Cost-effectiveness analysis of English memory assessment services two years after first consultation for patients with dementia.

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Key words: dementia, memory assessment services, England, cost-effectiveness analysis

Running title: cost-effectiveness of English memory clinics

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Word count
3493

Abstract

Objectives

Referral of patients with suspected dementia to memory assessment services (MAS) has been advocated and implemented in many countries. Our aim was to compare changes over two years in patients' health-related quality of life (HRQL) with thehealth and social care costs of diagnosis and treatment of people newly referred to MAS.

Methods

We analysed observational data from 1318 patients referred to 69 MAS who completed resource use and HRQL questionnaires at baseline, 3, 6, 12 and 24 months. We reported mean differences in HRQL (disease-specific DEMQOL and generic EQ-5D-3L), quality-adjusted life years (QALYs), costs and cost-effectiveness between baseline and 2-year follow-up.

Results

Two years after referral to MAS, patients reported a higher DEMQOL score (mean gain 4.47, 95% confidence interval: 3.08 to 5.90) and EQ-5D-3L (0.014, -0.011 to 0.039). Mean total costs and QALYs over 24 months was £2 411 (£1721 to £2873) and 0.027 (0.003 to 0.051), respectively. Assuming that patients' HRQL would not have altered over the two years had they not attended MAS, these outcomes suggest an incremental cost-effectiveness ratio of £89 546 (£38123 to £145864) based on the change observed with EQ-5D-3L. If we assumed that patients' HRQL would have declined by about 10% over this period had they not attended MAS, the cost-effectiveness ratio would be £25 056. The 32 (46%) of memory assessment services with over 50 new patients a month were more likely to be cost-effective than smaller ones ($p < 0.01$).

Conclusions

Memory assessment services are effective and can be cost-effective for diagnosing and treating people with suspected dementia. Large variations in costs between MAS suggest that many services could improve their cost-effectiveness.

1. Introduction

The number of people living with dementia worldwide has increased in the last two decades mainly driven by population ageing (1). In 2017 there were an estimated 50 million people with dementia, with nearly 10 million new cases expected now every year. Dementia is a major cause of disability and need for care in elderly people and is associated with rising health care costs. The costs associated with dementia worldwide are expected to rise above $1 trillion in 2018, which represents over 1% of the global GDP(2). These rising costs are mostly due to the increased need for social care, family support and health care (2).

There is research evidence that early diagnosis and support for those with dementia enables them to live well for longer and helps reduce long-term costs (3, 4). To encourage this, referral of people with suspected dementia to memory assessment services (MAS) has been advocated and implemented in many high-income countries. These services usually involve an integrated multi-professional team. However, the structural characteristics (eg staffing) and the services provided by MAS (eg post-diagnostic support) vary considerably both within and between countries (2). In England, services typically consist of a team of doctors, psychologists, nurses, occupational therapists and support workers that provide specialist assessment, diagnosis and treatment. The extent of variation in the structure and activities in English MAS has recently been reported (ref).

Given the variation in provision and uncertainties about the impact of MAS on patients' HRQL, there is a need for evidence on the relative effectiveness and cost-effectiveness of these services (5, 6). In particular, the benefits of a more integrated approach for diagnostic and post-diagnostic services is largely unknown (7). This lack of evidence partly reflects the challenges of evaluating memory services, which involve a wide range of diagnostic and treatment components. In addition, dementia care pathways often differ within health care systems (2) which makes comparison between studies evaluating MAS difficult.

Against this background, evidence from randomised trials is rare and tends to focus on evaluating specific components of memory services compared to no intervention. The main challenge with evaluating the full dementia care pathway through randomised trials is the impossibility of a 'control' group due to ethical objections to delaying referral (or treatment)

of people with suspected dementia. For example, a recent trial in the Netherlands, the AD-Euro study (8), compared dementia care provided by MAS versus general practitioners. However, this trial only compared models for post-diagnostic care and did not assess the impact of MAS on patients' HRQL and health care costs from the first assessment through diagnosis and treatment. Another trial, the MEDICIE study (9), compared an integrated multidisciplinary diagnostic approach by a specialist team (community mental health team and geriatric psychiatrist) with general practitioners (control arm). However, those patients randomised to the control group were either diagnosed by the GP or referred to regional memory or geriatric clinics, or regional mental health teams. Evidence from non-randomised studies on the effectiveness and cost-effectiveness of MAS is also scarce. Most published studies focused on a single MAS (10, 11) or on modelling projections (12).

