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Dementia in people from ethnic minority backgrounds: Disability, functioning and pharmacotherapy at the time of diagnosis

Running title: Dementia in ethnic minorities

Author's accepted manuscript

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Keywords: dementia; ethnic minorities; psychosis; polypharmacy; vascular dementia; antidepressants; health inequalities

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Brief summary: At dementia diagnosis, there are substantial differences in non-cognitive mental health symptoms and pharmacotherapy across ethnic minority groups and compared to the majority population.

Abstract (291/300)

Objectives: Increasingly, older populations in the UK and other well-resourced settings are ethnically diverse. Despite a concern that the prevalence of dementia is expected to rise, very little is known about the association of ethnicity and dementia amongst ageing older adults. The current study aimed to compare ethnic group differences in symptom profile and pharmacotherapy at dementia diagnosis.

Design: Cross-sectional study of patient characteristics at the point of dementia diagnosis.

Setting and Participants: 12,154 patients age 65 years or older diagnosed with dementia in South London between 2007 and 2015.

Methods: Data were extracted from the Clinical Record Interactive Search (CRIS) system, which provides anonymised access to the electronic health records of a large mental health care provider in South London. Patients from ethnic minority backgrounds were compared to White British individuals on mental and physical wellbeing, as well as functional scales and medications prescribed at dementia diagnosis, and subtype of dementia documented anywhere in the record.

Results: Compared to White British patients: Black African and Black Caribbean patients were more likely to present with psychotic symptoms and were less likely to have antidepressant treatment prescribed; White Irish patients had higher rates of substance/alcohol use and depressive symptoms were more prevalent in South Asian patients; all ethnic minority groups had a higher odds of polypharmacy; vascular dementia diagnoses were more common in Black and Irish ethnic minority groups.

Conclusions and Implications: At dementia diagnosis, there are substantial differences in non-cognitive mental health symptoms and pharmacotherapy across ethnic minority groups and compared to the White British majority population. Some of these differences might reflect access/treatment inequalities or implicit unconscious bias related to ethnicity, influencing both. They need to be taken into consideration to optimise pathways into care and personalise assessment and management.

Keywords: dementia; ethnic minorities; psychosis; polypharmacy; vascular dementia; antidepressants; health inequalities

Introduction

The number of people from ethnic minority backgrounds with dementia in the UK is projected to increase seven-fold in the coming 40 years ¹. However, substantial differences compared to the White British population remain, as people from ethnic minorities backgrounds are known to have higher prevalence of dementia, to be diagnosed with worse cognitive scores and at younger ages, and are more likely to present in crisis, which is often the trigger for receiving a formal diagnosis ¹⁻⁴. Conversely, several UK and international studies describe lower mortality in ethnic minorities after a diagnosis of dementia is established ^{5,6} and little is known what other clinical factors are present at dementia diagnosis in people from ethnic minority groups. These factors are important as they might elucidate which non-cognitive symptoms might be more prevalent in certain ethnic groups, whereby these also might be triggers for help-seeking and pathways into care. Similarly, differences in pharmacotherapy have been described in ethnic minority groups with dementia and other mental health condition ^{7,8}. Hence, the aim of this study was to investigate how people from ethnic minority backgrounds differ from the White British population in terms of symptoms and pharmacotherapy at the time of dementia diagnosis.

Methods

Data Source

Data were drawn from the Clinical Record Interactive Search (CRIS) system. CRIS provides research access to more than 450,000 anonymised health records from South London and Maudsley NHS Foundation Trust (SLaM), a large dementia and mental health provider for one of the UK's most ethnically diverse areas in South East London ⁹. CRIS has received ethical approval (Oxford REC C 18/SC/0372) and data are obtained either from structured fields in the source record or from free-text clinical documents through natural language processing algorithms using General Architecture for Text Engineering (GATE) software ⁹.

