Explanatory factors for health inequalities across different ethnic and gender groups: data from a national survey in England

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Word count: 3,236)main text)

No. of tables: 4

No. of figures: 1

No. of boxes: 0

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Abstract (246 words)

Background The objective of this study was to examine the relative contribution of factors explaining ethnic health inequalities (EHI) in poor self-reported health (pSRH) and limiting longstanding illness (LLI) between Health Survey for England (HSE) participants.

Method Using HSE 2003-06 data, the odds of reporting pSRH or of LLI in 3,809 Bangladeshi, Black African, Black Caribbean, Chinese, Indian, Irish, and Pakistani participants was compared with 12,808 White British participants. The effects of demographics, socio-economic position (SEP), psychosocial variables, community characteristics and health behaviours were assessed using separate regression models.

Results Compared with White British men, age-adjusted odds (OR, 95%CI) of pSRH were higher among Bangladeshi (2.05, 1.34-3.14), Pakistani (1.77, 1.34-2.33) and Black Caribbean (1.60, 1.18-2.18) males, but these became non-significant following adjustment for SEP and health behaviours. Unlike Black Caribbean men, Black African men exhibited a lower risk of age-adjusted pSRH (0.66, 0.43-1.00 (p=0.048)) and LLI (0.45, 0.28-0.72), which were significant in every model. Likewise, Chinese men had a lower risk of age-adjusted pSRH (0.51, 0.26-1.00 (p=0.048)) and LLI (0.22, 0.10-0.48). Except in Black Caribbean women, adjustment for SEP rendered raised age-adjusted associations for pSRH among Pakistani (2.51, 1.99- 3.17), Bangladeshi (1.85, 1.08-3.16), Black Caribbean (1.78, 1.44-2.21) and Indian women (1.37, 1.13-1.66) insignificant. Adjustment for health behaviours had the largest effect for South Asian women. By contrast Irish women reported better age-adjusted SRH (0.70, 1.51-0.96).

Conclusion SEP and health behaviours were major contributors explaining EHI. Policies to improve health equity need to monitor these pathways and be informed by them.

Key words:

Ethnic inequalities; self-rated health; socioeconomic position; social support; health behaviours

Introduction

Inequalities in health remain a worldwide problem both within and between countries[1], and have also been identified across different ethnic groups.[2-9] The factors underlying ethnic health inequalities (EHI) are disputed.[10;11] Early attempts at elucidating these relationships focussed on genetic differences,[11] with cultural differences and culturally-patterned disparities in lifestyle[12;13] being subsequent theories. More recent social ecological approaches postulate that material and social environments are important for the construction of health and illness (Berkman an Kawachi, 2000) and in generating EHI (Nazroo??). Poorer social determinants of health among ethnic minorities might contribute to ethnic health inequalities.[1] [13;14] The role of socio-economic factors in generating or exacerbating ethnic health inequalities (EHI) is important[14] but unclear.[4;11-13;15]

Compared to the majority group, lower SEP among ethnic minority groups, lower individual and community psychosocial resources.[12;16] (social networks,[19] and social support,[20] and social capital[22]) as well as poorer health behaviours (REF.) and mental health [23] (REF) may all be relevant in explaining EHI.

Accordingly, we examined the degree to which socio-economic, psychosocial and behavioural factors contribute towards explaining EHI in England in a single study. This study benefited from a large nationally representative sample with a wide range of measures of these factors, particularly socio-economic factors. Understanding the relative importance of these exposures can be two folds; it can help to generate hypothesis on the pathways through which they exert their effects on health and inform policies aiming to reduce EHI. A consideration of EHI is of growing importance, with migration and other demographic pressures leading to an increasingly ethnically diverse population in many countries. The

ethnic minority population in England has risen substantially: non-White groups accounted for 7% of the population in 1991 and 14% in 2011.[25]

Method

Participants and data collection

Data came from the Health Survey for England (HSE) 2003-2006. Each year, a new, nationally-representative, random sample of private households is selected, using two-stage, stratified probability sampling. Participants are visited by an interviewer and then a nurse.[26] Data were pooled together from the HSE 2003-06, to generate sufficiently large samples of ethnic minority populations. Most of the sample of ethnic minorities participated in 2004 (68.8%), when a boost sample was included of residents in England self-described as being of Bangladeshi, Black African, Black Caribbean, Chinese, Indian, Irish, or Pakistani origin,[5] the largest minority ethnic groups in England according to the 2001 Census.[27]

Up to four adults in boost households and 10 adults in core households were eligible. They were interviewed in English or selected other languages into which the questionnaire had been translated. The core household response rate in 2004 was 72%, with 90% of selected adults in co-operating households (66% of the estimated eligible sample of individuals) interviewed,[5] which were similar in the other years. 69% of known (66% of estimated) eligible boost households participated.[5] Research ethics consent for each survey was obtained from the relevant Research Ethics Committee prior to the survey.

Data

Information was obtained via self-report in face-to-face interviews. Poor self-rated health (pSRH) and limiting longstanding illness (LLI) were selected as outcomes. Participants were asked to describe their 'health in general' using five ordinal categories; as is commonly done (e.g. Idler and Angel[28]), pSRH was dichotomised into good (very good/good) and poor (fair/bad/very bad) self-rated health, representing 76% and 24% of participants respectively.. LLI was identified among participants who answered positively when asked if they had 'any long-standing illness, disability or infirmity', defined as 'anything that has troubled you over a period of time, or that is likely to affect you over a period of time' and limited their activities.

Potential explanatory variables identified from existing epidemiological research were grouped as follows:

Demographic variables: sex; age in ten-year bands; marital status (married or cohabiting, single or separated, divorced, widowed); and household size (1-2, 3-4, ≥5 occupants).

Socio-economic variables: Education (degree or equivalent, any other education, no qualification); equivalised household income quintiles; and economic activity (in employment, ILO unemployed, retired, other economically inactive).

Psychosocial variables: As part of the self-completion questionnaire, participants were asked whether they experienced no, moderate, or extreme anxiety or depression. Participants' perceived social support score was derived from seven questions regarding physical and emotional support received from family and friends: each response was assigned a score of one (no support), two (some support), or three (no lack of support), summed as no lack (21), some lack (18-20), or a severe lack of social support (<18).

