

Acculturation and the prevalence of pain amongst South Asian minority ethnic groups in the United Kingdom

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Acknowledgements

This work was funded by the United Kingdom's Arthritis Research Campaign.

We acknowledge the willing support of all the primary care physicians who permitted access to their patient populations and to the link workers and other members of the minority ethnic communities surveyed in this report for much advice, assistance and guidance.

ABSTRACT

Background: Musculoskeletal pain is reported more commonly by South Asians in the UK than by white Europeans. This may result from a variety of factors, including cultural differences and thus we investigated the extent to which differences in the prevalence of pain within the South Asian population could be explained by differences in acculturation (the extent to which immigrants take on the culture of their host population).

Methods: 933 Europeans and 1914 South Asian (1165 Indian, 401 Pakistani and 348 Bangladeshi) subjects were recruited from the age-sex registers of 13 general practices in areas with high densities of South Asian populations (Bolton, Oldham, Ashton-under-Lyne and Birmingham). A 28 item acculturation scale was developed based, for example on use of language, clothing style, use of own-culture media. Principle component analysis generated a score (range 0-100) which was validated against constructs expected to relate to acculturation, such as years full time education and time spent in the UK. The presence of widespread pain was assessed by the answer to the question “Have you suffered from pain all over the body in the past month ?”

Results: Widespread pain was more common in all three South Asian ethnic groups than in the white subgroup using the (OR = 3.7, 95% CI 2.9, 4.9), with this increase ranging from 2.7 to 5.8 in the different South Asian subgroups. There was a similar increase in consultation rates for pain. Within the South Asians, pooling all 3 groups, there was a strong negative association between acculturation score and widespread pain, which remained after adjusting for age and sex. OR (95% CI) per SD decrease in acculturation score- 1.2 (1.0, 1.3). As a consequence, adjusting for acculturation accounted for some, but not all, of the differences between the ethnic groups in the prevalence of widespread pain: OR 2.0 (95% CI 1.4, 3.0).

Conclusions: Widespread pain is more commonly reported in South Asians though there are interesting differences depending on how the symptom is ascertained. Lower acculturation has a strong influence on the reporting of pain, but cannot explain all of the difference between South Asian and European populations.

INTRODUCTION

There are frequent anecdotal reports suggesting inter-ethnic differences in the experience of musculoskeletal pain. Such observations are supported from the results of a population-based study which reported a higher prevalence of pain in “most joints” amongst South Asians compared to Europeans in the United Kingdom. This increase was considerably greater for widespread pain than any individual site of joint pain (1). One possible reason for variations in prevalence may be differences in the presumed underlying disorder or in pain reporting and associated health seeking behaviour. Indeed the latter does vary across cultures and societies (2).

Widespread pain is considered as one of the somatizing group of disorders which are predominantly ‘unexplained’ and such syndromes are strongly associated with abnormal illness behaviour and high rates of consultation (3,). Specifically the association between psycho-social factors and musculoskeletal pain has been shown to be greater where the pain is widespread as opposed to regional (where pain origin is more likely to be ‘explained’ (4). Thus any ethnic differences in widespread pain prevalence may be a result of psychosocial or cultural differences although a range of other factors, including genetic predisposition and the physical or social environment may be important.

One approach to exploring the relative contribution of these different factors in explaining ethnic differences in pain is to investigate the role of acculturation. The process of acculturation may be defined as that through which members of one culture may acquire the norms and values of another (host) culture (5). Acculturation has been identified as a factor in explaining excess poor health experienced by ethnic minorities in

North America (6-8) though the extent that experiences from the minority ethnic groups in that geographical area can be extrapolated more widely is limited.

Minority ethnic groups of South Asian origin, specifically Indians, Pakistanis and Bangladeshis, constitute the largest minority ethnic in the United Kingdom but both within and between these communities there are large differences in the level of acculturation. To date, there has been very little work focused on the role of cultural factors in possibly explaining differences in chronic syndromes such as musculoskeletal pain in South Asians; this lack reflecting in part the availability of a validated scale for assessing acculturation in this group.

The present study had three main aims. Firstly we wished to develop an instrument that could be used to measure levels of acculturation in UK South Asians. Secondly we wished to confirm previous observations of differences in widespread pain prevalence both between South Asians and Europeans, and for the first time to investigate possible differences in prevalence between the three main South Asian Groups. Finally we wished to explore the contribution of acculturation to explaining differences in pain reporting both within and between these three groups.

