Review Article

Psychosocial factors in relation to coronary heart disease in South Asians: a systematic review

Debhani Banerjee Gangopadhyay¹, Rajinder Bhopal²

¹Lanarkshire Campus, University of West of Scotland, Glasgow, United Kingdom
²Usher Institute of Population Health Sciences and Informatics, University of Edinburgh, Edinburgh, United Kingdom

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Abstract

Background: People of South Asia descent in the UK have high coronary heart disease (CHD) risk. Psychosocial factors affect the risk of CHD, independent of ethnicity. Factors such as stress, depression and anxiety are postulated to be predictors of heart disease. The objectives of this review were to systematically review quantitative research on psychosocial factors and CHD in South Asians in Europe and North America to answer the question: What is the relation between psychosocial factors and CHD in South Asians residing in Europe and North America?

Methods: A systematic literature review was conducted according to the recommendations of the Centre for Reviews and Dissemination and the PRISMA guidelines. Electronic databases were searched using relevant terms and data were extracted into data extraction forms. The quality assessment criteria were adapted from the National Institute for Health and Clinical Excellence (NICE) guidance 2009. A narrative review was planned.

Results: Five cross-sectional studies and their associated eight papers were included. The studies varied with reference to the age of samples, psychosocial factors and in reporting. For depression, four studies showed increased levels in South Asian population compared to the White population. Two studies reported low optimism present in South Asians compared to the general population. Four out of five studies showed lower social support in South Asian men in comparison to the general population. One study found that South Asians had low control and high social support at work compared to the White population. One study showed no differences in work strain.

Conclusions: The evidence was limited but indicated psychosocial risk factors were commoner in South Asians compared to the general population. New, large scale, especially prospective studies should explore this.

Keywords: Asians, ethnicity, coronary disease, psychosocial factors

Address for Correspondence: Debhani Banerjee Gangopadhyay, Lanarkshire Campus, University of West of Scotland, Glasgow, United Kingdom.
E-mail: debhani4002@googlemail.com

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Introduction
United Kingdom (UK) based South Asians whose ancestry is in the countries of the Indian sub-continent, including India, Pakistan, Bangladesh [1] have a higher risk of coronary heart disease (CHD) compared to the general population [2]. In North America, South Asians also have a high prevalence of premature atherosclerotic cardiovascular diseases [3]. The causes of this are still under debate. Conventional risk factors like diabetes, hypertension, hyperlipidemia, insulin resistance or metabolic syndrome fail to explain their comparatively high risk [4].

Psychosocial factors including stress, depression [5], chronic work stress [6], high demands at work, low job control [7], social support and personality traits are associated with the risk and progression of CHD [8-11]. The INTERHEART study established that the psychosocial index is a strong independent variable of acute myocardial infarction independent of geographical position or ethnicity of the participants [12] and showed that native South Asians had high levels of unfavorable psychosocial factors [13]. Fox and Shapiro suggested that stress could increase the occurrence of CHD in UK South Asians [14]. Previous reviews on psychosocial factors and CHD have not focused on South Asians [7,15,16]. We systematically reviewed quantitative research on the relation between psychosocial factors and CHD in South Asian adults residing in Europe and North America. These places were chosen as there has been a large migration from South Asia to these areas [17] and there has been much research on the risk factors for ischemic heart disease (IHD) there.

We had one research question: What is the relation between psychosocial factors and CHD in South Asians residing in Europe and North America?

Methods
Search strategy
The following databases were first searched from inception to August 2016:
• MEDLINE (from 1946)
• EMBASE (from 1947)
• PsychINFO (from 1806)
• Web of Science (from 1900)
• Google Scholar
• ASSIA (from 1987)
A repeat search was conducted on the above databases in April 2018. The search was conducted looking for free text terms and associated MeSH terms e.g. ‘South Asian’S, ‘Indian’S, ‘Pakistani’S, ‘Bangladeshi’S, Srilankan$, psychosocial factor$, stress, job strain, hostility, depression, anxiety, racism, social isolation, coronary heart disease, ischemic heart disease, myocardial infarction and stud$. The search results were then combined with Boolean operators to refine the results to ensure the precision and sensitivity of the searches [18]. Grey literature was searched in the Open Grey database.

The search strategy for EMBASE is shown below as an example. The search strategy in all databases is included in Table 1.

The following search terms were used for searching the population:
1. South Asia/ or Asian/ or ethnic group/
2. South Asian$.mp.
3. Bangladesh/
5. Indian/ or Asian/
6. Pakistani/ or South Asia/
10. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9
11. limit 10 to (adult <18 to 64 years> or aged <65+ years>)

The following search terms were used for searching the outcome:
12. ischemic heart disease/ep, et [Epidemiology, Etiology]
13. coronary artery disease/ or vascular disease/
The following search terms were used for searching the exposure/risk factors:

14. exp heart infarction/ep, et [Epidemiology, Etiology]
15. exp cardiovascular disease/
16. 12 or 13 or 14 or 15
17. coronary heart disease.mp.

This search was to combine the population, exposure/risk factors and outcome factors or commonly called PIO
31. 11 and 17 and 30
The above search yielded 533 results.

Table 1. Detailed search strategy

EMBASE
1. South Asia/ or Asian/ or ethnic group/
2. South Asian$.mp.
3. Bangladesh/
5. Indian/ or Asian/
6. Pakistan/ or South Asia/
10. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9
11. limit 10 to (adult <18 to 64 years> or aged <65+ years>)
12. ischemic heart disease/ep, et [Epidemiology, Etiology]
13. coronary artery disease/ or vascular disease/
14. exp heart infarction/ep, et [Epidemiology, Etiology]
15. exp cardiovascular disease/
16. 12 or 13 or 14 or 15
17. coronary heart disease.mp.
18. psychosocial factor*.mp.
19. exp "mixed anxiety and depression"/
20. bipolar depression/ or atypical depression/ or major depression/ or endogenous depression/ or long-term depression/ or exp depression/
21. mental stress/ or job stress/ or stress/
22. (work or job) adj2 (stress* or strain).mp.
23. anxiety/ or anxiety neurosis/ or anxiety disorder/
24. exp social isolation/
25. racism/
26. exp hostility/
27. 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26
28. job strain.mp.
29. 27 or 28
30. 17 or 29
24. exp social isolation/
25. racism/
26. exp hostility/
27. 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26
28. job strain.mp.
29. 27 or 28
30. 17 or 29
31. 11 and 17 and 30
The above search yielded 533 results.