Community characteristics: community participation (involved in a community activity); social capital (strong, fair or poor, calculated by pooling scores from three questions concerning whether participants considered people to be trustworthy, helpful or fair); and individuals' perceptions of their neighbourhood's quality (excellent, good, fair or poor, based on eight questions, for example whether participants enjoyed living in their neighbourhood, experienced much anti-social behaviour and had good local transport links).

Health behaviours: fruit and vegetable intake (≥5, 1-4, <1 portions/day); cigarette smoking status (never regular, ex-regular, current); alcohol consumption frequency (5-7, 1-4, <1 day/week, not in the last 12 months/non-drinker); and physical activity (≥5, 1-4, <1 day/week, none, with a session defined as any walking, sports or exercise lasting ≥30 minutes).

Analysis

Participants who described their ethnic background as Bangladeshi, Black African, Black Caribbean, Chinese, Indian, Irish or Pakistani were compared with participants who described themselves as White and born in the UK in HSE2004 combined with those who described themselves as British White (English, Northern Irish, Scottish, Welsh) in 2003/2005/2006. Analyses were restricted to participants aged 20-69 years due to few older survey participants among minority ethnic groups.

A number of participants did not answer certain questions: these were recoded into the largest category where they accounted for <5% of the available sample; where they comprised ≥5%, they were included as separate categories. This way of treating missing values retains information from participants who otherwise would be excluded using only participants who have information on all variables; this is the method used in the HSE reports.[29] In 2005, no

physical activity data was collected; this formed a separate category for physical activity. Some participants did not answer self-completion questions. Accounting for 5.5% of the available sample (from 2.7% of White British to 35.0% of Bangladeshi participants), these cases were included as a separate category to minimise reductions in sample size. Analyses including such persons increased the magnitude of EHI in SRH, compared with analyses excluding these individuals; the effect on LLI was less consistent (data not shown).

Explanatory variables were significantly associated with the independent and dependent variables of interest using chi-square tests. All variables fell below a collinearity threshold (r=0.60) except the two psychosocial variables (r=0.63). Both were included in the analyses, each deemed to measure a different but associated series of psychosocial domains. To examine the impact of each group of variables on EHI, logistic regressions were conducted, independently testing the effect of each group of explanatory variables, as including all variables in one model can lead to misinterpretation of effects.[30] Model 1 adjusted for age only. Other models adjusted for age plus: demographics (Model 2), socio-economic status (Model 3), psychosocial variables (Model 4), community characteristics (Model 5) or health behaviours (Model 6). Each model accounted for survey design, non-response weighting, and was stratified by sex. The reference group was White British participants. Analyses were conducted using Stata 12.

Results

In unadjusted descriptive analyses, pSRH was more common among Bangladeshi, Black Caribbean, Indian, and Pakistani participants compared with the White British population.

pSRH was less common among Black African and Chinese men but there was no difference in pSRH rates for Black African, Chinese and Irish women (Supplementary material, Table S1). White British and Irish participants were oldest, while Bangladeshi participants were the youngest. Having a degree or equivalent was highest among Chinese males (46%) and females (39%), and lowest in Black Caribbean males (17%) and Bangladeshi females (8%). Bangladeshi and Pakistani participants had the highest proportion in the lowest income quintile (32%-38%). The highest proportion in employment was found among White British males (74%) and Irish females (62%). (Table ??)

Poor self-rated health Adjusting for age only, Bangladeshi (OR 2.05, 95%CI 1.34-3.14), Pakistani (1.77, 1.34-2.33) and Black Caribbean (1.60, 1.18-2.18) men had higher odds of pSRH than White British men (Table 1, Model 1). Conversely Chinese (0.51, 0.26-1.00 (p=0.048)) and Black African men (0.66, 0.43-1.00 (p=0.048)) had lower odds. Adjusting for demographic factors (Model 2) and community characteristics (Model 5) made little or no difference to these associations. Accounting for psychosocial variables attenuated associations for Bangladeshi (1.57, 1.02-2.40) and Pakistani men (1.48, 1.10-2.00), while odds for Chinese men were rendered non-significant (Model 4). Adjusting for SEP abolished significant associations between ethnic minorities with increased odds of pSRH; however odds for Black African (0.45, 0.28-0.70), and Chinese men (0.52, 0.27-0.98) decreased further (Model 3). Adjusting for health behaviours (Model 6) resulted in Bangladeshi and Pakistani men having non-significantly lower odds of pSRH than White British men but had no effect on Black Caribbean men. Compared with White British men, Black African men had significantly lower odds of pSRH in every model. No significant difference in pSRH was found for Indian or Irish men compared with White British men.

Increased odds of pSRH was found among Pakistani (2.51, 1.99-3.17), Bangladeshi (1.85, 1.08-3.16), Black Caribbean (1.78, 1.44-2.21) and Indian women (1.37, 1.13-1.66) compared with White British women, adjusting only for age (Table 2, Model 1). Conversely Irish women had lower odds of pSRH (0.82, 0.67-0.99). Accounting for demographic factors (Model 2) and psychosocial health (Model 4) made little difference to these associations. After adjusting for health behaviours (Model 6), raised odds were attenuated for Indian and Pakistani women and abolished for Bangladeshi women. Increased odds for Bangladeshi women and lower odds for Irish women were rendered non-significant after adjusting for community characteristics (Model 5). SEP had the largest effect, abolishing all associations except for Black Caribbean women (1.65, 1.30-2.09) (Model 3); this group had raised odds of pSRH in every model. No significant difference in pSRH was found for Black African women compared with British White women in any model; Chinese women had around a 30% but non-significantly reduced odds in each model.

Limiting longstanding illness

Black African, Chinese and Indian men had lower odds of LLI than White British men, significant in every model (Table 3). Chinese men had the lowest odds, 77%-86% lower than for White British men, while Black African men had a 55%-70% reduction and Indian men a 33%-52% reduction. Accounting for SEP and health behaviours had the greatest magnitude effect by lowering odds even further. In contrast to increased odds of pSRH for Bangladeshi men (Table 2), they had lower odds of LLI compared with White British men after adjusting for health behaviours (0.45, 0.26-0.77) (Model 6), as did Pakistani men (0.49, 0.34-0.70).

