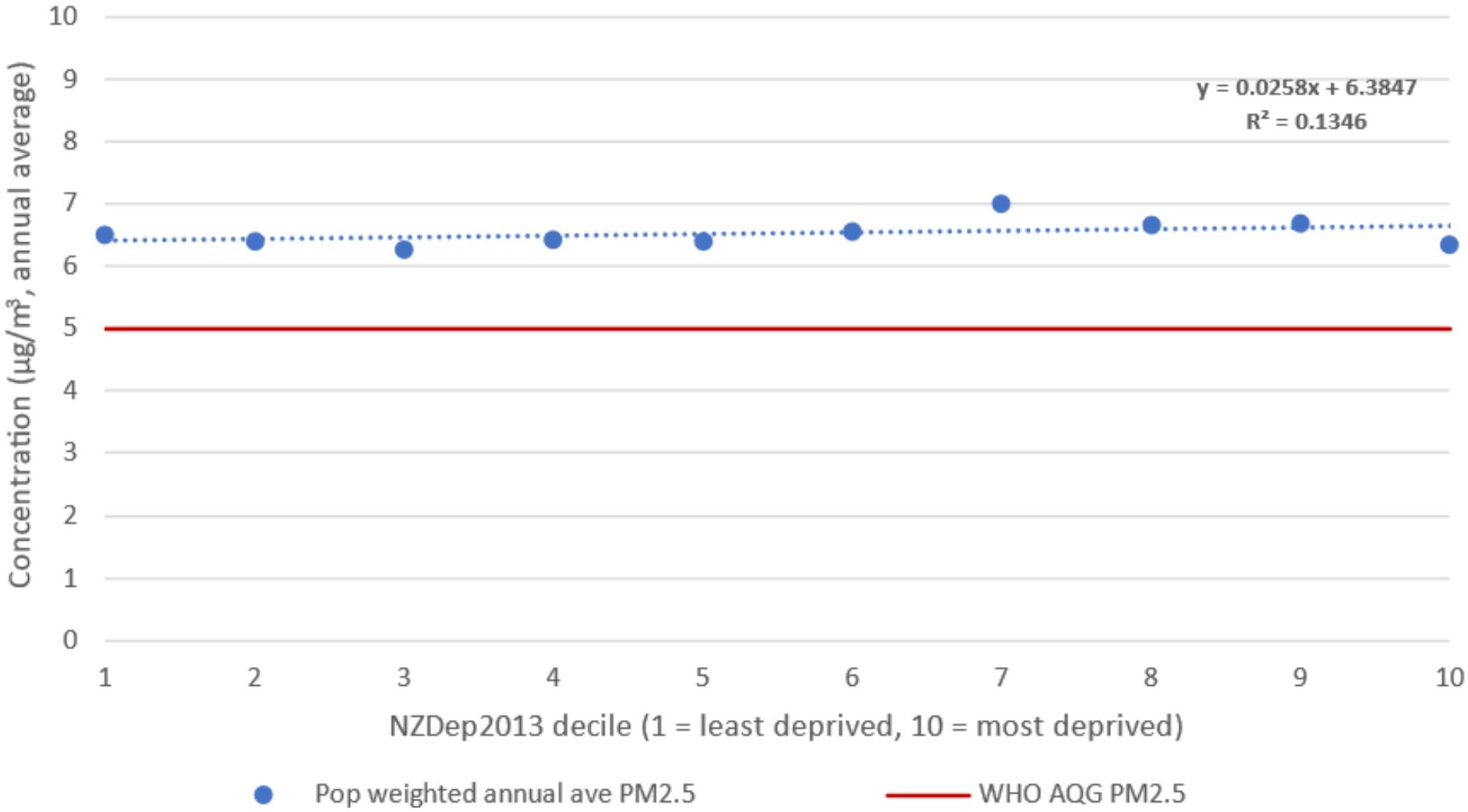
ETHNICITY


WHAT DID WE FIND?

