Growing Up in Ireland
National Longitudinal Study of Children

Concurrent Association of Physical Activity and Sedentary Behaviour on Obesity Risk among Growing Up in Ireland's Cohort '98 at 17/18 Years: A Latent Class Analysis

Eoin McNamara

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ESRI ECONOMIC & SOCIAL RESEARCH INSTITUTE

Trinity College Dublin
The University of Dublin

An Roinn Leanaí agus Gnóthaí Óige
Department of Children and Youth Affairs

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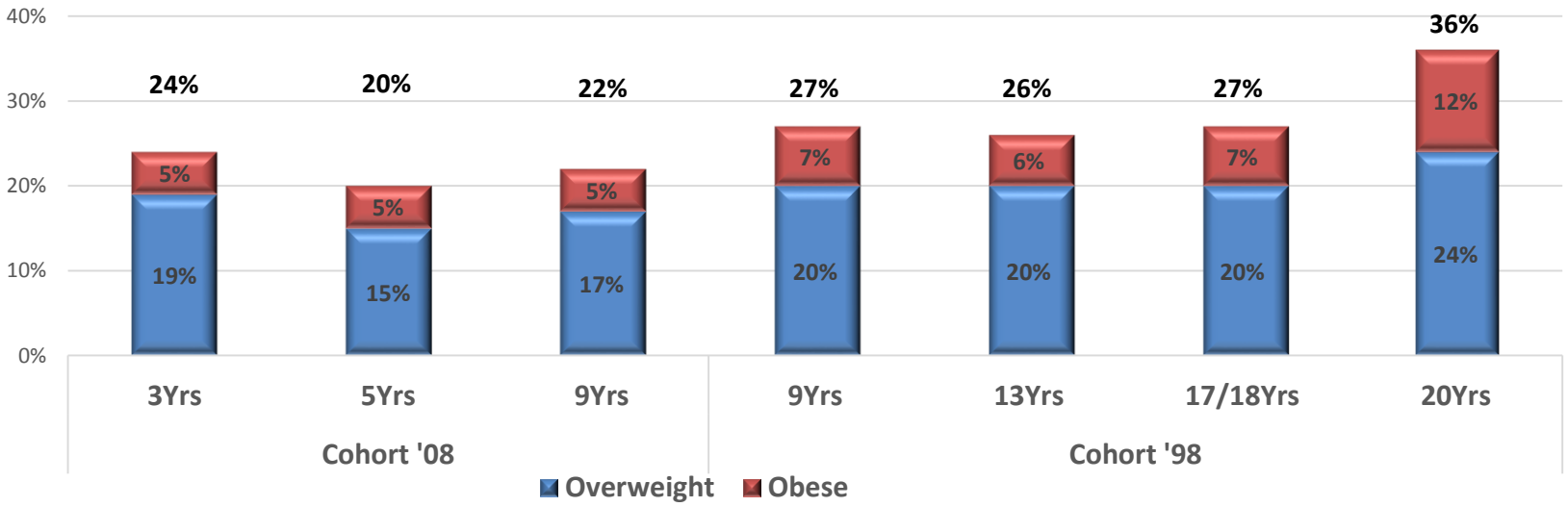
Adolescent Obesity

- Adolescent obesity is a major health concern
  - WHO: tenfold increase in number of obese children/adolescents worldwide between 1975 – 2016, from 11m to 124m (NCD-RisC, 2017)
    - Globally, obesity is now a greater health concern than hunger (GBD Survey, 2012)
  - Obesity costs Irish economy over €1.1 billion per year (safefood, 2012)
- Linked to many negative health outcomes, short- and long-term
  - Type II diabetes, high BP, CVD, cancers, mental health issues
- Trends: prevalence increases with age / tracks into adulthood – see ***GUI*** data:



Understanding Obesity

- Despite the magnitude of the problem, and the level of research interest in this issue, it's still difficult to conclusively explain the causes of obesity
- Basic principle: if energy consumption = energy expenditure
  ⟹ weight maintenance

