National SCIENCE Challenges

A BETTER START

E Tipu e Rea

Seasonal effects on 4-yr old obesity in New Zealand

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Host Institution

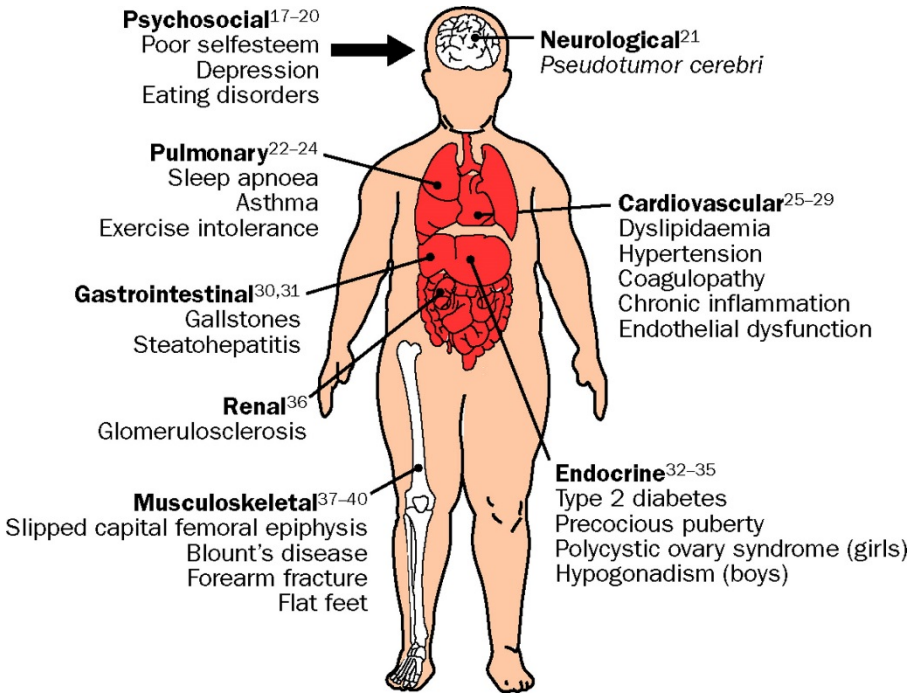
Disclaimer

Access to the data presented was managed by Statistics New Zealand under strict micro-data access protocols and in accordance with the security and confidentiality provisions of the Statistic Act 1975. Our findings are not Official Statistics. The opinions, findings, recommendations, and conclusions expressed are those of the researchers, not Statistics NZ

Outline

- Child obesity
- Seasonality and Obesity: 4 Research Questions
  1. Is there an effect?
  2. If so, does it differ by demographic factors?
  3. If so, does it affect referrals?
  4. If so, what are the possible reasons?
- Methods
  - Obesity measurement in B4SchoolCheck
  - Use of Integrated Data Infrastructure (IDI) data
- Results
- Conclusions

Child Obesity



- Child Obesity leads to a number of negative outcomes
  - Ebbeling et al., 2002, Lancet
- The earlier you can shift people off obesity trajectory, the better – focus increasingly on preschool
- Child obesity is prevalent worldwide (stabilising??)
- Child obesity is very prevalent in NZ (3rd highest)
  - Preschool obesity decreasing; stable(?) later
- Child obesity affects some groups more than others
  - Māori, Pacific, high deprivation areas

Seasonality and obesity

- Why expect there to be seasonal trends in child obesity?
  - Others have found it
- Preschool studies (fewer)
  - Stanojevic et al. (2008): obesity higher in winter/spring (Chile)
  - Kato et al. (2012): weight gain greatest in autumn (Japan)
  - Huong et al. (2014): greater underweight in summer (Vietnam)
  - Taylor et al. (2008): No effect (FLAME study, Dunedin)

Seasonality and obesity

- More studies at school age
  - Most show obesity higher in summer than winter (reviews: Baranowski et al., 2014; Frankle et al., 2014)
  - Suggestion that school is protective (organised physical activity during school year but not in summer), "accelerated weight gain"
    - Less obesogenic behaviours during 'structured days' (Brazendale et al., 2017)
  - …But two Japanese studies showed most children increased weight in winter and lost in summer, except obese children (Tobe at al., 1994; Kobayashi & Kobayashi, 2006).

Seasonality and birth weight

- Many studies
  - Mixed findings: summer and winter peaks, some suggestion (Chodick et al., 2009) that low birth weights in summer in mid latitudes (incl NZ: Dunedin study, Waldie et al., 2000), but low birth weights in winter in low and high latitudes
  - Have been changes over time: Denmark: Highest birth weight in autumn 1936-63, BUT a peak in summer developed over time and was highest 1964-1989 (Jensen et al., 2015).
  - Mostly small effects (<20 grams)

Seasonality and obesity

- Why does it matter?
  - If it exists, lack of awareness may lead to
    - Misinterpretation of trends from yearly surveys IF measurement at different times of year taken
      (doesn't affect NZ Health Survey, thankfully)
    - Undue alarm and referrals during certain seasons but lack of concern during other seasons
  - If it exists, important to understand causal factors to suggest possible policy mechanisms
  - If it exists, it may affect the results and interpretation of intervention studies with short follow up

Research Questions

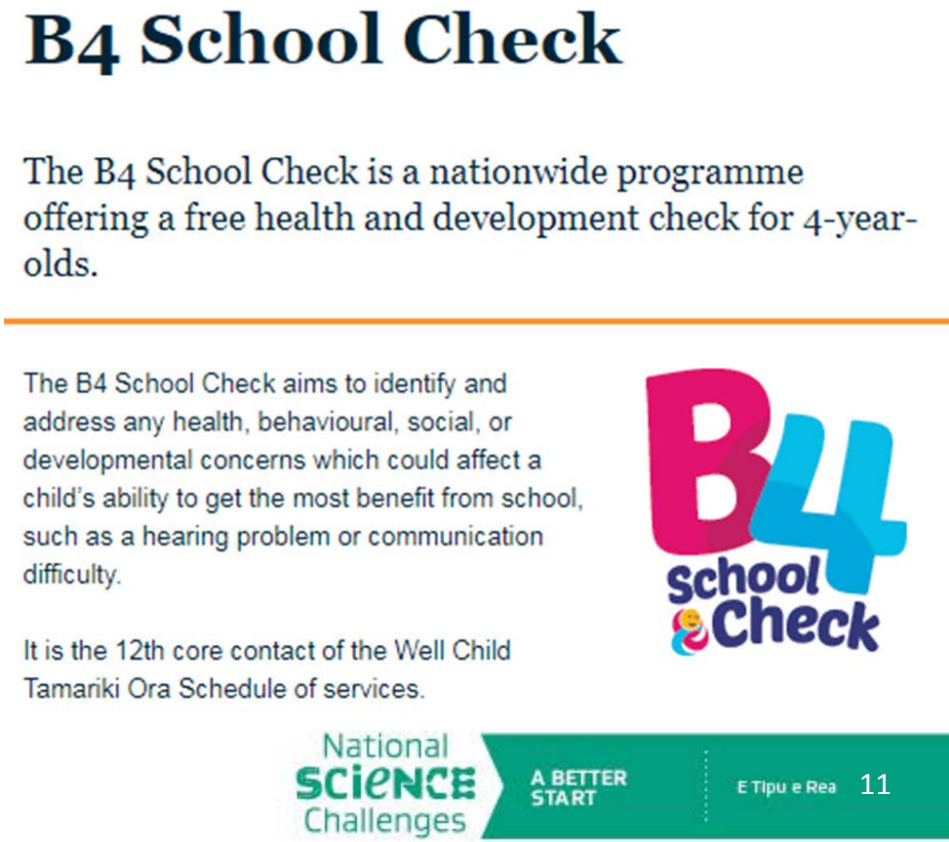
1) Is there evidence for seasonal effects on age-4 obesity in NZ?
2) If there is, does this differ by gender, ethnicity, deprivation, region?
3) If there is, is this reflected in the referral patterns for obesity?
4) If there is, what might be explaining it?

Methods

- Assess obesity and season of measurement as part of **B4-School Check**
- Link obesity data to other data (gender, ethnicity, area-level deprivation, region) using the **Integrated Data Infrastructure (IDI),** and assess associations
- Forms part of a larger body work for **E tipu e rea: A Better Start National Science Challenge**

B4School Check

- Established September 2008
  - We use 2010/2011 to 2015/2016
- Eligible children
  - Enrolled with a PHO on their 4th birthday
  - Target is 90% of eligible children
- Coverage 72-92%



B4 School Check

The B4 School Check is a nationwide programme offering a free health and development check for 4-year-olds.

