Discrimination makes me Sick!

Establishing a relationship between discrimination and health

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Abstract:

The attitudes of the general British population towards Muslims changed post 2001, and this change led to a significant increase in Anti-Muslim discrimination. We use this exogenous attitude change to estimate the causal impact of increased discrimination on a range of objective and subjective health outcomes. The difference-in-differences estimates indicate that discrimination worsens blood pressure, cholesterol, BMI, self-assessed general health, and some dimensions of mental health. Thus, discrimination is a potentially important determinant of the large racial and ethnic health gaps observed in many countries. We also investigate the pathways through which discrimination impacts upon health, and find that discrimination has a negative effect on employment, perceived social support, and health-producing behaviours. Crucially, our results hold for different control groups and model specifications.

Keywords: Racism, Discrimination, Muslim, September 11th, Terrorist attacks, Racial disparities, health outcomes

All mistakes and/or omissions are owned by the authors. Please email David Johnston (david.johnston@monash.edu) or Grace Lordan (glordan@tcd.ie) with questions or comments on this manuscript.

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1. Introduction

Large racial and ethnic health gaps exist in many developed countries (McKenzie, 2003). For example, in 2006 the at-birth life expectancy for white American men was 75.6 years and for black American men was 69.2 years (Arias, 2010). The most common explanation for these health gaps is that minority groups have lower socioeconomic status, and therefore different health inputs (e.g. higher smoking rates), and a lower ability to purchase medications and medical procedures when required (Smith and Kington, 1997). A related explanation is that the combination of residential segregation and lower socioeconomic status leads to lower quality hospitals and medical personnel in areas with higher proportions of minorities (House and Williams, 2000; Escarce and Kapur, 2003). Another potentially important determinant of racial and ethnic health gaps is discrimination. Discrimination is hypothesised to induce physiological and psychological arousal, which can have a deleterious effect on health. However, it is unknown whether this hypothesised determinant of racial health gaps is empirically important, because thus far relatively few empirical studies have focused on the discrimination-health relationship. The studies that do exist come almost exclusively from the public health literature, and although the majority find that discrimination has a significant negative effect on health, causality is rarely established. Moreover, a review of the literature found that every study had "at least one serious methodological limitation such as a small sample size, a limited number of statistical analyses, inadequate controls for potential confounders, inadequate assessment of discrimination or health status (or both), and reliance on cross-section data" (Williams et al., 2003, p.202). Considering the large racial disparities in health outcomes, and the potential role that discrimination plays in generating these disparities, the lack of thorough empirical research on the discrimination-health relationship is a major oversight. In this paper, our aim is to establish whether there is a causal impact of discrimination on health outcomes. In particular, we estimate the health effects of the recent increase in discrimination against Muslims residing in the United Kingdom.[1]

To date, a large proportion of discrimination-focused papers in the economics literature estimated the impact of discrimination on labour market outcomes. Of particular relevance are a group of recent papers examining the effects of anti-Muslim and anti-Arab discrimination (Aslund and Rooth (2005); Braakmann 2007a, 2007b; Davila and Mora 2005; Kaushal et al 2007; Rabby and

[1] In this work we consider discrimination to be the treatment of one particular group of people less favorably than others because of their race, color, nationality, or ethnic or national origin. In Britain the law recognizes two types of racial discrimination. These are direct and indirect discrimination. Direct discrimination occurs when race, color, nationality, or ethnic or national origin is used as an explicit reason for discriminating. Indirect discrimination occurs when there are rules, regulations or procedures operating, which have the effect of discriminating against certain groups. This may be subtle. In our work both of these two types of discrimination are subsumed under one effect of discrimination on health outcomes.

Rodgers III (2010)). For example, Braakmann (2007b) estimates the effect of terrorist events on the labour market outcomes of 16 to 64 year old UK Arab and Muslim men, and finds that the increase in discrimination had no significant effects. Another UK example is Rabby and Rodgers III (2010), who analyse the effect of discrimination on 16 to 25 year old Muslim men. They find a 9% to 11% relative decrease in employment for this group post September 11th 2001 (9/11), and a 10% decrease post the 2005 London underground bombings. A prominent US study is Kaushal et al (2007) who find that the relative wages and weekly earnings of Arab and Muslim men declined by between 9% and 11% post 9/11. The authors find no impact with respect to employment status or hours.

We know of only one public health paper (Lauderdale, 2006) that considers the health impacts of discrimination against Muslims. Specifically, Lauderdale (2006) explores whether there was an effect on the birth outcomes of Arab named mothers in California after 9/11. The author estimates logit regression models of low birth weight before and after 9/11, and finds that the estimated effect of being an Arab-named mother, compared to being a non-Hispanic white mother, was insignificant pre 9/11 and significantly positive post 9/11. Lauderdale concludes that this result is consistent with the hypothesis that ethnicity-related stress or discrimination during pregnancy worsens birth outcomes.

To our knowledge our work here is the first economics paper to consider the impact of discrimination on health outcomes in any context, although the role of statistical discrimination in access and quality of healthcare has been considered (Balsa and McGuire, 2001). One reason for the lack of research on the discrimination-health relationship is the empirical difficulties that must be overcome. Most importantly, establishing a causal relationship between discrimination and health outcomes is complicated by the many factors that influence an individual's health that are also correlated with their race and ethnicity. These factors include job availability and quality (Huffman and Cohen, 2004), access to and quality of care (Bach et al., 1999; Canto et al, 2000 and Shapiro et al, 1999) and spatial segregation (William and Collins, 2001; Jargowsky, 1997 and Massey and Fong, 1990). For many of these variables it is near impossible to find an accurate proxy measure in datasets because of their intangible nature. If there are omitted variables in a health outcomes regression that are correlated with discrimination and health, the estimated impact of discrimination is biased. This is particularly true if the values of the variables are driven by self-selection, which may occur when choosing a housing location or a particular job.[2]

[2] Some experimental research has successfully established causality. For example, Armstead et al (1989) and McNelly et al (1995) showed in an experimental framework that viewing racist behaviour elevates blood pressure. Other experimental examples include Sutherland and Harrell (1986).,

Another empirical difficulty arises from an inability to measure an individual's exposure to discrimination. Most existing research has examined the cross-sectional relationship between *perceived* discrimination and health, where perceived discrimination is measured through survey questions such as "Now, thinking over your whole life, have you ever been treated unfairly or badly because of your race or ethnicity" (Gee, 2002). However, there is a problem with using such survey questions, because the language used can generate reporting bias (Gomez and Trierweiler, 2001), and further, this bias may be associated with socioeconomic status and psychological characteristics (Meyer, 2003). If reported discrimination differs from true discrimination, estimates of the discrimination-health relationship will be biased, especially if the measurement error is related to individual level characteristics.

To overcome the empirical difficulties, we use data on the health of Muslims residing in the UK and apply a difference-in-differences analysis. This analytical approach compares the change in the health of Muslims between 1999 and 2004, with the change in the health of a comparable population over the same time period. We argue that over this 5-year period there was a significant increase in anti-Muslim discrimination, and that any observed changes in the relative health of Muslims during this period is due to this increase. The difference-in-differences estimates indicate that discrimination has a significantly negative impact on a range of objective and subjective health outcomes. Importantly, we find that the results hold for different control groups and model specifications.

