

## Influence of fatness, intelligence, education and sociodemographic factors on response rate in a health survey

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### ABSTRACT

*Study objective:* The aim was to investigate the characteristics of non-responders to an invitation to attend a health examination.

*Design:* Taking advantage of an ongoing study of obesity, this was a survey of a cohort of severely obese men, with a randomly selected control group.

*Participants:* The participants were draftees to the compulsory Danish military draft board examination between 1943 and 1977. Among 362 200 draftees, 1940 were identified as severely obese (body mass index  $\geq 31$  kg/m<sup>2</sup>). A comparison group of 1801 subjects was randomly drawn from the remaining population. During the period 1981-3 those still alive and living in the same region (1651 obese, 1504 control) were invited to a health examination.

*Measurements and main results:* The examination was attended by 964 obese (58%) and 1134 controls (75%). In both groups an increasing response rate was associated with decreasing body mass index, and increasing intelligence test score, educational level, current social class, age (up to 50 years) and proximity of residence. Logistic regression analysis showed that all these variables had independent effects on response rate. Frequency and duration of hospital admissions during the period 1977-82 did not differ among responders and non-responders in either group.

*Conclusion:* Response rates in health surveys are strongly influenced by degree of fatness, intelligence, educational level, social class, age, and proximity of residence.

Assessment of those who do not participate in health surveys is important for two reasons: it may reveal bias in the results of the survey, and it contributes to the evaluation of the effectiveness of the programme in reaching the target population. In longitudinal follow up studies, non-responders are characterised by having a higher frequency of chronic diseases and by originating from lower social classes than responders.<sup>1-3</sup> Information on the non-responders can usually be obtained only from public registers unless the subjects are visited in their homes.<sup>4 5</sup> In an epidemiological study on obesity, we had the opportunity to explore in more detail the psychosocial characteristics of non-responders. The study was based on a population of conscripts who had undergone an obligatory examination several years prior to the present examination, to which we invited the most obese and a randomly selected group of the

remaining population. The response rate was analysed in relation to information systematically gathered on body mass index, intelligence test score and level of education at the time of appearance before the military board, as well as on age, social status, residence and previous hospital admissions at the time of follow up.

### Methods

All Danish men attaining the age of 18 years are registered with the military authorities and are examined by the medical board within the next few years. The number and records of volunteers are not available, but, according to the authorities, they comprised about 2% during the period of this study.

The study population comprised the 400 975 men processed by the board in the metropolitan area of Copenhagen and surrounding counties from 1943 to

1977 and in the remaining part of Sjælland and surrounding islands from 1964 to 1977. All underwent systematic examination, including measurement of height and weight, except for 4.5% who were unquestionably unfit for service and did not appear before the board. Records were not available for those examined in the metropolitan area and found fit for service from 1958 to 1968 and who were living in another region in 1969. Thus, 362 200 were available for the study. The population has been described in detail elsewhere.<sup>6-8</sup>

#### OBESSE GROUP

Obesity is defined here as a body mass index  $\geq 31 \text{ kg/m}^2$ , which is about 45% or more above the old insurance standard.<sup>9</sup> We made a complete search of the files and found 1940 men fulfilling this criterion.

#### CONTROL GROUP

A control group was derived from a random 1% sample of the study population. With the exclusion of men for whom height and weight measurements were not available and the severely obese ( $n=21$ ) already included in the obese group, the control group comprised 3601 men. For the present purposes, we selected a random 50% sample of this control group.

#### DRAFT BOARD EXAMINATION

When appearing before the medical board, the young men are measured and weighed wearing their underclothes only. Since 1958 the examination has included an intelligence test (Børge Prien's test, 1953) and an assessment of educational level. The test is a 45 minute paper and pencil examination for groups and its principles and properties have been described previously.<sup>10</sup> It comprises four subtests—letter matrices, verbal analogies, number series, and geometric figures—with a total of 78 items. The test score was the total number of correct answers. Educational level was recorded on a nine point scale, primarily indicating years of schooling from 7 through 12 years. It also incorporated recognition, at lower levels, of some post-school training, and, at higher levels of success in public examinations including academic degrees.<sup>11</sup>

#### SOCIAL CLASS

Social class was derived from the subjects' occupations taken from the annual income tax returns. By use of the National Population Register, the occupational title of all subjects was obtained by November 1, 1980. Social class was rated on an eight point scale from 0 (low: unskilled, manual worker, eg, cleaner, porter) to 7 (high: advanced professional positions, eg, university professor, judge) according to a

modification of the scale, which was based on prestige in the society.<sup>12 13</sup>

