

Ethnicity and suicide risk: a population-based study from England

Authors:

Danah Alothman : Affiliation: School of Medicine, University of Nottingham, UK (worked from Kuwait)

Andrew Fogarty: Affiliation: School of Medicine, University of Nottingham, UK

Edward Tyrrell: Affiliation: School of Medicine, University of Nottingham, UK

Sarah Lewis: Affiliation: School of Medicine, University of Nottingham, UK

Timothy Card: Affiliation: School of Medicine, University of Nottingham, UK

Corresponding Author: Danah Alothman, email: msxda9@nottingham.ac.uk

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Abstract (96)

Using multiple linked electronic health databases, we conducted a large case-control study in England from 2001 through 2019 to examine the association between ethnicity and suicide risk. Asian, Black and Other ethnic groups had a significantly lower suicide risk compared to White individuals, with those of Asian ethnicity having the lowest risk (Odds Ratio 0.53, 95% Confidence Interval 0.47-0.60). This ethnicity related suicide risk was significantly altered by socio-demographic characteristics. These factors can inform the assessment and stratification of suicide risk, as well as the targeting of public health measures designed to reduce suicide incidence.

Introduction (165)

Suicide is a common cause of death both globally and in England. While the causes of suicide are complex and multi-factorial, identifying risk factors for suicide can help in assessing individual patients and designing public health interventions. Ethnicity and immigrant status have been proposed as risk factors but findings have been mixed (1). For example, the indigenous people of Australia (2) and the Dutch residents in the Netherlands (3) were reported to be at higher risk of suicide death than the general population and the non-Dutch residents in Netherlands, respectively. Conversely, higher risk of suicide was observed amongst non-resident Indians around the world in comparison to the native population (4). In England, a country with ethnic diversity, data on the relationship between ethnicity and suicide death has been based on only selected groups of people (5–7) and the risk of suicide in the general population remains poorly understood. We examined differences in suicide risk amongst the main ethnic groups using a population-based dataset from England.

Methods (383)

We conducted a case-control study using linked electronic health databases: Clinical Practice Research Datalink (CPRD) for primary care records (using GOLD and Aurum databases), Hospital Episode Statistics secondary care records and the Office for National Statistics for national mortality records. CPRD has a similar composition to the UK population with regards to age, gender and ethnicity (8) and HES refers to secondary care in England. The study covered the period from 2001 through 2019 and encompassed every suicide case recorded in ONS who were eligible for linkage with the CPRD and HES databases. Controls were selected randomly and longitudinally from the sampling frame of the entire CPRD database linkable to the HES and ONS databases. Controls were matched to cases on suicide date (risk-set sampling) and general practice. Of cases, 14,240 had 40 matched controls each. A further 275 cases had between 9 and 39 controls. We only included patients aged 15 years or above at suicide/index date, patients with an acceptable quality of records who also had at least one year of complete records prior to the index/suicide date, and practices regarded as up to standard (for CPRD GOLD) in their completeness and continuity of records.

Ethnicity records were derived from CPRD and complemented from HES where necessary. Ethnicity codes for CPRD GOLD were based on a validated code list from Mathur et al. (2014) (9) and the list was updated to include additional relevant codes. Codes for CPRD Aurum were developed anew (see Supplementary information 1 for all codes used in this study). We examined six main ethnic groups (Supplementary information 2). As a proxy for socioeconomic status (SES), we used the Index of Multiple Deprivation (IMD), a deprivation score based on the patient's home postcode with higher IMD scores representing lower SES. Missing data on ethnicity (13.6% of the sample) and IMD (0.5% of the sample) were handled using a separate category and multiple imputation, respectively. A sensitivity analysis limiting our study population to the period 2010-2019 was conducted. Conditional logistic regression was used to estimate odds ratios (ORs) and given the risk-set sampling nature of our study, ORs can be interpreted as rate ratios (10). Analysis was conducted using STATA v. 16. Approval was obtained for this study from the MHRA Independent Scientific Advisory Committee – reference number: 20_186RA.

Results (251)

The study included 594,674 participants: 14,515 suicide cases and 580,159 controls. 24% of suicide cases and 13.3% of controls had missing ethnicity data. Most suicide cases were of White ethnicity (70.9%). The relative suicide risk across different ethnic groups and their subpopulations are presented in Table 1.

Compared to White ethnicity, individuals with an Asian ethnicity were at lower risk of suicide (OR 0.53, 95% Confidence intervals CI 0.47 to 0.60) as to a marginally lesser degree were those classified as Black ethnicity (OR 0.60; 95%CI: 0.52 to 0.69). Those individuals with no data on ethnicity had a higher risk of suicide than those with White ethnicity (OR 2.15, 95% CI 2.06-2.24). The diminution of suicide risk among Black and Asian ethnicity was generally greater for female gender and those aged 55 years or above. Lower SES was associated with a lower risk of suicide in individuals of Asian, Black and Other ethnic categories. However, this was not the case for those in the Mixed or missing ethnic group categories. Based on the likelihood ratio test, all main effects and interactions (with age, gender, age and gender and SES) were statistically significant ($P < 0.05$). Limiting the study period to 2010-2019 in the sensitivity analysis reduced the proportion of missing ethnicity data to 9.0% for cases and 9.9% for controls. This did not lead to a significant change in suicide risk across the different ethnic groups, other than for the missing ethnicity group compared to White counterparts (OR 0.86, 95% CI 0.79-0.94).