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- Despite the magnitude of the problem, and the level of research interest in this issue, it's still difficult to conclusively explain the causes of obesity
- Basic principle: if energy consumption **>** energy expenditure
  - ➡ weight gain (usually via a small imbalance over time)
- BUT….in reality, it's a very complex, multifactorial issue
- Obesity is informed by a wide range of determinants:
  - genetic (gender), socio-demographic (income), environmental (access to green space/unhealthy foods) and behavioural/lifestyle
- Physical activity and sedentary behaviour (along with diet) are key behavioural determinants of obesity risk
  - **MODIFIABLE** ➡ Increased research focus on these determinants to better understand, target and reduce obesity risk

Physical Activity vs. Sedentary Behaviour

Physical Activity (PA):
Any bodily movement produced by skeletal muscles that requires energy expenditure

Sedentary Behaviour (SB):
Any waking, low-energy activity (<1.5METs) in a seated, supine or lying posture

- Not simply a trade-off between PA and SB – distinct behaviours that may each explain unique variance in obesity risk
- What's the best type of behavioural profile (in terms of combined PA and SB levels) to combat obesity risk?
  - Is it a case of 'high PA good' and 'high SB bad'?
  - Or is it a combination – what about high PA and high SB?

- **<u>Study Aim:</u>**

  Describe the combined influence of physical activity & sedentary behaviour on overweight & obesity risk for adolescents

Methods

- GUI Cohort '98 at 17/18 years (data collection completed in 2016)
- Overweight and obesity defined according to age- and gender-specific BMI status cut-offs (height and weight recorded by an interviewer)
- All participants were invited to complete a Time-Use Diary
- Time-Use Diary
  - 24 hours * four 15-minute periods = 96 slots
  - 24 activities to choose from
  - ~14% completed on each day of the week
- LCA: using TUD data, highlighted four behaviours (2*PA/2*SB) to create one unobserved variable to classify behavioural profiles for all participants
  - But which Time-Use Diary activities should be used to define these four physical activities and sedentary behaviours?

Classifying Time-Use Diary Activities

ACTIVITY	Physical Activity / Sedentary Behaviour?
1. Sleeping / Resting	
2. Personal Care or Getting Ready	
3. Eating	
4. Travelling	
5. At School / College	
6. At Work	
7. Doing Homework or Study	
8. Hanging around with Friends	
9. Spending Time with Family	
10. Playing with or Exercising Pet	
11. At Gym, Playing Sport or Doing Physical Exercise	
12. Attending a Sports Event	
13. Using the Internet / Emailing	
14. Playing Computer Games	
15. Talking on the Phone or Texting	
16. Music Lesson, Drama, Classes	
17. Watching TV, Films, Videos or DVDs	
18. Listening to Music	
19. Reading for Pleasure	
20. Housework	
21. Hobbies and other Leisure Activities	
22. Shopping	
23. Going to Discos & Bars	
24. Going to Party or Social Event	

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Grouping Time-Use Diary Activities

- Which behaviours to inform the LC variable?
  - PHYSICAL ACTIVITY:
    - **1. Exercise** = gym / sport / exercise + sports event
    - **2. Other PA** = hobbies + play with pet + chores + work
  - SEDENTARY BEHAVIOUR:
    - **3. Screen time** = internet + TV + video games + phone
    - **4. Other SB** = homework + reading

Table: Classifying 'high' category for each behaviour

PHYSICAL ACTIVITY	**1. Exercise**	High = ≥1 hour per day	70%
	2. Other PA	High = ≥1 hour per day	60%
SEDENTARY BEHAVIOUR	**3. Screen time**	High = ≥3 hours per day	57%
	4. Other SB	High = ≥3 hours per day	67%

