Title: Is the effectiveness of Memory Assessment Services associated with their structural and process characteristics?

Running head: Memory clinic characteristics and outcomes

Key words: Dementia; Memory Assessment Services; Memory Clinics; Health-related Quality of Life; Caregiver burden

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Key points:

- No previous study has looked at the characteristics of memory assessment services (MASs) in relation to patient or carer outcomes.
- In a large study of 785 patients attending 69 services, we show that most structural and process characteristics of MASs are not associated with patients' health-related quality of life (HRQL), carers' HRQL or carers' burden.
- The only exception is the involvement of allied health professionals such as occupational therapists, which is associated with better patient HRQL.

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Abstract

Objectives

To investigate whether structural and process characteristics of memory assessment services (MASs) are associated with outcomes (changes in patients' health-related quality of life (HRQL), carers' HRQL and carers' burden) over the first six months following the first appointment.

Methods

Data from 785 patients referred to 69 MASs and 511 of their lay carers, collected at the first appointment and six months later. Data on MAS characteristics collected using a questionnaire at baseline. We used multilevel linear regression models to explore the associations of patients' HRQL and carers' outcomes with structural and process characteristics of MASs. Analyses were conducted on the full sample of patients and carers, and separately on those patients diagnosed with dementia.

Results

None of the structural (skill mix, workload, volume, provision of clinical assessments, provision of psychosocial support) or process (waiting time, length and number of appointments, anti-dementia drug use, psychosocial interventions use) characteristics included in the analyses were associated with patients' or carers' outcomes at 6 months, apart from the presence of allied health professionals (AHPs), which was associated with a DEMQOL score 2.7 points higher. When only those with a diagnosis of dementia were considered, the association with presence of AHPs was no longer observed.

Conclusions

Apart from involving AHPs, alterations to the way memory assessment services are structured or function appear unlikely to improve their effectiveness in improving patients’ and carers’ HRQL. It is possible that the characteristics of MASs may influence patients’ and carers’ experience but this was not studied.

Introduction

The 2009 National Dementia Strategy for England (Department of Health, 2009) sought to increase the proportion of those with dementia who received a formal clinical diagnosis. This policy was reiterated in the Prime Minister’s Challenge on Dementia in 2012 (Department of Health, 2012) which envisaged this being accomplished by increasing the number of referrals to a Memory Assessment Service (MAS), a “multidisciplinary team that assesses and diagnoses dementia, and may provide psychosocial interventions.” (Royal College of Psychiatrists & NHS England, 2015)

A survey of a large random sample of MASs in England conducted in 2015 (Chrysanthaki et al., in submission) revealed considerable variation both in their structural characteristics (such as staffing levels, skill mix, provision of post-diagnostic support) and their processes (such as waiting times, length of appointments, frequency of follow-up). Given the wide differences in costs per patient that result from such variation, (Pennington et al., In press) it is important to know if such characteristics are associated with patient outcomes (Figure 1).

[Insert Figure 1 here]

Although the associations that structures (characteristics relating to the resources and organisation of services) and processes (those relating to the delivery and coordination of services (Donabedian, 1988)) have with outcomes have not been investigated in dementia care, there has been research in other areas of health care. As regards structural factors, research has largely been limited to aspects of staffing (workload, skill-mix) and has focused on adverse outcomes (safety) rather than the extent of benefit (health gain). High staff workload has been shown to be associated with poorer patient outcomes (Duffield et al., 2011, Ong et al., 2007, Tucker and UK Neonatal Staffing Study Group, 2002, Penoyer, 2010) as well as staff burnout and job dissatisfaction, which are themselves associated with poorer care quality. (Aiken et al., 2012, Rochefort and Clarke, 2010) However, the strength and validity of such evidence has sometimes been limited by inadequate adjustment for covariates and measurement error. (Butler et al., 2011, Griffiths et al., 2016) In studies looking at skill mix, associations with better outcomes have been found for specialist support staff in hospitals (Butler et al., 2011) and support workers in intermediate care. (Dixon et al., 2010)