Table 1: Odds ratio of suicide for different ethnicity categories (in comparison to White counterparts) across subpopulations

	White OR	Asian OR (95% CI)	Black OR (95% CI)	Other OR (95% CI)	Mixed OR (95% CI)	Missing Ethnic Group data OR (95% CI)
ALL	1	0.53 (0.47-0.60)	0.60 (0.52-0.69)	0.76 (0.63-0.90)	0.99 (0.81-1.22)	2.15 (2.06-2.24)
Gender						
Males	1	0.53 (0.46-0.62)	0.64 (0.54-0.75)	0.68 (0.55-0.86)	0.91 (0.70-1.19)	1.7 (1.65-1.81)
Females	1	0.51 (0.39-0.65)	0.55 (0.42-0.73)	0.92 (0.67-1.26)	1.28 (0.91-1.80)	2.08 (1.89-2.29)
Age*						
15-35	1	0.53 (0.42-0.66)	0.96 (0.76-1.22)	0.73 (0.53-1.00)	1.14 (0.83-1.57)	1.72 (1.57-1.88)
35-55	1	0.51 (0.42-0.62)	0.48 (0.39-0.60)	0.57 (0.43-0.77)	0.69 (0.48-0.97)	1.89 (1.77-2.02)
+55	1	0.46 (0.34-0.62)	0.35 (0.24-0.51)	1.05 (0.73-1.50)	1.31 (0.81-2.11)	3.12 (2.89-3.38)
Male						
Age*						
15-35	1	0.54 (0.42-0.71)	0.91 (0.68-1.21)	0.52 (0.34-0.78)	1.00 (0.66-1.51)	1.29 (1.16-1.43)
35-55	1	0.48 (0.39-0.61)	0.60 (0.47-0.77)	0.55 (0.39-0.96)	0.61 (0.39-0.96)	1.53 (1.42-1.66)
+55	1	0.47 (0.33-0.67)	0.27 (0.16-0.46)	1.06 (0.67-1.68)	1.27 (0.67-2.43)	2.89 (2.62-3.20)
Female						
Age*						
15-35	1	0.45 (0.27-0.75)	1.05 (0.63-1.74)	1.10 (0.63-1.93)	1.51 (0.86-2.68)	1.70 (1.35-2.14)
35-55	1	0.55 (0.38-0.79)	0.29 (0.18-0.46)	0.59 (0.34-1.04)	0.96 (0.53-1.75)	1.64 (1.40-1.94)
+55	1	0.39(0.20-0.75)	0.67 (0.38-1.19)	1.13 (0.59-2.15)	1.40 (0.64-3.03)	2.98 (2.53-3.50)
SES						
High (IMD 1-4)	1	0.69 (0.54-0.90)	1.04 (0.69-1.58)	0.93 (0.66-1.32)	0.68 (0.38-1.21)	2.24 (2.1-2.4)
Middle (IMD 5-7)	1	0.53 (0.42-0.67)	0.59 (0.44-0.79)	0.65 (0.45-0.94)	0.96 (0.64-1.44)	2.3 (2.13-2.49)
Low (IMD 8-10)	1	0.42 (0.34-0.51)	0.50 (0.42-0.61)	0.71 (0.55-0.94)	1.02 (0.77-1.34)	1.92 (1.78-2.08)

*Represents age in years at suicide death date for cases and index date for controls.

SES: socioeconomic status; IMD: index of multiple deprivation.

P-value was <0.05 for presented effects across all categories. A single P-value was obtained using a likelihood ratio test for all variables apart from socioeconomic status.

Missing data on IMD were interpolated via multiple imputation- a single P-value for socioeconomic status was obtained using Wald test.

Discussion (631):

This is the first large-scale population-based estimate of the relationship between suicide and ethnicity in England. Our analysis demonstrated that those identifying as White had a higher suicide risk than other ethnic groups, and that sociodemographic factors significantly modified the association between ethnicity and suicide. We have also shown that in lower SES, the Asian, Black and Other ethnicities were at lower risk compared to their White counterparts.

The data used in this study are of proven quality with cause of death being determined by official death registration and ethnicity data in linked CPRD-HES having been shown to be valid (9). While ethnicity and immigration status are correlated, the latter can represent a distinct identity group and the inability to distinguish between ethnicity and immigration status is a limitation in our study. Another limitation of our analysis includes the category with missing ethnicity data which carries the risk of ascertainment bias. However, given that the sensitivity analysis showed no significant change from our main analysis for the suicide risk across the known ethnic groups, ascertainment bias does not appear to be the explanation for our findings.

Suicide risk variations across ethnic groups may be partly due to ethnicity-specific religion and societal factors associated with the risk. As previously reported, populations with a predominance of Atheism and Christianity were at higher suicide risk than those with a predominance of Hinduism and Islam (11). This may explain the lower suicide risk amongst Asian individuals (of whom in England and Wales large proportions identify as Hindus or Muslims) compared to White individuals (who largely identify as Christians or Atheists) (12).

The tendency for suicide risk to converge towards that of the White ethnicity amongst younger non-White ethnic groups relative to older non-White ethnic groups may relate to differing upbringings and attitudes by age-group. The younger generation, who are more likely to be born in England, may have attitudes and experiences more similar to their White counterparts. Conversely, the older generations, perhaps more likely to be born outside of England, may retain attitudes and practices which offer potential protection from suicide or may be in effect a self-selected psychologically robust group willing to undergo migration. Furthermore, given that minority ethnicities are prone to live in close communities, the older generations may benefit from the more readily available social support. The potential positive effect of living in communities can also be deduced from the findings related to SES.

Minority ethnicities seem to be less affected by lower SES than their White counterparts. It could be that the local communities of ethnic minorities may decrease the sense of relative socioeconomic disparity.

