

## **Examining the effect of standardized packaging and limited flavour and brand descriptors of e-liquids among youth in Great Britain.**

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**Significance:** E-cigarette vaping among youth has increased in Great Britain (GB). Many vaping products feature bright colours, novel brand names and flavour descriptions, which may appeal to youth. This study examined the impact of fully branded and white standardized e-liquid packaging (including limiting brand and flavour descriptors) on peer interest in trying e-liquids among youth in GB.

**Methods:** A between-subjects experiment was included in the Action on Smoking and Health Smokefree GB Youth 2021 online survey (age 11-18; n=1628). Participants were randomised to view a set of three images of e-liquids from one of three packaging conditions: (1) fully branded (control), (2) white standardized, or (3) white standardized with coded brand names and limited flavour descriptors. Participants were asked which e-liquid they thought people their age would be most interested in trying, participants could also respond “no interest” or “don’t know”. Multinomial regression models were used to examine differences in selecting ‘interest in trying (ref)’, ‘no interest’ or ‘don’t know’ across the different packaging conditions.

**Results:** Compared with fully branded packaging (22.7%), youth had higher odds of reporting no interest among people their age in trying the e-liquids in white standardized packs with brand codes and limited flavour descriptors (30.3%, AOR=2.07[95%CI=1.53-2.79],  $p<.001$ ), but not white standardized packs with usual descriptors (23.1%, 1.21[0.89-1.65],  $p=.214$ ). Youth had higher odds of reporting no interest in trying the e-liquids in white standardized packs with brand codes and limited flavour descriptors (30.3%) compared to white standardized packs with usual descriptors (23.1%, AOR=0.59, 95% CI= 0.44-0.79,  $p<.001$ ).

**Conclusion:** Standardized e-liquid packaging, which also limits flavour and brand descriptors, may reduce the appeal of e-liquids to youth.

## INTRODUCTION

In Great Britain (GB), use of e-cigarettes at least once a month among youth aged 11-17 has increased, from 3.3% in 2021 to 7.0% in 2022 (1). E-cigarette and e-liquid branding often contain elements that are appealing to youth, such as cartoons (2,3). Youth also report finding the range of available e-cigarette flavours attractive, with fruit flavours especially popular (1). E-liquid brands often use images, sensory descriptors, and conceptual names (e.g, 'blue voltage' or 'solar') to describe flavours (4) on their packaging and online advertising (5,6), which have been found to be popular among youth (7). Flavours also play a key role in youth initiating and continuation of vaping (8)(1).

In GB, e-cigarettes which contain nicotine and nicotine-containing e-liquids are regulated by the Tobacco and Related Products Regulations (9). For example, e-liquid bottles can contain a maximum volume of 10mL, nicotine strength is limited to a maximum concentration of 20mg/mL, and packaging must display nicotine content, ingredients, and a nicotine health warning label (7); all broadcast media and cross-border advertising of nicotine vaping products is banned. Other forms of marketing are also regulated in GB for e-cigarette products through the Advertising Standards Authority (10). There are also regulations on the claims and themes that can be presented on packaging. For example, product packaging cannot include claims that they provide any health or lifestyle benefits, or have vitalising, energising, healing, rejuvenating, natural or organic properties (9). These regulations, however, can be quite conceptual and difficult to define and enforce, and do not restrict the use of colours and cartoons. Therefore, packaging is an important source of point-of-sale and peer-to-peer advertising for e-cigarette and e-liquid brands.

Previous research indicates that standardized cigarette packaging of tobacco cigarettes in olive green packs can reduce their appeal to youth (11), and similar findings have recently been observed for e-cigarettes. Using the Action on Smoking and Health (ASH) 2021 GB Adult and Youth surveys, we found standardized e-cigarette packaging can reduce appeal to youth (12), with fewer youth from GB reporting interest in trying e-cigarette products in standardized green (the same colour as tobacco cigarette packaging in GB) or white packs compared to fully branded packs. Similar effects of standardized packaging for e-liquids have been found among youth in England, Canada and the US (13).