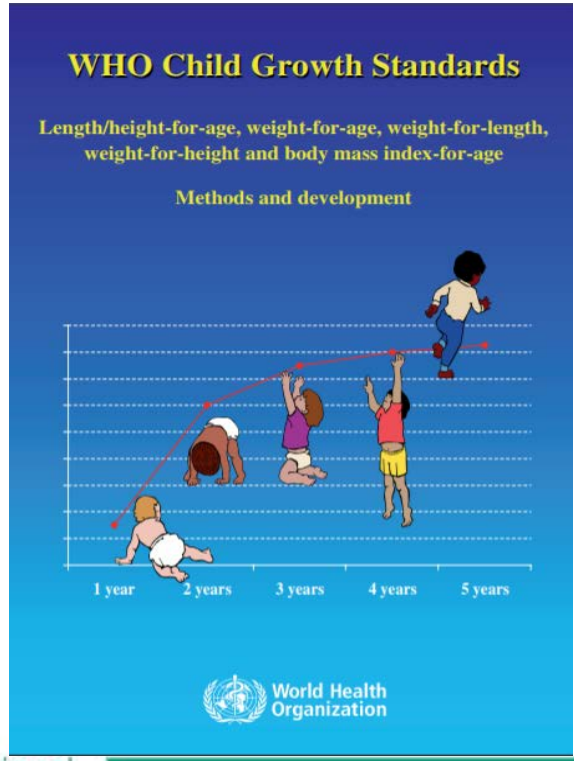
The B4 School Check aims to identify and address any health, behavioural, social, or developmental concerns which could affect a child's ability to get the most benefit from school, such as a hearing problem or communication difficulty.

It is the 12th core contact of the Well Child Tamariki Ora Schedule of services.

B4 School Check

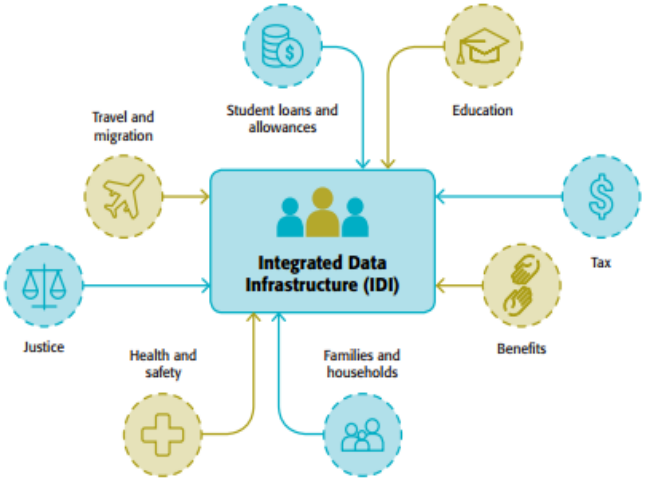
B4School Check

- Restricted data to:
  - those ages 48-60 months, for fiscal years 2010/2011 – 2015/2016
- Sample:
  - Height and weight for n=319,101 children, measured in light clothing, shoes removed
  - n=1803 (0.6%) excluded (extreme BMI >|5| SDs)
  - Final n=317 298 (84% of 4-year-olds)
- WHO Anthro package used to calculate zBMI
  - Overweight: ≥ 85th percentile
  - Obesity: ≥ 95th percentile
  - Extreme Obesity ≥ 99.7th percentile



Integrated Data Infrastructure (IDI)

Statistics New Zealand's Integrated Data Infrastructure (IDI) is a large research database containing de-identified microdata about people and households.



The IDI contains person-centred microdata from a range of government agencies, Statistics NZ surveys including the 2013 Census, and non-government organisations. For more information about data in the IDI, see **www.stats.govt.nz/idi-data**.

The Longitudinal Business Database (LBD) complements the IDI with microdata about businesses. For more information about data in the LBD, see **www.stats.govt.nz/lbd**.

Health and safety data

- ACC injury claims – from 1994
- B4 School Checks – from 2011
- Cancer registrations – from 1995
- Chronic conditions – from 2007
- General medical services claims – from 2002
- Health tracker – 2006–13
- Laboratory claims – from 2003
- Mortality – from 1988
- Immunisation – from 2006
- National non-admitted patient collection – from 2007
- Pharmaceuticals – from 2005
- PHO enrolments – from 2003
- Population cohort demographics and addresses – from 2004
- Mental health and addiction – from 2008
- Publicly funded hospital discharges – from 1988
- National Needs Assessment and Service Coordination Information System (SOCRATES)

Justice data

- Recorded crime: offenders – from 2009
- Recorded crime: victims – from 2014
- Court charges – 1992–2013
- Sentencing and remand – from 1998

Benefits and social services data

- Benefits – from 1990
- Youth services – from 2004
- Auckland City Mission – from 1996
- Children's Action Plan – from 2013

Tax and income data

- Tax and income – from 1999

Education and training data

- Early childhood education – 2008–15
- Primary education – from 2007
- Secondary education – from 2004
- Tertiary education – from 1994
- Industry training – from 2001
- Targeted training – from 2001

Student loans and allowances data

- Student loans and allowances – from 1992

Travel and migration data

- Driver licence and motor vehicle registers
- Border movements – from 1997
- Visa applications – from 1997
- Departure and arrival cards – from 1997
- Migrant Survey – from 2012
- Longitudinal Immigration Survey of NZ – 2005–09

Family and household data

- 2013 Census
- Births, deaths, marriages, and civil unions – from 1840
- Child, Youth and Family – from 1991
- Household Economic Survey – from 2006
- Household Labour Force Survey – from 2006
- NZ Income Survey – from 2006
- Working for Families – from 2003
- Tenancy – from 2000
- Social housing – from 1980
- Survey of Family Income and Employment – 2002–10

Integrated Data Infrastructure (IDI)

- Obesity and season of measure from B4SchoolCheck
  - Spring: Sep-Nov // Summer: Dec-Feb // Autumn: Mar-May // Winter: Jun-Aug
- Birth records from DIA
  - To calculate age to nearest month, birth season
- Gender from personal_details table
- Ethnicity from source_ranked_ethnicity table
- Most recent address from address_notification table
  - To assess area level deprivation and region.

Sample Descriptives: B4SC & IDI

	2010/2011	2011/2012	2012/2013	2013/2014	2014/2015	2015/2016
n [a]	45285	50469	50331	58029	56643	56541
MoH coverage rate (%)	72	79	80	91	92	92
Gender (%)						
Male	50.8	51.3	51.6	51.4	51.1	51.2
Female	49.2	48.7	48.4	48.6	48.9	48.8
Ethnicity [b] **(%)**						
European	74.0	72.2	72.5	71.2	69.8	69.1
Māori	27.0	25.9	26.0	25.9	26.1	25.8
Pacific	12.5	13.4	13.2	13.9	14.3	14.1
Asian	9.8	11.8	12.2	13.1	14.7	15.9
Deprivation (NZDep) (%)						
quintile 1 (least deprived)	18.3	18.9	19.0	19.3	18.8	19.6
quintile 2	17.4	18.0	18.3	18.0	18.7	18.5
quintile 3	18.2	17.9	18.2	18.6	18.2	18.3
quintile 4	19.0	18.7	19.4	19.3	19.5	19.0
quintile 5 (most deprived)	25.0	24.7	24.1	24.5	24.6	24.2

[a] ***randomly rounded to a base of 3, as per the confidentiality rules of Statistics New Zealand.***

[b] ***Ethnic groups are not mutually exclusive, a child can be classified as belonging to multiple ethnicities.***

E Tipu E Rea: A Better Start

National SCIENCE Challenges

A BETTER START

E Tipu e Rea

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Our Science

- What is A Better Start's job?
- What will A Better Start do on obesity?
- What will A Better Start do on learning?
- What will A Better Start do on mental health?
- What will A Better Start do on developmental and behavioural disorders?
- How does A Better Start's research programme work?
- What will A Better Start add to science in New Zealand?

