

## **Ethnic disparity in access to the Memory Assessment Service between South Asian and White British older adults in the UK: a cohort study**

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## **Ethnic disparity in access to the Memory Assessment Service between South Asian and White British older adults in the UK: a cohort study**

**Background:** Equality of access to memory assessment services by older adults from ethnic minorities is both an ethical imperative and a public health priority.

**Objective:** To investigate whether timeliness of access to memory assessment service differs between older people of White British and South Asian ethnicity.

**Design:** Longitudinal cohort.

**Setting:** Nottingham Memory Study; outpatient secondary mental healthcare.

**Subjects:** Our cohort comprised 3,654 White British and 32 South Asian older outpatients.

**Methods:** The criterion for timely access to memory assessment service was set at 90 days from referral. Relationships between ethnicity and likelihood of timely access to memory assessment service were analysed using binary logistic regression. Analyses were adjusted for socio-demographic factors, deprivation and previous access to rapid response mental health services.

**Results:** Among White British outpatients, 2,272 people (62.2%) achieved timely access to memory assessment service. Among South Asian outpatients, fourteen people (43.8%) achieved timely access to memory assessment service. After full adjustment, South Asian outpatients had a 0.47-fold reduced likelihood of timely access, compared to White British outpatients (odds ratio 0.47, 95% confidence interval 0.23-0.95, p-value=0.035). The difference became non-significant when restricting analyses to outpatients reporting British nationality or English as first language. Older age, lower index of deprivation and previous access to rapid response mental health services were associated with reduced likelihood of timely access, while gender was not.

**Conclusions:** In a UK mental healthcare service, older South Asian outpatients are less likely to access dementia diagnostic services in a timely way, compared to White British outpatients.

**Keywords:** memory assessment services, dementia, healthcare disparities, barriers to mental healthcare, South Asian ethnicity, gender differences, aged, outpatients, cohort study.

### **Keypoints:**

Older South Asian outpatients are less likely to achieve timely access to dementia services, once referred, compared to those White British in the UK.

No ethnic gap in timely access to dementia services is found between White British and South Asian with British nationality or English as first language.

Older age, lower deprivation and previous access to rapid response mental health services are associated with reduced likelihood of timely access to dementia services.

The estimated referral rate to dementia services is lowest among South Asian older women.

## **Introduction**

In many Western countries, the prevalence of dementia in Black, Asian and Minority Ethnic (BAME) groups is expected to increase as a result of increasing cultural diversity and population ageing<sup>1-5</sup>. In the UK, the South Asian minority – the largest BAME minority - accounts for about 7% of the total population and is steadily expanding and ageing<sup>3</sup>. As a result, the number of South Asian older adults with dementia is predicted to substantially and rapidly increase. Yet, South Asian older adults may face disparities in accessing dementia diagnostic services, compared to those White British leading to late or missed diagnosis of dementia<sup>6, 7</sup>.

Equal access to services and timely recognition of dementia in South Asian older adults are policy goals<sup>8,9</sup>. Timely diagnosis is essential for getting support, optimising safety and making choices about future care while the person with dementia retains the ability to participate in decision-making<sup>10, 11</sup>.

Whereas higher deprivation is a barrier to dementia services and treatment in other Western countries<sup>12-13</sup>, data from the UK are conflicting<sup>14-16</sup> and not detailing the South Asian minority. Qualitative literature has shown that barriers to timely diagnosis of dementia in older South Asian adults may include language, health beliefs, carers' attitudes, stigma and lack of cross-cultural adaptation of services<sup>17-20</sup>.

In particular, South Asian carers tend to delay help-seeking until a crisis occurs, due to attributing the symptoms of dementia to normal ageing or other physical or psychological causes, negative beliefs about psychiatry and sense of familial responsibility<sup>17</sup>. Knowledge about dementia may facilitate help-seeking but few campaigns target ethnic minorities<sup>21, 22</sup>. Furthermore, South Asians may seek help in primary care<sup>17</sup> but further barriers may then arise in accessing secondary care. Quantitative studies exploring the disparities that South Asians may face after referral to memory assessment services are lacking.

Our quantitative study aims to investigate whether older adults of South Asian ethnicity are less likely to achieve timely access to the memory assessment service, once referred, compared to older adults

of White British ethnicity in the Nottingham Memory Study. A secondary aim is to explore whether likelihood of timely access may be modulated by age, gender, deprivation and previous access to rapid response mental health services.

## **Materials and Methods**

### Nottinghamshire

In Nottinghamshire, most of the resident population reports White British ethnicity (92.6%), while 2.9% reports Irish, Gypsy or other White ethnicity, 1.4% Mixed, 2.2% Asian / Asian British, 0.6% Black / Black British and 0.3% are from Other ethnic groups<sup>23, 24</sup>. Among the Asians, two thirds are South Asians (Indian, Pakistani or Bangladeshi)<sup>23</sup>. South Asians include both first-generation immigrants and UK-born people. About 2.8% of the population of Nottinghamshire was born in non-UK, non-EU countries<sup>23, 24</sup>. In Nottingham, 5.3% of older adults aged 65 years and over do not have English as first language; in particular, half of these are non-proficient in English<sup>24</sup>. Nottingham has been amongst the most deprived cities in England, over the last decade<sup>25, 26</sup>.

### Study design and participants

Nottinghamshire Healthcare NHS Foundation Trust is a large secondary mental healthcare provider serving the catchment area of Nottinghamshire, UK, with around 800,000 residents. Older adults with suspected dementia are referred to its memory assessment service as outpatients, mainly by general practitioners. Access to memory assessment service is covered by the NHS and free of charge at the point of delivery. An electronic record is routinely created for each outpatient who is referred to the service. In this record, information on socio-demographic data is automatically entered at referral; data on age, gender, self-reported ethnicity, first language, nationality and domicile are recorded by the administrators, in specific mandatory fields, based on standardized codes. The record is then updated at every contact of the outpatient with the service, by recording all booked, attended, missed or cancelled visits. The dates of contacts as well as access to the other services of the Trust are recorded.

