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**An overview of the Laser-AD study: a longitudinal epidemiological study of people
with Alzheimer's disease (AD)**

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Abstract

Research into the epidemiological, clinical characteristics and economic impact of dementia is critical to increase understanding and better inform care and policy, and empower people with Alzheimer's disease (AD) and their families to make preparations and timely decisions about accommodation, care and treatment. The LASER-AD longitudinal study of people with AD and their carers, has contributed to our understanding of the progression, characteristics and costs of the disease, and to developing tools that help detect dementia earlier, screen and identify problems experienced by carers. Our work on quality of life showed that even those with severe dementia could report this meaningfully, although family proxy-ratings of quality of life do not necessarily mirror the views of the individual. Despite the impact of the disease process people with AD experience wellbeing in adversity and still live fulfilling lives. The study highlighted the high prevalence and severity of neuropsychiatric symptoms, carer anxiety, depression and abusive behaviour. It informed future directions for possible interventions, in particular, the central role of carer coping strategies in predicting carer mental illness. Current research is building on our findings, which have also been used to inform national and international plans for managing people with dementia and their carers.

An overview of the Laser-AD study: a longitudinal epidemiological study of people with Alzheimer's disease (AD)

Introduction:

There are currently 820,000 people living with dementia in the UK and this is rising, as the population ages (Jorm et al., 1987; Luengo-Fernandez et al., 2010). Dementia is a complex disorder, which affects the individual, their family and society. In brief, dementia is a progressive neurological disease characterised by loss of memory and ability to self-care. Mood changes and problems with communication, judgement and decision-making also occur frequently. Neuropsychiatric symptoms are common in dementia and are associated with carer distress, diminished quality of life for both individuals and their carers, and the breakdown of care (Ballard et al., 2004; Coen et al., 1997; Lyketsos et al., 2002), due to more rapid cognitive decline and premature institution (Cohen et al., 1993; Muraman et al., 2002; Rapoport et al., 2001). Research into the epidemiological, clinical characteristics and economic impact of dementia is critical to increase understanding and thus to inform better care and policy and empower people with Alzheimer's disease (AD) and their families to make preparations and timely decisions about accommodation, care and treatment.

In this review, we present an overview of the findings of the London and the South East Region (LASER-AD) study of the UK. The LASER-AD study was a 54 month, longitudinal epidemiological study of 224 people with AD and their carers. In the LASER-AD study, we investigated predictors of progression, institutionalisation and mortality in AD, costing models for AD, symptoms of AD, quality of life (QoL) and ageing well in adversity, as well as issues affecting carers of people with AD, including, psychological morbidity, attachment, coping, safety and elder abuse.

Study description

The relevant local research ethics committees gave approval for the study and informed consent was sought from all participants. If the patient with AD could not give informed consent, they were asked for assent and the caregiver was asked for their consent. Interviews with people with AD and their carers were usually carried out in the participant's home. Participants were purposively recruited and we sought to ensure they were representative of people with AD in terms of severity of cognitive impairment, gender and living situation (Fratiglioni et al., 1998). Inclusion criteria were: diagnosis of possible or probable AD (APA, 2008; McKhann et al., 1984), aged ≥ 55 years, living in either North London or Essex and having a family or statutory carer for ≥ 4 hours a week. Interviews were conducted by trained health professionals. Demographic data was collected and standardised instruments measured cognition, functional status, neuropsychiatric symptoms, quality of life and resource use. Physical examination and relevant blood tests were performed and all prescribed medication recorded. Follow-up interviews occurred at 6, 18, 30, 42 and 54 months.