Sample

Patients aged 65 years or older were included who received a diagnosis of dementia (according to International Classification of Disease, tenth revision (ICD-10) ¹⁰ criteria) from SLaM services between 1st January 2007 and 31st December 2015. Ethnicity recorded in the patients' health record was used as the primary grouping variable. We applied the following categories defined by the UK Office for National Statistics (ONS): White British, White Irish, Other White background, Black Caribbean, Black African, according to previous research on this population ^{8,11}. The South Asian group encompassed Bangladeshi, Indian and Pakistani individuals. Patients were excluded if no data on ethnicity was available or when they were from an ethnic group that was not sufficiently representative in our dataset to allow meaningful interpretation (as 'other mixed', 'Chinese', 'other Asian', and 'White and Asian mixed').

Demographic variables ascertained at the time of dementia diagnosis were age, gender, marital status (dichotomised to cohabiting and non-cohabiting), and a neighbourhood-level index of multiple deprivation (IMD) ¹². The Index of Multiple Deprivation (IMD) combines area-level indicators of deprivation across the domains of: income, employment, health, disability, education, housing deprivation, living environment and crime ¹². The Mini Mental State Examination (MMSE) score was applied as measure of cognition and approximated dementia severity ¹³.

Outcome variables

Scores from the structured Health of the Nation Outcome Scales (HoNOS65+) instrument were extracted closest to date of first dementia diagnosis. HoNOS65+ is a standard and routinely

completed measure of patient wellbeing used in UK mental health services ^{14,15} and we included subscales measuring problems caused by compromised physical health, mental health symptoms, and functional status. The HoNOS65+ subscales are rated on a Likert scale from 0 (no problem) to 4 (severe or very severe problem), which were dichotomised to ‘minor or no problem’ (scores of 0 and 1) and ‘mild to severe problems’ (scores 2 to 4) to facilitate interpretation. A detailed glossary for the HoNOS65+ instrument is available ¹⁶; for example the living conditions subscale rates overall severity of problems with the quality of living conditions/accommodation and aspects the clinicians are asked to assess are whether basic necessities are met (heat, light, hygiene) and, if so, whether the physical environment contributes to maximising independence and minimising risk ^{16, p. 437}.

Using a GATE-supported natural language processing algorithm ^{9,17} we extracted medication recorded in text fields (e.g. clinical correspondence, case notes), supplemented by recordings in structured fields, in a 6-month window around the index date of first dementia diagnosis. This window was chosen as it provides a valid approximation of prevalent prescribing at dementia diagnosis as shown in previous analyses ^{17,18}. We established whether patients were prescribed antipsychotics, antidepressants, acetylcholinesterase inhibitors (AChEIs; only in 6 months after dementia diagnosis ⁵), and whether they were subject to polypharmacy, i.e. prescribed at least four different medications (of any class) ¹⁹.

We further established if a diagnosis of Alzheimer’s disease (ICD-10 code F00) or vascular dementia (F01) was ever mentioned in a patient’s record, generating two binary variables in this respect.

Statistical analysis

We used STATA 13 software and first applied classical tests of hypotheses to identify overall group differences. In a second step ethnic minority groups were compared to the reference group (White British) using logistic regression models. We applied two different regression models: model 1 adjusted for age and gender; and model 2 adjusted for age, gender, index of multiple deprivation score, MMSE, marital status and year of diagnosis (to reflect changes in practice over time). As 23% of the included patients had missing data on at least one of the covariates and we assumed missingness to be at random, we imputed missing values using chained equations to maximise statistical power. Using the MI package in STATA we created twenty-three imputed datasets through replacing missing values through simulated values

assembled from potential covariates and outcome values ²⁰. We applied Rubin's rules to pool coefficients in final analyses ²¹.

Results

We identified 13,171 patients aged 65 years or older diagnosed with dementia in the nine-year observation period. After 376 patients were excluded as their ethnicity was not recorded and 641 patients as they were not among the five most prevalent ethnic groups, the final sample consisted of 12,154 patients. In the whole sample, mean (SD) age at diagnosis was 82.0 (7.1) years, 63.0% were female, and mean (SD) MMSE score was 18.6 (6.4).