MEDLINE
1. Asian Continental Ancestry Group/
2. South Asian$.mp.
3. Indian$.mp.
4. exp Bangladesh/
5. Bangladeshi$.mp.
6. Nepal/
7. Nepalese.mp.
8. exp India/
9. India.mp. or India/
10. Srilankan$.mp. or Sri Lanka/
11. Pakistan/
12. Pakistani$.mp.
13. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12
14. limit 13 to ("young adult and adult (19-24 and 19-44)" or "middle-aged (45 plus years)" or "all aged (65 and over")
15. psychosocial factor$.mp.
16. Stress, Psychological/ or job strain.mp.
17. work strain.mp.
18. Depression/
19. depressive disorder/ or depressive disorder, major/ or depressive disorder, treatment-resistant/
20. Anxiety Disorders/
21. Anxiety/ or anxiety.mp.
22. racism.mp. or Racism/
23. Social Isolation/
24. social isolation.mp.
25. stress.mp. or Stress, Psychological/
26. 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25
27. coronary heart disease.mp.
28. cardiac.mp.
29. cardiovascular diseases/ or vascular diseases/
30. myocardial ischemia/ or acute coronary syndrome/ or angina pectoris/ or coronary disease/ or myocardial infarction/
31. coronary artery disease.mp. or exp Coronary Artery Disease/
32. ischemic heart disease.mp.
33. exp Stroke/ or stroke.mp.
34. cerebrovascular.mp.
35. 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34
36. 13 and 26 and 35
Results = 329

ASSIA (Applied Social Sciences Index and Abstracts)
(coronary heart disease) OR (coronary arterial disease OR cardiovascular disease) AND (psychosocial factor OR psychosocial risk factors) OR (psychosocial work factors OR depression) OR (anxiety OR social isolation) OR (stress OR strain) AND (south Asian OR south Asians in America) OR (south Asians in Britain OR south Asians in Canada) OR (south Asians migration)

Results = 3938

PsychINFO
1. exp Acculturation/ or exp South Asian Cultural Groups/ or exp Immigration/ or exp Cross-Cultural Differences/
2. south Asian*.mp.
3. exp Minority Groups/ or Indian*.mp.
5. Srilankan*.mp.
8. 1 or 2 or 3 or 4 or 5 or 6 or 7
9. limit 8 to (320 young adulthood or 340 thirties or 360 middle age or "380 aged " or "390 very old ")
10. coronary heart disease.mp.
11. cardiovascular disorders/ or cerebrovascular disorders/
12. exp Heart Disorders/ or exp Myocardial Infarctions/ or coronary artery disease.mp.
13. cardiac.mp.
14. cardiac disorder.mp.
15. 10 or 11 or 12 or 13 or 14
16. Psychosocial Factors/ or Health Behavior/ or Risk Factors/ or exp Stress/ or psychosocial factor*.mp.
17. depression.mp. or Reactive Depression/ or Treatment-Resistant Depression/ or exp Major Depression/
18. Anxiety Disorders/ or Anxiety/ or anxiety.mp.
19. work strain.mp.
20. exp Occupational Stress/ or job strain.mp.
21. social isolation.mp. or Social Isolation/
22. racism/ or "race and ethnic discrimination"/ or social discrimination/
23. 16 or 17 or 18 or 19 or 20 or 21 or 22
24. 9 and 15 and 23

Results=70

Web of Knowledge
Topic= (south Asians OR India* OR Pakistan* OR Bangladeshi* OR Nepal* OR SriLanka*) AND Topic= (psychosocial factors OR depression OR anxiety OR social isolation OR work stress OR racism) AND Topic= (Coronary Heart Disease OR Cardiovascular Disease)
Timespan=All years.
Search language=Auto
Results= 266

Total results retrieved: 5136

Inclusion and exclusion criteria of papers
Cross-sectional, cohort and case-control studies were eligible. Language restrictions were not imposed. Papers published in peer-reviewed journals, grey literature and brief reports were included. The review included papers that published data on stress, anxiety, social isolation, racism, job strain, hostility, depression, stress at work and racial discrimination in relation to coronary heart disease, myocardial infarction and ischemic heart disease on adult South Asians resident in Europe and North America.
Randomized controlled trials, qualitative studies, studies on children and adolescents, those from outside Europe and North America and abstracts were excluded.
Handling and selection of references

References were downloaded into bibliographic software (Endnote web) and duplicate papers deleted. The papers were screened by DBG for eligibility by screening titles and abstracts followed by the screening of full text, and a final list of included studies was compiled. Data from the relevant studies were extracted into standardized data extraction forms.

Quality assessment

The articles were critically appraised using 29 quality assessment criteria adapted from NICE [19] by McLean et al [20]. Studies were rated as ++ if they fulfilled 21 or more criteria, as + with 15 to 20 criteria and as – with less than 15 criteria.

Meta-analysis was not planned or done because of the previously known heterogeneity of the methods and measured outcomes of the studies.

Results

![Flow chart of included studies](http://www.prisma-statement.org/2.1.4-PRISMA_Flow_2009_Diagram.pdf)

Figure 1. Flow chart of included studies (based on the PRISMA flow diagram)


Figure 1 shows that 5150 papers were identified by database searching and from other sources. Duplicate papers (n=152) were removed. Ten papers potentially fulfilled the eligibility criteria. Of these, four were excluded (n=4) because they did not fit the inclusion criteria [Box 1]. Bibliographies of the included six papers were searched and two relevant papers were included, giving eight in total.