There are 25 publications from the LASER-AD study and the details of individual papers are given in Table 1. The areas examined in this cohort of 224 people with AD and their carers include disease detection (Mahoney et al., 2005); predictors of progression (Fox et al., 2011; Livingston et al., 2007; Regan, et al., 2006), institutionalisation (Habermann et al., 2009) and mortality in AD (Paradise et al., 2009); costing models for AD (Livingston et al., 2004, Rive et

al., 2010a; Rive et al., 2010b); symptoms of AD (Train et al., 2004; Regan et al., 2005; Ryu et al., 2005) and characteristics of moderate-severe AD (Livingston et al., 2006); quality of life (Hoe et al., 2005; Hoe et al., 2007) and ageing well in adversity (Livingston et al., 2008). The issues affecting carers of people with AD, include psychological morbidity (Livingston et al., 2005; Maidment et al., 2005), attachment (Cooper et al., 2008a), coping (Cooper et al., 2006; Cooper et al., 2008b; Cooper et al., 2008c), safety in AD (Walker et al., 2006), carer attributions of behaviour in AD (Paton et al., 2004) and elder abuse in AD (Cooper et al., 2008d).

Disease detection in Alzheimer's disease

With the number of people with dementia rising as the population ages (Blansjaar et al., 2000), there is a need for a more sensitive and specific screening tool to aid early detection and diagnosis of dementia. Currently the most widely used screening test is the Mini-Mental State Examination (MMSE: Folstein et al., 1975). The MMSE is quick and easy to perform and requires no informant or specialist equipment, but it has a pronounced 'ceiling effect' (De Jager et al., 2002) and can fail to detect cognitive impairment in individuals with high pre-morbid ability or education (Huppert et al., 1995; Cullum et al., 2000). The TE4D (Test for the Early Detection of Dementia from Depression, also known as the TFDD; Ihl et al., 2000) was developed in Germany to differentiate early dementia from depression. Mahoney et al., (2005) modified this test for use in an English-speaking population and hypothesised that the TE4D-Cog would be more sensitive and specific than the MMSE in detecting mild cognitive impairment in people with AD. The TE4D has excellent validity, reliability and discriminative ability between people with and without early dementia. At cutpoint ≥ 35 , TE4D-Cog had 100% sensitivity and 84.0% specificity. It is also quick to administer, acceptable, easy to score and can detect change. The TE4D-Cog may therefore be a useful alternative to the MMSE as a dementia screening instrument.

Predictors of disease progression in Alzheimer's disease

Regan et al., (2006) investigated the relationship of vascular risk to the progression of AD, and examined whether people with AD who have vascular risk factors have a worse prognosis over 18 months than those without such risk factors. Clinical and biochemical indicators of vascular disease were not associated with rate of decline in cognition, neuropsychiatric symptoms, or functioning in AD over 18 months in people with AD who have a low burden of cerebrovascular risk factors. There was no difference in rate of deterioration between people with and without vascular risk factors. Treatment with statin medication, aspirin, or calcium channel blockers was also not associated with deterioration. However, having a cerebrovascular accident during the 18-month follow-up period contributed considerably to the rate of deterioration in cognition and functioning along with stopping acetylcholinesterase-inhibitors (AChEIs).

Livingston et al., (2007) undertook a comparison of those taking antipsychotic drugs for more than 6 months compared with those who were not, in terms of change in three measures of cognition and whether in naturalistic circumstances where those who do badly may stop antipsychotics, as opposed to randomised controlled trials. The effects of potential mediators and confounders (demographic factors, neuropsychiatric symptoms, cognitive severity and AChEIs) were examined. Greater baseline cognitive severity was the only predictor of

further cognitive decline. Although taking antipsychotics was associated with increased mortality, this was accounted for by greater age and cognitive impairment. Those people taking any or only atypical antipsychotics, over 6 months, were no more likely to decline cognitively than those who were not. An increased dose did not correlate with greater cognitive decline, suggesting no causative relationship between cognitive decline and antipsychotic prescription. Although clinicians should remain cautious when prescribing antipsychotic drugs to people with AD and only do so when the person is experiencing considerable distress and other treatments have not worked, these results suggest that, any increase in cognitive deterioration was not of the magnitude previously reported.

