



Contents lists available at ScienceDirect

Journal of Clinical Neuroscience

journal homepage: [www.elsevier.com/locate/jocn](http://www.elsevier.com/locate/jocn)

## Clinical study

## Affective improvement of neurological disease patients and caregivers using an automated telephone call service

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## ARTICLE INFO

## Article history:

Received 7 March 2018

Accepted 8 July 2018

Available online xxxxx

## Keywords:

ALS

Anxiety

MSA

Parkinson disease

SCD

Telephone call service

## ABSTRACT

Neurological disease patients living alone or with a single caregiver need a support system to care for their psychological symptoms. We evaluated the clinical effects of a unique telephone call system that automatically called participants at their desired times once a week for 3 months. In total, 104 neurological disease patients and caregivers were evaluated by the geriatric depression scale, apathy scale and state and trait anxiety inventories (STAI) forms X-I for depression, apathy and state anxiety, respectively. High baseline STAI scores ( $40 \geq$ ) significantly improved in the Parkinson's disease (PD), amyotrophic lateral sclerosis (ALS), and spinocerebellar degeneration (SCD) + multiple system atrophy (MSA) patients ( $p = 0.001$ ,  $p = 0.013$  and  $p = 0.046$ , respectively) after patients/caregivers used the telephone call service. The baseline (pre) STAI score significantly correlated with the score change (post-pre) in PD, ALS, SCD + MSA, Alzheimer's disease patients (ADp), and caregivers for ADp ( $p < 0.0001$ ,  $p = 0.001$ ,  $p = 0.011$ ,  $p = 0.025$  and  $p = 0.020$ , respectively). The geriatric depression scale and apathy scale did not significantly improve. The present study suggests that there is a positive effect of using an automated telephone call service for anxiety in neurological disease patients and caregivers, especially in ALS, SCD + MSA and PD patients with high STAI scores ( $40 \geq$ ).

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## 1. Introduction

Patients with a chronic progressive neurological disease, such as amyotrophic lateral sclerosis (ALS), spinocerebellar degeneration (SCD), multiple system atrophy (MSA), Parkinson's disease (PD), multiple sclerosis (MS) or Alzheimer's disease (ADp), and caregivers for AD patients (ADc) are at risk for psychological symptoms including anxiety, depression and apathy [1–3]. We previously reported an anxiety change after genetic testing for presymptomatic hereditary SCD patients [4]. Psychological symptoms affect disease symptoms and decrease the quality of life, but effective treatments and care have not been fully investigated in ALS, SCD + MSA, PD, MS, ADp and ADc. In particular, neurological disease patients living alone or with a single caregiver at home need a support system to help care for their psychological symptoms.

In the present study, therefore, we used a unique telephone call system for neurological disease patients living alone or with a single caregiver. This system automatically called participants at their desired time once a week, and participants could answer questions

simply by pressing the numbers #1, #2 or #3. We evaluated the clinical effects of the telephone call service for psychological symptoms, such as anxiety, depression or apathy, of patients and caregivers.

## 2. Methods

## 2.1. Participants

The present study included volunteer participants living alone ( $n = 15$ ) or with a single caregiver ( $n = 89$ ), with ALS ( $n = 19$ ), SCD ( $n = 11$ ), MSA ( $n = 7$ ), PD ( $n = 27$ ), MS ( $n = 16$ ) or ADp ( $n = 13$ ), or a caregiver for ADp (ADc) ( $n = 11$ ) from an outpatient clinic at Okayama University Hospital. The ALS, MSA, PD, MS and ADp cases were diagnosed by expert neurological clinicians according to the revised El Escorial criteria (possible, probable or definite) [5], MSA criteria [6,7], U.K. Parkinson's Disease Society Brain Bank clinical criteria [8], revised McDonald criteria [9], the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition or the International Classification of Diseases, Tenth Revision, respectively. SCD cases included two spinocerebellar ataxia (SCA) 2, one SCA1, one SCA3, one SCA31, one cortical cerebellar atrophy and five

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others, diagnosed by expert neurological clinicians and DNA analysis. Eleven SCD and seven MSA cases are combined in the present study. All participants gave written informed consent and the Okayama University Ethics Review Board approved all study procedures (approval # 2196).

