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Longitudinal change in food habits between adolescence (11-12 years) and adulthood (32-33 years): The ASH30 Study

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Abstract

Background

Links between diet in childhood and the prevention of disease in adulthood have been established. This longitudinal dietary survey provided quantitative evidence of dietary change from adolescence to adulthood, in Northumberland, England.

Methods

A longitudinal study recorded dietary change from adolescence to adulthood. Two x 3-day food diaries were collected in 1980 and 2000 from the same 198 respondents. Foods consumed were assigned to the five categories in The Balance of Good Health. Demographic and socio-economic information were obtained in 1980 and 2000.

Results

Intakes of foods containing fat and/ or sugar, and milk and dairy foods decreased (p<0.01and p<0.031 respectively), while intakes of fruit and vegetables increased (p<0.01). Intakes of bread other cereals and potatoes (p=0.002, r=+0.219), fruit and vegetables (p<0.01 r=+0.256) and meat, fish and alternatives (p=0.026 r=+0.158) 'tracked' from adolescence to adulthood. Men had increased intake from meat, fish and alternatives and decreased milk and dairy foods more than female respondents (p=0.003 and p=0.019). Respondents who had moved away from Northumberland had a greater increase in intake of fruit and vegetables compared with those who remained local (p=0.010). Individuals who had moved to a lower socio-economic group had increased their intake of bread, other cereals and potatoes (p=0.040).

Conclusion

Food intake changed considerably in a direction more in line with current dietary recommendations. Food intake in adolescence was a significant, but not strong, predictor of intake in adulthood. Dietary change is influenced by variables including gender, location and socio-economic status.

Keywords: diet, change, tracking, longitudinal.

Introduction

The importance of shaping and improving childhood dietary patterns has been emphasised [1] and links between prevention of disease in adulthood and childhood diets have been established [2]. Evidence of poor dietary habits in childhood and adolescence [3], has led to recommendations that healthy eating be promoted at an early age [1]. Nutrition in childhood impacts on growth and development, additionally there is an assumption that diet tracks from adolescence into adulthood. The theory of dietary tracking, defined as the 'preservation of relative position' [4], occurring from childhood into adulthood suggests that dietary habits and preferences developed in childhood may be maintained into adulthood.

The worldwide trend of increasing adolescent obesity throughout all income groups has raised much concern [5, 6]. Explanations for this trend are decreased physical activity [7] and a nutrition transition to more energy dense diets [8]. Understanding when, how and why dietary changes occur over time is critical to developing strategies for intervention. However, there are few longitudinal data on the change in nutrient intake from adolescence through to adulthood [9, 10].

Adolescents experience movements and life transitions [11]. Individuals form their identity, shaping their values, beliefs and morals [12]. These processes, in particular their past experiences in relation to food, contribute to their food choices. In addition inter-individualised differences in food choice and dietary intake are related to individual characteristics including gender, and socio-

economic groups [13]. There is a complex interaction between food choice and economic status [14, 15]. The dynamic nature of diet and its strong relationship with demographic, economic, social and health factors, mean that in order to understand dietary change and to promote a healthier diet we need to understand dietary change in its context. Understanding this change or transition in nutritional patterns may be beneficial in developing strategies to help prevent chronic diseases [16].

Measurement of food intake by free-living individuals is difficult [17], and quantifying change in food intake in a growing population presents a challenge. Between adolescence and adulthood, needs for energy and nutrients change markedly [18] which requires significant changes in food intake.

The overall objective was to explore longitudinal change in dietary intake from adolescence to adulthood. The analyses presented here seek to further the understanding of how diet changes or 'tracks' over this critical life period. The aims were: (a) to report longitudinal dietary change in 198 respondents between the ages of 12 and 33 years; (b) to explore dietary 'tracking' between the same time points; (c) to describe the effects of gender, socio-economic status and location on dietary change.

Methods

Dietary survey

In 1980, Hackett et al. [19] obtained dietary and anthropometric information from 405 11-12 year olds, attending seven schools in Northumberland, North

East England. The young adolescents took part in a study of diet and oral health. Between 1997 and 2000 a range of methods were used to contact the original participants including; the Medical Research Unit of the Office of National Statistics (ONS), sending letters to those who had been located, organising reunion parties, local media and 'word of mouth'. The result was that 298 of the original cases were retraced throughout the U.K. and 208 consented to take part in a subsequent study in 2000/01 (the ASH30 Study).