E Tipu e Rea

Grow and Branch Forth

E Tipu E Rea: A Better Start

- Three themes
  - Obesity (led by Wayne Cutfield)
    - José Derraik, Rachael Taylor, Susan Morton, Marewa Glover, Jacinta Fa'alili-Fidow
  - Mental Health (led by Sally Merry)
  - Education (led by Gail Gillon)
- Big Data team (exec: Barry Taylor, Rick Audas, Barry Milne)
  - Nichola Shackleton, Tong Zhu, Jessica McLay, Sheree Gibb (UoA), Jesse Kokaua, Rose Richards, Justine Camp, Nick Bowden (UO)
  - Work with themes within the BSC to address key research questions relating to child/youth obesity, literacy and mental health
  - Almost all of our work involves use of IDI data

E Tipu E Rea: A Better Start

- Obesity papers led by Big Data team
  - Trends in Obesity (Nichola)
  - Community Trajectories (Sheree)
  - Antibiotics Exposure and Obesity (Jessica)
  - Obesity, Deprivation and Ethnicity (Nichola)
  - Obesity and Oral Health (Rick)
  - Obesity and Seasonality (Barry)

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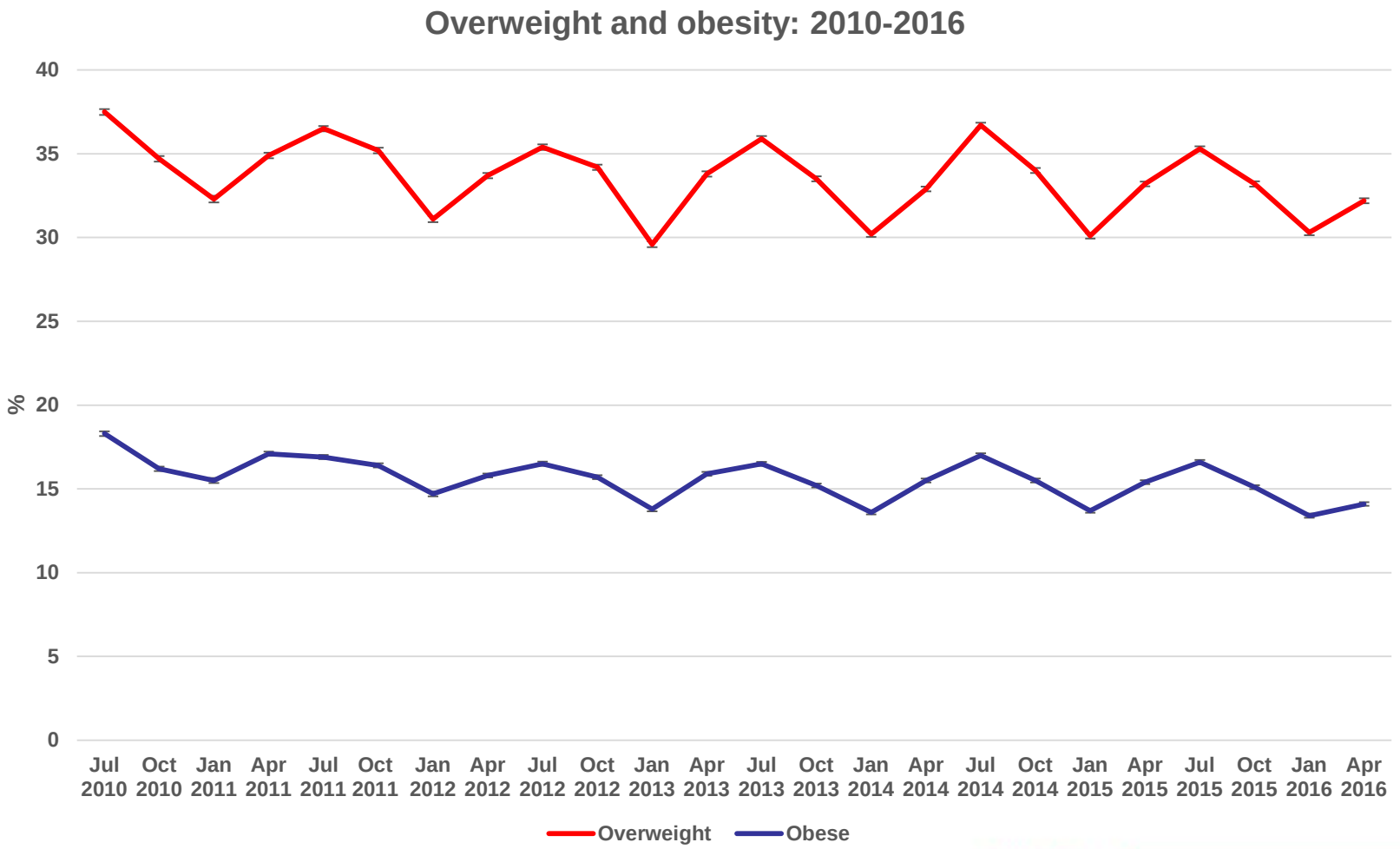
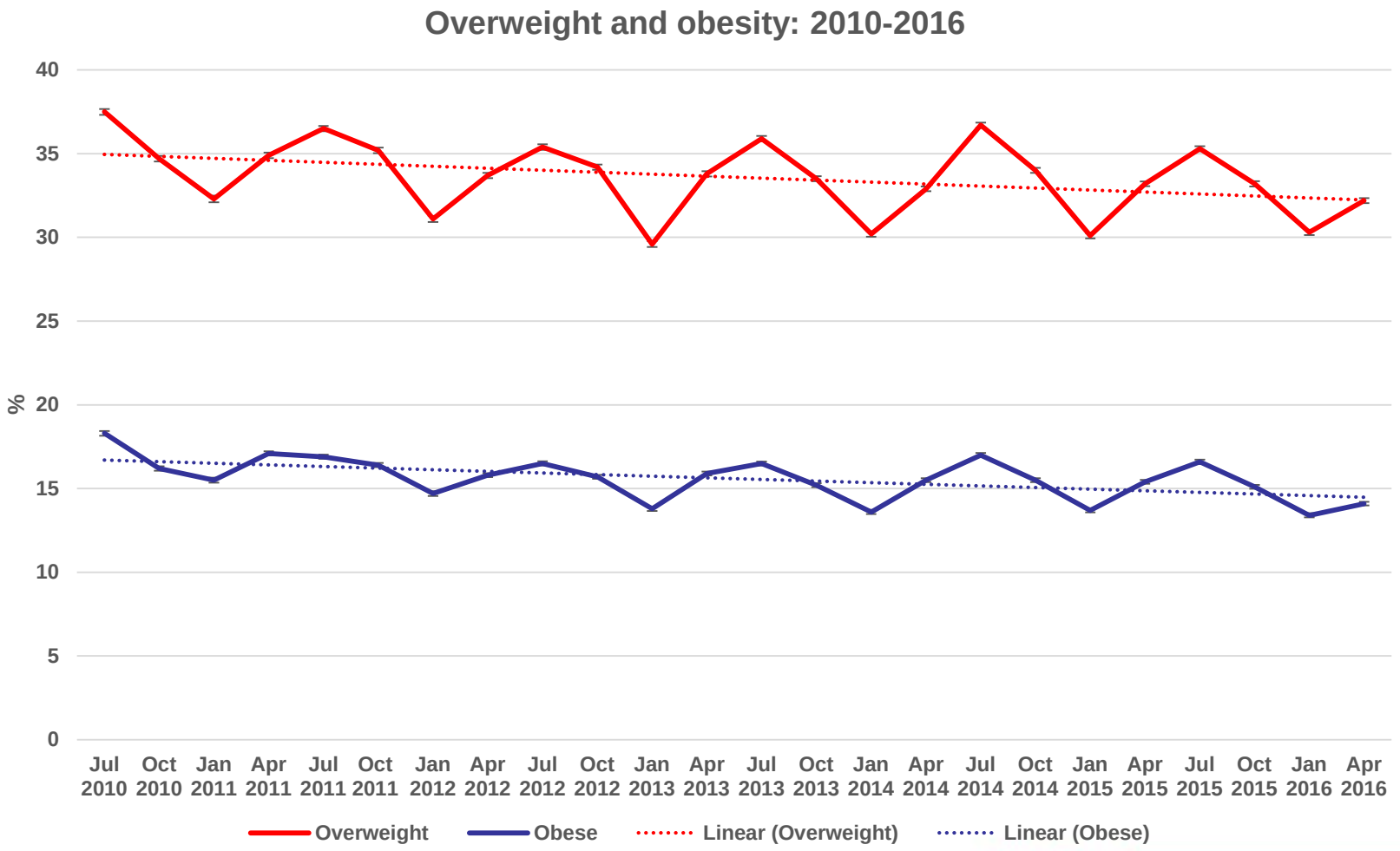
2) If there is, does this differ by gender, ethnicity, deprivation, region?
3) If there is, is this reflected in the referral patterns for obesity?
4) If there is, what might be explaining it?

