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1. Introduction

In 2015, dementia cost the United States of America alone \$226 billion; by 2050, this cost is projected to rise to \$1.1 trillion (1). An often underappreciated cost of dementia is the impact upon informal caregivers for dementia patients. Dementia caregiving is associated with heightened stress and increased depression (2). There is emerging evidence that dementia caregiving may impact upon central nervous system activity in informal caregivers (3; see **Figure 1**); this may exacerbate the physiological effects of ageing. Furthermore, there is evidence of a higher prevalence of irritable bowel syndrome in carers for relatives with serious illness (4). We examined the cognitive neurobiology and mental well-being of dementia caregivers, as well as interventions targeting stress and the caregiving role.

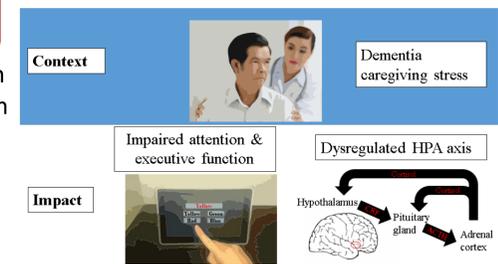


Figure 1: Dementia caregiving stress is associated with impaired cognitive performance and stress physiology (adapted from 4.)

2. Aims of the Study

- Aims:** (1). Examine psychological and gastrointestinal well-being in an Irish cohort of caregivers for family members with dementia. (2). Examine whether carer interventions can attenuate the impact of chronic stress.
- Hypotheses:** (1). Dementia caregiving is associated with heightened stress and worsened psychological and gastrointestinal health. (2). Carer interventions are associated with an attenuation of this effect.

3. Methods

Caregiver assessment

Family dementia caregivers were recruited via the Memory Clinic at St. Finbarr's Hospital, Cork. Caregivers were providing at least 10 hours of unpaid care per week to a relative or friend with dementia. Caregivers had been providing care for a mean of 46.5 months (SD = 41.7), and were providing a mean of 45 hours per week of care (SD = 52.3). Controls were recruited from the community, and were matched for age and gender.

	Caregivers (N = 79)	Controls (N = 34)
Age	56.4 (SD = 11.9)	55.3 (SD = 10)
Gender	F = 53, M = 26	F = 23, M = 11
Relation to care recipient	Child = 50, Spouse = 27, Sibling = 1, Friend = 1	N/A

Table 1: Participant characteristics

Exclusion criteria were: serious health problems, taking a medication that would confound the aims of the study, participation in a trial involving experimental drugs in the last 30 days.

Stress and mental health: Stress was assessed using the Cohen Perceived Stress Scale (PSS). Depression was assessed using the Beck Depression Inventory (BDI).

Gastrointestinal symptoms: Gastrointestinal symptoms were assessed using the irritable bowel syndrome symptom severity scale (IBS-SSS).

Neurocognitive performance: Participants completed the paired associates learning task (PAL), rapid visual information processing (RVP), simple reaction time and spatial span tests from the CANTAB platform (see **Figure 2**).



Figure 2: CANTAB: neurocognitive assessment.

Caregiver interventions

A subset of participants (N = 11) completed both a carer training program (CTP) and mindfulness-based stress reduction (MBSR) program, provided at St. Finbarr's Hospital, Cork, Ireland.

The **CTP** provided information about the nature of dementia, dealing with challenging behaviours, legal rights and entitlement, stress management and self-care.

The **MBSR program** involved practicing of mindfulness meditation with an experienced mindfulness practitioner, with discussion of mindfulness practice.

Each program was provided by an experienced instructor in a group format and lasted approximately 2 months.

5. Discussion & conclusions

- Dementia caregiving is associated with heightened levels of self-reported stress and depression, as well as poorer memory and sustained attention performance, but not with alteration in gastrointestinal symptoms. These findings may underpin a possible cognitive neurobiology of caregiving.
- Both MBSR and carer training programs for dementia caregivers may attenuate the impact of chronic stress on cognitive performance.
- A comprehensive physiological phenotyping of dementia caregivers is required to better understand the mechanisms of these effects.

6. Acknowledgements & Disclosure

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4. Results

Psychological and GI well-being in caregivers

Stress
Dementia caregivers reported significantly higher stress than non-caregivers, $F(1, 35) = 5.69, p = .02, \eta_p^2 = .14$ (see **Figure 3a**). However, this did not change significantly following the interventions (see **Figure 3b**).