Along with establishing a causal link between discrimination and health, we provide evidence on some possible pathways through which discrimination may act upon health. Again, applying a difference-in-differences analysis, we find that discrimination worsens labour market outcomes (predominantly part-time employment), perceived social support, and health-producing behaviours. We see this as an important contribution to the literature as thus far little research has been devoted to understanding the mechanisms and processes that may be driving the discrimination-health relationship. It also provides additional evidence for the large literature that examines the impact of discrimination on labour market outcomes.

This paper continues with sections that describe the observed increase in anti-Muslim discrimination and the transmission mechanisms through which discrimination may negatively impact health. Following are sections that describe the data and detail the empirical methodology.

Morris-Prather et al (1996) and Kinzie et al (1998), which also find a negative association between discrimination and health outcomes. Of course, experiments of this nature involve small samples and are thereby limited in their generalizability.

These are then followed by the main results and the robustness checks. The paper concludes with a discussion.

2. Background

2.1. Anti-Muslim Discrimination in the UK

Over the past decade the perceptions of Muslims in the UK have changed for the worse, and this change has led to increases in acts of discrimination against Muslims and in Muslims' own perceived levels of discrimination. The negative shock to perceptions began in early 2001, prior to the global upsurge in terrorism, with a series of riots in Bradford, Burnley and Oldham in May, June and July respectively. These riots largely involved men of Pakistani and Bangladeshi (in Oldham) origin in response to mobilizations by the British National Party (BNP) (Baggeley and Hussain; 2005) and the Runnymede Trust Report (2000) (Allen et al, 2005), and were said to be the worst outbreak of urban violence since the 1980's (Bagguley and Hussain; 2005). As such, the riots received a significant level of media attention.

Perceptions worsened further on September 11th 2001, when planes were flown into the Twin Towers in New York and the Pentagon, and over 3,000 people died. The 9/11 suicide attacks were co-ordinated by al-Qaeda, a group of activists that are largely of the Sunni Muslim religion. Two additional large scale terrorist attacks between 2001 and 2004 also negatively affected perceptions. The first occurred on 12th of October 2002 in a tourist district in Bali that was frequented by British, Australian and American tourists. The attack killed and injured 202 and 240 people respectively. The second attack occurred on the 11th of March 2004 in Madrid when ten bombs exploded on four morning rush-hour commuter trains, killing 191 people and injuring more than 1,800 others. Along with these two large attacks, occurrences of smaller attacks by Muslim extremists outside western countries also continued to make headlines (e.g. the Casablanca attacks in May 2003 and a suicide bomb attack in Netanya in March 2002).

During this period, the media greatly increased its coverage of Muslims and Islam (Poole, 2001 and Whittaker 2002), and many of the articles focused on Muslims as an out-group in Britain and promoted negative stereotypes (Muir and Smith, 2004). Pakistani and Bangladeshi communities in particular have been represented in the British media as separatist, insular and unwilling to integrate with wider society (Saeed, 2007). This has led to the widespread tendency to associate Muslims with terrorism post 2001 (Epstein, 2007; Forum Against Islamophobia and Racism, 2004a, 2004b; Human Rights Watch, 2007).

The series of terrorist attacks and the associated media coverage resulted in the deterioration of relations between British Muslims and other British residents, even though the majority of British Muslims condemned all attacks. This in-turn led to a significant increase in the level of harassment and attacks against Muslims (Modood, 2005). The enforcement of anti-terrorism legislation also led to the victimisation and stigmatisation of the Muslim community (Forum against Islamophobia and Racism; 2004a). A survey of British Muslims in 2002 indicated that 82.6% of respondents felt an increase in racism and 76.3% felt an increase in discriminatory experiences (Sheridan, 2006). Importantly, the level of harassment against Muslims increased across time, rather than reverting back to pre-2001 levels. For example, in 2003 there was a 12% increase in the number of hate crimes received by prosecutors (equalling 4,200 in total), and Islam was the "actual or perceived" religion of the victim in 10 out of the 18 cases.[3]

In this paper we focus on the impact of discrimination against Muslim Pakistanis and Bangladeshis. In 2001, 43% of the UK Muslim population were Pakistani and 16% were Bangladeshi (Office of National Statistics, 2004), therefore these groups represent a majority population of Muslims in the UK, and have become the primary recipients of anti-Muslim sentiment in Britain (Allen et al, 2005). We do not differentiate between types of Islamic faith (e.g. Sunni, Shiites, etc.), because even though the attacks detailed above were carried out largely by Sunni Muslims, the evidence suggests that the media and most British residents treat Muslims as a homogeneous group (Akbarzadeh and Smith, 2005; Halliday, 1999; Poole, 2002; Runnymede Trust, 1997; Sardar and Davis, 2002). [4]

2.2. Potential Health Effects of Discrimination

As discussed in section 2.1, incidences of hate crimes against Muslims have grown since 2001, and it is clear that the victims of these crimes (including their friends and family) will have experienced increased stress levels. However, Muslims in the UK that have not been directly exposed to discrimination may also have experienced increased stress levels, as the rise in hate crimes will have caused an increase in concern about events that could occur. That is, perceptions of racism and discrimination do not have to be objectively real to create stress. Another pathway in which

[3] Figures are from the Crown Prosecution Service, which is responsible for prosecuting criminal cases investigated by the police in England and Wales.
4 In addition, although recent work suggests that Muslim Pakistani's and Bangladeshis residing in Britain do not stand out as having a lower British identity in comparison to other ethnic groups who have come to Britain, evidence from the 2003 British Social Attitudes Survey highlights that only 9% of the non-Muslim respondents disagreed with the statement that 'Muslims are more loyal to Muslims than to Britain'(Manning and Roy, 2010). These findings led the authors to speculate that 'a more serious culture clash may be the refusal of the majority population to see minorities as British and it is this culture clash that we investigate in this work.

discrimination can impact on stress levels is termed 'internalized racism'. Internalization of racism occurs when a marginalized social group accepts their cultural stereotypes (Jones, 2000). Internalization of such stereotypes has negative impacts on self-worth and identity (Wyatt et al, 2003), and has the potential to increase the stress levels of any group that is subject to discrimination. For each of these stated reasons, it is expected that overall stress levels were higher among the Muslim population in 2004 than in 1999, all else being equal.

Stress has the potential to damage the body by activating physiologic systems, a fact first recognized by Selye (1936). Through allostasis, the autonomic nervous system, the hypothalamic–pituitary–adrenal (HPA) axis, and the cardiovascular, metabolic, and immune systems protect the body by responding to internal and external stress (McEwen, 1998). During a stressful event there is a rapid activation of the sympathoadrenal system and the hypothalamic-pituitary adrenocortical giving rise to behavioral and physiological responses calculated to help an individual survive (Vanitallie, 2002). Usually, in episodes of low stress or those that pass quickly, this response is protective, enhancing immune functions, promoting memory of dangerous events, increasing blood pressure and heart rate to meet the physical and behavioral demands of fight or flight, and making fuel more readily available to sustain intensified activity. If stress does not pass quickly, however, the exposure to the increased secretion of stress hormones can result in allostatic load (McEwen and Stellar, 1993), which is associated with negative health consequences. Firstly, those with elevated stress levels experience surges in blood pressure (McEwen, 1998). Overtime, these surges may result in myocardial infarction (Mullar and Tofler, 1990).