Among the process characteristics that have been studied, the association of waiting time with outcome appears to depend on the condition: longer waiting times were found to have a detrimental effect on pain and disability for those undergoing hip replacement (Hajat et al., 2002) but had no impact on well-being (global distress) in those awaiting psychological therapy.(Beck et al., 2015) The effect of the length of appointments on outcomes has not been studied, though in general practice it has been shown to have an impact on the amount of information communicated (Gude et al., 2013) and patient satisfaction (Goedhuys and Rethans, 2001). The frequency of follow-up appointments has been found to have no association with outcome for antenatal attendances for low-risk pregnancies (Dowswell et al., 2010) and for those who had deliberately self-poisoned.(Grimholt et al., 2015) One of the few process characteristics that has been shown to be associated with outcome is the volume of patients treated (Gandjour et al., 2003, Halm et al., 2002), though this is restricted to the more high technology areas of health care such as surgery (Shervin et al., 2007, Finks et al., 2011, Preston et al., 2015), critical care (Nguyen et al., 2015) and renal dialysis.(Pieper et al., 2015)

Our aim was to investigate the extent to which key structural and process characteristics of MASs are associated with outcome (changes in patient health-related quality of life (HRQL), carer HRQL and carer burden) over the first six months following the first appointment. A secondary aim was to consider the relationship for those in whom a diagnosis of dementia was made.

Methods

Data

We randomly selected 80 MASs from 212 clinics identified in a national survey in 2014. (Royal College of Psychiatrists & NHS England, 2015) Of these, 73 took part in the study and 69 successfully collected data from patients at baseline and six month follow up.(Park et al., In Press, Park et al., In submission). Patients attending their first appointment between September 2014 and April 2015 and their lay carers (if present) were eligible for inclusion provided they had sufficient proficiency in English to understand the consent process and questionnaires. Each site was asked to recruit up to 25 consecutive new patients.(Park et al., In Press) Questionnaires were completed by patients (interviewer administered) and their lay carers (self-administered) at the first appointment and six months later. Of the 1318 patients and 944 carers recruited and eligible for follow up, 883 (67%) patients and 569 (60%) carers completed questionnaires at six months (see Supplementary Material Figure 1).

Additionally at baseline, organisational questionnaires on the structural and process characteristics of MASs were sent by email to lead contacts at each site, who were requested to complete them with help from appropriate sources (clinic manager, clinical staff, human resources staff).(Chrysanthaki et al., in submission) All 69 MASs completed the organisational questionnaire.

Outcomes

The main outcomes were patients' dementia-specific measures of HRQL (DEMQOL and DEMQOL-Proxy scores (Smith et al., 2005)), patients' self- and proxy-reported generic measures of HRQL (EQ-5D-3L and EQ-5D-3L proxy scores (EuroQol Group, 1990)), carers' self-reported measure of HRQL (EQ-5D-3L score), and carer burden (Zarit Burden Interview (short form) score (Bedard et al., 2001)).

In DEMQOL (interviewer administered but self-reported by the patient) and DEMQOL-Proxy (proxy reported by a family carer), each item has responses on a four-point Likert scale with a higher score indicating better HRQL. For both measures we used equated scores (Smith et al., 2015) based on Rasch Measurement Theory, which were linearly transformed to range from 0 to 100. Both self- and proxy-reported EQ-5D-3L instruments have five items, each covering one domain: mobility, self-care, usual activities, pain/discomfort and anxiety/depression, and with responses to each item measured on a three-point scale. Summary EQ-5D-3L index scores were calculated using value sets derived from a UK general population survey to weight and combine responses.(EuroQol Group, 2015) A score of 0 represents death and 1 represents perfect health. The short form of the Zarit Burden Interview consists of 12 items measured on a five-point Likert scale, with a higher score indicting greater caregiver burden.(Bedard et al., 2001)

MAS structural and process characteristics

Those structural and process characteristics of MASs which varied between services were selected.(Chrysanthaki et al., in submission) Dementia policy experts, clinicians, researchers and a lay advisory group advised on the final selection. Structural variables selected were: skill mix (psychologists, allied health professionals, and advisory and support staff), number of new patients per whole time equivalent (WTE) staff per month, number of new patients seen by the MAS per month, provision of clinical assessments (at first appointment: ECG, neurological examination; at follow up: physical examination, vision/hearing/mobility assessment), and provision of post-diagnostic psychosocial interventions.

Process characteristics selected were: waiting time to first appointment (up to or more than six weeks, the recommended standard for time from referral to assessment (Royal College of Psychiatrists, 2016)), length of first appointment, number of follow-up appointments within the first year, proportion of patients prescribed anti-dementia drugs and proportion of patients using psychosocial support.