There is increasing evidence that anticholinergic medications may adversely affect cognitive function (Han et al., 2008; Tune 2001). These are used in a variety of conditions, for example psychiatric conditions, cardiac disease and bladder illnesses and people with dementia take these medications because of multiple illness comorbidities (Schubert et al., 2006). People with AD may be at particular risk of cognitive deterioration secondary to medication with anticholinergic effects because of marked reduction in the functioning of central cholinergic pathways (Pakashi & Kalman, 2008). Fox et al., (2011) examined the impact of medications with anticholinergic effects on cognitive impairment and deterioration in AD. Cognition was measured using three measures of cognitive function at three time-points: baseline, 6 and 18 months follow-up. 'Anticholinergic burden' scores were calculated using the Anticholinergic Burden scale (ABS: Boustani et al., 2008; Campbell et al., 2009, 2010) and included all prescribed and over the counter medication. The mean number of medications taken was four and the mean anticholinergic load was one. The total number of drugs taken and anticholinergic load correlated ($p < 0.01$). There were no differences in cognition for any of the three measures (ADAS-COG, MMSE and SIB) at either 6 or 18 months after adjusting for baseline cognitive function, age, gender and use of AChEIs between those with, and those without high anticholinergic load. Psychotropics were the commonest group of medications recorded with anticholinergic effects. The lack of an effect of anticholinergic burden may be because of the decreased sensitivity of people with more advanced cognitive impairment, or due to prolonged use of anticholinergic medication, or that any impact on cognitive function had occurred prior to enrolment in the study. Alternatively, medications with anticholinergic effects may not be as damaging to cognition as first thought in established AD.

Predictors of institutionalisation in Alzheimer's disease

Advancing dementia is one of the principal indicators for placement in long-term care settings and up to 90% of people with dementia are reported to enter an institution prior to death (Yaffe et al., 2002). Knowledge about predictors of entering care homes can enable policy makers to make accurate predictions about the need for future provision of care homes (Hope et al., 1998) and also inform the development of interventions to delay care home entry (McCann et al., 2005).

Haberman et al., (2009) examined a comprehensive range of carer and people with AD characteristics collected over 54 months to identify predictors of entering 24-h care. The mean time to 24-h care entry was 19 months. The main independent predictors of shorter time to enter 24-h care were the participants being: more cognitively or functionally impaired and having a paid versus a family carer, the carer being less educated and spending less

hours caring. In contrast with other studies (Luppa et al., 2008; Yaffe et al., 2002), the people with AD's behavioural symptoms and carer burden were not found to be significant predictors. People with AD cared for by their partner stayed longest at home, followed by those cared for by other family or friends, while those whose carer was paid entered 24-h care earliest. Interventions to improve impairment in people with AD's may have benefits for their health and allow them to remain at home longer. This financial benefit could more than offset the treatment cost.

Predictors of mortality in Alzheimer's disease

AD is associated with variable but shortened life expectancy, even at relatively early stages (Ganguli et al., 2005; Wolfson et al., 2001). Many people with mild to moderate disease die unexpectedly early, while others live more than a decade. Consistently reported determinants of shortened survival are increasing age (Burns et al., 1991; Brookmeyer et al., 2002), male sex (Jagger et al., 1995; Larson et al., 2004) and disease severity (Bowen et al., 1996; Moritz et al., 1997). Greater knowledge about predictors of survival may develop our understanding of AD. It could also empower people with AD and their families to make preparations and timely decisions about accommodation, care and treatment. Unfortunately, clinicians currently have limited information with which to advise about survival time, particularly for those with milder disease who still die unexpectedly early (Ganguli et al., 2005).

Paradise et al., (2009) investigated predictors of mortality in people with mild or moderate AD (the derivation cohort) for 42 months and tested these on a separate validation cohort. Independent determinants of shorter survival were identified and from these the SAM (Survival in Alzheimer's Model) was developed. The four-point risk scale according to whether an individual had none, one, two or all three of the identified risk factors, was tested on a validation cohort of 241 consecutive memory clinic patients who fulfilled the criteria for mild to moderate AD and had undergone a full physical examination. Baseline constructional apraxia, age and gait apraxia independently predicted shorter survival. More than 80% of those without any of these risk factors survived at least three and a half years, while only around a third of those with three risk factors survived this long. Survival was not associated with the prescription of antipsychotic or antidepressant medication, in agreement with Livingston et al., (2007) who found that antipsychotic medication was not associated with cognitive decline or survival. There is a clear difference in the survival time of people with mild or moderate AD according to their possession of the identified risk-factors. The SAM is a potentially useful tool for clinicians who previously had very limited specific and quantitative prognostic information to tell people with AD and their carers. This model predicted survival from age, constructional and gait apraxia. This may be because constructional and gait apraxia are relatively free from educational or cultural bias and thus are better indicators of severe neuropathology than global cognitive tests. Alternatively, they may increase falls or immobility, or represent disease sub-types with worse prognoses.