Overweight and obese time trends



Overweight and obese time trends



Overweight and obese by season

Season of measurement	BMI (z-score)	Overweight (%)	Obese (%)	Extremely Obese (%)
Spring	0.682	34.1	15.6	3.1
Summer	0.587	30.5	14.1	3.0
Autumn	0.665	33.4	15.6	3.3
Winter	0.735	36.2	16.9	3.4
Winter-Summer	+0.148 SD	+5.7 (+19%)	+2.8 (+20%)	+0.4 +13%

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2) If there is, does this differ by gender, ethnicity, deprivation, region?
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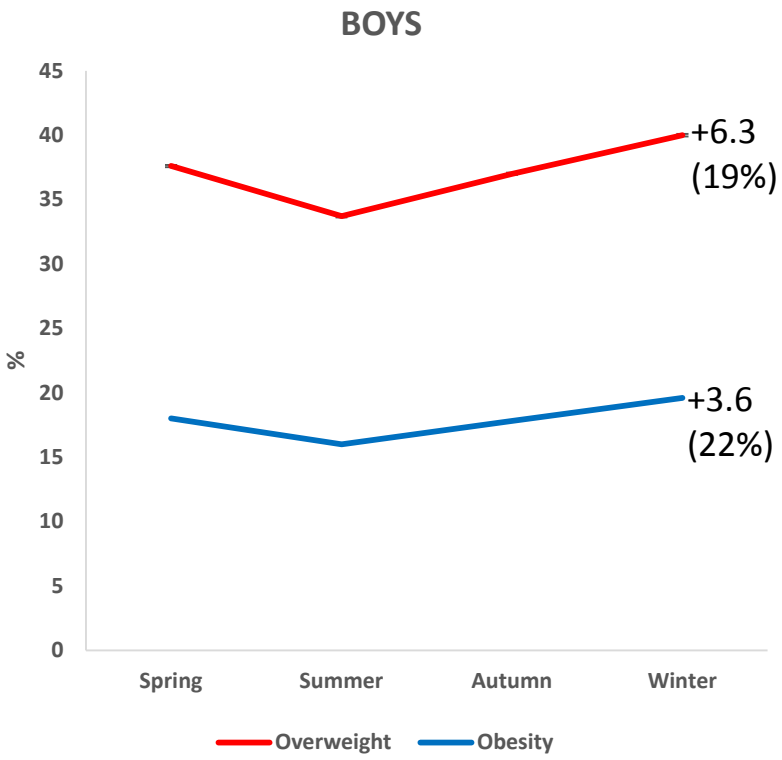
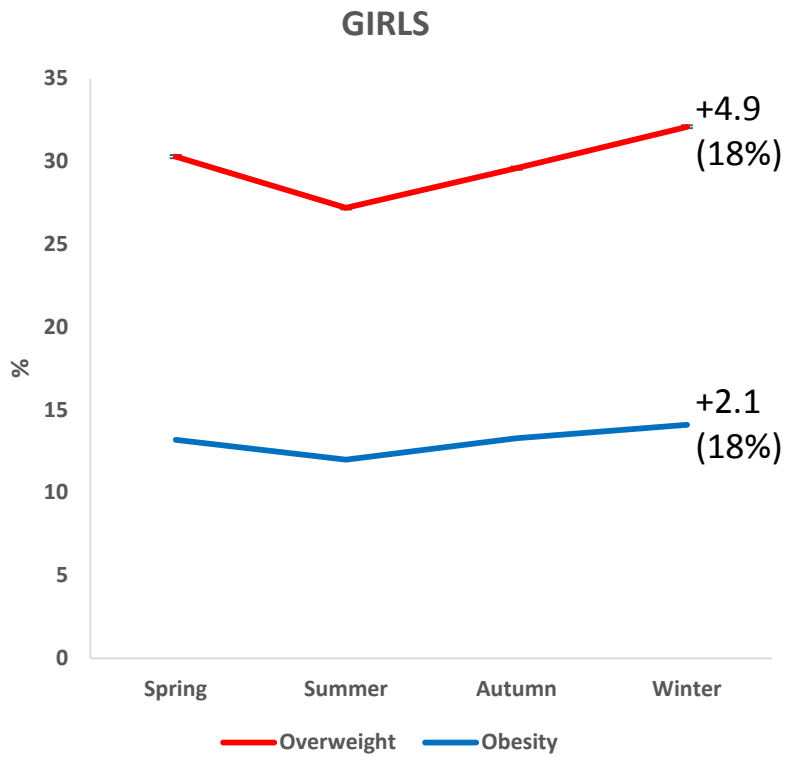
Is it different for boys and girls?