Table 2 summarizes the timings, settings and methods of the included papers.

Eight UK based papers 21-28 from four studies - London Life Sciences Prospective Population Study (LOLIPOP), Newcastle Heart Project, Whitehall II Cohort and a survey in Glasgow were included in the review.

The first column shows that the earliest paper was published in 1994 [28] and the latest in 2011 [21].

The second column shows that all the studies were cross-sectional. Five papers were from London [21-24,27] of which four were from a study named LOLIPOP and one from Whitehall 2. Two papers were from the Newcastle Heart Project study, in north-east England [25,26].

One study was in Glasgow [28]. The language of all papers was English. Four papers [22-25] did not comment on the nature of indicators of ethnicity. The third column summarizes the aims of the papers.
Box 1. List of excluded studies

1. Perspectives on the Crisis and Challenge of Cardiovascular Disease in the Diverse Asian Populations of California; Colman Ryan MD and Richard E. Shaw PhD; HAWAI’I MEDICAL JOURNAL, VOL 69, MAY 2010, SUPPLEMENT 2 - data not available on South Asians.

2. Cardiovascular Stress Responses among Asian Indian and European American Women and Men; Catherine M. Stoney, Ph.D., Joel W. Hughes, Ph.D., Kristin K, Kuntz, B.A., Sheila G. West, Ph.D., and Lisa M. Thornton, B.S. (Ann Behav Med 2002, 24(2): 113-121)- not answering aims and objectives of my study as this study did not compare effects of psychosocial factors between South Asians and the reference population. The purpose of this study was to test the hypothesis that the vasomotor response to stress, as indexed by hemodynamic measures, would be exaggerated in Asian Indian men and women, relative to European American individuals. The results showed that there is a decreased tendency of Asian Indians to vasodilate during psychological stress compared to the reference population.


Table 2. Summary table of timing, setting, methods and quality scores of the included eight papers

<table>
<thead>
<tr>
<th>a. First author (reference to bibliography)</th>
<th>a. Location</th>
<th>Aim of the study</th>
<th>Key tools used to measure psychosocial factors</th>
<th>a. Age group studied (years)</th>
<th>b. Sample size by ethnic group</th>
<th>c. Response rate</th>
<th>Summary of quality scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Williams R. (28)</td>
<td>a. UK (Glasgow)</td>
<td>The aim of the study is to develop a profile of non-biochemical coronary risks for the South Asian and the general population in Glasgow, with a focus on dietary patterns, and potential causes of stress</td>
<td>Questionnaires prepared for this study</td>
<td>a. 30-40, mean 35</td>
<td>b. South Asians-173 General Population-344</td>
<td>c. 80.5%</td>
<td>+ (study met 20/29 of the quality assessment criteria, and 2 of the unmet criteria were not applicable)</td>
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<tr>
<td>b. 1994</td>
<td>b. Cross-sectional</td>
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<tr>
<td>c. 1988</td>
<td>c. Name on the electoral register</td>
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<td></td>
</tr>
<tr>
<td>a. Hemingway (27)</td>
<td>a. UK (London)</td>
<td>To find out whether there were ethnic differences in psychosocial factors which</td>
<td>1. General Health Questionnaire</td>
<td>a. 35-55</td>
<td>b. South Asians-577 (Indian 61.6%)</td>
<td></td>
<td>++ (study met 22/29 of the quality assessment criteria, and of 3</td>
</tr>
<tr>
<td>Study</td>
<td>Design</td>
<td>Population</td>
<td>Methods</td>
<td>Main Findings</td>
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<td>---------------------------------------------------------------------</td>
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<td>----------------------------------------------------------------------------</td>
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<tr>
<td>Whitehall 2 study</td>
<td>c. Observer at baseline and by self-report at phase 5 follow up</td>
<td>Might be consistent with ethnic differences in CHD rate</td>
<td>3. Close persons questionnaire for social support</td>
<td>Whites-8973</td>
<td></td>
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<td></td>
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<td></td>
<td>4. Previously reported measures for psychosocial work characteristics</td>
<td>c. 73%</td>
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<tr>
<td>a. Pollard (26)</td>
<td>a. UK (Newcastle)</td>
<td>To compare the social networks of South Asian (Indians, Pakistanis and Bangladeshis) and European-origin participants in the Newcastle Heart Project, and to examine the relationships between social network sizes and coronary heart disease (CHD) risk factors in both groups</td>
<td>Questionnaire containing social network questions</td>
<td>a. 25-74</td>
<td></td>
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<td></td>
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<tr>
<td>c. 1993-1997</td>
<td>c. Newcastle Heart Study</td>
<td></td>
<td></td>
<td>Pakistanis 305</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>c. Residents with ancestral origins in India, Pakistan, or Bangladesh and who had at least three grandparents born in those countries</td>
<td></td>
<td></td>
<td>Bangladeshis 120</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>European-825</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>c. 67% for South Asian and 64% for European people</td>
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</tr>
<tr>
<td>a. Fischbacher (25)</td>
<td>a. UK (Newcastle)</td>
<td>To describe psychosocial work characteristics in the South Asian population and compare it to the European population</td>
<td>Work demand and control were assessed with questions and scales used in the Whitehall study (Bosma et al. 1997), which are based on Karasek’s questions</td>
<td>a. 25-74</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>c. Residents with ancestral origins in India, Pakistan, or Bangladesh and who had at least three grandparents born in those countries</td>
<td></td>
<td></td>
<td>c. 67% for South Asian and 64% for European people</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>a. Williams E. (24)</td>
<td>a. UK</td>
<td>To compare the exposure to psychosocial factors associated with cardiovascular risk in South Asian men and white European men residing in the UK</td>
<td>1. An adaptation of Pearlin’s economic strain scale</td>
<td>a. 35–75 years</td>
<td></td>
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<tr>
<td>b. 2007</td>
<td>b. Cross-sectional</td>
<td></td>
<td>2. Neighborhood Problems Scale for 10 potential problems; Social Network Index; Social support was assessed with a scale previously shown to</td>
<td>b. South Asians- 63</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. 2004-2006</td>
<td>c. LOLIPOP study</td>
<td></td>
<td></td>
<td>Sikh -52.4%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Hindu-19%</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Muslim-20.6%</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Christian- 7.9%</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>White Europeans- 42</td>
<td></td>
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</tr>
</tbody>
</table>
| a. Williams E. (23) | a. UK (London) | To examine the profile of conventional and novel psychosocial risk factors in South Asian compared with white men and women | 1. Job strain and effort-reward imbalance models for work stress  
2. Perceptions of discrimination scale for racial discrimination; an adaptation of Pearlin’s economic strain scale  
3. Social support inventory; Social Network Index; MacArthur social support scales  
4. Life Orientation Test for optimism; CES-D for depression | a. 35-75 yrs.  
b. South Asians-1130  
White Europeans-818  
c. 83% | ++  
(Study met 26/29 of the quality assessment criteria, and 1 of the unmet criteria was not applicable) |
| b. 2009 | | | | | |
| c. 2004-2006 | | | | | |
| a. Williams E. (22) | a. UK (London) | To explore the differences in psychosocial risk factors related to coronary heart disease (CHD) between the different subgroups of South Asians residing in the UK | 1. Social support inventory; Social Network Index for social networks; Santa Clara Strength of Religious Faith scale  
2. Job strain and effort/reward imbalance models  
3. 20-item Center for Epidemiologic Studies of Depression Scale  
4. Cook-Medley Hostility Scale | a. 35-75  
b. South Asians-1130  
(Sikh -50.5%  
Hindu-28.0%  
Muslim-15.8%)  
White Europeans-818  
c. 83% | ++  
(Study met 23/29 of the quality assessment criteria, and 4 of the unmet criteria were not applicable) |
| b. 2010 | | | | | |
| c. 2004-2006 | | | | | |
| a. Williams E. (21) | a. UK (London) | Assessing the relationship between hostility and metabolic and autonomic risk factors for CHD in a large population-based sample and testing whether the associations were similar in white and South Asian men and women | Cook-Medley Hostility Scale | a. 35-75 yrs.  
b. South Asians-1004  
White Europeans-743  
c. 45% | ++  
(Study met 24/29 of the quality assessment criteria and 3 of the unmet criteria were not applicable) |
| b. 2011 | | | | | |
| c. 2004-2006 | | | | | |
The fourth column shows that there was variation in the nature and measurement of psychosocial factors limiting the comparisons. Participants self-completed questionnaires or were interviewed. In Williams et al, 2010 [22] and Williams et al, 2009 [23], Pearlin’s economic strain scale measured financial stress, the Perceptions of Discrimination scale identified racial discrimination and the Issues checklist scale measured family conflict. In Williams et al, 2007 [24], racial discrimination was assessed with questions from the Fourth National Survey of Ethnic Minorities and neighborhood stress with the Neighborhood Problems Scale.

