Title

Ethnic disparities in preventable hospitalisation in England – an analysis of 916,375 emergency admissions

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All authors contributed to the planning and reporting of this work (JP, JK, PAL). JP conducted the study. The corresponding author attests that all listed authors meet the authorship criteria and that no others meeting the criteria have been omitted.

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The authors have no interests to declare (JP, JK, PAL).

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Transparency declaration
The lead author (JP) affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

Dissemination declaration
This is a database study and dissemination to study participants is not possible/applicable.

Patient and public involvement
It was not appropriate or possible to involve patients or the public in the design, or conduct, or reporting, or dissemination plans of our research.

Patient consent
Not applicable.

Data sharing
The data that support the findings of this study are available from NHS Digital, but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available.

What is already known on this subject

- Emergency hospital admissions are distressing for patients, associated with poorer long-term outcomes, and are costly to the healthcare system.

- Indicators for admissions considered preventable have been defined and known as ambulatory care sensitive conditions (ACSC). ACSC admissions have been associated with patients under the age 5 years, the elderly, deprivation, and ethnicity. The English NHS monitors ACSC in the general population and saw a 40% rise between 2001 and 2011.
- Studies in US, New Zealand, and Scotland have found higher risk of ACSC admission for many ethnic minorities compared to the White majority populations.

What this study adds

- This is the first study of its kind in England and the first investigation of the different ACSC outcomes for all major ethnic groups in the UK.
- Preventable emergency admissions (ACSC) were especially high among patients with Bangladeshi, Pakistani, Black African, White Other or Other background with up to two-fold differences compared to the White British majority group in England.
- The results for the different ACSC outcomes suggest that the identified ethnic groups may not be receiving optimal primary care.

Abstract (word count: 245)

Objectives To study ethnic inequalities in ambulatory care sensitive conditions (ACSC) in England.

Design Observational study of inpatient hospital admission database enhanced with ethnicity coding of patient surnames. The primary diagnosis of the first episode in spells with emergency admission were coded with definitions for acute ACSC, chronic ACSC, and vaccine-preventable diseases.

Setting Secondary care at NHS hospitals in England.

Participants 916,375 ACSC emergency admissions in 739,618 patients were identified between April 2011 and March 2012.

Main outcome measures Odds ratios (OR) of ACSC for each ethnic group relative to the White British majority group adjusted for age, sex, and area deprivation.

Results Acute ACSC admission risk adjusted for age and sex was particularly high amongst Other (OR 1.73; 95% CI 1.69 to 1.77) and Pakistani (1.51; 1.48 to 1.54) compared to White British patients. For chronic ACSC, high risk was found amongst Other (2.02; 1.97 to 2.08), Pakistani (2.07; 2.02 to 2.12), and Bangladeshi (1.36; 1.30 to 1.42). For vaccine-preventable diseases, Other (2.42; 2.31 to 2.54), Pakistani (1.94; 1.85 to 2.04), Bangladeshi (1.48; 1.36 to 1.62), Black African (1.45; 1.36 to 1.54), and White Other (1.38; 1.33 to 1.43) groups. Elevated risk was only partly explained in analyses also adjusting for area deprivation.

Conclusions ACSC admission was especially high among individuals of Bangladeshi, Pakistani, Black African, White Other, or Other background with up to two-fold differences compared to the White British group. This suggest that these ethnic groups are not receiving optimal primary care.

Keywords
Health services, preventive medicine, epidemiology, ethnicity

Introduction

Emergency hospital admissions are distressing for patients, associated with poorer long-term outcomes, and are costly to the healthcare system. Many healthcare systems are therefore undergoing reforms to reduce emergency admissions by improving early detection, treatment and monitoring of a range of conditions in less intensive settings, i.e. primary and community care services [1,2]. These conditions are known as ambulatory care sensitive conditions (ACSC). ACSC include acute, chronic, and vaccine-preventable conditions such as urinary tract infections, chronic obstructive pulmonary disease (COPD), and pneumonia. ACSC admissions have been associated with patients under the age 5 years, the elderly, deprivation, and ethnicity [1].