Latent Class Model

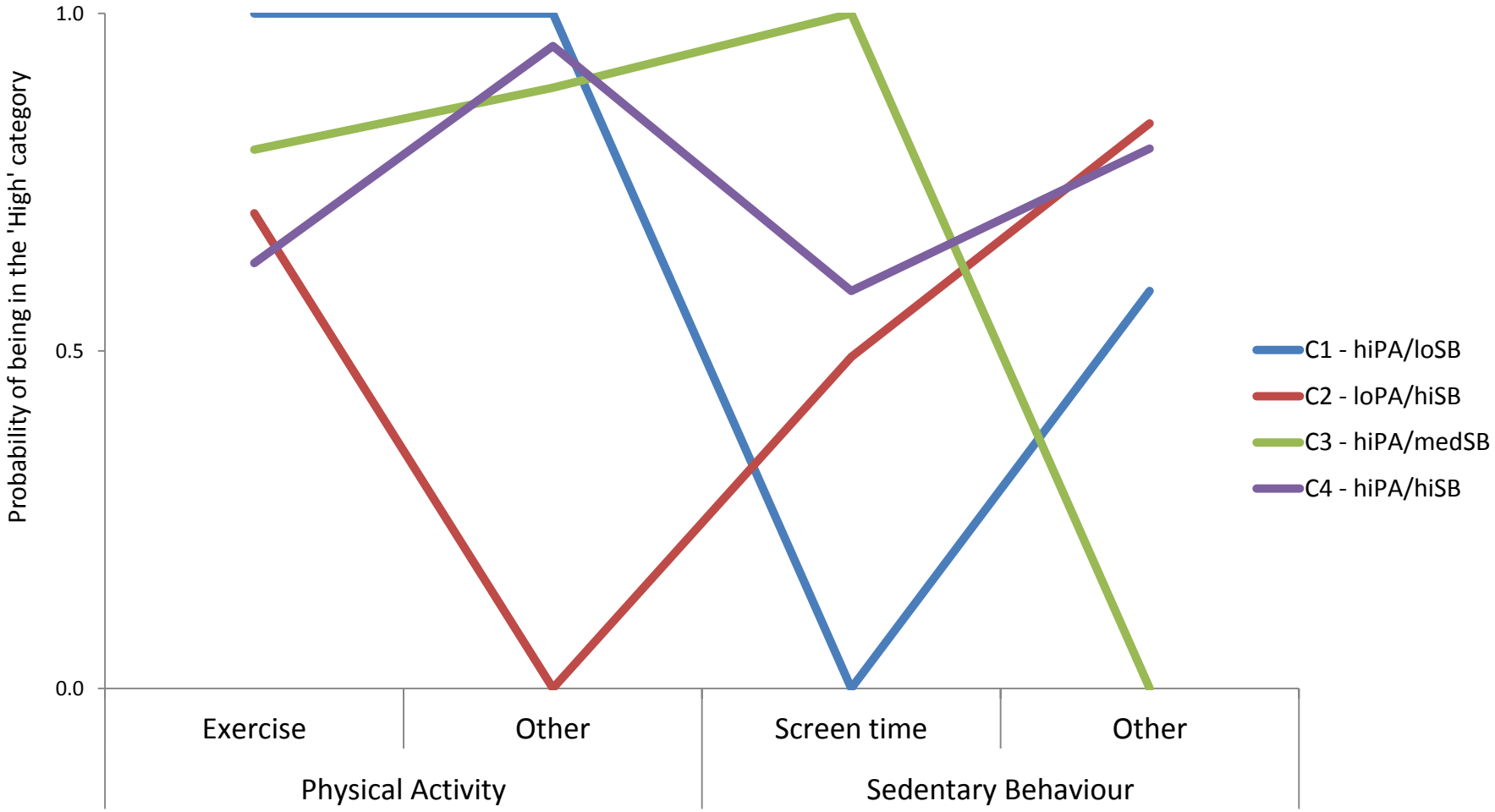
- LCA used to identify unobserved (latent) classes in the cohort based on their likely response to each of the four behaviours
- Four-class model was deemed to have the best fit to the data
  - Class 1: High PA / Low SB (8%) hiPA/loSB
  - Class 2: Low PA / High SB (37%) loPA/hiSB
  - Class 3: High PA / Medium SB (16%) hiPA/medSB
  - Class 4: High PA / High SB (39%) hiPA/hiSB