Increased odds of LLI compared with White British women were found only for Pakistani women (1.61, 1.23-2.09 adjusting for age only, Table 4, Model 1), however this relationship was attenuated after adjustment for psychosocial health (Model 4) and abolished by adjusting for SEP (Model 3), or health behaviours (Model 6). Consistent with findings for men, Chinese (e.g. 0.32, 0.14-0.71) and Black African women (e.g. 0.43, 0.29-0.64, Model 1) had marked and significantly lower odds of LLI in every model. Indian women had lower odds of LLI, which became significant after adjusting for SEP (0.70, 0.55-0.88), psychosocial health (0.75, 0.59-0.96), community characteristics (0.74, 0.58-0.95) or health behaviours (0.58, 0.45-0.75). This was also the case for Irish women adjusting for demographic (0.80, 0.66-0.96) or psychosocial factors (0.82, 0.68-0.99). Bangladeshi women had 50% lower odds of LLI than White British women after adjustment for SEP. Results are summarised in Figure 1.

Because of missing items not available in other survey years, analyses were repeated, limited to HSE2004 participants only (Tables S2-S3). Results were similar for most ethnic groups however no significant differences in health outcomes were observed for Black Caribbean men, while Indian men had substantially raised odds of both outcomes. Results for women were similar in the two datasets, although greater inequalities in pSRH were found in 2004, particularly among Bangladeshi women.

Discussion

Pakistani, Bangladeshi and Black Caribbean men and women had the highest odds of pSRH, compared with White British adults. Pakistani women had the worst health, having increased odds of both pSRH and LLI. These findings are consistent with analysis showing increases in certain cardiovascular risk factors from 1994 and 2004 for Black Caribbean, Pakistani and the

Bangladeshi population,[31] and higher rates of LLI among Pakistani women using census data.[32]

Findings highlight heterogeneity among ethnic groups: for example, White British men had poorer health than Black African men, whilst Black Caribbean males had increased odds of pSRH. Similarly the Indian population showed better health than Pakistani or Bangladeshi participants, having lower odds of LLI in each model. This emphasises the importance of disaggregating such groups into distinct ethnic categories – a practice not always undertaken.[33;34]

Analyses restricted to HSE2004 participants only found similar or worse health for Indian than Pakistani men in most models. Participants from minority ethnic groups in HSE 2003/2005/2006 needed sufficient English language skills to be interviewed, whereas translations and bilingual field staff were provided in HSE2004. Results from HSE2004 are closer to those from the SABRE study, where Indian men had elevated risk of disability, and were non-native English speakers.[35] If health is related to immigration status and integration into the majority population, one would expect worse EHI in HSE2004, where there were more non-native English speakers.

The strongest overall determinants of EHI, particularly for pSRH, was SEP, which abolished associations in most groups except Black African males (lower odds of pSRH), and Black Caribbean women (higher odds of pSRH). This was followed by health behaviours, themselves strongly social patterned, particularly for those of South Asian descent. This was also the case for LLI, where the raised odds ratio for Pakistani women (the only ethnic group

with significant higher odds of LLI) was abolished after adjustment for SEP and health behaviours. This contrasts with some mortality studies, which found that adjustment for SEP had little impact upon EHI despite known inequalities in occupational class.[36]

One explanation for discrepancies in the perceived importance of SEP is how studies of EHI have accounted for SEP in a manner that fails to capture the complexity of socio-economic inequalities faced by minority groups.[24] Rather than adjust solely for occupational class, this paper employed a broader definition of SEP, including employment status, income and education. Many minority ethnic groups receive lower incomes than White British individuals within the same occupational class or educational level, with employment rates lower among minority ethnic groups, who experience unemployment for longer periods than White British individuals.[37;38] Complex relationships between socio-economic factors are clear. While 21% of White British men were educated to degree level or above and a similar 23% fell into the top income quintile, figures for Bangladeshi men were 18% and 1% respectively (Table S1).

It is therefore unsurprising that papers exploring EHIs have been able to substantially attenuate disease risks only after accounting for a tranche of socio-economic variables.[37] Adjustment for a single domain of SEP will risk underestimating the importance of socio-economic disadvantage. Additionally, studies adjusting for SEP in an effort to statistically isolate ethnicity-health relationship will have done so counter-intuitively, masking the substantial and unresolved contribution of socio-economic inequalities to EHI, particularly among minority ethnic women.[38]

Overall, Chinese and Black Africans, of whom few were born in the UK, had the best health. Black African and Chinese participants had the lowest odds of LLI in every model, and males had the lowest odds of pSRH. This was the most robust association, particularly for LLI which was statistically significant even after adjustment in each model. This suggests that the better health experienced is outside the social and demographic factors suggested here: this could be a result of a healthy migrant effect, which is not captured by survey data, or other factors which require further investigation. However ethnic minorities born outside the UK exhibited more pronounced EHIs than those born in the UK using 2004 data only (Supplementary material, Table S4-S5). This was especially apparent among South Asians for the pSRH outcome. While a migrant's disease risk reflects that found in their country of origin in the short term, the effect of new country-specific exposures following migration produces shifts in risk toward those seen in the host nation.[39] EHIs are not inevitable.

Differences between LLI and pSRH

Higher odds of pSRH among ethnic groups were not reflected in odds of LLI (with the exception of Pakistani women). A discrepancy between lower rates of LLI and higher rates of pSRH health, particularly among Bangladeshi and Pakistani men, was also found using census data.[32] The reason for such discrepancies are unclear and may be due to different interpretations of pSRH by ethnic groups, which is an area for further research. Studies examining both health outcomes have determined that indicators of SRH and LLI are strongly correlated with one another.[40]

Strengths and limitations

The main strengths of this study include the use of nationally-representative samples of the non-institutionalised population benefiting from good response rates, spanning across four years. The broad conceptual model adopted serves as a further strength, but was limited to

variables included in the survey. Information not available that may explain EHIs further include detailed dietary data, healthcare access, life stresses, coping mechanisms, and racial discrimination.

Although interviews and self-completion questionnaires were conducted in participants' primary language in HSE2004, substantial non-response occurred for self-completion questionnaires, which could be due to fatigue, perceived invasion of privacy, or literacy problems. This limits interpretation of results, particularly conclusions about social participation. Members of minority ethnic groups in the other HSE years were limited to those with sufficient English to give informed consent and answer questions, so may be less representative of their ethnic group than those participating in HSE2004. Four years' data were used for the main analyses to overcome the limitation of small sample sizes in HSE2004 for some ethnic groups, which may explain the non-significant findings for Chinese men in HSE2004. Unfortunately country of birth was asked only in HSE2004 and therefore we could not compare foreign- and UK-born participants in the pooled dataset. Data on other potentially important factors such as discrimination and racism,[24] geographic location, migration and acculturation, medical care, and exposure to stress and resources[13;15] that may contribute to EHI, were not available for inclusion in these analyses.