Our aim was to determine the effectiveness and cost-effectiveness of MAS in a large representative sample of sites so as to obtain generalizable evidence and identify the extent of variation that exists. We conducted a longitudinal study that followed up 1318 patients referred to 69 MAS in England (13). In previous papers, we reported HRQL (14), costs (15) and cost-effectiveness (16) between first assessment and 6 months. This showed that MAS improved patient's HRQL, according to both disease-specific and generic HRQL instruments, irrespective of the severity of peoples' cognitive impairment. While there was little variation in outcome between MAS, there was considerable variation in costs (15) and hence, the cost-effectiveness varied considerably (16). However, the sustainability of such changes over a longer time period is unknown. In this paper we report the relative costs and outcomes of MAS for the diagnosis, treatment and follow up care up to two years after first consultation. We examine whether the cost-effectiveness of MAS differs according to key characteristics of the patients and the memory clinics.

2. Methods

2.1 Study design

Full details on the sampling, recruitment and data collection methods are reported elsewhere (13, 16). Briefly, the study included 69 MAS, a random sample from the 212 clinics identified by the Royal College of Psychiatrists' National Audit. The resulting sample was representative when compared with those in the National Audit in terms of: i) location: all

regions of England, ii) volume of new referrals per month (63 versus 72 nationally), iii) waiting time for first consultation (5.8 versus 5.2 weeks), and iv) proportion accredited by the Royal College of Psychiatrists (26% versus 30%). People with suspected dementia and their carers (if present) attending their first appointment at one of the MAS between September 2014 and April 2015 were eligible for inclusion in the study. All eligible participants who consented (N=1318) were included regardless of the diagnosis they later received (ie whether or not they were labelled as having dementia). For practical reasons, at 24 months, the follow-up was restricted to the 30 MAS with the highest recruitment rates at baseline. Previously we had observed that outcomes were not associated with size of MAS or recruitment rates. At 24 months 643 patients and 467 carers were eligible for inclusion.

Patients were interviewed at baseline and asked to report on their socio-demographic characteristics, disease-specific HRQL (DEMQOL) and generic HRQL (EQ-5D-3L). Carers also completed a separate baseline questionnaire that included self-reported HRQL, carer burden, proxy-reported HRQL of the patient, and resources used in the last four weeks. Patients and carers who were willing to continue in the study attended a follow-up appointment (at the clinic or patient's home) at 6, 12 and 24 and reported on their HRQL and burden of care. Carers were also mailed resource use questionnaires at 3, 6, 12 and 24 months. All follow-up questionnaires were identical to baseline, except the 24-month resource use questionnaire, which was simplified (excluded details about intensity of contacts with health care professionals which was assumed to be similar to that at 6 months).

Each MAS was asked (by email) to complete an organisational survey, with telephone follow-up to maximise the response rate. This survey included data on four components: 1) structural characteristics, such as the number of staff, allocation of time to different activities (e.g. diagnosis and treatment); 2) information on first appointment (e.g. clinical assessment, diagnosis); 3) post-diagnostic support, including pharmacological and non-pharmacological treatments; and 4) intensity of follow-up care (e.g. time to first follow-up, frequency and clinical assessment)

2.2 Health outcomes

This study focuses on HRQL reported by the patient. Proxy-reports by their carer are reported elsewhere (14, 17). Patient questionnaires included disease-specific (DEMQOL(18)) and generic (EQ-5D-3L (19)) HRQL outcomes. DEMQOL consists of 28-item HRQL score, with

a higher score indicating better HRQL. Each of the 28 items is scored on a four-point scale, using an improved scoring algorithm with well-established psychometric properties (20).

The EQ-5D-3L is a generic measure of health status and includes five items covering different health domains: mobility, self-care, usual activities, pain/discomfort and anxiety/depression (scored on an item-specific 3-point scale). The EQ-5D-3L profiles were combined with health state preferences values from the UK general population (19) to give EQ-5D-3L utility scores, anchored at 0 (death) and 1 (perfect health). Although generic, this instrument has shown adequate reliability for measuring HQRL in patients with dementia (21).

Quality-adjusted life years (QALYs) were calculated by valuing each patient's survival time by their EQ-5D-3L score at baseline, 6, 12 and 24 months according to the 'area under the curve' approach. To construct QALYs based on DEMQOL, we have derived a preference-based score (DEMQOL-U) from the original DEMQOL measure, using a previously developed algorithm (22).