NATIONAL EXPOSURE BY NZDEP2013: NO_2

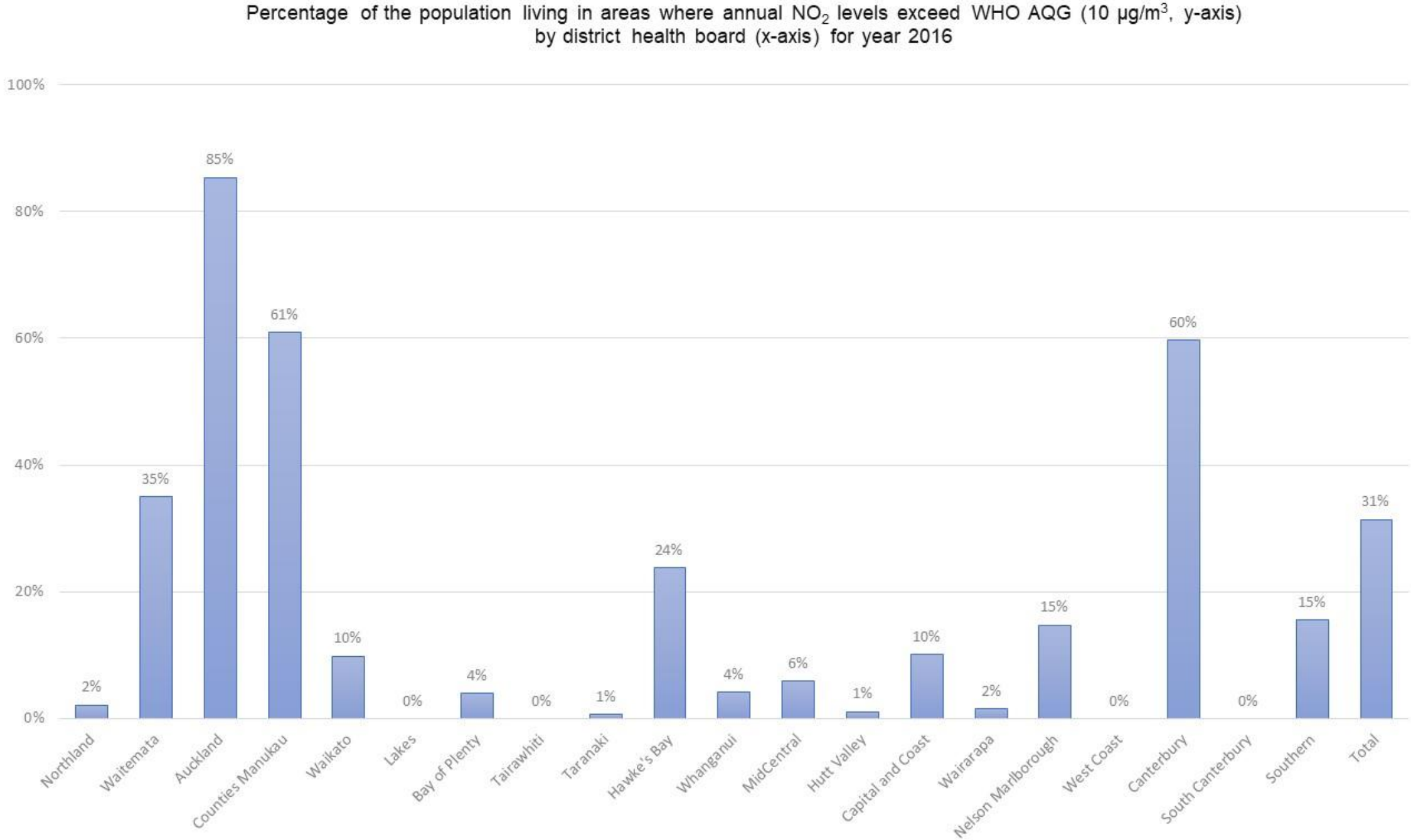


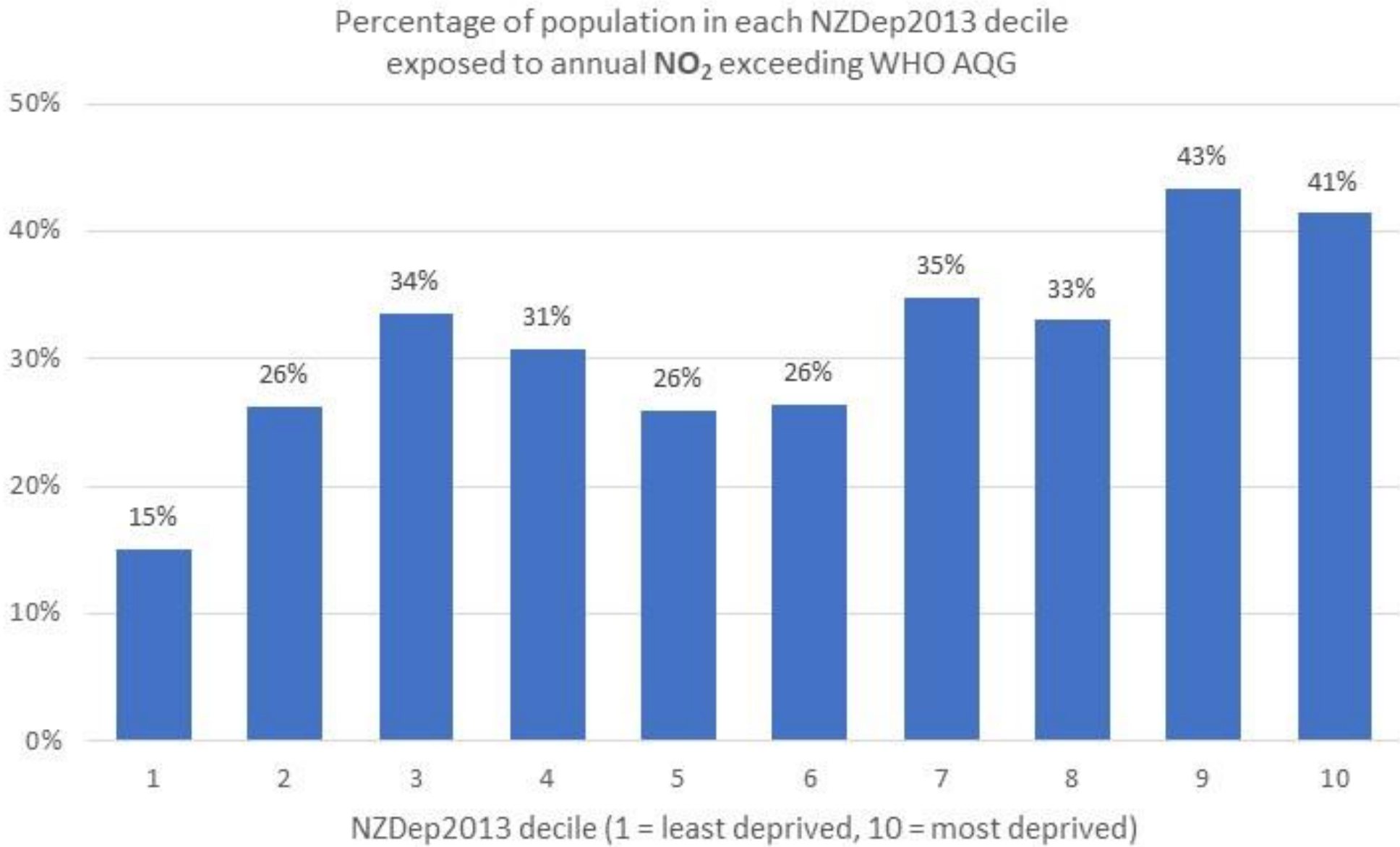
NATIONAL EXPOSURE BY NZDEP2013: $PM_{2.5}$



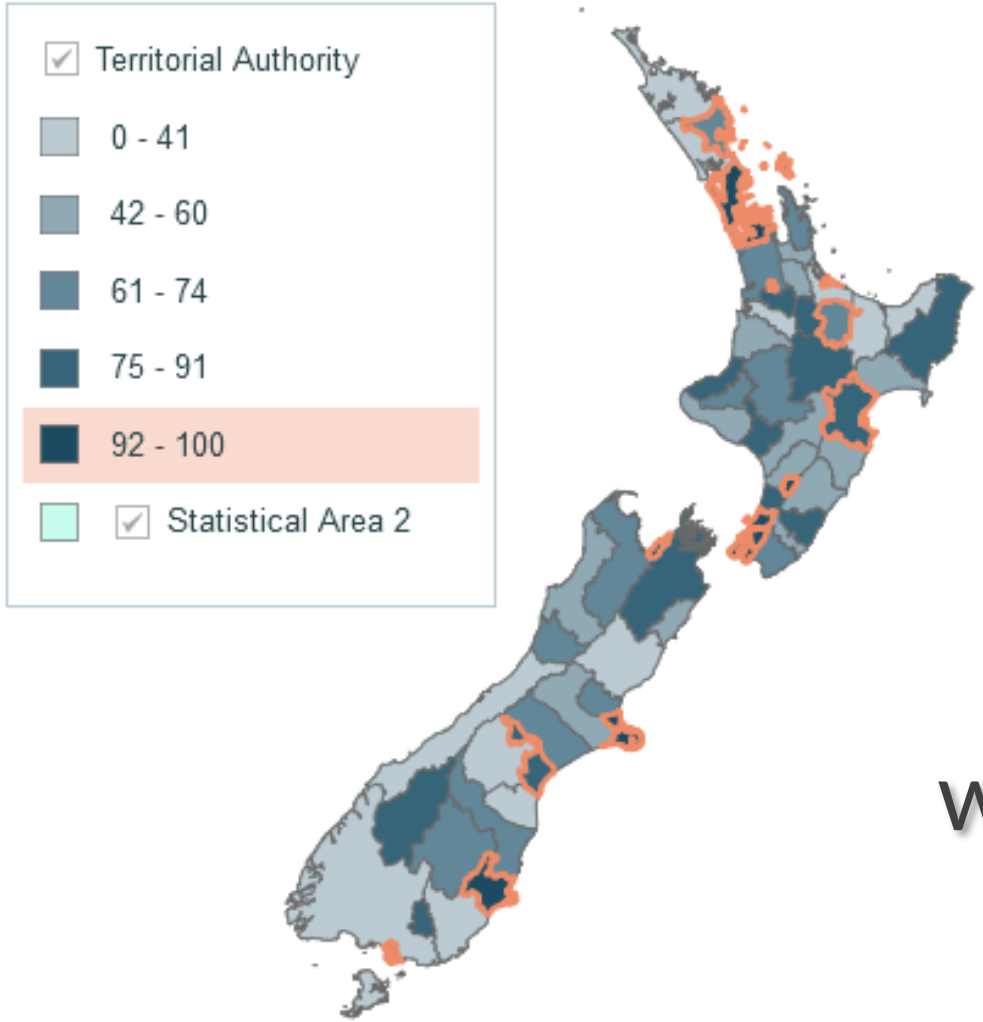
EXPOSURE BY DHB

District Health Board	Population (2016)	Population-weighted annual average concentration ($\mu g/m^3$)	
		NO_2	$PM_{2.5}$
WHO Air Quality Guideline (annual)		*10*	*5*
Northland	176,310	4.3	5.2
Waitematā	588,355	8.5	5.6
Auckland	481,290	12.9	5.9
Counties Manukau	538,370	10.0	5.6
Waikato	402,005	6.2	5.8
Lakes	109,120	5.2	8.1
Bay of Plenty	232,805	5.7	5.0
Tairāwhiti	48,745	4.9	7.0
Taranaki	118,610	4.7	5.5
Hawke's Bay	166,790	7.6	7.3
Whanganui	65,040	5.4	5.8
MidCentral	176,385	5.6	5.7
Hutt Valley	149,550	5.9	5.5
Capital and Coast	307,375	6.6	5.7
Wairarapa	44,840	4.5	7.2
Nelson Marlborough	150,255	6.0	8.2
West Coast	32,920	3.9	8.0
Canterbury	540,950	9.8	9.1
South Canterbury	59,775	5.0	9.5
Southern	323,780	6.4	8.8
All New Zealand	**4,713,270**	**7.8**	**6.5**