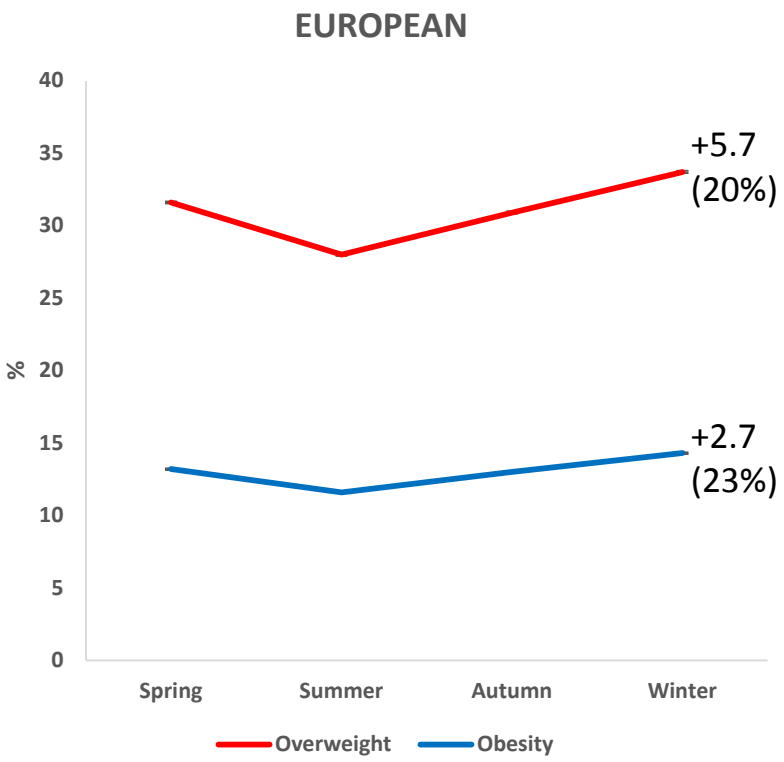
- **NO**

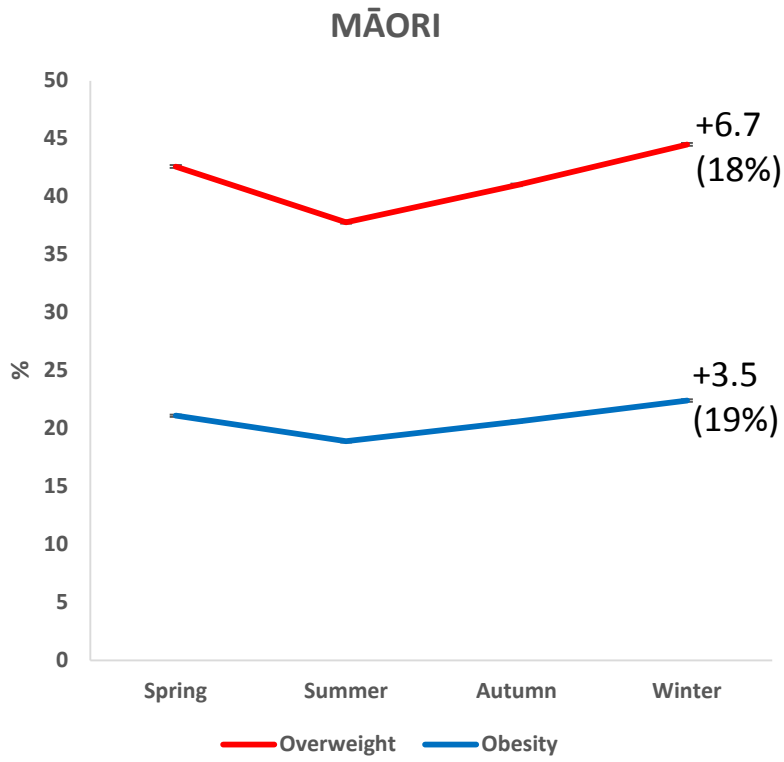




Does it differ by **ethnic group?**

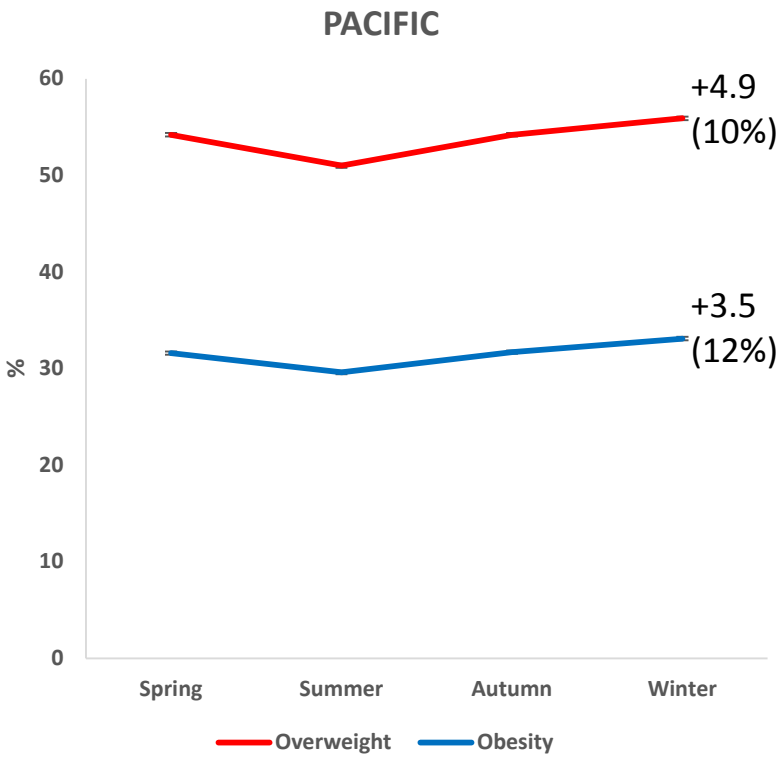
- **A LITTLE**

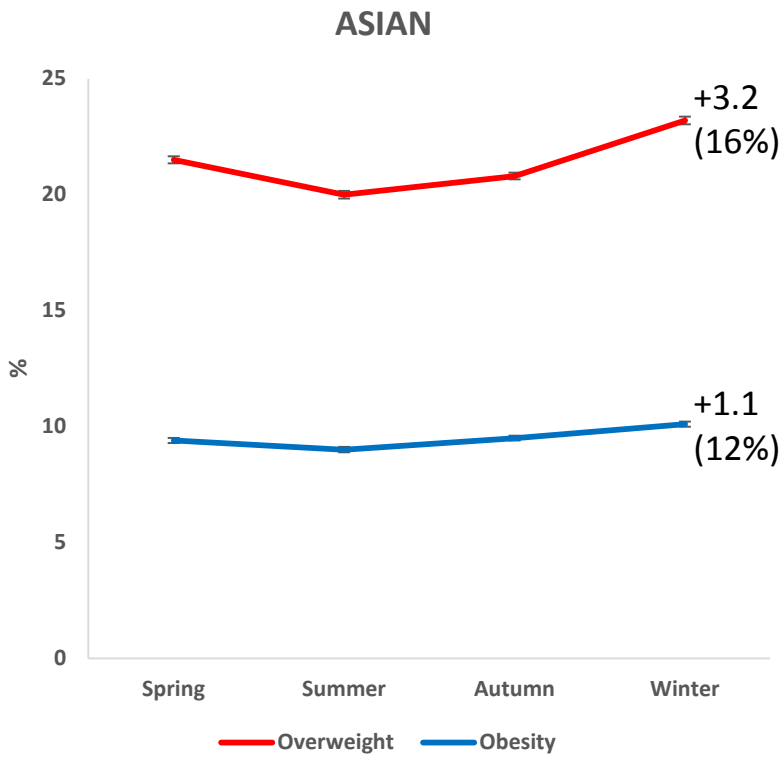




Does it differ by **ethnic group?**

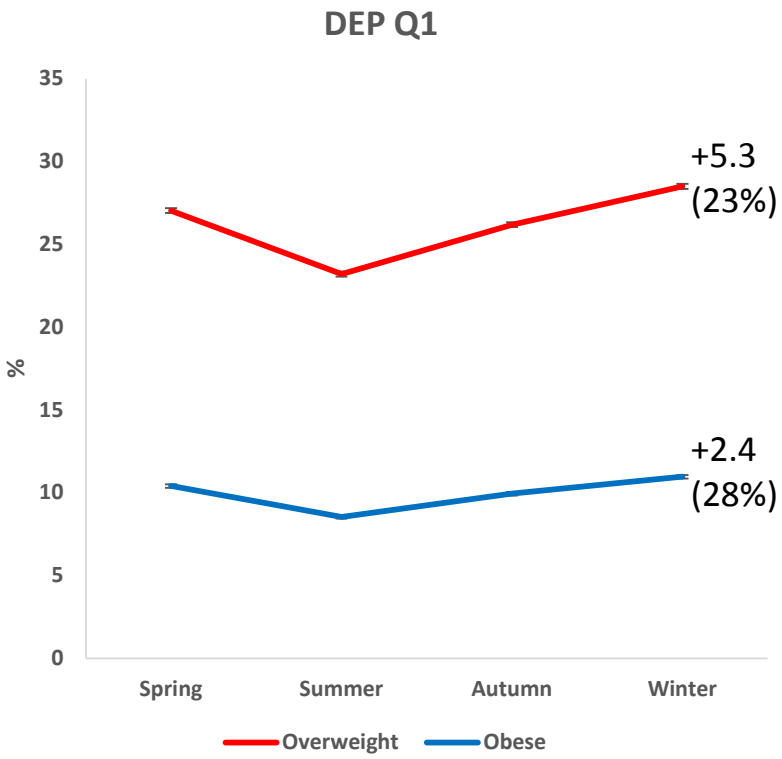
- **A LITTLE**, smaller effect for Asian and perhaps Pacific