Table: Probability of being in the 'high' category for each behaviour, by latent class

		Class 1 - hiPA/loSB	**Class 2** - loPA/hiSB	**Class 3** - hiPA/medSB	**Class 4** - hiPA/hiSB
% of cohort		8%	37%	16%	39%
Physical Activity	1. Exercise	1.00	0.70	0.80	0.63
	2. Other PA	1.00	0.00	0.89	0.95
Sedentary Behaviour	3. Screen time	0.00	0.49	1.00	0.59
	4. Other SB	0.59	0.84	0.00	0.80

Latent Class Model

Figure: Probability of being in the 'high' category for each behaviour, by latent class



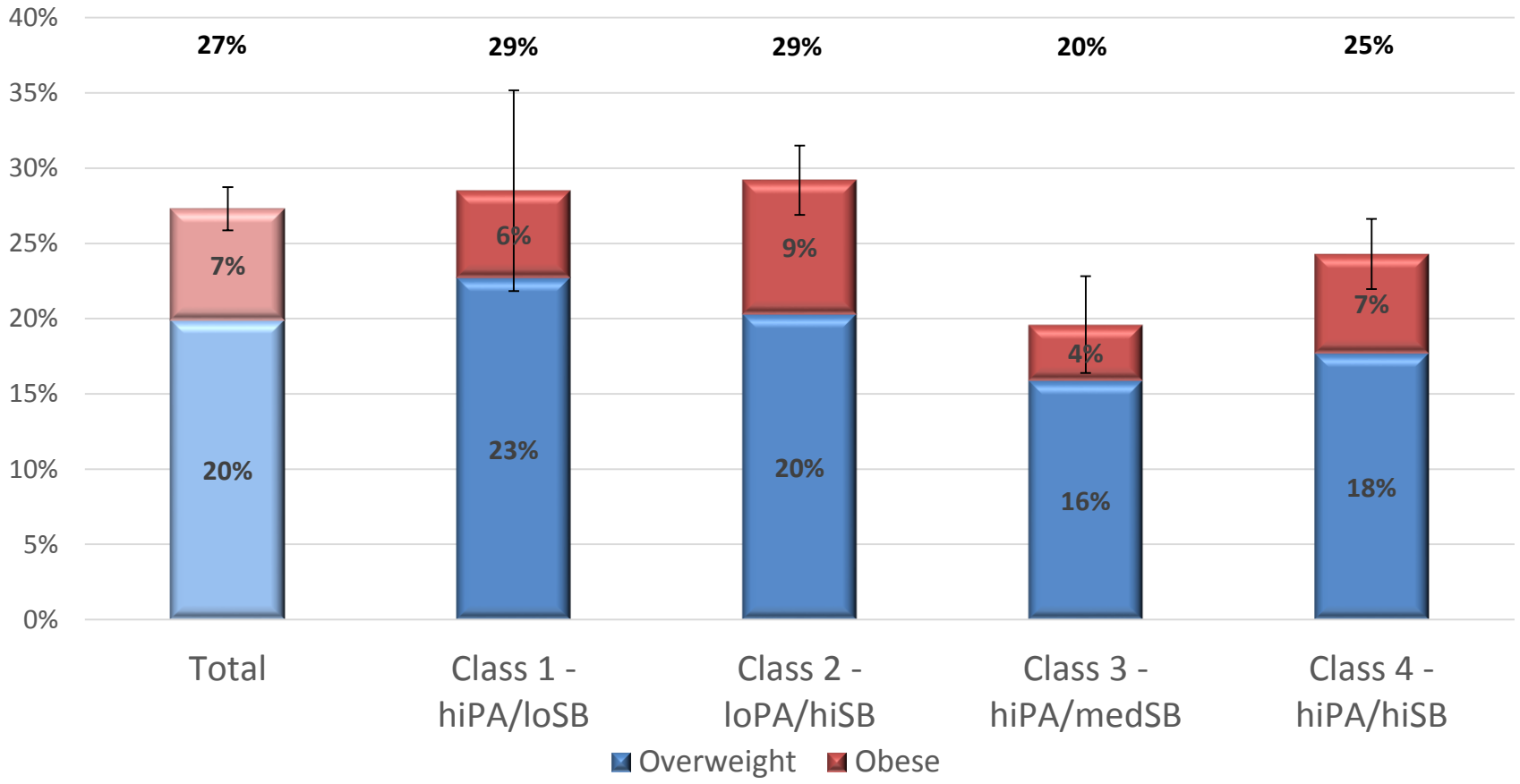
Descriptive Statistics

Table: Cohort Descriptive Statistics according to Latent Class (n=3,622)