Despite self-rated health being a valid measure among ethnic groups when compared with other measures of morbidity using the HSE,[41] and a predictor of future mortality[28]; survey questions may have been interpreted differentially by groups: even with accurate translation, cultural and subjective interpretations of pSRH and LLI may vary. Being cross-sectional, this

study could not explore temporality. Poor SRH or LLI can lead to an inability to find work and therefore poverty.

Conclusions

Substantial variation in EHI were found in England but were less than previously reported. Heterogeneity existed among Black and South Asian populations; care must be taken in disaggregating these groups. SEP accounted for much of the difference in worse health outcomes of ethnic minority groups, followed by health behaviours, themselves strongly associated with SEP, particularly among South Asian populations. Findings support interventions focussed upon decreasing socio-economic inequalities and disparities in positive health behaviours between ethnic groups, particularly among individuals of South Asian descent. The ability of policymakers to realise such change is likely to be dependent upon the degree to which barriers to equity can be overcome.[42]

What is already known on this subject:

Health inequalities within and between populations are strongly associated with inequalities in social determinants of health. Minority ethnic groups are often among the most disadvantaged groups in society. Although ethnic health inequalities (EHIs) are well-recognised, the relative importance of various underlying determinants is disputed.

What this study adds:

The social construction of EHIs differs by ethnic group, gender, and health outcome. Some groups report worse health but other groups report better health than the White British population. Socio-economic position is most important in explaining worse health outcomes among ethnic minorities, with health behaviours also important in South Asian populations. Awareness of these influences is important in designing effective policies capable of tackling EHIs.

Acknowledgements

We thank colleagues at NatCen Social Research and UCL; the staff who ran the surveys; the participants in the survey; the Sir Isaiah Berlin Travel Scholarship Fund; and participants at the Society for Social Medicine Annual Scientific Meeting for their helpful suggestions.

Contributors: JM had the initial idea and wrote the initial draft of the paper; MR, ND and VS prepared the datasets; MR, CK and LNF analysed the data; all authors contributed to conceptualizing, designing and interpreting the analyses, and redrafting the paper. All authors approved the final version.

Funding: JM and LNF are and CK and MR were funded by the Health and Social Care Information Centre (HSCIC) to work on the Health Survey for England but no funding was received to conduct these analyses. MR is grateful to the Sir Isaiah Berlin Travel Scholarship Fund for a contribution to costs to travel to Israel for a meeting with the co-authors to discuss the data and analyses. The Health Survey for England (HSE) 2003 and 2004 were funded by the Department of Health; HSE2005 and 2006 were funded by HSCIC. The funders played no part in decisions or work concerning the analyses or publication of the paper. The views are those of the authors, not the funders.

The authors declare that they have no conflict of interest.

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Table 1. Ethnic differences in poor self-rated health (pSRH) for men aged 20-69: effects of explanatory variables. Odds of pSRH compared with better SRH, Health Survey for England 2003-08 (N=16617)[a]