Our results were comparable to those in the United States in that Asian and Black ethnicities had lower suicide risk compared to White individuals (13). Despite other previous studies in England being focused on selected groups, our findings were consistent with previous findings of reduced suicide risk amongst Asian individuals compared to White individuals (5–7). Previous data from higher education students in England and Wales showed lower suicide rates amongst Black students compared to White students (similar to the younger age-groups in our study), but slightly higher rates amongst Asian students (14). Our findings contrast to results shown amongst psychiatry patients in England and Wales, where suicide risk was increased in young Black males and females and young South-Asian females relative to their White counterparts (7). Differences in the study populations, study dates, and methods can likely explain the differences in results.

These data suggest that preventive strategies should be ethnicity-sensitive incorporating systematic and social factors distinct to each ethnicity. We recommend that ethnicity is considered when targeting suicide prevention strategies with a priority to White ethnicity, particularly those with a lower SES, and the more affluent and younger age-groups of ethnic minority communities.

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Supplementary information 1

Ethnicity codes for CPRD Gold were based on the code list from Mathur et al. (2014) (9), but the list was updated to include additional relevant codes (see Table 1). Codes for CPRD Aurum were developed anew by searching the relevant terms in the CPRD browser using the wildcard character (*) and by searching the hierarchical structure of the coding system (see Table 2).

Table 1: Read codes and terms for ethnicity records in CPRD Gold.

Read code	Read term	Read code	Read term
9i0..00	british or mixed british - ethnic category 2001 census	9t25.00	white: other white ethnic grp- scotland ethnic cat 2011 cens
9t20.00	white: scottish - scotland ethnic category 2011 census	9T12.00	Other European in New Zealand
9i21.00	scottish - ethnic category 2001 census	9T11.11	Pakeha
9i24.00	northern irish - ethnic category 2001 census	9i2P.00	other republics former yugoslavia - ethnic categ 2001 census
9t21.00	white: other british - scotland ethnic category 2011 census	9i2S.00	other mixed white - ethnic category 2001 census
9t00.00	white:eng/welsh/scot/ni/brit - england and wales 2011 census	9i2B.00	italian - ethnic category 2001 census
134B.00	race: caucasian	9i2E.00	gypsy/romany - ethnic category 2001 census
9S1..00	white	9T4..00	Romanian
9S10.00	white british	9SAC.00	other european (nmo)
9i23.00	cornish - ethnic category 2001 census	9i2D.00	traveller - ethnic category 2001 census
9S13.00	white scottish	9T8..00	Portuguese
9i00.00	white british - ethnic category 2001 census	9S12.00	other white ethnic group
9t10.00	white - northern ireland ethnic category 2011 census	9t02.00	white: gypsy/irish traveller - eng+wales eth cat 2011 census
9S14.00	other white british ethnic group	9t23.00	white: gypsy/irish traveller - scotland ethnic cat 2011 cens
9i20.00	english - ethnic category 2001 census	9Si..00	irish traveller
9i22.00	welsh - ethnic category 2001 census	9SAA.11	greek (nmo)
9i25.00	ulster scots - ethnic category 2001 census	9i2J.00	kosovan - ethnic category 2001 census
9i10.00	white irish - ethnic category 2001 census	9SAB.00	turkish/turkish cypriot (nmo)
9t01.00	white: irish - england and wales ethnic category 2011 census	9i26.00	cypriot (part not stated) - ethnic category 2001 census
9i1..00	irish - ethnic category 2001 census	9i2K.00	albanian - ethnic category 2001 census
9t22.00	white: irish - scotland ethnic category 2011 census	9i2H.00	commonwealth (russian) indep states - ethn categ 2001 census
9S11.00	white irish	9i2L.00	bosnian - ethnic category 2001 census
9SA9.00	irish (nmo)	9SAA.00	greek/greek cypriot (nmo)
9i29.00	turkish - ethnic category 2001 census	9T11.00	New Zealand European
9i2G.00	baltic estonian/latvian/lithuanian - ethn categ 2001 census	9t24.00	white: polish - scotland ethnic category 2011 census
9SAB.11	turkish (nmo)	9i2C.00	irish traveller - ethnic category 2001 census
2261.00	O/E - Europeanoid	9T5..00	Bulgarian
9t03.00	white: other white backgrd- eng+wales ethnic cat 2011 census	9SAB.12	turkish cypriot (nmo)
9T6..00	Czech	9i2F.00	polish - ethnic category 2001 census
9i2..00	other white background - ethnic category 2001 census	9i2Q.00	mixed irish and other white - ethnic category 2001 census
9T7..00	Slovak	9i27.00	greek - ethnic category 2001 census
		9SAA.12	greek cypriot (nmo)