SUBJECTS AND METHODS

Overview of Study Design

The first stage involved the development and piloting of questionnaire-based acculturation scale using South Asian volunteers. Secondly the psychometric properties of the acculturation scale were assessed and an appropriate scoring system derived from a sample of respondents to a population-based cross-sectional survey of South Asian (including those of Indian, Pakistani and Bangladeshi origin) and European

populations. Specifically the construct validity of those acculturation scores were assessed in relation to attributes such as duration of residence in the UK. The data from the whole survey was used to assess the prevalence both in widespread pain in the three South Asian and in the European groups. Finally the association with the derived acculturation scores and the prevalence of pain was assessed.

Development of Acculturation Scale

A questionnaire was developed covering several items of acculturation considered appropriate for use in UK South Asians based on a literature review and existing acculturation scales (developed in other countries and for different ethnic groups) and discussion groups with community link-workers from Indian, Pakistani and Bangladeshi backgrounds. The aim was to ensure the appropriateness of the questions being posed and to ensure that they covered all relevant areas of interest (face and content validity). The questionnaire was then pre-piloted in various groups of South Asians including students, hospital clinic attenders and local ethnic leaders. Questions that were ambiguous, incompletely answered or did not distinguish between groups were dropped

The scale was designed to reflect the language, religious beliefs and traditions of culture and lifestyle distinctive to South Asians from the Indian subcontinent. Eight distinct domains were identified and covered both behaviour and beliefs (the final questionnaire is provided in Appendix A). The domains were:

- 1) *Language* – language was assessed at two levels. Firstly the relative use of English and traditional South Asian languages at home and outside the home and secondly proficiency of using English as a language (ability to understand, speak, read and write English).
- 2) *Religion* – two questions enquired about religious belief and practices.

- 3) *Alienation and belonging* – 2 questions related to whether the respondent saw the UK as their “home” and whether they felt a part of British society.
- 4) *Traditions/celebrations* – 2 questions related to observance and participation in important traditional South Asian cultural festivals.
- 5) *Customs* – enquiry was made about the respondent's fear of loss of cultural identity for themselves and their family.
- 6) *Media* – 3 questions enquired about the respondent's media preference (South Asian or English) regarding television, radio and newspapers.
- 7) *Clothing* – 2 questions enquired about the respondent's clothing preference (traditional South Asian or Western) at home and outside the home environment.
- 8) *Living conditions* – one question enquired about living with family or extended family.

The study questionnaire was translated and back translated into the main South Asian languages (Gujarati, Bengali, Urdu and Punjabi).

Selection of Population Samples

For the subsequent investigation, population samples were selected. The population sampling frames were derived from the age-sex registers of thirteen general practices in areas with high densities of South Asian populations across the 3 target groups based on the UK 2001 Census. Ten general practices in the North West towns of Bolton, Oldham and Ashton-under-Lyne, and three from the West Midlands city of Birmingham participated. All registered patients, both European and Asian, from the thirteen study practices aged 18-75 were eligible for inclusion in the study. All those with Asian sounding surnames (used only as a first screen to identify South Asians) and a random sample of Europeans were selected for study, a total of 7668 subjects.

Questionnaire

A questionnaire was then developed which incorporated the following items. Firstly individuals were asked to self-identify their ethnic group using categories from the 2001 UK census. Secondly questions were asked about place of birth, religion and main language. If not born in UK, length of time spent in UK was sought, and the number of years of education. Thirdly the questionnaire included the acculturation score described above. Finally a number of questions aimed to determine the prevalence and severity of widespread pain, the cardinal feature of the fibromyalgia syndrome (9). Questions therefore asked about the presence of pain lasting at least 24 hours in the previous one month. Widespread pain was additionally defined by a positive answer to pain 'all over the body' Two indicators of pain severity were also assessed: (i) if the pain had led to primary care consultation and (ii) severity of pain was measured using a numerical rating score (NRS) with scale 0-10.

Each subject was mailed an English language version of the questionnaire. A note in each of the appropriate South Asian languages (Urdu, Punjabi, Bengali and Gujarati) offered a version of the same questionnaire in any of those languages, if requested by mail or telephone. Following the initial mailing, non-responders at two weeks were sent a postcard reminder, followed by a repeat questionnaire at four weeks if there was still no reply. If this second questionnaire was not returned, a contact visit by a link worker (usually of the same ethnic group) was made to offer assistance in completing the questionnaire.

Analysis

Derivation of Acculturation Scales

The questionnaire included the items shown in Appendix 1. For each item a subject scored 0 or 1, with 1 being the more acculturated response. A principal component analysis was undertaken (See Appendix 2) from which 3 distinct subscales were derived: (1) behaviours suggesting greater acculturation in the host community (including use of the English language, and wearing western style clothing), (2) attitudes indicative of greater or lesser acculturation (such as feelings of acceptance, fears of discrimination and concerns regarding loss of cultural identity) and (3) behaviours associated with the society of origin (including use of Asian media, and non-use of the English language). All three subscales were transformed to a 0-100 scale, with a higher score representing greater levels of acculturation. The reliability coefficients (Cronbachs alpha) for the three scales formed were 0.93, 0.75 and 0.72.