2.3 Costs

We reported costs related to four main components: 1) health care costs related to the use of both pharmacological (dementia drugs) and non-pharmacological treatments (e.g. cognitive stimulation therapy and music/dance therapies); 2) use of social services, such as home care, cleaner and meals on wheels; 3) informal care provided by relatives or friends; and 4) costs of services by the MAS, derived from proportion of time spent by staff on diagnostic assessment (including diagnostic tests), on post-diagnostic support and on follow up care. Health care contacts with health care professionals such as GPs and nurses were not collected at 24 months for two reasons: 12 months after the first visit to the MAS it was assumed use of such services would be unaffected by the involvement of MAS; and many of these health care contacts will be for reasons other than dementia, given the high prevalence of comorbid conditions.

Unit costs for health and social care professionals were taken from national costs sources (23). Dementia drug costs were obtained from the British National Formulary (BNF, 2014). Psychosocial support services were costed per session, and unit costs taken from national sources and related literature(23). Costs related to informal care were valued at £6 per hour based on the national minimum wage for 2013-2014. At the MAS level, staff use was valued

using unit costs for health care professionals (23). The costs of imaging and other diagnostic tests were taken from NHS reference costs (24).

2.4 Cost-effectiveness

For the purposes of determining the cost-effectiveness of MAS our analysis took a health services perspective, and included costs related to drugs, primary care and psychosocial interventions. We reported mean DEMQOL, EQ-5D-3L and patient costs at baseline and each follow-up. Any missing data were addressed using multiple imputation (see full details in Supplementary Material). Mean differences in HRQL outcomes and total costs between baseline and two years were obtained, together with 95% confidence intervals (CI), using non-parametric bootstrapping (2000 bootstrap replications). We assessed the cost-effectiveness of MAS by reporting incremental cost-effectiveness ratios (ICER) and incremental net monetary benefits (INB). The former corresponds to the ratio between the incremental cost and incremental QALY, whereas the latter was obtained by valuing the incremental QALY by the willingness to pay threshold recommended by NICE (£30,000 per QALY), and subtracting from this the incremental cost.

The base case analysis assumed that patients' HRQL (and costs) would have remained constant between baseline and the 2-year follow-up had they not attended MAS. In sensitivity analysis, we considered alternative departures from this assumption. For example, we hypothesised that patients would have lower HRQL (EQ-5D-3L and DEMQOL-U) due to deteriorating cognitive function had they not attended MAS. We considered decrements in HRQL of 1% (age and sex-related HRQL decrement in the general population (25)), 5% and 10%.

We reported incremental cost and QALY and cost-effectiveness by patient (e.g. age, sex and ethnicity group) and MAS (e.g. number of new patients per month, cost of MAS per patient and whether MAS provided psychosocial support) subgroups. Mean differences in the net benefits between subgroups were adjusted for patient's socio-demographic characteristics and baseline HRQL. We have allowed for potential clustering by MAS using random effects models(26). Uncertainty around adjusted differences in the net benefits was obtained from the bootstrap samples.

3. Results

Baseline patient and clinic characteristics, and HRQL measures were mostly complete for all 1318 patients recruited (Tables S1 and S2, Supplementary Material). Of 944 informal carers, resource use was reported for 830 (63%) patients (374 patients did not have a carer in attendance at the first visit). At 12 months, both disease-specific and generic HRQL was reported for over 50% patients, whereas resource use was available for only 35% of patients (Table S1). At 24 months, the proportion of patients with reported outcomes (out of the total sample) was lower given that only 30 MAS were included in the longer-term follow-up.

Table 1 reports health, social and informal care costs at baseline and at 3, 6, 12 and 24 months follow up. At 24 months, patients referred to MAS were associated with a statistically significant increase in monthly costs for drugs (mean difference £10, 95% CI 7.0 to 14.6) and social care (mean difference £123, 95% CI 78 to 169) compared with that at baseline Although primary care, psychosocial support and informal care costs were higher at 2 years, the change was not statistically significant. At the MAS level, assessment costs comprised half of the total cost of memory services: mean cost was £886 (95% CI 846, 932) (Table 3). Over two years, the mean total cost per patient, which included drugs, primary care and psychosocial interventions costs, and the MAS's assessment, intervention and review costs was £2411 (95% CI 1721 to 2873).