Read code	Read term
9i2N.00	serbian - ethnic category 2001 census
9i28.00	greek cypriot - ethnic category 2001 census
9i2T.00	other white or white unspecified ethnic category 2001 census
9i2A.00	turkish cypriot - ethnic category 2001 census
9i2M.00	croatian - ethnic category 2001 census
9i2R.00	oth white european/european unsp/mixed european 2001 census
9i12.00	mixed: white and black caribbean - ni ethnic cat 2011 census
9SB5.00	black caribbean and white
9t04.00	mixed: white+black caribbean - eng+wales eth cat 2011 census
9i3..00	white and black caribbean - ethnic category 2001 census
9i4..00	white and black african - ethnic category 2001 census
9t05.00	mixed: white+black african - eng+wales eth cat 2011 census
134L.00	race: afro-caucasian
9SB6.00	black african and white
9t13.00	mixed: white and black african - ni ethnic cat 2011 census
9t14.00	mixed: white and asian - ni ethnic category 2011 census
9i5..00	white and asian - ethnic category 2001 census
9SB2.00	other ethnic, asian/white orig
9t06.00	mixed: white+asian - eng+wales ethnic category 2011 census
9i63.00	chinese and white - ethnic category 2001 census
9SB..00	other ethnic, mixed origin
9i6..00	other mixed background - ethnic category 2001 census
9SB3.00	other ethnic, mixed white orig
9t15.00	mixed: other mixed/multiple ethnic backgrd - ni 2011 census
9i62.00	black and white - ethnic category 2001 census
9SB4.00	other ethnic, other mixed orig
9S51.00	other black - black/white orig
9t26.00	mixed/multiple ethnic grps: any- scot ethnic cat 2011 census
9i64.00	asian and chinese - ethnic category 2001 census
9S52.00	other black - black/asian orig
9i65.00	other mixed or mixed unspecified ethnic category 2001 census
9SB1.00	other ethnic, black/white orig
9i60.00	black and asian - ethnic category 2001 census
9t07.00	mixed: other mixed/multiple backgrd - eng+wales 2011 census
9i61.00	black and chinese - ethnic category 2001 census
9S6..00	indian
1347.00	indian origin
9T1D.00	indian
9t08.00	asian/asian brit: indian - eng+wales ethnic cat 2011 census

Read code	Read term
9i7..00	indian or british indian - ethnic category 2001 census
9t28.00	asian: indian, indian scot/indian brit- scotland 2011 census
9t16.00	asian or asian british: indian - ni ethnic cat 2011 census
9t27.00	asian: pakistani/pakistani scot/pakistani brit- scot 2011
9t09.00	asian/asian british:pakistani- eng+wales eth cat 2011 census
9i8..00	pakistani or british pakistani - ethnic category 2001 census
9t17.00	asian/asian british: pakistani - ni ethnic cat 2011 census
9S7..00	pakistani
134M.00	race: pakistani
134I.00	race: bangladeshi
9i9..00	bangladeshi or british bangladeshi - ethn categ 2001 census
9t0A.00	asian/asian brit: bangladeshi- eng+wales eth cat 2011 census
9S8..00	bangladeshi
9t29.00	bangladeshi, bangladeshi scot or bangladeshi brit- scot 2011
9t18.00	asian/asian british: bangladeshi - ni ethnic cat 2011 census
9iA2.00	kashmiri - ethnic category 2001 census
9SA6.00	e afric asian/indo-carib (nmo)
9SA7.00	indian sub-continent (nmo)
9t2B.00	asian: other asian group - scotland ethnic cat 2011 census
2263.00	O/E - Mongoloid origin
134K.00	race: west indian
9iA9.00	mixed asian - ethnic category 2001 census
9iA8.00	british asian - ethnic category 2001 census
2263.11	o/e - asian origin
9SA6.12	indo-caribbean (nmo)
9T9..00	Nepali
9iA3.00	east african asian - ethnic category 2001 census
9iA6.00	sinhalese - ethnic category 2001 census
9iAA.00	other asian or asian unspecified ethnic category 2001 census
9iA5.00	tamil - ethnic category 2001 census
1343.00	asian origin
9SH..00	other asian ethnic group
9iA..00	other asian background - ethnic category 2001 census
9iA4.00	sri lankan - ethnic category 2001 census
9SA8.00	other asian (nmo)
134A.00	west indian origin
9iA1.00	punjabi - ethnic category 2001 census
9t1A.00	asian/asian british: other asian - ni ethnic cat 2011 census
9T1E.00	other asian
9t0C.00	asian/asian brit: other asian- eng+wales eth cat 2011 census

Read code	Read term
9SA6.11	east african asian (nmo)
9iA7.00	caribbean asian - ethnic category 2001 census
9t1C.00	black/afri/carib/black brit: caribbean- ni eth cat 2011 cens
9S2..00	black caribbean
9t2E.00	carib/black: caribbean/carib scot/carib brit-scotland 2011
9iB..00	caribbean - ethnic category 2001 census
9t0E.00	black/african/caribbn/black brit: caribbean - eng+wales 2011
9t2D.00	african: any other african - scotland ethnic cat 2011 census
9iC..00	african - ethnic category 2001 census
2262	O/E - Negroid
9SA5.00	other african countries (nmo)
9t2C.00	african: african/african scot/african brit - scotland 2011
9t1B.00	black/afri/carib/black brit: african- ni eth cat 2011 census
1342.00	african origin
9S44.00	black - other african country
9t0D.00	black/african/carib/black brit: african-eng+wales 2011 cens
9S3..00	black african
9S42.13	black guyana
9S45.00	black e afric asia/indo-caribb
9S43.12	black arab
9S5..00	black - other, mixed
9S45.11	black east african asian
9S4..00	black, other, non-mixed origin
9iD0.00	somali - ethnic category 2001 census
9S43.11	black north african
9S41.00	black british
9t1D.00	black/afri/carib/black brit: other - ni eth cat 2011 census
918t.00	Carer from Black and minority ethnic group
9S45.12	black indo-caribbean
9iD3.00	mixed black - ethnic category 2001 census
9SA3.00	caribbean i./w.i./guyana (nmo)
9t2F.00	carib/black: black/black scot/black brit-scotland 2011 cens
9S43.13	black iranian
9S42.11	black caribbean
9S47.00	black - other asian
9SA3.13	guyana (nmo)
9SG..00	other black ethnic group
9S48.00	black black - other
9iD..00	other black background - ethnic category 2001 census
9iD4.00	other black or black unspecified ethnic category 2001 census
9S43.00	black n african/arab/iranian
9iD2.00	black british - ethnic category 2001 census