Prior to the introduction of standardised packaging for cigarettes, flavour descriptors, such as 'mild' or 'smooth', were banned (9). Brand identity has been shown to be important to people who smoke (16), with youth reporting that brand names can be appealing and encourage purchase (17). Youth are also reported to perceive certain cigarette brand names as cool and sophisticated even when in standardised packs (14), and rate packs with brand descriptors removed as less appealing, less cool and less glamorous than packs with descriptions such as 'slim' and 'pink' (15). Brand names have also been found to influence cigarette taste and risk perceptions (11). Therefore, it may be that reducing brand and flavour descriptions from e-liquids could also reduce brand identity, and in turn appeal to youth; however, there is no current research in this area. This study therefore aimed to examine the impact of standardized e-liquid packaging with limited flavour and coded brand descriptors on e-liquid product appeal among youth in GB.

## METHODS

**Data source:** Data were from the online 2021 ASH Smokefree GB Youth Survey, which collects data on tobacco and vaping product use among youth aged 11-18 years in GB. This survey is conducted annually by ASH and is drawn from an existing online panel maintained by YouGov. Active sampling was used, whereby restrictions were put in place to ensure only those who are selected from a YouGov panel of registered users were allowed to take part (13). Respondents were invited by email to participate in the online survey, which took place between 25<sup>th</sup> March to 16<sup>th</sup> April 2021. Informed consent was provided either by the parents of those aged 11–15 years or by those individuals aged 16–18 years. Ethical approval for the analyses in this paper was not required as this study involved secondary analysis of pre-existing data, in line with King's College London policy.

**Design:** A 'between-subject' experiment was included on completion of the ASH Smokefree GB Youth Survey to examine perceptions of e-liquid pack images that were digitally altered to remove brand imagery and colour, and limit flavour and brand descriptors (Figure 1). Participants were randomised using simple randomisation to one of three experimental conditions, in which they viewed a set of three images of e-liquids in packaging which was either: (1) fully branded (i.e., usual colours, images, brands and flavour descriptors; control); (2) white standardized with usual descriptors (i.e., no colours or images, but usual brands and flavour descriptors); or (3) white standardized with coded brand names and limited flavour descriptions (Figure 1). Within each condition, participants viewed three different brands of e-liquids with three different flavours; brands and flavours were constant across conditions.

The initial survey was completed by n=2,513 youth, of whom n=1,654 were successfully recontacted to take part in the e-liquid experiment. Respondents who reported 'Prefer not to say' for the outcome (n=12) or 'Don't want to say' for any covariates (n=14) were excluded from the sample, resulting in a final analytic sample of n=1,628 respondents.

Figure 1. E-liquid Packs by Experimental Condition

Condition 1 (control): Fully branded packs with usual imagery, brand names, and flavour descriptions



Condition 2: White standardized packs with usual brand names and flavour descriptions



Condition 3: White standardized packs with coded brand names and limited flavour descriptions



## Measures

Table S1 shows the measures used and their coding.

### *No interest in trying e-liquid products among people your age (outcome)*

Respondents were shown a set of three images of e-liquid packs based on experimental condition (Figure 1) and asked, “Which of these products do you think people your age would be most interested in trying?”. Participants could select one of the three brands, ‘none of these,’ ‘don’t know’ or ‘prefer not to say’. Response options were coded as ‘interest in trying’ if any of the three brands were selected, ‘no interest in trying’ if ‘none of these’ was selected, or ‘don’t know’ (as previous analysis of these data indicated a significant proportion of ‘don’t know’ responses to questions about standardized packaging (12)) (Table S1). Respondents who selected ‘prefer not to say’ were excluded (n=12).

### *Vaping status*

Respondents were asked, “Have you ever heard of e-cigarettes? They are also sometimes called vapes, shisha pens or electronic cigarettes”. Those who responded ‘Yes’ were asked “Which ONE of the following is closest to describing your experience of e-cigarettes?” with available responses ranging from ‘I have never used an e-cigarette’ to ‘I use e-cigarettes every day’. Response options were coded into three categories: ‘Never used’ (youth who were not aware of vapes or had never vaped), ‘Ever used’ (youth who had only tried vaping or who had stopped vaping) and ‘Currently use’ (youth who vaped at least monthly). Respondents who reported ‘Don’t want to say’ were excluded (Table S1).