Patient and carer characteristics

Data were collected at baseline on the following characteristics of patients: age (categorised as <75 years, 75-79 years, 80-84 years, ≥85 years); sex; ethnicity (white or other); socio-economic status (quintiles of the national ranking of Index of Multiple Deprivation scores based on patients' residential postcodes) (Department for Communities and Local Government, 2011); and number of comorbid conditions from a pre-specified list (Chard et al., 2011), categorised as 0, 1, 2 and 3 or more. At six month follow up, data on patient diagnosis were extracted from their clinic records (dementia, mild cognitive impairment (MCI), other diagnosis, no diagnosis reached).

Data on the following carer characteristics were collected at baseline: age (grouped into 10-year categories, each representing similar proportions of data <60, 60-69, 70-79, ≥80 years); sex; ethnicity; socio-economic status; and relationship to the patient (spouse, son or daughter, other).

Missing data

Of the 883 patient respondents at six months, 785 (89%) had data on all items used in the analysis and these form the main analysis sample. Of these, 511 (58%) had carers who also took part in the study and provided proxy-reported data. For each outcome, analyses were restricted to respondents with complete data on the variables examined.

Statistical analysis

Patient, carer and MAS characteristics were summarised as means and standard deviations (SDs) or percentages. We used multilevel linear regression models to explore the relationships between MAS characteristics and patient outcomes at six months (DEMQOL score, DEMQOL-Proxy score, self-reported EQ-5D-3L index, proxy-reported EQ-5D-3L index). In addition, two carer outcomes were considered: carers' own HRQL (EQ-5D-3L index) and carer burden (Zarit Burden Interview short form score).

MAS characteristics were included in the models in two stages. First, we included all structural variables (skill mix variables, number of new patients per WTE staff per month, number of new patients seen per month, provision of clinical assessments, provision of psychosocial support). Second, process characteristics were added (waiting time, length and number of appointments, anti-dementia drug use, psychosocial interventions use). Patient outcome models were additionally adjusted for patient-level variables (HRQL score at baseline, patient age, sex, ethnicity, deprivation, comorbidity and diagnosis), while carer outcome models were adjusted for carer-level variables (HRQL or burden score at baseline, carer age, sex, ethnicity, deprivation, relationship to patient and patient's diagnosis). All models included MAS as a random effect. Analyses were conducted on the full sample of patients and carers, and also on the sub-sample of patients (or carers of patients) in whom dementia had been diagnosed.

We report results from random effect models as adjusted differences in HRQL or burden score with 95% confidence intervals (with Bonferroni correction for multiple testing; family-wise error rate of 0.05 divided by the number of tests conducted for each model).

Ethical approval

The study protocol was approved by the National Research Ethics Service Committee London (reference: 14/LO/1146) and the London School of Hygiene & Tropical Medicine ethics committee (reference: 8418).

Results

Sample characteristics

The characteristics of patients and carers are described in Table 1. Respondents at six months were similar to non-respondents for most characteristics measured at baseline (age, sex, ethnicity, co-morbidities), but patients from the most socioeconomically deprived areas were underrepresented at follow up (14% v 21%, $p<0.001$). On average, carers were younger than patients (mean age 67 versus 78 years). More than two-thirds of carers were female, and the majority (71%) were the spouse of the patient. The characteristics of included MASs are summarised in Table 2.

[Insert Table 1 and Table 2 here]

Change in outcomes

Changes in HRQL and caregiver burden between baseline and 6 months are presented in Table 3. HRQL measured using DEMQOL (change: 3.4 points, 95% CI 2.7 to 4.1), DEMQOL-Proxy (change:1.3, 95% CI 0.5 to 2.1) and self-reported EQ-5D-3L (change: 0.02, 95% CI 0.01 to 0.05) increased, indicating an improvement, while change in proxy-reported EQ-5D-3L was not statistically significant (-0.02, 95% CI -0.04 to 0.004)).

Changes in mean carer HRQL and carer burden scores were not statistically significant.

[Insert Table 3 here]

Association between MAS characteristics and patient HRQL

Self-reported HRQL at six months was associated with only one of the MAS characteristics, the presence of allied health professionals (AHPs, comprising occupational therapists (93% of AHP staff), physiotherapists (3.5%) and speech & language therapists (3.5%)): DEMQOL score was 2.7 points higher among patients attending one of the 49 (71%) MASs with AHPs compared to those without, in the fully adjusted model (Table 4). However, no such association was seen for EQ-5D-3L or for DEMQOL-Proxy.