We designed the Nottingham Memory Study, an outpatient longitudinal cohort study, with the primary aim to explore disparities in access for South Asian outpatients to the memory assessment

service. We analysed all anonymised electronic records of outpatients who were referred as new consecutive outpatients to the memory assessment service of Nottinghamshire Healthcare NHS Foundation Trust, between 3rd March 2014 and 17th August 2018 (n = 3,819). We excluded those younger than 65 years at referral (n = 7) or of unknown gender (n = 1). Therefore, the Nottingham Memory Study is an outpatient longitudinal cohort study of 3,811 men and women aged 65 years and older who were referred as new consecutive outpatients to the memory assessment service of Nottinghamshire Healthcare NHS Foundation Trust between 3rd March 2014 and 17th August 2018. The Nottingham Memory Study is a one-wave cohort, with complete data on age and gender. In the total cohort, ethnicity was recorded in 3,781 (99.2%) outpatients, at referral, based on 2011 Census categories<sup>23</sup>. In the total cohort, most outpatients were White British (n = 3,654, 95.9%), while Irish and other White ethnicities accounted for 1.3%, Mixed ethnicity for 0.2%, all Asian / Asian British for 1%, all Black / Black British for 0.4% and Other ethnic group for 0.2%. Among the Asians, we grouped outpatients of Indian, Pakistani and Bangladeshi ethnicity as South Asians<sup>3</sup>. The current study includes 3,654 and 32 older adults of White British and South Asian ethnicity, respectively. Figure 1 shows the flow-chart of study inclusion criteria.

#### Demographic and clinical characteristics

We retrieved data on age, gender, marital status, nationality and first language, as recorded in the electronic records, at referral. We categorized nationality as British, non-British or unknown; we categorized first language as English, non-English or unknown. We also retrieved data on referral to Rapid Response Liaison Psychiatry, prior to referral to memory assessment service, for each outpatient.

We estimated deprivation by the Index of Multiple Deprivation decile, which we extrapolated from postcodes<sup>25</sup>. The Index of Multiple Deprivation is the official measure of relative deprivation for small areas in England. It ranks every small area in England from 1 (most deprived area) to 32,844

(least deprived area)<sup>25</sup>. Deciles are calculated by ranking all small areas from most deprived to least deprived and dividing them into ten equal groups<sup>25</sup>. Therefore, the deciles range from the first, which includes the most deprived 10 percent of small areas nationally, to the tenth, which includes the least deprived 10 percent of small areas nationally<sup>25</sup>. Index of Multiple Deprivation is an area-level index, where higher values indicate lower deprivation<sup>25</sup>.

### Timely access

On 21<sup>st</sup> December 2018, we retrospectively collected data on access to the memory assessment service, for each outpatient, from referral. By collecting data on 21<sup>st</sup> December 2018, we had a minimum follow-up of 120 days from referral for each outpatient. We calculated the time to access the memory assessment service as the time from referral to first attended visit. We defined as “timely access” the access within 90 days from referral. Ninety days is a timeframe used by the NHS in the context of long-term complex health needs<sup>27</sup>.

### Statistical analysis

We reported the characteristics of the study outpatients as number (percentages) for categorical variables and as mean (standard deviation, SD) for age, which we used as a continuous variable. Age was normally distributed in our study population. We plotted and visually inspected the distribution of the Index of Multiple Deprivation deciles in the study population, in White British and South Asian outpatients, respectively (Supplementary Figure 1); as these were not normally distributed, we reported the median (interquartile range, IQR) of the Index of Multiple Deprivation deciles. Differences in characteristics at referral between White British and South Asian outpatients were assessed using chi-square test for categorical variables, student’s T-test for mean age and Mann-Whitney U test for median Index of Multiple Deprivation.

Moreover, we tested for gender-differences among White British and South Asian outpatients, respectively, in characteristics at referral.

We estimated the annual rate of referral to memory assessment service for men and women aged 65 years and older, of South Asian and White British ethnicity, based on the 2011 Census<sup>23</sup>.

We calculated the time to access the memory assessment service for each outpatient who had an attended visit during follow-up. We dichotomized the outpatients into 1) those who achieved access to the memory assessment service within 90 days and 2) those who either accessed the memory assessment service later than 90 days from referral or never accessed it.

Binary logistic regression models were used to assess the association between ethnicity and likelihood of being assessed by memory assessment service within 90 days from referral (described in this study as “timely access”). The independent variable was ethnicity and the reference category was the White British ethnicity. We performed our analyses in three steps. In the first step, crude analyses were performed (Model 0). In the second step, we adjusted for age and gender (Model 1). Finally, analyses were further adjusted for Index of Multiple Deprivation decile and previous referral to the Rapid Response Liaison Psychiatry (Model 2).

To explore potential barriers, we performed sensitivity analyses by including only 1) participants who reported British nationality and 2) participants who reported English as their first language, respectively. In these analyses, we excluded 1) participants with either non-British or unknown nationality and 2) participants with a first language other than English or unknown, respectively. Furthermore, to explore gender-differences, we repeated all analyses after stratifying by gender.

All analyses were performed using SPSS software (version 20.0.0).



## **Findings**

### Characteristics of study population

The total study population included 3,654 White British and 32 South Asian older outpatients (Figure 1). Table 1 shows the characteristics of the study population at referral to the memory assessment service. In the total population, mean age was 80.1 (SD 6.9) years and 57.4% of participants were women. South Asian outpatients were younger, more likely to be men and live in a less deprived area compared to those who were White British (Table 1 and Supplementary Figure 1). South Asian outpatients were less likely to report having British nationality and English as their first language compared to those who were White British (Table 1). No South Asian outpatient was known to Rapid Response Liaison Psychiatry while 10.3% of those White British were (Table 1).

Gender-differences among South Asian and White British outpatients are detailed in Table 2. Among the South Asian outpatients, men were more likely to be married or in a civil partnership, to report British nationality and English as their first language, compared to women.

### Estimates of referral rates

The estimated rate of referral to memory assessment service was 4.6 and 2.3 referrals per year for every 1,000 men and women, respectively, aged 65 years and older, of South Asian ethnicity. It was 4.6 and 5 referrals per year for every 1,000 men and women, respectively, aged 65 years and older, of White British ethnicity.

### Timely access and ethnicity

In the total population, 2,286 (62.0%) outpatients were seen in memory assessment service within 90 days from referral. Among all those who were seen within 90 days, mean age was 79.7 (SD 6.8) and median Index of Multiple Deprivation decile 6 (IQR 4; 8); among all those who were not seen within 90 days, mean age was 80.9 (SD 7.0) and median Index of Multiple Deprivation decile 7 (IQR 4; 9).

For White British, 2,272 (62.2%) were seen within 90 days, whereas for South Asian 14 (43.8%) were seen within 90 days.

South Asian ethnicity was associated with a reduced likelihood of timely access to memory assessment service (Table 3). South Asian outpatients had a reduced likelihood to access memory assessment service within 90 days from referral compared to those White British (odds ratio (OR) 0.47, 95% Confidence Interval (CI) 0.24-0.95, p-value = 0.037, crude model). This association remained consistent after full adjustment (OR 0.47, 95% CI 0.23-0.95, p-value=0.035, Model 2).