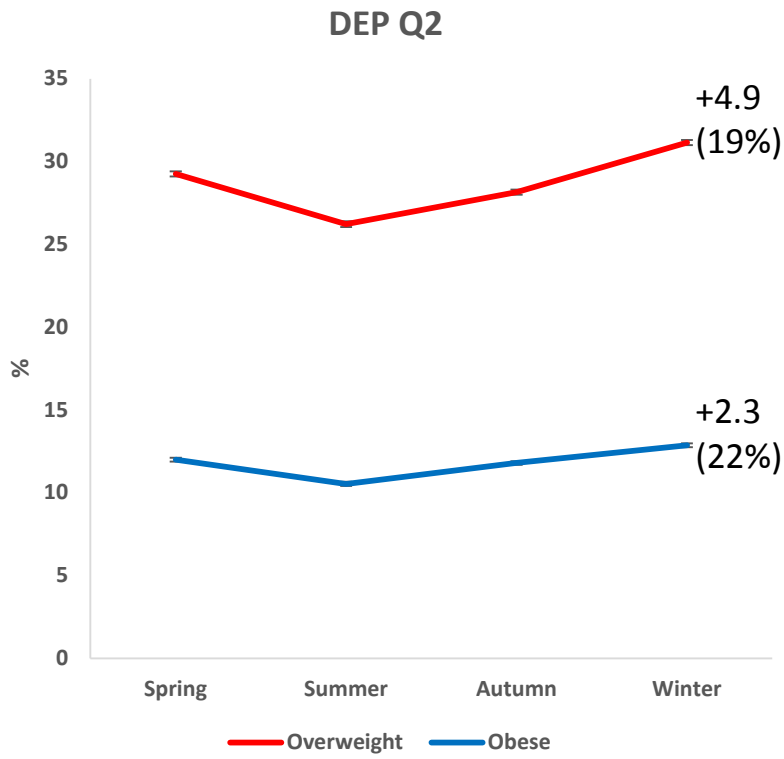




Does it differ by **deprivation group?**

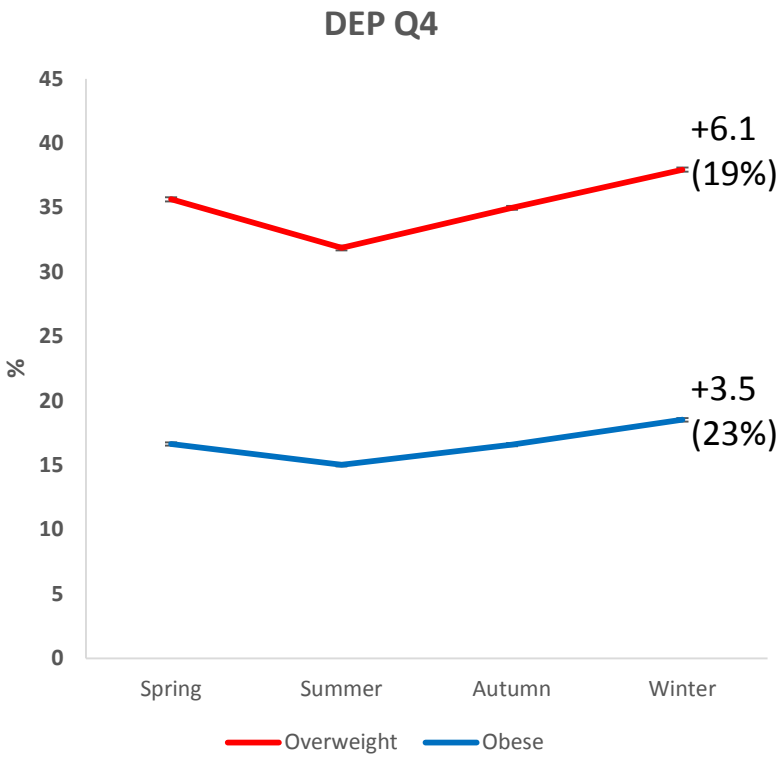
- **POSSIBLY**

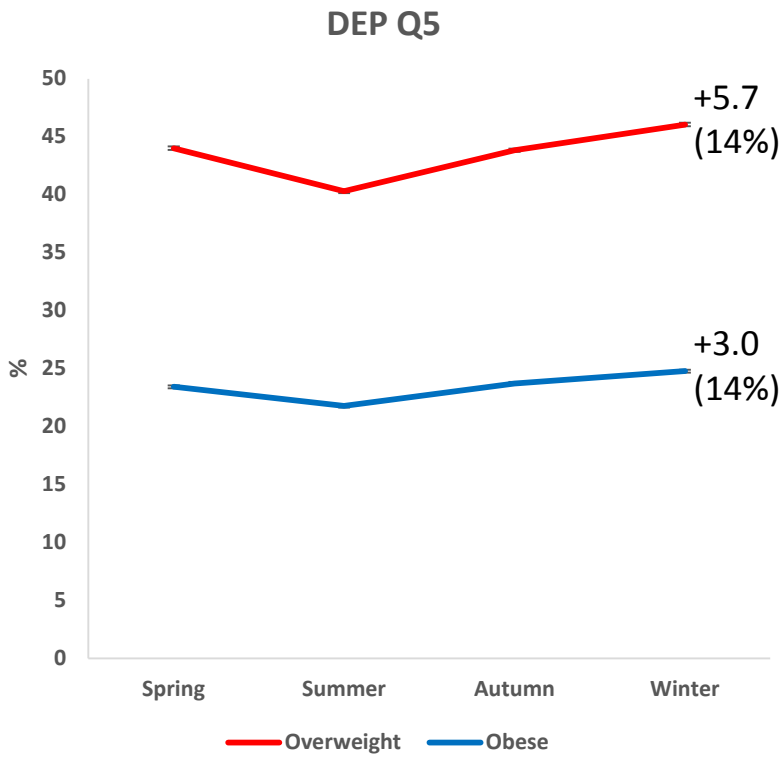




Does it differ by **deprivation group?**

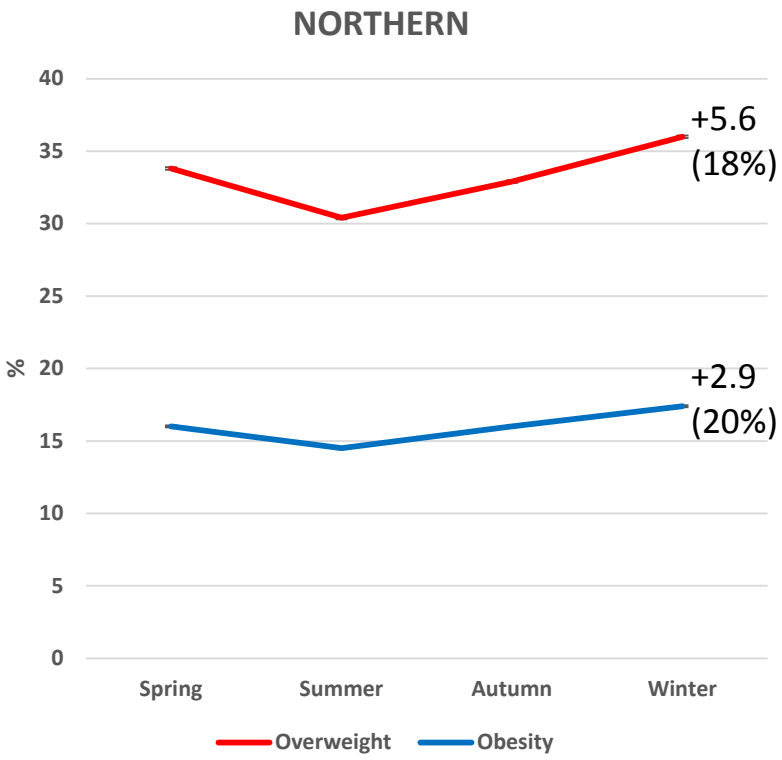
- **POSSIBLY** smaller effect for highest deprivation group

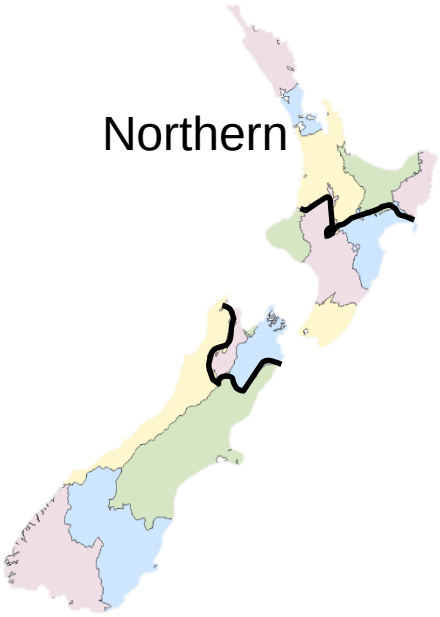




Does it vary by **region**?

- **NO**





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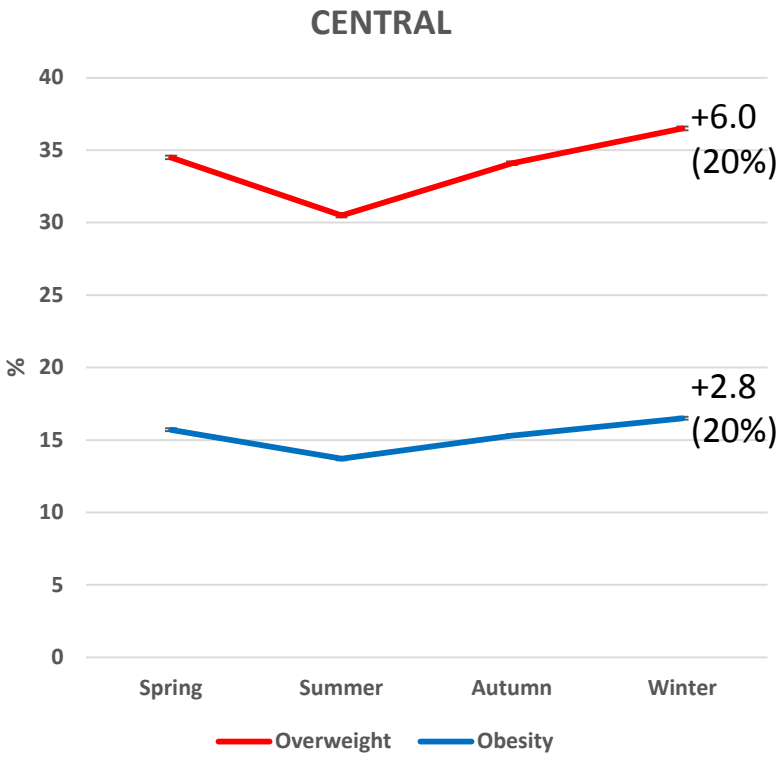