Neither DEMQOL nor DEMQOL-Proxy score was associated with any of the other MAS characteristics, in partially or fully adjusted models. Similarly, self- and proxy-reported generic measures of patient HRQL (EQ-5D-3L index) were not associated with any of these MAS characteristics.

[Insert Table 4 here]

Association between MAS characteristics and carer outcomes

None of the MAS characteristics were associated with carer HRQL or caregiver burden, in partially or fully adjusted models (Table 5).

[Insert Table 5 here]

Associations for patients with diagnosis of dementia

Among the subset of patients who had been diagnosed with dementia, none of the patient outcomes (DEMQOL, DEMQOL-Proxy, self-reported EQ-5D-3L index, proxy-reported EQ-5D-3L index) or carer outcomes (carer EQ-5D-3L index, Zarit Burden Interview score) were associated with any of the MAS characteristics. The results of these analyses are presented in Supplementary Tables 1 and 2.

Discussion

Main findings

None of the structural and process characteristics of MASs were associated with patient or carer outcomes six months after the first appointment, with one exception. The presence of allied health professionals (AHPs) was associated with better self-reported HRQL. When only those with a confirmed diagnosis of dementia were considered, the association with presence of AHPs was no longer observed.

The lack of association with HRQL for most variables may either be because the structures and processes studied were not the appropriate ones, or the extent of change in outcomes over six months meant the study lacked sufficient power to detect their influence. Thus while we can be confident that the factors studied do not have a major impact on outcomes we cannot discount the possibility they have a small effect, although the scale of any such impact is likely to be too small to have any policy relevance. However, the lack of evidence for associations of many structural and process factors with outcomes does not mean that these characteristics are of no consequence for patients. It is possible that they are associated with other aspects of the quality of care, in particular patients’ and carers’ experience (e.g. extent to which information needs were met; being treated with dignity and respect; time spent waiting in clinics).

Comparison with other studies

No other studies have looked at characteristics of MASs in relation to patient or carer outcomes so comparisons can only be made with research in other areas of health care. The lack of association of outcome with the frequency of follow-up appointments is consistent with studies in antenatal care (Dowswell et al., 2010) and care of deliberate self-harm.(Grimholt et al., 2015) While the adverse effect of long waiting times has been demonstrated for cancer (Chen et al., 2008) and chronic pain (Lynch et al., 2008), our failure to detect an association in MASs is similar to that reported for psychological therapy.(Beck et al., 2015) This may reflect the fact that the majority of people who are referred to memory clinics are not acutely unwell or in crisis,(Park et al., In Press) which may lead them to believe that their difficulties are not urgent. Positive associations between outcomes and the volume of cases seen have similarly been restricted to high technology areas of care (in which high volume may be a proxy for experience and dexterity) (Black and Johnston, 1990) with no evidence of such associations in long-term care and mental health services, activities that have more in common with MASs.

The absence of any association between outcomes and staff workload and skill-mix (with the exception of the presence of AHPs) that we observed differs from that found in some areas of hospital care. This may be explained by the difference in focus of most studies, which have considered adverse outcomes (deaths, complications, readmission) (Aiken et al., 2012, Duffield et al., 2011, Penoyer, 2010, Rochefort and Clarke, 2010, Wilson et al., 2011, Al-Amin, 2016) rather than the benefits of care (effectiveness).

The beneficial effect of AHPs (predominantly occupational therapists) on patients' HRQL, independent of workload or the presence of other types of staff, may reflect the types of support provided by these staff, as although we considered whether services provide psychosocial support we did not look at specific types of support. More generally, AHPs' presence may be an indicator of a multidisciplinary approach to dementia care, which has been shown to improve HRQL in patients.(Wolfs et al., 2008)

Strengths and limitations

This is one of the few studies in health care research to examine the relationship between structural and process characteristics and the effectiveness, rather than the safety, of services. It is the first to consider such relationships in MAS and dementia care.