At 24 months, patients referred to MAS experienced better quality of life according to all HRQL measures compared to baseline, but this was not statistically significant for the generic measure (EQ-5D-3L) (Table 2). For example, mean differences in DEMQOL-U was 0.027 (95% CI 0.012 to 0.041) but for EQ-5D-3L was 0.012 (95% CI -0.011 to 0.039). The total QALYs gained by 2 years, based on the DEMQOL-U, was 0.04 (95% CI 0.026 to 0.054) and on the EQ-5D-3L was 0.027 (95% CI 0.001 TO 0.051) (Table 3). This meant a cost per QALY of £59,975 and £89,546 according to gains in DEMQOL-U and EQ-5D-3L, respectively. These ICERs are above the NICE's recommended threshold of £30,000 per QALY gain (incremental net benefits are negative).

Those estimates assume patients' HRQL would have remained unchanged over the 2-year follow up if they had not received care initiated by a MAS. Table 4 reports the cost-effectiveness results for the sensitivity analysis scenarios in which it is assumed a decrease in HRQL had the patients not attended MAS. When a 1% decrease in the DEMQOL-U over the 2-year period is assumed, the total QALYs gained increases to 0.051 (95% CI 0.037 to 0.065) and ICER falls to £47,915 (95% CI 32,550 to 68,506). Larger assumed decrements in HRQL

increase the probability of MAS being cost-effective (cost per QALY between £16,429 and £33,254).

Subgroup analyses according to patient and clinic characteristics are summarised in Figure 1 and Table 5, respectively. Incremental net benefits are similar by patient age, sex, socioeconomic status and number of comorbidities (Figure 1). Non-white patients benefit less from memory services than white patients, though due to the small sample size the confidence interval was very large.

Table 5 suggests that MAS with a wide-ranging multi-disciplinary team (psychologists, allied health professionals, advisory staff) were more cost-effective compared to MAS with no such staff; the adjusted mean difference in net benefits was £2335 (95% CI 1262 to 3322). The more patients treated per WTE staff, the more cost-effective the MAS, though this only reached statistical significance when there were 7 or more patients per WTE staff. Larger MAS, with an average number of patients per month above 50 were statistically significantly more cost-effective than MAS with 25 or fewer monthly new patients. These differences were mostly due to lower incremental costs (economies of scale) rather than outcome differences. Not surprisingly, MAS with lower cost per new patient (below £2500), were relatively more cost-effective (P-values<0.01), because these were associated with a considerably lower average total cost. For example, adjusted mean difference in the net benefits between MAS in the 5th and 4th quintile was £1,464 (95% CI 933 to 1993)

4. Discussion

People with suspected dementia who attended MAS experienced better health-related quality of life two years after referral. The cost per QALY derived from EQ-5D-3L was £89,546 but sensitivity analyses suggested that, assuming a small deterioration of 10% in patient's HRQL had they not attended MAS, the cost per QALY is £25 056 (ie within the acceptable NICE threshold of £30,000). A 10% deterioration would correspond to a decrease in EQ-5D score from 0.71 to 0.64 over two years, which is less than the decline observed in patients assigned to standard care in previous trials (9, 27-29); the MEDICIE trial reported a decline from 0.53 to 0.37 over only one year (9). Cost-effectiveness estimates based on the disease specific DEMQOL-U suggest even lower costs per QALY as the observed gain in QALYs is about 40% higher.

The value for money of MAS is similar across different patient subgroups. However, there was strong evidence that cost-effectiveness differed according to clinic characteristics. In particular, large clinics (50 or more new patients per month) are relatively more cost-effective than smaller clinics, perhaps benefitting from economies of scale. Patients in these large clinics do not necessarily have better mean HRQL outcomes two years after referral. In addition, MAS with lower average costs per new patient (below £2500) were significantly more cost-effective, irrespective of the number of new patients per month.

Our short-term cost-effectiveness analysis (16) reported that patients attending a MAS had a QALY gain according to DEMQOL-U of 0.021 and EQ-5D-3L of 0.023 over the first six months after referral. This study shows that the improvement in HRQL is maintained to two years, although the EQ-5D-3L gain is smaller (0.014) than at 6 months (0.023). However, as the HRQL gain is sustained for an additional 18 months, the QALY gain at 2 years has increased four-fold from 0.006 to 0.027. Given that most of the costs associated with a MAS are incurred in the first 6 months after the first consultation, the difference in mean total cost at 6 and 24 months is not very large (£1899 vs £2411). Overall, the continuous HRQL gain and small rise in total costs at 2 years increased considerably the likelihood of memory services being cost-effective.

