

## SHORT COMMUNICATION

# The obesity epidemic in young men is not confined to low social classes—a time series of 18-year-old German men at medical examination for military service with different educational attainment

AM Toschke<sup>1\*</sup>, R Lüdde<sup>2</sup>, R Eisele<sup>2</sup> and R von Kries<sup>1</sup>

<sup>1</sup>*Institute of Social Pediatrics and Adolescent Medicine, Ludwig-Maximilians-University Munich, Munich, Germany; and*  
<sup>2</sup>*Bundeswehr Institute of Medical Statistics and Data Processing, Andernach, Germany*

**OBJECTIVE:** Obesity prevalence is increasing worldwide and obesity is associated with low education. To assess if the overall increase of obesity prevalence is due to increasing obesity prevalence among low educated strata only.

**DESIGN:** Data on  $n = 1\,883\,783$  males in their 19th year of life seen at physical examinations due to general conscription in Germany from 1989 to 1998.

**MEASUREMENTS:** Stature and weight were measured in underpants and obesity defined as body mass index  $> 30$  kg/m<sup>2</sup>.

**RESULTS:** From 1989 to 1998 an increase of body mass index values  $> 70$ th percentile was observed. Overall obesity prevalence increased from 3.4% (95% CI 3.3–3.5) to 5.7% (95% CI 5.6–5.8). During the whole observation period, the prevalence of obesity was inversely related to educational level. The increase of obesity prevalence, however, was unrelated to educational level: for education less than 10 y from 4.9% (95% CI 4.7–5.0) to 7.7% (95% CI 7.5–7.9), for education of 10 y from 2.6% (95% CI 2.5–2.7) to 5.3% (95% CI 5.1–5.5) and for education of more than 10 y from 1.6% (95% CI 1.4–1.8) to 3.4% (95% CI 3.2–3.5).

**CONCLUSION:** Prevalence of obesity increased among recruits of all educational levels, suggesting that preventive measures against obesity have to target all educational levels.

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### Introduction

Overweight and obesity prevalence in children, adolescents and young adults is increasing worldwide,<sup>1,2</sup> and in particular in the US.<sup>3</sup> Obesity is associated with low social class.<sup>4</sup> Data from the Third National Health and Nutrition Survey (NHANES III) recently reported a higher increase of obesity prevalence among adolescents with African American or Hispanic origin compared to Non-Hispanic white adolescents,<sup>5,6</sup> suggesting that the increase might be related to ethnic and/or sociodemographic factors. Emphasis on individuals of low educational level only would also potentize increasing

prevalence of related morbidity in subsequent years,<sup>7</sup> and have major implications on targets or success, respectively, of potential prevention and intervention programs.

Population based data on  $n = 1\,883\,783$  19-year-old males from the mandatory conscription health examinations in Germany over 10 y were analyzed to assess if the increase of obesity prevalence is confined to low educational level only.

### Material and methods

#### Participants

All young men in Germany are supposed to serve in the army, except if two elder brothers did their service already. Since the average number of children (male and female) in families in Germany is less than two,<sup>8</sup> this exemption accounts for  $< 1\%$  of the population. Prior to being drafted all young men have a medical examination. This medical

\*Correspondence: Dr AM Toschke, Division of Pediatric Epidemiology, Institute of Social Pediatrics and Adolescent Medicine, Ludwig-Maximilians-University Munich, Heiglhofstr. 63, D-81377 Munich, Germany.  
E-mail: toschke@biostat.info, URL: <http://www.epiresearch.info>  
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examination is mandatory for all young men independent of their later choice to serve in the army or to do an obligatory 'substitute service' either (1) in noncombatant state organizations or as (2) a 'civilian service' in hospitals and alike or (3) as a 'development worker' in a developing country. Less than half of the male population actually do their military service—most of the rest opts for civilian service. Local registry offices, which have no information on the young men's educational level, provide information on names, addresses and birth dates of 19-year-old males with German nationality for district recruiting offices. Thus, invitation to the medical examination by district recruiting offices is not related to the young man's actual educational or vocational training. All are well advised to have their obligatory medical examination as early as possible: those not fitting for service do neither military service nor a 'substitute service'. The sample reported here included young men attending at the medical examination in the 19th year of life. In Germany, about 50% of the male birth cohort was seen for the physical examination related to conscription in their 19th year of life. These data were analyzed for the birth cohorts 1970–1979. Cohort sizes decreased by time from 245 909 in 1989 (birth year 1970) to 152 331 in 1998 (birth year 1979) proportional to decreasing birth rates.<sup>8</sup> The remaining 50% of the birth cohort were examined up to the 26th year of age due to restricted capacity of district recruiting offices or due to other reasons such as acute disease, injury or recruit's request to postpone when invited for examination. The size of the entire study population was 1 883 783 male Germans in their 19th year of life.

Data on educational status obtained at the physical examination for the first time were categorized into three strata with regard to experienced school years. Stature and weight were measured in underpants by physicians of respective district recruiting offices.

The data were entered by two independent data typists. Cases with implausible data for height, weight or educational level (<1%) were deleted.

### Statistical analysis

Body mass index (BMI) was calculated as weight in kilograms divided by squared height in meters. The BMI distribution of recruits born in 1970 was used as reference in order to assess BMI shifts in following cohorts. Overweight and obesity were defined according to cutoff points of 25 and 30 kg/m<sup>2</sup> as proposed by the WHO.<sup>9</sup> Prevalence of obesity and 95% exact confidence limits were calculated based on the binomial distribution.<sup>10</sup> The 3-y weighted moving averages were calculated to reduce random variation over time.<sup>11</sup>

All calculations were carried out with the statistical software package SAS version 8.2 (SAS Institute Inc., Cary, NC, USA) and R version 1.9.1 ([www.r-project.org](http://www.r-project.org)).