A positive association between discrimination and blood pressure has been found by James et al. (1994), Dressler (1990) and Guyll et al. (2001); though in contrast, Williams and Neighbors (2001) and Poston et al (2001) found no significant association. Importantly, most studies that examine the effects of discrimination on blood pressure have not focused on establishing causality. The main exceptions are researchers who have used laboratory experiments to link racism and discrimination to a blood pressure response. For example, Guyll et al (2001) found an increase in diastolic blood pressure in response to a speech stressor for individuals who had reported having experienced discrimination.

Stress attributed to discrimination may also cause weight gain. Specifically, it is hypothesized that stress results in neuroendocrine-autonomic dysregulation, which in turn influences the accumulation of excess body fat (Rosmond and Bjorntorp, 1998). In addition to this mechanism, it is plausible that individuals may overeat as a coping mechanism. There are many examples in the literature that find an association between discrimination and weight. In a study by Tull et al. (1999) internalized racism is found to be significantly correlated with waist circumference. Cozier et al

(2010) find that weight increases as levels of discrimination increase. Positive associations are also found by Butler et al, 2002; Chambers et al, 2000; Gee et al, 2008 and Vines et al, 2007.

Long-term stress also leads to a suppressed immune defense that may allow the progression of some tumors (Reiche et al, 2004) and a lower pain threshold that may allow the progression of muscular skeletal pain disorders (Blackburn-Munro and Blackburn-Munro, 2001). It is therefore intuitive that there may be an impact on general health status. To this end, many studies have found that discrimination impacts on global health status negatively (for example Schulz et al, 2000; Karlslen and Nazroo, 2002.

The area explored the most within the racism and health literature is the association between mental health and racial discrimination (Williams et al, 2003 show that of 53 studies in their systematic review, 32 include at least one measure of mental health). Dysfunction of the hypothalamic-pituitary-adrenal (HPA) axis that may be experienced during periods of prolonged stress is also suggested as a contributor to psychiatric diseases such as depression (de Kloet et al, 2005). In general, the evidence from the literature supports an association between discrimination and mental health (for example et al Gee, 2006; Diaz et al, 2001 and Finch et al, 2000).

The medical literature indicates that the stress from discrimination may cause high blood pressure, unhealthy levels of BMI, and lower general health and mental health. Thus, we consider each of these measures of health status in our empirical analysis. In addition, we also consider the effect of discrimination on cholesterol levels. Given the medical link between discrimination and blood pressure and weight gain, it is reasonable to expect that discrimination may also negatively affect an individual's cholesterol levels.

3. Method, Data and Descriptives

3.1. Difference-in-Differences and the Specification of Treated and Control Groups

We estimate the effect of discrimination on health by comparing changes in the health of Muslims living in England before and after the recent upsurge in terrorism, with changes in the health of a similar non-Muslim population. The Muslim population is called the treated group and the similar population the control group; the empirical approach is called difference-in-differences (DD). A comparison of health changes in the treated group with health changes in the control group is necessary, because unobserved time-varying factors unrelated to increases in discrimination may have affected the health of the treated group. The potential estimation bias caused by changes in circumstances unrelated to discrimination is controlled for so long as the control group is affected by changes in circumstances in a similar way as the treated group. This fundamentally untestable

assumption is called the common trends assumption, as it requires the trend in the health of the treated and control groups to have been the same in the absence of any anti-Muslim discrimination. We use multivariate regression analysis to estimate the DD effect:

(1) $$Health_i = \beta_0 + \beta_1 Treated_i + \beta_2 After_i + \beta_3 Treated_i \cdot After_i + X_i'\beta_4 + \varepsilon_i$$

where $Health_i$ represents a health outcome for individual i, $Treated_i$ an indicator for belonging to the treated group, $After_i$ an indicator for being surveyed after the terrorist attacks, X_i a vector of individual-level characteristics used to control for observed time-varying factors, and ε_i a random error term. The DD effect is given by β_3, the coefficient on the interaction term.

To estimate regression equation (1) we require data that contains information on health, and ethnicity and religion, before and after recent terrorist attacks. Furthermore, the data should contain sufficiently large numbers of treated and control group observations. The 1999 and 2004 versions of the Health Survey for England (HSE) satisfy these criteria nicely. The HSE began in 1991 and is an annual survey designed to monitor trends in the nation's health. The unit of survey is the household, and information is collected from both adults and children. Importantly, information is collected through a combination of a face-to-face interview, a self-completion questionnaire and a medical examination conducted by a qualified nurse. Using the Postcode Address File as a sampling frame, the HSE is considered to be representative of England (Erens et al., 2001).

We use data from the 1999 and 2004 surveys because in these years the HSE over-sampled ethnic minorities. More specifically, the surveys contained two parts: a general population sample that followed the same pattern as in other years; and a minority ethnic 'boost' sample, designed to yield interviews with members of seven large minority ethnic groups in England: Black Caribbean, Black African, Indian, Pakistani, Bangladeshi, Chinese and Irish (for additional details see Erens et al., 2001). The ethnic boost sample is an important feature because it's crucial for our analysis that we have sufficiently large samples of Muslims and similar non-Muslims. Other large scale British surveys, for example the British Labour Force Survey and the British Household Panel Survey, have far fewer useful observations than the 1999 and 2004 HSE. Given the over sampled ethnic groups and the survey information on religious affiliation, we define our treated group as Muslim Pakistanis and Bangladeshis.[5] As discussed in Section 2.1, Pakistani and Bangladeshi Muslims make up the majority of the Muslim population in the UK, and have experienced significant increases in discrimination since 2001.

[5] Ethnicity is assessed with the question: "What is your cultural background?". Religion is assessed with the question: "What is your religion or church?".

The criterion utilized to form the control group is integral to the DD estimation approach. In our context the control group should have similar health inputs as Muslim Pakistanis and Bangladeshis, in the hypothetical absence of terrorism-related discrimination.[6] For example, the control group should have similar knowledge of the UK health system, live in similar neighborhoods, and have similar health behaviors (e.g. diet, smoking, exercise). For this reason, we use as our controls non-Muslim individuals who are most similar to Muslim Pakistanis and Bangladeshis, namely non-Muslim Indians. Previous labor market discrimination papers have omitted Indians from their control groups because Indians are too similar to Pakistanis and Bangladeshis, and so may have also suffered from anti-Muslim discrimination. (see Kaushal et al., 2007 and Braakmann, 2010). If non-Muslim Indians also suffer from discrimination, then estimated DD effects under-estimate the true causal effects. Notwithstanding this limitation, we believe that non-Muslim Indians are still the best control group. Firstly, we believe that minimizing the risk of breaking the common trend assumption is more important than minimizing the risk of having downwards biased estimates. Braakmann (2010) conducts a pseudo-intervention DD analysis and finds "strong evidence against the common trend assumption" for an employment outcome, when using both UK natives, and (non-Indian) migrants from Africa, Asia, South America and the Caribbean as controls. Similarly, Kaushal et al. (2007) find evidence against the common trend assumption for women in their US study. Secondly, unlike labor market outcomes, discrimination can harm an individual's health without the individual directly experiencing discrimination. For example, a Muslim may experience stress because of comments made against Muslims in the media or because of reports of discrimination against Muslims (see Section 2.2); however, it is unlikely that any other group would experience this stress. Thus, visual and behavioural similarities between the treatment groups are less important for health outcomes than they are for labor market outcomes.

