AM-Week2 Case Study 1 Japanese Pre-school students

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Title

Clustering patterns of obesity-related multiple lifestyle behaviours and their associations with overweight and family environments: a cross-sectional study in Japanese preschool children

- NCBI
- US National Library of Medicine
- BMJ Open
- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5128936/

Keywords:

EPIDEMIOLOGY

- deals with the incidence, distribution, and possible control of diseases and other factors relating to health

PUBLIC HEALTH

❓ Confused Points

- **Cluster analysis** was performed using children's 4 lifestyle behaviors based on those **non-missing values (n=1545)**.
- adjusted significance level using the Holm's method

Introduction

1. Various weight-related behaviors are related to each other, and **lifestyle behavior patterns clustered around habitual behaviors**, rather than individual behaviors, are considered to be related to body weight status.
2. it is important to assess associations of children's lifestyle behaviour patterns with both aspects of family environments.
    - family environments such as
        - siblings
        - single parent
        - working mother
    - the influence of parents' habitual behaviours
        - children with more active parents were more physically active

Purpose

(1) to **identify** lifestyle behavior **patterns** of diet, physical activity, sedentary and sleep behaviours in preschool children

(2) to **examine the association** between identified behavior **clusters and overweight/obesity**

(3) to **investigate differences** in children's family environments according to clusters.

Population

- all preschool children aged 3–6 years who attended childcare facilities (24 nursery schools and 10 kindergartens) in Tsuruoka city

Main Outcome Measures:

Children's Lifestyle Behaviors

1. dinner timing
2. outside playtime
3. screen time
4. night-time sleep duration

Family environments

1. **Family members living with children:**
    - Category 1: two parents / one parent
    - Category 2: siblings / no sibling
    - Category 3: grandparent/ no grandparent
    - Category 4: Maternal employment: full-time / part-time / self-employed
2. **Habitual family and parents' behaviours**
    - Category 1: family has regular meal times / not
    - Category 2: Parents' habitual exercise meet recommendation / not
    - Category 3: Parents' screen time <2 or 2–3 or ≥4 hours/day.

Children's anthropometric measurements

- **Measure** weight (kg) and height (cm)
- Children were **classified** as non-overweight or overweight (including obese)

Participant characteristics

- Children
    - sex
    - age
- Parents
    - age
    - weight and height
        - used to calculate parents' BMI

Statistical analysis

Setting:

1. use SAS
2. cluster analysis
3. variables for four behaviors were **standardized** (z-scores)

Clusters:

1. partitioning data into different clusters (3–7) by **Euclidean distances between observations**
2. Cluster solutions are **sensitive to the initial cluster centres.**
3. To find optimal specifications for initial cluster centres
    - **1000 iterations** of each cluster procedure using **randomly generated** initial group centres were conducted

    - Identify the solution with the **largest overall r^2 value**
        - represents relative heterogeneity **between** clusters compared with heterogeneity **within** clusters .
4. To examine the **stability** of the cluster solutions
    - the total sample was **randomly divided into two subsamples**
    - **Cohen's κ coefficient** of the cluster solutions of both subsamples with that of the total sample was calculated (κ=0.92 and 0.93 for this final cluster solution).
5. The **final cluster** solution was determined according to
    - large values of the **pseudo-*F*** index
    - high **interpretability** and **stability** of cluster patterns

Significance Tests:

1. the mean values of the **four lifestyle behaviors**
    - ANOVA
2. Participant characteristics, children's weight status and family environments
    - X^2 tests: frequency measures
    - ANOVA: continuous variables
3. **statistically significant**
    - two-sided p values <0.05
    - significance level was adjusted using the **Holm's method**
        - addressing problems of multiple testing

Results

Final Sample:

- 1545 children
    - 825 boys
    - 720 girls
- Mean age:
    - 4.2 years old
- Standard Deviation of Age:
    - 0.9 years

Cluster patterns of lifestyle behaviors

- **Six distinct clusters were identified**
    - **Cluster 1:**

        - the earliest dinner timing
        - the least screen time
        - the longest night-time sleep duration
    - **Cluster 2:**
        - much sleep duration as in C1
        - relatively late dinner timing
    - **Cluster 3:**
        - late dinner timing
        - the shortest sleep duration
    - **Cluster 4:**
        - the least amount of outside playtime
    - **Cluster 5:**
        - the most outside playtime
    - **Cluster 6:**
        - he most screen time
        - shorter sleep duration
- **Participants Characteristics:**
    - **C1 and C2:** higher proportions of **girls**
    - **C4 and C5:** consisted of more **boys**
    - **C5:** highest mean age
    - However, all these characteristics of children and parents were **not significantly different** across clusters.

Table 1

- Mean values of four obesity-related lifestyle behaviors by cluster pattern

Mean (SD)	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	p Value comparing 6 clusters*	Adjusted significance level (rank)†
	n=268	n=271	n=257	n=336	n=238	n=175		
Dinner timing (pm)	5:57 (0:19)	6:48 (0:19)	7:05 (0:20)	6:13 (0:17)	6:30 (0:23)	6:29 (0:26)	<0.001	0.013 (1)‡
Outside playtime (hours/day)	1.7 (0.6)	1.4 (0.6)	1.3 (0.6)	1.2 (0.5)	3.1 (0.6)	1.6 (0.7)	<0.001	0.017 (2)‡
Screen time (hours/day)	1.5 (0.8)	2.1 (0.8)	1.8 (0.8)	1.8 (0.7)	2.1 (0.8)	4.2 (0.9)	<0.001	0.050 (4)‡
Night-time sleep duration (hours/day)	10.4 (0.4)	10.3 (0.4)	9.2 (0.4)	9.4 (0.4)	9.6 (0.5)	9.4 (0.5)	<0.001	0.025 (3)‡

