Abstract

Objectives Mediation analyses were conducted to explore the contribution of lifestyle behaviours in the ethnic pattern of poor health outcomes in Leicester, England.

Study design Cross-sectional study

Methods The study used data on 1,959 participants from the Leicester Health and Wellbeing Survey (2015). Lifestyle behaviours were physical activity, diet, smoking and alcohol drinking. Poor health outcomes were the presence of long-term illness and poor self-reported health.

Results Poor health outcomes were less common in Black and Minority Ethnic groups (BMEs) than Whites. Smoking was less common in BMEs than Whites. Poor health outcomes were more common in ex-smokers and current smokers than never smokers. Health outcomes were associated with smoking even after adjusting for ethnicity. The association of ethnicity and health outcomes reduced after adjusting for smoking, suggesting that the effect was mediated by smoking.

Conclusions In Leicester, Whites had poorer health outcomes than BMEs, which were not mediated by physical activity, diet and alcohol drinking but were mediated by smoking.

Keywords Ethnicity, lifestyle behaviours, poor health outcomes, Leicester

Main text

Introduction

Lifestyle behaviours, such as physical activity, diet, smoking and alcohol drinking, are modifiable factors.[1,2] Variations in health between different population groups, due to factors like these, are called health inequities, which are unfair and avoidable.[1] In England, health inequity is a major issue, and the costs associated with health inequities are substantial.[3] Its reduction is a key goal of public policy.[1-3] Thus, understanding the behavioural determinants of health inequities are important for achieving such a goal.

England is an ethnically diverse country.[4] Variations in health have been reported between Whites and Black and Minority Ethnic groups (BMEs, comprises of mixed, Asian or Asian British, Black and Black British, and other ethnic group). Usually, BMEs are at higher risk of poor health outcomes compared to Whites.[5-7] Studies on the extent to which lifestyle behaviours contribute to ethnic inequities in health are growing. For example, analysis of the Health Survey for England (HSE) 2003-2006 data showed that lifestyle behaviours are one of the major contributors explaining ethnic inequities in health, especially explaining poor health outcomes in South Asians.[8] When determining the mechanisms through which ethnicity is related to health outcomes, it is important to note that health outcomes are determined by factors associated with ethnicity. The distribution of these factors, such as lifestyle behaviours, manifest unequally in different population groups and can be conceptualised broadly as ethnic differences.[6-9]

Leicester is the largest city in the East Midlands region of England.[10] It is one of the most ethnically diverse cities - around 50% of the population are from BME backgrounds compared to around 15% in England.[4] Leicester exhibits some of the most complex health needs and biggest health inequities.[10,11] The aim of the study was to explore the contribution of lifestyle behaviours in the ethnic pattern of poor health outcomes in this multi-ethnic city population. It was hypothesised that the association of ethnicity and health outcomes was mediated by

lifestyle behaviours, and ethnicity was still affecting health outcomes. The proposed mediational model was a causal model, as shown in Figure 1.

Methods

Study design and participants, and data source and collection procedure

This study used data from the Leicester Health and Wellbeing Survey (2015). This survey was commissioned by the Leicester City Council (Public Health Division). The data were collected by an independent research agency, Ipsos MORI. Trained interviewers conducted face-to-face interviews with the participants using a quantitative questionnaire, under the Market Research Society Code of Conduct and the Data Protection Act, 1998. The aim of the survey was explained to the potential participants and consent was obtained from those interested in participating. The survey was conducted from January to June 2015. A total of 2,321 residents, aged 16 years or above, were interviewed in pre-assigned sample points across Leicester. Quotas were set by age, sex, ethnicity and work status to ensure demographic representativeness. The interviewers continued to knock on the doors until they reached the target. Data were not collected on those who opted against taking part. In this study, data on 1,959 (out of 2,321) participants between 16 and 65 years of age were analysed and data on the remaining 362 participants aged over 65 years were excluded. Age is a strong confounder, and thus, participants above 65 years of age were excluded. Older people are usually different in terms of their lifestyle behaviours and health outcomes.[12]