The dietary collection method used in both 1980 and 2000 was two 3-day food diaries followed by an interview on the fourth day to clarify uncertainties and to determine portion size. Where the most suitable method for quantifying food portion sizes in 1980 was calibrated food models [(20)], in 2000, a photographic food atlas [(21)] was used. Foods consumed were allocated to one or a combination of up to five groups which comprise The Balance of Good Health food groups (BGH) from the National Food Guide [(22)] according to specifications made by Gatenby et al. [(23)]. The BGH model recommends that a balanced diet should consist of approximately 33% fruit and vegetables, 33% bread, other cereals and potatoes, 15% milk and dairy products, 12% meat, fish and alternatives and 8% foods containing fat and/ or sugar [(23)]. Consumption of foods within groups was quantified by expressing the weight of food consumed from each of the five BGH food groups as a percentage of total weight of food consumed. Dietary change was expressed as the difference in percentage contribution made by each BGH food group to total weight of food eaten comparing 2000 with 1980 (2000 – 1980).

Socio-economic information

Demographic information was collected using a questionnaire. To compare socio-economic status at both time points, the 1970 Registrar General's [24] definitions were used, with 1980[25] and 2000 occupations fitted to the best possible classification. This process was carried out under the advice and supervision of the Occupational Information Unit of the Office of National Statistics and further detail can be found in Fletcher et al. [26]. Social class was divided into four groups: group 1, (high), group 2, (middle), group 3 (low), group 4 (unclassifiable: retired, unemployed and unknown).

Analysis

Data analyses were carried out using SPSS Version 10.0. Dietary intakes (1980 and 2000) and changes in intake (2000 – 1980) of groups of respondents were compared using T-tests or, for three or more factors, an ANOVA and Dunnett's T3 post-hoc tests (significance $p<0.05$). The tracking of percentage contribution to total food intake was assessed using Pearson correlation analyses.

Ethical approval was obtained from the U.K. Multi Research Ethics Committee and from fifty Local Research Ethics Committees.

Results

One hundred and ninety eight respondents (81 male, 117 female) completed all aspects of the survey. The mean age of respondents in 1980 was 11.6 years (SD 0.30) and in 2000 was 32.5 years (SD 0.33). The validity of the food intake data was tested for low energy reporting[27] and all respondents were included in the analysis.

Comparison of participants in the 2000 survey with the non-participants

Comparisons between the participants and non-participants of the 2000 study show the participating group tended to have a higher proportion of females and to have been from a higher socio-economic status in 1980. Food intake in 1980, however, was not significantly different.

Food intake in 1980 and 2000

Table 1 describes the range and average percentage contribution to total food weight from the five BGH food groups. Between 1980 and 2000 there were no significant changes in the proportions of food derived from the bread, other cereals and potatoes and meat, fish and alternatives BGH food groups (Table 1). However there was an 8.8% unit reduction in the contribution to total food intake from foods containing fat and/ or sugar and a much smaller, but statistically significant, (1.6% unit) fall in intake of milk and dairy foods, which contrasted with an almost doubling of intake of fruit and vegetables.

'Tracking' of intakes between 1980 and 2000

Intakes of fruit and vegetables (p<0.001, r=+0.256), bread, other cereals and potatoes (p=0.002, r=+0.219) and meat, fish and alternatives (p=0.026, r=+0.158) as a proportion of total food intake were correlated significantly between 1980 and 2000. There were no significant correlations in intakes between 1980 and 2000 for milk and dairy foods (r=+0.097), or for foods containing fat and/ or sugar (r=+0.009) as a proportion of total food intake. While intake of fruit and vegetables, in both absolute terms i.e. g/d and as percent of total food weight, increased significantly between 1980 and 2000, these intakes tended to maintain their relative position in the distribution or

‘tracked’ i.e. those that had a lower intake in 1980, relative to their peers, maintained a lower intake in 2000.