Assessment of Construct Validity of the Acculturation Scales

To examine the construct validity of the questionnaire it was hypothesized that certain key demographic variables would be associated with increased acculturation. The demographic variables used to test the construct validity of the acculturation scale were: younger age, male gender, whether born in UK, increased length of time spent in UK (as an absolute value and as a proportion of lifetime), and increased years of education (categorised as none, 1-7 years, 8-12 years, or more than 12 years). The association of each of the above constructs with the principal component scores was assessed using linear regression. In order to test whether the associations between predictors and the acculturation score was the same in the three ethnic groups (Indians, Pakistanis and Bangladeshis) interaction terms were added to the linear regression model. A multivariate model was built up including all significant predictors and interactions. From this the differences in acculturation between the three ethnic groups were assessed, and

whether any such the differences could be explained by differences between the groups in the demographic predictors of acculturation.

Ethnicity was defined in two ways. Firstly this was based on the subjects' self-reports as being Indian, Pakistani, Bangladeshi or European. Secondly a cluster analysis was undertaken based on the following variables reported in the questionnaire: command and use of South Asian languages, religious affiliation and place of birth of subject, parents and grandparents. This analysis identified seven statistically distinct subgroups which were homogenous in terms of languages spoken, regional lineage and migratory patterns. These groups were then mapped to the self reported ethnicities (Table 1). In order to ensure homogenous groups with respect both to characteristics and self-perception of ethnicity, any subjects whose assignment was discordant with the variables analysed were excluded.

Pain prevalences and consultation rates were compared across the subgroups using logistic regression, with the European group as the reference. The odds ratios for each ethnic group were adjusted for age (in the age bands 18-24, 25-34, 35-44, 45-54, 55-64 and 65-75 years). Pain-related severity numerical rating scores were analysed by comparing inter-ethnic group medians and interquartile ranges (IQR), and tested for statistical significance using the rank sum test. Acculturation scores were compared across South Asian subgroups. Finally associations between widespread pain reporting and levels of acculturation within South Asians are expressed as age and gender adjusted odds ratios per standard deviation increase in score, with their 95% confidence intervals.

RESULTS

Response rates

The study questionnaire was mailed to 7668 individuals. There were several inaccuracies in the address lists as determined by post office returns, notification of deaths and subjects missing from local electoral registers. We therefore estimated that 1774 questionnaires had not been received. Of the 5894 successfully delivered questionnaires, following concerted efforts made to contact initial non-responders outlined above, 2998 (51%) were completed and returned. As the final ethnicity was determined from the responses to the questionnaire, it was not possible to compare ethnic specific response rates, although the responses from those with and without Asian sounding surnames were broadly similar. From the responders 1949 participants considered themselves to be South Asian, and 933 to be European. As described above South Asian subjects were excluded if their answers did not map to their self report. From this analysis 35 were so excluded leaving 1914.

The demographic characteristics of the eight ethnic groups (Europeans and seven South Asian subgroups) are shown in Table 2. The largest South Asian groups were Indian Gujarati, Indian Punjabi, Pakistani Urdu and Bengali speaking Bangladeshi. There were large differences in the age and gender distribution of the respondents by ethnic group reflecting the demographic construction of the UK population, though in part this may reflect differences in the age and gender specific response rates. All subsequent analyses were therefore adjusted for age and gender

Construct validity of Acculturation Scores

The results of the univariate linear regression of acculturation scores on the hypothesised predictors are given in Table 3, pooled across the ethnic groups. The scores are expressed as the change in acculturation score per one-unit increase in the value of each predictor. A negative score means that an increase in that variable is associated with a decrease in acculturation.

The first behavioural component (see above) correlated strongly with the hypothesised predictors: thus those who had spent more time in the UK and those with more education tended to be more acculturated. The second component of attitudes did not correlate with any of the predictors except gender, which interestingly acted in the opposite direction compared to the first component. The third component of behaviour (mainly language use, see above) also correlated to the predictors in a similar way to the first component, but the associations were generally less strong.

The distribution of the acculturation scores between the Asian subgroups is shown in Table 4. The scores show considerable variation, even between subgroups originating from the same country.