Variables	n	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 4 OR (95% CI)	Model 5 OR (95% CI)	Model 6 OR (95% CI)
Ethnicity							
White British	12808	1	1	1	1		1
Black Caribbean	475	**1.60 (1.18, 2.18)**	**1.52 (1.11, 2.10)**	1.23 (0.88, 1.73)	**1.65 (1.21, 2.24)**	**1.49 (1.10, 2.04)**	**1.45 (1.04, 2.03)**
Black African	494	**0.66 (0.43, 1.00)**	**0.63 (0.41, 0.95)**	**0.45 (0.28, 0.70)**	**0.59 (0.39, 0.88)**	**0.63 (0.42, 0.95)**	**0.49 (0.32, 0.77)**
Indian	748	1.08 (0.86, 1.36)	1.12 (0.89, 1.42)	1.06 (0.82, 1.37)	1.10 (0.87, 1.40)	1.13 (0.90, 1.43)	0.90 (0.70, 1.16)
Pakistani	577	**1.77 (1.34, 2.33)**	**1.75 (1.31, 2.33)**	1.24 (0.91, 1.69)	**1.48 (1.10, 2.00)**	**1.67 (1.24, 2.23)**	0.82 (0.58, 1.15)
Bangladeshi	408	**2.05 (1.34, 3.14)**	**2.03 (1.31, 3.15)**	1.01 (0.60, 1.68)	**1.57 (1.02, 2.40)**	**1.74 (1.11, 2.72)**	0.71 (0.43, 1.18)
Chinese	347	**0.51 (0.26, 1.00)**	**0.52 (0.27, 0.98)**	**0.35 (0.16, 0.78)**	0.54 (0.26, 1.14)	**0.49 (0.25, 0.96)**	**0.40 (0.20, 0.80)**
Irish	760	1.10 (0.90, 1.34)	1.04 (0.85, 1.28)	0.98 (0.79, 1.21)	0.98 (0.79, 1.22)	1.11 (0.91, 1.35)	1.03 (0.84, 1.27)
Demographics							
Marital status							
Married or cohabiting	11926	-	1	-	-	-	-
Single or separated	3626	-	**1.39 (1.23, 1.58)**	-	-	-	-
Divorced	860	-	**1.94 (1.63, 2.32)**	-	-	-	-
Widowed	205	-	**1.39 (1.03, 1.88)**	-	-	-	-
Household size							
1-2 occupants	8170	-	1	-	-	-	-
3-4 occupants	6433	-	**0.83 (0.75, 0.93)**	-	-	-	-
5 or more occupants	2014	-	1.08 (0.90, 1.29)	-	-	-	-
Socio-economic variables							
Education							
Degree or equivalent	3798	-	-	1	-	-	-
Any other education	9148	-	-	**1.54 (1.34, 1.77)**	-	-	-
No qualification	3671	-	-	**2.34 (2.00, 2.74)**	-	-	-
Equivalised income							
Highest quintile	3447	-	-	1	-	-	-
4th quintile	3334	-	-	1.18 (0.99, 1.40)	-	-	-
3rd quintile	2825	-	-	**1.67 (1.41, 1.97)**	-	-	-
2nd quintile	2173	-	-	**2.11 (1.75, 2.53)**	-	-	-
Bottom quintile	2110	-	-	**2.65 (2.19, 3.22)**	-	-	-
Don't know/refused[b]	2728	-	-	**1.71 (1.43, 2.05)**	-	-	-
Economic activity							
In employment	12109	-	-	1	-	-	-
ILO unemployed	796	-	-	**1.60 (1.28, 1.99)**	-	-	-
Retired	1866	-	-	**1.67 (1.41, 1.98)**	-	-	-
Other economically inactive	1846	-	-	**6.11 (5.26, 7.10)**	-	-	-
Psychosocial variables							
Anxiety/depression							
Not anxious or depressed	13170	-	-	-	1	-	-
Moderately	2197	-	-	-	**4.74 (4.23, 5.32)**	-	-
Extremely	258	-	-	-	**25.93 (4.22, 5.32)**	-	-
No self-completion[c]	992	-	-	-	**2.45 (2.00, 3.01)**	-	-
Social and Emotional support							
No lack	8891	-	-	-	1	-	-
Some lack	4000	-	-	-	**1.34 (1.21, 1.49)**	-	-
Severe lack	2734	-	-	-	**1.68 (1.49, 1.89)**	-	-
No self-completion[c]	992	-	-	-	Collinear	-	-
Community characteristics							
Community participation							
Involved in an activity	8848	-	-	-	-	1	-
Not inolved in an activity	5510	-	-	-	-	**1.54 (1.40, 1.70)**	-
No answer/Refused	1267	-	-	-	-	**1.48 (1.25, 1.74)**	-
No self-completion[c]	992	-	-	-	-	**3.31 (1.25, 1.74)**	-
Social capital							
Strong	4194	-	-	-	-	1	-
Fair	4034	-	-	-	-	**1.25 (1.10, 1.42)**	-
Poor	7397	-	-	-	-	**1.52 (1.35, 1.72)**	-
No self-completion[c]	992	-	-	-	-	Collinear	-
Neighbourhood quality							
Excellent	4068	-	-	-	-	1	-
Good	4113	-	-	-	-	**1.24 (1.08, 1.42)**	-
Fair	5865	-	-	-	-	**1.63 (1.44, 1.84)**	-
Poor	1579	-	-	-	-	**2.94 (2.47, 3.49)**	-
No self-completion[c]	992	-	-	-	-	Collinear	-
Health behaviours							
Fruit and vegetable intake							
5 or more portions a day	4332	-	-	-	-	-	1
1-4 portions a day	10508	-	-	-	-	-	1.12 (1.00, 1.25)
Less than 1 portion a day	1777	-	-	-	-	-	**1.64 (1.38, 1.94)**
Cigarette smoking status							
Never regular smoker	7826	-	-	-	-	-	1
Ex-regular smoker	4301	-	-	-	-	-	**1.52 (1.35, 1.70)**
Current smoker	4490	-	-	-	-	-	**2.54 (2.26, 2.86)**
Alcohol consumption frequency							