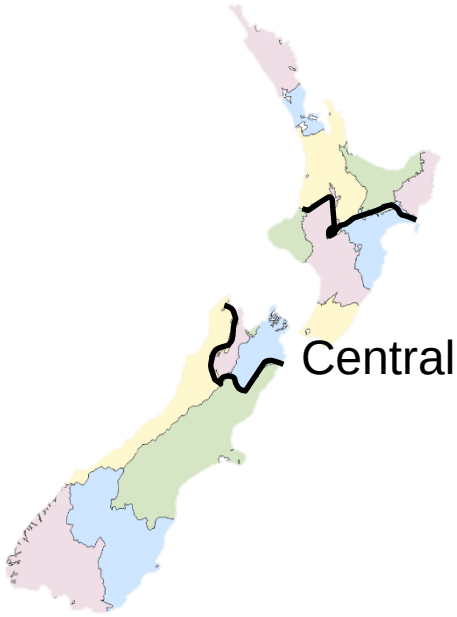

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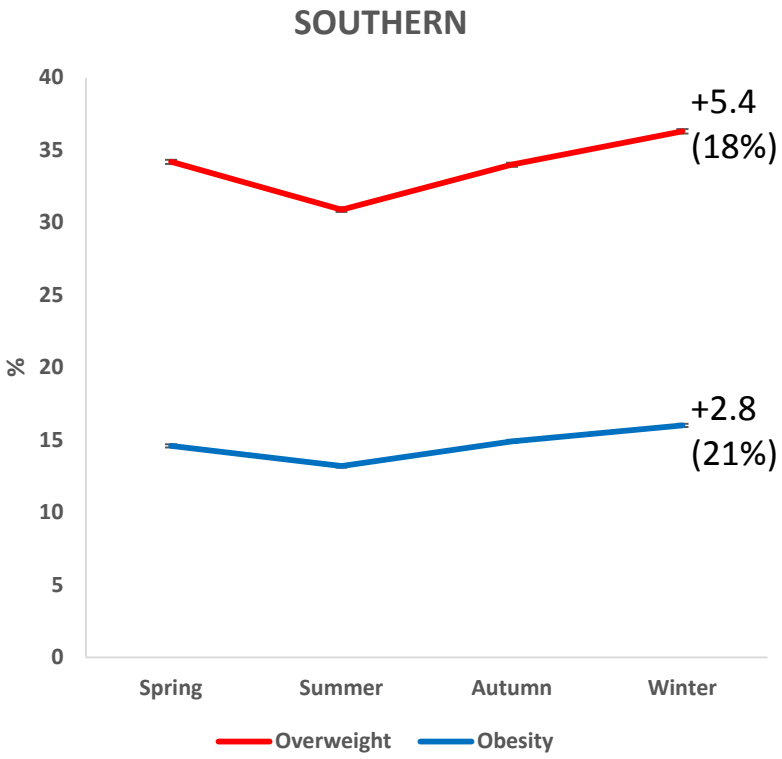
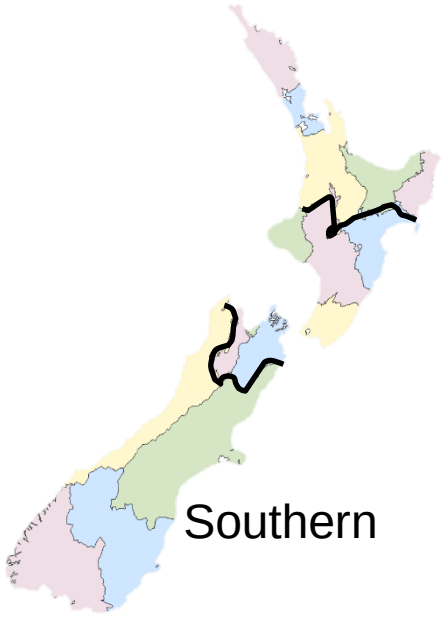
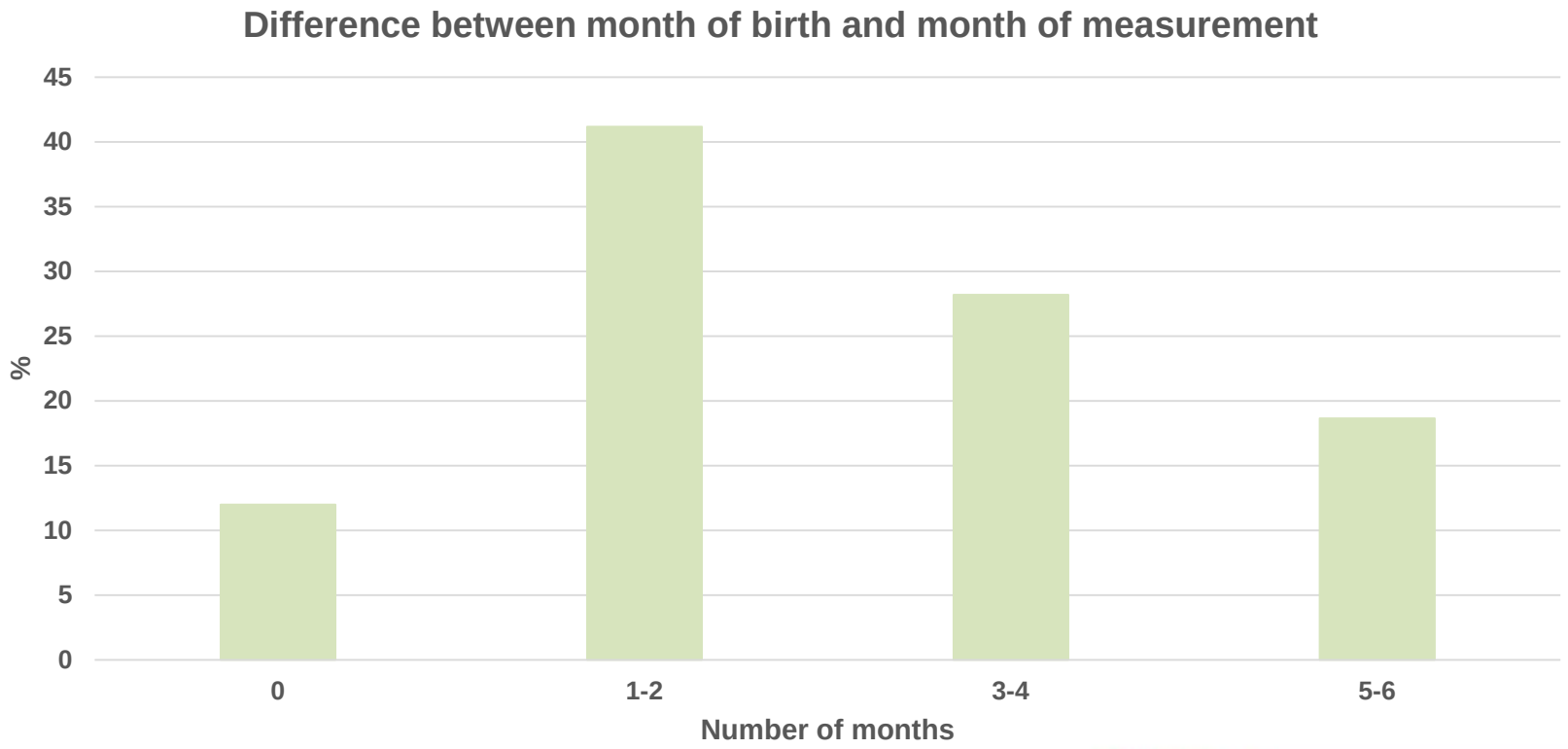
- **NO**





Is it a season of birth effect in disguise?

- Children more likely to be seen close to their birthday



Is it a season of birth effect in disguise?

- **NO**, in models adjusted for each other, gender, ethnicity, deprivation, rurality and time trends…

	OVERWEIGHT OR (95% CI)	**OBESE OR (95% CI)**
Season of measurement		
Spring (v summer)	1.18 (1.15-1.20)	1.13 (1.10-1.16)
Autumn (v summer)	1.13 (1.10-1.15)	1.11 (1.08-1.15)
Winter (v summer)	1.28 (1.25-1.31)	1.23 (1.19-1.26)
Season of birth		
Spring (v summer)	0.99 (0.97-1.01)	1.00 (0.97-1.03)
Autumn (v summer)	1.04 (1.02-1.07)	1.04 (1.01-1.07)
Winter (v summer)	1.00 (0.98-1.02)	1.01 (0.98-1.04)