Dietary change

The change in intake of the BGH food groups as a percentage of total food weight between 2000 and 1980 was used to estimate the change in the diets of the individuals (Table 1). There was a dramatic reduction in consumption of foods containing fat and/ or sugar for the respondents over twenty years; in contrast, intakes of fruit and vegetables increased by 10.6% units. Figure 1 and 2 display the extent and direction of change in percentage contribution from foods containing fat and/ or sugar and fruit and vegetables for each participant in the study. Of the 198 participants, 86% had decreased their intake of foods containing fat and/ or sugar between 1980 and 2000, with the extent of change ranging from +20.7 to –26.8% units (Figure 1). In contrast, 82% of participants increased their intake of fruit and vegetables with individual changes ranging from –17.7 to +45.2% units (Figure 2). There was a significant negative correlation between the differences in percentage contributions from fruit and vegetables, and foods containing fat and/ or sugar ($r=-0.374$, $p<0.001$). That is, a greater increase in fruit and vegetable was associated with a greater decrease in foods containing fat and/ or sugar.

Dietary change and gender

Table 2 indicates that the males within the cohort had increased their consumption of meat, fish and alternatives by 2.3% units, whereas female participants had decreased intakes of this food group by 1% unit. Female participants had decreased their milk and dairy foods less than male participants (0.2% compared with 3.7% units respectively).

Dietary change and location in 2000

At the time of data collection (2000) the majority of respondents (78%) were living in Northumberland and Tyne and Wear with 22% living elsewhere in the U.K. Change in percentage contributions from fruit and vegetables was related to location (Table 2). The 43 individuals who had moved elsewhere had a greater increase in percentage contribution from fruit and vegetables (14.4% compared with 9.5% units) than those individuals who stayed in the locality.

Dietary change and movement of socio-economic group

Most individuals were in the middle socio-economic group in 1980 (46%) by 2000 the largest group of respondents were in the highest group (43%) (Table 3). Only 33% of the respondents remained in the same socio-economic group from 1980 to 2000, 85 (43%) moved to a higher socio-economic group and 44 (22%) to a lower socio-economic group. All of the respondents who had an unclassified socio-economic group in 1980 had moved to another socio-economic group by 2000.

Change in intakes of bread, other cereals and potatoes were significantly different between the three socio-economic groups (p=0.030); intakes had decreased the most in respondents who moved to a higher socio-economic group and had increased in respondents who moved to a lower socio-economic group (p=0.040). None of the other changes in intake of BGH food groups were significantly different.

Socio-economic group and location

Individuals who had moved to elsewhere in the U.K. were of a significantly higher socio-economic group in 2000 (p=0.002) compared with those living in Northumberland and Tyne and Wear. In 2000, 37% of these individuals who had remained in Northumberland and Tyne and Wear were in the highest socio-economic group compared with 66% of the group who had moved to elsewhere in the UK. The individuals who lived elsewhere (2000) had the highest proportion in the high and middle groups and only one individual in each of the low and unclassified socio-economic groups.

Discussion

Main finding of this study

This study has shown significant changes over 20 years in the intakes of; foods containing fat and/ or sugar, fruit and vegetables, and milk and dairy foods, as a proportion of total food weight. Intakes of three food groups, bread, other cereals and potatoes, fruit and vegetables and meat, fish and alternatives 'tracked' between 1980 and 2000. Fruit and vegetable intake, although significantly different between the two time periods also showed significant tracking, indicating that although respondents changed their intake, they maintained their relative intake of this food group. This finding indicates the importance of dietary patterns established in early adolescence.

Limitations of this study

While the sample size of the ASH30 study is relatively small this is the first British study to assess longitudinal food intake between early adolescence and early to mid-adulthood. The ASH30 cohort were largely a homogenous

group of white individuals with very little ethnic variation which was representative of the area in which they lived in 1980. The individuals who took part in the follow-up study were of a higher social class and more were female than in the original 1980 study [28], following a pattern found in earlier work [29, 30].

Between 1980 and 2000 there have been major secular changes, including changes in cultural diversity and an overall general increase in interest in healthy eating – all of which may have contributed to the results of the ASH30 study. A number of factors may have influenced these results although every effort was made to minimise error in the collection of dietary intake data. Despite the evidence of possible under-reporting of food intakes all respondents were included in the analysis, in line with the approach taken by the U.K. National Diet and Nutrition Survey (NDNS) [31, 32].