5-7 days a week	3746	-	-	-	-	-	1
1-4 days a week	7752	-	-	-	-	-	0.99 (0.88, 1.12)
Less frequently	3085	-	-	-	-	-	**1.70 (1.49, 1.95)**
Not in the last 12 months	2034	-	-	-	-	-	**2.60 (2.15, 3.15)**
Physical activity							
Less than 1 day a week	5308	-	-	-	-	-	1
1-4 days a week	4505	-	-	-	-	-	**1.22 (1.07,1.40)**
5 or more days a week	4230	-	-	-	-	-	**3.24 (2.87, 3.65)**
Not asked in 2005	2574	-					**1.60 (1.40, 1.83)**
Goodness of fit		0.125	0.609	<0.001	0.794	0.064	0.015

[a] Each model was adjusted for age group in ten year bands

[b]Equivalised household income was calculated by dividing the total household income by a household McClement score (determined according to the number, age and relationships of adults and children in the household).

[c]Missing: Refers to participants who chose not to answer relevant questions asked as part of the self-completion component of the Health Survey for England.

Table 2. Ethnic differences in poor self-rated health (pSRH) for women aged 20-69: effects of explanatory variables. Odds of pSRH compared with better SRH, Health Survey for England 2003-08 (N=20462)[a]

Variables	n	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
		OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Ethnicity							
White British	15662	1	1	1	1	1	1
Black Caribbean	784	**1.78 (1.44, 2.21)**	**1.55 (1.25, 1.91)**	**1.65 (1.30, 2.09)**	**1.74 (1.39, 2.17)**	**1.62 (1.29, 2.04)**	**1.75 (1.39, 2.22)**
Black African	592	1.04 (0.77, 1.42)	0.94 (0.69, 1.28)	0.75 (0.54, 1.04)	1.02 (0.74, 1.40)	1.01 (0.73, 1.38)	0.85 (0.61,1.19)
Indian	881	**1.37 (1.13, 1.66)**	**1.42 (1.16, 1.73)**	1.21 (0.98, 1.51)	**1.35 (1.10, 1.65)**	**1.31 (1.07, 1.61)**	1.11 (0.89, 1.39)
Pakistani	670	**2.51 (1.99, 3.17)**	**2.60 (2.04, 3.30)**	1.21 (0.94, 1.56)	**2.14 (1.63, 2.81)**	**2.22 (1.75, 2.82)**	**1.57 (1.21, 2.05)**
Bangladeshi	471	**1.85 (1.08,3.16)**	**1.93 (1.12, 3.35)**	0.65 (0.38,1.12)	**1.87 (1.10, 3.15)**	1.49 (0.85, 2.63)	0.99 (0.49, 1.98)
Chinese	398	0.69 (0.44,1.09)	0.68 (0.43, 1.08)	0.60 (0.35,1.03)	0.68 (0.42, 1.09)	0.70 (0.44, 1.10)	0.68 (0.42, 1.10)
Irish	968	**0.82 (0.67,0.99)**	**0.78 (0.64, 0.95)**	0.84 (0.69,1 .02)	**0.79 (0.65, 0.97)**	0.85 (0.70, 1.03)	**0.82 (0.67, 1.00)**
Demographics							
Marital status							
Married or cohabiting	13973	-	1	-	-	-	-
Single or separated	3957	-	**1.46 (1.30, 1.64)**	-	-	-	-
Divorced	1641	-	**1.81 (1.60, 2.05)**	-	-	-	-
Widowed	855	-	**1.78 (1.50, 2.11)**	-	-	-	-
Household size							
1-2 occupants	9778	-	1	-	-	-	-
3-4 occupants	8164	-	0.92 (0.83, 1.01)	-	-	-	-
5 or more occupants	2484	-	0.94 (0.81, 1.11)	-	-	-	-
Socio-economic variables							
Education							
Degree or equivalent	3818	-		1	-	-	-
Any other education	11527	-	-	**1.28 (1.11, 1.47)**	-	-	-
No qualification	5081	-	-	**2.38 (2.05, 2.76)**	-	-	-
Equivalised income							
Highest quintile	3501	-	-	1	-	-	-
4th quintile	3648	-	-	**1.40 (1.17, 1.66)**	-	-	-
3rd quintile	3521	-	-	**1.90 (1.61, 2.24)**	-	-	-
2nd quintile	3139	-	-	**2.40 (2.04, 2.82)**	-	-	-
Bottom quintile	3177	-	-	**2.99 (2.52, 3.53)**	-	-	-
Don't know/refused[b]	3440	-	-	**1.80 (1.52, 2.12)**	-	-	-
Economic activity							
In employment	12056	-	-	1	-	-	-
ILO unemployed	593	-	-	**1.68 (1.32, 2.14)**	-	-	-
Retired	2551	-	-	**2.12 (1.82, 2.48)**	-	-	-
Other economically inactive	5226	-	-	**2.72 (2.47, 2.99)**	-	-	-
Psychosocial variables							
Anxiety/depression							
Not anxious or depressed	15246	-	-		1	-	-
Moderately	3706	-	-	-	**3.76 (3.43, 4.12)**	-	-
Extremely	412	-	-	-	**21.63 (16.2, 29.0)**	-	-
No self-completion[c]	1062	-	-	-	**2.33 (1.90, 2.86)**	-	-
Social and Emotional support							
No lack	12849	-	-	-	1	-	-
Some lack	4251	-	-	-	**1.26 (1.14, 1.39)**	-	-
Severe lack	2264	-	-	-	**1.68 (1.46, 1.92)**	-	-
No self-completion[c]	1062	-	-	-	Collinear	-	-
Community characteristics							
Community participation							
Involved in an activity	10843	-	-	-	-	1	-
Not 24nvolved in an activity	7048	-	-	-	-	**1.54 (1.42, 1.68)**	-
No answer/Refused	1473	-	-	-	-	**1.49 (1.29, 1.73)**	-
No self-completion[c]	1062	-	-	-	-	**3.70 (2.94, 4.65)**	-
Social capital							
Strong	5367	-	-	-	-	1	-
Fair	5749	-	-	-	-	**1.50 (1.34, 1.68)**	-
Poor	8248	-	-	-	-	**2.00 (1.79, 2.24)**	-
No self-completion[c]	1062	-	-	-	-	Collinear	-
Neighbourhood quality							
Excellent	5493	-	-	-	-		-
Good	5170	-	-	-	-	**1.16 (1.04, 1.31)**	-
Fair	6892	-	-	-	-	**1.53 (1.37, 1.71)**	-
Poor	1809	-	-	-	-	**2.82 (2.42, 3.28)**	-
No self-completion[c]	1062	-	-	-	-	Collinear	-
Health behaviours							
Fruit and vegetable intake							
5 or more portions a day	6179	-	-	-	-	-	1
1-4 portions a day	12607	-	-	-	-	-	**1.30 (1.18, 1.43)**

Less than 1 portion a day	1640	-	-	-	-	-	**1.86 (1.60, 2.15)**
Cigarette smoking status							
Never regular smoker	11757	-	-	-	-	-	1
Ex-regular smoker	3826	-	-	-	-	-	**1.31 (1.19,1.46)**
Current smoker	4843	-	-	-	-	-	**1.86 (1.60,2.15)**
Alcohol consumption frequency							
5-7 days a week	2679	-	-	-	-	-	1
1-4 days a week	7991	-	-	-	-	-	1.17(1.02, 1.34)
Less frequently	6170	-	-	-	-	-	**2.01(1.75, 2.30)**
Not in the last 12 months	3586	-	-	-	-	-	**2.95 (2.51,3.47)**
Physical activity							
Less than 1 day a week	4794	-	-	-	-	-	1
1-4 days a week	6667	-	-	-	-	-	**1.16 (1.02,1.31)**
5 or more days a week	5839	-	-	-	-	-	**2.60 (2.31,2.94)**
Not asked in 2005	3126						**1.46 (1.27, 1.67)**
Goodness of fit		0.370	0.538	<0.001	0.351	0.386	0.082

[a] Each model was adjusted for age group in ten year bands

[b]Equivalised household income was calculated by dividing the total household income by a household McClement score (determined according to the number, age and relationships of adults and children in the household).

[c]No self-completion: Refers to participants who chose not to answer relevant questions asked as part of the self-completion component of the Health Survey for England.

Table 3. Ethnic differences in limiting longstanding illness (LLI) for men aged 20-69: effects of explanatory variables. Odds of LLI compared to no LLI, Health Survey for England 2003-08 (N=16617)[a]