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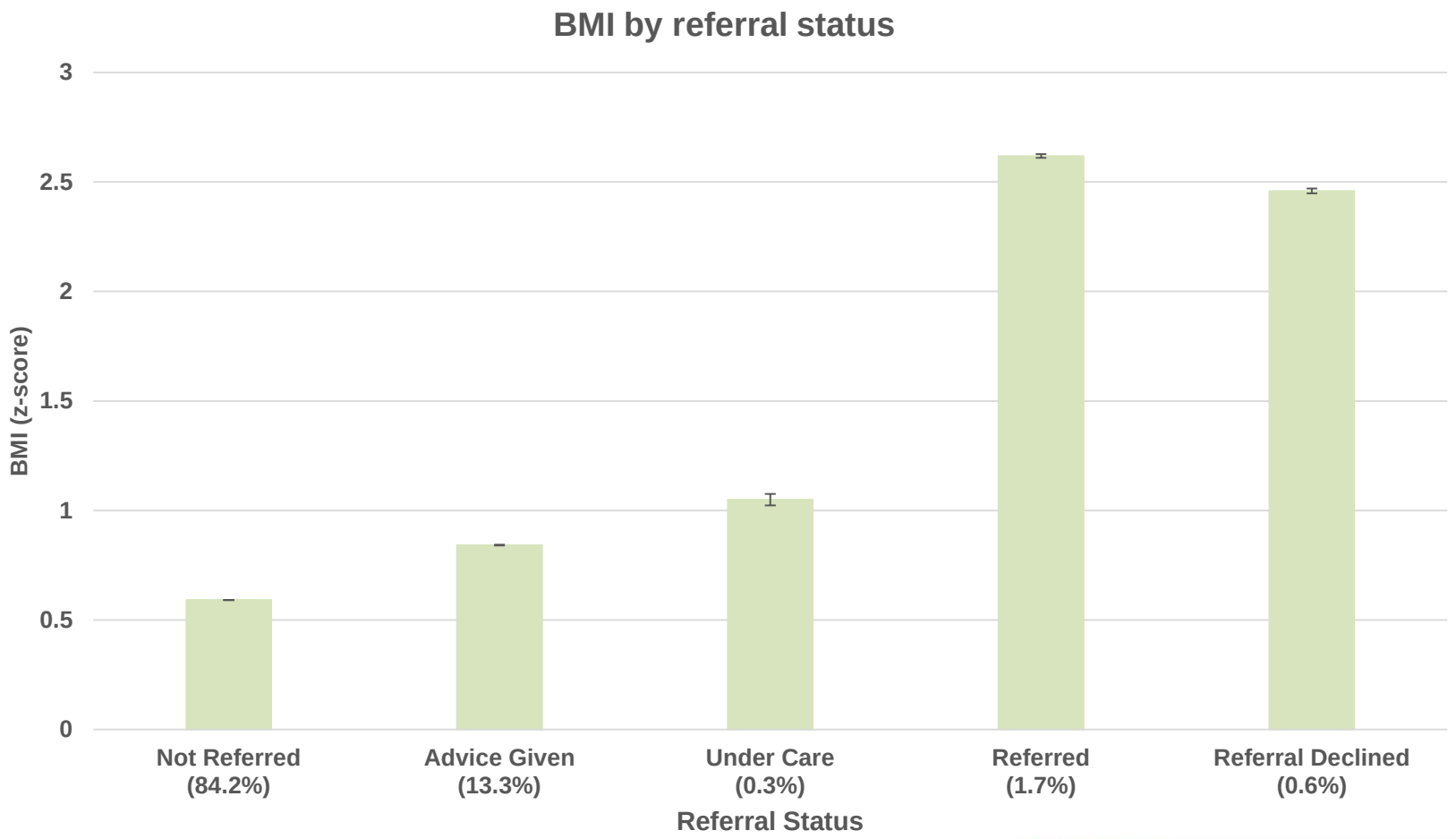
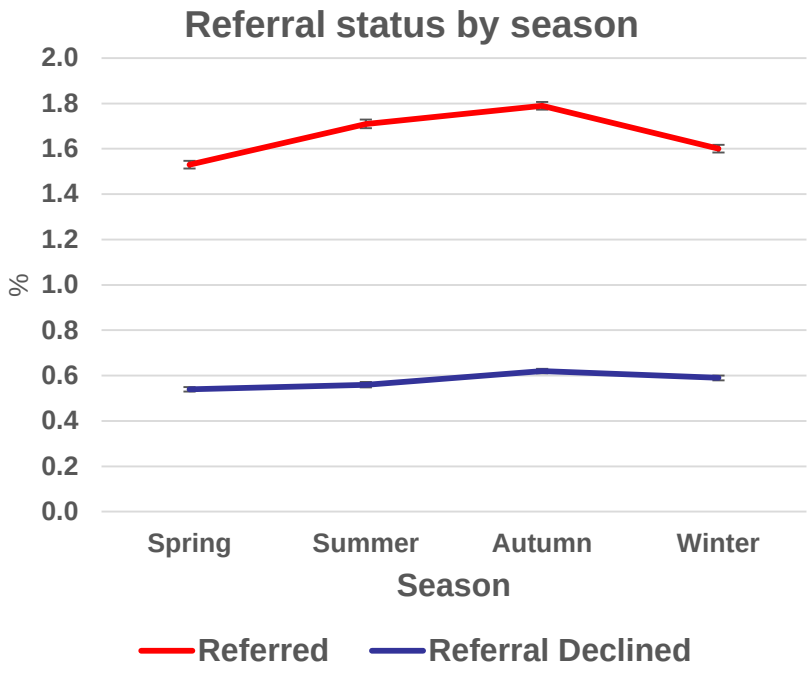
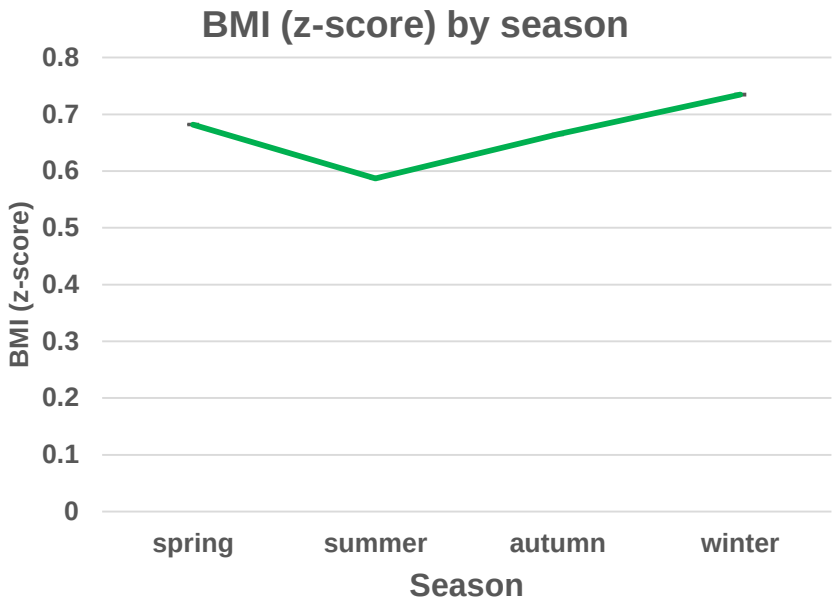
B4School Check Obesity referrals



Obesity referrals by season

- Are there seasonal differences in referrals?
  - Not in the same way as seasonal differences in obesity





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What does the literature say?

- Suggestion due to increased energy intake and less energy expenditure
  - Vietnamese study (Huong et al., 2014) showed lowest energy intake in summer
  - …But FLAME study (Dunedin; Taylor et al., 2008) showed no seasonal differences in physical activity in 4 and 5 year olds (effects at age 3, though: summer/ winter BOTH higher than spring)
  - However, may be more sedentary and less time outside, less walking around, etc.

What does the literature say?

- Evidence from UK that physical activity in children declines with increasing rainfall

- **Next step:** investigate localised rainfall (& temperature, sunshine) prior to B4ScCheck measurement to see if any explain finding
  - No evidence for a regional effect using current data

Other suggestions

Marewa Glover:

I put this to my focus group of Māori parents (urban n=7) last week.

They were all like duh of course! Reasons given were – spending more time indoors, changing what's eaten in winter e.g. stews, less time at the park – it's too cold / rain. BUT one contributor we didn't have was that they avoid taking their kids to places that had "too many germs" – hence they avoid taking their kids to swimming (if they can even afford that). I asked about indoor recreational facilities like Chipmunks – No! Too many germs. This also makes them wary of taking kids to things that will bring their children into contact with lots of other children. One reason they need to do this is because if one of their children contracts cold/flu it'll go through the whole household (they had 2-4 kids).

Limitations

- Unequal distribution of children across season
  - Summer 20-21%, Autumn 27-28%, Spring/Winter 25-26%
  - Possible that those with low zBMI more likely to have B4SchoolCheck over summer? Can't rule it out, but…
    - Peak in winter nearly as strong as trough in summer
    - No spike in autumn (which seems to take most of summer excess)
    - No characteristic (e.g., eth/dep) varies by season of measure
- Misclassification of Māori and Pacific zBMI; Incomplete coverage of 4-year olds
  - Should affect each season equally
- Height/weight measurement protocols not followed
  - E.g., heavier clothes/shoes worn in winter. Can't rule it out, but…
    - Effect too large; no regional differences

Conclusions

- There are strong effects of season on 4-year old obesity in NZ
  - These are consistent across gender, ethnicity, deprivation and region
- Practitioners need to be aware
  - Referral activity in B4SchoolCheck not affected
- Causes of seasonal effect need thorough investigation, and policy implications assessed

QUESTIONS?