

## Randomised controlled trial of animal facilitated therapy with dolphins in the treatment of depression

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### Abstract

**Objective** To evaluate the effectiveness of animal facilitated therapy with dolphins, controlling for the influence of the natural setting, in the treatment of mild to moderate depression and in the context of the biophilia hypothesis.

**Setting** The study was carried out in Honduras, and recruitment took place in the United States and Honduras.

**Design** Single blind, randomised, controlled trial.

**Participants** Outpatients, recruited through announcements on the internet, radio, newspapers, and hospitals.

**Results** Of the 30 patients randomly assigned to the two groups of treatment, two dropped out of the treatment group after the first week and three withdrew their consent in the control group after they had been randomly allocated. For the participants who completed the study, the mean severity of the depressive symptoms was more reduced in the treatment group than in the control group (Hamilton rating scale for depression,  $P = 0.002$ ; Beck depression inventory,  $P = 0.006$ ). For the sample analysed by modified intention to treat and last observation carried forward, the mean differences for the Hamilton and Beck scores between the two groups was highly significant ( $P = 0.007$  and  $P = 0.012$ , respectively).

**Conclusions** The therapy was effective in alleviating symptoms of depression after two weeks of treatment. Animal facilitated therapy with dolphins is an effective treatment for mild to moderate depression, which is based on a holistic approach, through interaction with animals in nature.

### Introduction

Biophilia shows how human health and wellbeing are strictly dependent on our relationships with the natural environment.<sup>1-3</sup> In the biophilic vision, the manifestation of emotions and the affiliation with nature are an innate human tendency. Disrupting the affiliation with nature and thus losing the biophilic equilibrium means to alter and damage our psychophysical health.<sup>4,5</sup>

Numerous researchers have presented evidence showing the therapeutic value of nature and animals for sick and disabled people. We focused on the thera-

peutic benefit that the interaction with animals may have in treating mild to moderate depressive disorders. We chose the bottlenose dolphin, *Tursiops truncatus*, for the animal facilitated therapy and mild to moderate depression as the illness to be treated.

### Methods

We studied outpatients, recruited through announcements on the internet, radio, newspapers, and hospitals in the United States and Honduras between November 2002 and December 2003, who had a diagnosis of a mild or moderate depressive disorder as defined by ICD-10 criteria.<sup>6</sup> To avoid bias in responses to assessment, we emphasised that people were only taking part in a research study and told not to expect any improvement. Eligibility criteria included an age of 18-65 and a score of at least 11 on the modified, 17 item, Hamilton rating scale for depression<sup>7</sup> at baseline, after a period of four weeks without taking drugs. Serious anxiety disorder was defined a priori as a score on Zung's self rating anxiety scale of 45 or more.<sup>8</sup> Patients were required to discontinue antidepressant drugs or psychotherapy at least four weeks before entering the study. We excluded patients with psychotic features, major depressive disorders, cyclothymia, or bipolar disorders. Patients were not allowed to take antidepressant or anxiolytic drugs during the study.

### Procedure

Field research work took place at the Roatan Institute for Marine Sciences, Honduras. Participants were asked for a medical certificate from their treating therapist confirming a diagnosis of mild or moderate depression without psychotic features (ICD-10 criteria).<sup>6</sup> Once participants had been selected by the panel of psychiatrists and clinical psychologists, on arrival at the institute, a psychological and medical examination was done, and participants received an induction to the institute facilities and the island. Experienced clinical raters who were blinded to treatment assignments, to the hypothesis under testing, and to the fact that block randomisation was being used, administered the Hamilton rating scale for depression at baseline and at the end of the treatment.

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BMJ 2005;331:1231-4



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We used block randomisation to assign participants randomly to one of the two groups of treatment. In the experimental group, participants were asked to play, swim, and take care of the dolphins. They had an introductory session, to explain about dolphin behaviour and water safety. The first part of the trial, which took half an hour, was structured so the participants could familiarise themselves with the animals. Participants were standing in the water, close to the trainer. The dolphins, following the trainer's signals, performed trained behaviours (such as a jump or a swim). Participants were able to touch the dolphins when close to the trainer. The second part of the trial, another half an hour, was unstructured, and free and spontaneous interactions occurred. Participants were snorkelling in the water with the dolphins. In the control group, participants were assigned to an outdoor nature programme featuring the same water activities as the animal care programme but in the absence of dolphins, to control for the influence of water and other, non-specific, environmental factors. In the outdoor nature programme, participants had to swim and snorkel in the barrier coral reef for one hour a day and had a similar degree of individualised human contact as in the animal care programme. Patients were informed of the marine ecosystem, the barrier coral reef, and water safety.