These findings are consistent with a previous calculation of the cost-effectiveness of memory services in England (12). Using a cost-effectiveness model, that study suggested that MAS were likely to be cost-effective if QALY gain (per person year) was above 0.01. We have observed a gain well above that. While Banerjee and Wittenberg's projections included potential cost savings from reduced use of residential care (not considered in our study), their model did not include the direct costs related to diagnosis.

This is the first study reporting on the cost-effectiveness of memory services over a two year follow up. There are several strengths to this paper. Firstly, the cost-effectiveness analysis is based on the largest observational study of patients referred to MAS in England. Unlike previous studies focussing on a single memory clinic (10, 11, 30), our sample is representative of MAS across all regions in the country and in terms of other organisational features (13). Secondly, this study reports on the cost-effectiveness of MAS providing a broad, integrated approach to diagnosis, treatment and follow up care of patients with dementia. This is in contrast with previous cost-effectiveness studies focussing on particular

components of care, such as diagnosis (9) or follow-up care (31). Thirdly, this economic evaluation is based on rigorous collection of data on different measures of effectiveness (both disease-specific and generic HQRL measures), and costs to the NHS, social care, carers and patients (societal perspective). Fourthly, our cost-effectiveness findings are based on longitudinal measurements of both costs and outcomes over two years, and hence captures the impact of MAS over a longer period than previous studies based on a single time point and short follow up: either 3 months (30), 6 months (16) or one-year (9, 31).

There are three main limitations to this study. First,we did not include a comparison (control) group. The immediate implication is that we had to make an assumption about what would have been patients' costs and outcomes at 2 years had they not been referred to MAS. In our main analysis (base-case), we assumed that patients' HRQL and costs have remained constant over the 2-year period. This may be plausible for costs because had patients not attended MAS, they were likely to have remained undiagnosed and continued to receive the same level of care as before. However, based on previous studies, the HRQL of patients receiving standard (usual) care is likely to deteriorate over time (9, 27-29). In sensitivity analysis, we have allowed for up to 10% reductions in HRQL over time, and found that the study's conclusions are sensitive to these assumptions.

Second, as with other studies based on self-reported outcome measures or proxy-reported resource use questionnaires, our study had a considerable proportion of individuals with missing HRQL or cost data. We have used a widely recommended approach, multiple imputation, for handling missing data (32). This approach assumes that any differences between patients with observed and missing data can be explained (and adjusted for) by the observed data (missing-at-random assumption). Accordingly, we have included in our imputation model a wide range of likely missing data predictors, such as baseline patient and MAS characteristics, follow-up process measures and observed endpoints. In addition, the imputation model recognised that the chances of observing the data were more similar within than across MAS.

Third, data on resource use at 24 months were collected using a simplified version of the questionnaire completed by carers at baseline, 3, 6 and 12 months. Thus the questionnaire only asked carers to indicate if there had been any contact with a health care professional but did not seek details about the intensity of any contact. We therefore had to estimate costs attributable to each contact with health professionals according to median values derived

from responses to the 6-month questionnaire. Overall, this may have resulted in a slight overestimation of the health and social care costs at 24 months.

The principal implication for policy and practice is the need for a sizeable proportion of MAS to review their costs and learn from MAS that achieve similar outcomes but at lower cost.

Our study suggests that having large multidisciplinary teams is associated with improved cost-effectiveness of MAS. Also, gains in patient's HRQL (both disease-specific and generic HRQL) appear to be significantly higher in MAS that offer allied health professionals, principally occupational therapists. In addition, average costs seem to be lower in these MAS, perhaps due to operational efficiencies (e.g. economies of scale and staff specialisation). Moreover, our findings suggest that there may be technical efficiency gains (lower average cost per new patient) in providing diagnostic and post-diagnostic dementia care. While there is little evidence from our study to what contributes to these efficiency gains, this may be due to contextual factors such as differential average appointment times and quality of care. A first step to exploring such possibilities has been an initiative to bring together interested MAS staff at an Open Space event to start exchanging ideas and experiences.

As regards further research, it would be interesting to incorporate carer's own HRQL gains into the economic evaluation of MAS as this may provide additional benefits that the current analysis does not take into account. A second avenue to pursue would be to explore even longer follow-up to see if the benefits are sustained for even longer than two years.