### *Smoking status*

Respondents were asked to report which statement best applied to their experience with cigarettes, ranging from ‘I have never smoked cigarettes, not even a puff or two’ to ‘I usually smoke more than six cigarettes a week’. Response options were coded into three categories: ‘Never smoked’ (youth who had never smoked), ‘Ever smoked’ (youth who had tried smoking or who had stopped smoking) and ‘Currently smoke’ (youth who reported currently smoking). Respondents who reported ‘Don’t want to say’ were excluded (Table S1).

### *Sociodemographic covariates*

Covariates were sex (male, female), age group (11-15 years, 16-18 years) and social grade (ABC1, C2DE; Table S2)(12). Social grade was based on the occupation of the chief income earner in the

household, and was asked of the parents of those participants aged 11–15, and directly of those participants age 16–18.

## ANALYSES

Chi squared tests were used to test for successful randomisation of conditions (Table 1).

A multinomial logistic regression model was fit to examine whether reporting ‘interest in trying’ (reference group), ‘no interest in trying’, and ‘don’t know’ differed between the three packaging conditions. Interactions between packaging condition and vaping status, and packaging condition and smoking status, were then added to multinomial models. All analyses were adjusted for gender, age group, social grade, vaping and smoking status. Unweighted data were used because the conditions were randomised.

## RESULTS

Overall, there were similar proportions of males (48.1%) and females (51.9%) and more youth aged 11-15 years (56.6%) than aged 16-18 years (43.7%). The majority were from a higher socioeconomic background (ABC1; 71.4%) (Table 1). Just under a half of youth (48.2%) reported that they perceived people their age would be interested in trying one of the e-liquid products shown, just over one-quarter reported no interest (25.4%), and 26.4% reported don’t know (Table 2). No significant differences in sociodemographic characteristics or vaping/smoking status were observed across experimental conditions, indicating successful randomisation (Table 1).

Youth who were shown white standardised packaging with brand codes and limited flavour descriptions (30.3%), but not white standardised packaging with usual descriptions (23.1%), had significantly greater odds of reporting no interest in trying (‘interest in trying’ as reference) any of the e-liquids shown, compared to those in the fully branded packaging condition (22.7%) (Table 2, Figure S1). Comparing the two white standardized packaging conditions, youth were significantly more likely to report no interest in trying packs with brand codes and limited flavour descriptors (30.3%) than standardized packaging with usual descriptors (23.1%, AOR=0.59, 95% CI= 0.44-0.79,  $p<.001$ ).

Youth who were shown white standardised packaging with usual descriptors (28.0%), and with brand codes and limited flavour descriptors (30.5%), were significantly more likely to report that they don’t know (‘interest in trying’ as reference) compared to those in the fully branded packaging (21.0%) (Table 2, Figure S1). Comparing the two white standardized packaging conditions, reporting ‘don’t know’ was significantly higher among youth shown packaging with brand codes and limited flavour descriptors (30.5%), than with usual descriptions (28.0%) (AOR=0.72, 95% CI=0.54-0.96,  $p=.024$ ).

When adjusting the reference category to ‘no interest’ (data not shown in tables), youth who were shown white standardised packaging with brand codes and limited flavour descriptors (39.2%), were significantly less likely to report that people their age would be interested in trying one of the products displayed compared to those shown fully branded packaging (56.3%)(AOR=0.48, CI=0.36-0.65,  $p<.001$ ). Youth were significantly more likely to report interest in trying packs in standardized white packs with usual descriptors (48.9%), than standardized white packs with brand codes and limited flavour descriptors (39.2%)(AOR=1.70, CI=1.26-2.30,  $p<.001$ ). There was no significant difference in interest between fully branded packs (56.35%) and standardized packs with usual descriptors (48.9%)(AOR=0.82, 95% CI=0.61-1.12,  $p=.214$ ).

