Developing and Validating a Model for Predicting Child and Adolescent Obesity in Greater Beirut, Lebanon using Machine Learning: A Population and School-based Study

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Background

- In the context of the rapid nutrition transition experienced by middle-income countries of the Arab region, an increase in the prevalence of overweight and obesity among children and adolescents is witnessed.
- Children and adolescent's food choices and dietary behaviors are potential risk factors for the development of obesity.

Aim

To identify predictors of child and adolescent obesity at the individual and school levels in Greater Beirut, Lebanon.

Methods

Study Design: Cross-sectional study using cluster-randomized sampling conducted from January-May 2022.

Participants: 2,125 school children from grades 4, 5, 6 from 47 schools in Greater Beirut, Lebanon.

Data Collection and possible predictors:

Child questionnaires: Data on child demographics, eating habits and dietary intake, physical activity

Questionnaires with school directors: School policies and in-school food outlet characteristics

Child anthropometry (height and body weight)

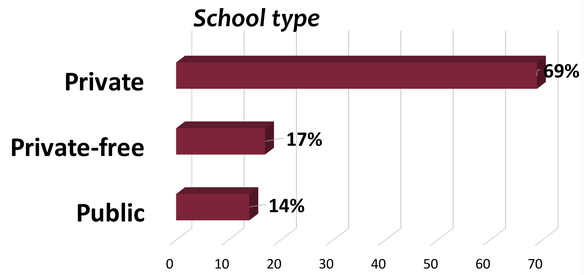
Outcome: Obesity defined as a BMI Z-score > +2SD according to WHO growth standards.

Data Analysis: Adaptive LASSO logistic regression model was used to predict obesity. Model discrimination was measured through the area under the receiver operating characteristic curve (AUC/ C-Statistic). Model calibration was measured through a calibration plot and calibration slope.

Findings

48% Boys | **52% Girls**

Mean age (SD): 10.7 years (1.2)



Predictors of obesity retained in the model included:

Individual-level predictors

- Male sex
- Skipping breakfast on school days
- Eating while watching television or other screen ≥ 3 days a week

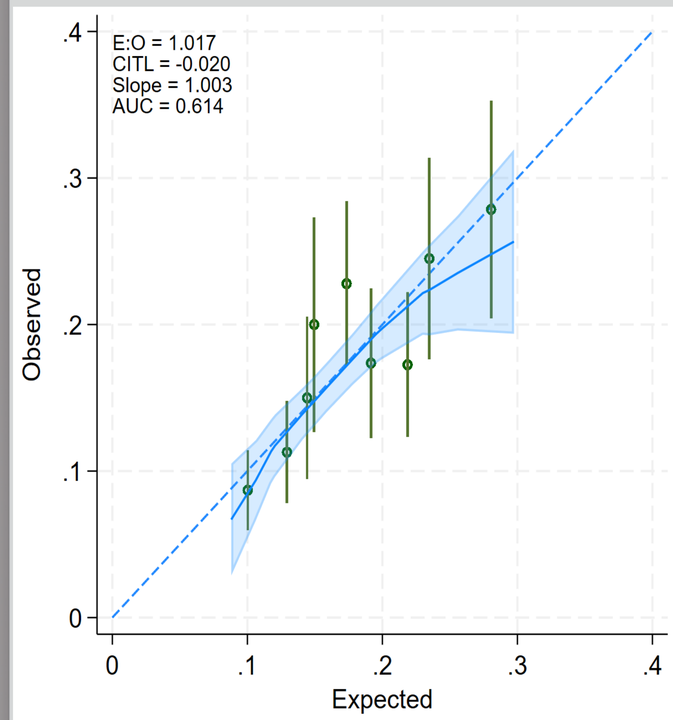
School-level predictor

- Attending public school

To illustrate model usage

- A boy attending public school, skipping breakfast on school days, and eating while watching television or other screen ≥ 3 days a week has a **30%** risk of obesity
- A girl attending private school, not skipping breakfast on school days, and eating while watching television or other screen 1 day a week has an **8%** risk of obesity

The Adaptive LASSO model showed moderate discrimination of C-Statistic: 0.614 (95%CI:0.58-0.64) and excellent calibration slope of 1.00 (95%CI:0.69-1.31).



Conclusion

- There is a need to address child and adolescent obesity in Greater Beirut by promoting healthy dietary habits focusing on breakfast consumption and limiting screen use during meals.
- Community-level socioeconomic and structural factors play a role in schoolchildren's obesity in Lebanon.
- Interventions are needed particularly in public schools to address the threats to healthy eating behaviors among schoolchildren.

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