Percentage of the population living in areas where annual NO_2 levels exceed WHO AQG (10 µg/m^3, y-axis) by district health board (x-axis) for year 2016
100%
80%
60%
40%
20%
0%
2%
35%
85%
61%
10%
0%
4%
0%
1%
24%
4%
6%
1%
10%
2%
15%
0%
60%
0%
15%
31%
Northland
Waitemata
Auckland
Counties Manukau
Waikato
Lakes
Bay of Plenty
Tairawhiti
Taranaki
Hawke's Bay
Whanganui
MidCentral
Hutt Valley
Capital and Coast
Wairarapa
Nelson Marlborough
West Coast
Canterbury
South Canterbury
Southern
Total

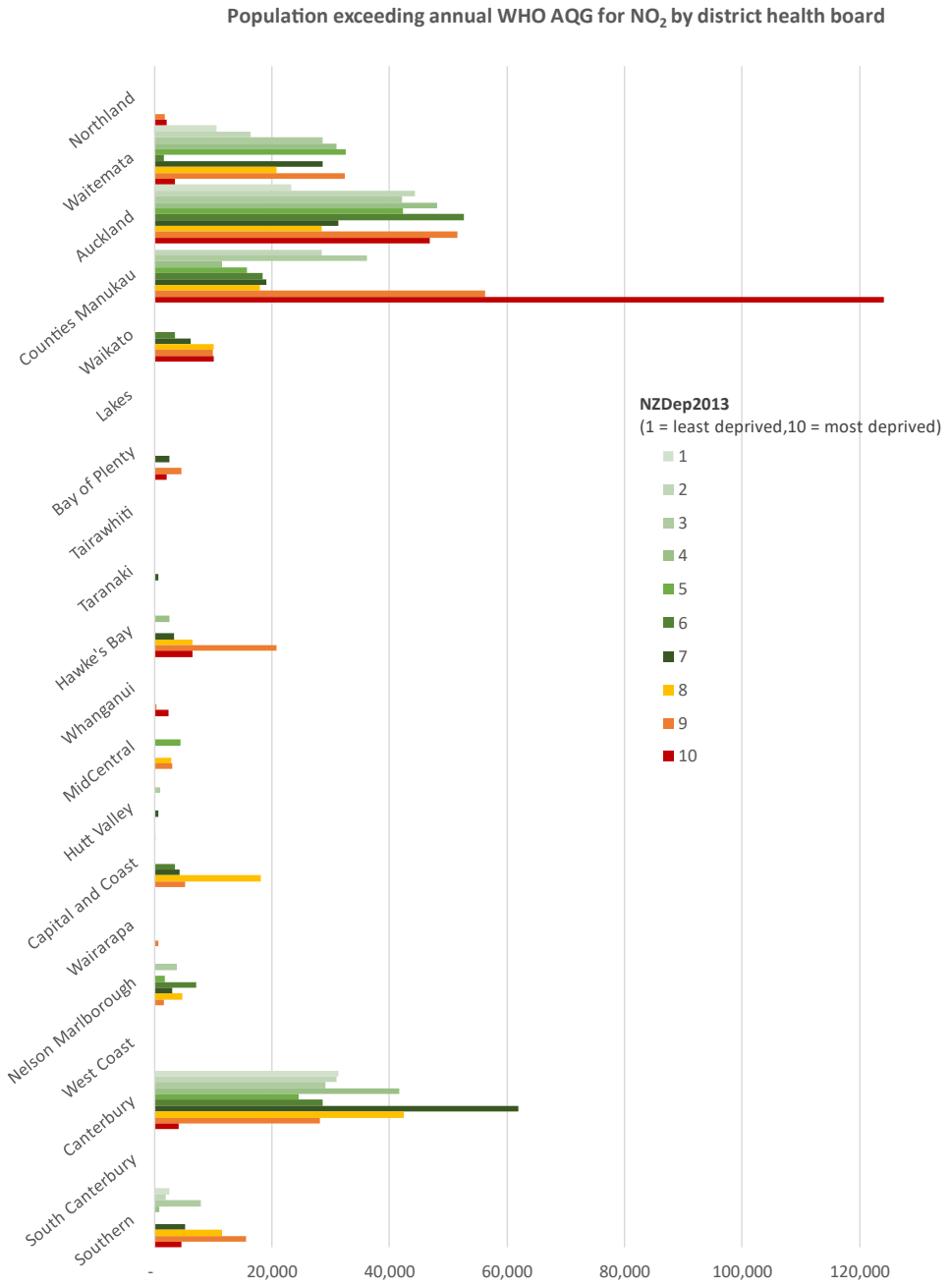

Percentage of population in each NZDep2013 decile exposed to annual NO_2 exceeding WHO AQG
50%
40%
30%
20%
10%
0%
15%
26%
34%
31%
26%
26%
35%
33%
43%
41%
1
2
3
4
5
6
7
8
9
10
NZDep2013 decile (1 = least deprived, 10 = most deprived)

Health impacts from human-made (anthropogenic) air pollution | Premature deaths (among people aged 30+ years) | Premature deaths due to human-made $PM_{2.5}$ and NO_2 | Number of deaths (2016)