Timely access and age, deprivation and previous referral to the rapid response services

In the fully adjusted model, older age, lower deprivation and previous referral to the Rapid Response Liaison Psychiatry were associated with reduced likelihood of timely access to memory assessment service (all p-values <0.001), while gender was not (data not shown).

Supplementary Figure 2 illustrates that the proportion of outpatients achieving timely access gradually declined with increasing age (p-value < 0.001). Supplementary Figure 3 and 4 show that likelihood of timely access to the memory assessment service was lowest in the outpatients in the ninth and tenth Index of Multiple Deprivation deciles – those from the least deprived areas. In particular, 55.1% and 44.5% of the outpatients in the ninth and tenth decile – those from the least deprived areas – achieved timely access versus 63.2% to 72.4% of the outpatients in the deciles from first to eight – those from the most deprived areas (p-value < 0.001).

Among the outpatients not previously referred to the Rapid Response Liaison Psychiatry, 2,093 (63.3%) achieved timely access to the memory assessment service; among those previously referred to the Rapid Response Liaison Psychiatry, 193 (51.1%) achieved timely access (Supplementary Figure 5). The binary logistic regression analyses showed that the outpatients with previous referral to the Rapid Response Liaison Psychiatry had a 0.59-fold reduced likelihood of timely access,

compared to those outpatients with no previous referral, after full adjustment (OR 0.59, 95% CI 0.48 – 0.74, p-value < 0.001).

Similar findings were observed for the outcome of accessing memory assessment service within 120 days (Supplementary Table 1).

#### Nationality, language and gender

No difference in timely access to memory assessment service by ethnicity was found when restricting the analyses to participants of British nationality (n=3,057) (Table 4), or to those with English as their first language (n=2,589), (Table 5). In gender-stratified analyses, the ethnic gap in likelihood of timely access to memory assessment service was not significant in women (Supplementary Table 2), while the ethnic gap tended to be significant in men (Supplementary Table 3).

## Discussion

In our cohort study in a secondary mental healthcare setting, about two thirds of all outpatients achieved timely access to memory assessment service (within 90 days from referral). South Asian outpatients were less likely to achieve timely access to memory assessment service compared to White British, even after adjustment for covariates. Furthermore, factors associated with reduced likelihood of timely access to memory assessment service were older age, being known to rapid response mental health services and lower index of deprivation.

Our findings of ethnic disparities in timely access to dementia diagnostic services, after referral, is complementary to other studies suggesting that older adults from ethnic minorities underuse dementia services, present to dementia services later in the illness and are globally less likely to receive diagnosis and treatment for dementia in Western countries<sup>6, 28</sup>. Previous literature has highlighted under-recognition of dementia in South Asian older adults in both the community and acute hospital settings in the UK and US<sup>29-32</sup>. In the THIN database, a nationally representative UK database of primary care electronic health records, Asian women were 18% less likely and Asian men 12% less likely to have a new dementia diagnosis, compared with White adults<sup>29</sup>. Likewise, in a large Californian insurance database, Asian-American had lower age-adjusted dementia incidence rates compared to White and African-American adults<sup>31</sup>; among Asian-Americans, South Asians had the lowest rate<sup>32</sup>.

The true prevalence of dementia in South Asians living in Western countries remains unknown. We cannot infer whether lower rates of dementia diagnosis reflect a truly lower prevalence of dementia or a higher proportion of undiagnosed dementia. Yet, South Asian older adults have a high burden of cardiovascular and psychosocial risks factors for dementia. South Asians adults have a greater burden of diabetes<sup>33-35</sup> and coronary heart disease<sup>36-37</sup> than White adults. Lifetime social adversity, which contributes to cognitive decline, may disproportionately affect ethnic minorities and migrants<sup>38</sup>. All

these may suggest a high risk of dementia in South Asians and raise concerns on undiagnosed dementia.

In our study, South Asians appeared under-referred. Likewise, older adults from non-English-speaking backgrounds were under-referred to a memory clinic in Melbourne, Australia, in the 1990s<sup>39</sup>. In contrast, non-White older adults were equally referred to a memory clinic, compared to White adults, in London, in the early 2000s<sup>40</sup>. Moreover, African-Caribbean outpatients were well represented in a London memory service, but possibly presented at late stages of dementia<sup>41</sup>. However, London is the most ethnically diverse area across England<sup>3, 23</sup> and may be more inclusive of ethnic minorities.

The novel finding of our study is that South Asian older adults face a disparity in timely access to the memory assessment service, after referral, compared to those White British. This disparity is independent of age, gender, deprivation and previous referral to rapid response services. The dementia diagnostic pathway comprises multiple stages, settings and barriers. Previous literature has focused on awareness and recognition of dementia in South Asians in the community<sup>17, 21-22</sup>, primary care<sup>29</sup> and acute care settings<sup>30</sup>. We explored the ethnic gap in that tract of the dementia diagnostic pathway from referral to first access to outpatient secondary mental healthcare services.

We speculate that many outpatients were identified as having memory issues by their primary care or other medical practitioners, during a consultation for physical or mental health symptoms other than dementia or not attributed by the outpatients to dementia – outpatients were not seeking help for dementia. Although a referral to dementia services requires the consent, the outpatients and their caregivers may not fully understand its relevance or face barriers to attendance. These barriers could include intercurrent acute physical or mental illness, hospitalisation and death; these equally affect White British and South Asian outpatients. Further barriers specific to access to secondary care, compared to primary care, may be: unfamiliarity with the service; a complex booking system based on letters written in English; the need to be accompanied by a caregiver; or the stigma associated with

mental healthcare hospitals. The latter may disproportionately affect ethnic minorities, as suggested by an Australian study on Asian caregivers<sup>42</sup>.

Interestingly, in our study, outpatients with a previous referral to the rapid response psychiatric services had subsequent reduced likelihood of timely access to the memory assessment services. The referral to the rapid response services may have been triggered by delirium, which is associated with physical and mental co-morbidities and increased risk of hospitalisation, institutionalisation and death<sup>43</sup>. Therefore, those outpatients with a previous referral to the rapid response services may have been admitted to hospital or institutions, died, or were too frail to attend the services. Likewise, older age was associated with reduced likelihood of access. South Asian older adults in the UK are a heterogeneous population, with diverse immigration histories, cultural and linguistic backgrounds and socioeconomic status. Of note, the ethnic gap became null when restricting to outpatients with British nationality. Unfortunately, the number of South Asian outpatients with British nationality or English as first language was very small and our sensitivity analyses were likely underpowered. We hypothesised that British nationality and English as first language may reflect a longer residence in the UK, a British education and a higher level of integration into British society. Previous studies have highlighted language barriers<sup>44-49</sup>.