When examining interactions, there was no significant interaction between packaging condition and vaping status ( $\text{Chi}^2= 14.86$ ,  $p=.062$ ), or smoking status ( $\text{Chi}^2= 3.93$ ,  $p=.863$ )

**Table 1: Participant characteristics ASH-Y 2021, overall and by experimental condition (N=1628)**

	Total	Branded packaging	White standardized with brand codes and limited flavour descriptors	White standardized packaging with usual descriptors	Difference between experimental conditions
	%(n)	%(n)	%(n)	%(n)	$\text{X}^2, \text{df (p)}$
<b>Total</b>	100(1628)	33.0(538)	33.7(548)	33.3(542)	
<b>Sex</b>					
Male	48.1(774)	48.1(259)	46.9(257)	47.6(258)	0.16,2(.919)
Female	51.9(854)	51.9(279)	53.1(291)	52.4(284)	
<b>Socioeconomic status</b>					
C2DE	28.6(466)	29.4(158)	27.0(148)	29.5(160)	1.06,2(.589)
ABC1	71.4(1162)	70.6(380)	73.0(400)	70.5(382)	
<b>Age</b>					
11-15 years	56.5(922)	57.1(307)	56.0(307)	56.8(308)	0.13,2(.936)
16-18 years	43.5(706)	42.9(231)	44.0(241)	43.2(234)	
<b>Vaping status</b>					
Never <sup>a</sup>	86.2(1403)	86.8(467)	85.6(469)	86.2(467)	2.51,4(.643)
Ever	9.7(158)	9.9(53)	10.4(57)	8.9(48)	
Current	4.1(67)	3.3(18)	4.0(22)	5.0(27)	
<b>Smoking status</b>					
Never	83.9(1366)	87.4(470)	82.8(454)	81.5(442)	7.96,4(.093)
Ever	11.7(191)	9.7(52)	12.2(67)	13.3(72)	
Current	4.4(71)	3.0(16)	4.9(27)	5.2(28)	

<sup>a</sup> Includes respondents who had never heard of e-cigarettes.

All data are unweighted



**Table 2: Multinomial associations between reporting no interest in trying or Don't Know and e-liquid packaging condition, ASH-Y 2021 (n=1628)**

	Interest in trying any e-liquid displayed (ref)	No interest in trying any e-liquid displayed			Don't know		
	%(n)	%(n)	AOR(95%CI)	p	%(n)	AOR(95%CI)	p
<b>Total</b>	48.2(784)	25.4(414)			26.4(430)		
<b>Packaging condition</b>							
Branded packaging	56.3(303)	22.7(122)	1	ref	21.0(113)	1	ref
White standardized packaging	48.9(265)	23.1(125)	1.21(0.89-1.65)	.214	28.0(152)	1.62(1.20-2.19)	<b>.002</b>
White standardized with limited flavour and coded brand descriptors	39.2(215)	30.3(166)	2.07(1.53-2.79)	<b>&lt;.001</b>	30.5(167)	2.27(1.67-3.07)	<b>&lt;.001</b>
<b>Sex</b>							
Male	41.9(324)	28.6(221)	1	ref	29.6(229)	1	ref
Female	53.7(459)	22.5(192)	0.62(0.48-0.79)	<b>&lt;.001</b>	23.8(203)	0.62(0.49-0.79)	<b>&lt;.001</b>
<b>Socioeconomic status</b>							
C2DE	42.9(200)	26.6(124)	1	ref	30.5(142)	1	ref
ABC1	50.2(583)	24.9(289)	0.85(0.64-1.11)	.227	25.0(290)	0.73(0.56-0.95)	<b>.019</b>
<b>Age</b>							
11-15 years	41.8(385)	29.4(271)	1	ref	28.9(266)	1	ref
16-18 years	56.4(398)	20.1(142)	1.67(1.29-2.16)	<b>&lt;.001</b>	23.5(166)	1.41(1.09-1.81)	<b>.008</b>
<b>Vaping status</b>							
Never <sup>a</sup>	45.0(632)	27.4(384)	1	ref	27.6(387)	1	ref
Ever	65.8(104)	13.3 (21)	0.42(0.24-0.72)	<b>.002</b>	20.9(33)	0.76(0.47-1.22)	.262
Current	70.1 (47)	11.9 (8)	0.29(0.12-0.72)	<b>.008</b>	17.9(12)	0.76(0.35-1.65)	.488
<b>Smoking status</b>							
Never	45.2(617)	26.7(365)	1	ref	28.1(384)	1	ref
Ever	62.8(120)	17.3 (33)	0.74(0.47-1.17)	.196	19.9(38)	0.60(0.38-0.93)	<b>.022</b>
Current	64.8 (46)	21.1 (15)	1.30(0.61-2.75)	.495	14.1(10)	0.45(0.20-1.02)	.056

<sup>a</sup> Includes respondents who had never heard of e-cigarettes.