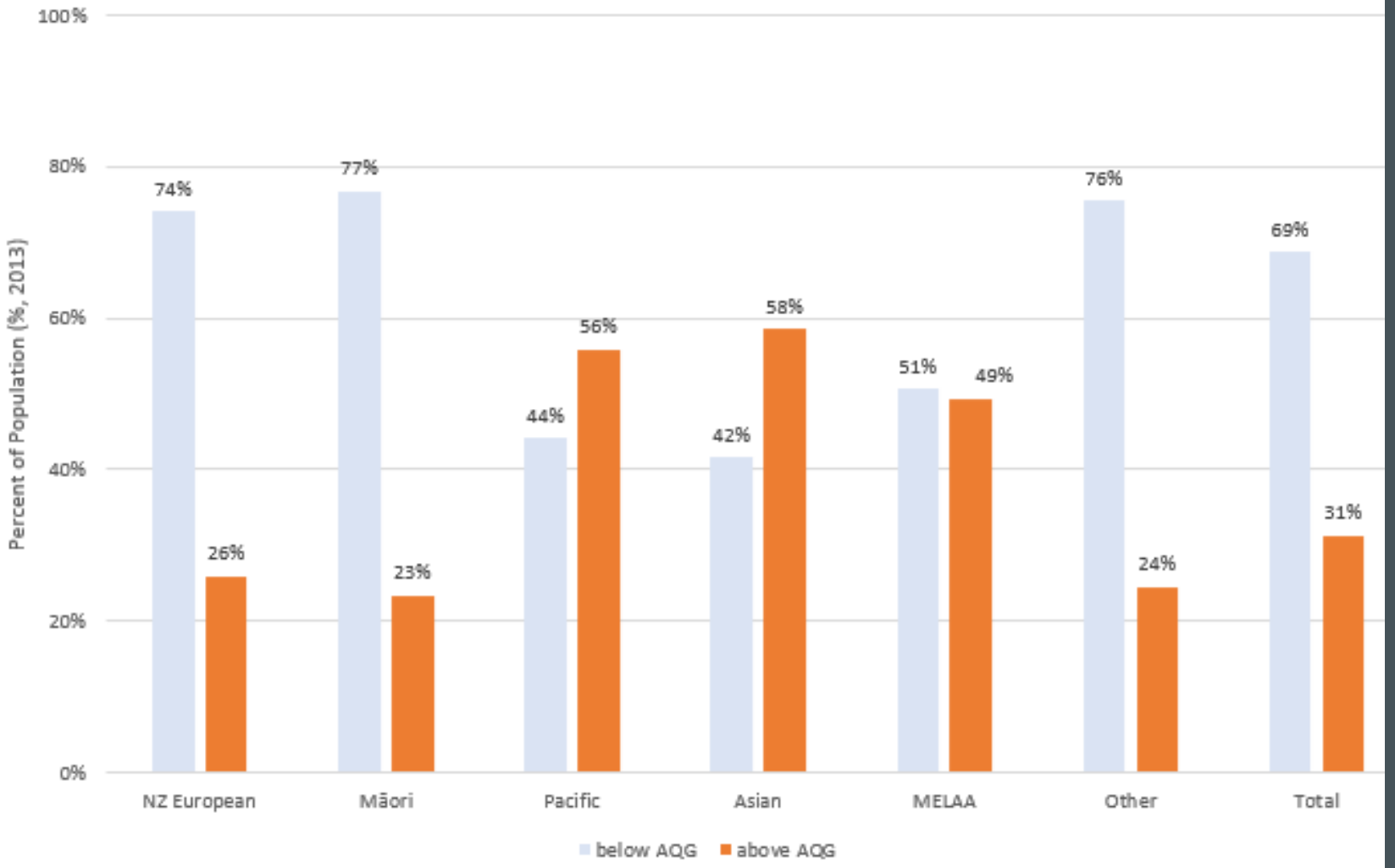
yeah? so what,
we already knew that

Number of people living in areas with NO_2 above WHO AQG in 2016, by DHB



NATIONAL EXPOSURE BY ETHNIC GROUP

Ethnic group (total response)[1]	Population-weighted[2] annual average concentration (µg/m³)	
	NO_2	$PM_{2.5}$
WHO Air Quality Guideline (annual)	*10*	*5.0*
NZ European	7.3	6.6
Māori	7.1	6.4
Pacific	9.9	6.2
Asian	10.5	6.2
Middle Eastern / Latin American / African (MELAA)	9.9	6.4
Other	7.1	6.6
New Zealand Population Weighted Average	**7.8**	**6.5**

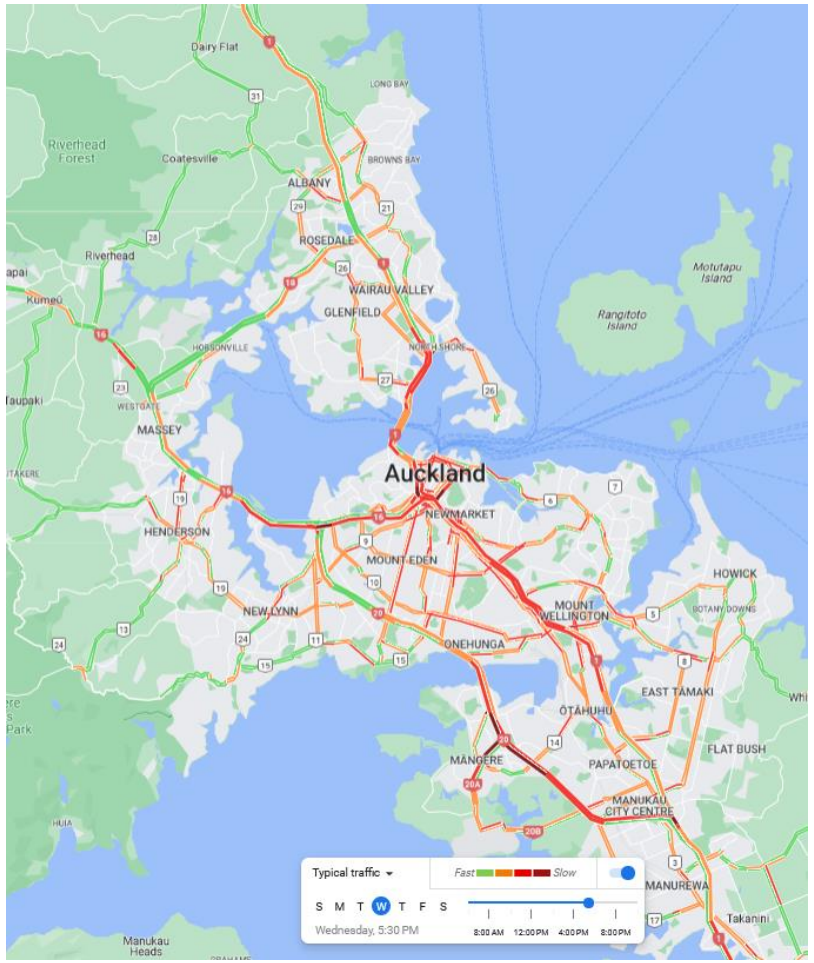


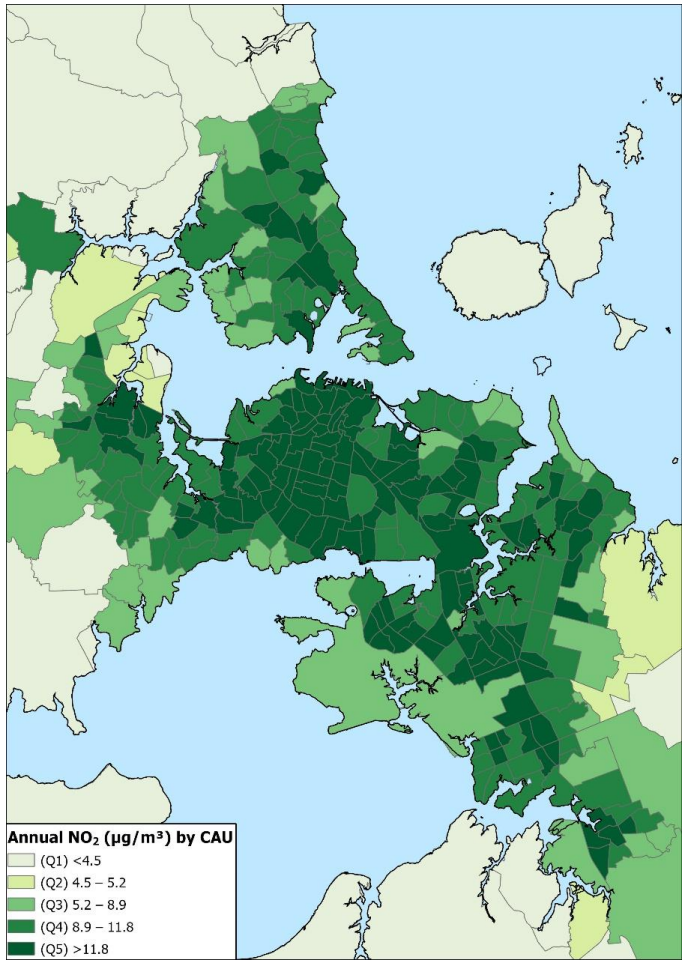
Percent New Zealanders exposed to annual NO_2 levels below and above the WHO AQG for NO_2 by ethnic group