Each session took about one hour a day. To avoid disappointment for the participants in the control group, which might have affected the results, they also had a day session with the dolphins at the end of the treatment and after the final evaluation. Both programmes were run simultaneously and lasted for a period of two weeks for each group. The treatments were given daily, Monday to Friday.

### Assessment

Behavioural and psychological measures were conducted at baseline and at the end of treatment by using a modified, 17 item, Hamilton rating scale for depression, the Beck depression inventory,<sup>9 10</sup> and the Zung self rating anxiety scale.<sup>8</sup> We defined a clinically important improvement a priori as a Hamilton score of no more than 7 at the end of treatment, and a satisfactory therapeutic response as a reduction in the Hamilton score by at least 50% from baseline to the end of treatment.

On the basis of our power calculation, we needed 30 patients in total. To compensate for dropouts, we planned to enrol 50 patients in total.

### Statistical analysis

We conducted preliminary *t* tests for equality of means for two independent groups of observations for the Hamilton, Beck, and Zung's scores, to evaluate the significance of the changes in the scores from baseline to the end of treatment. The primary analysis was a modified analysis by intention to treat and last observation carried forward.

### Results

Altogether 105 patients responded to the invitations for the study. After exclusions, 30 patients underwent block randomisation: 15 were assigned to the experimental group and 15 to the control group. In the control group, three participants withdrew before treatment started, and in the experimental group, two participants dropped out after the first week of treatment. Differences between groups at baseline did not reach significance (see [bmj.com](http://bmj.com)).

### Treatment and efficacy

The preliminary two tailed *t* test for equality of means for two independent groups of observations for the Hamilton and Beck scores from baseline to the end of treatment was highly significant in the patients who completed treatment (animal care programme,  $n = 13$ ; outdoor nature programme,  $n = 12$ ). For the Hamilton scale (95% confidence interval 1.66% to 6.11%,  $P = 0.002$ ; equal variances not assumed), the mean differences in change scores for the animal care programme and the outdoor nature programme were 8.38 (SD 1.98) and 4.50 (SD 3.15), respectively. For the Beck depression inventory (2.43% to 13.3%,  $P = 0.006$ ; equal variances assumed), the mean differences in scores between the programmes were 15.46 (SD 5.69) and 7.58 (SD 7.42), respectively. Therefore the animal care programme had a significantly higher effect in decreasing the depressive symptoms of the subjects than the outdoor nature programme.

For the modified analysis, the two tailed *t* test for equality of means for two independent groups of observations confirmed the significant differences for the Hamilton and Beck scores (table).

The proportion who fell below the cut-off point on the Hamilton scale (participants who completed the

Mean of the difference in scores from baseline to end of study and mean scores at baseline and week 2 on the Hamilton rating scale for depression, Beck depression inventory, and Zung's self rating anxiety scale in the modified intention to treat sample\*

Variable	P value (95% CI)†	No of participants	Mean difference in change scores (SD)	95% CI‡	Mean score at baseline (SD)	Mean score at week 2 (SD)
<b>Hamilton rating scale for depression</b>						
Treatment group	0.007 (1.112 to 6.221)	15	7.27 (3.47)	5.46 to 9.07	14.53 (2.59)	7.27 (2.52)
Control group		15	3.60 (3.36)	1.79 to 5.41	14.47 (2.20)	10.87 (3.38)
<b>Beck depression inventory</b>						
Treatment group	0.012 (1.774 to 12.89)	15	13.40 (7.58)	9.47 to 17.33	20.27 (6.65)	6.87 (5.60)
Control group		15	6.07 (7.28)	2.14 to 10.00	18.80 (6.91)	12.73 (7.64)
<b>Zung self rating anxiety scale</b>						
Treatment group	0.102 (NS) (0.861 to 8.994)	15	9.80 (7.32)	6.32 to 13.28	42.87 (8.37)	33.07 (6.01)
Control group		15	5.73 (5.76)	2.25 to 9.22	43.20 (7.62)	37.47 (9.18)

\*Scores represent the amount of reduction from baseline to end of treatment. Higher scores on the scales, indicate more severe depression or anxiety.

†*t* test for independent groups of observations, comparing mean difference in change scores for treatment group and control group. The 95% confidence interval refers to the mean difference in change scores; equal variance assumed.

‡Confidence interval for mean difference in change scores between baseline and week 2.

study and received a score no higher than 7 on this scale) was 77% for the animal care programme and 25% for the outdoor nature programme. For the modified analysis, the proportions were 67% and 20%, respectively.