Prevalence of Pain

The crude pain prevalence data are shown in Table 5. The crude prevalence of widespread pain was greater in all seven South Asian subgroups (pooled prevalence across all subgroups 21%) than in Europeans (9%). Amongst the South Asian subgroups the prevalence amongst Sylhetis (those speaking Sylheti alone) (11%) was significantly lower than amongst other minority ethnic groups (range 16-23%), although after adjusting for age and gender the difference was no longer significant. The excess of widespread pain amongst South Asian ethnic subgroups was evident across age

groups and in both genders (data not shown). After adjusting for age and gender, the excess widespread pain prevalence in South Asians was even greater (odds ratio 3.7, 95% CI 2.9 - 4.9). The odds ratio compared Europeans ranged from 2.7 in Sylhetis to 5.8 in Bengali/Sylhetis (those speaking both languages), with the Indian and Pakistani subgroups having intermediate odds ratios from 3.4 to 4.2 (Table 5). Consultation rates were higher across all South Asian subgroups, with odds ratios ranging from 2.4 in Sylhetis to 5.7 in Bengali/Sylhetis. The medians and interquartile ranges of the numerical rating scores for widespread pain severity were identical between Europeans and South Asians (median 7, IQR 5 - 8). Within South Asian subgroups, median severity scores ranged from 5 (IQR 4 - 7) in Gujarati Africans to 8 (IQR 6 - 9) in Gujeratis ($p=0.0007$).

Finally the association between the derived acculturation scores and widespread pain were assessed (Table 6). Combining together the South Asian study population, a decrease in behaviour acculturation score was significantly associated with an increased probability of reporting widespread pain in the past month, with an odds ratio of 1.17 per standard deviation decrease (95% CI 1.03, 1.33). The association between low acculturation scores and increase risk of pain was also observed for chronic pain (lasting more than 3 months), widespread pain, severe pain (NRS above the median) and pain leading to GP consultation (Table 6). Similarly, low acculturation in terms of attitudes was found to be associated with widespread pain in the past month, as well as several other measures of widespread pain. After adjusting for both acculturation scores, the odds ratio for South Asians decreased from 3.7 to 2.0 (95% CI 1.4, 3.0). No associations were found between the language acculturation component and widespread pain.

DISCUSSION

In summary, age and gender adjusted widespread pain prevalence in South Asians is almost threefold that in reported in Europeans. However, there is also a pronounced variation in reporting of widespread pain between groups of South Asians formed along linguistic, religious and geographical lines. These inter-ethnic differences extend to general practitioner consultation. The degree of acculturation had an important influence on the likelihood of reporting pain: the greater the degree of acculturation the lower the prevalence of pain. These findings may provide some insight into understanding of the mechanism by which there may be increased widespread pain prevalence in South Asians.

In order to investigate this topic we needed to develop an acculturation scale: prior to the current study there was no such instrument available for use in South Asians. The scale was assessed for internal consistency, validity, comprehension and reliability and performed well and was completed by the overwhelming majority of respondents. The scale correlated with key constructs of acculturation including levels of education, time in the UK, age, generational status, sex and ethnic group. These measures of construct validity of the acculturation behavioural scale were demonstrated for all South Asian groups.

Language usage was a major marker of acculturation. In other populations, language usage and familiarity with the language of the host culture has been shown to be the most important measure of acculturation (10-12), and have been used as proxy (11-12) measures for acculturation, however they cannot replace the formal measure of acculturation. Previous attempts at measuring acculturation have been restrictive in their content, they have chosen to focus on certain aspects of acculturation while ignoring others (12) or a combination of language and ethnic identification (13). Many previous

studies (14) have been limited to students from university settings and consequently are not representative of the vast majority of immigrants. Other studies have tended to aggregate culturally or linguistically different individuals into one category or to view, for example all Asians as a culturally homogeneous group (15)

Interestingly, the principal component analysis suggested three distinct dimensions of acculturation were being captured by the items on the questionnaire which could be divided into behavioural traits related to the host culture, attitude traits, and behavioural traits related to the culture of origin. In the development of our scale we noted that the scale was measuring three different domains. We therefore created sub-scales of acculturation in our study corresponding to these three domains, instead of awarding one composite score for acculturation.

The attitude scale seemed to be measuring something that was not related to the pre-hoc defined constructs of acculturation. Thus feelings of belonging and anxiety about being part of a minority did not change with increasing residence in the UK. By contrast however these aspects were as strongly associated with the reporting of pain as the behavioural ones.

The samples in the current study were selected to represent the 3 largest South Asians groups in the UK but it is always appropriate to be cautious to generalise the findings of this study to ethnic minorities outside those studied. Subjects were largely recruited from socio-economically deprived areas, which may have implications for the external validity of the results, as widespread pain has been linked to social deprivation (16,17).

Furthermore, the association between ethnicity and widespread pain may be confounded by further factors which have not been addressed in this study, such as

psychological distress, adverse work-related psychosocial factors and attitudes to health and illness behaviour.