Patient characteristics according to ethnic group

Significant differences across groups were identified for all variables with the exception of problems with agitated behaviour, non-accidental self-injury, and physical health problems (see Table 1). In terms of demographic variables, the White British group were the oldest and the Black African group youngest at the time of dementia diagnosis. The White British and the Other White group had the highest proportion of females and the South Asian group the lowest. South Asian patients were most likely to be married and White Irish patients least likely. Black Caribbean and African patients lived in the most deprived and White British and South Asian patients in the most affluent areas. Mean MMSE score at diagnosis was highest in the White British group and lowest in the Black Caribbean and African as well as the Other White group. A subtype diagnosis of Alzheimer's disease was least common in Black Africans, in whom a diagnosis of vascular dementia was most frequent.

In terms of HoNOS65+ scores in the problematic range (see table 1), substance use (which includes alcohol use) was most common in White Irish (6.2%) and least common in South Asians (1.4%). Black Caribbean and African patients were most likely to suffer from problematic psychotic symptoms (19.3% and 19.9% respectively), whereby this was least likely in the White British group (13.1%). Problematic depressive symptoms were most common in South Asian (18.7%) and Other White (18.9%) patients and least common in White British (14.0%). Difficulties with activities of daily living and living conditions were most common in Black and Irish groups, and least common in South Asians. Problems with occupational/recreational daytime activities were most common in Black African and least common in White Irish patients. In terms of pharmacotherapy, polypharmacy was most common in the Black African (54.8%) group and least prevalent in the White British group (43.1%). Antipsychotic prescribing was most prevalent in White Irish (19.3%) and least common in White British (13.9%) patients. White Irish (31.0%) and Other White (32.1%)

patients were most likely to be prescribed an antidepressant and Black Caribbean (22.5%) and African (24.5%) patients least likely.

Regression models to test for differences in relation to a White British reference group

To assess for the independence of differences between individual ethnic groups and the reference group (White British) we applied two logistic regression models presented in Tables 2 (dementia subtype, mental and physical health problems) and Table 3 (functioning and pharmacotherapy). In Model 2 (adjusted for age, gender, deprivation, cognition and year of dementia diagnosis), Black Caribbean patients were less likely to present with non-accidental self-injury and to be prescribed an antidepressant than the White British majority population. They were more likely to be diagnosed with vascular dementia and to present with psychotic symptoms. Similarly, Black African patients were in Model 2 more commonly diagnosed with vascular dementia and suffering from psychotic symptoms, and less likely to be prescribed an antidepressant. Additionally, they were less likely to present with agitated behaviour, but their living conditions were more commonly rated problematic than in the White British group. In Model 2 patients in the Other White group had an increased likelihood of presenting with depressed mood and being prescribed an antipsychotic, antidepressant or an AChEI. This group was less likely to present with difficulties with ADLs compared to the White British group. The White Irish group was in Model 2 more likely to present with substance/alcohol use and to have a diagnosis of vascular dementia. South Asian patients diagnosed with dementia were in Model 2 more likely to have problems with depressed mood, and less likely to present with ADL and living condition problems than the White British majority population. All five ethnic minority groups were at higher odds to be on a polypharmacy regime than the White British population.

Discussion

Our study included more than 12,000 patients with a specialist diagnosis of dementia under a near-monopoly mental health and dementia care provider in the ethnically diverse area of Southeast London. There were differences in disability and pharmacotherapy, between ethnic minorities present at dementia diagnosis both across groups and compared to the White British reference population. A higher occurrence of psychotic symptoms and lower use of antidepressants was a striking finding in the Black Caribbean and Black African groups. Older White Irish patients presented with an increased likelihood of substance/alcohol use compared to the White British population, and South Asian patients had more problematic depressive symptoms at dementia diagnosis. A vascular dementia diagnosis was more common in Black Caribbean and Black African as well as White Irish patients and all ethnic minority groups were at a higher odds of polypharmacy.