The main limitation relates to the availability of data on structures and processes. It is possible that there are characteristics that were not measured that do have an association with outcomes. In addition, some characteristics were difficult to define so there may have been some inconsistency in the way they were reported by MAS staff. For example, determining the WTE staff levels for some MASs was difficult as some staff worked in more than one site or service. Follow-up telephone conversations with sites helped to minimise inconsistencies. In addition, some data were based on estimates of typical or mean values by MAS staff rather than derived from data in individual patients' clinic records (e.g. mean waiting time and length of first appointment). It was not feasible to collect patient-level data to validate these estimates.

Implications

Given the large variations in costs per patient between MASs, the lack of discernible associations between most MAS characteristics and patient or carer HRQL and caregiver burden suggests that there is scope for improvements in efficiency by standardising the way clinics are organised. However, before advocating and implementing changes to the structure and processes of MASs it is necessary to consider whether there are any additional characteristics that might influence the outcome of care that need to be investigated. In addition, structural and process characteristics may be associated with differences in patients' and carers' experiences, which are highly valued by those using the services. Finally, further work is needed to explore the role of AHPs in improving patient outcomes, and to determine whether the observed benefits for HRQL are attributable to specific interventions or to other organisational characteristics of MASs.

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Figure 1: Conceptual framework for categorisation of memory assessment service (MAS) characteristics

Table 1: Characteristics of patients and carers

Patient characteristics (n=785)	**N (%)**
Age (years)	
<75	246 (31%)
75-79	173 (22%)
80-84	208 (27%)
≥85	158 (20%)
Sex	
Male	389 (50%)
Female	396 (50%)
Ethnicity	
White/White British	743 (95%)
Other ethnicity	42 (5%)
Deprivation (quintiles of IMD)	
1 – least deprived	217 (28%)
2	166 (21%)
3	146 (18%)
4	148 (19%)
5 – most deprived	108 (14%)
Number of comorbidities	
0	165 (21%)
1	222 (28%)
2	191 (24%)
3 or more	207 (26%)
Diagnosis	
Dementia	419 (54%)
Mild cognitive impairment	198 (25%)
Other diagnoses	42 (5%)
No diagnosis	126 (16%)
Carers characteristics (n=511)	
Age (years)	
<60	130 (25%)
60-69	111 (22%)
70-79	182 (36%)
≥80	88 (17%)
Sex	
Male	157 (31%)
Female	354 (69%)
Ethnicity	
White/White British	488 (96%)
Other ethnicity	19 (4%)
Missing	4
Deprivation (quintiles of IMD)	
1 – least deprived	141 (28%)
2	113 (22%)
3	98 (19%)
4	91 (18%)
5 – most deprived	63 (13%)
Missing	5
Relationship to patient	

Spouse	360 (71%)
Son or daughter	113 (22%)
Other	36 (7%)
Missing	2

Table 2: Characteristics of memory assessment services (MASs) which varied between services (n=69)

Clinic characteristic	**N (%)**
Structure characteristics	
Psychologists	46 (67%)
Allied Health Professionals	49 (71%)
Advisory & Support staff	37 (54%)
New patients per WTE staff per month	
1-3	22 (32%)
4-6	23 (34%)
7 or more	23 (34%)
Missing	1
New patients seen per month	
<25	14 (21%)
25-49	22 (32%)
50-74	21 (31%)
75 or more	11 (16%)
Missing	1
ECG offered at first appointment	41 (59%)
Neurological examination offered at first appointment	30 (43%)
Physical examination offered at follow up	35 (51%)
Vision/hearing/mobility assessment offered at follow up	24 (35%)
Provides psychosocial support	56 (81%)
Process characteristics	
Waiting time to first appointment (weeks)	
≤6	50 (72%)
>6	19 (28%)
Mean waiting time to first appointment (weeks)	6.3 (SD 5.4)
Length of first appointment (minutes)	
≤60	19 (27%)
61-90	37 (54%)
>90	13 (19%)
Number of follow up appointments within first year	
None	7 (10%)
1	8 (12%)
2	22 (32%)
3 or more	17 (25%)
Variable	14 (21%)
Missing	1
% Anti-dementia drug use	38.4% (SD 21)
% Psychosocial interventions use	18.3% (SD 17)

Table 3: Patient and carer outcomes at baseline and 6 months and difference between time points