The self reporting of pain itself may be culturally determined and does not necessarily represent any difference in the occurrence of pathological processes leading to pain.

We chose to use the phenotype of a positive answer to 'pain all over' as this has been shown in previous population studies, in Europeans, to be closely related to psychosocial factors. It is an impossible task to 'validate' pain reporting within a population and more complex between culturally diverse populations. By undertaking sub group analyses on those with severe and those with consulting pain, we attempted to reduce the heterogeneity of the outcome measure. Ultimately a study such as this can only conclude about the subjective reporting of pain.

We attempted to maximise participation in this population-based study by using general practice registers as a sampling frame, offering questionnaire translations in various languages, and making considerable efforts to chase up non-responders through repeat questionnaires and link worker visits. Despite strenuous attempts to maximise participation, as anticipated in the populations studied there was a relatively poor response rate which might have lead to levels of non-response bias both in the reporting of pain and its association with the acculturation scale scores which might have been different between the groups. The nature of the study meant that accurate ethnic assignment could only be made following participation which hinders attempts to assess the levels of any such bias. As a crude indicator we assessed the level of pain in subjects who answered without a reminder and those who required further follow up (reluctant responders). These data (not shown) do not suggest any differential non-response bias, between the groups in relation to pain

The results of this study are consistent with those from other work in this area. Allison et al (1), in a study from Greater Manchester, found increased risks of “pain in most joints” in South Asians compared to the local white population, with odds ratios ranging from 3.4 in Bangladeshis to 5.1 in Pakistanis. A survey in Glasgow found a greater prevalence of musculoskeletal pain reporting in South Asian women than the general population (35 vs. 26%), although the reverse was found for South Asian men (18). Increased general practice attendance in adult Asians compared to Europeans has been reported previously (19,20). The present study has shown that such disproportionate health seeking behaviour persists when musculoskeletal symptoms are considered in isolation. Furthermore, the prevalence of pain syndromes has been shown to be greater in specific subgroups within the UK’s South Asian population.

The mechanisms underlying the excess widespread pain prevalence in South Asians are unclear, although some possible explanations have been proposed. There may exist a pain threshold disparity between ethnic groups. There is some evidence for this from experimental studies though some studies have reported no such differences (21,22). Levels of psychological distress may be greater in South Asians, specifically those less acculturated to their new environment. This hypothesis warrants further investigation, although it would be expected that this also would have resulted in an excess of low back pain. However, Rogers and Allison (23) report an apparent lack of demarcation in South Asians between body pain and personal concerns which other ethnic groups may describe as “depression”. Furthermore, they note that while Europeans and Afro-Caribbeans assign pain to specific joints, South Asians tend to demonstrate a heightened sense of ‘soma’, and describe pain radiating through the whole body. An excess of widespread pain may occur if there were communication barriers between European doctors and patients from ethnic minorities, and if this subsequently affected

their treatment plan. In this study however, many of the general practitioners involved were themselves of South Asian origin. Finally there may be more biological explanations; predominant amongst these is the possibility of 'sub clinical' osteomalacia. We have recently showed in a population of young South Asian females that there is a high prevalence of Vitamin D deficiency which was associated with widespread pain reporting in that group (24), though the numbers studied precluded a more definitive answer. Vitamin D intake or serum data were not available in the current cohort.

In summary, this study has confirmed an excess prevalence of widespread pain but not regional pain (as exemplified by back pain) in South Asians living in the UK. It has extended knowledge by demonstrating that this excess prevalence varies in magnitude between population groups of South Asian origin. Further, this study has demonstrated that the excess is principally related to those whose culture reflects their South Asian origin rather than their host country (the United Kingdom). Future work could usefully determine the role of specific cultural factors in relation to excess musculoskeletal symptoms.

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Table 1 – South Asian subgroups identified by Cluster Analysis

<i>Cluster Name</i>		<i>Description</i>	<i>N</i>
Indian	Gujarati	Gujarati speakers with no African roots	600
Indian	African-Gujarati	Gujarati speakers with African roots	196
Indian	Punjabi	Punjabi speakers	369
Pakistani	Punjabi-Urdu	Punjabi & Urdu users	164
Pakistani	Urdu	Pure Urdu users	237
Bangladeshi	Bengali-Sylheti	Bengali & Sylheti users	231
Bangladeshi	Sylheti	Pure Sylheti users	117