Aside from systematic differences in treatment groups, the most common source of bias in DD analyses occurs when changes in migration patterns cause the composition of the treated or control groups to change across time. In our case, the concern is that the treated group (Muslim Pakistanis and Bangladeshis) changed over time because changes in security policies or migration rules made migration to England more difficult.[7] However, this should not be problematic because Indians are likely to have suffered equally from any changes to migration rules. In addition, even if changes to migration rules restricted Pakistani and Bangladeshi migration more than Indian

[6] More correctly, the treated and control groups should have similar time trends in their health inputs, in the hypothetical absence of discrimination changes. However, it is difficult to believe that the counterfactual *trends* in health inputs are likely to be identical between treatment groups that have substantially different *levels* of health inputs.

[7] 80% of the treated group and 77% of the control group are immigrants. Of these treated and control immigrant groups, the average number of years spent living in the UK are 20 and 24 years, respectively. Roughly, 13% and 12% of these immigrant groups have resided in the UK for less than five years.

migration, the likely result is that migration from Pakistan and Bangladesh became more positively selected. In other words, any tightening of migration rules against our treated group would work to increase the health of our treated group across time. Given our findings of negative health effects, any migration bias would therefore work to make our estimates less negative.

3.2. Objective, Mental and General Health Outcomes

Another advantage of the HSE is that for consenting individuals it contains health information collected by a nurse.[8] The nurse interview involved anthropometric measurements, blood pressure tests, the collection of blood and saliva samples (which were sent to a laboratory for analysis), and the recording of prescribed medications. We use this information to construct three health outcomes: systolic blood pressure (mmHg), diastolic blood pressure (mmHg), and total cholesterol (mmol/L). These outcomes are generally accepted by clinicians as measures of a person's underlying health. We also use nurse collected height and weight measurements to construct individuals' body mass index (BMI), which equals weight in kilograms divided by squared height in meters. As discussed in Section 2.2, discrimination can increase an individual's stress levels and subsequently their allostistic load, and so there is a direct biological pathway between discrimination and deterioration in these particular health outcomes.

Mental health is another health dimension that is potentially affected by discrimination. We measure mental health using the 12-item version of the General Health Questionnaire (GHQ) contained in the self-completion questionnaire of the HSE. The GHQ is a commonly used self-reported measure of mental health and consists of questions regarding the respondent's emotional and behavioural health over the past few weeks. The 12 items in the GHQ are: ability to concentrate, sleep loss due to worry, perception of role, capability in decision making, whether constantly under strain, problems in overcoming difficulties, enjoyment of day-to-day activities, ability to face problems, whether unhappy or depressed, loss of confidence, self-worth, and general happiness. For each of the 12 items the respondent indicates on a four-point scale the extent to which they have been experiencing a particular symptom. For example, the respondent is asked 'have you recently felt constantly under strain', to which they can respond: not at all (0), no more than usual (1), rather more than usual (2), much more than usual (3). As our primary mental health measure we use the

[8] Approximately 85% of our sample consented to the nurse visit and approximately 60% completed the nurse interview, which occurred within 2 weeks of the initial face-to-face interview. From this group, approximately 75% consented to having a blood sample taken during the nurse's visit.

respondents mean response.[9] In addition, we consider some individual GHQ items that are most likely to be affected by stress and thereby discrimination.

Figure 1 presents the mean changes in our four objective health measures along with our mental health measure between 1999 and 2004 for our control group and our treated group (each outcome is standardized for ease of comparison). It appears that for the control group, blood pressure (BP) and mental health improved, BMI did not change and cholesterol worsened. Conversely, for the treated group BP and mental health are roughly constant, whereas BMI and cholesterol worsened. Overall, the impression is that the health of the treated group worsened *relative* to the control group.

Our final two health outcomes are self-assessed general health measures. The first is based on the question "How is your health in general? Would you say it was very good, good, fair, bad or very bad?" We create a binary variable by assigning a value of one to those in bad or very bad health, and zero otherwise. The second general health measure is based on the question "Now I'd like you to think about the two weeks ending yesterday. During those two weeks did you have to cut down on any of the things you usually do about the house or at work or in your free time because of illness or injury?" The outcome variable equals one if the respondent has cut down on activities due to poor health, and zero otherwise.

The means and standard deviations for each of our objective, mental and general health outcomes are presented in Table 1 by treatment group. Table 1 also presents descriptive statistics for some potential intermediate outcomes (discussed in Section 4.4) and a sub-set of our control variables. The statistics are calculated for treated and control groups aged 18 years and older with non-missing BMI information and non-missing control variable information. Importantly, our estimation samples vary in size across the different health outcomes. For example, we have 6292 treated and control observations with self-assessed general health information (collected during the initial face-to-face interview) and 2464 with valid cholesterol information (collected via a blood test during the nurse interview). The variation in sample sizes across the health outcomes is due to non-response in survey questions, not consenting to the nurse visit or to particular elements of the nurse interview, and not returning valid measurements. For example, BP measurements were not taken from pregnant women and invalid BP measurements occurred if a respondent had eaten, smoked, drunk alcohol or undertaken vigorous exercise in the last 30 minutes.

[9] Averaging the 12 responses is equivalent to the more common approach of summing the 12 responses (the coefficients will simply differ by a factor of 12). We have used the former so that the scale is equal to the scale of individual GHQ items, which we also use as outcomes.

Clearly, there exists a potential for non-random selection into our estimation samples, particularly into those that require non-missing nurse-collected health information. However, if the selection mechanism is relatively stable across sample years, then any sample selection effects should have little impact on our difference-in-differences estimates. Furthermore, if we restrict the samples to be identical for all health outcomes, we obtain estimates that are quantitatively similar to those we present.

The sample means for our control variables suggest that the control group – non-Muslim Indians – is older, better educated and more likely to live in suburban areas than the treated group – Muslim Pakistanis and Bangladeshis. For example, the average age is 42 in the control group and 37 in the treated group, and 31% of the control group live in non-suburban areas compared to 65% of the treated group. Fixed differences between the treatment groups are controlled for implicitly in the DD approach; however, time-varying treatment group differences can cause estimation bias. Importantly, in Section 4.2 we test whether the differences between treatment groups are important for our DD analysis, and find that our estimates are robust.