Read code	Read term
9t2G.00	carib/black: any other black/caribbean grp - scotland 2011
134H.00	race: afro-caribbean
9S42.00	black caribbean/w.i./guyana
9t0F.00	black/afr/carib/black brit: other black-eng+wales 2011 cens
9SA3.12	west indian (nmo)
9S42.12	black west indian
9SA3.11	caribbean island (nmo)
9S46.00	black indian sub-continent
9iD1.00	nigerian - ethnic category 2001 census
9S9..00	chinese
9t2A.00	asian: chinese - scotland ethnic category 2011 census
9T1C.00	Chinese
9t0B.00	asian/asian brit: chinese - eng+wales ethnic cat 2011 census
9t19.00	asian/asian british: chinese - ni ethnic cat 2011 census
9iE..00	chinese - ethnic category 2001 census
9SA4.11	north african arab (nmo)
9iFG.00	latin american - ethnic category 2001 census
9SA4.00	n african arab/iranian (nmo)
9iF1.00	japanese - ethnic category 2001 census
9iFE.00	kurdish - ethnic category 2001 census
9iF7.00	muslim - ethnic category 2001 census
9t1F.00	other ethnic group: any other grp- ni ethnic cat 2011 census
9t1E.00	other ethnic group: arab - ni ethnic category 2011 census
9iFJ.00	mauritian/seychellois/maldivian/st helena eth cat 2001census
9t0H.00	other ethnic: any other grp - eng+wales eth cat 2011 census
9T1Y.00	other new zealand ethnic group
9t2J.00	other ethnic grp: any other ethnic grp- scotland 2011 census
9SC..00	vietnamese
9SAD.00	other ethnic nec (nmo)
9SA1.00	brit. ethnic minor. spec.(nmo)
9iF9.00	arab - ethnic category 2001 census
9SJ..00	other ethnic group
9T1B.00	south east asian
9iF6.00	jewish - ethnic category 2001 census
9iF0.00	vietnamese - ethnic category 2001 census
9t0G.00	other ethnic group: arab - eng+wales ethnic cat 2011 census
9iF5.00	hindu - ethnic category 2001 census
2264.00	O/E - Australoid
9iFD.00	iranian - ethnic category 2001 census
9SA..00	other ethnic non-mixed (nmo)
9iF3.00	malaysian - ethnic category 2001 census
9T1A.00	other pacific ethnic group

Read code	Read term
9iF8.00	sikh - ethnic category 2001 census
9iF..00	other - ethnic category 2001 census
9iF4.00	buddhist - ethnic category 2001 census
9iF2.00	filipino - ethnic category 2001 census
9iFB.00	mid east (excl israeli, iranian & arab) - eth cat 2001 cens
9iFF.00	moroccan - ethnic category 2001 census
9iFK.00	any other group - ethnic category 2001 census
9T16.00	Tongan
9T19.00	Fijian
9T3..00	Yemeni
9T17.00	Niuean
9T15.00	Cook Island Maori
9T1..00	new zealand ethnic groups
9T14.00	Samoan
9T2..00	Traveller - gypsy
9T13.00	New Zealand Maori
9T18.00	Tokelauan
9T1Z.00	new zealand ethnic group nos
9iFH.00	south and central american - ethnic category 2001 census
9t2H.00	other ethnic grp: arab/arab scot/arab british-scotland 2011

Read code	Read term
9SA2.00	brit. ethnic minor. unsp (nmo)
9iFC.00	israeli - ethnic category 2001 census
9SA4.12	iranian (nmo)
9iFA.00	north african - ethnic category 2001 census
9t1..00	ethnic category - 2011 census northern ireland
9SD..00	ethnic group not given - patient refused
9SZ..00	ethnic groups (census) nos
9S...00	ethnic groups (census)
9i...00	ethnic category - 2001 census
226Z.00	o/e - ethnic group nos
9t0..00	ethnic category - 2011 census england and wales
9iG..00	ethnic category not stated - 2001 census
9t...00	ethnic category - 2011 census
226..11	o/e - ethnic origin
9SE..00	ethnic group not recorded
9T...00	ethnicity and other related nationality data
226..00	o/e - ethnic group
9t2..00	ethnic category - 2011 census scotland
916E.00	Patient ethnicity unknown

Table 2: Medical code IDs and terms for ethnicity records in CPRD Aurum.

Medical code ID	Term
1968051000006116	White:Eng/Welsh/Scot/NI/Brit - England and Wales 2011 census
196641000006110	RACE: Caucasian
248616100000112	White - Northern Ireland ethnic category 2011 census
141441000000119	Welsh - ethnic category 2001 census
141451000000116	Northern Irish - ethnic category 2001 census
459726019	White British
248728100000112	White: Scottish - Scotland ethnic category 2011 census
141461000000118	Cornish - ethnic category 2001 census
141431000000111	Scottish - ethnic category 2001 census
285925010	White
1780408016	Other white British ethnic group
248732100000116	White: other British - Scotland ethnic category 2011 census
1780407014	White Scottish
142691000000116	Ulster Scots - ethnic category 2001 census
158341000000117	British or mixed British - ethnic category 2001 census
106398100000117	White British - ethnic category 2001 census