	Mean (SD)		**Difference**
	Baseline	**6 months**	**(95% CI)**
Patient outcomes			
DEMQOL (n= 785)	65.6 (12.5)	68.8 (12.7)	3.2 (2.5 to 4.0)
DEMQOL-Proxy (n=508)	57.0 (9.5)	58.5 (10.7)	1.5 (0.7 to 2.3)
EQ-5D-3L (self-reported) Index (n=772)	0.72 (0.27)	0.74 (0.28)	0.02 (.006 to 0.04)
EQ-5D-3L (proxy-reported) Index (n=483)	0.63 (0.30)	0.61 (0.31)	-0.02 (-0.04 to .009)
Carer outcomes			
EQ-5D-3L (self-reported) Index (n=494)	0.79 (0.25)	0.78 (0.25)	-0.009 (-0.03 to .009)
Zarit Burden Interview score (n=476)	12.5 (8.8)	12.7 (9.0)	0.2 (-0.3 to 0.8)

Higher DEMQOL, DEMQOL-Proxy and EQ-5D-3L scores indicate better HRQL. Higher Zarit Burden Interview score indicates greater burden.

Table 4: Differences in mean patient HRQL scores at six months, by MAS characteristics

MAS characteristics	**DEMQOL (n=785)**		**DEMQOL-Proxy (n=508)**		**Self-reported EQ-5D-3L Index (n=772)**		**Proxy-reported EQ-5D-3L Index (n=483)**	
Structural characteristics	**Model 1**	**Model 2**	**Model 1**	**Model 2**	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Psychologists	-0.1 (-2.7 to 2.5)	-0.2 (-2.6 to 2.3)	-1.8 (-4.4 to 0.8)	-1.6 (-4.1 to 1.0)	-0.001 (-.05 to .04)	-0.01 (-.06 to .03)	0.01 (-.07 to .09)	0.01 (-.07 to .09)
Allied Health Professionals	1.5 (-1.4 to 4.5)	**2.7 (0.02 to 5.5)***	1.1 (-2.6 to 4.8)	0.5 (-2.3 to 3.3)	0.03 (-.03 to .08)	0.04 (-.02 to 0.1)	0.02 (-.06 to 0.1)	0.002 (-.09 to .09)
Advisory & Support staff	-0.2 (-3.1 to 2.7)	-0.9 (-4.2 to 2.5)	0.6 (-1.7 to 2.9)	1.1 (-1.0 to 3.1)	-0.02 (-.07 to .02)	-0.03 (-.08 to .02)	-0.02 (-0.1 to .05)	-0.02 (-0.1 to .06)
New patients per WTE staff per month (Reference: 1-3)								
4-6	0.2 (-2.4 to 2.8)	0.3 (-2.9 to 3.6)	0.005 (-3.1 to 3.1)	-0.3 (-3.1 to 2.6)	0.03 (-.02 to .08)	0.03 (-.04 to 0.1)	0.04 (-.03 to 0.1)	0.05 (-.04 to 0.1)
7 or more	1.2 (-2.7 to 5.1)	1.1 (-2.8 to 5.1)	-0.08 (-3.9 to 3.8)	-0.3 (-3.6 to 3.0)	0.02 (-.05 to .09)	0.02 (-.06 to 0.1)	0.04 (-.07 to 0.2)	0.03 (-0.1 to 0.2)
New patients seen per month (Reference: <25)								
25-49	-2.0 (-5.2 to 1.1)	-2.2 (-5.4 to 1.0)	0.1 (-3.7 to 3.9)	0.5 (-3.2 to 4.2)	-0.04 (-0.1 to .05)	-0.03 (-0.1 to .06)	-0.05 (-0.2 to .07)	-0.06 (-0.2 to .07)
50-74	-1.1 (-4.5 to 2.5)	-1.6 (-5.7 to 2.5)	-0.6 (-4.6 to 3.4)	-0.8 (-4.6 to 3.1)	-0.06 (-0.1 to .03)	-0.05 (-0.1 to .04)	0.004 (-0.1 to 0.1)	-0.009 (-0.1 to 0.1)
75 or more	-0.9 (-5.3 to 3.4)	-1.3 (-5.7 to 3.1)	0.9 (-3.0 to 4.7)	0.5 (-3.7 to 4.8)	-0.04 (-0.1 to .05)	-0.03 (-0.1 to .08)	-.009 (-0.1 to 0.1)	0.0002 (-0.2 to 0.2)
ECG offered at first appointment	-0.1 (-2.9 to 2.6	0.3 (-2.7 to 3.2)	-0.3 (-3.1 to 2.4)	-0.8 (-3.7 to 2.0)	0.02 (-.04 to .08)	0.02 (-.05 to .08)	0.009 (-.06 to .08)	0.007 (-.06 to .08)
Neurological examination offered at first appointment	0.3 (-2.6 to 3.2)	1.0 (-1.6 to 3.7)	1.2 (-1.1 to 3.6)	0.8 (-2.0 to 3.6)	-0.03 (-.08 to .02)	-0.02 (-.08 to .04)	-0.05 (-0.1 to .02)	-0.07 (-0.1 to .01)
Physical examination offered at follow up	1.3 (-1.2 to 3.9)	1.7 (-1.8 to 5.2)	-1.5 (-3.6 to 0.7)	-0.9 (-3.9 to 2.1)	0.04 (-.02 to .09)	0.04 (-.03 to 0.1)	0.05 (-.03 to 0.1)	0.06 (-.05 to 0.2)
Vision/hearing/mobility assessment offered at follow up	-1.5 (-4.5 to 1.4)	-1.8 (-5.5 to 1.9)	1.3 (-1.5 to 4.2)	1.2 (-2.2 to 4.7)	-0.02 (-.09 to .04)	-0.03 (-0.1 to .05)	-0.05 (-0.1 to .03)	-0.06 (-0.2 to .05)
Provision of psychosocial support	-1.1 (-3.7 to 1.4)	-2.1 (-4.6 to 0.4)	0.1 (-3.1 to 3.3)	0.8 (-2.4 to 4.1)	0.05 (-.02 to 0.1)	0.04 (-.03 to 0.1)	0.02 (-.06 to 0.1)	0.04 (-.04 to 0.1)