Costing models for Alzheimer's disease

Economic evaluations of chronic progressive diseases, such as AD, typically rely on modelling techniques because clinical trials are often too short to measure long-term outcomes of treatment alternatives. While cognitive impairment is a major clinical feature, on

its own it is a poor predictor of disease severity. Other manifestations of AD progression, such as the worsening of a person's ability to perform day-to-day activities and behavioural disturbances are also important, resulting in a greater need for long-term institutional care and increased healthcare expenditure (Jonsson et al., 2006; Small et al., 2002; Zhu et al., 2006). The symptomatology and duration of AD, and costs associated with care of dependent people with AD; make it an extremely challenging disease for the individual, carers and society as a whole. Institutionalisation is the largest component of the direct costs of AD (Hux et al., 1998; Trabucchi et al., 1999). An alternative approach to modelling AD progression and the cost-effectiveness of pharmacological treatments for AD is based on a person with AD's need for full-time care. This is defined in terms of the amount of supervision and care required by a person with AD on a daily basis, regardless of the locus of care and who the carer is. Data from the LASER-AD data was used to establish costing models for AD looking at dependency, predictors to full time care and treatment with memantine for moderate to-severe AD.

Livingston et al., (2004) validated a qualitative method for classifying disability in AD within a UK community setting using basic and instrumental activities of daily living and to examine the potential relationship between dependency and care costs. Three clusters with different levels of functional disability ('dependent', 'non-dependent' or 'nondependent but with instrumental functional disability') were identified. The cost of caring for people with AD was driven by functional ability, a surrogate and measurable marker of independence. The relationship between costs and disability levels was not, however, linear suggesting that there is a threshold of dependency above which people with AD are relatively low users of health and social care services. Therefore, treatments that enable people to remain above this threshold may save resources. The ability to qualitatively classify people according to functional disease stage will have future usefulness for assessing and monitoring people with AD, allowing more accurate identification of assistance needs and potentially delaying institutionalisation.

Rive et al., (2010a) developed a model to predict the length of time before people with AD of varying severity require full-time care. Using the classification of dependency established in Livingston et al., (2004), participants who were dependent and/or institutionalised were considered to require full-time care; non-dependent and non-institutionalised participants were assumed to be pre-full-time care. The model identified the rate of deterioration and reflected differences in disease progression. Rive et al., (2010a) found that baseline cognitive impairment, functional disability and behavioural disturbances were strong predictors of time to full-time care. In addition, the rate of cognitive decline and functional impairment predicted time to full-time care. The predictive model presented is useful for future studies, as it enables the effects of pharmacological interventions in AD to be identified and examined over a longer-term perspective.

Delay of full-time care is clinically and economically relevant for decision makers, carers and people with AD. Particularly in people with very advanced AD, evaluating the impact of treatment based on the time taken to reach a more severe state is no longer appropriate; time to full-time care represents the most, and perhaps only, relevant outcome for people with advanced AD and their carers. Rive et al., (2010b) undertook a cost-utility analysis to assess the cost effectiveness of memantine in the UK healthcare setting. The model simulated 5-year progress of people with AD until they need full-time care, defined as a

person becoming either dependent or institutionalised. Transition probabilities were based on the predictive equation established in Rive et al., (2010a). Two major data sources were combined: a meta-analysis of six large multicentre randomised controlled clinical trials for memantine (Winblad et al., 2007), and data from the LASER-AD study. Treatment with memantine prolonged time to full-time care on average by 6 weeks per participant compared to standard care over the 5-year evaluation period, representing a 7% increase in the time to full-time care compared to standard treatment. Memantine was also associated with a gain of 0.031 QALY (Quality Adjusted Life Years) compared to routine care. The health benefits with memantine translated into cost savings that completely offset the additional cost of memantine above that of standard care. The treatment is therefore associated with increased benefits at no additional costs relative to its alternative, and can be regarded as a cost-effective treatment choice for the management of moderate and severe AD.