4. Results

4.1. Main Difference-in-Differences Estimates

Table 2 presents the DD estimates for our objective, mental and general health outcomes. Each row corresponds to regression equation (1) for a different health outcome, with only the coefficient on the treatment indicator (β_3) presented, i.e. the coefficient on the interaction between indicators for being surveyed in year 2004 and being a Muslim Pakistani or Bangladeshi. Each regression model also includes covariates representing: the year is 2004, an individual is Muslim Pakistani or Bangladeshi, an individual's age and their age squared, an individual's gender (male = 1), country of birth, how long the individual has lived in the UK, the individual's level of English proficiency, whether or not the individual is a degree holder (yes = 1), whether the individual has an urban or rural residence (yes = 1), and eight geographical region dummies (North East, North West, Yorkshire, West Midlands, East Midlands, Eastern, South East and South West, with London omitted). The coefficients for the control variables are not presented, but have the expected sign. That is, health outcomes are significantly worse for males, older individuals, immigrants, those who speak English poorly, and the less educated.

The first four rows of Table 2 show that the objective health of Muslim Pakistanis and Bangladeshis significantly worsened relative to non-Muslim Indians between 1999 and 2004.

Specifically, systolic blood pressure worsened by 3.1 mmHg, diastolic blood pressure worsened by 2.4 mmHg, BMI worsened by 0.52 units, and total cholesterol worsened by 0.21 mmol/L. These quantities are statistically significant, and of a meaningful magnitude. To demonstrate the latter, we re-estimate the DD models with binary outcomes representing unhealthy levels of blood pressure, BMI and cholesterol: (i) systolic BP > 140 or diastolic BP > 90; (ii) BMI > 25; and (iii) total cholesterol > 5. The estimated increases in the probability of being above these three cut-offs equal 6.4 percentage points (t = 2.41), 5.1 percentage points (t = 1.86) and 8.6 percentage points (t = 2.14), respectively.

Rows 5 to 8 in Table 2 report the estimated effects of discrimination on mental health. Row 5 shows that the average GHQ response of Muslim Pakistanis and Bangladeshis did not significantly worsen or improve relative to non-Muslim Indians: the estimated effect equals 0.03, which is around 7% of a standard deviation, and it has a t-statistic of 1.3. To better understand this unexpectedly small mental health effect we estimate our DD model for 3 of the 12 GHQ items that we would expect discrimination to most strongly affect: unable to enjoy normal day-to-day activities, losing confidence in yourself, and thinking of yourself as a worthless person. For the latter two statements, rows 7 and 8, we find significant effects, indicating that there was an increase in the propensity to have low self-confidence.[10] Therefore, it seems that the increase in discrimination has affected the psychology of Muslim Pakistanis and Bangladeshis, but it has not done so in such a way as to increase the occurrence of mental illness. This finding, however, comes with the qualification that the GHQ items refer to behavior and emotions over the past few weeks as compared with normal levels, and so may not be the best measure of mental illness symptoms that people have experienced for months or years.

Rows 9 and 10 in Table 2 present DD estimation results for the two self-assessed general health measures described earlier. We do not consider these self-assessed measures to be as reliable as our objective health measures[11]; however, they are frequently used in empirical health literature and so provide useful comparisons with other studies. Furthermore, it can be argued that over and above an individual's true health status, how someone feels about their own health is an important outcome, as it is a primary driver of one's quality of life. The estimated DD effects for both self-assessed measures show a negative impact, which is consistent with our objective health estimates. That is, the general health of Muslim Pakistanis and Bangladeshis has worsened relative to the

[10] Of the other nine individual GHQ items, only the estimated DD effect for 'felt couldn't overcome difficulties' was significantly different from zero. Results are available upon request.

[11] Groot (2000), Crossley and Kennedy (2002), Etilé and Milcent (2006), and Johnston et al. (2009) amongst others, have shown that self-assessed health measures can suffer from reporting bias.

general health of non-Muslim Indians: the probability of bad or very bad health increased by 3.0 percentage points, and the probability of poor health limiting normal activities increased by 5.2 percentage points.

In summary, the DD estimates presented in Table 2 suggest that increased discrimination towards Pakistani and Bangladeshi Muslims in the UK between 1999 and 2004 has caused the physical health of this group to deteriorate. Next, we explore the robustness of this finding.

4.2. Tests of Robustness

Table 3 presents DD estimates for each health outcome for four robustness specifications. First, we investigate the sensitivity of our main results to the inclusion of a large set of control variables (e.g. age, education, region of residence, English proficiency). Column 1 presents estimates from models including only indicators for year 2004 ($After_i$), Muslim Pakistani or Bangladeshi ($Treated_i$), and the interaction between year 2004 and Muslim Pakistani or Bangladeshi ($Treated_i \cdot After_i$):

(2) $$Health_i = \alpha_0 + \alpha_1 Treated_i + \alpha_2 After_i + \alpha_3 Treated_i \cdot After_i + \varepsilon_i$$

The estimates of α_3 are similar to those presented in Table 2. The main difference is that the standard errors are larger without the additional controls, resulting in some estimated effects losing their statistical significance. In particular, the estimated effects for systolic blood pressure, the GHQ item 'losing confidence in self', and the general health measure 'bad or very bad health', are now 0.13, 0.11 and 0.31, respectively.

In column 2 we present results from DD models in which the control variable effects are allowed to differ by treatment group status:

(3) $$Health_i = \gamma_0 + \gamma_1 Treated_i + \gamma_2 After_i + \gamma_3 Treated_i \cdot After_i + X_i'\gamma_4 + Treated_i \cdot X_i'\gamma_5 + \varepsilon_i$$

This approach allows for the possibility that some changes might have affected the treated and control groups differently over time. Again, the estimates are similar to those in Table 2. Each of the objective health and general health measures are significantly positive; however, the weak mental health effects are further reduced.

As discussed, the choice of control group is crucial to the validity of the DD estimation approach. To determine the robustness of our results we re-estimate our main DD regression model – equation (1) – with non-Muslim whites as controls rather than non-Muslim Indians. This control

group definition was (implicitly) used in Lauderdale's (2006) DD study of the effect of discrimination against Arab women after September 11 in the US on birth outcomes. The estimates in Column 3 indicate that relative to non-Muslim whites, the health of Muslim Pakistanis and Bangladeshis has worsened: estimated effects for blood pressure, cholesterol, some GHQ items, and general health are significantly positive. The robustness of our results to the use of this alternative control group is encouraging.

Our final robustness check involves restricting our year 2004 sample to HSE respondents interviewed after the occurrence of the Madrid bombings on March 11 2004. If discrimination is greatest immediately after a terrorist attack, and if the negative effect of discrimination on health occurs quickly, we should expect the DD estimates to be larger for our post-March sample than for our full sample. Column 4 shows that there is no such difference.[12]

4.3. Estimated Health Effects by Age

Our main DD model – equation (1) – restricts the health effects to be the same for all types of people. However, it has been found in previous studies that these effects can differ across the population, especially with respect to age. For example, Rabby and Rodgers III (2010) found that labor market effects in the UK were only significant for men aged 16 to 25 years. They argue that given the typical terrorist profile, younger Muslims are more susceptible to fear and discrimination and hence young Muslim men experience worse outcomes than older Muslim men. In this sub-section we investigate the possibility that the estimated effects presented in Section 4.1 are driven by particularly large effects for a certain age group. Regression equation (4) allows the treatment effect to differ by age:

(4)

$$[Health]_i = [\delta_0 + \delta]_1 [Treated]_i + \delta_2 [After]_i + \delta_3 [Treated]_i \cdot [After]_i + \sum_k [\delta_4 k$$

where age_i represents demeaned age, δ_3 represents the DD effect for people with mean age, and δ_{5k} represents how the DD effects vary for people older and younger than the average. We have experimented with different values for k, which gives the degree of polynomial in age, but only present results for $k = 1$ because no higher terms are statistically significant. In other words, we present results in which we include interactions with a linear age term.