Table 2 - Demographic characteristics by ethnic group

Group	Subgroup	Number of Subjects	Female Gender n (%)	Age at participation (years) median (IQR)	Years in Education n (%) by group			
					0	1-7	8-12	>12
Indian	Gujarati	600	312 (52)	40 (28,50)	79 (14)	132 (23)	130 (22)	238 (41)
	African Gujarati	196	94 (48)	41 (32,48)	14 (7)	45 (23)	58 (30)	75 (39)
	Punjabi	369	194 (53)	40 (29,54)	82 (23)	66 (18)	87 (24)	124 (35)
Pakistani	Urdu	237	126 (53)	41 (32,54)	99 (44)	40 (18)	39 (17)	48 (21)
	Urdu/Punjabi	164	84 (51)	26 (20,34)	12 (8)	20 (13)	48 (30)	80 (50)
Bangladeshi	Bengali/Sylheti	231	110 (48)	29 (23,40)	62 (27)	58 (26)	43 (19)	63 (28)
	Sylheti	117	16 (14)	28 (24,37)	43 (38)	28 (25)	17 (15)	24 (21)
European	All	933	549 (59)	50 (36,60)	6 (1)	55 (6)	605 (66)	251 (27)

Table 3

Association between Derived Acculturation Scores and Constructs Tested

Predictor	Category	Behaviour	Attitudes	Language
Gender	Female vs. Male	-17.2 (-20.1, -14.4)	5.6 (2.9, 8.3)	-1.6 (-3.9, 0.6)
Age	Per decade	-8.6 (-9.5, -7.6)	1.2 (0.2, 2.1)	-4.8 (-5.5, -4.0)
Born in UK	Yes vs. No	28.1 (25.1, 31.2)	-3.0 (-6.0, 0.0)	24.7 (22.5, 27.0)
Time settled	Per decade	3.0 (1.5, 4.5)	-0.2 (-1.5, 1.2)	3.2 (2.1, 4.4)
% of Lifetime In the UK	Per 10%	45.4 (40.6, 50.3)	-4.5 (-9.4, 0.4)	36.2 (32.5, 39.9)
Education	None	-47.7 (-51.1, -44.2)	5.4 (1.6, 9.1)	-14.4 (-17.4, -11.3)
	1-7yrs	-17.9 (-21.3, -14.4)	1.9 (-1.9, 5.6)	-7.9 (-11.0, -4.9)
	8-12 yrs	-6.5 (-9.8, -3.1)	0.5 (-3.1, 4.2)	-1.4 (-4.4, 1.6)
	>12yrs	Reference	Reference	Reference

Table 4: Acculturation Scores by Ethnic group

<i>Group</i>	<i>Subgroup</i>	Behaviour	Attitudes	Language
Indian	Gujarati	72 (70, 74)	75 (73, 77)	28 (27, 30)
	African Gujarati	90 (87, 94)	66 (63, 70)	43 (40, 46)
	Punjabi	74 (71, 76)	76 (73, 78)	30 (28, 32)
Pakistani	Urdu	45 (42, 48)	72 (69, 75)	21 (18, 23)
	Urdu/Punjabi	85 (81, 89)	65 (62, 69)	44 (41, 47)
Bangladeshi	Bengali/Sylheti	56 (53, 59)	70 (67, 73)	23 (20, 25)
	Sylheti	71 (66, 75)	68 (64, 73)	33 (30, 37)

Table 5 Prevalence of Widespread Pain by Ethnic Group

Group	Subgroup	Prevalence				Consultation Rate			
		Cases	Crude Prevalence (%)	Odds Ratio*	Confidence Interval	Cases	Crude Rate (%)	Odds Ratio*	Confidence Interval
Indian	Gujarati	120	20	3.4	(2.5, 4.7)	109	18	3.7	(2.6, 5.1)
	African Gujarati	44	23	3.9	(2.5, 5.9)	34	17	3.4	(2.1, 5.4)
	Punjabi	80	22	3.6	(2.5, 5.1)	67	18	3.4	(2.4, 4.9)
Pakistani	Urdu	54	23	3.8	(2.6, 5.6)	48	21	3.9	(2.6, 5.9)
	Urdu/Punjabi	26	16	4.2	(2.5, 7.0)	17	10	3.5	(1.9, 6.3)
Bangladeshi	Bengali/Sylheti	52	23	5.8	(3.8, 8.8)	42	19	5.7	(3.6, 8.9)
	Sylheti	12	11	2.7	(1.4, 5.2)	9	8	2.4	(1.1, 5.2)
European	All	86	9	Reference	-	76	8	Reference	-

*Adjusted for age and gender

Table 6 – Age/gender-adjusted associations between acculturation component scores and widespread pain prevalence in South Asians