Study variables

Relevant data were extracted from the survey dataset. The standard UK census survey question for ethnicity was used for data collection.[4] Participants were asked: 'To which of the groups on this card do you consider you belong? Just read out the letter that applies.' The main categories available were – White, Mixed, Asian or Asian British, Black or Black British, and other ethnic group. Under each of these categories, further options were available. In our study, potential confounders were age (in years), sex and index of multiple deprivation 2015

(IMD) (represented the socio-economic status; IMD combines seven domains of deprivation - income, employment, education, skills and training, health and disability, crime, barriers to housing and services, and living environment; 5 quintiles of IMD with 1 and 5 representing the most and least deprived groups, respectively).[13] Four lifestyle behaviours (potential mediator variables) were physical activity (moderate-intensity; ≥150 minutes/week and <150 minutes/week),[14] diet (fruit and vegetables; ≥5 portions/day and <5 portions/day),[15] smoking (included cigarettes and bidi; never, ex-smoker and current smoker), and alcohol drinking (never, ex-drinker and current drinker). In the survey, participants were asked validated questions like 'Do you have any long-standing illness, disability or infirmity? By long-standing I mean anything that has troubled you over the last 12 months, or that is likely to affect you over the coming 12 months' and 'How is your health in general?'[16] Poor health outcomes were the presence of long-term illness and poor self-reported health (i.e., fair, bad and very bad options).

Ethics

This study was approved by the Research Ethics Committee, Division of Epidemiology and Public Health, The University of Nottingham (UK).

Statistical analyses

For categorical variables, numbers and percentages were calculated. For normally distributed continuous variables, mean and standard deviation were calculated. Simple logistic regression methods were used to investigate the association between different variables. Health outcomes were dichotomous variables. Mediation analyses for dichotomous variables are not fully developed, unlike for continuous variables.[17,18] Thus, in order to determine the role of lifestyle behaviours in the ethnic pattern of poor health outcomes, we followed the steps (logistic regression mediation) suggested by Nathaniel Herr:[19]

(1) Estimate the association between ethnicity and lifestyle behaviour

(2) Estimate the association between lifestyle behaviour and the health outcome, controlling for ethnicity
(3) Estimate the association between ethnicity and the health outcome (the total effect)
(4) Estimate the association between ethnicity and the health outcome, controlling for lifestyle behaviour (the direct effect).

For every potential mediator variable, the indirect effect, P value (using the Sobel test to determine if the indirect effect of ethnicity on the health outcome through lifestyle behaviour was significant or not) and percentage of the effect that was mediated ((the indirect effect/the total effect)*100) were calculated. Two models were made - (a) unadjusted (b) adjusted for potential confounders (age, sex and IMD). All data were analysed using Stata V.14 for Windows software.

Results

Table 1 shows the characteristics of participants in Leicester. Health outcomes were associated with ethnicity and lifestyle behaviours (physical activity, smoking and alcohol drinking), such that poor health outcomes were less common in BMEs than Whites, poor health outcomes were more common in those doing <150 mins/week of physical activity than those doing ≥150 mins/week of physical activity, poor health outcomes were more common in ex-smokers and current smokers than never smokers, and the presence of long-term illness was more common in ex-drinkers than never drinkers.

Table 2 reports the association between ethnicity and lifestyle behaviours. Ethnicity and lifestyle behaviours were associated, such that doing ≥150 mins/week of physical activity and eating ≥5 portions/day of diet were more common in BMEs than Whites, and smoking and alcohol drinking were less common in BMEs than Whites.

Table 3a and 3b report the mediation analyses. The association of ethnicity and health outcomes increased after adjusting for physical activity and hence, physical activity was not a mediator. Similarly, alcohol drinking was not a mediator. Health outcomes were not associated with diet after adjusting for ethnicity, and hence, diet was not a mediator. Health outcomes were associated with smoking even after adjusting for ethnicity. The association of ethnicity and health outcomes reduced after adjusting for smoking, suggesting that the effect was mediated by smoking. In the case of the presence of long-term illness and poor self-reported health, 18% and 92% of effects were mediated by smoking, respectively. In the adjusted models, similar results were found.