Medical code ID	Term
157281000000117	English - ethnic category 2001 census
459727011	White Irish
141301000000110	Irish - ethnic category 2001 census
248467100000118	White: Irish - England and Wales ethnic category 2011 census
248736100000112	White: Irish - Scotland ethnic category 2011 census
106404100000111	White Irish - ethnic category 2001 census
285978014	Irish (NMO)
157991000000110	Serbian - ethnic category 2001 census
1968081000006112	White: other White backgrd-Eng+Wales ethnic cat 2011 census
142751000000115	Bosnian - ethnic category 2001 census
142741000000118	Kosovan - ethnic category 2001 census
115830100000115	Bulgarian
411596013	Turkish (NMO)
142781000000114	Mixed Irish and other White - ethnic category 2001 census
937391000006115	Oth White European/European unsp/Mixed European 2001 census
138231000000116	Albanian - ethnic category 2001 census

Medical code ID	Term
142711000000119	Greek Cypriot - ethnic category 2001 census
937371000006116	Other republics former Yugoslavia - ethnic categ 2001 census
141661000000115	Cypriot (part not stated) - ethnic category 2001 census
138191000000113	Gypsy/Romany - ethnic category 2001 census
286009010	Other European in New Zealand
405070017	Greek/Greek Cypriot (NMO)
142761000000117	Croatian - ethnic category 2001 census
138181000000111	Traveller - ethnic category 2001 census
459786016	Irish traveller
142791000000111	Other mixed White - ethnic category 2001 census
285987017	Other European (NMO)
156921000000110	Turkish - ethnic category 2001 census
133078012	Portuguese
142721000000113	Turkish Cypriot - ethnic category 2001 census
937411000006115	Other White or White unspecified ethnic category 2001 census
1968071000006114	White: Gypsy/Irish Traveller - Eng+Wales eth cat 2011 census
459728018	Other white ethnic group
116033100000119	Czech
1968441000006112	White: Gypsy/Irish Traveller - Scotland ethnic cat 2011 cens
1158211000000111	Romanian
411597016	Turkish Cypriot (NMO)
286008019	Pakeha
937311000006113	Commonwealth (Russian) Indep States - ethn categ 2001 census
248748100000113	White: Polish - Scotland ethnic category 2011 census
1551471000000116	Slovak
411595012	Greek Cypriot (NMO)
158481000000115	Italian - ethnic category 2001 census
141311000000112	Other White background - ethnic category 2001 census
286007012	New Zealand European
138201000000110	Polish - ethnic category 2001 census
405071018	Turkish/Turkish Cypriot (NMO)
411594011	Greek (NMO)
1968461000006111	White: other White ethnic grp-Scotland ethnic cat 2011 cens
937301000006110	Baltic Estonian/Latvian/Lithuanian - ethn categ 2001 census
138171000000114	Irish Traveller - ethnic category 2001 census
142701000000116	Greek - ethnic category 2001 census
1968091000006110	Mixed: White+Black Caribbean - Eng+Wales eth cat 2011 census
460153018	Black Caribbean and White
141321000000118	White and Black Caribbean - ethnic category 2001 census
1968261000006110	Mixed: White and Black Caribbean - NI ethnic cat 2011 census

Medical code ID	Term
460154012	Black African and White
141331000000116	White and Black African - ethnic category 2001 census
196611000006111	RACE: Afro-caucasian
1968271000006115	Mixed: White and Black African - NI ethnic cat 2011 census
1968101000006116	Mixed: White+Black African - Eng+Wales eth cat 2011 census
1968111000006118	Mixed: White+Asian - Eng+Wales ethnic category 2011 census
285991010	Other ethnic, Asian/White orig
1968281000006117	Mixed: White and Asian - NI ethnic category 2011 census
141341000000113	White and Asian - ethnic category 2001 census
141351000000111	Other Mixed background - ethnic category 2001 census
285952017	Other Black - Black/White orig
285993013	Other ethnic, other mixed orig
285992015	Other ethnic, mixed white orig
158361000000116	Asian and Chinese - ethnic category 2001 census
1968471000006116	Mixed/multiple ethnic grps: any- Scot ethnic cat 2011 census
1968291000006119	Mixed: other Mixed/multiple ethnic backgrd - NI 2011 census
141471000000113	Black and Asian - ethnic category 2001 census
141481000000110	Black and Chinese - ethnic category 2001 census
157291000000115	Black and White - ethnic category 2001 census
285953010	Other Black - Black/Asian orig
285990011	Other ethnic, Black/White orig
937511000006119	Other Mixed or Mixed unspecified ethnic category 2001 census
285989019	Other ethnic, mixed origin
1968121000006114	Mixed: other Mixed/multiple backgrd - Eng+Wales 2011 census
141491000000112	Chinese and White - ethnic category 2001 census
1968301000006118	Asian or Asian British: Indian - NI ethnic cat 2011 census
781081000006113	Indian
1968491000006115	Asian: Indian, Indian Scot/Indian Brit- Scotland 2011 census
157271000000119	Indian or British Indian - ethnic category 2001 census
1968131000006112	Asian/Asian Brit: Indian - Eng+Wales ethnic cat 2011 census
285954016	Indian
250228011	Indian origin
196721000006111	RACE: Pakistani
1968311000006115	Asian/Asian British: Pakistani - NI ethnic cat 2011 census
141361000000114	Pakistani or British Pakistani - ethnic category 2001 census
285955015	Pakistani
1968481000006118	Asian: Pakistani/Pakistani Scot/Pakistani Brit- Scot 2011
1968141000006119	Asian/Asian British:Pakistani-Eng+Wales eth cat 2011 census