In conclusion, the early diagnosis and treatment of dementia is at the core of national dementia strategies in many countries. Our study suggests that a model of care based on English MAS is effective and may be cost-effective for the diagnosis, treatment and follow up care of patients with dementia. Patients' HRQL gains are maintained two years after referral and may be sufficient to warrant the costs involved in providing memory services. Under realistic assumptions about the consequences of no treatment, the cost per QALY of MAS comes within NICE's recommended threshold of £20,000- £30,000 per QALY gain.

Acknowledgments

References

Tables

Table 1 – Monthly health, social and informal care costs (£ GBP) reported by carers up to 24 months.

	Drugs	Primary care*	Psychosocial interventions	Social care	Informal care
Baseline	0.02 (0.21)	64.1 (732)	10.6 (81.1)	66 (369)	1486 (1601)
3-months	5.1 (24.5)	24.8 (175)	5.0 (51.8)	95 (779)	1526 (1347)
6 months	6.1 (32.2)	51.6 (309)	12.2 (105)	150 (1227)	1582 (2619)
12 months	7.4 (66.4)	116 (561)	21.6 (297)	169 (1192)	1347 (4378)
24 months	14.2 (128)	-	20.4 (190)	261 (1616)	1611 (3261)
Mean difference [95% CI]†	10.3 [7.0, 14.6]	13.2 [-39.1, 45.0]	7.2 [-0.66, 15.8]	137 [86.3, 192]	66 [-46, 192]

Mean (SD) costs for each follow up are reported after multiple imputation (N=1318). Confidence intervals were obtained by non-parametric bootstrapping (2000 replications). *Primary care costs were not collected at 24 months; after 12 months these were assumed to be the same had the patients not attended MAS, and hence the reported mean difference is between baseline and 12 months. †Average monthly difference between baseline and 2 years, calculated as $\Delta cost_{monthly} = (3 \times cost_{3\,months} + 3 \times cost_{6\,months} + 6 \times cost_{12\,months} + 12 \times cost_{24\,months} - 24 \times cost_{baseline})/24$; Δ - mean difference

Table 2 – Health-related quality of life according to different outcome measures between baseline and 24 months.

	DEMQOL	DEMQOL-U	EQ-5D-3L
Baseline	65.2 (12.0)	0.838 (0.13)	0.710 (0.27)
6-months	68.7 (13.7)	0.860 (0.14)	0.733 (0.32)
12-months	69.0 (17.1)	0.858 (0.19)	0.719 (0.39)
24-months	69.7 (23.7)	0.865 (0.29)	0.724 (0.51)
Mean difference [95% CI]* at 2 years	4.43 [3.08, 5.90]	0.027 [0.012, 0.041]	0.014 [-0.011, 0.039]

Mean (SD) costs for each follow up are reported after multiple imputation (N=1318). *Confidence intervals were obtained by non-parametric bootstrapping (2000 replications).

Table 3 – Mean difference in total costs (£ GBP), QALYs and cost-effectiveness of memory clinic services at 24 months.

	Mean [95% CI]*
Costs (£ GBP)	
Health care†	579 [-468, 540]
Memory assessment services	
Assessment	886 [846, 932]
Interventions	422 [402, 445]
Review	524 [495, 555]

Total cost (per patient)‡	2411 [1721, 2873]
Quality-adjusted life years	
QALY$_{DEMQOL-U}$	0.040 [0.026, 0.054]
QALY$_{EQ-5D}$	0.027 [0.003, 0.051]
Cost-effectiveness	
INB (QALY$_{DEMQOL-U}$)	-1205 [-1841, -472]
INB (QALY$_{EQ-5D}$)	-1607 [-2475, -650]
ICER (QALY$_{DEMQOL-U}$)	59 975 [40212, 96205]
ICER (QALY$_{EQ-5D}$)	89 546 [38123, 145864]

*Mean (95% CI) reported after multiple imputation (N=1318). Confidence intervals were obtained from 2000 bootstrap replications. †Mean difference in total health care costs is calculated as: $\Delta cost_{health\ care} = 24 \times \Delta cost_{drugs} + 12 \times \Delta cost_{primary\ care} + 24 \times \Delta cost_{psychosocial\ interventions}$; Δ - mean difference. ‡Assuming a health services perspective, the total cost accrued up to two years included health care (dementia drugs, psychosocial interventions and primary care) costs, and the MAS' assessment, intervention and review costs up to 24 months. Incremental net benefit (INB) is calculated by multiplying the mean QALY by the willingness to pay threshold recommended by NICE (£30,000 per QALY), and subtracting from this the mean total cost. Incremental cost-effectiveness ratio (ICER) is calculated by dividing mean total cost by mean QALY.