Component of acculturation (see text)	Behaviour <i>OR (95% CI)*</i>	Attitudes <i>OR (95% CI)*</i>	Language <i>OR (95% CI)*</i>
Widespread Pain:			
During past month	1.17 (1.03, 1.33)	1.29 (1.14, 1.45)	1.04 (0.82, 1.32)
Chronicity	1.22 (1.06, 1.40)	1.25 (1.10, 1.43)	1.00 (0.77, 1.31)
GP consultation	1.25 (1.09, 1.43)	1.28 (1.13, 1.46)	1.05 (0.81, 1.36)
Severity	1.19 (0.99, 1.43)	1.13 (0.94, 1.36)	1.05 (0.73, 1.51)
Interference with daily activities	1.35 (1.14, 1.61)	1.17 (1.00, 1.38)	0.95 (0.68, 1.33)
Interference with work activities	1.22 (1.01, 1.46)	1.26 (1.06, 1.50)	0.98 (0.69, 1.40)

**Odds ratio per 1 SD decrease in acculturation score*

Appendix 1

Self-administered questionnaire of Acculturation

The following questions relate to languages and cultural aspects of the South Asian community. Please complete the following 17 questions and return in the pre-paid envelope.

Page 17

1. Below are a list of languages which you may speak. For each please indicate with a tick if you are able to understand, speak, read or write the language.
(please tick all that apply)

	Understand	Speak	Read	Write
English	_____	_____	_____	_____
Urdu	_____	_____	_____	_____
Punjabi	_____	_____	_____	_____
(Bengali) Bangla	_____	_____	_____	_____
Sylheti	_____	_____	_____	_____
Gujarati	_____	_____	_____	_____
Other	_____	_____	_____	_____

(please specify) _____

2. What is the main language you use: (please tick all that apply)

	at home?	with friends?	with neighbours?	at work?
English	_____	_____	_____	_____
Urdu	_____	_____	_____	_____
Punjabi	_____	_____	_____	_____
(Bengali) Bangla	_____	_____	_____	_____
Sylheti	_____	_____	_____	_____
Gujarati	_____	_____	_____	_____
Other	_____	_____	_____	_____

(please specify) _____

3. Which of the following best describes your religious affiliation?
(Please tick only one box)

not religious	<input type="checkbox"/> 1
Christian	<input type="checkbox"/> 2
Muslim	<input type="checkbox"/> 3
Hindu	<input type="checkbox"/> 4
Sikh	<input type="checkbox"/> 5
Buddhist	<input type="checkbox"/> 6
other (please specify)	<input type="checkbox"/> 7 _____

4. Do you see Britain as your "home"? If no which country would you describe as your "home"? (please specify) _____ Yes No

5. Do you feel a part of British society? Yes No

6. Do you see your future as secure? Yes No

7. Do you fear racist attacks? Yes No

8. Do you fear being discriminated against if applying for a job because of your ethnic origin? Yes No

9. Do you fear being denied opportunities at work because of your ethnic origin? Yes No

10. Do you fear a loss of cultural identity for yourself? Yes No

11. Do you fear a loss of cultural identity for your children/ future children? Yes No

12. In the past year have you celebrated any traditional South Asian cultural festivals? Yes No

13. In what languages are the television programmes/videos/films you usually watch and the radio stations you regularly listen to?
(please tick only one box)

Don't watch television/videos/films or listen to the radio	<input type="checkbox"/> 1
South Asian languages only	<input type="checkbox"/> 2
Mostly South Asian languages	<input type="checkbox"/> 3
South Asian and English languages equally	<input type="checkbox"/> 4
Mostly English Language	<input type="checkbox"/> 5
Only English language	<input type="checkbox"/> 6

Page 18

14. In what languages are the newspapers you regularly read?
(please tick only one box)

Don't read newspapers	<input type="checkbox"/> 1
South Asian languages only	<input type="checkbox"/> 2
Mostly South Asian languages	<input type="checkbox"/> 3
South Asian and English languages equally	<input type="checkbox"/> 4
Mostly English language	<input type="checkbox"/> 5
Only English language	<input type="checkbox"/> 6

15. What type of clothing do you usually wear at home? (please tick only one box)

Traditional SouthAsian clothing	<input type="checkbox"/> 1	Western style clothing	<input type="checkbox"/> 2	Western and South Asian clothing equally	<input type="checkbox"/> 3
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16. What type of clothing do you usually wear outside the home? (please tick only one box)

Traditional SouthAsian clothing	<input type="checkbox"/>	Western style clothing	<input type="checkbox"/>	Western and South Asian clothing equally	<input type="checkbox"/>
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17. Thinking about where you are living at the moment, please indicate below who you live with (please tick as many boxes as apply)

I live alone	<input type="checkbox"/>
I live with my parents	<input type="checkbox"/>
I live with friends	<input type="checkbox"/>
I live with my partner/spouse	<input type="checkbox"/>
I live with my children	<input type="checkbox"/>
I live with my in-laws	<input type="checkbox"/>
I live with my grandparents	<input type="checkbox"/>
I live with other members of my family (not listed above)	<input type="checkbox"/>