[12] Ideally, we would also conduct a DD analysis with a pseudo intervention (for an example see Kaushal et al., 2007); however, we do not have two HSE ethnic boost surveys before 2001 in which to conduct such an analysis.

Estimates of δ_3 – average age effect – and δ_{51} – age interaction effect – for each health outcome are presented in Table 4. As expected, the estimates of δ_3 are close to the estimates presented in Table 2. The age interaction effects are, however, statistically insignificant for each objective health measure and mental health measure. These results indicate that the DD effect does not vary by a statistically significant magnitude with age. Note again that this null finding holds true if we include higher-order age interaction terms in the model. The age interaction effects are statistically significant for the two self-assessed general health measures. The positive coefficients suggest that the deleterious effect of discrimination on general health was larger for older Muslims than for younger Muslims, which runs contrary to Rabby and Rodgers III (2010) labor market findings. Overall, the estimates in Table 4 provide only weak evidence that discrimination effects vary with age.

5. Impact of Discrimination on Employment, Social Support and Exercise

The preceding section indicates that anti-Muslim discrimination post 2001 caused the health of Muslims in England to deteriorate. This relationship may have been caused by a direct impact of discrimination (or perceived discrimination) on stress levels, which in-turn negatively impacted upon health (see Section 2.2 for a review of this mechanism). The relationship could also have in-part been caused by indirect impacts of discrimination. Therefore, in this section we investigate some potential indirect pathways through which discrimination may have harmed health. More specifically, we re-estimate our main DD model for three outcomes that may have been influenced by discrimination, and which in previous research have been shown to impact upon health. The three intermediate outcomes are: (i) employment status (full-time or part-time; full-time); (ii) social support[13]; and (iii) exercise (average hours playing sport per week; number of days in past 4 weeks in which active for at least 30 minutes at a time).[14]

With respect to employment status, it is expected that taste discrimination (Becker, 1957) against certain individuals may cause them to have worse labour market outcomes. Specifically, taste discrimination implies that employers and colleagues may have a feeling of discomfort working alongside individuals of a particular race, ethnicity or religion. In addition, taste discrimination may

[13] The social support index is constructed by averaging people's responses to seven statements: People I know do things to make me feel happy; People I know make me feel loved; People I know can be relied upon; People I know will see that I am taken care of; People I know accept me just as I am; People I know make me feel important; People I know give me support and encouragement. For each statement people can respond with: not true (1); partly true (2); certainly true (3).

[14] Mulvaney-Day et al (2007), Okabayashi et al (2004) and Gorman and Sivaganesan (2007) find that social support or social capital has a positive impact on health, and Devillanova (2008) and Deri (2005) present evidence on the link between social networks and health service utilization. Countless studies have found that sport participation, and exercise more generally, improves health (see for example Lechner (2009)). Similarly, many studies find that employment improves health (so long as work hours are not excessive) and that unemployment harms health (see for example Charles and DeCicca (2008)).

lead employers to believe that customers are less likely to do business with people of certain races or ethnicities. As a result of taste discrimination, the discriminated against group are more likely to be dismissed, have their work-hours reduced, and to have difficulties finding new employment. More indirectly, a taste for discrimination at the employee, employer or customer level may also have a negative effect on the likelihood a discriminated-against individual quits searching for employment. Also, it is plausible that those who feel harassed at work withdraw from the labour force. In all cases, taste discrimination results in worse labour market outcomes.

If taste discrimination causes some individuals to retreat from certain racial, ethnic or religious groups in the workforce, it follows that the same individuals will have an increased reluctance to socialize with the groups they dislike. Consequently, the social networks of the discriminated-against group may deteriorate. This process may also work in reverse. If a racial or ethnic group perceive that there is a negative attitude towards them (for example this negative attitude may be publicized in the media) they may themselves withdraw from socializing with others. Either way, individuals experiencing discrimination will be less likely to socialize and interact with people from other ethnic or religious groups, and this is likely to reduce their perceived social support and also their ability to pursue certain life styles (e.g. playing team sports).

The results for the intermediate outcomes (using non-Muslim Indians as controls and non-Muslim whites as controls) are shown in Table 5. The results are similar for each control group (as was found for the health outcomes) and as discussed in Section 3.1 we believe non-Muslim Indians are the more credible control group, and so we only discuss in detail the estimates for non-Muslim Indians. The DD results indicate that anti-Muslim discrimination decreased social support by 0.122 units (around 27% of a standard deviation), decreased time spent playing sport by 0.24 hours per week (around 10% of a standard deviation), and decreased the probability of employment (full-time or part-time) by 7 percentage points. Interestingly, we find no effect of discrimination on full-time employment, suggesting that the negative employment effects are driven by reductions in part-time employment only. The significant 7 percentage point employment effect is somewhat different to the findings in Braakmann (2007b) and Kaushal et al. (2007), who find no significant employment effects with a similar identification strategy. However, it is comparable to the estimated effect in Rabby and Rodgers III (2010) for 16-25 year old Muslim men. Overall, the results in Table 5 suggest that social support, exercise and employment are possible pathways through which discrimination influences health, and hence there is evidence that taste discrimination may have occurred post 2001. We stress, however, that this conclusion is tentative, as our analysis is informal –Table 5 should be seen as providing suggestive evidence.

6. Discussion

Large inequalities in health outcomes by race and ethnicity have been documented in a number of economic studies. For example, Chou et al. (2004) show that Black non-Hispanics and Hispanics have significantly higher BMI values than Whites, while persons of other races have lower BMI values. The most common economic explanation for racial and ethnic health inequalities is that race and ethnicity are strongly correlated with socioeconomic status, and that socioeconomic status is an important health input. In this paper we investigate another explanation for racial and ethnic health inequalities, namely discrimination. Though there exists many economic studies examining the determinants and impact of discrimination, the impact of discrimination on wages for example, to our knowledge this is the first economic study to estimate the impact of discrimination on any health outcome.

Rather than lack of interest, we attribute the dearth of discrimination-health papers to the empirical difficulties that must be overcome in order to establish a causal link between discrimination and health. The chief difficulty is that many factors that influence an individual's health are also correlated with race and ethnicity. In addition, it is difficult to accurately measure an individual's exposure to discrimination and their true health status. This paper overcomes these methodological difficulties by using data on medically measured health outcomes for Muslims residing in the UK from 1999 and 2004. We argue that exogenous changes in the perception of Muslims by the general population in the UK (for the worse) resulted in increased levels of discrimination. Applying a difference-in-differences analysis, we find that the increased discrimination caused the relative health of Muslims to deteriorate. We find that this result holds for different health outcomes, control groups and model specifications.