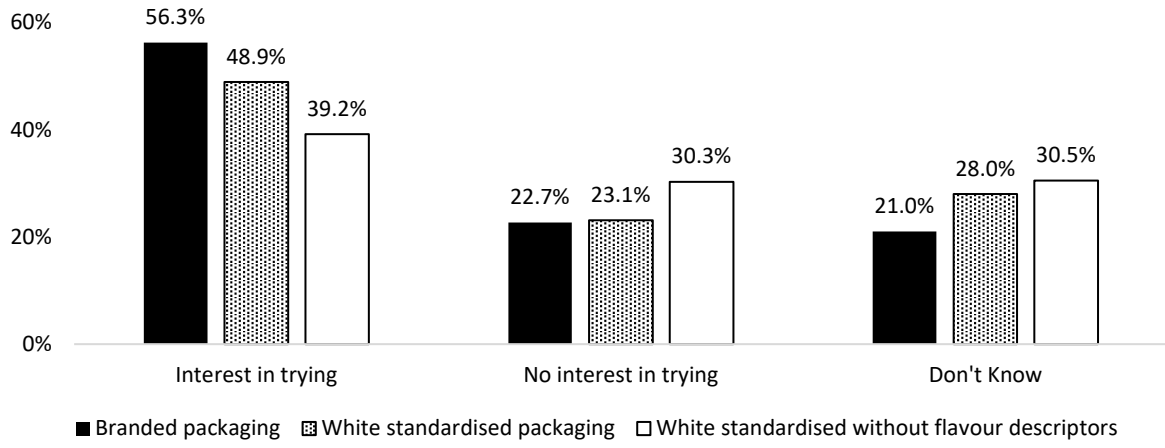
+ Caution, analyses based on small cell counts

Reference category is 'other' including interest in trying any of the brands and don't know.

Analyses were adjusted for sex, age, socioeconomic status, vaping status and smoking status.

All data are unweighted

**Figure 1: Responses to e-liquids among youth aged 11-18, by experimental condition; ASH 2021**



## DISCUSSION

Overall, compared with fully branded e-liquid packaging, we found that significantly more youth reported that people their age would not be interested in trying packs which were in standardized white, with limited flavour descriptions and coded brand descriptions. More youth also reported that people their age would not be interested in trying any of the e-liquids in standardized white packaging with usual descriptors than fully branded packs, however the difference was not significant. Don't know responses were also greater among youth who viewed standardized white packaging, and standardized white packaging with limited flavour and coded brand descriptions.

Our findings on standardized packaging are consistent with previous findings on packaging of e-cigarette starter kits (12) and e-liquid packs (13) among 16- to 19-year-olds, and with previous literature on tobacco packaging (11). The findings concerning the combination of limiting flavour descriptions and using coded brand names are also consistent with findings from tobacco cigarettes with coded brand names (16), and flavour descriptors (11).

Our findings suggest that restricting flavour and brand descriptors alongside standardizing packaging on nicotine e-liquids reduces the appeal of products to youth, indicating that this could be a possible policy direction to reduce vaping products appeal to youth. Don't know responses were also seen to increase for both standardized packaging conditions, suggesting that removing some branding elements and descriptors make youth less able to distinguish between and choose a product. Interactions between smoking and vaping status and condition were found too not be significant. It may be that there were too few youth who were currently vaping or smoking to reliably examine the associations of standardized packaging among these groups. However, this may also indicate that youth are attracted to product packaging irrespective of their smoking or vaping status.

We do not know how regulating brand and flavour descriptors of vaping products would affect perceptions of tobacco products and subsequent smoking among adults and youth. Misperceptions of e-cigarette relative harm to tobacco cigarettes are common among youth and adults, especially among those who smoke (17,18). Moreover, misperceptions of the relative harm are associated with reduced odds of using e-cigarettes to quit smoking among adults (19). Previous research has found that e-liquids that were presented in standardized white or olive packaging were more likely to be perceived as equally or more harmful than smoking compared to fully branded packs among youth (13). Therefore, care must be taken for future packaging regulation to not inaccurately inflate harm perceptions, and, in turn, dissuade people who smoke from using e-cigarettes to help them quit smoking. Future research is needed to explore the effects of standardized packaging and restrictions on branding and flavour descriptions, especially among adults who smoke.