Neuropsychiatric symptoms

In the LASER-AD study, we investigated the prevalence, persistence and change in neuropsychiatric symptoms in people with mild, moderate and severe AD, and their relationship to prescriptions of psychotropic drugs and exercise.

Ryu et al., (2005) found that three-quarters of participants experienced neuropsychiatric symptoms and that these were usually clinically significant and persistent over 6 months (80%). Those with less severe symptoms were more likely to improve. Overall, deterioration in neuropsychiatric symptoms was predicted by deterioration in MMSE scores. We did not find an association between neuropsychiatric symptoms and specific psychiatric treatments, probably due to under-treatment and the complexity of symptoms. Clinically significant neuropsychiatric symptoms were associated with greater costs of care. Train et al., (2004) found that more neuropsychiatric symptoms, and in particular hallucinations and aberrant motor behaviour were associated with greater cognitive impairment. Antipsychotics were more likely to be prescribed with lower MMSE scores, while AChEIs were less likely.

Previous evidence has shown that exercise protects against depression in older adults (Mather et al., 2002; Teri et al., 2003). Regan et al., (2006) investigated the relationship of exercise and other risk factors to depression in AD and found that regular exercise may protect against depression. Exercise levels were classified into three categories: absent, moderate, and vigorous, using the previous two weeks exercise levels to confirm regularity and recency. Independent predictors of depression were: lack of exercise, taking AChEIs and having less involvement in hobbies or interests. People who took any exercise were less likely to be depressed than those that were sedentary. These findings in people with AD are consistent with previous studies showing that exercise is protective against depression across the age range (Lawlor & Hopker, 2001). We did not find evidence to support the theories that the development of depression in AD is linked directly to vascular pathology, measured using the Hachinski Ischaemic score (Hachinski et al., 1975), or to retention of insight (in terms of milder impairment).

Characteristics of people with severe and moderately severe Alzheimer's disease

The progression of AD is conventionally divided into three stages: mild, moderate and moderately severe-severe and evaluation is based on global, cognitive, functional and

behavioural disabilities. In the LASER-AD study, Livingston et al., (2006) collected information about moderately severe and severe AD participants (MMSE < 15) over 6 months and compared them to those at an earlier stage in the disease. Several neuropsychiatric symptoms were more frequent and/or severe in moderately severe–severe participants. However, after 6 months, no significant behavioural changes were observed in any of the three severity groups and anti-psychotic prescription did not change either. Globally, total health and social service resource use were lower in the more advanced stages, possibly due to participants being institutionalised and not requiring home care services. But carer time increased significantly after 6 months for all participants and at all severity levels. Even at the later stages of AD, participants show varying rates of decline. While moderately severe and severe participants are more often dependent than less severe participants, they are not homogeneous and differ considerably in their needs and abilities. Therefore, moderately severe and severe participants can be regarded as being amenable to intervention and have the potential to experience varying and even high levels of QoL. Moreover, this decline increases burden on carers.

Quality of life in Alzheimer's disease

Health Related Quality of Life (HRQoL) is particularly important in chronic, degenerative disorders such as dementia because of the limited relevance of outcomes such as symptoms and survival rates (Jonsson et al., 2000). The person with dementia's subjective ratings of QoL are the gold standard for measuring QoL but these may be difficult to elicit and of questionable validity, particularly in severe dementia where observational ratings may be more useful (Novella et al., 2001). In the LASER-AD study, we explored the self ratings of QoL in severe dementia and comparisons of self and proxy ratings of QoL and the concept of wellbeing in adversity.