The higher likelihood of vascular dementia in Black Caribbean, Black African and White Irish patients, which remained significant after adjusting for demographic factors, cognition and deprivation, is likely to reflect poorer general health and a higher prevalence of vascular risk factors in these populations over the life course^{22,23}. Interestingly, this was not the case for the South Asian group, despite recognised high rates of cardiovascular disease in those constituent populations²⁴. One reason for this might be the small sample size, which can have impacted on power and precision and is reflected in wider confidence intervals. Moreover, South Asian patients with dementia in our South East London sample were diagnosed with fewer indicators of poorer health and socioeconomic position, at a similar deprivation score and lower occurrence of difficulties with ADLs and living conditions compared to the White British majority population. This indicates that our sample is not nationally representative of the South Asian population in the UK, as national data shows that especially Pakistani and Bangladeshi people are more likely than the White British population to live in more deprived circumstances²⁵.

The South Asian group was more likely to display depressive symptoms at the time of dementia diagnosis. This is in line with a recent study showing that older South Asian adults with subjective memory problems, when interviewed, were more likely to describe symptoms commonly associated with depression than those without cognitive difficulties²⁶. Similarly,

the prevalence of depressive symptoms has been described as higher among older South Asian elders compared to White European elders in a UK study ²⁷.

The Black Caribbean and Black African groups presented with more psychotic symptoms than the White British group, which is similar to recent findings in late-life depression from this data source ⁸ and also in line with studies on incident risks of schizophrenia in clinical studies and surveys of working age adults in the UK ²⁸⁻³⁰. This could be related to cultural, social, and religious characteristics, but could also be a consequence of both perceived and experienced discrimination, which has been shown in previous work to be associated with an increased risk of psychotic experiences in racially marginalised groups ^{28,30,31}. It is also possible that the higher rate of psychotic symptoms is a marker of presentation with more advanced dementia, as Black minorities have been found to be less likely to seek and receive a dementia diagnosis ³² and psychotic symptoms might be a trigger for help-seeking when cognitive difficulties are not conceptualised as an illness or are felt to be a personal matter ⁴.

Another notable finding in this context is the lower likelihood of antidepressant prescribing in Black Caribbean and African patients compared to White British, White Irish and Other White patients. This is in concordance with previous research on antidepressant receipt in older Black African and Black Caribbean populations ^{8,33}. One explanation for this might be that clinicians are less likely to offer antidepressants to Black Caribbean or Black African patients as lower antidepressant treatment initiation rates in ethnic minorities are described in the wider literature ³⁴. It has further been described that differing illness models and perceived stigma lead to antidepressant treatment being less acceptable to Black Caribbean groups ^{35,36}. Lastly, there might be a lower occurrence of depressive symptoms in Black Caribbeans and Black Africans, which is however not supported by our data, which shows similar rates of depressive symptoms in White British and Black patients as per clinician rated scales.

Despite the lower prevalence of antidepressant prescribing in Black Caribbean and Black African elders, polypharmacy was more common in all ethnic minority groups compared to the White British majority population, a finding that remained statistically significant after adjustment for potential confounders including cognition and deprivation. This is an important finding, as polypharmacy in dementia is associated with a number of adverse outcomes including mortality, emergency department attendance and hospitalisation, even after adjustment for mental and physical co-morbidities. ¹⁹. As people from Black minority

backgrounds are less likely to be initiated on psychotropic medications^{7,8}, these higher levels of prescribing are likely to reflect comorbid physical health problems¹. They could however also indicate an inequality in the application of deprescribing (the process of identifying medications to be ceased, substituted, or reduced to address polypharmacy) strategies in this population^{37,38}. In a previous study from the US, it was noted that African American elders took fewer prescribed and over-the-counter medications than did White sample members³⁹. In the UK, as the health system is free at the point of contact, access to treatments may be less restricted. We observed a higher likelihood of polypharmacy across all ethnic minority groups, this could either reflect a higher number of medications prescribed due to other underlying health conditions which we were unable to directly assess in the study, or alternatively, reflect harmful prescribing practices. This should be explored in future work.