Medical code ID	Term
1968321000006111	Asian/Asian British: Bangladeshi - NI ethnic cat 2011 census
1968501000006111	Bangladeshi, Bangladeshi Scot or Bangladeshi Brit- Scot 2011
1968151000006117	Asian/Asian Brit: Bangladeshi-Eng+Wales eth cat 2011 census
285956019	Bangladeshi
937541000006115	Bangladeshi or British Bangladeshi - ethn categ 2001 census
196631000006117	RACE: Bangladeshi
141571000000114	Caribbean Asian - ethnic category 2001 census
1968341000006116	Asian/Asian British: other Asian - NI ethnic cat 2011 census
157301000000116	Sinhalese - ethnic category 2001 census
285977016	Other Asian (NMO)
141521000000110	Punjabi - ethnic category 2001 census
250243013	Race: West indian
141561000000119	British Asian - ethnic category 2001 census
411584018	Indo-Caribbean (NMO)
412016016	O/E - Asian origin
459784018	Other Asian ethnic group
141541000000115	East African Asian - ethnic category 2001 census
136081000000111	Sri Lankan - ethnic category 2001 census
402434017	O/E - Mongoloid origin
937651000006117	Other Asian or Asian unspecified ethnic category 2001 census
405069018	E Afric Asian/Indo-Carib (NMO)
250231012	West Indian origin
1572831000000110	Nepali
141551000000117	Tamil - ethnic category 2001 census
285976013	Indian sub-continent (NMO)
141531000000112	Kashmiri - ethnic category 2001 census
1968171000006110	Asian/Asian Brit: other Asian-Eng+Wales eth cat 2011 census
141381000000117	Other Asian background - ethnic category 2001 census
411583012	East African Asian (NMO)
286020010	Other Asian
1968521000006118	Asian: other Asian group - Scotland ethnic cat 2011 census
250224013	Asian origin
141511000000116	Mixed Asian - ethnic category 2001 census
154401000000118	Caribbean - ethnic category 2001 census
514611000006111	Black Caribbean
1968361000006117	Black/Afri/Carib/Black Brit: Caribbean- NI eth cat 2011 cens
1968551000006110	Carib/Black: Caribbean/Carib Scot/Carib Brit- Scotland 2011
1968191000006111	Black/African/Caribbn/Black Brit: Caribbean - Eng+Wales 2011
1968351000006119	Black/Afri/Carib/Black Brit: African- NI eth cat 2011 census

Medical code ID	Term
30683015	Black African
1968531000006115	African: African/African Scot/African Brit - Scotland 2011
1968541000006113	African: any other African - Scotland ethnic cat 2011 census
250223019	African origin
1968181000006113	Black/African/Carib/Black Brit: African- Eng+Wales 2011 cens
141391000000115	African - ethnic category 2001 census
285943014	Black - other African country
285971015	Other African countries (NMO)
453109012	Black West Indian
1968201000006114	Black/Afr/Carib/Black Brit: other Black- Eng+Wales 2011 cens
411577014	Black Indo-Caribbean
1968371000006112	Black/Afri/Carib/Black Brit: other - NI eth cat 2011 census
411575018	Black Iranian
405065012	Black N African/Arab/Iranian
157311000000119	Black British - ethnic category 2001 census
1598531000000117	Carer from Black and minority ethnic group
285948017	Black Indian sub-continent
285930014	Black Caribbean
453110019	Black Guyana
411578016	Caribbean Island (NMO)
141601000000119	Nigerian - ethnic category 2001 census
411580010	Guyana (NMO)
411574019	Black Arab
411576017	Black East African Asian
411573013	Black North African
459782019	Other black ethnic group
285950013	Black Black - other
1968571000006117	Carib/Black: any other Black/Caribbean grp - Scotland 2011
158371000000111	Mixed Black - ethnic category 2001 census
141591000000113	Somali - ethnic category 2001 census
196601000006113	RACE: Afro-caribbean
937731000006115	Other Black or Black unspecified ethnic category 2001 census
405067016	Caribbean I./W.I./Guyana (NMO)
514651000006112	Black E Afric Asia/Indo-Caribb
1968561000006112	Carib/Black: Black/Black Scot/Black Brit- Scotland 2011 cens
405064011	Black Caribbean/W.I./Guyana
285931013	Black, other, non-mixed origin
285932018	Black British
411579012	West Indian (NMO)
285949013	Black - other Asian
285951012	Black - other, mixed

Medical code ID	Term
158351000000119	Other Black background - ethnic category 2001 census
141401000000117	Chinese - ethnic category 2001 census
550541000006110	Chinese
1968161000006115	Asian/Asian Brit: Chinese - Eng+Wales ethnic cat 2011 census
56590016	Chinese
1968511000006114	Asian: Chinese - Scotland ethnic category 2011 census
1968331000006114	Asian/Asian British: Chinese - NI ethnic cat 2011 census
286012013	New Zealand Maori
138261000000114	Iranian - ethnic category 2001 census
285958018	Other ethnic non-mixed (NMO)
138241000000113	Jewish - ethnic category 2001 census
138251000000111	Arab - ethnic category 2001 census
850671000006119	Traveller - gypsy
1968221000006116	Other ethnic: any other grp - Eng+Wales eth cat 2011 census
138281000000117	Muslim - ethnic category 2001 census
141651000000118	Malaysian - ethnic category 2001 census
1968391000006113	Other ethnic group: any other grp- NI ethnic cat 2011 census
253634013	O/E - Australoid
1968211000006112	Other ethnic group: Arab - Eng+Wales ethnic cat 2011 census
286021014	Other New Zealand ethnic group
1968581000006119	Other ethnic grp: Arab/Arab Scot/Arab British- Scotland 2011
1968591000006116	Other ethnic grp: any other ethnic grp- Scotland 2011 census
142861000000114	Latin American - ethnic category 2001 census
142901000000119	Any other group - ethnic category 2001 census
286022019	New Zealand ethnic group NOS
286015010	Tokelauan
285960016	Brit. ethnic minor. unsp (NMO)
937871000006114	Mid East (excl Israeli, Iranian & Arab) - eth cat 2001 cens
285959014	Brit. ethnic minor. spec.(NMO)
411581014	North African Arab (NMO)
286006015	New Zealand ethnic groups
286013015	Cook Island Maori
523591000000116	Yemeni
141641000000116	Filipino - ethnic category 2001 census
141631000000113	Japanese - ethnic category 2001 census
411582019	Iranian (NMO)
142881000000117	Buddhist - ethnic category 2001 census
456650013	Vietnamese
286017019	Other Pacific ethnic group
142841000000113	Kurdish - ethnic category 2001 census