Discussion

The main finding of this study

Poor health outcomes were less common in BMEs than Whites. Smoking was less common in BMEs than Whites. Poor health outcomes were more common in ex-smokers and current smokers than never smokers. Health outcomes were associated with smoking even after adjusting for ethnicity. The association of ethnicity and health outcomes reduced after adjusting for smoking, suggesting that the effect was mediated by smoking.

What is already known on this topic?

In our study, poor health outcomes were less common in BMEs than Whites. This finding is consistent with other surveys.[16,20] In 2012, the prevalence of limiting long-standing illness or disability in Great Britain was 20% and 11% in Whites and BMEs, respectively.[20] In the 2011 Census, the poor self-reported health in Leicester was 22% and 17% in Whites and BMEs, respectively.[16] Better self-reported health in BMEs could be an indication of the positive impact of past actions introduced by the relevant authorities to address health inequities faced by BMEs (e.g., better access to quality healthcare services). On the other hand, long-term illness was less common in BMEs, and this could be the result of undiagnosed cases/unawareness of their illness (e.g., type 2 diabetes) or they might have restrained from disclosing their

personal information in a survey.[21-23] In our study, poor health outcomes were more common in Whites, and this serves as an alert to relevant authorities. There is a clear need to do an in-depth study on this issue and take necessary actions accordingly.

We found that smoking mediated the association of ethnicity and health outcomes. Smoking has a harmful effect on nearly all the body organs, causes many diseases, and negatively affects a person's overall health.[24] In England, smoking is the single biggest cause of preventable illness and death.[25,26] In our study, the prevalence of smoking was 23%. In 2017, the Public Health England's health profile for Leicester reported an 18% prevalence.[10] In Leicester, smoking, the biggest lifestyle risk factor, is more common in Whites (29%) than BMEs (13%).[11] Similarly, in England, smoking rates are generally less common in BMEs compared to the general population. However, these rates vary greatly between BME sub-groups.[27,28] Since our study found that Whites had poorer health outcomes compared to BMEs, which in turn was mediated by smoking, so the relevant authorities should conduct a health equity audit of evidence-based actions to change this unhealthy behaviour (e.g., access to, take-up and outcome of NHS Health Checks and Smoking Cessation services). The health inequities that are driven by variations in smoking prevalence will only be reduced through actions that have a greater effect on smokers in higher prevalence groups. This means using both population-level interventions which these smokers are more sensitive to and targeting interventions on these smokers.[25,27] It should be noted that smoking is only one form of tobacco usage, especially in BMEs.[27] Thus, future research on this topic must include other forms of tobacco usage.

Lifestyle behaviours are one of the major contributors explaining ethnic inequities in health.[8] However, this concept is not without objections. Experts have argued that ethnic groups are, conveniently, seen as the cause of their own problems by supposedly following unhealthy lifestyles associated with their cultures. Research on lifestyle behaviours has led to mixed conclusions - for some lifestyle behaviours, BMEs generally fare well, and for others, they fare

less well. At the same time, there are huge variations in lifestyle behaviours across ethnic groups, age, genders, socio-economic deprivation, religions and generations. Their recommendation is to focus on socio-economic causes, as the socio-economic inequities associated with ethnicity are the main drivers of ethnic inequities in health.[7]