### Strengths and limitations

To our knowledge, our study is the first quantitative study to show that South Asian older outpatients experience delay in access to dementia diagnostic services, compared to White British, after referral to secondary services. Strengths of our study are the large total cohort sample size, the longitudinal cohort design and the use of real-life, routinely collected data, which could facilitate its replication in other secondary mental healthcare settings in the UK. In our cohort, data on ethnicity were systematically collected. All ethnic minorities were represented in small numbers and in lower

proportions compared to those in the general population. This supports the hypothesis of under-referral of older adults from ethnic minorities, in line with previous literature<sup>6, 7, 17</sup>.

Our study was sufficiently powered for our main analyses on ethnic-related disparities in timely access. Yet, the small number of South Asian older adults is a major limitation, and the sensitivity analyses in the sample with British nationality or English language are likely underpowered. In particular, the under-recording of the first language limits us in drawing conclusions on the role of the language barrier. Access within ninety days from referral may be deemed not timely; yet, our data showed that about one third of all patients did not achieve this outcome. A further limitation is that the true prevalence of diagnosed and undiagnosed dementia by ethnicity in the community remains unknown. Nevertheless, our study provides important new insights about referral and access to secondary mental healthcare under universal health coverage.

### Implications

Future research should elucidate the causes of delayed or missed access to memory assessment services, after referral. Qualitative interviews with outpatients who did not achieve timely access (or their caregivers) may provide insight. Quality improvement projects should target women from ethnic minorities.

In conclusion, our study shows that South Asian older outpatients are less likely to achieve timely access to secondary healthcare dementia diagnostic services, after referral, compared to those White British in the UK. Our findings may be relevant to other Western countries where South Asian communities are growing and ageing.

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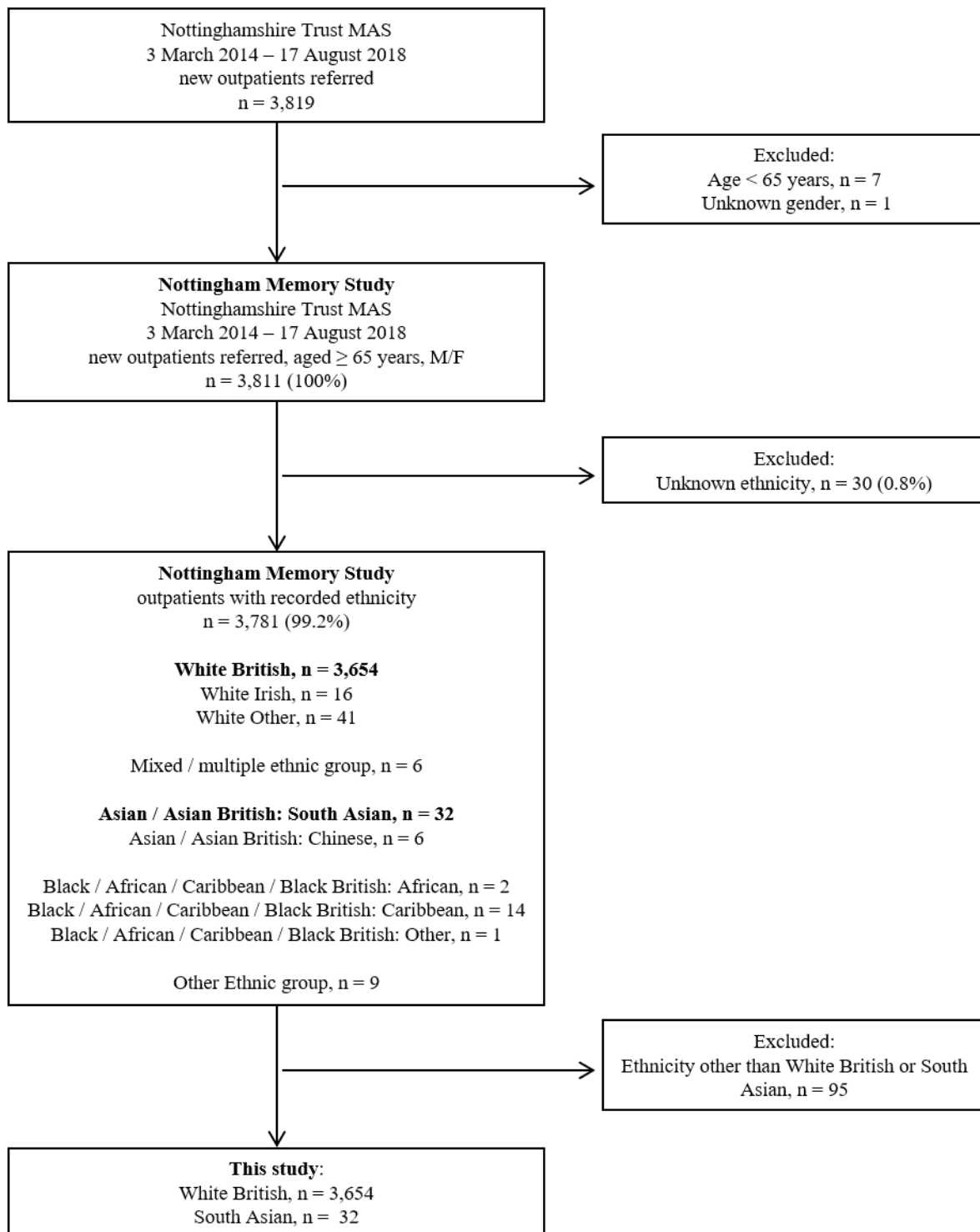
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**Figure 1. Flow-chart of study inclusion criteria**



Abbreviations: n: number, MAS: Memory Assessment Service, M/F: men / women.

**Table 1. Characteristics of the study population at referral to MAS, by ethnicity**

	Total	White British	South Asian	p-value
	n=3686	n=3654	n=32	
Women, n (%)	2114 (57.4)	2103 (57.6)	11 (34.4)	0.008
Age, mean ( $\pm$ SD)	80.1 (6.9)	80.2 (6.9)	76.1 (4.9)	0.001
Marital status, n (%)				
• Married / civil partnership	1863 (50.5)	1841 (50.4)	22 (68.8)	0.072
• Widowed / single / divorced / separated	1577 (42.8)	1567 (42.9)	10 (31.3)	
• No data / not disclosed / not known	246 (6.7)	246 (6.7)	0 (0)	
Nationality, n (%)				
• British	3057 (82.9)	3048 (83.4)	9 (28.1)	<0.001
• Non-British	18 (0.5)	6 (0.2)	12 (37.5)	
• unknown	611 (16.6)	600 (16.4)	11 (34.4)	
First language, n (%)				
• English	2589 (70.2)	2580 (70.6)	9 (28.1)	<0.001
• Non-English	11 (0.3)	2 (0.1)	9 (28.1)	
• unknown	1086 (29.5)	1072 (29.3)	14 (43.8)	
IMD, median (IQR)	6 (4; 8)	6 (4; 8)	8 (5; 10)	0.002
Known to RRLP, n (%)	378 (10.3)	378 (10.3)	0 (0)	0.055

Abbreviations: MAS: Memory Assessment Service, SD: standard deviation, IQR: interquartile range, IMD: Index of Multiple Deprivation, RRLP: Rapid Response Liaison Psychiatry. P-values are calculated by chi-square test for categorical variables. The p-value for difference in mean age is calculated by student's T-test for means. The p-value for difference in median IMD is calculated by non-parametric Mann-Whitney U test.