Although the mean anxiety scores in both treatment groups fell, the *t* test for the Zung scores did not reach significance (95% confidence interval -0.65% to 9.24%,  $P=0.086$ ; equal variance assumed). The mean difference in change scores for the animal care programme was 11.46 (SD 6.32) and for the outdoor nature programme 7.17 (SD 5.57). The animal care programme did not have a significantly greater effect in reducing the anxiety symptoms of the subjects than the outdoor nature programme. However, only 40% of the sample had a clinically important anxiety score before the treatment (Zung score  $>45$ ). In other words, only 40% of the sample under study had mild or moderate depression with anxiety symptoms before the treatment. For the modified analysis, the *t* test for equality of means for two independent groups of observations for the Zung scores did not reach significance (table).

## Discussion

Animal facilitated therapy with dolphins is more effective than “water” therapy in treating people with mild to moderate depression after the influence of the natural setting has been controlled for. To the best of our knowledge, this is the first randomised, single blind, controlled trial of animal facilitated therapy with dolphins. The natural setting itself is also an important factor that has to be considered in the treatment of emotional disorders. This is confirmed by other studies.<sup>11 12 13</sup> The effects exerted by the animals were significantly greater than those of just the natural setting. The echolocation system, the aesthetic value, and the emotions raised by the interaction with dolphins may explain the mammals’ healing properties.

Depressive symptoms improved after two weeks of treatment. In conventional therapy—psychotherapy or drug therapy—symptoms usually improve substantially after four weeks. No side effects were noted, although accidental injuries may occur. Although water phobia and inability to swim represent limitations of the treatment, the presence of dolphins may help to overcome such limitations, functioning as a distraction. The difference in reduction of anxiety symptoms between the animal care programme and the outdoor nature programme did not reach significance; however, only 40% of the sample under study had clinically important anxiety symptoms before the treatment. The overall reduction in the anxiety symptoms in both treatment groups may be explained by the therapeutic property of water.<sup>13</sup>

## Limitations

One limitation was our inability to blind participants to the treatment. Another limitation was the restrictive exclusion criteria, which may reduce generalisability of the findings. To avoid social desirability bias, we emphasised to patients that they were only taking part in a research study and told not to expect any improvement. To prevent disappointment in the participants in the control group—which might have affected the

## What is already known on this topic

Animal facilitated therapy may help improve psychological disorders

## What this study adds

The biophilic method of intervention, which is based on a holistic approach through the interaction with animals in nature, and the stimulation of the nervous system through the senses, has the potential to bring alternative clinical strategies to the treatment of emotional disorders

Participants in both groups of the study (the animal care group and the outdoor nature group) reported lasting improvement of their symptoms

In patients with mild or moderate depression, using drugs or conventional psychotherapy may not be necessary when biophilic treatment with animals is used

results of the study—they also had a day session with the dolphins after the final evaluation. Because of logistical and financial limitations, we did not do a follow-up study; however, three months or more after the intervention, the 10 participants in the animal care programme and the three participants in the outdoor nature programme who had a score of no more than 7 on the Hamilton rating scale for depression at the end of treatment provided a self report about their mental health status. Nine of the 10 participants in the animal care programme and all three of the outdoor nature programme reported lasting improvement and did not require treatment.

## Conclusions

The biophilic method of intervention represents a new emphasis in psychiatry and has the potential to bring alternative clinical strategies to the treatment of emotional disorders. Psychiatric rehabilitation occurs, operating on the emotional, holistic, and psychophysical aspects of participants through the interaction with animals in nature and the stimulation of the nervous system through the senses.

We are thankful for the support given by the Tursiops Society Onlus and the advice and support given by Andrew Weil and Brian Becker of the University of Arizona, USA; Stephen Kellert of Yale University, USA; and Costantino Balestra of the Université Libre de Bruxelles, Belgium. We thank Yvonne Hartgers, Arnaldo Javier Montoya Stone, Aida Lagos, Hector Murcia Pinto for medical, psychological diagnosis and assistance; the research participants, the Psychiatric Hospital of Tegucigalpa and Roatan Hospital. We also thank the following for logistical support: Honduras Institute of Tourism; Universidad Nacional Autónoma de Honduras; Regione Piemonte, Italy; Anthony’s Key Resort; IGV Club; TGI Diving; International Dolphin Watch; Voice Magazine Bay Islands; G Antonioli Clothing, Turin, Italy.

Contributors: See bmj.com.

Funding: Voluntary contributions acknowledged above.

Competing interests: None declared.

Ethical approval: Bioethical committee of the scientific research unit of the Universidad Nacional Autónoma de Honduras, Faculty of Medical Sciences.

1 Kellert SR. *Kinship to mastery. Biophilia in human evolution and development*. Washington DC: Island Press, 1997:3-115.