Strengths and limitations of this study

This study has a number of strengths and weaknesses. This is the first study to determine the role of lifestyle behaviours in the ethnic pattern of poor health outcomes in a multi-ethnic population in Leicester. In terms of generalisability, the study findings could be valid in settings with similar populations. The questions were adapted from the health and wellbeing measurement section of the UK census survey questionnaire, which has been used several times and has improved over time. This ensured the validity and reliability of the questionnaire. The trained interviewers used a standardised protocol for data collection. Missing data could lead to bias, but it was nil in this study. Quota sampling has its own limitations (e.g., problems in making inferences from the sample to the population). All the data were self-reported, and subjectivity, recall bias, and social desirability bias could have been an issue. Thus, studies incorporating objective measures and existing records could be used in the future, which would cross-check our study findings and provide a more complete picture. Around 89% of all respondents spoke and read English 'very' or 'fairly' well, and language was an issue with some participants. In such cases, a family member or a professional interpreter was involved in the interview process, which might have influenced a small number of responses. Health outcomes may vary between BME sub-groups. For example, analysis of HSE 2003-2006 data showed that some BME sub-groups reported poor health outcomes while some others reported better health outcomes than Whites.[8] In our study, they were combined as a single group as the sample size in each subgroup was not adequately large enough. Thus, further research is needed to explore health outcomes in BME sub-groups, including those that are invisible in the standard ONS classification of ethnicity.[25] Although someone's ethnicity does not change over time, however, being a self-assessed characteristic, it can change with the

changing views of national identity. In our study, this chance was negligible as we had only two broad groups (Whites and BMEs). The assumed causal association between lifestyle behaviours and health outcomes might not be valid, and these lifestyle behaviours could be the result of health outcomes (i.e., reverse causality). This would be better explored through a long-term longitudinal study. However, a long-term longitudinal study would be much more expensive and challenging to conduct compared to our study.

In conclusion, in Leicester, Whites had poorer health outcomes than BMEs, which were not mediated by physical activity, diet and alcohol drinking but were mediated by smoking.

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Statement of ethical approval

The study was approved by the Research Ethics Committee, Division of Epidemiology and Public Health, The University of Nottingham (UK).

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Competing interests

No potential conflict of interest was reported by the authors.

References

1. National Institute for Health and Care Excellence (NICE). Health inequalities and population health: local government briefing. Manchester: NICE. 2012. https://www.nice.org.uk/advice/lgb4

2. Public Health England (PHE). Chapter 5: inequality in health. Health profile for England. London: PHE. 2017. https://www.gov.uk/government/publications/health-profile-for-england/chapter-5-inequality-in-health
3. The Marmot Review. Fair society healthy lives. Strategic review of health inequalities in England post-2010. London: The Marmot Review. 2010. http://www.instituteofhealthequity.org/resources-reports/fair-society-healthy-lives-the-marmot-review/fair-society-healthy-lives-full-report-pdf.pdf
4. Office for National Statistics (ONS). 2011 Census: ethnic group, local authorities in England and Wales. Newport: ONS. 2012. https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/2011censuskeystatisticsforlocalauthoritiesinenglandandwales
5. Bécares L. Which ethnic groups have the poorest health? Ethnic health inequalities 1991 to 2011. Manchester: Centre on Dynamics of Ethnicity. 2013. http://hummedia.manchester.ac.uk/institutes/code/briefingsupdated/which-ethnic-groups-have-the-poorest-health.pdf
6. National Centre for Research Methods (NCRS). Mathur R, Grundy E, Smeeth L. Availability and use of UK based ethnicity data for health research. Southampton: NCRS. 2013. http://eprints.ncrm.ac.uk/3040/1/Mathur-_Availability_and_use_of_UK_based_ethnicity_data_for_health_res_1.pdf
7. Nazroo JY. Ethnic inequalities in health: addressing a significant gap in current evidence and policy. "If you could do one thing..." Nine local actions to reduce health inequalities. London: British Academy. 2014. https://www.thebritishacademy.ac.uk/sites/default/files/James%20Y.%20Nazroo%20-%20Ethnic%20Inequalities%20in%20Health%20-%20Addressing%20a%20Significant%20Gap%20in%20Current%20Evidence.pdf
8. Mindell JS, Knott CS, Ng Fat LS, et al. Explanatory factors for health inequalities across different ethnic and gender groups: data from a national survey in England. Journal of

Epidemiology and Community Health. 2014; 68(12):1133-44. https://www.ncbi.nlm.nih.gov/pubmed/25096809