Our study suggested that older Irish men and women in this sample of people with dementia were at an increased risk of substance/ harmful alcohol use. Previous studies from the UK have indicated that alcohol use disorders may be more likely to be implicated in psychiatric and other physical health morbidities amongst Irish people⁴⁰. Heavier use may be linked to coping with stressors, including social isolation within the post migration context⁴¹. Although the perception of higher rates of alcohol use in people of Irish origin amongst clinicians might have led to increased scrutiny and screening, this is unlikely to fully explain the more than 50% increased odds compared to the White British population, which we detected after adjustment for potential confounders. The increased prevalence of alcohol/ substance use in our study might also explain the increased rates of vascular dementia in the White Irish group, since alcohol is associated with cerebrovascular and cardiovascular complications⁴². Alcohol misuse in older people is a growing problem for health and social care providers, but remains overlooked because it is largely hidden from public view^{43,44}. However, in the last few years, the subject has been brought into focus because of the recognition of a growing burden of morbidity and mortality that includes alcohol-related hospital admissions, alcohol-related deaths and the presence of accompanying mental disorders ('dual diagnosis')⁴⁵.

A strength of this study is the large population-based sample from an ethnically diverse catchment, with the high representation of ethnic minority groups giving sufficient power to conduct these analyses. This strengthens the generalisability of our study when comparing these findings to those from studies conducted primarily on selectively recruited cohorts in which ethnic minorities are frequently underrepresented⁴⁶. These strengths need to be balanced

with the limitations of using routinely collected data. First, it needs to be acknowledged that the ethnic minority categories were relatively broad and cannot account for heterogeneity within groups; for example, the ‘South Asian’ category included individuals of Pakistani, Indian and Bangladeshi ethnicity, who are known to have differing histories of migration, settlement and health outcomes in the UK ⁴⁷. Hence, we can only make inferences about broad characteristics, which do not necessarily apply at an individual level ⁴⁸. Second, socioeconomic position could only be estimated through an index of neighbourhood-level socio-economic deprivation assessed at the area-level ¹². Third, while mental health difficulties and functioning were ascertained through several HoNOS65+ subscales, the single HoNOS65+ physical illness subscale is relatively brief without details on specific long-term condition. Nevertheless, it has been shown to have useful predictive validity of unfavourable outcomes in people with dementia ^{5,19}. Fourth, medication prescription was determined around the time of dementia diagnosis through natural language processing, which cannot account for the time-dependent nature of prescribing. For example, we did not find variation in prevalent prescribing of antipsychotic medications between groups, but were unable to ascertain durations of prescriptions, which have been reported to differ in a UK primary care database ⁷. However, the aim of our study was to assess factors present at diagnosis, instead of a longitudinal evaluation. Lastly, although we incorporated a range of clinically relevant potential confounders in our analysis, causal inferences cannot be readily be drawn in an observational study of this nature.

Conclusions and Implications

Improving early detection of dementia is a public health priority ⁴⁹, particularly in ethnic minority groups. Inexpensive interventions to encourage timely help-seeking, such as general practitioners/family doctors sending out postal leaflets with accompanying personalised letters, have been shown to be feasible and acceptable in ethnic minority populations ⁵⁰. While these interventions primarily emphasise that cognitive difficulties are a valid reason to seek professional help, our study additionally highlights differences in non-cognitive symptoms between ethnic groups at dementia presentation. Specifically, the presence of psychotic experiences could be an early sign of dementia in Caribbean and African communities, with similar significance of depressive symptoms in South Asian communities. Conversely, those symptoms could represent a crisis point as trigger to access care ⁴ and differences between ethnic groups at presentations might diminish if variances in help-seeking are reduced (e.g. through the aforementioned interventions). The results of our study also call for consistent