		Class 1 - hiPA/loSB	**Class 2 -** loPA/hiSB	**Class 3 -** hiPA/medSB	**Class 4 -** hiPA/hiSB	**Total**
Age	17Yrs	82%	83%	79%	83%	**82%**
Gender	Male	42%	50%	42%	55%	**50%**
Income Quintile	Lowest	18%	16%	14%	19%	**17%**
	Highest	25%	21%	29%	21%	**22%**
Family Type	Two parent, large	21%	26%	27%	23%	**25%**
PCG Education	Junior cert or less	17%	17%	8%	19%	**16%**
	Degree or more	22%	21%	28%	21%	**22%**
No. of friends		2.5	2.4	2.6	2.5	**2.5**

Association between latent class and overweight/obesity risk

Figure: Prevalence of overweight & obesity according to Latent Class (n=3,622)



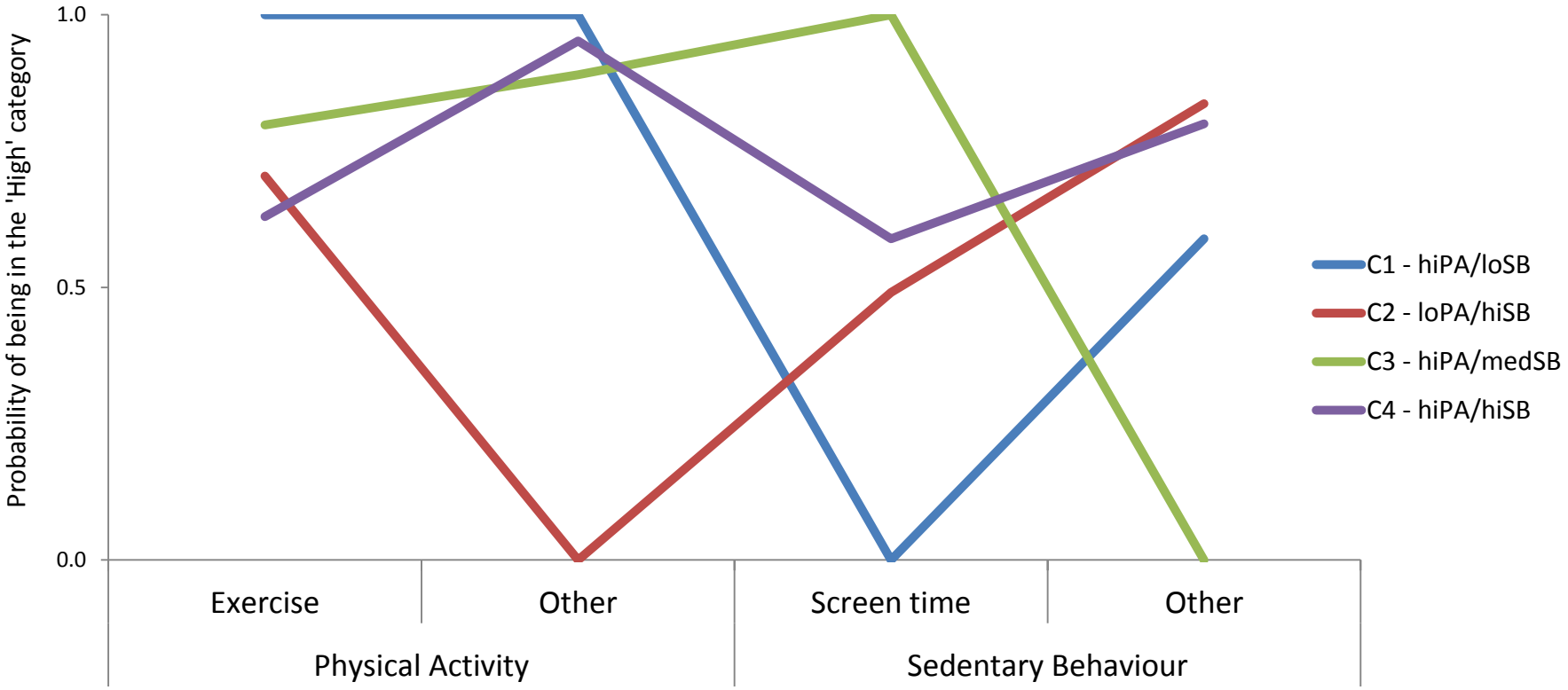
Does Latent Class predict Overweight/Obesity Risk?