The Balance of Good Health [22] is an established and accepted public health model. Using per cent of total food weight at each time point permitted the observation of change, or 'tracking' of food habits despite change in absolute amounts associated with change in body size. Measuring dietary change in terms of food is a difficult task and the BGH model, a nationally accepted public health nutrition tool, was chosen as the best available food model. The grouping of foods using this model provides a picture of the diet as a whole, but has the disadvantage that the broad nature of the BGH food groups obscures potentially significant changes in types of food consumed, e.g. a

change from whole milk to semi skimmed milk, or replacement of sugar-rich, low fibre breakfast cereals with unsweetened wholegrain alternatives.

The results show that for these individuals, food intake changed towards the BGH [22] recommendations with age. However, at both 11 -12 and 32 - 33 years, mean intakes of foods containing fat and/or sugar, and meat, fish and alternatives were higher, and that of fruit, vegetables, bread, other cereals and potatoes were lower than current recommendations [22].

What is already known on this topic

The Amsterdam Growth and Health longitudinal study [10] observed, in a similar age group, nutrient intake to be moderately stable over time, but for diet to be changeable. The dietary changes observed in the ASH30 sample between 1980 and 2000 were similar to wider dietary changes observed in the U.K. The National Food Survey (NFS) [33] can be used as a comparison, although the NFS is a cross-sectional study of foods consumed in households and does not account for foods eaten outside the home and generational issues in eating patterns. Between 1975 and 2000, the NFS recorded a 7% unit increase in intakes of fruit and vegetables while the respondents in the ASH30 Study increased their intake by an average of 10.6% units. Over the 20 year period the respondents in the ASH30 Study had reduced their intake of bread, other cereals and potatoes less than has been reported in the NFS sample (-0.6% compared with -4% units). Milk and dairy foods decreased in both by similar amounts (-1.6% units ASH30 and -2% units NFS). The NFS did not show any change in meat, fish and alternatives and this food group increased by only 0.4% units (not significant) in the ASH30 Study. However,

the respondents in the ASH30 Study decreased their intake of foods containing fat and/ or sugar (-8.8% units) much more than that recorded in the NFS (-1% units).

What this study adds

Change in dietary patterns from adolescence to adulthood may be influenced by multiple factors including secular and generational changes. Adolescent eating patterns are frequently described as unhealthy [34], and while evidence suggests that diet and eating patterns developed in adolescence 'track' to adulthood, adults are perceived to have 'better' diets [35]. Previous national surveys of the different age groups provide evidence of this generational issue. For example, consumption of confectionery might be expected to reduce between adolescence to adulthood. The National Diet and Nutrition Survey of 4 -18 year olds [3] reported that non-milk extrinsic sugars represented a 16.7% contribution to total energy intake of boys and 16.4% of girls aged 4 - 18 years, while contributing 13.6% of energy intake for men and 11.9% for women (19 - 64 years) [32]. This was reflected in the ASH30 Study where intake of foods containing fat and/ or sugar fell dramatically compared with that recorded in the NFS and the average diet eaten by adults was 'healthier' in comparison with their adolescent diet when assessed against the BGH guidelines [22].

Men and women have different food intakes, perceptions of food and understandings of food meanings [36]. The ASH30 cohort displayed significant gender differences in dietary change; over the 20 year period men significantly increased their intake of meat, fish and alternatives, while women

decreased their intake. The recent NDNS [37] reported that men were more likely than women to have eaten most types of meat and meat products, with the exception of some poultry and lamb dishes. Meat consumption has been described as a marker of masculinity [38], and gender differences have been observed in attitudes to meat [38, 39] and meat intakes [37].

Female respondents had decreased their intake of milk and dairy foods less than male respondents. The smaller decrease in female consumption could be attributed to males having had a higher mean intake in 1980 while females in 2000 were consuming more dairy products in the form of low-fat dairy products. This is supported by the recent NDNS findings [37] where women were more likely than men to consume dairy products such as skimmed milk, cottage cheese, fromage frais and yoghurts.

Location in 2000 was associated with socio-economic status; individuals who had moved away from NE England were of a higher socio-economic group in 2000. Only two respondents had moved further North the remaining 42 had moved South of Northumberland, with the largest cluster in London (n=6). The North/ South divide in fruit and vegetable intake [40] was reaffirmed by the observation that individuals who had moved away from Northumberland and Tyne and Wear had increased their fruit and vegetable intake significantly more than those who remained (14.4% compared with 9.5% units).