- 2 Kellert SR, Wilson EO. *The biophilia hypothesis*. Washington DC: Island Press, 1993:180.
- 3 Fromm E. *The anatomy of human destructiveness*. New York: Holt, Rinehart & Winston:366.
- 4 Lorenz K. Die acht Todstünden der zivilisierten Menschheit. Munich: Piper, 1973:15-142.
- 5 Gelder M, Mayou R, Cowen P, eds. *Oxford textbook of psychiatry*. Oxford University Press, 1996:211-7.
- 6 World Health Organization. *The ICD-10 classification of mental and behavioural disorders: diagnostic criteria for research*. Geneva: WHO, 1993.
- 7 Hamilton M. Development of a rating scale for primary depressive illness. *Br J Soc Clin Psychol* 1976;6:278-96.
- 8 Zung WWK. A rating instrument for anxiety disorders. *Psychosomatics* 1971;12:371-9.
- 9 Beck AT, Ward CH, Mendelson M, Erbaugh J. An inventory of measuring depression. *Arch Gen Psychiatry* 1961;4:53-63.
- 10 American Psychiatric Association. Handbook of psychiatric measures. *Am J Psychiatry* 2000;515-89.
- 11 Ulrich RS, Simons RF, Losito BD, Fiorito E, Miles MA, Zelson M. Stress recovery during exposure to normal and urban environments. *J Environ Psychol* 1991;11:201-230.
- 12 Blehar MC, Rosenthal NE. Seasonal affective disorders and phototherapy: report of the National Institute of Mental Health-sponsored workshop. *Arch Gen Psychiatry* 1989;46:469-74.
- 13 Levine B. Use of hydrotherapy in reduction of anxiety. *Psychol Rep* 1984;55:526.

(Accepted 27 June 2005)

## Psychosocial effects of the 2001 UK foot and mouth disease epidemic in a rural population: qualitative diary based study

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BMJ 2005;331:1234-7

### Abstract

**Objectives** To understand the health and social consequences of the 2001 foot and mouth disease epidemic for a rural population.

**Design** Longitudinal qualitative analysis.

**Setting** North Cumbria, the worst affected area in Britain.

**Sample** Purposive sample of 54 respondents divided into six demographically balanced rural occupational and population groups.

**Main outcome measures** 3071 weekly diaries contributed over 18 months; 72 semistructured interviews (with the 54 diarists and 18 others); 12 group discussions with diarists

**Results** The disease epidemic was a human tragedy, not just an animal one. Respondents' reports showed that life after the foot and mouth disease epidemic was accompanied by distress, feelings of bereavement, fear of a new disaster, loss of trust in authority and systems of control, and the undermining of the value of local knowledge. Distress was experienced across diverse groups well beyond the farming community. Many of these effects continued to feature in the diaries throughout the 18 month period.

**Conclusions** The use of a rural citizens' panel allowed data capture from a wide spectrum of the rural population and showed that a greater number of workers and residents had traumatic experiences than has previously been reported. Recommendations for future disaster management include joint service reviews of what counts as a disaster, regular NHS and voluntary sector sharing of intelligence, debriefing and peer support for front line workers, increased community involvement in disposal site or disaster management, and wider, more flexible access to regeneration funding and rural health outreach work.

### Introduction

The United Kingdom's foot and mouth disease epidemic in 2001 has been described as the most serious to occur in a country previously free of the

disease.<sup>1 2</sup> Between 6.5 million and 10 million animals were slaughtered across the UK, and in north Cumbria 893 farms had confirmed infected cases, with a further 1934 having culls of livestock, representing 70% of farms.<sup>3 4</sup> Restrictions on public rights of way and advice to stay away from the countryside led to a collapse in tourist numbers and loss of recreational use of the landscape for a year.<sup>5</sup>


Crucially, because the epidemic was treated as an animal problem, it was held to be something affecting farmers, ignoring the large numbers of other occupations and residents drawn into the crisis. Healthcare services in north Cumbria and other severely affected areas did not record any significant increase in demand during the epidemic and subsequent months, which was taken to mean that the health and social effects of the disaster were not significant.


Voluntary local helplines and rural support groups, however, were besieged with appeals for help: "health" during the crisis was more about survival and practical support than medical interventions. This apparent contradiction called for a qualitative study that could capture evidence about the impact of the disaster and processes of recovery from "on the ground" accounts collected over time.

### Methods

#### Study design

This large qualitative ethnographic study recruited "lay experts" whose experiential contribution to knowledge is often overlooked. With the help of a multi-agency steering group (see [bmj.com](http://bmj.com)), we drew up a rural citizens' panel with a demographic and occupational sampling frame. The panel of 54 respondents was pur-

 Details of the study's multi-agency steering group, respondents, and development of the major analytical themes appear on [bmj.com](http://bmj.com)

 This is the abridged version of an article that was posted on [bmj.com](http://bmj.com) on 7 October 2005: <http://bmj.com/cgi/doi/10.1136/bmj.38603.375856.68>