Table: Likelihood of being classified as overweight or obese according to latent class

	Baseline Model*		Final Model**	
ref: Class 2 - loPA/hiSB	**Sig.**	**Odds Ratio**	**Sig.**	**Odds Ratio**
Class 1 - hiPA/loSB	0.622	0.92	0.623	0.89
Class 3 - hiPA/medSB	0.01	0.76	0.85	0.97
Class 4 - hiPA/hiSB	0.006	0.78	0.023	0.75
R^2	0.01		0.11	
	*controlling for gender		**control for gender, family income, family type, parental education, parental overweight and obesity, YP friends	

Does Latent Class predict Overweight/Obesity Risk?

Significantly reduced risk of being overweight or obesity (OR 0.75) for Class 4 compared to Class 2: **hiPA/hiSB vs. loPA/hiSB**



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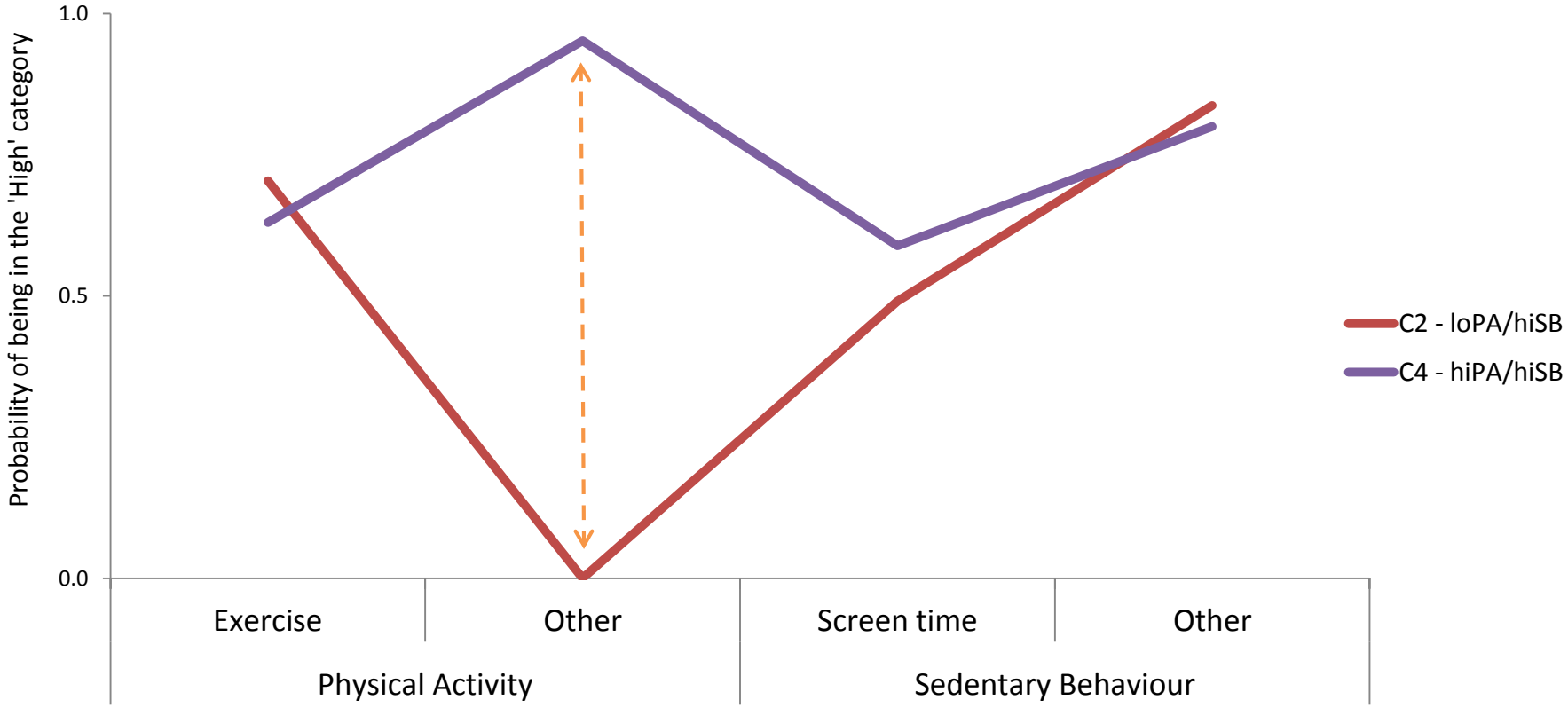

Conclusion

- Combined PA & SB behaviour profile can potentially predict overweight/obesity risk in adolescents
- Differences observed in this cohort due to **"Other PA"**
  - Policy/intervention implications
  - PA guidelines do not need to be met solely through exercise or sports in an organized, formal setting
  - Any activity that leads to increased heart rate/energy expenditure can be effective in combatting obesity risk e.g. housework, work, active commuting, walking