9. Pearce N, Foliaki S, Sporle A, et al. Genetics, race, ethnicity, and health. British Medical Journal. 2004; 328(7447):1070-2. https://www.bmj.com/content/328/7447/1070
10. PHE. Health profiles: Leicester. London: PHE. 2017. https://fingertips.phe.org.uk/profile/health-profiles/area-search-results/E06000016?place_name=Leicester&search_type=parent-area
11. Leicester City Council. Joint strategic needs assessment. Leicester: Leicester City Council. 2016. https://www.leicester.gov.uk/your-council/policies-plans-and-strategies/health-and-social-care/data-reports-information/jsna/jsna-2016/
12. British Medical Association (BMA). Growing older in the UK: a series of expert-authored briefing papers on ageing and health. London: BMA. 2016. https://www.bma.org.uk/collective-voice/policy-and-research/public-and-population-health/healthy-ageing
13. Ministry of Housing, Communities and Local Government (MHCLG). English indices of deprivation 2015. London: MHCLG. 2015. https://www.gov.uk/government/statistics/english-indices-of-deprivation-2015
14. Department of Health (DH). UK physical activity guidelines. London: DH. 2011. https://www.gov.uk/government/publications/uk-physical-activity-guidelines
15. PHE. The eatwell guide. London: PHE. 2016. https://www.gov.uk/government/publications/the-eatwell-guide
16. ONS. 2011 Census. Newport: ONS. 2012. https://www.ons.gov.uk/census/2011census
17. Kenny DA. Mediation. 2018. http://davidakenny.net/cm/mediate.htm
18. Samawi H, Cai J, Linder DF, et al. A simpler approach for mediation analysis for dichotomous mediators in logistic regression. Journal of Statistical Computation and Simulation. 2018; 88(6):1211-27. https://www.tandfonline.com/doi/abs/10.1080/00949655.2018.1426762

19. Herr NR. Mediation with dichotomous outcomes. http://www.nrhpsych.com/mediation/logmed.html
20. ONS. Prevalence of limiting long-standing illness or disability. Opinions and Lifestyle Survey: adult health in Great Britain, 2012. Newport: ONS. 2014. https://webarchive.nationalarchives.gov.uk/20151014021821/http://www.ons.gov.uk/ons/rel/ghs/opinions-and-lifestyle-survey/adult-health-in-great-britain--2012/index.html
21. Szczepura A. Access to health care for ethnic minority populations. Postgraduate Medical Journal. 2005; 81(953):141-7. https://www.ncbi.nlm.nih.gov/pubmed/15749788
22. Scheppers E, van Dongen E, Dekker J, et al. Potential barriers to the use of health services among ethnic minorities: a review. Family Practice. 2006; 23(3):325-48. https://www.ncbi.nlm.nih.gov/pubmed/16476700
23. Kappelhof J. Surveying ethnic minorities: the impact of survey design on data quality. The Hague: Netherlands Institute for Social Research. 2015. https://dspace.library.uu.nl/handle/1874/313224
24. U.S. Department of Health and Human Services. The health consequences of smoking - 50 years of progress: a report of the surgeon general. Atlanta: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health. 2014. https://www.surgeongeneral.gov/library/reports/50-years-of-progress/full-report.pdf
25. Action on Smoking and Health (ASH). Briefing: health inequalities and smoking. London: ASH. 2016. http://ash.org.uk/information-and-resources/briefings/ash-briefing-health-inequalities-and-smoking/
26. Cancer Research UK. Cancer research UK briefing: the impact of tobacco use on health inequalities. London: Cancer Research UK. 2014. https://www.cancerresearchuk.org/sites/default/files/policy_december2014_inequalities_briefing.pdf

27. Millward D, Karlsen S. Tobacco use among minority ethnic populations and cessation interventions. London: Race Equality Foundation. 2011. https://raceequalityfoundation.org.uk/wp-content/uploads/2018/03/health-brief22_0.pdf
28. PHE. Public health outcomes framework: health equity report. Focus on ethnicity. London: PHE. 2017. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/733093/PHOF_Health_Equity_Report.pdf