#### FOLLOW UP STUDY

All subjects included in the obese group and a random 50% sample of the control group, totalling 3707, were selected for participation in the follow up study. During the period November 1, 1981 to August 15, 1983 information was obtained every third month from the Central National Register regarding current address of those for whom the examination was planned to take place during the ensuing three months. Only subjects living east of Store Bælt at the time of examination were invited to participate. They comprised 3155 men (85%), the remaining having moved, emigrated, disappeared or died, or their addresses were unknown. Those selected for the follow up examination were invited by letter to participate in a health examination performed by the Copenhagen City Heart Study at the Rigshospital.<sup>4</sup> A reply slip was attached to the letter of invitation urging the recipient to indicate whether or not he wished to attend the examination. A reminder was sent 3 months after the first invitation to those who had either not responded or failed to appear. The participants were divided into seven regional groups according to proximity of their current residence: region 1 comprised the municipalities closest to the hospital and region 7 comprised municipalities up to 100 km from the place of examination.

#### HOSPITAL ADMISSION

Information regarding the respondent's admission to every Danish somatic hospital during the period 1977-82 was obtained from National Health Service Hospital Admission Register.<sup>14</sup>

#### STATISTICAL METHODS

The  $\chi^2$  test and the Goodman-Kruskal test (gamma) for trends in two and three dimensional contingency tables were used.<sup>15</sup> The combined influence on response rate of body mass index, intelligence test score, education, social class, age and residence distance of the invited subjects was evaluated by logistic regression analysis.<sup>16</sup>

## Results

#### BODY MASS INDEX

The response rate was 75.4% (1134/1504) in the control group and only 58.3% (964/1654) in the obese group ( $p < 0.000$ ,  $\chi^2$  test). For both weight groups there was an increasing rate of non-response with increasing body mass index at the time of appearance before the medical board ( $p < 0.000$ , Goodman-Kruskal's test) (fig 1).

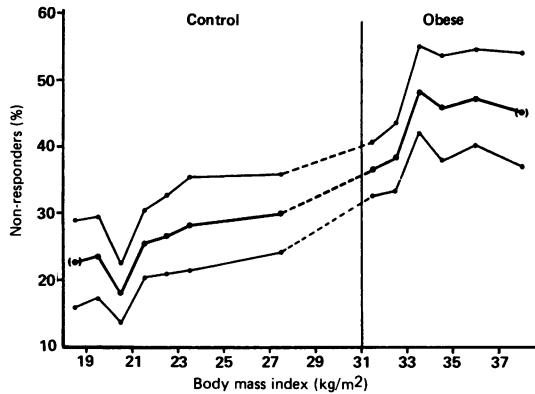


Fig 1 Response rate with 95% confidence limits in relation to body mass index. The brackets indicate telescoped values.

AGE

The response rate proved to be dependent on age at the time of invitation (table 1). Thus the response rate was highest among the 35–50-year-olds in both groups and lowest among the 20–25-year-olds. Within age groups the obese subjects consistently showed a lower response rate ( $p < 0.000$ , Goodman-Kruskal's test).

Table 1 Response rate among obese and controls in relation to age

Age	Obese group		Control group		Difference %
	n	%	n	%	
24–28	445	50.3	226	64.4	14.4
29–33	528	55.9	315	72.1	16.2
34–38	459	62.5	354	77.4	14.9
39–43	128	72.7	241	78.8	6.1
44–48	42	76.2	132	81.1	4.9
49–53	32	68.8	138	81.2	12.4
54–64	17	64.7	98	75.5	10.8
Total	1651	58.4	1504	75.4	17.0

RESIDENCE DISTANCE

The response rate in the control group for subjects living on Sjælland (region 1–5) was between 72.3 and 84.4%. Among controls living on adjacent islands (region 6) the response rate decreased to 66.2%, and for the region furthest away (region 7) the response rate was 55.1%. Within each region obese subjects showed a lower response rate (table 2) ( $p < 0.000$ ,  $\chi^2$  test).

INTELLIGENCE TEST SCORE

With increasing intelligence test score at the time of appearance before the medical board, an increasing

Table 2 Response rate among obese and controls in relation to residence

Region	Obese group		Control group		Difference %
	n	%	n	%	
1	408	64.0	372	72.3	8.3
2	178	61.8	221	83.7	21.9
3	170	61.8	226	84.5	22.7
4	117	65.0	167	75.5	10.5
5	239	62.3	235	78.3	16.0
6	394	48.5	201	66.2	17.7
7	145	45.2	78	55.1	9.9
Total	1651	58.4	1504	75.4	17.0

response rate was demonstrated in both the control group and the obese group ( $p < 0.000$ , Goodman-Kruskal's test) (fig 2). The response rate increased in the control group from 47.5% among those with the lowest score to 93.9% among those with the highest score; the corresponding rates in the obese group were 47% and 87.5% respectively.