- Limitations / Future Research:
  - Develop LC model; robustness check of assumptions
  - Combine with questionnaire data
  - Develop behavioural profile with addition of dietary data
  - Objective PA data (ideally!)

THANK YOU!

Many thanks to….

- My ***GUI*** colleagues and our colleagues at the DCYA, TCD and CSO
- Huge thanks to all the ***GUI*** study participants and their families

Questions, comments or feedback welcome.

eoin.mcnamara@esri.ie

Regression

Table: Likelihood of being classified as overweight or obese according to latent class

	Model 1		Model 2		Model 3	
	Sig.	**Exp(B)**	**Sig.**	**Exp(B)**	**Sig.**	**Exp(B)**
female	0.002	1.27	0.017	1.22	0.12	1.19
LCA4class1	**0.622**	**0.92**	**0.377**	**0.85**	**0.709**	**0.91**
LCA4class3	**0.01**	**0.76**	**0.011**	**0.74**	**0.56**	**0.92**
LCA4class4	**0.006**	**0.78**	**0.011**	**0.79**	**0.023**	**0.75**
quintile1w3			0.002	1.56	0.114	1.39
quintile2w3			0.003	1.46	0.014	1.53
quintile3w3			0.011	1.36	0.039	1.38
quintile4w3			0.081	1.23	0.022	1.40
twoparentsmallw3			0.011	1.29	0.003	1.45
PCGoverweight					0.004	1.45
PCGobese					0	2.90
SCGoverweight					0	2.14
SCGobese					0	3.03
R2	0.01		0.02		0.11	