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Childhood Obesity, Obesity Treatment Outcome, and Achieved Education: A Prospective Cohort Study


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 A B S T R A C T

Purpose: Childhood obesity represents a social burden. This study aims to investigate whether achieved educational level differs in young adults who have suffered obesity in childhood compared with the general population and to determine how obesity treatment influences achieved educational level.

Methods: This prospective cohort study includes subjects from the Swedish Childhood Obesity Treatment Registry (BORIS, n = 1,465) who were followed up after 20 years of age. They were compared with a randomly selected matched population-based group (n = 6,979). Achieved educational level was defined as ≥ 12 years in school (completers). Covariates include sex, migration background, and attention deficit disorders for both groups. Furthermore, age and degree of obesity at start of obesity treatment, treatment duration, and efficacy were analyzed in the obese cohort.

Results: In the obese cohort, 55.4% were school completers, compared with 76.2% in the comparison group (adjusted odds ratio [OR] = .42, $p < .0001$). Subjects with moderate obesity had a completion rate of 64.4%, compared with 50.9% among subjects with morbid obesity (adjusted OR = .57, $p < .0001$). Successful obesity treatment was associated with increased future educational level, compared with those experiencing no treatment effect (61.9% vs. 51.3% completers; adjusted OR = 1.4, $p < .05$). In children with attention deficit disorder, obesity was not an extra risk for not completing 12 or more years of schooling, $p = .11$.

Conclusions: Obesity in childhood was associated with low educational level in early adulthood. Children and adolescents with obesity may require special support at school in addition to health care treatment to lose weight.

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 IMPLICATIONS AND
 CONTRIBUTION

Childhood obesity is associated with a broad range of social consequences. This study shows that obesity in childhood and adolescence is associated with a strikingly lower achieved educational level and that successful obesity treatment increases the likelihood of achieving 12 or more years of schooling.

Long-term social consequences of childhood obesity, such as lower income and lower marriage frequency, have been established for more than 20 years [1,2]. A potential relationship

Conflicts of Interest: The authors have no conflicts of interest to disclose.

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between obesity and school performance has also been suggested, but the association is still unclear. Being obese in childhood and adolescence has been associated with lower school performance and academic achievement both in school- and population-based studies [1–5]. However, other studies have been unable to confirm any association between academic achievement and obesity [6,7] or, as in one study, observed an association in females but not in males [1]. In addition to the complexity of such a relationship, methodological limitations,

such as the use of self-reported data and cross-sectional design in some studies, have contributed to the uncertainty. Attention-deficit disorders (ADHD/ADDs) have been shown to be more common in obese subjects [8], and it is of importance to take ADHD/ADD into consideration when evaluating the effect of childhood obesity on school performance. Furthermore, it has not been shown whether weight loss is associated with improved school performance.

The aim of this study was to investigate whether the achievement of 12 or more years of schooling in young adults differ between subjects who have undergone childhood obesity treatment compared with a population-based matched comparison group. We also aimed to study how response to obesity treatment and other factors, such as sex, migration background, degree of obesity, and ADHD influence the level of educational achieved. We used data from the Swedish National Register for childhood obesity treatment and a population-based comparison group.

Subjects and Methods

Subjects

In this prospective observational cohort study, the source of the obese cohort was subjects included in the Swedish National Registry for treatment of childhood obesity—BORIS (www.e-boris.se), from December 1994 until September 2010. Children who undergo obesity treatment are entered into BORIS by the local health care provider. Treatment is intended to be long term and primarily entails lifestyle modification. Registration in BORIS is approved by the families, and data are obtained from clinical settings. In Sweden, all health care is free of charge for children and adolescents under 18 years of age.