**Table 2. Gender-differences among White British and South Asian participants, at referral to MAS**

	White British		p-value**	South Asian		p-value**
	Women	Men		Women	Men	
Age, mean ( $\pm$ SD)	n=2103 80.8 (6.9)	n=1551 79.4 (6.8)	<0.001	n=11 74.8 (6.8)	n=21 76.8 (3.7)	0.297
Marital status, n (%)						
• Married / civil partnership	814 (38.7)	1027 (66.2)	<0.001	5 (45.5)	17 (81.0)	0.040
• Widowed / single / divorced / separated	1128 (53.6)	439 (28.3)		6 (54.5)	4 (19.0)	
• No data / not disclosed / not known	161 (7.7)	85 (5.5)		0 (0)	0(0)	
Nationality, n (%)						
• British	1750 (83.2)	1298 (83.7)	0.852	1 (9.1)	8 (38.1)	0.033
• Non-British	4 (0.2)	2 (0.1)		3 (27.3)	9 (42.9)	
• unknown	349 (16.6)	251 (16.2)		7 (63.6)	4 (19.0)	
First language, n (%)						
• English	1480 (70.4)	1100 (70.9)	0.455	1 (9.1)	8 (38.1)	0.222
• Non-English	2 (0.1)	0 (0)		4 (36.4)	5 (23.8)	
• unknown	621 (29.5)	451 (29.1)		6 (54.5)	8 (38.1)	
IMD, median (IQR)	6 (4; 8)	6 (4; 8)	0.020	7 (6;10)	9 (5; 10)	0.935
Known to RRLP, n (%)	225 (10.7)	153 (9.9)	0.413	0 (0)	0 (0)	NA

Abbreviations: MAS: Memory Assessment Service, SD: standard deviation, IMD: Index of Multiple Deprivation, IQR: interquartile range, RRLP: Rapid Response Liaison Psychiatry. P-value\* indicates gender-differences among the White British participants; p-value\*\* indicates gender-differences among South Asian participants. P-values are calculated by chi-square test for categorical variables. The P-value for difference in mean age is calculated by student's T-test for means. The p-value for differences in median IMD is calculated by non-parametric Mann-Whitney U test.

**Table 3. Association between South Asian ethnicity and outcome of accessing MAS within 90 days from referral, compared to White British ethnicity**

Model	OR [95% CI]	p-value
0	0.47 [0.24 – 0.95]	0.037
1	0.42 [0.21 – 0.86]	0.017
2	0.47 [0.23 – 0.95]	0.035

Binary logistic regression analyses. Abbreviations: MAS: Memory Assessment Service, OR: odds ratio, CI: confidence interval. Model 0 is adjusted by ethnicity only. Model 1 is adjusted by ethnicity, age and gender. Model 2 is adjusted by ethnicity, age, gender, previous referral to the RRLP and IMD decile. The analyses in Model 0 and 1 are performed in the total population of 3,686 outpatients. The analyses in Model 2 are performed in 3,683 outpatients, due to missing data on Index of Multiple Deprivation decile for three White British outpatients.



**Table 4. Association between South Asian ethnicity and outcome of accessing MAS within 90 days from referral, compared to White British ethnicity, in subpopulation who reported British nationality (n = 3,057)**

Model	OR [95% CI]	p-value
0	0.99 [0.25 – 3.97]	0.990
1	0.90 [0.22 – 3.63]	0.884
2	1.04 [0.25 – 4.25]	0.961

Binary logistic regression analyses. Abbreviations: MAS: Memory Assessment Service, OR: odds ratio, CI: confidence interval. Model 0 is adjusted by ethnicity only. Model 1 is adjusted by ethnicity, age and gender. Model 2 is adjusted by ethnicity, age, gender, previous referral to the Rapid Response Liaison Psychiatry and Index of Multiple Deprivation decile. The analyses in Model 0 and 1 are performed in 3,057 outpatients. The analyses in Model 2 are performed in 3,054 outpatients, due to missing data on Index of Multiple Deprivation for three White British outpatients.

**Table 5. Association between South Asian ethnicity and outcome of accessing MAS within 90 days from referral, compared to White British ethnicity, in subpopulation who reported English as their first language (n = 2,589)**

Model	OR [95% CI]	p-value
0	0.63 [0.17 – 2.34]	0.486
1	0.59 [0.16 – 2.22]	0.438
2	0.75 [0.20 – 2.88]	0.677

Binary logistic regression analyses. Abbreviations: MAS: Memory Assessment Service, OR: odds ratio, CI: confidence interval. Model 0 is adjusted by ethnicity only. Model 1 is adjusted by ethnicity, age and gender. Model 2 is adjusted by ethnicity, age, gender, previous referral to the Rapid Response Liaison Psychiatry and Index of Multiple Deprivation decile. The analyses in Model 0 and 1 are performed in 2,589 outpatients. The analyses in Model 2 are performed in 2,587 outpatients, due to missing data on Index of Multiple Deprivation for two White British outpatients.

**Supplementary Table 1. Association between South Asian ethnicity and outcome of accessing MAS within 120 days from referral, compared to White British ethnicity**

Model	OR [95% CI]	p-value
0	0.58 [0.29 – 1.17]	0.128
1	0.51 [0.25 – 1.02]	0.058
2	0.53 [0.26 – 1.07]	0.077

Binary logistic regression analyses. Abbreviations: MAS: Memory Assessment Service, OR: odds ratio, CI: confidence interval. Model 0 is adjusted by ethnicity only. Model 1 is adjusted by ethnicity, age and gender. Model 2 is adjusted by ethnicity, age, gender, previous referral to the Rapid Response Liaison Psychiatry and Index of Multiple Deprivation decile. The analyses in Model 0 and 1 are performed in the total population of 3,686 outpatients. The analyses in Model 2 are performed in 3,683 outpatients, due to missing data on IMD for three White British outpatients.