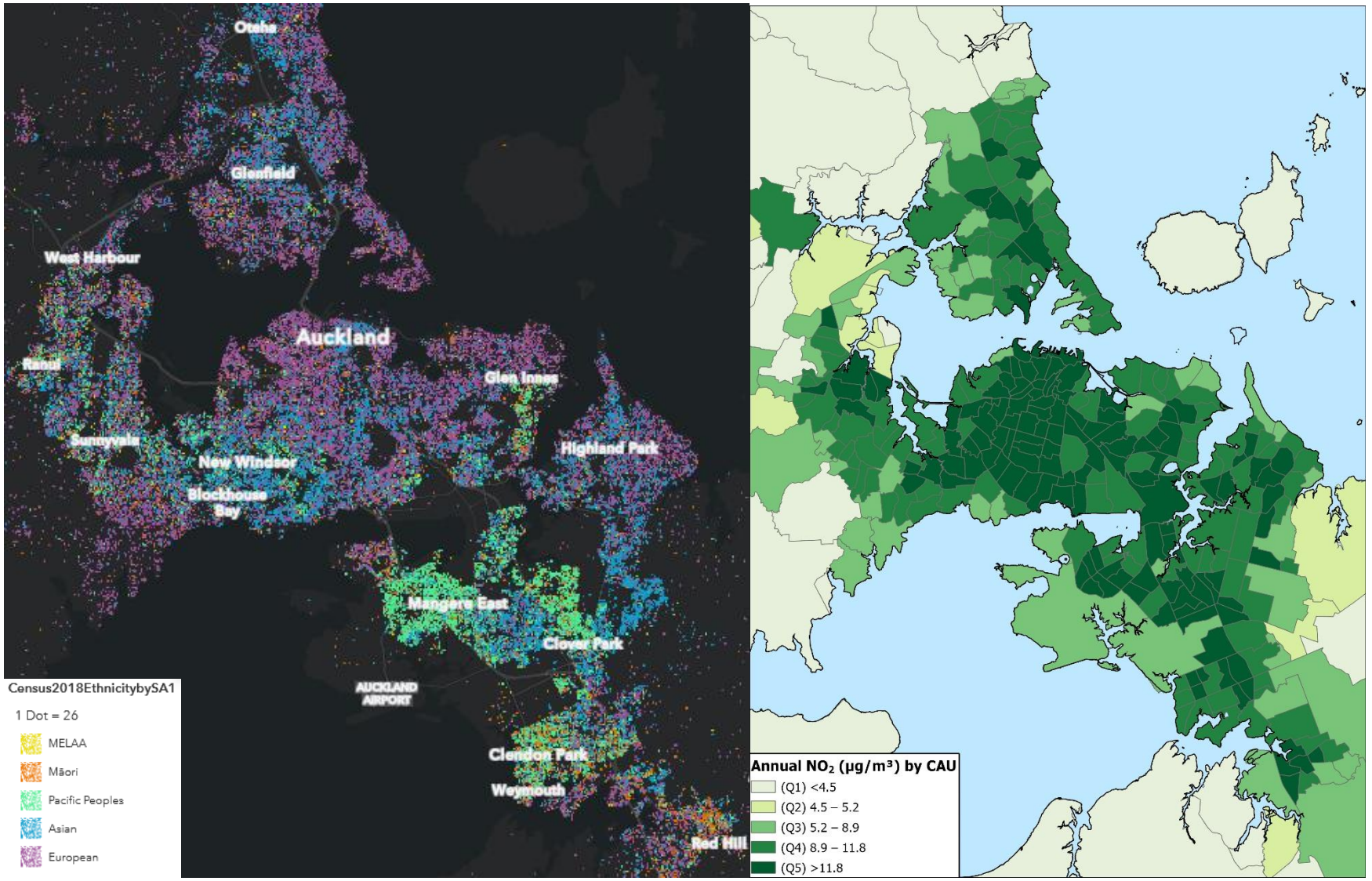
CASE STUDY: NATIONAL, URBAN & AUCKLAND NO_2

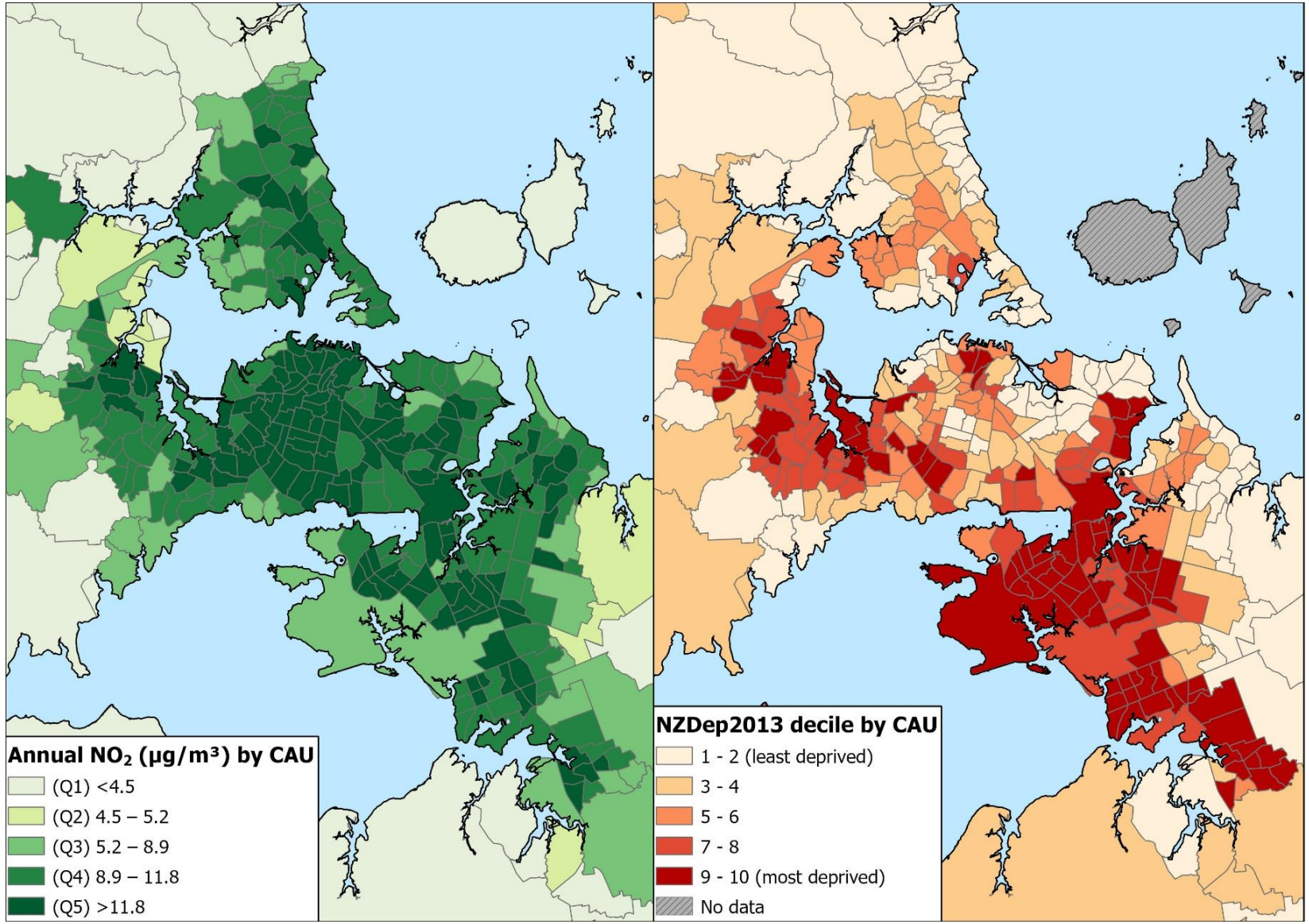
Ethnic Group	Population-weighted annual average concentration NO_2 ($\mu g/m^3$, 2016)		
	National	National Urban	Auckland Urban Airshed
NZ European	7.3	8.2	10.7
Māori	7.1	7.8	11.1
Pacific	9.9	10.1	11.7
Asian	10.5	10.7	11.9
MELAA	9.9	10.2	11.8
Other	7.1	8.1	10.8
Total	**7.8**	**8.6**	**10.7**
WHO Guideline = 10 $\mu g/m^3$			