Hoe et al., (2005) examined the ability of people with severe dementia to rate their own QoL using the Quality of Life in Dementia Scale (QOL-AD: Logsdon et al., 1999). It is known that people with mild to moderate dementia can provide valid assessments of their own QoL, but it was unclear whether these instruments are useful in those with severe dementia. We found evidence for the validity and reliability of the QOL-AD in people with MMSE scores of 3–11, and that it was possible for most individuals with a score of 3 or more on the MMSE to rate QoL meaningfully using the QOL-AD. The findings showed (counter-intuitively) that QoL does not decrease as cognition worsens and that QoL ratings were influenced by the person's mood. This challenges the commonly-held assumption that worsening dementia is associated with worse QoL. Hoe et al., (2007) then compared self-ratings of QoL for people with dementia with proxy-ratings by family carers. Although highly correlated, there were also important differences. As with earlier studies, QoL was rated lower by family carers than by the individual (Logsdon et al., 1999; Sands et al., 2004; Selai et al., 2001). Fewer depressive symptoms, living at home and taking AChEIs predicted higher ratings of QoL in people with dementia. Clinicians should therefore be aware that proxy-ratings do not replicate the person with dementia's views of QoL, although they give important and consistent information.

Wellbeing in adversity

Successful ageing may not only be about escaping illness but also having a positive attitude towards one's life despite poor health (Depp & Jeste, 2006). "Successful ageing" is often defined as the absence of physical and cognitive impairment, usually neglecting the possibility of positive adaptation or resilience in the face of health related adversity and is most closely related to being younger (Depp & Jeste, 2006). This implies that successful ageing is deficit based, and does not include older people who may be living "successfully", with some degree of impairment. Many people with chronic conditions consistently rate their own quality of life highly (Albrecht & Devlieger, 1999). This "disability paradox" highlights the multidimensional nature of QoL, which encompasses emotional, social and psychological as well as health related domains (Albrecht & Devlieger, 1999; Vogel et al., 1006). Livingston et al., (2008) examined the predictors of successful ageing, or wellbeing in adversity, in people with AD using a self-rated, single item "life as a whole" measure. Mean "wellbeing in adversity" scores did not change significantly over time, and future wellbeing was directly predicted by mental health (anxiety and depression) and social relationships rather than by either global dementia severity or general health. These factors fully mediated the relationship found between health perception and wellbeing 18 months later. This contradicts the earlier literature that defined "successful ageing" as lack of illness. The measure of "wellbeing in adversity" was not related to age.

Carers for people with Alzheimer's disease

As the number of people with AD increases, so too does the number of carers (Blansjaar et al., 2000). Family carers provide the majority of care for people with dementia, (Baumgarten et al., 1992) and they experience significantly higher levels of psychological morbidity, depression, stress, and burden than people who are not carers or who are caring for physically ill relatives (Brodaty et al., 1990; Eagles et al., 1987; Livingston et al., 1996; Morris et al., 1988). Data from the LASER-AD study was used to look at psychological morbidity, attachment, coping and knowledge in family carers.

Carer psychological morbidity

Family carers of people with dementia experience high rates of stress, distress, and psychological illness. Various factors are associated with carer "burden" and "stress," such as being a woman, having a poor relationship with the person with AD, lack of social support, and the person with AD having dementia (Burns & Rabin, 2000; Pinquart & Sorenson, 2003; Oyeboode, 2013). Sources of stress may vary according to the carer's own situation: Spouses, being older, may experience strain due to physical or financial problems, whereas adult children may have conflicting responsibilities, such as work or children (Oyeboode, 2013). Maidment et al., (2005) found nearly a quarter of carers of people with AD interviewed for the LASER-AD study screened positive for anxiety and 10% for depression. Carer anxiety was significantly predicted by the carer being female, living with the person with AD, rating the quality of their relationship as poor, having poor perceived health, and the care-recipient's level of dependency. Higher irritability scores and the carer's perception of poor health strongly predicted depression. We concluded that clinicians should be alert for risk factors for anxiety and depression; specifically, additional difficulties, such as carer poor health, the quality of the relationship between the carer and the person with AD, and irritability in the person with AD, because these are potentially modifiable.