**Supplementary Table 2. Association between South Asian ethnicity and outcome of accessing MAS within 90 days from referral, compared to White British ethnicity, in women (n = 2,114)**

Model	OR [95% CI]	p-value
0	0.52 [0.16 – 1.70]	0.277
1	0.44 [0.13 – 1.46]	0.181
2	0.49 [0.15 – 1.62]	0.242

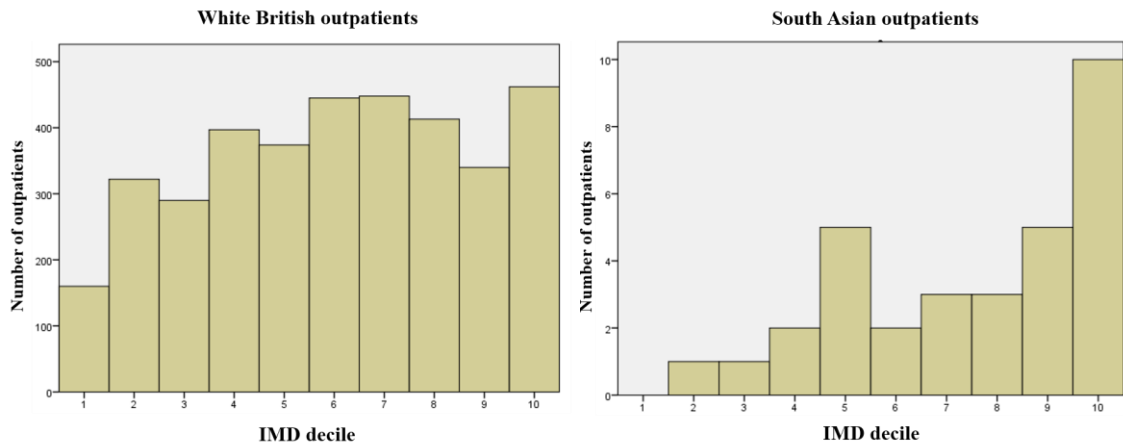
Binary logistic regression analyses. Abbreviations: MAS: Memory Assessment Service, OR: odds ratio, CI: confidence interval. Model 0 is adjusted by ethnicity only. Model 1 is adjusted by ethnicity and age. Model 2 is adjusted by ethnicity, age, previous referral to the Rapid Response Liaison Psychiatry and Index of Multiple Deprivation decile. All the analyses are performed in the total sample of 2,114 women.

**Supplementary Table 3. Association between South Asian ethnicity and outcome of accessing MAS within 90 days from referral, compared to White British ethnicity, in men (n = 1,572)**

Model	OR [95% CI]	p-value
0	0.44 [0.19 – 1.06]	0.068
1	0.41 [0.17 – 0.99]	0.047
2	0.46 [0.19 – 1.12]	0.086

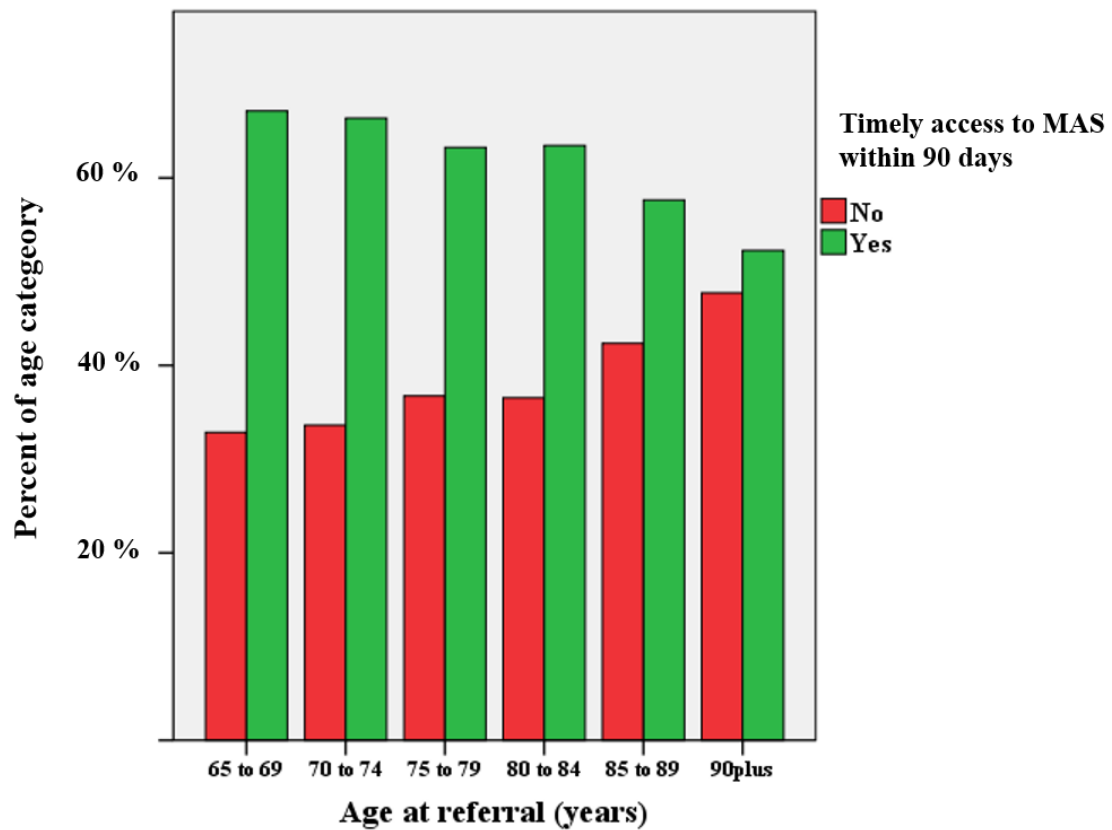
Binary logistic regression analyses. Abbreviations: MAS: Memory Assessment Service, OR: odds ratio, CI: confidence interval. Model 0 is adjusted by ethnicity only. Model 1 is adjusted by ethnicity and age. Model 2 is adjusted by ethnicity, age, previous referral to the Rapid Response Liaison Psychiatry and Index of Multiple Deprivation decile. The analyses in Model 0 and 1 are performed in the total sample of 1,572 men. The analyses in Model 2 are performed in 1,569 men, due to missing data on Index of Multiple Deprivation for three White British men.