Medical code ID	Term
142831000000116	Israeli - ethnic category 2001 census
504723011	Tongan
142811000000112	North African - ethnic category 2001 census
286018012	South East Asian
286014014	Niuean
157351000000115	Hindu - ethnic category 2001 census
285988010	Other ethnic NEC (NMO)
1968381000006110	Other ethnic group: Arab - NI ethnic category 2011 census
937941000006111	Mauritian/Seychellois/Maldivian/St Helena eth cat 2001census
142851000000111	Moroccan - ethnic category 2001 census
501416013	Fijian
405068014	N African Arab/Iranian (NMO)
142891000000115	Sikh - ethnic category 2001 census
459785017	Other ethnic group
141621000000111	Vietnamese - ethnic category 2001 census
138271000000119	South and Central American - ethnic category 2001 census
507015012	Samoan
141411000000115	Other - ethnic category 2001 census
141291000000111	Ethnic category - 2001 census
456651012	Ethnic group not given - patient refused
649261000006110	Ethnic groups (census)
2484471000000115	Ethnic category - 2011 census
2484591000000115	Ethnic category - 2011 census Scotland
141421000000114	Ethnic category not stated - 2001 census
286005016	Ethnicity and other related nationality data
456652017	Ethnic group not recorded
2484551000000111	Ethnic category - 2011 census Northern Ireland
308131000000114	Patient ethnicity unknown
253635014	O/E - ethnic group NOS
253627011	O/E - ethnic group
286003011	Ethnic groups (census) NOS
253628018	O/E - ethnic origin
2484511000000112	Ethnic category - 2011 census England and Wales
196681000006116	RACE: Mixed
459729014	Mixed ethnic census group
253630016	O/E - Negroid
4740361000006111	Other ethnic, Asian/White origin
459730016	Black - ethnic group
4917901000006112	Indian subcontinent country
2537217015	Race: White
371005013	Race: Other
250222012	European origin

Medical code ID	Term
250225014	North American origin
196651000006112	RACE: Chinese
196661000006114	RACE: Japanese
12009371000006110	Patient declined to provide information about ethnic group
4740381000006118	Other ethnic, mixed white origin
1564921000006112	Indian
196691000006118	RACE: Not stated
250227018	Australian origin
196701000006118	RACE: Oriental

Medical code ID	Term
196621000006115	RACE: Arab
2645811000000115	Roma ethnic group
196731000006114	RACE: Unknown
2361121000000119	Born in British Indian Ocean Territory
196671000006119	RACE: Korean
250230013	Far Eastern origin
1968251000006113	Irish Traveller - Northern Ireland ethnic cat 2011 census
4740341000006112	Other ethnic, Black/White origin
4740401000006118	Other ethnic, other mixed origin

Supplementary information 2

Table 1: the six main categories of ethnicity examined in this study.

Ethnicities	Main ethnic groups for analysis
British, Irish Other white	White
White and black Caribbean White and black African White and Asian Other mixed	Mixed
Indian Pakistani Bangladeshi Other Asian	Asian
Caribbean African Other Black	Black
Chinese Other ethnic groups	Other
Missing/Unknown	Missing/Unknown

Declaration of Interest:

We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

We confirm that the manuscript has been read and approved by all named authors and that there are no other persons who satisfied the criteria for authorship but are not listed. We further confirm that the order of authors listed in the manuscript has been approved by all of us.

We confirm that we have given due consideration to the protection of intellectual property associated with this work and that there are no impediments to publication, including the timing of publication, with respect to intellectual property. In so doing we confirm that we have followed the regulations of our institutions concerning intellectual property.

We understand that the Corresponding Author Danah Alothman is the sole contact for the Editorial process (including Editorial Manager and direct communications with the office). she is responsible for communicating with the other authors about progress, submissions of revisions and final approval of proofs. We confirm that we have provided a current, correct email address which is accessible by the Corresponding Author and which has been configured to accept email from msxda9@nottingham.ac.uk

ORCID profiles

Danah Alothman	0000-0001-9009-8993
Andrew Fogarty	0000-0001-9426-977X
Edward Tyrrell	0000-0003-2171-6334
Sarah Lewis	0000-0001-5308-6619
Timothy Card	0000-0003-2555-2250

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All authors contributed to the study design. D.A. conducted the analysis and drafted the manuscript, but all authors contributed to the final version of the manuscript and approved it.

Data availability:

The data used for this work were obtained under license from CPRD. This license does not permit further sharing. However, anyone wishing to access the data can obtain it direct from CPRD subject to their licensing requirements.