Moving to a higher socio-economic group was associated with a decrease in consumption of bread, other cereals and potatoes compared with those who

stayed in the same socio-economic group or who moved to a lower socio-economic group. Individuals who moved to a lower socio-economic group increased their intake of this food group over the 20 years. The cost of bread may explain the increase in this BGH food group in the lower socio-economic groups. This may be associated with the perception that starchy foods are cheap, filling and good value for money. Other cereal food consumption increased between 1975 and 2000, The NFS [33] reported increased purchasing of cereal based convenience foods, such as pizza, pasta and cereal snacks.

Body Mass Index (BMI) of respondents was recorded at both time points. Earlier work on the ASH30 sample established that relative BMI, as an index of adiposity, does track from adolescence to adulthood [41] [42]. This is reflected in the significant tracking of food intake described in this paper and also in nutrient intake [41].

There are many reasons for dietary change from adolescent to adulthood. The perceptions of, and attributions for, this dietary change have been explored [43]. This longitudinal study has shown that in the transition between adolescence and adulthood, the food intake of respondents had changed significantly yet also 'tracked' significantly. These findings emphasise the importance of establishing 'healthy' eating patterns in childhood and adolescence. These results demonstrate that eating patterns are carried through to adulthood, but indicate that food habits remain amenable to change in early adulthood.

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Table 1 Balance of Good Health (BGH) food groups: minimum, maximum, mean and standard error of mean for all 198 participants % contribution of each food to total food weight at mean age 11.6 years (1980) and 32.5 years (2000) and difference (2000-1980) in % contribution.

BGH food group	Mean age	Per cent contribution to total food weight			
		Min %	Max %	Mean (SE)	*p*
Fruit & vegetables	11.6 y (1980)	2.2	33.8	14.6 (0.5)	<0.01
	32.5 y (2000)	3.9	53.9	25.2 (0.8)	
	Difference in per cent contribution			10.6 (0.8)	
Bread other cereals & potatoes	11.6 y	12.9	58.1	30.3 (0.5)	0.349
	32.5 y	11.7	46.6	29.7 (0.5)	
	Difference in per cent contribution			-0.6 (0.6)	
Milk & dairy foods	11.6 y	1.4	39.6	17.2 (0.5)	0.031
	32.5 y	0.4	47.3	15.6 (0.6)	
	Difference in per cent contribution			-1.6 (0.7)	
Meat, fish & alternatives	11.6 y	5.2	33.6	16.7 (0.4)	0.494
	32.5 y	4.2	37.2	17.0 (0.5)	
	Difference in per cent contribution			0.4 (0.5)	
Foods containing fat &/ sugar	11.6 y	8.0	38.7	21.2 (0.4)	<0.01
	32.5 y	0	39.5	12.4 (0.4)	
	Difference in per cent contribution			-8.8 (0.6)	

Figure 1 Difference (2000-1980) in % contribution to total food weight from foods containing fat and/ or sugar for all respondents (n=198)