## 2.2. Automated telephone call service and clinical evaluation

All participants received an automated telephone call service (Andes phone®) to check their medical conditions at their desired times, once a week for 3 months. The participants (patients or caregivers) answered questions from the telephone service by pressing the appropriate number: #1 for 'no problem', #2 for 'request a phone call within a few days by a medical consultant', and #3 for 'request an immediate phone call by a medical consultant'. When the participants pressed #2 or #3 for the telephone service, a member of the Okayama Prefecture Intractable Disease Medical Council staff called them back within a few days (for #2) or as soon as possible (for #3) to listen to the problems from the patients or caregivers and carefully advise them of necessary medical consultations. The percentage of each answer type (#1, #2, and #3), and any calls/answers made in error, by the participants was recorded.

Just before (pre) and 3 months after (post) the telephone call service, all participants were evaluated at the outpatient clinic of Okayama University Hospital by affective assessments such as the geriatric depression scale (GDS) [10], apathy scale (AS) [11] and state and trait anxiety inventories (STAI) [12] forms X-I for depression, apathy and state anxiety, respectively. They were also evaluated by the general cognitive test mini-mental state examination (MMSE) [13] at the outpatient clinic. Clinical demographic data such as age, sex and disease duration were also analyzed.

## 2.3. Statistical analysis

Comparisons between baseline characteristics (gender, age and disease duration), the scores of cognitive (MMSE) and affective assessments before (pre) and after (post) the telephone call service, and the percentage of answer types (no problem, request a call back within a few days or request an immediate call back, or any

calls/answers made in error) for the telephone service for six groups (ALS, SCD + MSA, PD, MS, ADp, and ADc) were carried out with the Kruskal–Wallis test for continuous variables, and with Pearson's chi-squared test ( $\chi^2$ ) for comparison of proportions. Changes in affective assessment scores between pre- and post-telephone service were analyzed using the Wilcoxon signed-rank test. Spearman's rank correlation-coefficient test was conducted to examine correlations among STAI scores of pre-telephone service and subtraction (post- from pre-telephone service), and among STAI scores of subtraction and the percentage of 'request call back' answers for the telephone service. Statistical analyses were performed using GraphPad Prism 5 (version 5.00; GraphPad Software, Inc., San Diego, CA). A P value of less than 0.05 was considered significant.

## 3. Results

### 3.1. Clinical characteristics of neurological disease patients and caregivers

The clinical characteristics of ALS, SCD plus MSA, PD, MS, ADp and ADc are shown in Table 1. The ratio of men was larger in ALS patients, while it was smaller in MS, ADp and ADc groups ( $\chi^2=16.37$ ;  $p=0.006$ ). The mean ages at examination of MS patients were younger than in the other five groups (### $p < 0.001$  vs ALS, \* $p < 0.05$  vs SCD + MSA, <sup>†††</sup> $p < 0.001$  vs PD, <sup>\$\$\$</sup> $p < 0.001$  vs ADp and ADc), while the ages of ADp patients were older compared with SCD + MSA patients (\* $p < 0.05$ ), and the disease durations of ADp patients were shorter compared with SCD + MSA, PD and MS patients (\* $p < 0.05$  vs SCD + MSA, <sup>††</sup> $p < 0.01$  vs PD, <sup>\$</sup> $p < 0.05$  vs MS). For general cognitive assessments, MMSE scores were significantly lower in ADp patients compared with ALS, PD and MS patients (Table 1, # $p < 0.05$  vs ALS, <sup>††</sup> $p < 0.01$  vs PD, <sup>\$\$\$</sup> $p < 0.001$  vs MS).