The English National Health Service (NHS) saw a 40% rise in ACSC admissions in 2001-2011 [1] and a 42% rise in emergency admissions between 2006 and 2017 making this a policy area of urgency [3]. ACSC indicators were introduced into the NHS Commissioning Outcome Framework in 2012 to monitor this area for quality of care improvements for the general population [1]. Whilst ACSC has been studied before in England, there has to our knowledge not been a study of ethnic inequalities in ACSC in England nor of its geographical distribution for these groups. A study of ACSC is particularly pertinent for the understanding of ethnic inequalities, because they are indicative of how patients from different minorities access and navigate the healthcare system. Studies in US, New Zealand, and Scotland have found higher risk of ACSC admission for many ethnic minorities compared to the White majority populations [4–6]. A recent Scottish study found that South Asian groups had higher risk of ACSC admission compared to the White majority group [4].

The primary objective of this study was to elucidate whether ethnicity plays an important role in ACSC among emergency admissions in England at a national and regional level. For this study we gathered data on hospital admission from Hospital Episode Statistics (HES) for different ethnic groups in 2011 and linked them to the 2011 Census population estimates.

The completeness of ethnicity data in HES was very low in the 1990s, but has since improved [7]. To address potential gaps in the ethnicity records, a freely available software, Ethnicity Estimator (EE) was used to code patient surnames to major ethnic groups [8]. We report on the ethnicity estimation as a secondary objective of this paper.

Methods

Inpatient hospital admission records with an emergency admission route were obtained from NHS England's Hospital Episode Statistics (HES), April 2011-March 2012. Diagnoses in HES are coded to the International Classification of Diseases (ICD10) system [9]. The primary diagnosis of the first episode in spells with emergency admission were coded with definitions for acute ambulatory care sensitive conditions (ACSC), chronic ACSC, and vaccine-preventable diseases [1] (see Table S1, Supplementary materials for definitions). Only the first episode for each admission was considered to focus on whether the admission could have been prevented. The data were deduplicated so that a

patient could only contribute to the risk of each ACSC group once.

In this population-based study, the denominators came from the 2011 Census and the numerators from HES. Both denominators and numerators are self-assigned ethnic group. The census ethnicity classification is the result of extensive consultation [10] and HES ethnicity classification was based on the 2001 Census [11]. We made a few modifications to harmonise the differences between how data are collected and released at small area level for the 2001 and 2011 censuses. HES-recorded ethnicity categories for Black Other and Other were combined accordingly and all Mixed groups were analysed as one. For Census base population data, Arabic and Black Other were combined with Other.

There is a growing literature about the use of names to impute ethnicity in studies where this information is not routinely collected or is available through data linkage [8,12–14]. Software developed at University College London [8,15] has been used in over 60 scientific studies and social equity audits in applications as diverse as accident and emergency department utilisation, residential segregation, labour market discrimination, and the composition of company boards. The Ethnicity Estimator (EE) software was deployed in this study to address problems with missing self-reported ethnicity information in HES [8,12,13]. To retain full anonymity, the surname coding was carried out in an air-gapped, secure data facility by NHS Digital linking name information in the Patient Demographic Service to HES. We calculated the proportion of each ethnic group correctly predicted by the EE software as a secondary outcome.

The census denominator data were obtained at local authority level. Area deprivation quintiles were accordingly coded at this level [16] by creating population-weighted mean scores and quintiles. Odds ratios (OR) were calculated for each ethnic group using logistic regression with White British as reference group adjusting for age, sex, and area deprivation. Standardised morbidity ratio (SMR) was calculated by ethnic group and local authority district for a combined ACSC outcome (acute, chronic, or vaccine-preventable). The results for areas with less than 20 cases were suppressed. All analyses were carried out using Stata 14 [17] and maps were created using QGIS 3.16 [18].

Results

A total of 916,375 ACSC emergency admissions in 739,618 patients were identified in 2011/12. The most common ACSC were urinary tract infections (17.0% of all ACSC), COPD (12.5%), and pneumonia (10.5%) (Table 1). The majority of ACSC patients were from the White British group (83.3%) followed by White Other (3.7%), Pakistani (2.5%), Other (2.2%), Indian (2.0%), Black African (1.1%), Asian Other (1.1%), White Irish (1.1%), Mixed (1.0%), Black Caribbean (0.9%), Bangladeshi (0.6%), and Chinese (0.2%) (Table 2). Amongst all patients, especially those from Other and Pakistani groups had a significantly higher risk of emergency admission for preventable causes with some variation between gender and whether acute ACSC, chronic ACSC, or vaccine-preventable diseases. Age- and sex-standardised odds ratios of acute ACSC admissions were particularly high for Other (OR