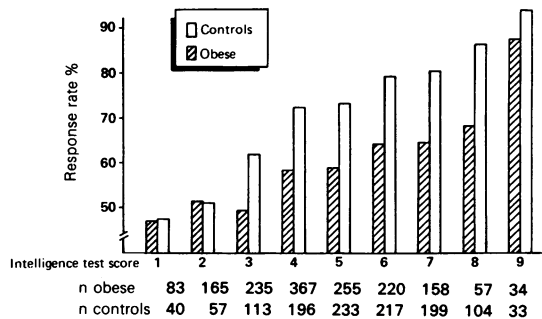


Fig 2 Response rate in relation to intelligence test score.

EDUCATIONAL LEVEL

Educational level at the time of draft board examination showed largely the same trend as described for the intelligence test scores. Both among control and obese subjects, there was an increasing response rate with increasing educational level ( $p < 0.000$ , Goodman-Kruskal's test), although the response rate decreased among those with the highest educational level in the control group compared with those at a lower educational level (fig 3). The largest differences in response rate between control and obese subjects were found at the intermediate educational levels.

SOCIAL CLASS

There was an increasing response rate with increasing social class ( $p < 0.000$ , Goodman-Kruskal's test) (fig 4). In both weight groups the response rate was lower in the highest social class than in the preceding class.

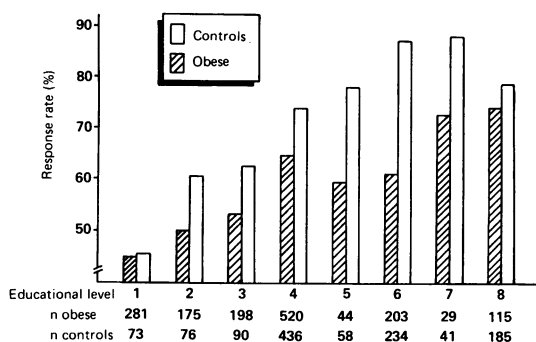


Fig 3 Response rate in relation to educational level.

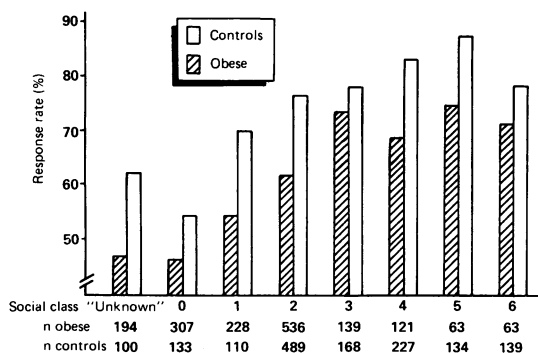


Fig 4 Response rate in relation to social class.

For subjects with unknown social class the response rate corresponded to that found for social class 0-1. In each social class the obese had a lower response rate than the controls.

#### HOSPITAL ADMISSIONS

During the period 1977 to 1982, 28% of the responders had been admitted to hospital for a somatic disease compared with 30% of the non-responders ( $p = 0.13$ ,  $\chi^2$  test) (table 3). There were no statistically significant differences between responders and non-responders with regard to the total number of days of hospital admission ( $p < 0.09$ , Mann-Whitney test) or the total number of admissions per person ( $p < 0.08$ , Mann-Whitney test). No differences could be found between the obese and control subjects.

#### MULTIVARIATE ANALYSES

Logistic regression analyses of the combined effect on the response rate of the variables age, residence distance, intelligence test score, educational level and social class showed that each of these variables with the exception of intelligence test score had an independent effect in the obese group. In the control group educational level and social class did not have any independent effect (table 4). A similar result was obtained when the variables were examined on nominal scales.

In the obese group, group body mass index did not have a significant independent effect on the response

Table 3 Hospital admissions among responders and non-responders

	Obese			Controls		
	Responders	Non-responders	<i>p</i>	Responders	Non-responders	<i>p</i>
Number	964	687		1134	370	
Admitted to hospital	32.4%	31.4%	0.7 <sup>a</sup>	24.9%	29.5%	0.08 <sup>a</sup>
Days of hospital admission per person	4.35	4.67	0.7 <sup>b</sup>	2.81	5.18	0.09 <sup>b</sup>
Admissions per person	0.64	0.68	0.8 <sup>b</sup>	0.44	0.63	0.08 <sup>b</sup>

<sup>a</sup>  $\chi^2$  test, <sup>b</sup> Mann-Whitney test

Table 4 Logistic regression analyses<sup>a</sup> of non-response among obese and controls