Depression was measured using the 20-item Center for Epidemiologic Studies of Depression Scale in three papers [22-24]. Hemingway et al used the General Health Questionnaire to measure depression and anxiety [27].

Optimism was assessed with the Life Orientation Test in two papers [23-24].

Psychosocial work stress was explored in five papers [22-25,27]. Work stress was measured using scales used in the Whitehall II study in three papers [22-24]. Fischbacher et al [25] assessed work demand and control with a questionnaire based on Karasek’s scales.

Hostility was measured using a modified version of the Cook-Medley Hostility Scale in four papers [21,23,27].

Williams et al, 2010 and Williams et al, 2009 [22-23] used the social support inventory and measured negative aspects of social support, social networks and religiosity. In Williams et al, 2007 [24], social networks were measured using the Social Network Index and social cohesion using a scale developed for neighborhood studies in Chicago. Pollard [26] measured the social network with a social network questionnaire. Hemingway [27] used the Close Persons Questionnaire to assess social support.


The last column of Table 2 shows the summary quality assessment score of each of the included eight papers. All the studies scored ++ on quality assessment criteria except one [28] which scored +.

Methods of analysis and results of the studies (Tables 3, 3a, 3b, 4 and 5)

Table 3 provides a summary of the analysis and results of the different psychosocial factors identified across six of the included papers [21,23-26,28]. Two papers [22,27] are not included in Table 3, but are described separately in Tables 4 and 5 as these two papers reported the resulted in a different way compared to other papers. In one of the papers [22], the South Asian population was divided according to religion and the other paper [27] had reported the combined results for men and women in South Asian and White population.

Tables 3a and 3b provide further analysis of papers already included in Table 3.

Williams et al, 1994 [28] found that South Asian women, compared to the general population had more stress and pressure due to household tasks and yet they did not have any less pleasure and satisfaction with this work. South Asian women were more likely to have been mugged or assaulted than the general population, however, fewer South Asian men were victims of vandalism, mugging and assault than the general population. Fewer South Asian men and women reported feeling they had someone to turn to for support compared to the general population. However, a greater number of South Asian men and women saw their parents or sibling yearly compared to the general population.

Pollard et al, 2003 [26] found that though South Asians had larger families than the reference White European population. South Asian men had less contact with relatives compared to the White Europeans. South Asian men also had limited contact with friends compared to the reference population. South Asian men and women visited places of worship more frequently than the reference population.