Supplementary Figure 1. Index of Multiple Deprivation decile distribution at referral, by ethnicity



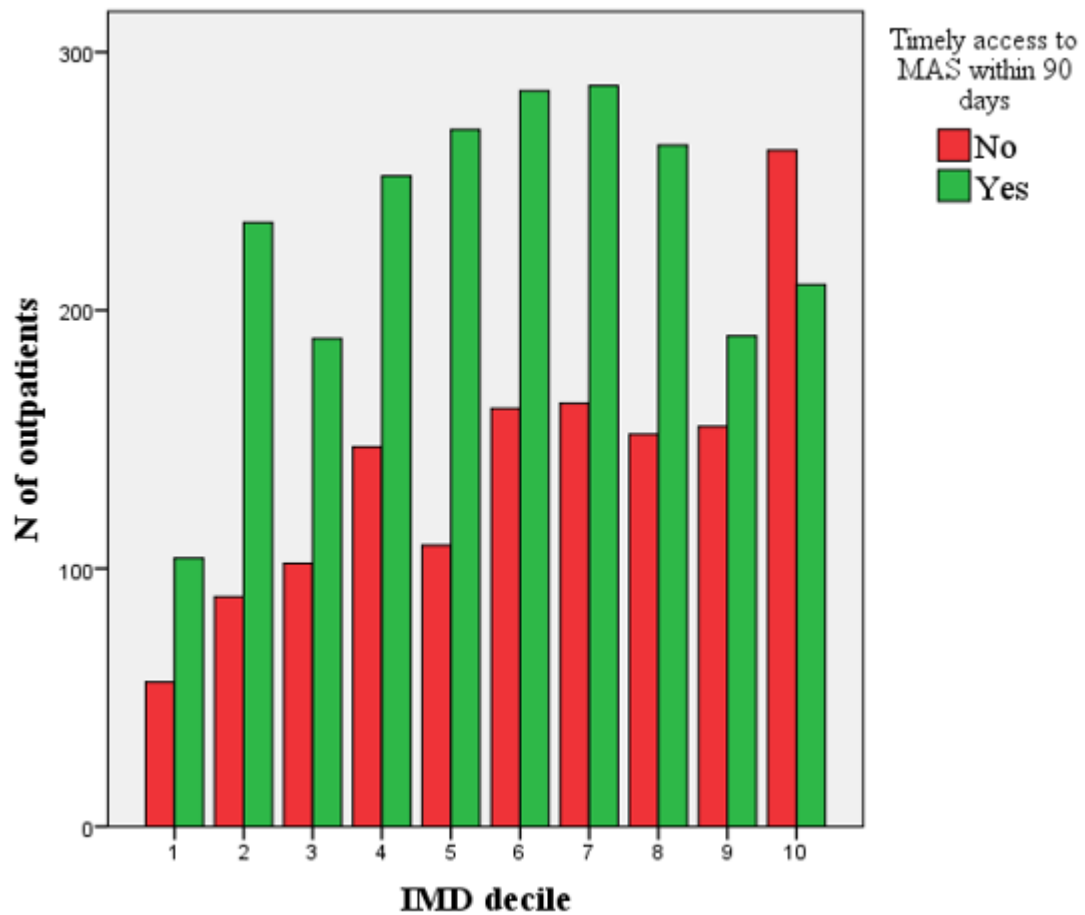
Abbreviations: IMD: Index of Multiple Deprivation. The graph on the left shows data on 3,651 White British outpatients (three White British outpatients had missing data on IMD and were excluded); the graph on the right shows data on 32 South Asian outpatients.

Supplementary Figure 2. Timely access to MAS by age category, in the total study population.



Abbreviations: MAS: memory assessment service. Number of outpatients in each age category: 65 to 69 years, n = 274; 70 to 74 years, n = 559; 75 to 79 years, n = 819; 80 to 84 years, n = 980; 85 to 89 years, n = 746; 90plus, n = 308.

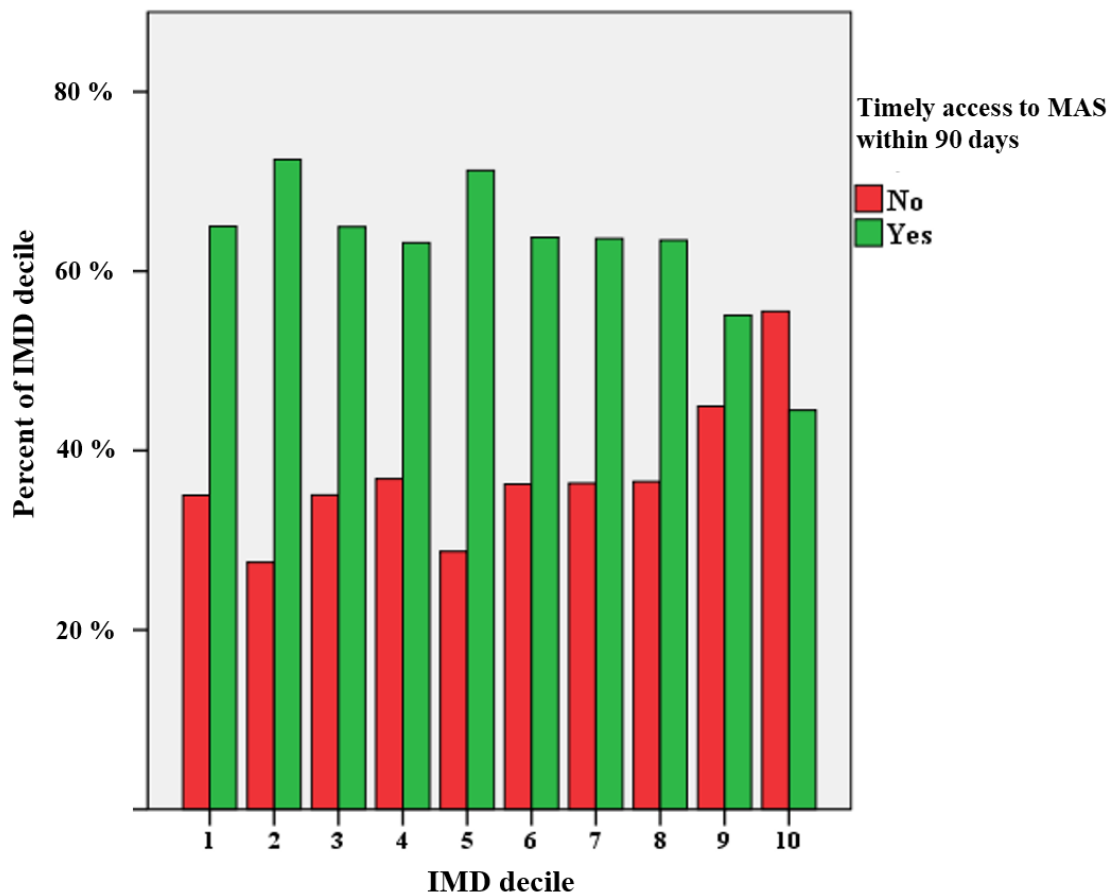
Supplementary Figure 3. Timely access to MAS by Index of Multiple Deprivation decile, in the total study population



Abbreviations: n: number, IMD: Index of Multiple Deprivation, MAS: memory assessment service. This graph shows data on a total of n = 3,683 outpatients. Three outpatients had missing data on IMD and were excluded.