Along with establishing a causal link between discrimination and health, we explore some possible pathways through which discrimination may affect health outcomes. Using a difference-in-differences approach, we find that the increase in discrimination significantly reduced part-time (but not full-time) employment. The estimated effect equalled approximately 7 percentage points – an economically and statistically significant quantity. Given the large literature documenting the important relationship between employment outcomes and health, we conclude that this is a potentially important pathway through which discrimination affects health. We also find that discrimination reduced perceptions of social support by around one-quarter of a standard deviation, and reduced the amount of (non-home based) exercise by around one-tenth of a standard deviation.

The results of this paper are particularly worrisome given the recognized gap between Bangladeshi and Pakistani Muslims' health status and the level attained by the general population in Britain (Abbas, 2005). Therefore, it seems that this period has, if anything, worsened this gap. In addition, given the underground tube and bus bombings in London on 7th July 2005 and the possibility of higher levels of discrimination, it is possible that the gap continued to grow post 2005. It is hoped that this work has highlighted a racial disparity in health outcomes that will get adequate policy attention. In particular, while we would never advocate a curtailing of free speech, there is a role for the media to avoid sensationalism, and present a fair and balanced view of British Muslims. In addition, there is a role for a policy to strengthen social support and networks in Muslim communities to ensure that events of a discriminatory nature are reported, a feeling of security and safety is increased and the propensity to internalize the effects of discrimination are diminished. Finally, given that the majority of British Muslims live in four areas in England (In total, according to the 2001 Census, there are about 1.6 million Muslims living in the whole of the UK, with most of these living in England. In particular, the majority reside in - i) London (607,000, with more than 30% of the UKs total Muslim population living in the Tower Hamlet of East London), ii) Birmingham (192,000), iii) Greater Manchester (125,219) and iv) West Yorkshire Metropolitan County (150,000, the Bradford-Leeds Urban area (ONS, 2004)), policies to improve the quality of care in these areas for illnesses associated with increased stress (allostatic load) should be achievable.

While the data in this work relates to Muslims residing in the UK, the fact that our work highlights a casual impact of discrimination on health suggests a more general relationship. That is, it is possible that other ethnic and racial minorities residing in the UK, and indeed in other countries, experience similar impacts on their health status that is owed to discrimination. In this regard, future research should investigate whether there is a casual impact on health for other groups and other countries. Clearly, such research has a clear merit for health policy as it allows the effective targeting of resources to the most vulnerable groups and thus directly addresses health inequalities.

In addition, our work raises an eyebrow to the sentiment that religion is a private matter whereby heterogenous tastes can be readily accommodated within society without serious costs (Manning and Roy, 2010). Clearly, at least in the case of Muslims, this is no longer true when it comes to health outcomes. Perhaps, this new evidence will encourage economists to consider other markers of ethnicity, aside from race, when considering impacts on labor, health and wellbeing outcomes.

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Figure 1: Differences in Physical and Mental Health Outcomes between 1999 and 2004

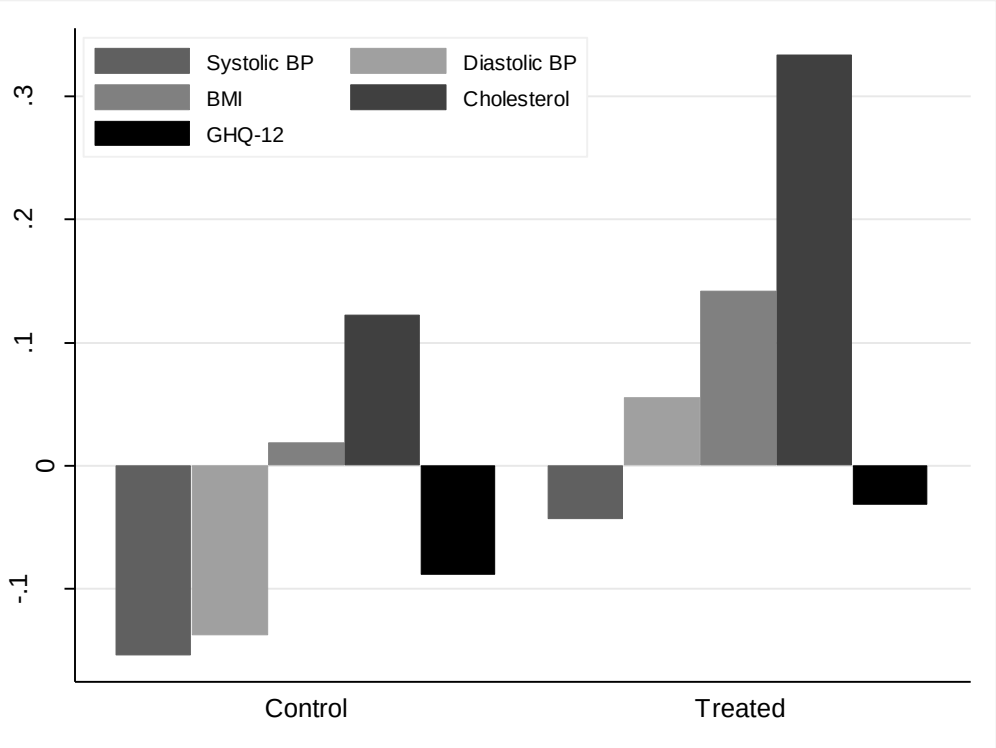

Table 1: Description of the Treated and Control Samples

	Controls		Treated	
	Mean	Std Dev.	Mean	Std Dev.
Health Outcomes				
Systolic blood pressure (mmHg)	129.538	17.955	124.748	16.683
Diastolic blood pressure (mmHg)	74.393	11.271	71.465	11.238
Body mass index	26.083	4.696	25.800	4.759
Total cholesterol (mmol/L)	5.321	1.038	5.053	1.040
GHQ-12 mean response	0.886	0.434	0.920	0.487
Bad or very bad health (dv)	0.089	0.285	0.145	0.352
Cut activities due to poor health (dv)	0.153	0.360	0.166	0.372
Intermediate Outcomes				
Perceived social support	2.659	0.425	2.621	0.463
Average hours doing sport per week	0.875	2.044	0.728	2.791
Employed (full-time or part-time)	0.666	0.472	0.422	0.494
Employed full-time	0.513	0.500	0.256	0.437
Selected Control Variables				
Age	41.872	14.727	36.591	13.963
Male (dv)	0.473	0.499	0.494	0.500
Not born in United Kingdom (dv)	0.767	0.423	0.796	0.403
Years living in United Kingdom	24.875	11.419	20.594	10.809
English language ability	1.388	0.789	1.961	1.059
University degree holder (dv)	0.293	0.455	0.106	0.308
Live in an urban area (dv)	0.295	0.456	0.643	0.479
Live in a rural area (dv)	0.018	0.132	0.006	0.075
Sample size	1983		3204	

Note: The control group are non-Muslim Indians. The treated group are Muslim Pakistanis and Bangladeshis. dv denotes dummy variable. Sample size corresponds to the sample with non-missing control variable information, and non-missing BMI information. The total sample sizes for non-missing blood pressure, total cholesterol, GHQ-12 and general health information for the control group equal 1299, 1130, 2001 and 2287, and for the treated group equal 1702, 1334, 2934 and 4005.