Table 4 – Mean [95% CI]* total costs, QALYs and cost-effectiveness across sensitivity analysis (SA) scenarios according to possible decrements (1%, 5% and 10% in health-related quality of life (EQ-5D-3L and DEMQOL-U) had the patients not attended MAS.

Scenario	Total cost	Total QALY$_{DEMQOL-U}$	Total QALY$_{EQ-5D}$	ICER$_{DEMQOL-U}$	ICER$_{EQ-5D}$
Base case		0.040 [0.026, 0.054]	0.027 [0.001, 0.051]	59 975 [40212, 96205]	89 546 [38123, 145864]
SA1	2411 [1721, 2873]	0.051 [0.037, 0.065]	0.038 [0.012, 0.062]	47 915 [32550, 68506]	63 861 [36395, 98559]
SA2		0.081 [0.067, 0.095]	0.061 [0.036, 0.086]	29 969 [21335, 38786]	41 048 [25093, 65839]
SA3		0.124 [0.110, 0.138]	0.098 [0.073, 0.122]	19 504 [14101, 24108]	25 056 [16918, 34276]

*Confidence intervals were obtained by non-parametric bootstrapping (2000 replications). SA1 – Age and sex related decrement (~1%) in EQ-5D-3L over the 2-year period; SA2 – 5% decrement in EQ-5D-3L over 2-year period; SA3 – 10% decrement in EQ-5D-3L over 2-year period.

Table 5 – Incremental cost, incremental QALY and incremental net benefit (at £30 000 per QALY) at 24 months according to different clinic characteristics.

| Clinic characteristics	N (n)	Incremental cost (SD)	Incremental QALY (SD)	Incremental net benefit (SD)	Adjusted mean difference in net benefits [95% CI]*
Number of follow-up appointments per patient within the first year					
0	7 (154)	2221 (12239)	0.010 (0.891)	-1934 (30306)	reference
1	8 (146)	2546 (9768)	0.064 (1.005)	-633 (31853)	1300 [-819, 3325]
2	22 (431)	2117 (16726)	0.021 (0.551)	-1484 (23458)	450 [-1194, 2137]
3 or more	17 (311)	2967 (9844)	0.016 (0.584)	-2525 (20207)	-592 [-2309, 1032]
Variable	14 (249)	2177 (10136)	0.039 (0.729)	-990 (24043)	944 [-824, 2619]
Presence of psychologist, allied health professional & support staff					
No	47 (885)	2571 (9297)	0.007 (0.483)	-2382 (17018)	Reference
Yes	22 (433)	1068 (14762)	0.067 (0.595)	-47 (22799)	2335 [1262, 3322]
Number of new patients per whole-time equivalent staff					
< 4	22 (421)	3082 (11975)	0.022 (0.577)	-2456 (21117)	reference
4-6	23 (449)	2295 (13294)	0.028 (0.544)	-1462 (20804)	994 [-51, 2142]
> 7	23 (421)	1858 (8918)	0.030 (0.636)	-952 (21385)	1504 [228, 2731]
Average number of new patients per month					
1-25	14 (223)	3253 (13838)	0.025 (0.717)	-2508 (25555)	reference
25-49	23 (443)	2717 (12065)	0.030 (0.594)	-1829 (21570)	680 [-804, 2098]
50-74	21 (445)	1975 (11922)	0.027 (0.533)	-1176 (20368)	1332 [56, 2662]
> 75	11 (207)	1753 (8362)	0.020 (0.893)	-1139 (27814)	1369 [413, 3083]
Cost of MAS per new patient (quintiles)					
> £2540	15 (276)	4270 (11748)	0.045 (0.741)	-3959 (24330)	reference
£1812 - £2540	18 (335)	2806 (10768)	0.023 (0.560)	-2495 (24545)	1464 [933, 1993]
£1346 - £1811	11 (243)	2241 (9164)	0.005 (0.654)	-2093 (21929)	1866 [407, 3454]
£910 - £1345	11 (189)	1452 (18750)	0.023 (0.560)	-763 (25775)	3196 [1711, 4731]
< £910	14 (275)	1336 (9915)	0.045 (0.741)	22 (23693)	3981 [2465, 5434]

Use psychosocial interventions per month (% patients)					
<10%	10 (132)	2410 (13981)	0.028 (0.814)	-1639 (29527)	reference
10-30%	37 (777)	2406 (11061)	0.027 (0.511)	-1612 (18752)	27 [-1532, 1614]
>30%	22 (409)	2407 (12299)	0.026 (0.633)	-1619 (22834)	20 [-1629, 1754]

N - number of clinics. n - number of patients. *Mean differences in net benefits were adjusted for age, sex, ethnicity, deprivation, number of comorbidities, baseline EQ-5D, clinic characteristics considered in this table, and clustering within clinics (using multilevel linear regression).