1.73; 95% CI 1.69-1.77) and Pakistani (1.51; 1.48-1.54) patients (Figure 1). For chronic ACSC, the odds ratios were very high for Other (2.02; 1.97-2.07), Pakistani (2.07; 2.02-2.11), and Bangladeshi (1.36; 1.30-1.42) groups. For vaccine-preventable diseases, the same was true for Other (2.42; 2.31-2.54), Pakistani (1.94; 1.85-2.04), Bangladeshi (1.48; 1.36-1.62), Black African (1.45; 1.36-1.54), and White Other (1.38; 1.33-1.43) groups. For the combined ACSC outcome, two groups had particularly elevated odds ratios, Pakistani (1.74; 1.71-1.76) and Other (1.92; 1.88-1.95) (Table 3). Standardising the incidence for area deprivation showed that the results for the groups with elevated risk was partly, but not entirely explained by area deprivation (Figure 1, Table 3). Similar findings were obtained when analysing the data without surname imputation (Figure S1, Table S2, (Supplementary materials)). Overall, Chinese, Mixed, and White Irish had risks well below White British and some groups had comparable risks. Especially, the Pakistani and Other groups appear to be faced with problems around healthcare access for acute and chronic preventable conditions. The results on vaccine-preventable diseases suggest that many ethnic minorities are less well protected.

The maps of ACSC standardised morbidity ratio showed higher risk in Inner London and the old industrial areas of the Midlands and the North. This was consistent for both White British and Pakistani, although Pakistani patients experienced higher risk in other parts of the country.

The sensitivity of the EE software to correctly predict the HES-recorded ethnicity varied by ethnic group (Table 2).

Discussion

Ethnic inequalities in health are manifested in numerous ways and predominantly have social determinants such as poor living and working conditions, discrimination, social exclusion, adverse health behaviours, and poor healthcare accessibility [19]. The incidence of preventable hospitalisations indicates how patients from ethnic minorities access and navigate the healthcare system. We found that among all emergency admissions, especially patients with Other, Bangladeshi, Pakistani, Black African, and White Other backgrounds had higher odds ratio of emergency ambulatory care sensitive conditions (ACSC) relative to the White British majority group, e.g. close to twice as high for the Pakistani and the Other groups.

A study of ACSC in England, 2001-2011, found an overall rise in ACSC admissions of 40% [1]. Part of the increase was attributed to the ageing population, although age-standardised rates still increased 25% over the same time period. The study found the greatest increases in urinary tract infections, pyelonephritis, pneumonia, gastroenteritis, and chronic obstructive pulmonary disease. The authors stated that the first two conditions are difficult to diagnose in the elderly and hence not always detected and treated early enough to prevent a hospital admission [1]. For pneumonia, they found that cases in the elderly have risen over decades in many countries. They speculated whether the increase in ACSC reflected an ageing population with increasingly complex health and social care needs. They also observed that the rise in ACSC coincided with a rise in emergency admission for non-ACSC.

The authors concluded that more reforms were required to improve how primary, secondary, community and adult social care services were organised and delivered under the banner of 'integrated care'.

As evident from this and other papers, several ethnic minorities have been associated with high relative risk of ACSC conditions; notwithstanding that they only account for a smaller proportion of the ACSC problem overall [5]. A recent Scottish study found that ACSC admissions were significantly higher in South Asian groups compared to the White Scottish population [4]. US studies have found higher rates among Black, Hispanic, and Other groups relative to the White majority group [6]. Studies from New Zealand found higher rates among Maori and Pacific Islanders compared to the White majority group [6]. Common for these studies are calls to improve not only access to primary care but also the quality of care received for both ethnic and migrant groups.

The admission risk was generally lower for Chinese patients compared to White British. The Chinese group in the UK has been associated with fewer health problems than other groups including lower mortality [20]. It may also be the case that many from the Chinese group have a preference for traditional Chinese medicine outside the NHS and hence are less well recorded in official records [21].

The results of this study suggest that many ethnic groups are not receiving optimal primary care. The reasons for this could be a combination of structural barriers and health-seeking behaviours. From a supply perspective, general practices offer free health checks including cardiovascular risk profiles and follow-up for patients with chronic conditions such as asthma, diabetes, and heart diseases. These services may not at present reach high risk groups without both greater vigilance among general practitioners and outreach activities to increase the use of primary care and health checks locally. General practices also offer vaccination against diseases such as pneumonia in the elderly and other risk groups and would also provide an appropriate service for detection and treatment of common conditions such as urinary tract infections. The ethnic disparities in vaccine-preventable diseases found in this study suggest that the offer of vaccinations in high-risk groups such as the elderly does not reach all ethnic groups equally well. Concerningly, a recent review of ethnic inequalities in the UK found that many ethnic groups were less satisfied with the healthcare services than the White British group [19], which is a further indication of issues with both access and quality of care.