screening for alcohol/substance abuse in Irish elders, and for subsequent interventions to take place to mitigate harmful drinking, which could result in meaningful reductions of cardiovascular and dementia risk factors. The higher likelihood of vascular dementia diagnoses in Black and Irish elders highlights differences in risk factor profiles and the need for public health interventions emphasising circulatory health in ethnic minority groups.

Our study also found divergent care pathways to the White British majority population with higher likelihood of presenting with polypharmacy in ethnic minorities and variations in antidepressant use. As a consequence, while culturally responsive care should take differences in presentation into account, established evidence-based practices, such as measures to avoid inappropriate medications or harmful polypharmacy, need to be promoted in all ethnic groups^{37,38}.

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Tables

Table 1: Sample Characteristics

	White British (n=8,420; 69.3%)	Black Caribbean (n=1,661; 13.7%)	Black African (n=310; 2.6%)	Other White (n=773; 6.4%)	White Irish (n=626; 5.2%)	South Asian (n=364; 3.0%)	P-value*
Demographics[§]							
Mean age (SD)	83.0 (7.1)	79.9 (6.4)	75.9 (6.4)	81.7 (6.9)	80.1 (6.9)	79.1 (6.7)	<0.001
Female gender (%)	64.0%	55.9%	55.2%	64.4%	58.3%	54.7%	<0.001
Married or cohabiting (%)	32.4%	31.6%	37.8%	35.8%	26.6%	48.1%	<0.001
IMD (SD)	26.1 (11.4)	31.4 (9.0)	32.1 (8.6)	28.1 (9.9)	29.8 (10.1)	25.6 (10.1)	<0.001
MMSE (SD)	19.0 (6.3)	17.2 (6.4)	17.7 (6.9)	16.9 (6.8)	18.5 (6.3)	18.6 (6.7)	<0.001
Dementia subtype[±]							
Alzheimer's disease diagnosis (F00)	61.8%	58.2%	55.8%	63.9%	57.4%	64.8%	0.001
Vascular dementia diagnosis (F01)	27.8%	39.0%	42.9%	30.4%	34.8%	27.2%	<0.001
HoNOS65+ Score in problematic range[§]							
Agitated behaviour (%)	20.3%	21.8%	17.6%	23.0%	23.7%	19.3%	0.095
Non-accidental self-injury (%)	1.7%	1.0%	0.7%	1.7%	2.3%	1.7%	0.179
Substance/alcohol use (%)	2.9%	3.8%	2.7%	2.6%	6.2%	1.4%	<0.001
Psychotic symptoms (%)	13.1%	19.3%	19.9%	14.4%	14.6%	13.6%	<0.001
Depressed mood (%)	14.0%	15.5%	15.6%	18.9%	16.5%	18.7%	0.001
Physical health problems (%)	56.3%	58.2%	57.8%	56.0%	57.9%	51.3%	0.263
Relationship problems (%)	16.9%	20.1%	17.6%	19.6%	21.4%	13.9%	0.001
Activities of daily living (ADL) problems (%)	61.9%	64.2%	63.8%	59.7%	64.3%	51.6%	<0.001
Living condition problems (%)	12.6%	14.4%	19.9%	12.0%	14.5%	5.8%	<0.001
Occupational and recreational activities (%)	31.9%	36.4%	36.8%	34.4%	29.8%	30.0%	0.002
Pharmacotherapy[∞]							
Polypharmacy (≥4 medications) (%)	43.1%	51.2%	54.8%	48.4%	48.9%	51.1%	<0.001
Antipsychotic prescribed (%)	13.9%	17.2%	18.4%	18.2%	19.3%	15.4%	<0.001
Antidepressant prescribed (%)	26.9%	22.5%	24.5%	32.1%	31.0%	24.5%	<0.001
Acetylcholinesterase inhibitor (AChEI) prescribed (%)	23.0%	22.5%	22.3%	25.6%	22.4%	28.3%	0.112