Variables	n	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 4 OR (95% CI)	Model 5 OR (95% CI)	Model 6 OR (95% CI)
Ethnicity							
White British	12808	1	1	1	1	1	1
Black Caribbean	475	0.96 (0.68, 1.35)	0.90(0.63, 1.27)	0.77(0.53, 1.12)	0.97 (0.69, 1.37)	0.90 (0.64, 1.26)	0.83(0.57,1.21)
Black African	494	**0.45 (0.28, 0.72)**	**0.43(0.27, 0.70)**	**0.30(0.17, 0.51)**	**0.41 (0.26, 0.64)**	**0.44 (0.27, 0.70)**	**0.30(0.19,0.49)**
Indian	748	**0.67 (0.51, 0.88)**	**0.72(0.54, 0.94)**	**0.65(0.49, 0.88)**	**0.66 (0.50, 0.88)**	**0.68 (0.52, 0.90)**	**0.48(0.36,0.65)**
Pakistani	577	1.19 (0.88, 1.61)	1.28(0.93, 1.75)	0.89(0.63, 1.26)	0.99 (0.70, 1.40)	1.11 (0.81, 1.52)	**0.49(0.34,0.70)**
Bangladeshi	408	1.41 (0.87, 2.28)	1.55(0.95, 2.52)	0.75(0.40, 1.40)	1.07 (0.62, 1.83)	1.22 (0.74, 2.01)	**0.45(0.26,0.77)**
Chinese	347	**0.22 (0.10, 0.48)**	**0.23(0.11, 0.48)**	**0.14(0.06, 0.45)**	**0.23 (0.10, 0.53)**	**0.21 (0.10, 0.46)**	**0.16(0.07,0.36)**
Irish	760	1.02 (0.83, 1.24)	0.97(0.79, 1.18)	0.91(0.73, 1.14)	0.91 (0.74, 1.12)	1.02 (0.84, 1.25)	0.97(0.78,1.19)
Demographics							
Marital status							
Married or cohabiting	11926	-	1	-	-	-	-
Single or separated	3626	-	**1.45(1.28, 1.64)**	-	-	-	-
Divorced	860	-	**1.65(1.39, 1.96)**	-	-	-	-
Widowed	205	-	1.02 (0.74, 1.41)	-	-	-	-
Household size							
1-2 occupants	8170	-	1	-	-	-	-
3-4 occupants	6433	-	**0.84(0.74, 1.41)**	-	-	-	-
5 or more occupants	2014	-	**0.89(0.74, 1.06)**	-	-	-	-
Socio-economic variables							
Education							
Degree or equivalent	3798	-	-	1	-	-	-
Any other education	9148	-	-	**1.30(1.13, 1.50)**	-	-	-
No qualification	3671	-	-	**1.49(1.27, 1.74)**	-	-	-
Equivalised income							
Highest quintile	3447	-	-	1	-	-	-
4th quintile	3334	-	-	1.04(0.88, 1.21)	-	-	-
3rd quintile	2825	-	-	1.18(1.00, 1.40)	-	-	-
2nd quintile	2173	-	-	**1.37(1.14, 1.65)**	-	-	-
Bottom quintile	2110	-	-	**1.53(1.26, 1.87)**	-	-	-
Don't know/refused[b]	2728	-	-	0.92(0.77, 1.11)	-	-	-
Economic activity							
In employment	12109	-	-	1	-	-	-
ILO unemployed	796	-	-	1.60(1.25, 2.05)	-	-	-
Retired	1866	-	-	**2.18(1.85, 2.56)**	-	-	-
Other economically inactive	1846	-	-	**11.18(0.95, 13.14)**	-	-	-
Psychosocial variables							
Anxiety/depression							
Not anxious or depressed	13170	-	-	-	1	-	-
Moderately	2197	-	-	-	**4.02 (3.58, 4.51)**	-	-
Extremely	258	-	-	-	**23.6 (15.9, 35.0)**	-	-
No self-completion[c]	992	-	-	-	**2.07 (15.9, 35.0)**	-	-
Social and Emotional support							
No lack	8891	-	-	-	1	-	-
Some lack	4000	-	-	-	1.12 (1.01, 1.25)	-	-
Severe lack	2734	-	-	-	**1.27 (1.12, 1.44)**	-	-
No self-completion[c]	992	-	-	-	Collinear	-	-
Community characteristics							
Community participation							
Involved in an activity	8848	-	-	-	-	1	-
Not 26nvolved in an activity	5510	-	-	-	-	**1.43 (1.30, 1.57)**	-
No answer/Refused	1267	-	-	-	-	**1.32 (1.12, 1.56)**	-
No self-completion[c]	992	-	-	-	-	**2.63 (2.10, 3.29)**	-
Social capital							
Strong	4194	-	-	-	-	1	-
Fair	4034	-	-	-	-	1.11 (0.97, 1.27)	-
Poor	7397	-	-	-	-	**1.35 (1.20, 1.51)**	-
No self-completion[c]	992	-	-	-	-	Collinear	-
Neighbourhood quality							
Excellent	4068	-	-	-	-	1	-
Good	4113	-	-	-	-	**1.20 (1.04, 1.39)**	-
Fair	5865	-	-	-	-	**1.50 (1.33, 1.70)**	-
Poor	1579	-	-	-	-	**2.54 (2.16, 3.00)**	-
No self-completion[c]	992	-	-	-	-	Collinear	-
Health behaviours							
Fruit and vegetable intake							
5 or more portions a day	4332	-	-	-	-	-	1
1-4 portions a day	10508	-	-	-	-	-	**1.13(1.01,1.26)**
Less than 1 portion a day	1777	-	-	-	-	-	**1.49(1.26,1.77)**

Cigarette smoking status							
Never regular smoker	7826	-	-	-	-	-	1
Ex-regular smoker	4301	-	-	-	-	-	**1.37(1.23,1.53)**
Current smoker	4490	-	-	-	-	-	**1.52(1.34,1.72)**
Alcohol consumption frequency							
5-7 days a week	3746	-	-	-	-	-	1
1-4 days a week	7752	-	-	-	-	-	0.98(0.87,110)
Less frequently	3085	-	-	-	-	-	**1.54(1.35,1.76)**
Not in the last 12 months	2034	-	-	-	-	-	**2.69(2.24,3.24)**
Physical activity							
Less than 1 day a week	5308	-	-	-	-	-	1
1-4 days a week	4505	-	-	-	-	-	**1.35(1.19,1.54)**
5 or more days a week	4230	-	-	-	-	-	**3.22(2.83,3.67)**
Not asked in 2005	2574	-	-	-	-	-	**1.62(1.41,1.87)**
Goodness of fit		0.541	0.426	**<0.001**	0.887	0.846	**0.001**

[a] *Each model was adjusted for age group in ten year bands*

[b] *Equivalised household income was calculated by dividing the total household income by a household McClement score (determined according to the number, age and relationships of adults and children in the household).*

[c] *No self-completion: Refers to participants who chose not to answer relevant questions asked as part of the self-completion component of the Health Survey for England.*

Table 4. Ethnic differences in limiting longstanding illness (LLI) for Women aged 20-69: effects of explanatory variables. Odds of LLI compared to no LLI, Health Survey for England 2003-08 (N=20462)[a]