Fischbacher et al [25] showed that compared to their European counterpart, more South Asian men had high job control and high decision latitude, but similar proportions had high job demand and fewer South Asians were in high skilled jobs. South Asian people were more likely to be in low demand/high control jobs. However, the patterns varied according to the types of jobs done by the South Asians, the majority of whom were self-employed.
Table 3. Summary table of analysis and results of included six papers

<table>
<thead>
<tr>
<th>a. First author (bibliographic reference)</th>
<th>a. Method of analysis</th>
<th>Psychosocial factors</th>
<th>Male</th>
<th>Statistical significance (95% confidence interval or ‘p’ value or both)</th>
<th>Female</th>
<th>Statistical significance (95% confidence interval or ‘p’ value or both)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Williams R. (28)</td>
<td>a. 1. Kendall’s tau</td>
<td>Stress/pressure in a day (great amount)</td>
<td>No data</td>
<td>No data</td>
<td>P value not given</td>
<td>4</td>
</tr>
<tr>
<td>b. Stressful conditions and events</td>
<td>b. 2. Analysis of variance</td>
<td>Pleasure/ satisfaction in day (very little)</td>
<td>No data</td>
<td>No data</td>
<td>P value not given</td>
<td>24</td>
</tr>
<tr>
<td>c. Not stated</td>
<td>b1. Percentage value (%)</td>
<td>Ever victim in GB of vandalism</td>
<td>38</td>
<td>25</td>
<td>&lt;0.05</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>b2. ‘p’ values</td>
<td>Ever victim in GB of mugging/assault</td>
<td>19</td>
<td>15</td>
<td>P value not given</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Parent/sibling seen &gt;once daily</td>
<td>3</td>
<td>31</td>
<td>P value not given</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt; yearly</td>
<td>4</td>
<td>25</td>
<td>&lt;0.001</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Has someone to turn to</td>
<td>88</td>
<td>78</td>
<td>&lt;0.5</td>
<td>94</td>
</tr>
<tr>
<td>a. Pollard (26) - Newcastle Heart Project</td>
<td>a. 1. T test</td>
<td>Contact with relatives (%)</td>
<td>None per month</td>
<td>14</td>
<td>14</td>
<td>P value not given</td>
</tr>
<tr>
<td></td>
<td>2. Chi-squared test</td>
<td>None per month</td>
<td>64</td>
<td>75</td>
<td>P value not given</td>
<td>65</td>
</tr>
<tr>
<td></td>
<td>3. Logistic regression</td>
<td>1-5 per month</td>
<td>22</td>
<td>11</td>
<td>P value not given</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>4. Analysis of variance</td>
<td>Contact with friends (%)</td>
<td>None per month</td>
<td>9</td>
<td>2</td>
<td>P value not given</td>
</tr>
<tr>
<td>c. Age</td>
<td>b. 1. Percentage (%)</td>
<td>None per month</td>
<td>49</td>
<td>75</td>
<td>P value not given</td>
<td>61</td>
</tr>
<tr>
<td></td>
<td>2. ‘p’ values</td>
<td>6+ per month</td>
<td>42</td>
<td>23</td>
<td>P value not given</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Attendance at worship (%)</td>
<td>Never or rarely</td>
<td>85</td>
<td>17</td>
<td>P value not given</td>
</tr>
</tbody>
</table>
a. Fischbacher (25) - Newcastle Heart Project
b. Work demand, decision latitude, skill discretion, job control and social support
c. Age

<table>
<thead>
<tr>
<th></th>
<th>At least once a month</th>
<th>15</th>
<th>83</th>
<th>&lt;0.001</th>
<th>24</th>
<th>50</th>
<th>&lt;0.001</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Scores divided into tertiles and the top tertile of each score compared with the lower two tertiles</td>
<td>Demand (%) highest tertile</td>
<td>41</td>
<td>42</td>
<td>1 (-9.11)</td>
<td>44</td>
<td>28</td>
<td>-17 (-29.7 - 4)</td>
</tr>
<tr>
<td></td>
<td>Decision (%) highest tertile</td>
<td>26</td>
<td>53</td>
<td>26 (16.36)</td>
<td>18</td>
<td>44</td>
<td>26 (12, 40)</td>
</tr>
<tr>
<td></td>
<td>Skill (%) highest tertile</td>
<td>52</td>
<td>31</td>
<td>-21 (-31.11)</td>
<td>37</td>
<td>40</td>
<td>2 (-12.17)</td>
</tr>
<tr>
<td></td>
<td>Control (%) highest tertile</td>
<td>35</td>
<td>42</td>
<td>7 (-3.17)</td>
<td>23</td>
<td>33</td>
<td>10 (-5.25)</td>
</tr>
</tbody>
</table>

a. Williams (24) - LOLLIPPOP study
b. Psychosocial factors (chronic stress, protective factors in the social environment and psychological factors)
c. None (reason stated)

<table>
<thead>
<tr>
<th></th>
<th>Job control (0-100) (low-high) [mean (SD)]</th>
<th>83.2 (16.6)</th>
<th>69.7 (19.1)</th>
<th>(p =0.004)</th>
<th>No data</th>
<th>No data</th>
<th>No data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Job demands (0–100) (low-high) [mean SD]</td>
<td>70.2 (16.4)</td>
<td>65.1 (15.2)</td>
<td>P value not given</td>
<td>No data</td>
<td>No data</td>
<td>No data</td>
</tr>
<tr>
<td></td>
<td>Financial strain (0–100) (low-high) [mean (SD)]</td>
<td>45.7 (7.3)</td>
<td>53.3 (15.2)</td>
<td>(p =0.004)</td>
<td>No data</td>
<td>No data</td>
<td>No data</td>
</tr>
<tr>
<td></td>
<td>Neighborhood cohesion (0–100) (low-high) [mean (SD)]</td>
<td>69.0 (15.0)</td>
<td>61.1 (18.0)</td>
<td>(p =0.021)</td>
<td>No data</td>
<td>No data</td>
<td>No data</td>
</tr>
<tr>
<td></td>
<td>Perceived discrimination in the workplace (%)</td>
<td>11.4</td>
<td>35.0</td>
<td>(p =0.029)</td>
<td>No data</td>
<td>No data</td>
<td>No data</td>
</tr>
<tr>
<td></td>
<td>Emotional support (no support) (%)</td>
<td>11.9</td>
<td>27.0</td>
<td>(p=0.023)</td>
<td>No data</td>
<td>No data</td>
<td>No data</td>
</tr>
<tr>
<td></td>
<td>Depression (CES-D, 0–60) [mean (SD)]</td>
<td>6.5 (5.1)</td>
<td>12.5 (10.7)</td>
<td>(p&lt;0.001)</td>
<td>No data</td>
<td>No data</td>
<td>No data</td>
</tr>
<tr>
<td>Optimism (0–24) [mean (SD)]</td>
<td>15.8 (2.5)</td>
<td>13.7 (2.7)</td>
<td>(p&lt;0.001)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>------------</td>
<td>------------</td>
<td>-----------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Williams (23) - LOLIPOP study
b. Psychosocial factors (financial strain, family conflict, job control, depression)
c. Age, socioeconomic status