Livingston et al., (2005) developed the Carers for Alzheimer's Disease Problems Scale (CAPS) comprising common risk factors for anxiety and depression for family carers of people with dementia. The CAPS was tested in a representative sample of people with AD and their carers and had high sensitivity and specificity in detecting carers with screen positive anxiety and depression. The five areas identified as predictors were: neuropsychiatric symptoms and depression in the care-recipient, co-residence and relationships with the care-recipient, and physical health of the carer. The CAPS is the first screening tool to enable clinicians to identify rapidly those dementia carers at risk of having significant anxiety or depressive symptoms and its use as part of the routine assessment may be helpful.

As the evidence shows the quality of the carer- care-recipient relationship predicts those carers most at risk from anxiety, Cooper et al., (2008a) examined the relationship of attachment styles to anxiety in carers of people with dementia. The Attachment Questionnaire (Hazan and Shaver, 1987; 1990) was used to measure the participant's subjective attachment style (secure, avoidant and anxious/ambivalent). Most carers reported that their main attachment style was secure, but more avoidant attachment and less secure attachment predicted anxiety. Carers who were less secure, or who had a more avoidant attachment style, reported higher anxiety, and that this relationship was partially mediated by their greater use of dysfunctional coping strategies. Furthermore a proportion of anxiety was independent of carer burden and coping, and may relate to circumstances extraneous to caring. Carers are therefore likely to benefit from interventions that aim to modify use of coping strategies.

Coping in family carers

Coping is a process by which people manage stress. Cooper et al., (2006) investigated the relationship of anxiety with coping strategies in family carers of people with dementia. Coping strategies were classified as problem-focused, emotion-focused and dysfunctional (Carver et al., 1997). Problem-focused coping strategies involve defining a problem, generating alternative solutions and considering their relative costs and benefits. Emotion-focused strategies seek to lessen the emotional distress associated with a situation through trying to change one's feelings about it. Depression and greater use of dysfunctional coping strategies were the only factors which independently predicted anxiety. Addressing coping strategies may therefore be helpful for managing carer anxiety. The Brief COPE is a self-completed questionnaire measuring coping strategies. Cooper et al., (2008b) investigated the validity and reliability of the COPE and its dysfunctional, problem-focused or emotion-focused subscales in carers of people with dementia. We found evidence for good internal consistency and construct validity and the brief COPE demonstrated sensitivity to change for the problem-focused and dysfunctional coping scales. Change in emotion-focused coping was correlated with change in other types of coping but not burden. Using these Brief COPE subscales in clinical research was recommended, as the measures reflect the components of potential therapeutic interventions needed. In a subsequent paper, we found using emotion-focussed coping strategies in response to carer burden seemed to protect carers from developing higher anxiety levels a year later; however using problem-focused strategies did not (Cooper et al., 2008c). Use of dysfunctional coping was related to higher anxiety score and most of those who were anxious at baseline remained anxious 1 year later. Successful caregiving for people with degenerative disease probably involves using

problem-focussed coping strategies where situations can be changed, and adapting emotionally when they cannot. Especially in later stages of caring, many of the problems which carers face are likely to be intractable and therefore responding to them with problem-focused strategies may prove frustrating and ineffective. Implementing psychological interventions to emphasise emotion-focused coping may help to reduce anxiety in dementia carers.

Safety in Alzheimer's disease

Within the LASER-AD study, Walker et al., (2006) explored safety issues in dementia from a carer's perspective. Even when the level of dementia is mild, carers generally feel it is unsafe to leave the person with AD alone. The majority of carers (80%) took their own measures to keep the person with AD safe. Despite this, most (70%) reported at least one incident occurring in the last year which posed a significant risk to the person with AD. Walker et al., (2006) found the number of risk minimisation strategies implemented was neither related to the number of risk incidents nor to carer morbidity. We concluded that there is inevitably a level of risk associated with having dementia and living in the community, and both carers and professionals have to accept that, albeit infrequently, the person with AD will be in danger. Risk reducing measures are not absolute guarantees and can be regarded as analogous to harm minimisation strategies used to decrease risk for other mental health problems.