### 3.2. Effects of the automated telephone call service

Baseline GDS scores were not different among all six groups before the automated telephone call service (Table 1). Although

**Table 1**  
Clinical characteristics of patients with ALS, SCD + MSA, PD, MS, AD and caregivers for AD.

	ALS	SCD + MSA	PD	MS	ADp	ADc	Statistical Analysis
No. of cases	19	18	27	16	13	11	
Men (%)	68.4	50.0	48.1	18.8	7.7	36.4	<sup>a</sup> $\chi^2 = 16.37$ ; $p = 0.006$
Age at examination (y)	67.3 ± 9.0	63.6 ± 12.3	71.7 ± 6.8	37.7 ± 9.3 <sup>###,*,†††</sup>	76.3 ± 4.3 <sup>*,\$\$\$</sup>	75.7 ± 6.3 <sup>\$\$\$</sup>	<sup>b</sup> $p < 0.0001$
Disease duration (y)	3.5 ± 3.1	7.6 ± 5.9	6.3 ± 4.5	6.4 ± 5.4	2.1 ± 1.5 <sup>*,††,§</sup>		<sup>b</sup> $p = 0.0007$
MMSE	27.3 ± 3.0	27.2 ± 2.7	27.7 ± 2.0	28.8 ± 1.6	23.9 ± 2.9 <sup>#,††,\$\$\$</sup>		<sup>b</sup> $p = 0.001$
Pre-telephone service							
GDS	6.7 ± 3.3	6.2 ± 4.3	5.2 ± 3.7	5.7 ± 3.8	4.1 ± 4.1	3.6 ± 3.4	<sup>b</sup> $p = 0.179$
AS	17.1 ± 6.0	18.0 ± 10.9	12.9 ± 7.4	14.7 ± 7.9	10.5 ± 9.4	13.5 ± 10.9	<sup>b</sup> $p = 0.074$
STAI (X-I)	44.4 ± 12.2	44.0 ± 14.1	42.0 ± 12.5	37.9 ± 15.6	33.4 ± 9.4	34.9 ± 8.2	<sup>b</sup> $p = 0.068$
Post-telephone service							
GDS	6.7 ± 4.1	5.9 ± 3.7	4.9 ± 3.8	5.2 ± 3.8	2.3 ± 2.2 <sup>#</sup>	4.9 ± 4.4	<sup>b</sup> $p = 0.048$
AS	17.4 ± 8.6	17.3 ± 9.0	12.6 ± 6.8	12.3 ± 7.4	13.8 ± 9.1	15.7 ± 8.9	<sup>b</sup> $p = 0.336$
STAI (X-I)	38.5 ± 10.3	39.2 ± 11.3	32.2 ± 9.6	39.2 ± 13.8	34.0 ± 10.5	34.4 ± 7.2	<sup>b</sup> $p = 0.199$
Answer for telephone service							
No problem (%)	78.6	76.3	68.5	73.9	82.3	65.9	<sup>b</sup> $p = 0.204$
Request call back (%)	3.5	4.5	10.0	1.1	0.7	3.8	<sup>b</sup> $p = 0.092$
Error (%)	17.9	19.2	21.5	25.0	17.0	30.3	<sup>b</sup> $p = 0.381$

Data are expressed mean ± SD. Inter-group comparisons: # $p < 0.05$  vs ALS; ### $p < 0.001$  vs ALS; \* $p < 0.05$  vs SCD + MSA; \*\* $p < 0.01$  vs SCD + MSA; <sup>††</sup> $p < 0.01$  vs PD; <sup>†††</sup> $p < 0.001$  vs PD; <sup>\$</sup> $p < 0.05$  vs MS; <sup>\$\$\$</sup> $p < 0.001$  vs MS.

ADc, Alzheimer's disease-caregiver; ADp, Alzheimer's disease-patient; ALS, amyotrophic lateral sclerosis; AS, apathy score; GDS, geriatric depression scale; MMSE, mini-mental state examination; MS, multiple sclerosis; MSA, multiple system atrophy; PD, Parkinson disease; SCD, spinocerebellar degeneration; SD, standard deviation; STAI, state-trait anxiety inventory.

<sup>a</sup> Chi square test.

<sup>b</sup> Kruskal–Wallis test.

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