<table>
<thead>
<tr>
<th>a. Williams (23) - LOLIPOP study</th>
<th>a. 1. Analyses of covariance 2. Chi-square test</th>
<th>b. 1. Mean value (+/- standard deviation or standard error values) 2. Percentage (%)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Financial strain (mean [SD or SE])</td>
<td>2.9 (0.16)</td>
<td>3.8 (0.14)</td>
<td>(p&lt;0.001)</td>
</tr>
<tr>
<td>Family conflict (mean [SD or SE])</td>
<td>8.6 (0.50)</td>
<td>10.9 (0.39)</td>
<td>(p&lt;0.001)</td>
</tr>
<tr>
<td>Job control (0-100) (mean [SD or SE])</td>
<td>54.6 (1.35)</td>
<td>48.3 (1.15)</td>
<td>(p&lt;0.001)</td>
</tr>
<tr>
<td>Depression (mean [SD or SE])</td>
<td>11.7 (0.39)</td>
<td>14.5 (0.35)</td>
<td>(p&lt;0.001)</td>
</tr>
<tr>
<td>Job strain (0-100) (mean [SD or SE])</td>
<td>1.19 (0.12)</td>
<td>1.34 (0.10)</td>
<td>P value not given</td>
</tr>
<tr>
<td>Effort–reward imbalance (0-100) (mean [SD or SE])</td>
<td>1.63 (0.08)</td>
<td>1.74 (0.07)</td>
<td>P value not given</td>
</tr>
<tr>
<td>Work support (0-100) (mean [SD or SE])</td>
<td>57.0 (1.26)</td>
<td>45.4 (1.06)</td>
<td>(p&lt;0.001)</td>
</tr>
</tbody>
</table>

a. Hostility (mean [SD]) | 12.1(5.30) | 13.6 (5.01) | (p<0.001) |

b. Mean values (standard deviations)
Williams et al, 2007 [24] provided data for men only and showed that the South Asian men had lower control in their jobs compared to the White European population, but the ethnic groups did not differ with regard to job demands. South Asians experienced higher financial strain and lower neighborhood cohesion. The greater percentage of South Asians were discriminated by their employers on racial grounds. South Asians had less emotional support and were more depressed and less optimistic than the White Europeans.

Williams et al, 2009 [23] reported that South Asians experienced more financial strain, more family conflict, less job control (for South Asian men only and not South Asian women) and more depression. These effects were largely independent of socioeconomic status. The study also demonstrated that there was no statistically significant difference in the level of job strain and effort-reward imbalance between the different ethnic groups but social support at work was noted to be more in the general population than the South Asian population.

Williams et al, 2011 [21] showed that the South Asian population had a statistically significant increased level of hostility in comparison to the White Europeans.

Tables 3a and 3b show subgroup analysis by religion and by place of ancestral origin. Table 3a shows the analysis of psychosocial factors in Fischbacher et al [25] by religion namely Muslims and Non-Muslims. Only non-Muslim people were more likely to have high job control and high decision latitude in comparison to Europeans.

Table 3b shows that Pollard [26] shows analysis by country of ancestral origin namely India, Pakistan and Bangladesh. There were no significant differences amongst the men of the three ancestral groups in frequency of contact with friends or relatives, but there were significant differences for women in contact with a friend. There was a difference in the subgroups regarding attendance at worship and Pakistani and Bangladeshi men attended worship more frequently than Indian men. Indian women attended worship more frequently than Pakistani and Bangladeshi women.

Table 4 shows a summary of the analysis and results of the different psychosocial factors among the different religious subgroups in the South Asian population in Williams et al [22] compared with the reference population. The differences in work stress, emotional support, family conflict, depression and hostility between religious subgroups were not statistically significant.

Table 5 shows that Hemingway et al, 2001 [27] did not find any statistically significant differences in anxiety between ethnic groups. South Asians had more depression, higher negative support, less emotional support, more social support at work, less job control, higher effort-reward imbalance and higher hostility than the white population.