The maps showed regional effects in the incidence of preventable hospitalisation. Inner London and the old industrial centres of the Midlands and the North had higher incidence than the national average. These industrial and post-industrial areas are associated with persistent deprivation on multiple accounts [16,22–24] and an indication that preventable hospitalisation overlap with regional patterns of deprivation. The incidence for the Pakistani group was more widespread than for the White British and not only concentrated in the most deprived regions. The elevated risk of ACSC admission deattenuated partly when adjusting for area deprivation, which again suggests that the difference between these groups and White British was only partly explained by residence in deprived

areas.

The Other ethnic group was associated with the highest risk of ACSC admissions. This is inherently not a well-defined group, which makes the interpretation of the results more complicated. It could highlight problems associated with a conglomerate of marginalised ethnic groups, but more detailed studies would be needed to unpack this.

Limitations

HES is a unique data set with both strengths and limitations to be acknowledged. It is an administrative dataset that may also reflect time-variant healthcare system factors, e.g. as a result of policy-driven target setting. As a particular strength, HES captures all hospital admissions commissioned by NHS England, which is estimated to cover 98-99% of all hospital activity in England [25]. Patients have recently gained the right to opt out of having their data used for research retrospectively. So far only a small proportion of HES patients have exercised this right [25]. For our research we rely on the accuracy of the coding of each episode of care and acknowledge that while the accuracy may vary, studies have found HES adequate for both research and managerial decision-making [26].

Definitions for ACSC vary in the literature in the number of conditions that are included. We have aligned our definitions with those published by Bardsley et al. (2013), which are also used by the English NHS. ACSC indicators were introduced into the NHS Commissioning Outcome Framework in 2012 [1]. They are not direct indicators of healthcare delivery, but deemed to have value in the monitoring quality of care at a high level [3]. Further studies would therefore be required to map out the more specific healthcare needs, health-seeking behaviours, and barriers for the identified groups. Recording of ethnicity will never be entirely objective as it relates to identity and data in this study were furthermore derived from two different sources of self-assigned ethnicity, i.e. HES for admissions and Census 2011 for base population. It cannot be excluded from consideration that recorded ethnicity may vary with the timing, mode, and context of the response process. Moreover, there could be differences in the coding of a negatively defined category such as Other.

Recorded ethnicity information in HES was below 50% before 2000, but has since improved [7,27]. Only 5.2% of patients in this 2011 study had missing ethnicity information. Combining HES-recorded ethnicity with surname derived ethnicity (EE), as in this study, will also not escape a degree of subjectivity, but is a way to develop a more complete analysis that avoids imputing as missing-at-random. While the imputation increased the incidence for these groups in absolute terms, it only had a modest effect on relative risk and did not change the main findings of the study (Figure 1, Table 3, Figure S1, Table S2). Many bearers of Irish surnames today perceive themselves as White British [8,12]. Surname imputation is more error prone as a consequence. Similar results were nonetheless obtained with and without surname imputation for this group too.

Mixed ethnic group could not be enhanced in the analyses as there is no category for it in the current

version of the EE software. About 2% of the population identified as mixed ethnicity in the 2011 Census [28].

The deprivation adjustment of the regression analyses was conducted at level of local authority because of data availability. It is possible that more of the variation could have been explained if it had been possible to adjust at a finer level of geography.

Conclusions

Preventable emergency admissions were especially high among patients with Bangladeshi, Pakistani, Black African, White Other, or Other background with up to two-fold differences compared to the White British majority group. The results for the different ACSC outcomes suggest that the identified ethnic groups are not receiving optimal primary care. Further studies will be needed to uncover specific barriers. Greater vigilance among health staff along with outreach activities to increase uptake of health checks and other interventions could potentially increase early detection of chronic conditions in these groups. Problems with acute conditions suggest underuse of general practices and community services. For vaccine-preventable diseases, ethnic disparities suggest that the offer of vaccinations in high-risk groups such as the elderly does not reach all ethnic groups equally well. There was some geographical overlap for the combined ACSC endpoint with regions of high levels of deprivation, but the geographical distribution was more dispersed for the Pakistani compared to the White British group. The overall findings of this study, suggest that many ethnic minorities are not receiving optimal primary and preventive care.

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Tables and figures

Table 1 Emergency admissions for ambulatory care sensitive conditions in 2011.