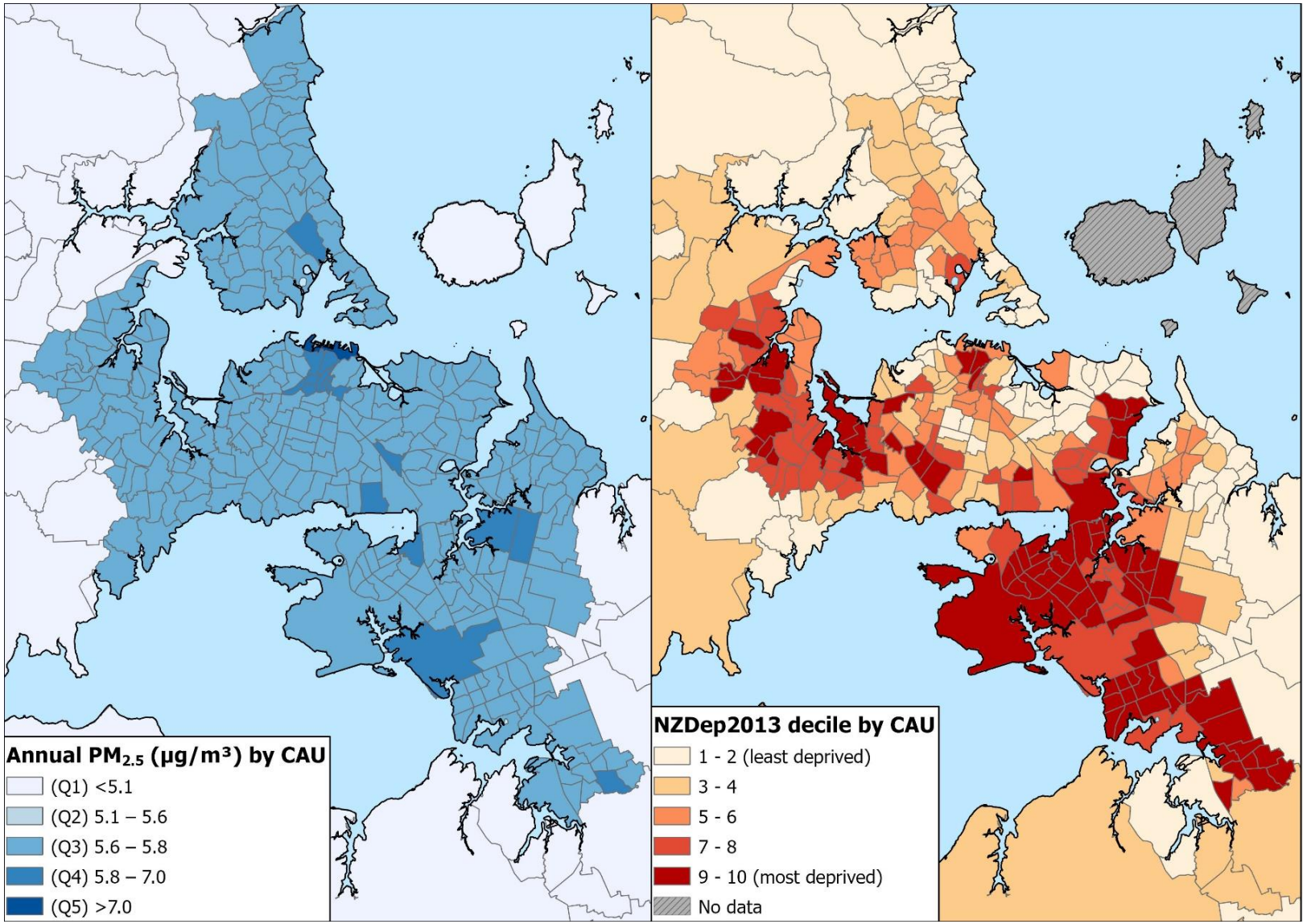
CASE STUDY: AUCKLAND NO_2

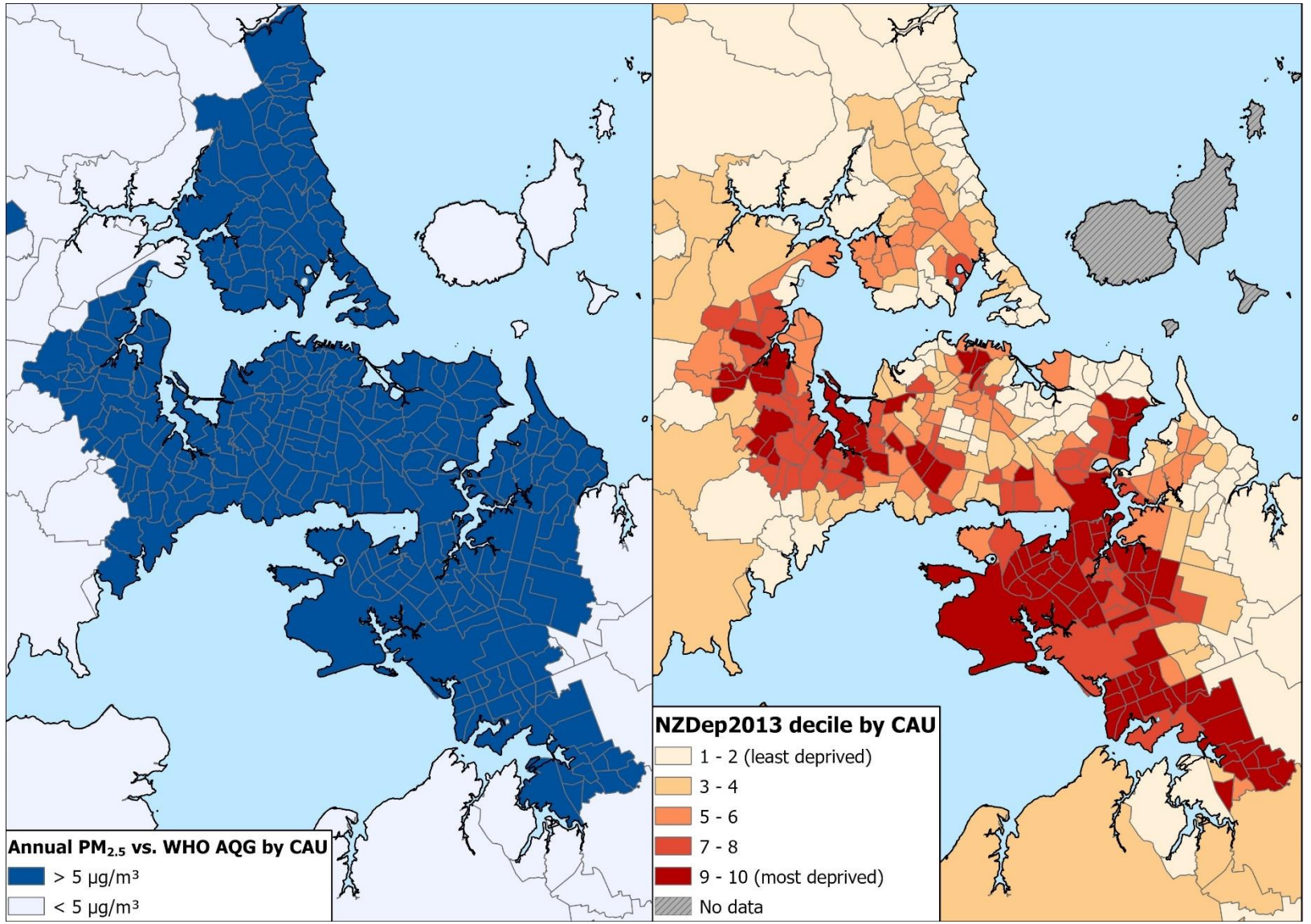




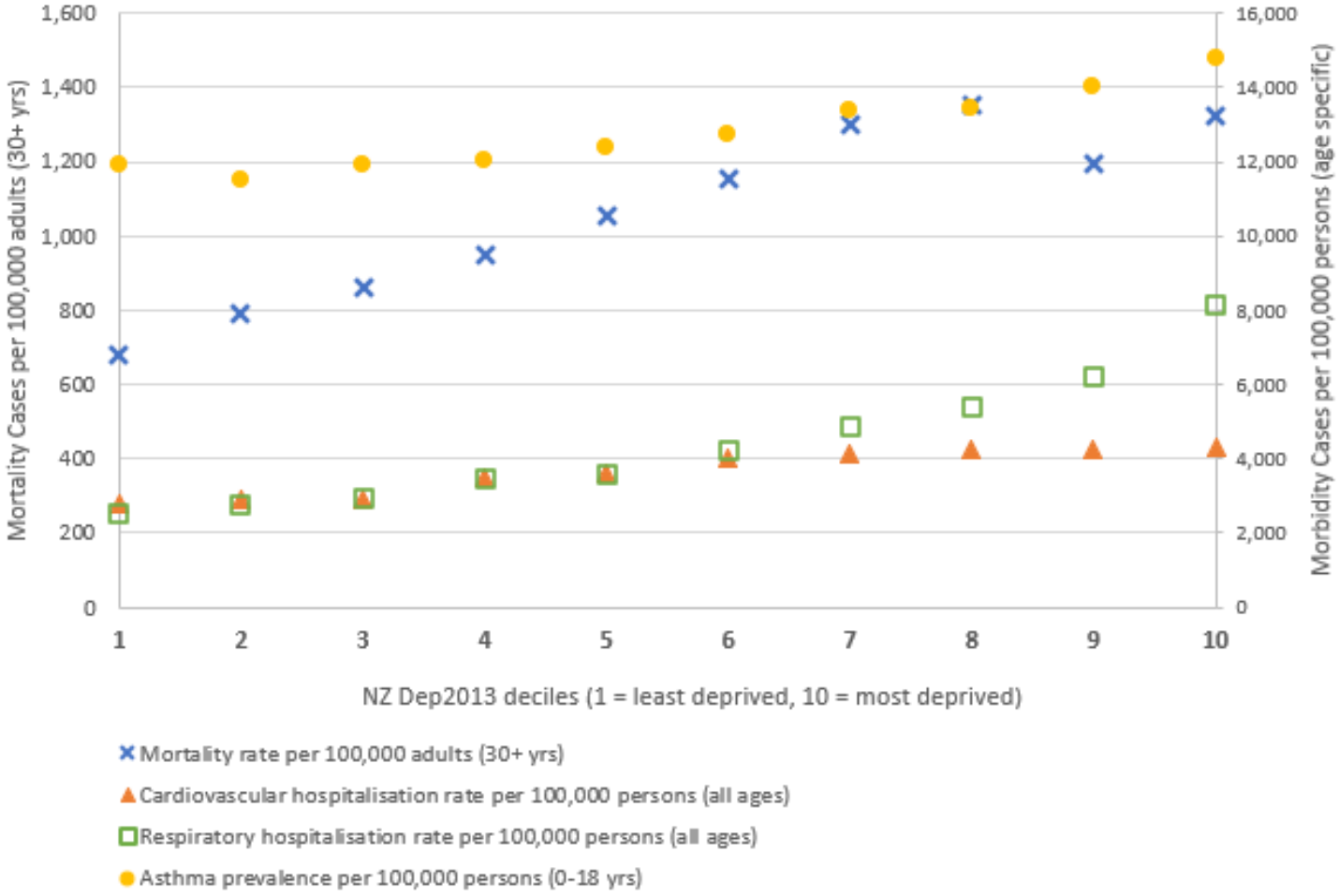

Otaha
Glenfield
West Harbour
Auckland
Ranui
Glen Innes
Sunnyvale
New Windsor
Highland Park
Blockhouse Bay
Mangere East
Clover Park
AUCKLAND AIRPORT
Clendon Park
Weymouth
Red Hill
Census2018EthnicitybySA1
1 Dot = 26
MELAA
Māori
Pacific Peoples
Asian
European
Annual NO₂ (µg/m³) by CAU
(Q1) <4.5
(Q2) 4.5 – 5.2
(Q3) 5.2 – 8.9
(Q4) 8.9 – 11.8
(Q5) >11.8


Annual NO_2 (µg/m³) by CAU
(Q1) <4.5
(Q2) 4.5 – 5.2
(Q3) 5.2 – 8.9
(Q4) 8.9 – 11.8
(Q5) >11.8
NZDep2013 decile by CAU
1 - 2 (least deprived)
3 - 4
5 - 6
7 - 8
9 - 10 (most deprived)
No data