Page 19

Appendix 2

Statistical Derivation of Acculturation Scale

Identification of components of acculturation

Principal components analysis was used to identify separate components within the acculturation scale. A minimax rotation was used to ensure that each variable loaded as much as possible onto one component and as little as possible onto the others, and a “scree” plot¹ was used to determine the number of components of interest.. A scree plot it created by plotting the variance explained by each component in decreasing order of size. Only components that explain more of the variation than expected are retained in the analysis: they can be identified by looking for an “elbow” in the scree plot, with a steep slope to the left and a flatter slope to the right. The components to the left of this elbow are the ones to be retained. The principal components were “simplified” by setting the loadings of each variable on each component to either 1 (if the loading was greater on this component than either of the others, and the loading was at least 0.4), or 0 (Table 7. The correlation between the original principal components and these simplified principal components were assessed to determine whether the simplified components were adequate substitutes for the original components.

¹ A scree plot is a plot of the eigenvalues of the principal components analysis against the component number. There should be a sharp bend in this plot: points to the left of the bend represent components that are worth further investigation.

Internal consistency

The internal consistency of the subscales developed using the simplified principal components was assessed using Cronbach's alpha. This statistic assumes that all of the items of a test are measuring the same latent (i.e. not directly measurable) variable, and assesses the reliability with which that variable can be measured by the test.

Table 7 – Loading of variables in the on rotated principal components

Variable	Component Loading			Simplified Component Loading		
	1	2	3	1	2	3
Do you understand English ?	0.73	-0.01	-0.05	1	0	0
Do you speak English ?	0.77	-0.03	-0.02	1	0	0
Do you read English ?	0.84	-0.04	0.01	1	0	0
Do you write English ?	0.77	-0.05	0.04	1	0	0
Do you speak English at home ?	0.56	-0.05	0.17	1	0	0
Do you speak English with friends ?	0.75	-0.03	0.19	1	0	0
Do you speak English with neighbours ?	0.68	-0.04	0.12	1	0	0
Do you speak English at work ?	0.68	-0.10	0.03	1	0	0
Do you have a religious affiliation ?	0.08	-0.00	0.22	0	0	0
Do you see Britain as your home	0.15	0.45	0.18	0	1	0
Do you feel part of British society ?	0.15	0.55	0.06	0	1	0
Do you see your future as secure ?	0.05	0.57	-0.01	0	1	0
Do you fear racist attacks	0.02	0.57	0.03	0	1	0
Do you fear discrimination because of you ethnic origin	0.16	0.73	0.00	0	1	0
Do you fear being denied opportunities because of you ethnic origin	0.11	0.73	0.01	0	1	0
Do you fear a loss of cultural identity	0.03	0.60	-0.09	0	1	0
Do you fear a loss of cultural identity for your children	0.01	0.57	-0.12	0	1	0
Have you celebrated any South Asian cultural festivals in the last year	0.04	0.07	0.17	0	0	0
What language television/radio do you listen to?						
Only South Asian	0.25	0.16	-0.04	0	0	0
Mainly South Asian	0.50	0.19	-0.04	1	0	0
South Asian and English equally	0.62	0.19	0.04	1	0	0
Mainly English	0.36	-0.03	0.43	0	0	1
Only English	0.18	-0.03	0.44	0	0	1
In what language are the newspapers you regularly read ?						
Only South Asian	0.65	-0.01	-0.01	1	0	0
Mainly South Asian	0.80	0.01	0.08	1	0	0
South Asian and English equally	0.82	0.01	0.12	1	0	0
Mainly English	0.63	-0.04	0.42	1	0	0
Only English	0.45	-0.04	0.51	1	0	0
What type of clothing do you usually wear at home ?						
Western only	0.37	0.04	-0.27	0	0	0

Western and South Asian	0.63	0.02	0.03	1	0	0
What type of clothing do you usually wear outside the home ?						
Western only	0.28	0.04	-0.29	0	0	0
Western and South Asian	0.66	-0.02	-0.04	1	0	0
Do you understand a non-English language ?	0.03	-0.01	0.26	0	0	0
Do you speak a non-English language ?	0.08	0.05	0.39	0	0	0
Do you read a non-English language ?	0.01	0.07	0.55	0	0	1
Do you write a non-English language ?	0.03	0.04	0.58	0	0	1
Do you speak a non-English language at home ?	0.11	-0.03	0.47	0	0	1
Do you speak a non-English language with friends ?	0.25	-0.03	0.61	0	0	1
Do you speak a non-English language with neighbours ?	0.26	-0.06	0.52	0	0	1
Do you speak a non-English language at work ?	0.11	0.02	0.49	0	0	1