### Table 3a. Analysis of psychosocial factors in Fischbacher et al [25] according to the subgroup of South Asian population by religion namely Muslims and Non-Muslims

<table>
<thead>
<tr>
<th>Psychosocial factors by stress</th>
<th>Non-Muslim</th>
<th>Difference (95% CI), p value</th>
<th>Muslim</th>
<th>Difference (95% CI), p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Between Europeans and Non-Muslims</td>
<td></td>
<td>Between Europeans and Muslims</td>
</tr>
<tr>
<td><strong>Male</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demand (%) (highest tertile)</td>
<td>44</td>
<td>3 (11, 16)</td>
<td>41</td>
<td>0 (12, 12)</td>
</tr>
<tr>
<td>Decision (%) (highest tertile)</td>
<td>61</td>
<td>34 (21, 48)</td>
<td>47</td>
<td>20 (9, 32)</td>
</tr>
<tr>
<td>Skill (%) (highest tertile)</td>
<td>41</td>
<td>10 (24, 3) (p&lt;0.0001)</td>
<td>25</td>
<td>27 (16, 38) (p=0.14)</td>
</tr>
<tr>
<td>Control (%) (highest tertile)</td>
<td>55</td>
<td>19 (5, 33) (p=0.006)</td>
<td>35</td>
<td>-1 (12, 11)</td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demand (%) (highest tertile)</td>
<td>23</td>
<td>21 (35,8)</td>
<td>40</td>
<td>-4 (30, 22)</td>
</tr>
<tr>
<td>Decision (%) (highest tertile)</td>
<td>45</td>
<td>27 (11,43)</td>
<td>36</td>
<td>18 (8, 43)</td>
</tr>
<tr>
<td>Skill (%) (highest tertile)</td>
<td>38</td>
<td>0 (15, 16)</td>
<td>50</td>
<td>13 (16, 42)</td>
</tr>
<tr>
<td>Control (%) (highest tertile)</td>
<td>33</td>
<td>11 (-5, 27)</td>
<td>22</td>
<td>0 (28, 28)</td>
</tr>
</tbody>
</table>
Table 3b. Subgroup analysis of psychosocial factors in Pollard et al [26] according to the country of ancestral origin

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th>Females</th>
<th>Overall ethnic group difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>p*</td>
<td>p*</td>
<td>B*</td>
</tr>
<tr>
<td>Contact with relatives (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None per month</td>
<td>15</td>
<td>15</td>
<td>8</td>
</tr>
<tr>
<td>1-5 per month</td>
<td>74</td>
<td>75</td>
<td>78</td>
</tr>
<tr>
<td>6+ per month</td>
<td>11</td>
<td>10</td>
<td>14</td>
</tr>
<tr>
<td>Contact with friends (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None per month</td>
<td>3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>1-5 per month</td>
<td>72</td>
<td>77</td>
<td>73</td>
</tr>
<tr>
<td>6+ per month</td>
<td>25</td>
<td>20</td>
<td>25</td>
</tr>
<tr>
<td>Attendance at worship (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never or rarely</td>
<td>29</td>
<td>13</td>
<td>8</td>
</tr>
<tr>
<td>At least once a month</td>
<td>71</td>
<td>87</td>
<td>92</td>
</tr>
</tbody>
</table>

*Indians  P-Pakistanis  B-Bangladeshis  ns—not statistically significant

Rationale for a narrative systematic review

The tables demonstrate considerable heterogeneity across the studies in quality assessment, methods and psychosocial measures. Hence, the meta-analysis of the included studies was not deemed appropriate.

Table 4. Subgroup differences in psychosocial factors relating to coronary heart disease in the UK South Asian population in William et al [22] according to religion

<table>
<thead>
<tr>
<th>a. First author (bibliographic reference)</th>
<th>a. Method of analysis</th>
<th>Psychosocial factors</th>
<th>Sikhs</th>
<th>Muslims</th>
<th>Hindus</th>
<th>General population</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. Key risk factors</td>
<td>b. Summary measure for key analysis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Key confounders</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Williams et al (22)</td>
<td>1. Analysis of covariance</td>
<td>Financial strain (mean[95%CI])</td>
<td>3.54 (3.2–3.9) (p&lt;0.5)</td>
<td>5.06 (4.5–5.6) (p&lt;0.001)</td>
<td>3.90 (3.5–4.3) (p&lt;0.5)</td>
<td>3.01 (2.7–3.3) (p&lt;0.001)</td>
</tr>
<tr>
<td>b. Chronic stressors (overcrowding, discrimination, work stress, financial strain)</td>
<td>2. Fischers least significance difference tests</td>
<td>Social cohesion (mean[95%CI])</td>
<td>60.8 (59.2–62.4) (p&lt;0.5)</td>
<td>56.2 (53.4–59.1) (p= 0.013)</td>
<td>58.4 (56.2–60.5) (p&lt;0.5)</td>
<td>62.2 (60.8–63.5) (p&lt;0.5)</td>
</tr>
<tr>
<td>c. Age, sex, socioeconomic position</td>
<td>1. Mean values (95% confidence intervals)</td>
<td>Perceived racial discrimination (% [95% CI])</td>
<td>38.1 (34.5–41.7) (p= 0.034)</td>
<td>39.2 (32.6–45.8) (p= 0.034)</td>
<td>28.6 (23.7–33.4)</td>
<td>Not applicable</td>
</tr>
<tr>
<td></td>
<td>2. Percentage (%) (95% confidence intervals)</td>
<td>Social network (mean[95%CI])</td>
<td>5.56 (5.4–5.7) (p = 0.024)</td>
<td>5.11 (4.8–5.4) (p&lt;0.001)</td>
<td>5.25 (5.0–5.5) (p&lt;0.5)</td>
<td>5.02 (4.9–5.1) (p&lt;0.5)</td>
</tr>
</tbody>
</table>
Table 5. Analysis of psychosocial factors in Hemingway et al [27] combining men and women in South Asians and White population

<table>
<thead>
<tr>
<th>a. First author (Bibliographic reference)</th>
<th>a. Method of analysis</th>
<th>Psychosocial factors</th>
<th>White/general population men and women combined</th>
<th>South Asian men and women combined</th>
<th>Statistical significance (p value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Hemingway (27)</td>
<td>1. Direct standardization</td>
<td>Depression</td>
<td>1.0</td>
<td>1.38 (1.1-1.7)</td>
<td>0.001</td>
</tr>
<tr>
<td>b. Minor psychiatric morbidity (GHQ), social supports, work psychosocial characteristics</td>
<td>2. Logistic regression</td>
<td>Anxiety</td>
<td>1.0</td>
<td>0.86 (0.7-1.1)</td>
<td>0.18</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Negative support</td>
<td>1.0</td>
<td>2.61 (2.1-3.3)</td>
<td>0.0001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Emotional support</td>
<td>1.0</td>
<td>0.71 (0.5-0.9)</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td>b. OR (95%CI)</td>
<td>Social support at work</td>
<td>1.0</td>
<td>1.17 (1.0-1.4)</td>
<td>0.12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control at work</td>
<td>1.0</td>
<td>0.82 (0.7-1.0)</td>
<td>0.06</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Effort reward imbalance</td>
<td>1.0</td>
<td>1.33 (1.1-1.7)</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hostility</td>
<td>1.0</td>
<td>2.58 (2.0-3.4)</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