Conditions	Freq.	%
Acute ACSC		
Cellulitis	63,044	6.9
Dehydration	10,615	1.2
Dental conditions	10,485	1.1
ENT	84,219	9.2
Gangrene	1,346	0.1
Gastroentereritis	73,403	8.0
Nutritional deficiencies	205	<.1
Pelvic inflammatory disease	4,805	0.5
Perforated ulcer	4,980	0.5
UTI/Pyelonephritis	155,948	17.0
Sub-total	*409,050*	*44.5*
Chronic ACSC		
Angina	61,625	6.7
Asthma	54,613	6.0
COPD	114,454	12.5
Congestive Heart Failure	56,448	6.2
Convulsion/Epilepsy	77,783	8.5
Diabetes complications	23,142	2.5
Hypertension	6,648	0.7
Iron-deficiency anaemia	12,075	1.3
Sub-total	*406,788*	*44.4*
Vaccine-preventable diseases		
Flu	1,163	0.1
Pneumonia	96,525	10.5
TB	1,618	0.2
Other vaccine preventable	1,231	0.1
Sub-total	*100,537*	*10.9*
Total	916,375	100

Table 2 Patients with ACSC by ethnic group and sensitivity of EE software (Kandt & Longley, 2018) in predicting NHS ethnic group where missing together with the Census 2011 population denominators for England.

Ethnic group	NHS-recorded		NHS-recorded + name imputation		Sensitivity of EE software	Population denominator
	Freq.	%	Freq.	%	%	Freq.
Asian Other	7,558	1.0	7,967	1.1	18.7	819,402
Bangladeshi	4,331	0.6	4,654	0.6	59.5	436,514
Chinese	1,601	0.2	1,760	0.2	68.5	379,503
Indian	13,859	1.9	14,986	2.0	72.4	1,395,702
Pakistani	17,203	2.3	18,551	2.5	79.9	1,112,282
Black African	7,557	1.0	8,329	1.1	55.9	977,741
Black Caribbean	6,800	0.9	6,975	0.9	9.8	591,016
Other	15,629	2.1	15,948	2.2	4.3	881,170
White Other	25,053	3.4	27,452	3.7	42.5	2,430,010
White British	588,333	79.5	616,327	83.3	90.1	42,279,236
White Irish	6,056	0.8	7,867	1.1	47.8	517,001
Mixed	7,280	1.0	7,280	1.0	-	1,192,879
Missing	38,358	5.2	1,522	0.2	-	-
Total	739,618	100	739,618	100	-	53,012,456

Table 3 Age-, sex-, and deprivation adjusted odds ratios (OR 95% CI) for the combined ACSC outcome. NHS-recorded ethnicity replaced with EE prediction where missing (Kandt & Longley, 2018).

Ethnic group	Age-sex adj. OR (95% CI)	p	Age-sex-deprivation adj. OR (95% CI)	p
White British	Ref	-	Ref	-
Asian Other	1.04 (1.02-1.07)	<.001	1.01 (0.98-1.03)	.640
Bangladeshi	1.13 (1.10-1.17)	<.001	0.99 (0.96-1.02)	.590
Chinese	0.51 (0.49-0.54)	<.001	0.49 (0.47-0.51)	<.001
Indian	1.05 (1.03-1.07)	<.001	0.99 (0.97-1.01)	.193
Pakistani	1.74 (1.71-1.76)	<.001	1.54 (1.52-1.57)	<.001
Black African	0.95 (0.93-0.97)	<.001	0.86 (0.84-0.88)	<.001
Black Caribbean	0.98 (0.96-1.01)	.173	0.88 (0.86-0.90)	<.001
Other	1.92 (1.88-1.95)	<.001	1.76 (1.73-1.78)	<.001
White Other	1.20 (1.18-1.21)	<.001	1.16 (1.15-1.18)	<.001
White Irish	0.88 (0.86-0.90)	<.001	0.85 (0.83-0.87)	<.001
Mixed	0.60 (0.59-0.61)	<.001	0.57 (0.56-0.59)	<.001

Figure 1 Odds ratios (OR) of ACSC admission by ethnic group relative to White British adjusted for age, sex, and area deprivation, 2011. Top: Acute ACSC. Middle: Chronic ACSC. Bottom: Vaccine-preventable diseases. Open circles: risk adjusted for age group and sex. Filled circles: adjusted for age group, sex, and area deprivation.

Figure 2 Preventable hospitalisation Standardised Morbidity Ratio by Local Authority District for White British and Pakistani in 2011.