Process characteristics								
Waiting time to first appointment >6 weeks	N/A	-0.3 (-3.0 to 2.4)	N/A	-1.4 (-4.4 to 1.6)	N/A	-0.005 (-.07 to .06)	N/A	-0.005 (-0.1 to .09)
Length of first appointment (Reference: ≤60 mins)	N/A		N/A		N/A		N/A	
61-90 mins		0.6 (-2.4 to 3.6)		-0.7 (-3.1 to 1.6)		0.01 (-.06 to .08)		-0.02 (-0.1 to .08)
>90 mins		-1.2 (-4.9 to 2.6)		1.0 (-2.1 to 4.1)		-0.003 (-.08 to .08)		-0.02 (-0.1 to 0.1)
Number of follow up appointments (Reference: None)	N/A		N/A		N/A		N/A	
1		-1.3 (-6.7 to 4.1)		2.0 (-4.0 to 8.0)		-0.05 (-0.2 to .05)		0.02 (-0.1 to 0.2)
2		0.2 (-5.2 to 5.5)		0.04 (-3.2 to 3.2)		-0.02 (-0.1 to .07)		0.004 (-0.1 to 0.1)
3 or more		0.2 (-4.9 to 5.4)		-1.7 (-5.2 to 1.8)		-0.002 (-0.1 to 0.1)		-0.06 (-0.2 to .06)
Variable		-0.02 (-5.8 to 5.7)		-2.2 (-5.7 to 1.4)		-0.03 (-0.1 to .07)		-0.02 (-0.2 to 0.1)
% anti-dementia drug use	N/A	2.4 (-2.8 to 7.5)	N/A	-0.2 (-5.4 to 5.0)	N/A	0.03 (-0.1 to 0.2)	N/A	-0.1 (-0.3 to 0.1)
% psychosocial interventions use	N/A	-6.7 (-13.4 to .09)	N/A	1.4 (-7.3 to 10.0)	N/A	-0.05 (-0.2 to 0.1)	N/A	0.09 (-0.2 to 0.4)

Adjusted differences and Bonferroni-corrected 95% confidence intervals (family-wise error rate of 0.05 for each model divided by number of tests). Higher score indicates better HRQL. Model 1 adjusted for all structural characteristics, HRQL score at baseline, patient age, sex, ethnicity, deprivation, comorbidity, diagnosis and MAS as a random effect. Model 2 adjusted for all structural and process characteristics, HRQL score at baseline, patient age, sex, ethnicity, deprivation, comorbidity, diagnosis and MAS as a random effect. * Statistically significant at family-wise error rate <0.05.