Table 2

- **Differences in characteristics** of participants by cluster pattern

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	p Value comparing 6 clusters	Adjusted significance level (rank)*†
	n=268	n=271	n=257	n=336	n=238	n=175		
Children Sex (%)								
Boys	47.0	49.0	54.5	58.6	58.4	53.1	0.017‡	0.007 (1)
Girls	53.0	51.0	45.5	41.4	41.6	46.9		
Age (years)	4.2 (0.9)	4.2 (0.8)	4.2 (0.8)	4.2 (0.9)	4.4 (0.9)	4.2 (0.9)	0.022§	0.008 (2)
3 years (%)	24.3	23.2	24.9	27.1	17.7	24.6	0.039‡	0.010 (3)
4 years (%)	38.4	34.3	38.1	28.0	30.2	34.3		
5 years (%)	32.5	38.8	33.5	40.2	45.4	34.3		
6 years (%)	4.8	3.7	3.5	4.7	6.7	6.8		
Parents								
Age (years)								
Mothers	33.3 (4.1)	34.0 (4.4)	33.7 (4.8)	33.6 (4.3)	33.0 (4.1)	33.0 (4.8)	0.049§	0.013 (4)
Fathers	36.0 (5.4)	36.3 (5.5)	36.2 (5.6)	36.4 (5.5)	35.5 (5.4)	36.0 (6.5)	0.592§	0.050 (7)
Overweight¶ (%)								
Mothers	7.5	5.8	9.8	8.2	5.6	12.3	0.143‡	0.017 (5)
Fathers	24.1	26.4	30.5	30.3	23.0	21.2	0.160‡	0.025 (6)

Differences in children's weight status and family environments by cluster pattern

- The prevalence of overweight in children was **significantly different** across clusters
- the lowest in C1 (4.0%)
- the highest in C6 (15.1%)

Table 3

Differences in children's overweight and family environments by cluster pattern

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	p Value comparing 6 clusters*	Adjusted significance level (rank)†
	n=268	n=271	n=257	n=336	n=238	n=175		
Children's weight status								
Non-overweight	96.0	93.2	91.6	91.0	89.0	84.9	0.007	0.010 (6)‡
Overweight§	4.0	6.8	8.4	9.0	11.0	15.1		
Family environments								
Family members living with children								
Parental status								
Two parents	90.6	95.2	90.7	89.9	91.2	86.9	0.079	0.013 (7)
One parent	9.4	4.8	9.3	10.1	8.8	13.1		
Presence of siblings								
None (only child)	20.1	19.2	23.0	21.4	16.4	26.3	0.199	0.017 (8)
One or more	79.9	80.8	77.0	78.6	83.6	73.7		
Presence of grandparents								
None	39.9	51.7	54.9	42.9	41.6	44.6	0.002	0.007 (4)‡
One or more	60.1	48.3	45.1	57.1	58.4	55.4		
Maternal employment status								
Unemployed	38.7	39.0	17.8	16.7	23.5	23.2	<0.001	0.006 (3)‡
Employed	61.3	61.0	82.2	83.3	76.5	76.8		
Habitual family and parents' behaviours								
Meal regularity								
Regular	72.1	66.4	58.3	64.9	64.2	52.3	0.002	0.008 (5)‡
Irregular	27.9	33.6	41.7	35.1	35.8	47.7		
Habitual exercise (minutes/week)								
Mother								
<150	98.4	99.2	97.6	98.1	96.0	97.6	0.240	0.025 (9)
≥150	1.6	0.8	2.4	1.9	4.0	2.4		
Father								
<150	92.2	90.7	89.8	90.5	91.7	91.9	0.943	0.050 (10)

≥150	7.8	9.3	10.2	9.5	8.3	8.1		
Screen time (hours/day)								
Mother								
<2	54.0	48.3	53.0	52.7	40.5	20.0	<0.001	0.005 (1)‡
2–3	39.2	40.6	40.2	38.2	42.8	42.6		
≥4	6.8	11.1	6.8	9.1	16.7	37.4		
Father								
<2	46.8	37.4	37.9	42.5	30.3	15.4	<0.001	0.006 (2)‡
2–3	44.0	55.3	53.9	49.5	59.0	51.0		
≥4	9.2	7.3	8.2	8.0	10.7	35.6		

Significant different variables

Family members living with children

1. presence of grandparents
2. maternal employment status

Parent behaviors

1. meal regularity
2. screen time

Result

1. **C6** has the **highest** risk of being overweight
    - the most screen time
    - shorter
        - sleep duration
        - average dinner timing
        - outside playtime compared
2. **C1** has the lowest risk
    - least screen time
    - the longest sleep duration
    - the earliest
        - dinner timing
        - average outside playtime

3. **regardless** of dinner timing and outside playtime **screen time** and night-time **sleep duration** were **notable**
    - supported by other studies
        - more screen time and short sleep duration were **independent** risk behaviors for childhood overweight
4. a **negative association** between screen time and sleep duration has been found
5. mealtime **regularity** may be **more important** than **dinner timing** for children's overweight.

Limitations:

1. this study was a **cross-sectional design**
    - a causal relationship cannot be identified
2. measurements were based on the **principal caregivers' reports**
    - may have introduced **recall** and social desirability **bias**
3. **confounding** variable
    - **socioeconomic** status is not included
4. the data used in our study were collected in **2003**
    - **may not necessarily reflect** frequencies and proportions of **recent** lifestyle behaviors
    - However, patterns be considered to be **unchanged** over time

Conclusions

1. This study **suggests** that public health approaches to prevent children's overweight/obesity should focus on decreasing screen time and increasing night-time sleep duration.
2. **To shape those behaviors**, regular mealtimes and decreasing parents' screen time within family environments need to be targeted among family members.