Variables	n	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
		OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Ethnicity							
White British	15662	1	1	1	1	1	1
Black Caribbean	784	1.02 (0.81, 1.27)	0.88(0.70, 1.10)	0.94(0.74, 1.19)	0.96 (0.76, 1.21)	0.92 (0.72, 1.16)	0.96(0.76, 1.21)
Black African	592	**0.43(0.29, 0.64)**	**0.39(0.27 0.57)**	**0.34(0.22, 0.50)**	**0.40 (0.27, 0.60)**	**0.39 (0.27, 0.58)**	**0.32(0.22, 0.48)**
Indian	881	0.79(0.63, 1.01)	0.83(0.66, 1.06)	**0.70(0.55, 0.88)**	**0.75 (0.59, 0.96)**	**0.74 (0.58, 0.95)**	**0.58(0.45, 0.75)**
Pakistani	670	**1.61(1.23, 2.09)**	**1.68(1.29, 2.19)**	0.87(0.67, 1.14)	1.31 (0.99, 1.73)	**1.40 (1.07, 1.84)**	0.93(0.70, 1.22)
Bangladeshi	471	1.09(0.60, 2.00)	1.16(0.63, 2.13)	**0.50(0.28, 0.90)**	1.01 (0.57, 1.82)	0.89 (0.48, 1.64)	0.55(0.27, 1.13)
Chinese	398	**0.32(0.14, 0.71)**	**0.31(0.14, 0.70)**	**0.27(0.11, 0.65)**	**0.30 (0.13, 0.69)**	**0.32 (0.14, 0.72)**	**0.29(0.13, 0.64)**
Irish	968	0.83(0.69, 1.00)	**0.80(0.66, 0.96)**	0.86(0.71, 1.03)	**0.82 (0.68, 0.99)**	0.85 (0.70, 1.02)	0.84(0.70, 1.02)
Demographics							
Marital status							
Married or cohabiting	13973	-	1	-	-	-	-
Single or separated	3957	-	**1.45(1.29, 1.64)**	-	-	-	-
Divorced	1641	-	**1.68(1.48, 1.90)**	-	-	-	-
Widowed	855	-	**1.45(1.22, 1.73)**	-	-	-	-
Household size							
1-2 occupants	9778	-	1	-	-	-	-
3-4 occupants	8164	-	**0.84(0.77, 0.93)**	-	-	-	-
5 or more occupants	2484	-	0.89(0.77, 1.04)	-	-	-	-
Socio-economic variables							
Education							
Degree or equivalent	3818	-	-	1	-	-	-
Any other education	11527	-	-	1.01(0.89, 1.14)	-	-	-
No qualification	5081	-	-	**1.27(1.11, 1.47)**	-	-	-
Equivalised income							
Highest quintile	3501	-	-	1	-	-	-
4th quintile	3648	-	-	**1.21(1.05, 1.40)**	-	-	-
3rd quintile	3521	-	-	**1.33(1.15, 1.55)**	-	-	-
2nd quintile	3139	-	-	**1.76(1.50, 2.07)**	-	-	-
Bottom quintile	3177	-		**2.00(1.71, 2.33)**	-	-	-
Don't know/refused[b]	3440	-		**1.24(1.06, 1.44)**	-	-	-
Economic activity							
In employment	12056	-	-	1	-	-	-
ILO unemployed	593	-	-	**1.34(1.02, 1.76)**	-	-	-
Retired	2551	-	-	**2.18(1.87, 2.54)**	-	-	-
Other economically inactive	5226	-	-	**2.84(2.59, 3.12)**	-	-	-
Psychosocial variables							
Anxiety/depression							
Not anxious or depressed	15246	-	-	-	1	-	-
Moderately	3706	-	-	-	**3.19 (2.90, 3.52)**	-	-
Extremely	412	-	-	-	**12.3 (9.44, 15.91)**	-	-
No self-completion[c]	1062	-	-	-	**2.38 (1.89, 2.98)**	-	-
Social and Emotional support							
No lack	12849	-	-	-	1	-	-
Some lack	4251	-	-	-	1.11 (1.01, 1.23)	-	-
Severe lack	2264	-	-	-	**1.28 (1.13, 1.45)**	-	-
No self-completion[c]	1062	-	-	-	Collinear	-	-
Community characteristics							
Community participation							
Involved in an activity	10843	-	-	-	-	1	-
Not inolved in an activity	7048	-	-	-	-	**1.17 (1.08, 1.27)**	-
No answer/Refused	1473	-	-	-	-	1.11 (0.96, 1.30)	-
No self-completion[c]	1062	-	-	-	-	**3.08 (2.43, 3.91)**	-
Social capital							
Strong	5367	-	-	-	-	1	-
Fair	5749	-	-	-	-	**1.34 (1.21, 1.50)**	-
Poor	8248	-	-	-	-	**1.62 (1.46, 1.79)**	-
No self-completion[c]	1062	-	-	-	-	Collinear	-
Neighbourhood quality							
Excellent	5493	-	-	-	-	1	-
Good	5170	-	-	-	-	**1.14 (1.02, 1.28)**	-
Fair	6892	-	-	-	-	**1.47 (1.33, 1.63)**	-
Poor	1809	-	-	-	-	**2.41 (2.08, 2.80)**	-
No self-completion[c]	1062	-	-	-	-	Collinear	-
Health behaviours							
Fruit and vegetable intake							
5 or more portions a day	6179	-	-	-	-	-	1
1-4 portions a day	12607	-	-	-	-	-	1.04(0.95, 1.14)

Less than 1 portion a day	1640	-	-	-	-	-	**1.37(1.17, 1.59)**
Cigarette smoking status							
Never regular smoker	11757	-	-	-	-	-	1
Ex-regular smoker	3826	-	-	-	-	-	**1.32(1.19, 1.45)**
Current smoker	4843	-	-	-	-	-	**1.61(1.47, 1.78)**
Alcohol consumption frequency							
5-7 days a week	2679	-	-	-	-	-	1
1-4 days a week	7991	-	-	-	-	-	**1.09(0.96, 1.24)**
Less frequently	6170	-	-	-	-	-	**1.62(1.43, 1.84)**
Not in the last 12 months	3586	-	-	-	-	-	**2.43(2.09, 2.83)**
Physical activity							
Less than 1 day a week	4794	-	-	-	-	-	1
1-4 days a week	6667	-	-	-	-	-	**1.20(1.07, 1.36)**
5 or more days a week	5839	-	-	-	-	-	**2.41(2.14, 2.71)**
Not asked in 2005	3126	-	-	-	-	-	**1.46(1.27, 1.67)**
Goodness of fit		0.587	0.190	**<0.001**	0.167	0.913	**<0.001**

[a] Each model was adjusted for age group in ten year bands

[b]Equivalised household income was calculated by dividing the total household income by a household McClement score (determined according to the number, age and relationships of adults and children in the household).

[c]No self-completion: Refers to participants who chose not to answer relevant questions asked as part of the self-completion component of the Health Survey for England.