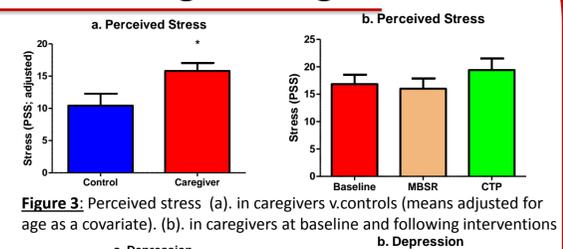


Figure 3: Perceived stress (a). in caregivers v. controls (means adjusted for age as a covariate). (b). in caregivers at baseline and following interventions

Depression
Dementia caregivers reported higher depression than non-caregivers, a marginally significant effect, $F(1, 32) = 3.72, p = .06, \eta_p^2 = .1$ (see **Figure 4a**). However, this did not change significantly following the interventions (see **Figure 4b**).

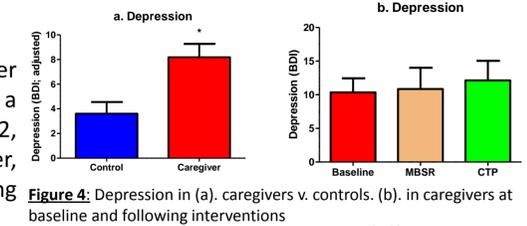


Figure 4: Depression in (a). caregivers v. controls. (b). in caregivers at baseline and following interventions

GI symptoms
Dementia caregivers did not differ from non-caregivers in GI symptoms, and their symptoms did not change significantly following the interventions (see **Figure 5**).

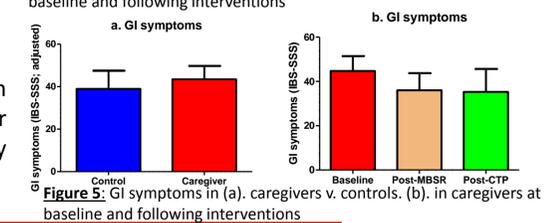


Figure 5: GI symptoms in (a). caregivers v. controls. (b). in caregivers at baseline and following interventions

Cognitive performance

Caregivers made significantly more errors on the Paired Associates Learning (PAL) test, 8 patterns: $F(1, 37) = 5.18, p = .03, \eta_p^2 = .12$ (see **Figure 6a**), but made marginally fewer errors post-intervention, $F(1.1, 6.8) = 3.07, p = .08, \eta_p^2 = .34$ (see **Figure 6b**). Caregivers had slower reaction time on the Rapid Visual Information Processing (RVP) test, $F(1, 36) = 3.22, p = .08, \eta_p^2 = .08$ (see **Figure 7a**), but had marginally faster reaction time post-intervention, $F(2, 12) = 3.44, p = .07, \eta_p^2 = .37$ (see **Figure 7b**). There were no differences between caregivers and controls in spatial memory performance or simple reaction time, and these were not affected by MBSR or CTP.

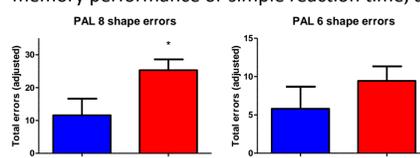


Figure 6a: Paired associates learning errors in caregivers and controls

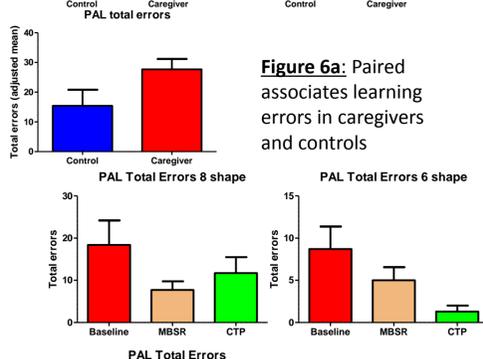


Figure 6b: Paired associates learning errors in caregivers before and after intervention

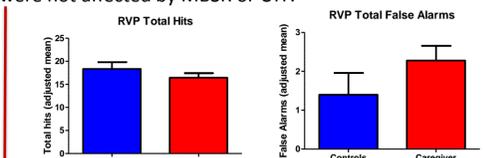


Figure 7a: Sustained attention performance in caregivers and controls

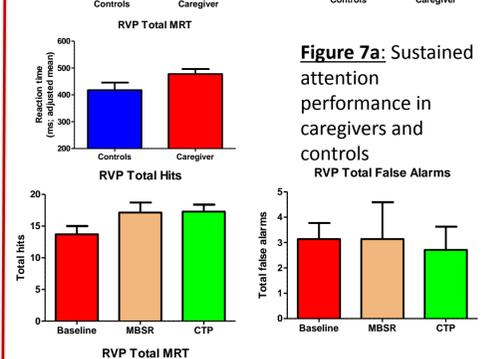


Figure 7b: Sustained attention performance in caregivers before and after intervention

7. References

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