Table 2: Main Difference-in-Differences Estimates

	Estimated Effect		Sample Size
Objective Health Measures			
(1) Systolic blood pressure (mmHg)	3.109***	(1.059)	3001
(2) Diastolic blood pressure (mmHg)	2.366***	(0.761)	3001
(3) Body mass index	0.519**	(0.256)	5187
(4) Total cholesterol (mmol/L)	0.211**	(0.083)	2464
GHQ12 Mental Health Measures			
(5) GHQ-12 mean response	0.033	(0.026)	4935
(6) Unable to enjoy day-to-day activities	0.041	(0.035)	4935
(7) Losing confidence in self	0.091**	(0.046)	4935
(8) Thinking of self as worthless	0.092**	(0.041)	4935
Self-Assessed General Health			
(9) Bad or very bad health	0.030**	(0.015)	6292
(10) Cut activities due to poor health	0.052***	(0.019)	6292

Note: The estimated effect is the OLS regression coefficient for a variable that equals one if the individual is a Muslim Pakistani or Bangladeshi in 2004, and zero otherwise. Each regression model also includes the covariates: year 2004, Pakistani or Bangladeshi, age, age squared, male, country of birth, years living in UK, English ability, degree holder, urban residence, regional residence, and 8 geographical region dummies. Robust standard errors are shown in parentheses. *, ** and *** denote significance at .10, .05 and .01 levels.

Table 3: Difference-in-Differences Estimates from Robustness Models

	Without control variables (1)	With full interaction effects (2)	Non-Muslim whites as controls (3)	Interview after Madrid bombings (4)
(1) Systolic blood pressure (mmHg)	1.933	3.792***	1.862*	3.092***
	(1.259)	(1.103)	(1.023)	(1.188)
(2) Diastolic blood pressure (mmHg)	2.205***	2.755***	3.528***	2.244***
	(0.808)	(0.794)	(0.706)	(0.857)
(3) Body mass index	0.584**	0.458*	0.290	0.417
	(0.271)	(0.266)	(0.184)	(0.282)
(4) Total cholesterol (mmol/L)	0.222**	0.273***	0.169**	0.190**
	(0.088)	(0.086)	(0.078)	(0.091)
(5) GHQ-12 mean response	0.027	0.017	0.030	0.020
	(0.027)	(0.027)	(0.020)	(0.029)
(6) Unable to enjoy day-to-day activities	0.045	0.030	0.021	0.040
	(0.035)	(0.036)	(0.026)	(0.038)
(7) Losing confidence in self	0.074	0.067	0.083**	0.046
	(0.046)	(0.048)	(0.034)	(0.051)
(8) Thinking of self as worthless	0.075*	0.061	0.085***	0.070
	(0.041)	(0.041)	(0.031)	(0.045)
(9) Bad or very bad health	0.017	0.032**	0.010	0.029*
	(0.016)	(0.016)	(0.011)	(0.017)
(10) Cut activities due to poor health	0.049**	0.053***	0.037***	0.050**
	(0.019)	(0.019)	(0.013)	(0.020)

Note: The figures presented are OLS regression coefficients for a variable that equals one if the individual is a Muslim Pakistani or Bangladeshi in 2004, and zero otherwise. Models in column 1 also include the covariates: year 2004 and Pakistani or Bangladeshi. Models in columns 2, 3 and 4 also include the covariates: year 2004, Pakistani or Bangladeshi, age, age squared, male, country of birth, years living in UK, English ability, degree holder, urban residence, regional residence, and 8 geographical region dummies. Models in column 2 additionally include interactions between each of the listed control variables and Pakistani or Bangladeshi. Robust standard errors are shown in parentheses. *, ** and *** denote significance at .10, .05 and .01 levels.

Table 4: Difference-in-Differences Estimates by Age

	Main Effect		Age Interaction Effect	
Objective Health Measures				
(1) Systolic blood pressure (mmHg)	2.093**	(1.037)	-0.013	(0.085)
(2) Diastolic blood pressure (mmHg)	1.223	(0.772)	-0.010	(0.054)
(3) Body mass index	0.476*	(0.263)	0.018	(0.017)
(4) Total cholesterol (mmol/L)	0.214**	(0.084)	0.004	(0.007)
GHQ12 Mental Health Measures				
(5) GHQ-12 mean response	0.039	(0.027)	0.002	(0.002)
(6) Unable to enjoy day-to-day activities	0.046	(0.036)	0.002	(0.003)
(7) Losing confidence in self	0.094**	(0.047)	0.004	(0.003)
(8) Thinking of self as worthless	0.092**	(0.042)	-0.001	(0.003)
Self-Assessed General Health				
(9) Bad or very bad health	0.027*	(0.015)	0.002*	(0.001)
(10) Cut activities due to poor health	0.048***	(0.019)	0.004***	(0.001)

Note: The main effect estimates are the coefficients for a variable that equals one if the individual is a Muslim Pakistani or Bangladeshi in 2004 and zero otherwise. The age interaction estimates are the coefficients for the interaction between age and a variable that equals one if the individual is a Muslim Pakistani or Bangladeshi in 2004 and zero otherwise. See regression equation (4) for the full regression specification and the note to table 2 for the list of control variables. Robust standard errors are shown in parentheses. *, ** and *** denote significance at .10, .05 and .01 levels.

Table 5: Difference-in-Differences Estimates for Intermediate Outcomes

	Estimated Effect		Sample Size
Non-Muslim Indians as Controls			
(1) Perceived social support	-0.122***	(0.026)	4964
(2) Average hours doing sport per week	-0.244**	(0.116)	6273
(3) No. of active days per 4 weeks	-0.470	(0.508)	6273
(4) Employed (full-time or part-time)	-0.069***	(0.024)	5833
(5) Employed full-time	-0.004	(0.024)	5833
Non-Muslim Whites as Controls			
(6) Perceived social support	-0.044**	(0.018)	17656
(7) Average hours doing sport per week	-0.185*	(0.097)	19333
(8) No. of active days per 4 weeks	-1.437***	(0.340)	19333
(9) Employed (full-time or part-time)	-0.112***	(0.017)	15615
(10) Employed full-time	-0.014	(0.016)	15615

Note: The estimated effect is the OLS regression coefficient for a variable that equals one if the individual is a Muslim Pakistani or Bangladeshi in 2004, and zero otherwise. Each regression model also includes the covariates: year 2004, Pakistani or Bangladeshi, age, age squared, male, country of birth, years living in UK, English ability, degree holder, urban residence, regional residence, and 8 geographical region dummies. Employment models estimated using a restricted sample of individuals with age < 65. Robust standard errors are shown in parentheses. *, ** and *** denote significance at .10, .05 and .01 levels.