There are some limitations to this research. First, the survey measure asked respondents about interest among people their age; therefore, responses did not represent participants' own interest in trying the products shown, but rather their perception of peer interest. Second, our research is only among youth; therefore, we are unsure what effect reduced branding and flavour descriptors on e-liquids would have on adults' interest in use. Our prior work has found that standardizing e-cigarette packaging reduces appeal to youth without reducing the appeal to adults, including adults who smoke (12). However, it is unclear if this generalises to reduced branding elements. Second, our findings are also based on e-liquids that are used for refillable devices. The vaping product market is diverse, particularly with the significant rise in disposable e-cigarette use among youth (1). We

therefore cannot be certain that our findings apply across products, and future research is needed across a variety of vaping products.

### **Conclusions**

Standardized e-liquid packaging, which also limits flavour and brand descriptors, may reduce the appeal of e-liquids to youth compared to fully branded packs which are currently on the market. Future research is needed to investigate the effect of removing flavour and brand descriptions among adults who smoke and impacts on harm perceptions.

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## **Conflicts of Interest**

David Hammond has provided paid expert witness testimony on behalf of public health authorities in response to legal challenges from tobacco, vaping, and cannabis companies, including standardized packaging laws for tobacco products. All authors declare no conflicts of interest.

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## **Data availability**

Data are available on reasonable request.

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**Table S1.** Measure wording for outcome, vaping status, and smoking status in the ASH Youth Survey 2021

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INTEREST IN TRYING PRODUCTS SHOWN (OUTCOME)

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'Which of the following products would *people your age* be most interested in trying?'

- a 'Slushie'
- b 'Puff Dragon'
- c 'Moreish Puff'
- d 'Prefer not to say' (excluded)
- e 'None of these products'
- f 'Don't know'

Coding

Interest in trying (a-c), vs no interest in trying (e), vs Don't know (f)

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VAPING STATUS

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1. 'Have you ever heard of e-cigarettes? They are also sometimes called vapes, shisha pens or electronic cigarettes.'

- a 'Yes'
- b 'No'
- c 'Don't know'

2: *Among those who had ever heard of e-cigarettes:* 'Which ONE of the following is closest to describing your experience of e-cigarettes?'

- a 'I have never used an e-cigarette'
- b 'I have only tried an e-cigarette once or twice'
- c 'I use e-cigarettes sometimes, but no more than once a month'
- d 'I use e-cigarettes more than once a month, but less than once a week'
- e 'I use e-cigarettes more than once a week but not every day'
- f 'I use e-cigarettes every day'
- g 'I used e-cigarettes in the past but no longer do'
- h 'Don't want to say' (excluded)

Coding

Never (1b, 1c, 2a), Ever (2b, 2g), Current (2c-2f)

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SMOKING STATUS

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'Which ONE of the following BEST applies to you?'

- a 'I have never smoked cigarettes, not even a puff or two'
- b 'I have only ever tried smoking cigarettes once'
- c 'I used to smoke sometimes but I never smoke cigarettes now'
- d 'I sometimes smoke cigarettes now but less than once a week'
- e 'I usually smoke between once and six cigarettes a week'
- f 'I usually smoke more than six cigarettes a week'
- g 'Don't want to say' (excluded)

Coding:

Never (a), Ever (b, c), Current (d-f)

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**Table S2:** Social grade classification system, based on occupation of the chief income earner in the household

A	Higher managerial, administrative and professional
B	Intermediate managerial, administrative and professional
C1	Supervisory, clerical and junior managerial, administrative and professional
C2	Skilled manual workers
D	Semi-skilled and unskilled manual workers
E	State pensioners, casual and lowest grade workers, unemployed with state benefits only
Social grade was based on the occupation of the chief income earner in the household, and was asked of the parents of those participants age 11–15, and directly of those participants age 16–18.	