Carer attributions of behaviour in Alzheimer's disease

There is little research exploring what carers think is the cause of problem behaviour in people with dementia. Paton et al., (2004) found attributions regarding problematic behaviours were extremely varied and the majority of carers did not attribute symptoms to AD despite being aware of the diagnosis. Many believed that the symptoms were under the persons' control and some that the person with AD would improve. As in other studies, short-term memory loss was identified most frequently by carers as problematic (Whitehouse & Chamberlain, 2000). Many other symptoms were difficult for carers to deal with, for example, aggression, apathy, hallucinations, delusions and anxiety were often identified as troubling. Aggression was only rarely attributed to AD, more often it was attributed to other factors such as childhood experiences or premorbid personality. Whilst it is plausible that aggression could be rooted in such factors, it is likely that AD may be a contributory factor. That carers tend not to attribute symptoms to AD, suggests they have a different understanding of dementia, or are trying to minimise or deny the effects of illness, and often think that information given is not applicable to their situation. This has implications for clinicians working with people with dementia and carers in this area, especially regarding the nature and presentation of information about dementia. Education by clinicians should focus on the understanding of carers and, in particular, explore and come to a mutual understanding of the symptoms, control and prognosis specifically focusing on the person for whom they care.

Elder abuse in Alzheimer's disease

Detecting elder abuse accurately is important but inherently difficult, as it is often perpetrated against vulnerable people by those they rely on, and few elder abuse measures are

validated. In the LASER-AD study, Cooper et al., (2008d) investigated the acceptability and validity of the Modified Conflict Tactics Scale (MCTS), and compared carer self-report and observer-rated elder abuse screens for the first time. Of eighty-six people with AD and their family carers interviewed, 24(27.9%) were identified as abuse cases using the self-report MCTS. The MCTS was acceptable and had convergent and discriminant validity for measuring carer abuse. By contrast, the observer-rated Minimum Data Set Abuse screen (MDS-A) failed to identify any cases of abuse. Carer burden, being a male carer and caring for someone who was less functionally impaired but with more cognitive impairment and irritability predicted carer reports of abuse. Asking family carers about abuse is therefore more likely to lead to its detection and earlier studies have underestimated the prevalence of abuse and its link to carer stress. Furthermore, the findings appeared to refute the UK government elder abuse reduction policy of the time which assumed that few incidents of abuse arises from carer stress.

Conclusion

The LASER-AD longitudinal study of people with AD and their carers has been very influential over the past 12 years. It has contributed to our understanding of the progression, characteristics and costs of the disease. The work on quality of life showed that people with dementia often rate this highly, and showed for the first time that even those with severe dementia could report this meaningfully. We reported that family proxy-ratings of QoL do not necessarily mirror the views of the individual, even in the severe stages of the disease. We found that despite the impact of the disease process people with AD experience wellbeing in adversity and still live fulfilling lives. The study highlighted the high prevalence and severity of neuropsychiatric symptoms, of carer anxiety, depression and abusive behaviour. It informed future directions for possible interventions, such as the central role of carer coping strategies in predicting carer mental illness and by indicating the link between exercise and better outcomes. The study also contributed to the development of tools that help detect dementia earlier and screen and identify the specific problems experienced by carers. Work continues to try to help more people with AD and their carers experience high quality of life. Current research that builds on our findings include a clinical trial of a manualised based coping strategy programme to promote better mental health in carers of people with dementia (START: Strategies for Relatives) and a longitudinal study into the epidemiology and risk factors for elder abuse in dementia (CARD: Caring for Relatives with Memory Disorders). Furthermore, data from the LASER-AD contributed to the Technology Assessment Report (NICE, 2011) which reviewed the clinical and cost effectiveness of antedementia medication and allowed AChEIs to be prescribed for people with early AD. Our findings have also contributed to national health and social care guidelines for managing and supporting people with dementia and their carers (NICE-SCIE, 2012). In addition, the LASER-AD study had been used to inform international plans to address Alzheimer's disease and elder abuse in the USA (US Department of Health and Human Services, 2013; Nakhnikian, 2011) and in Europe (Soares et al., 2010).

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Declaration of interests

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