* chi²-test, Kruskal-Wallis test or ANOVA

§ at or closest to date of dementia diagnosis;

∞ recorded within 6 months before or after dementia diagnosis (AChEI only in 6 months post dementia diagnosis)

± anytime in the source record

SD = standard deviation; IMD = Index of Multiple Deprivations (higher score indicates living in a more deprived area);

MMSE = Mini-Mental State Examination score

Table 2: Odds ratios (95% Confidence Intervals) for dementia subtype and HoNOS65+ mental and physical health problems in logistic regression models

	Dementia subtype				Problems according to HoNOS65+ at the time of dementia diagnosis (problem present vs. absent)											
	Alzheimer's disease		Vascular dementia		Agitated behaviour		Non-accidental self-injury		Substance use		Psychotic symptoms		Depressed mood		Physical health problems	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
White British	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Black Caribbean	0.88 (0.79-0.98)	0.94 (0.84-1.05)	1.65 (1.47-1.84)	1.56 (1.39-1.75)	1.07 (0.93-1.22)	0.89 (0.77-1.03)	0.60 (0.36-1.02)	0.55 (0.32-0.94)	1.02 (0.76-1.37)	1.00 (0.74-1.35)	1.56 (1.35-1.80)	1.47 (1.27-1.71)	1.09 (0.94-1.26)	1.00 (0.86-1.16)	1.18 (1.06-1.32)	0.99 (0.88-1.11)
Black African	0.79 (0.63-1.00)	0.82 (0.65-1.04)	1.96 (1.56-2.49)	1.86 (1.47-2.36)	0.84 (0.62-1.14)	0.69 (0.50-0.95)	0.44 (0.11-1.81)	0.38 (0.09-1.58)	0.58 (0.28-1.23)	0.52 (0.24-1.15)	1.64 (1.22-2.20)	1.51 (1.12-2.05)	1.04 (0.75-1.43)	0.94 (0.68-1.30)	1.34 (1.06-1.70)	1.09 (0.86-1.39)
Other White	1.09 (0.93-1.27)	1.12 (0.96-1.32)	1.14 (0.97-1.34)	1.12 (0.95-1.31)	1.17 (0.98-1.41)	0.99 (0.82-1.19)	0.98 (0.54-1.77)	0.98 (0.54-1.78)	0.83 (0.52-1.33)	0.89 (0.55-1.42)	1.14 (0.92-1.41)	1.09 (0.88-1.35)	1.41 (1.16-1.71)	1.36 (1.12-1.66)	1.05 (0.90-1.22)	0.95 (0.81-1.11)
White Irish	0.84 (0.71-0.99)	0.93 (0.78-1.10)	1.39 (1.17-1.65)	1.27 (1.07-1.51)	1.19 (0.98-1.45)	1.09 (0.89-1.33)	1.38 (0.79-2.41)	1.31 (0.74-2.30)	1.67 (1.16-2.40)	1.53 (1.05-2.23)	1.14 (0.90-1.44)	1.08 (0.85-1.37)	1.16 (0.93-1.46)	1.11 (0.88-1.39)	1.17 (0.99-1.40)	1.06 (0.89-1.26)
South Asian	1.17 (0.94-1.46)	1.06 (0.85-1.33)	0.96 (0.76-1.22)	1.04 (0.82-1.32)	0.91 (0.70-1.20)	0.89 (0.67-1.18)	1.04 (0.45-2.39)	1.08 (0.47-2.50)	0.37 (0.15-0.92)	0.42 (0.17-1.05)	1.09 (0.80-1.49)	1.12 (0.82-1.54)	1.35 (1.02-1.79)	1.34 (1.01-1.78)	0.93 (0.75-1.16)	0.93 (0.74-1.16)