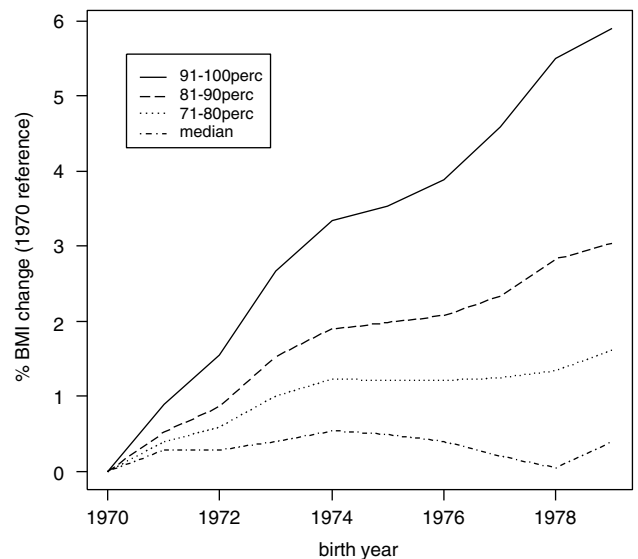
## Results

Over an observation period of 10 y, no meaningful relative changes of BMI values <70th percentile were observed (less than 1% change compared to the respective BMI values in 1989; birth cohort 1970 (reference)): the median remained virtually unchanged (Figure 1). In contrast, the increase of BMI values between the 71st to 80th percentile was 1.6%, between the 81st to 90th percentile 3.0% and between the 91st to 100th percentile 5.9% within 10 y. The corresponding smoothed time series is shown in Figure 1. The increase of upper percentiles could not be explained by confounding due to educational level (data not shown).

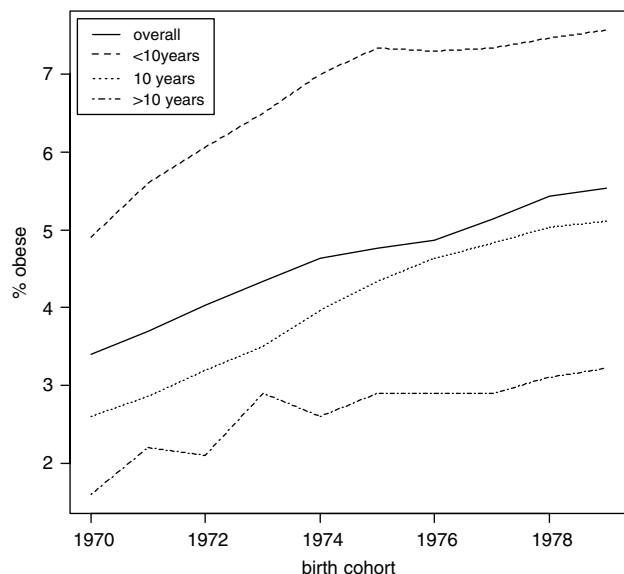
Overall obesity (BMI >30 kg/m<sup>2</sup>) prevalence increased from 3.4% (95% CI 3.3–3.5) for recruits born in 1970 to 5.7% (95% CI 5.6–5.8) for recruits born in 1979. Over the whole observation period, the prevalence of obesity was highest for recruits with the lowest educational level and lowest for those with the highest educational level. The increase, however, was almost parallel for all strata. The respective increments for education less than 10 y, education of 10 y and education of more than 10 y were 4.9% (95% CI 4.7–5.0) to 7.7% (95% CI 7.5–7.9), 2.6% (95% CI 2.5–2.7) to 5.3% (95% CI 5.1–5.5) and 1.6% (95% CI 1.4–1.8) to 3.4% (95% CI 3.2–3.5), respectively. Corresponding weighted moving averages of this time series are shown in Figure 2. Similar trends were observed for overweight (data not shown).

## Discussion

Prevalence of obesity increased among recruits of all educational levels. The increase did not affect the median BMI and become detectable for BMI values >70th percentile



**Figure 1** Smoothed trend of BMI percentiles that changed more than 1% over 10 y (median as reference).



**Figure 2** Increasing prevalence of obesity in the 19th year of life by years of school education.

only. Confinement of the increase to upper percentiles of the BMI distribution is in accordance with recent studies among children, adolescents and young adults.<sup>12–16</sup>

Disproportionate selection of young men with <10 school years of education by year of recruitment or secularly increasing educational attainment might account for a biased overall trend in the BMI distribution. This, however, seems to be unlikely since the proportion of those with <10 y of school education was stable with 39.0% for the birth cohort 1970 and 39.4% for the birth cohort 1979. These proportions are comparable to an unchanged percentage of around 37% with less than 10 y of school education in Germany from 1992 to 1999.<sup>17</sup> Furthermore, truncation does not appear to be a problem: the proportion of those who qualified for university studies after >10 school years remained stable over time at 78.3% in 1992 (year of examination: 1991) and 76.9% in 1999 (year of examination: 1998).<sup>17</sup> In total, around 24% of all adolescents qualified for University studies.<sup>17</sup> Additionally, the proportion of those who have started university studies within 3 y after qualifying decreased only slightly from 74.2% in 1990 to 68.1% in 1999.<sup>18</sup> This may explain why the overall trends in the BMI distribution remained unchanged following adjustment for educational attainment.

Confounding by sex, age and ethnicity can be excluded since only males within their 19th year of life and with German nationality were examined.

Although still more obese people are from low social classes, the increase in the overall prevalence of obesity is

not confined to these but affects all educational levels. Therefore, preventive measures against obesity have to target all educational levels.

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