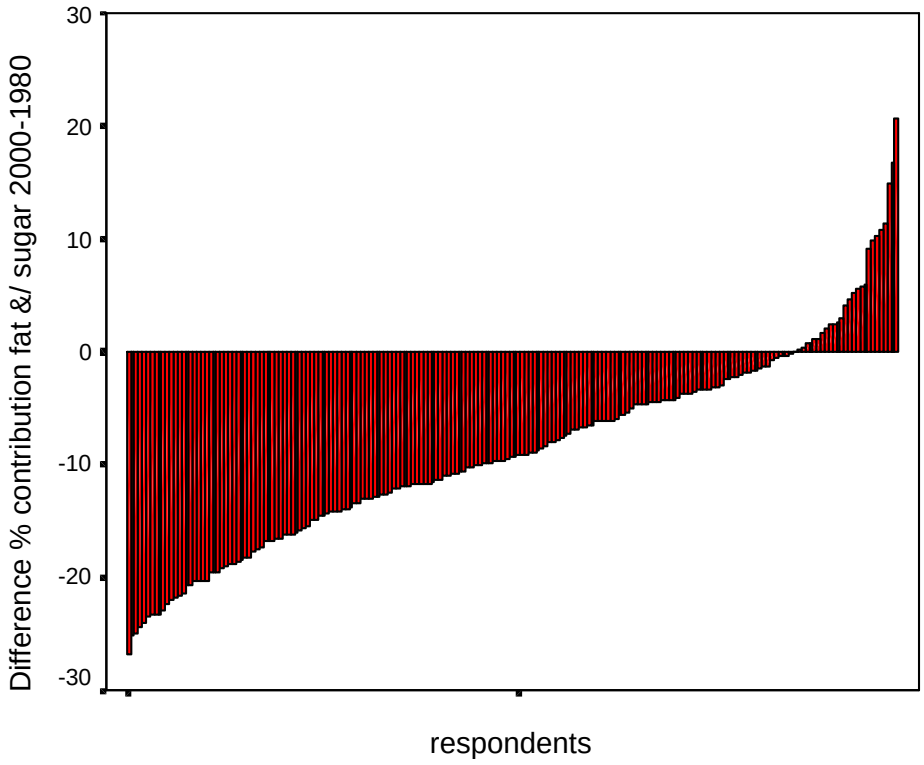

Figure 2 Difference (2000-1980) in % contribution to total food weight from fruit and vegetables for all respondents(n=198)

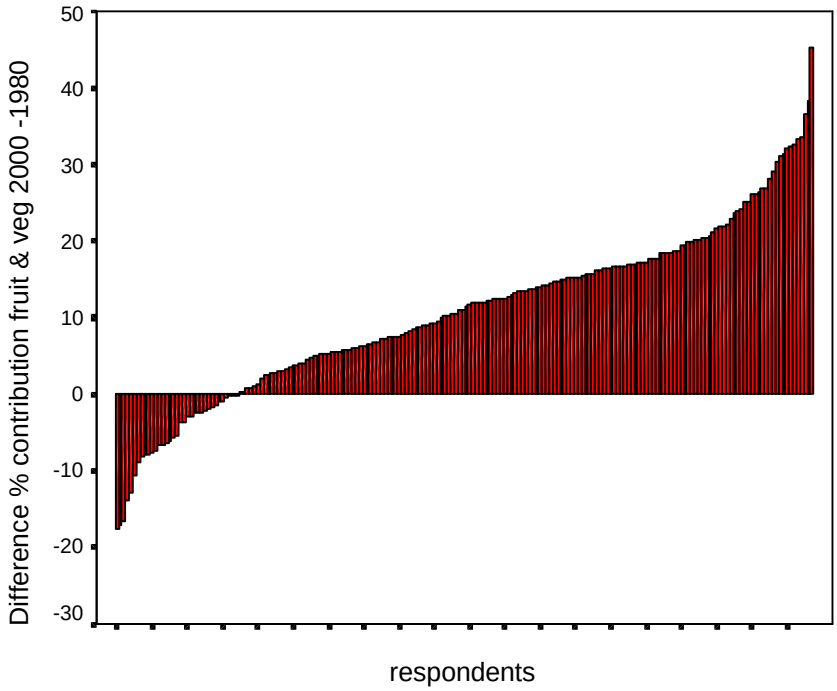

Table 2 Balance of Good Health food group difference in % contribution to total food weight 2000 – 1980, for male and female participants and according to location(n=198)

Difference in BGH food groups 2000-1980	Mean change % contribution (Std error mean)		*p*	Mean change % contribution (Std error mean)		*p*
	Male	Female		Northumberland	Elsewhere	
Fruit & vegetables	9.0 (1.2)	11.7 (1.0)	0.089	9.5 (0.9)	14.4 (1.4)	0.010
Bread other cereals & potatoes	0.0 (1.0)	-1.0 (0.8)	0.43	-0.8 (0.7)	0.3 (1.3)	0.445
Milk & dairy foods	-3.7 (1.2)	-0.2 (0.9)	0.019	-1.1 (0.9)	-3.6 (1.4)	0.162
Meat, fish and alternatives	2.3 (0.8)	-1.0 (0.7)	0.003	0.6 (0.6)	-0.3 (1.1)	0.488
Foods containing fat &/ sugar	-7.6 (1.0)	-9.6 (0.8)	0.10	-8.2 (0.7)	-10.8 (1.2)	0.084

Table 3 Social class in 1980 and 2000 according to 1970 classifications[24] (n=198)

		Social Class Groups							
		1 High		2 Middle		3 Low		4 Unclassified	
		n	%	n	%	n	%	n	%
Social class by 1970[a]	1980	52	26	91	46	45	23	10	5
	2000	86	43	73	37	32	16	7	4