Figures

Figure 1 – Incremental net monetary benefits (at £30 000 per QALY) at 24 months by patient subgroups.

Incremental net benefit [95% CI] (£ GBP)
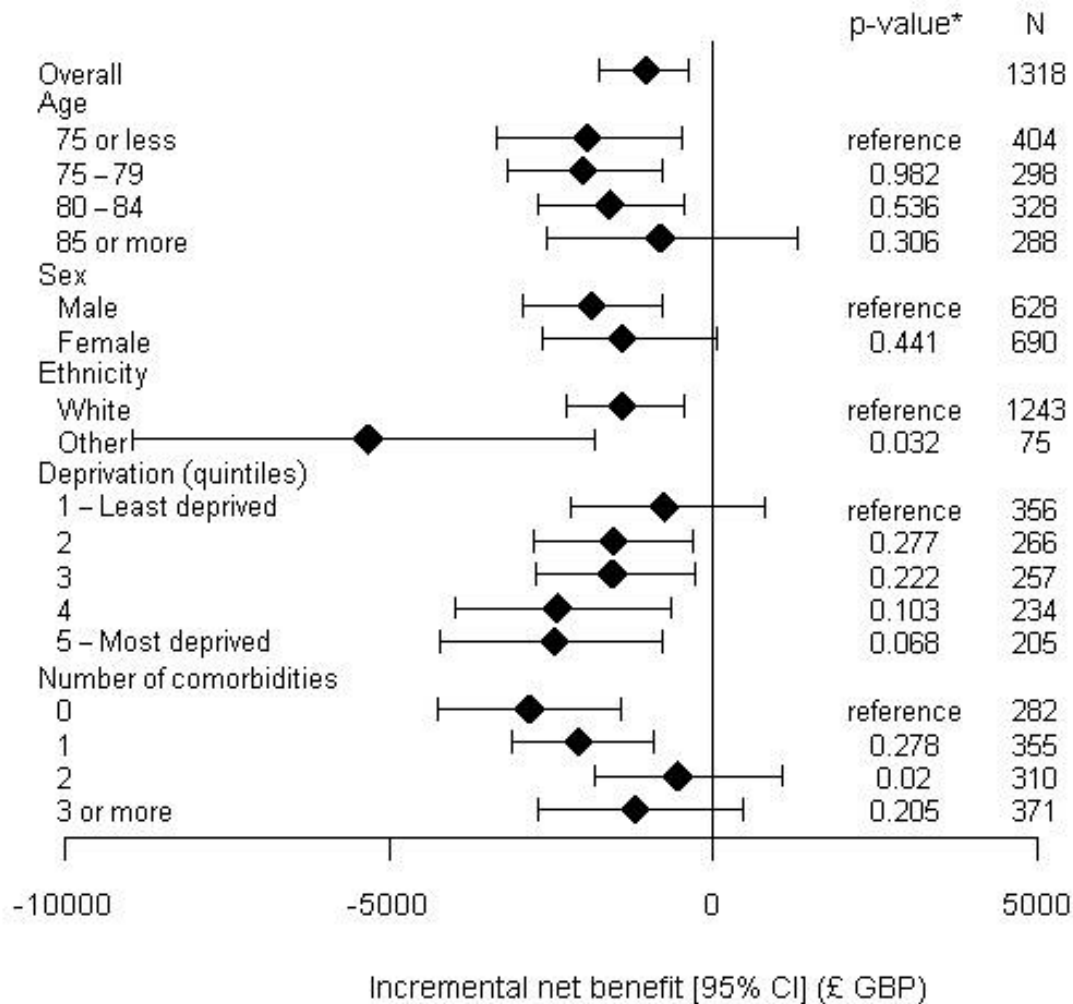
*p-values are derived from adjusted mean differences in the net benefits between the different subgroups and the reference category. These differences were adjusted for age, sex, ethnicity, deprivation, number of comorbidities, baseline EQ-5D-3L, and clustering by clinic.

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