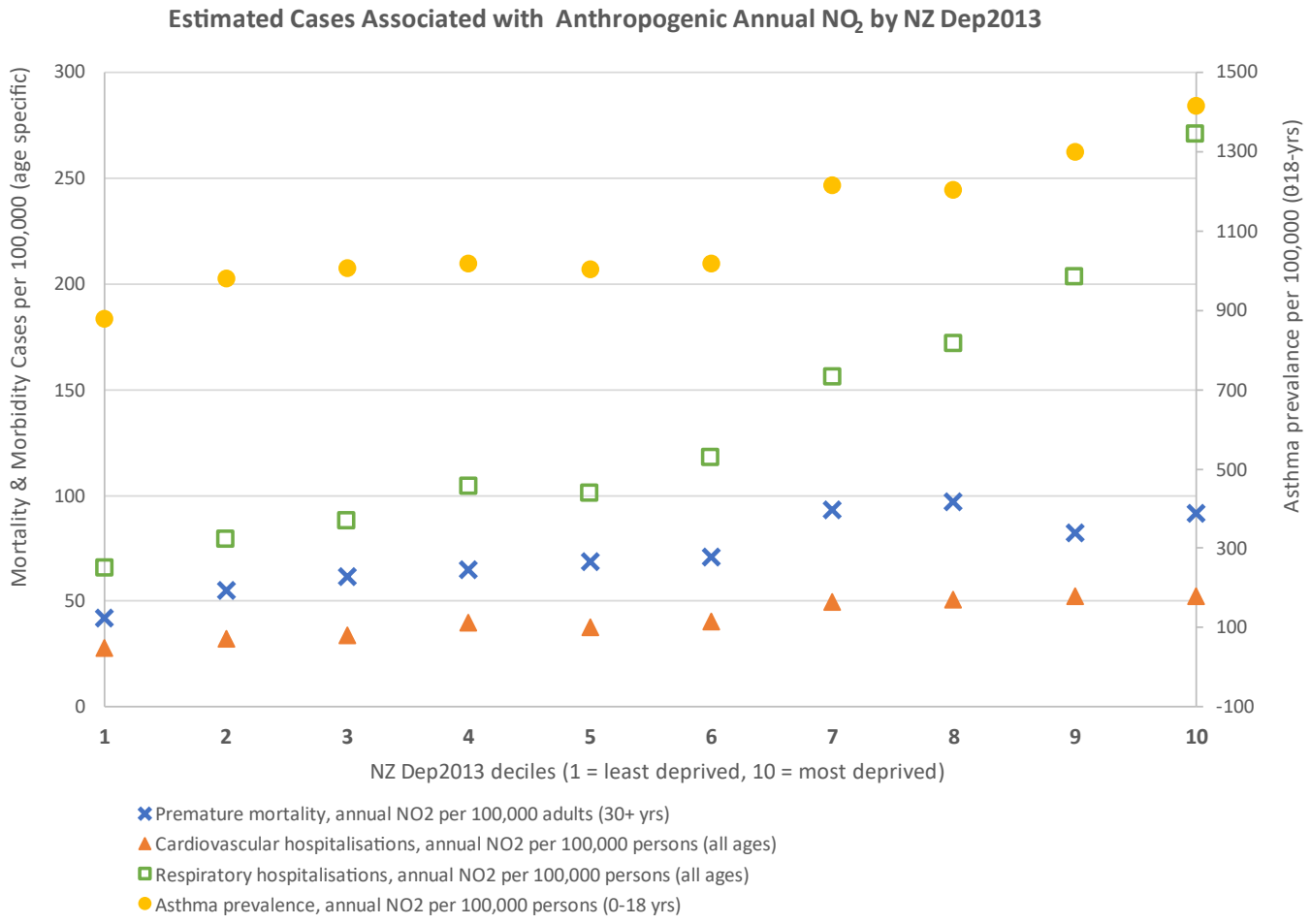

Annual PM2.5 (µg/m³) by CAU
(Q1) <5.1
(Q2) 5.1 – 5.6
(Q3) 5.6 – 5.8
(Q4) 5.8 – 7.0
(Q5) >7.0
NZDep2013 decile by CAU
1 - 2 (least deprived)
3 - 4
5 - 6
7 - 8
9 - 10 (most deprived)
No data


Annual $PM_{2.5}$ vs. WHO AQG by CAU
> 5 µg/m³
< 5 µg/m³
NZDep2013 decile by CAU
1 - 2 (least deprived)
3 - 4
5 - 6
7 - 8
9 - 10 (most deprived)
No data

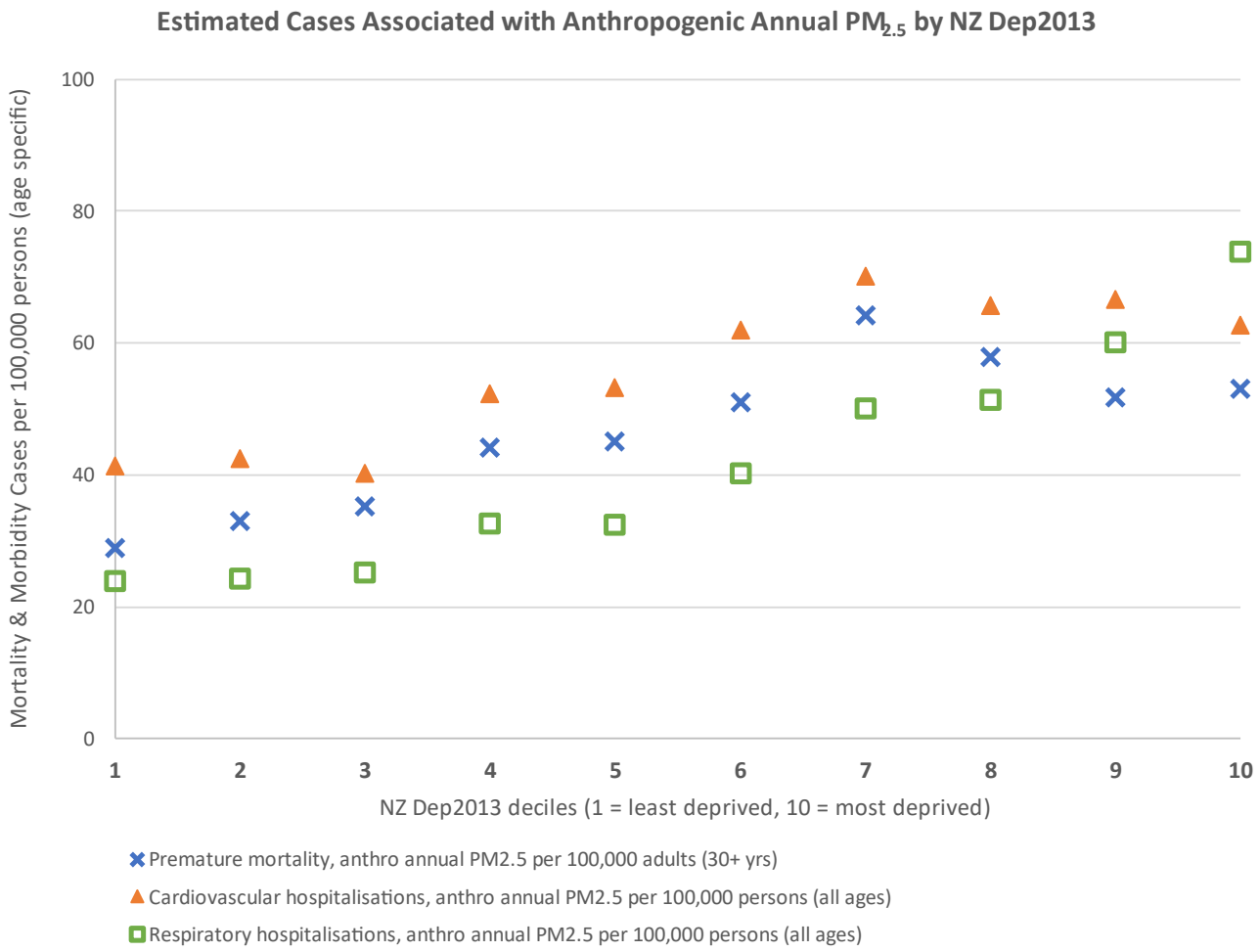
BASE INCIDENCE HEALTH STATISTICS (2016) BY NZDEP2013



ESTIMATED IMPACTS ANTHROPOGENIC NO_2 BY NZDEP2013



ESTIMATED IMPACTS ANTHROPOGENIC $PM_{2.5}$ BY NZDEP2013



DECILE 10
vs
DECILE 1

- rate of premature mortality (30 years +) associated with exposure to NO_2 and $PM_{2.5}$ is **two times higher**
- rate of cardiovascular hospitalisation associated with exposure to NO_2 and $PM_{2.5}$ is **1.7 times higher**

DECILE 10
vs
DECILE 1

- rate of respiratory hospitalisation associated with exposure to NO_2 is **four times higher**
- rate of respiratory hospitalisation associated with exposure to $PM_{2.5}$ is **three times higher**
- rate of asthma prevalence in 0–18-year-olds associated with exposure to NO_2 is **1.6 times higher.**

CONCLUSIONS

Chronic population exposure to NO_2 in New Zealand is elevated in:

- Auckland, Counties Manukau, Waitematā, Canterbury and Hawke's Bay DHB areas
- Asian, Pacific peoples, MELAA ethnic groups (in part driven by urban area effect)
- People living in more deprived areas

CONCLUSIONS

Health impacts from air pollution are much higher in more deprived areas due to higher baseline incidence of disease **and** higher levels of pollution.

Our findings mean that policy that targets air pollution improvements in more deprived areas would deliver bigger health benefits.

Our findings mean that policy that targets air pollution improvements in more deprived areas would deliver bigger health benefits.

Especially policy that reduces motor vehicle emissions.

In Aotearoa, New Zealand clean air is a taonga for Māori.

Shouldn’t we be striving to achieve this basic human right?

THANK YOU / NGĀ MIHI

NGĀ PATAI / ANY QUESTIONS?

lou@emissionimpossible.co.nz

k.mason@massey.ac.nz