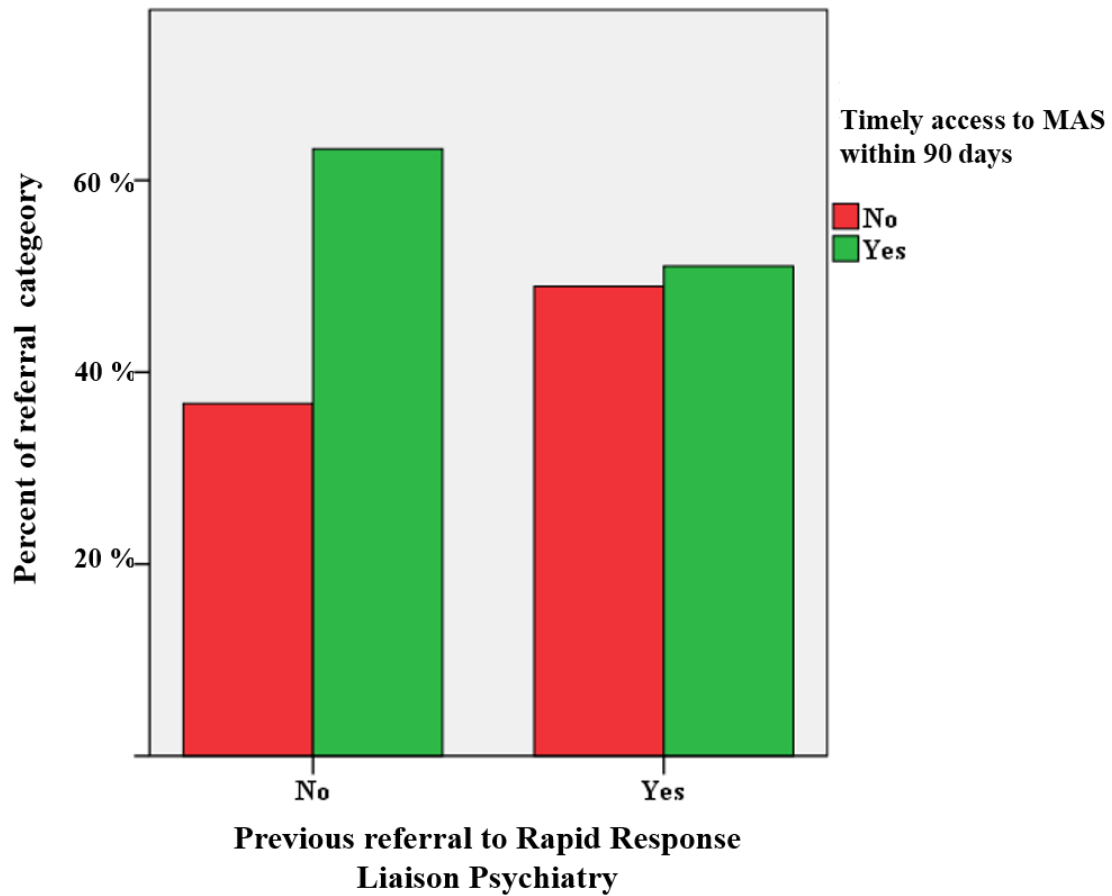


Supplementary Figure 4. Timely access to MAS by Index of Multiple Deprivation decile, in the total population (shown as percentage of IMD decile category).



Abbreviations: MAS: memory assessment service, IMD: Index of Multiple Deprivation. Number of outpatients per IMD decile: first decile, n = 160; second decile, n = 323; third decile, 291; fourth decile, n = 399; fifth decile, n = 379; sixth decile, n = 447; seventh decile, n = 451; eighth decile, n = 416; ninth decile, n = 345; tenth decile, n = 472. This graph shows data on a total of n = 3,683 outpatients. Three outpatients had missing data on IMD and were excluded.

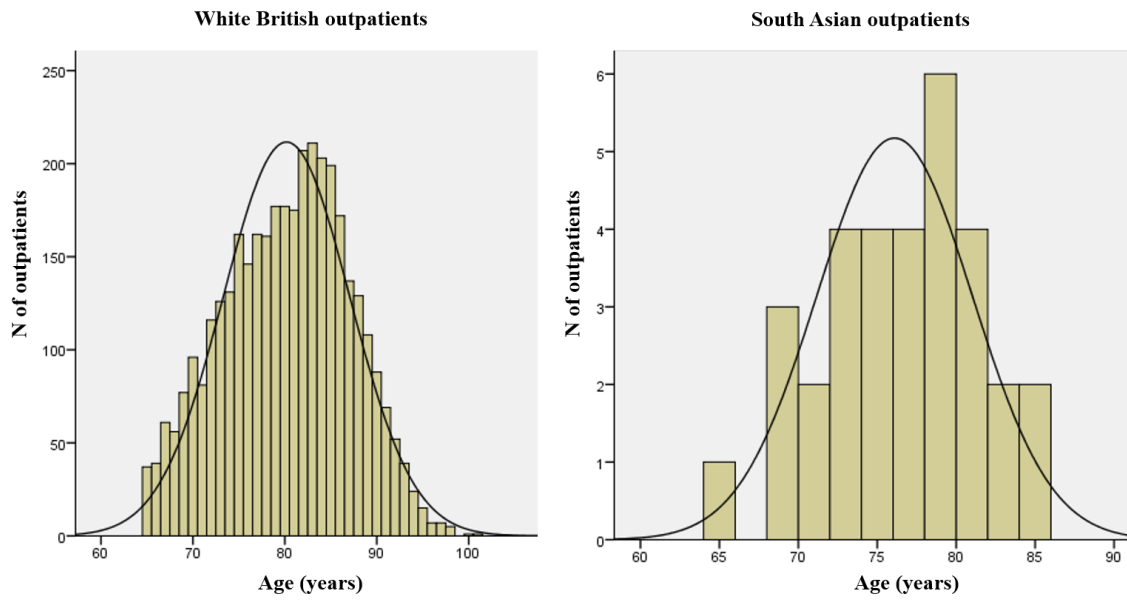
Supplementary Figure 5. Timely access to MAS by previous referral to the Rapid Response Liaison Psychiatry, in the total study population.



Abbreviations: MAS: memory assessment service. Number of outpatients by referral category: not previously referred to Rapid Response Liaison Psychiatry, n = 3,308; previously referred to Rapid Response Liaison Psychiatry, n = 378.

For reviewers only

Figure 1 for reviewers only. Age distribution at referral, by ethnicity.



Abbreviation: n: number.