A comparison group, consisting of five individuals for each obese subject, randomly selected from the Swedish Total Population Register, was matched by sex, year of birth, and living area, at the initiation of childhood obesity treatment. Sweden, which comprises approximately nine million people, is divided into more than 2,500 living areas, which were used in the matching process to determine socioeconomic background. All regions of Sweden were represented. No information about body mass index (BMI) was available for the comparison group at baseline or for either of the groups in adulthood. Because all individuals in Sweden have been assigned a unique ID number [9], which was used in this linking, we risk no duplication of individuals in the cohorts.

The inclusion criteria were at treatment initiation below 18 years of age and obese according to the International Obesity Task Force definition; at follow-up (December 31, 2012) alive and age ≥ 20 years, which is at least 1 year after ordinary completion of the 12th grade in Sweden. The exclusion criteria in both groups were diagnosed mental retardation, obesity syndromes (Laurence-Moon-Bardet-Biedl and Prader Willi) and Down syndrome (Figure 1). The study was approved by the Ethics Committee of Stockholm, Sweden (No. 2011/632-31/4).

Educational and diagnostic information

Compulsory school education in Sweden, as regulated by law, consists of 9 years of schooling and is free of charge. In addition to free education, students also have access to free school health care and school lunches. The upper secondary school comprises

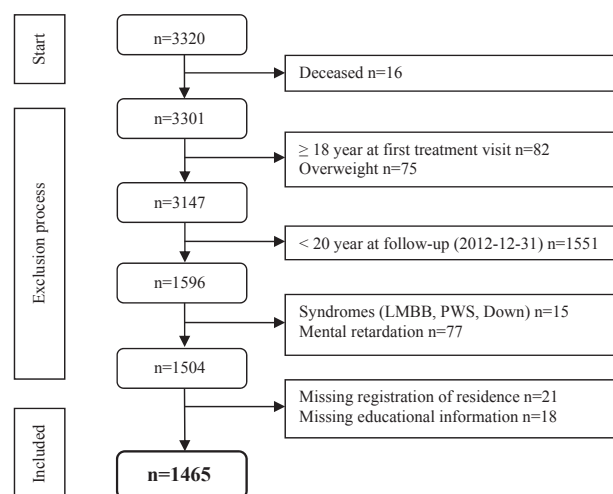


Figure 1. Flowchart of exclusion process. LMBB = Laurence-Moon-Bardet-Biedl syndrome; PWS = Prader-Willi syndrome, Down = Down syndrome.

three additional years, also free of charge, which individuals may elect to attend after completing compulsory school. To achieve the academic level of 12 years of schooling in Sweden, a set number of education points, approximately 90%, has to be achieved in combination with passed mandatory classes consisting of Swedish, English, mathematics, and degree project.

Through the unique national personal identity number, we initiated a register linkage of the obese cohort and the matched general population group to data on highest completed educational level from the National Education Registry. This was performed by Statistics Sweden. Diagnoses of mental retardation and excluded syndromes were collected from the Patient Registry and Data regarding psychostimulant drugs for ADHD/ADD were collected from the National Prescribed Drug Registry, held by the National Board of Health and Welfare.

Definitions

The primary outcome was the educational level achieved based on the International Standard Classification of Education [10]: completion of ≥ 12 years of schooling.

Migration background has been shown to affect school grades in Sweden [4]. Hence, to evaluate if migration background affects the primary outcome, the subjects were divided into two groups based on both the subjects' and their parents' countries of birth: Scandinavian—subjects born in Scandinavian countries (Sweden, Finland, Denmark, Norway, and Iceland) with one or two parents born in Scandinavia; and non-Scandinavian—subjects born outside Scandinavia or born in Scandinavia with two parents born outside Scandinavia. Data were retrieved from Statistics Sweden.

Age at the start of treatment was handled as a continuous variable. Data were retrieved from BORIS.

To compare the degree of obesity between children of different ages and sexes, an international age- and sex-dependent BMI standard deviation score (the BMI SDS) was used. Moderate and morbid obesity was classified according to Cole et al. [11] Anthropometric data were retrieved from BORIS.

Treatment effect was divided into three categories: responders, subjects who decreased their degree of obesity

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