Table 5: Differences in mean carer HRQL (EQ-5D-3L Index) and carer burden (Zarit Burden Interview) scores at six months, by MAS characteristics

MAS characteristics	**EQ-5D-3L Index (n=487)**		**Zarit Burden Interview score (n=469)**	
Structural characteristics	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Psychologists	0.001 (-.04 to .04)	-0.002 (-.05 to .04)	0.7 (-1.0 to 2.4)	0.4 (-1.2 to 2.1)
Allied Health Professionals	-0.04 (-0.1 to .01)	-0.04 (-0.1 to .02)	-0.4 (-2.6 to 1.8)	-0.5 (-2.5 to 1.6)
Advisory & Support staff	0.005 (-.05 to .06)	-0.003 (-.06 to .06)	0.3 (-1.4 to 2.0)	0.3 (-1.6 to 2.2)
New patients per WTE staff per month (Reference: 1-3)				
4-6	-0.04 (-0.1 to .02)	-0.03 (-0.1 to .04)	-0.5 (-2.4 to 1.4)	-0.7 (-2.9 to 1.4)
>6	-0.06 (-0.1 to .007)	-0.05 (-0.1 to .009)	1.5 (-0.8 to 3.8)	1.3 (-1.3 to 3.9)
New patients seen per month (Reference: <25)				
25-49	0.06 (-.03 to 0.1)	0.05 (-.03 to 0.1)	0.7 (-1.9 to 3.2)	0.9 (-1.9 to 3.7)
50-74	0.03 (-.07 to 0.1)	0.02 (-.08 to 0.1)	2.1 (-0.4 to 4.6)	2.8 (-.02 to 5.6)
75 or more	0.05 (-.04 to 0.1)	0.05 (-.04 to 0.2)	-0.04 (-2.7 to 2.7)	0.7 (-2.2 to 3.6)
ECG offered at first appointment	0.001 (-.05 to .05)	0.009 (-.05 to .06)	0.1 (-1.6 to 1.9)	-0.3 (-2.2 to 1.9)
Neurological examination offered at first appointment	-0.01 (-.06 to .04)	-0.01 (-.08 to .05)	-0.5 (-2.1 to 1.1)	-0.2 (-2.3 to 1.9)
Physical examination offered at follow up	-0.02 (-.07 to .04)	0.008 (-.06 to .08)	1.0 (-0.9 to 3.0)	0.8 (-1.7 to 3.4)
Vision/hearing/mobility assessment offered at follow up	0.03 (-.02 to .09)	0.008 (-.06 to .08)	-0.8 (-2.9 to 1.2)	-0.7 (-3.2 to 1.9)
Provision of psychosocial support	0.005 (-.05 to .06)	0.009 (-.06 to .07)	0.8 (-1.4 to 2.9)	1.0 (-1.2 to 3.2)
Process characteristics				
Waiting time to first appointment >6 weeks	N/A	0.01 (-.05 to .07)	N/A	-0.1 (-2.1 to 1.8)
Length of first appointment (Reference: ≤60 mins)	N/A		N/A	
61-90 mins		0.02 (-.05 to .09)		0.3 (-1.3 to 2.0)
>90 mins		0.01 (-.08 to 0.1)		0.2 (-1.9 to 2.2)
Number of follow up appointments (Reference: None)	N/A		N/A	
1		-0.03 (-0.1 to .08)		0.6 (-3.2 to 4.4)
2		-0.0006 (-0.1 to 0.1)		-0.3 (-3.4 to 2.7)
3 or more		-0.03 (-0.1 to .08)		0.5 (-2.5 to 3.5)
Variable		-0.03 (-0.2 to .09)		-1.0 (-4.3 to 2.3)
% anti-dementia drug use	N/A	-0.05 (-0.2 to .07)	N/A	-0.2 (-4.0 to 3.5)
% psychosocial interventions use	N/A	-0.03 (-0.2 to 0.1)	N/A	3.0 (-3.0 to 9.0)

Adjusted differences and Bonferroni-corrected 95% confidence intervals (family-wise error rate of 0.05 for each model divided by number of tests). Higher EQ-5D-3L Index indicates better HRQL. Higher Zarit Burden Interview score indicates greater burden. Model 1 adjusted for all structural characteristics, HRQL score at baseline, patient age, sex, ethnicity, deprivation, comorbidity, diagnosis and MAS as a random effect. Model 2 adjusted for all structural and process characteristics, HRQL score at baseline, patient age, sex, ethnicity, deprivation, comorbidity, diagnosis and MAS as a random effect.