	Obese			Controls			Total group		
	Coefficient	SE	<i>p</i>	Coefficient	SE	<i>p</i>	Coefficient	SE	<i>p</i>
Body mass index (kg/m <sup>2</sup> )	0.038	0.023	0.09	0.055	0.028	0.05	—	—	—
Obese/control	—	—	—	—	—	—	0.400	0.090	0.000
Age (years)	-0.040	0.012	0.001	-0.039	0.014	0.003	-0.040	0.009	0.000
Residence distance	0.080	0.025	0.001	0.068	0.034	0.05	0.076	0.020	0.000
Intelligence test score	-0.006	0.006	0.3	-0.033	0.008	0.000	-0.016	0.005	0.001
Educational level	-0.085	0.040	0.04	-0.069	0.053	0.2	-0.085	0.012	0.008
Social class	-0.131	0.039	0.001	-0.058	0.047	0.2	-0.101	0.03	0.001

<sup>a</sup> Odds ratio may be obtained as the exponential function of the coefficient

rate (table 4). In the control group, a statistically significant increase ( $p=0.05$ ) in response rate was found with decreasing body mass index.

Analysis of the total study population, including both obese and control subjects (but excluding body mass index as a separate variable) showed that the covariables had significant independent effects (table 4). The covariables could only in part account for the difference in response rate between the obese and control groups. Odds ratio for non-response by an obese subject compared with a control subject was 2.07 (coefficient 0.731, SE 0.084,  $p=0.000$ ), which, when including the independent variables in the analysis, decreased to 1.49 — still highly significantly different from 1 ( $p=0.000$ ) (table 4).

### Discussion

This study shows that the response rate in an unselected random sample of a male population invited to attend a health examination was 75%. If the invited male had been extremely overweight in his youth, the response rate was only 58%. Other determinants for the response rate included age, proximity of residence, intelligence test score, educational level and social status, all of which proved to have an independent influence; these characteristics, however, could not account in full for the lower response rate among obese subjects.

The response rate of the subjects initially of normal weight was concordant with that of other studies.<sup>4, 17</sup> The Framingham study showed a response rate in the primary trial of 74.5% calculated in a similar fashion and disregarding sex.<sup>17</sup>

As judged from the literature, the impact of age on the response rate is ambiguous. In the Copenhagen City Heart Study, as well as the present study, the response rate was highest among middle aged subjects and lowest among the 20–29-year-olds.<sup>4</sup>

In 1962 Bell<sup>18</sup> suggested that responders in population studies have a higher intelligence than non-responders, but provided no data in support of this contention. Tune<sup>19</sup> found a small difference in intelligence test score, using Raven's progressive matrices, between responders and non-responders at a follow up questionnaire on sleeping habits among subjects who had previously volunteered for participation in an examination in the unit. Our study was based on obligatory attendance and intelligence testing long before the participants were invited to the health examination. The results showed a monotonically increasing response rate with increasing intelligence test score. The response rate increased from below 50% in the lowest test score class to over 90% in the highest. Previous studies have shown that responders come from a higher social class,

have a higher income, more are married and they have more children than do the non-responders.<sup>1, 5, 20</sup> We found that the response rate increased with increasing educational level at the time of appearance before the medical board and with the subjects' current social status. The psychosocial characteristics such as intelligence test score, education and social class are closely inter-related,<sup>21</sup> but each single variable still had an independent impact on the response rate. In an intensive social and psycho-pathological study, Paikin *et al*<sup>5</sup> found that non-responders have a less well-developed social competence, which, in turn, reflects a poorly integrated personality structure. The study was partly based on non-responders who had been traced and interviewed in their homes by a psychiatrist. We found that among the psychosocial factors, the cognitive functions are of decisive importance for the attendance rate.

Previous studies have shown that morbidity and mortality rates are higher for non-responders.<sup>1–4, 20</sup> Thus Wilhelmsen *et al*<sup>2</sup> found a higher frequency of chronic diseases and alcohol problems among non-responders and a three times higher mortality rate for such entities as heart diseases, neoplasms, accidents and other causes. In our study morbidity was assessed by hospital admissions, and no differences could be shown between responders and non-responders. This might be attributable to the fact that our study comprised quite young adults who have a low frequency of chronic diseases. Another explanation might be that non-responders are also non-attenders and non-users of health services, especially in younger age groups.

The subject's weight at the examination by the medical board proved to be of great importance for the attendance rate. Among both the obese and the control subjects, the non-response rate increased with increasing relative weight (fig 1). The difference in response rate among obese and control subjects, however, could only partly be attributed to the other characteristics. Obesity has not previously been shown to be a cause of non-attendance in population studies. In addition to the psychosocial characteristics investigated in the present study, other psychological factors, such as lack of self-esteem, may contribute to this.<sup>21–23</sup> Considering that prejudice about obesity is also prevalent among health professionals,<sup>24</sup> it is understandable that obese subjects might be less willing to subject themselves to the critical comments their obesity may provoke.

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