Discussion
Principal findings
Our principal finding is that given the potential importance of the subject there is a serious shortage of published data. This needs to be remedied. The results indicate that South Asians had higher levels of psychosocial risk factors than the reference population which is noted below. The question of whether the association with health outcomes was similar could not be answered for the lack of prospective studies with relevant outcomes.
Apart from one paper [25] all others established higher psychosocial risk factors in South Asians residing in the UK.
One paper [22] established that a greater number of Muslims were subject to poor socioeconomic circumstances, with respect to homeownership, income and social deprivation. From these papers, it could be noted that Muslims were in a disadvantaged position in comparison to Hindus and Sikhs with respect to psychosocial factors, but not with respect to social relationships. Since the review suggests that Muslims were more exposed to psychosocial adversities in comparison to Sikhs and Hindus, hence the conclusions also apply to the different subsets of the South Asian population.
One paper [25] concluded that there was no statistically significant difference between the overall balance of job demand and control in South Asian and European people and increased work strain does not contribute to the increased risk of CHD in UK South Asian people. However, another paper [27] showed some evidence of more psychosocial stress among the South Asians in the Whitehall 2 study [27].
The authors found that South Asians had greater effort/reward imbalance and less job control, greater depression and hostility compared to the reference population. Fischbacher postulated that the difference in psychosocial work characteristics between the findings of Hemingway et al [27] and Fischbacher et al [25] were due to the difference in the category of occupation of the respondents. The first one collected data from civil servants while Fischbacher included participants from a broader range of occupations in their study.

Strengths and limitations
The strengths included that studies were assessed for methodological quality; grey literature was included to minimize publication bias [30]. Reporting followed the recommendations of the Centre for Reviews and Dissemination (CRD) [31] and the PRISMA guidelines [32]. This review imposed no restrictions on the publication year or language. A rigorous search process was applied. The databases were searched at the beginning of the review and repeated to identify up-to-date relevant papers. In this review, several psychosocial factors...
were identified. The risk factors were measured by validated questionnaires in the included papers, providing information regarding a spectrum of psychosocial factors. Williams [21-23] and Fischbacher [25] tested the used checklists and scales for internal scale consistency (Cronbach's alpha score) thus ensuring the reliability of the measurements.

The limitations include the possibility of publication bias, although we have tried to address this by searching grey literature. The literature was sparse, wholly from the UK, mostly from London and only from four separate studies. There is also a possibility of bias concerning the methods involved. The search was conducted solely by DBG as the work started as a Master of Public Health (MPH) project, for which autonomous working under regular supervision by RSB was a requirement. There were 5150 articles retrieved initially from the search results, the fact that this has been screened by one individual could have led to bias. Furthermore, the extracted data in the tables were double-checked by RSB, to help minimize errors.

All the studies in the review are cross-sectional in design; none of the studies are prospective studies or randomized controlled trials. Future prospective studies are needed to further explore the association since it is difficult to determine if the psychosocial factors described preceded the coronary heart disease event in the included studies. These cross-sectional studies need to be interpreted with caution [22]. The methods of assessment of psychosocial factors across the papers lacked standardization. This compromises the ability to compare findings across studies.

The language of all the included papers was English, although there was no restriction on language in the inclusion criteria. This fact signifies a lack of research in this field in non-English speaking countries.

A number of measurement tools were not validated specifically for the South Asian population like the Karassik questionnaire used by Fischbacher [25]. It had been tested with the White European and North American populations but not in South Asian samples [25].

Comparison with other studies

Several researchers had conducted literature reviews [8,16,17,34] in the past investigating the link between psychosocial factors and CHD and have established a positive correlation between stress [17], social support [17,34]; work-related psychosocial factors [16,34]; depression [34] and etiology and prognosis of CHD. A very recent meta-analysis had established a modest association between job insecurity and IHD risk [35]. Previous reviews were conducted in the UK and America but did not specify the ethnicities studied.

It seems reasonable to assume that in the South Asian population there is an association between psychosocial factors and CHD based on the previous INTERHEART study [12,29].

In the context of incidence of CHD and its associated mortality, Bangladeshis are in the highest unfavorable position followed by Pakistanis and Indians [35]. The subgroup analysis in the current review showed that Muslims were in a disadvantageous position in comparison to Hindus and Sikhs with respect to psychosocial factors, but not with respect to social relationships. It would be important to explore in future research whether the above sub-group findings could be related to the high burden of CHD in the Muslim population [2].

Implications for research

These papers show that South Asians are subjected to higher work stress, but no research has focused on stress due to the threat of job loss. Further research exploring job insecurities in the South Asians are essential as evidence shows job insecurity act as risk factors of CHD [36].

This review has included relevant papers from the UK only, despite broader geographical inclusion criteria. No research was available for the rest of Europe or North America either in English or other languages. Previous reviews have shown a scarcity of research data in non-White populations in Europe [37]. More research should be directed towards the South Asian population residing in other parts of the UK, the rest of Europe and indeed on the Indian subcontinent.

Conclusion

There is some evidence of a higher prevalence of psychosocial factors in South Asians than in reference populations. Studies should be planned to explore the prospective associations between such risk factors and health outcomes.

Conflict of interest

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