Bold: p<0.05

Model 1: adjusted for age and gender

Model 2: adjusted for age, gender, index of multiple deprivation score, MMSE, marital status and year of diagnosis

Table 3: Odds ratios (95% Confidence Intervals) for HoNOS65+ functional problems and pharmacotherapy in logistic regression models

	Problems according to HoNOS65+ at the time of dementia diagnosis (problem present vs. absent)										Pharmacotherapy at dementia diagnosis					
	Relationship problems		ADL problems		Living condition problems		Occupational problems		Polypharmacy (≥4 medications)		Antipsychotic prescribed		Antidepressant prescribed		Acetylcholinesterase inhibitor (AChEI) prescribed	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
White British	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Black Caribbean	1.13 (0.98-1.30)	1.00 (0.86-1.15)	1.22 (1.09-1.37)	0.94 (0.83-1.07)	1.14 (0.97-1.34)	0.99 (0.84-1.16)	1.23 (1.09-1.39)	1.05 (0.93-1.19)	1.35 (1.21-1.50)	1.21 (1.08-1.35)	1.17 (1.02-1.36)	1.09 (0.94-1.27)	0.76 (0.67-0.86)	0.72 (0.63-0.82)	0.90 (0.79-1.02)	1.05 (0.92-1.21)
Black African	0.93 (0.69-1.27)	0.81 (0.59-1.11)	1.37 (1.07-1.37)	1.06 (0.82-1.38)	1.67 (1.24-2.25)	1.46 (1.07-1.98)	1.28 (1.00-1.64)	1.08 (0.84-1.40)	1.51 (1.20-1.91)	1.29 (1.02-1.63)	1.12 (0.83-1.51)	1.02 (0.75-1.39)	0.78 (0.60-1.02)	0.74 (0.57-0.97)	0.78 (0.59-1.03)	0.89 (0.67-1.18)
Other White	1.17 (0.96-1.42)	1.06 (0.87-1.29)	0.97 (0.83-1.14)	0.77 (0.65-0.92)	0.96 (0.76-1.21)	0.90 (0.71-1.14)	1.15 (0.97-1.35)	1.01 (0.86-1.20)	1.23 (1.06-1.42)	1.17 (1.01-1.36)	1.34 (1.10-1.62)	1.26 (1.03-1.53)	1.25 (1.07-1.47)	1.23 (1.04-1.44)	1.11 (0.94-1.32)	1.24 (1.04-1.48)
White Irish	1.25 (1.02-1.53)	1.09 (0.88-1.35)	1.22 (1.02-1.46)	1.03 (0.86-1.25)	1.17 (0.92-1.49)	1.01 (0.79-1.30)	0.93 (0.78-1.12)	0.83 (0.69-1.00)	1.23 (1.05-1.45)	1.19 (1.00-1.40)	1.36 (1.10-1.68)	1.23 (0.99-1.53)	1.17 (0.98-1.40)	1.13 (0.95-1.36)	0.89 (0.73-1.09)	1.04 (0.85-1.27)
South Asian	0.73 (0.53-0.99)	0.76 (0.55-1.03)	0.75 (0.60-0.93)	0.71 (0.56-0.89)	0.45 (0.29-0.71)	0.48 (0.31-0.76)	0.96 (0.75-1.22)	0.95 (0.75-1.22)	1.33 (1.08-1.65)	1.29 (1.04-1.59)	1.00 (0.75-1.34)	1.04 (0.77-1.40)	0.83 (0.65-1.07)	0.85 (0.66-1.09)	1.20 (0.95-1.52)	1.13 (0.89-1.44)

Bold: p<0.05

Model 1: adjusted for age and gender

Model 2: adjusted for age, gender, index of multiple deprivation score, MMSE, marital status and year of diagnosis