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RESEARCH ARTICLE

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'Therapists in action'—Home treatment in adolescent anorexia nervosa: A stepped care approach to shorten inpatient treatment

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Abstract

Objective: It was the aim of this pilot study to apply a novel eating disorder (ED)-specific home treatment (HoT) to adolescents with anorexia nervosa (AN) and to investigate its feasibility, effects and safety.

Method: Twenty-two patients consecutively admitted to the hospital and fulfilling DSM-5 criteria for typical or atypical AN received HoT after 4–8 weeks of inpatient treatment. During the first two months of HoT, the patient and her family were visited on average three to four times per week, during the third and fourth months of HoT once or twice a week by a multi-professional team. Body mass index, ED and general psychopathology, quality of life and treatment satisfaction were assessed in the patients at admission, start and end of HoT and the 1-year follow-up as well as carers' skills and burden.

Results: The majority of patients successfully achieved target weight within HoT and maintained it successfully at the 1-year follow-up. ED and general psychopathology in the patients and carers' skills improved significantly associated with a high treatment satisfaction.

Conclusions: HoT seems to be a promising new tool to improve outcome in adolescent AN and to reduce time of hospitalisation. Larger randomised controlled trials are needed to generalise these results.

KEYWORDS
adolescence, anorexia nervosa, community-based treatment, home treatment, outcome

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Astrid Dempfle and Brigitte Dahmen contributed equally to this study.

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1 | INTRODUCTION

Anorexia nervosa (AN) is listed amongst the four most important psychiatric disorders of childhood and adolescence by the World Health Organization (WHO) (2005) 'with lifelong consequences'. In an observational study 20 years after inpatient treatment (IP), only 40% of patients fully recovered, whereas 16% followed an unremitting course (Fichter, Quadflieg, Crosby, & Koch, 2017). Although the recovery rate is significantly higher in adolescents than in adults (Steinhausen, 2002), a high proportion of young patients requires more than one hospitalisation (Steinhausen, Grigoroiu-Serbanescu, Boyadjieva, Neumärker, & Metzke, 2009). In a more recent study by Madden et al. (2015), over one third of the original sample had been readmitted to hospital independent of a shorter or longer prior hospital intervention at the 1-year follow-up.

Adolescents and children often experience hospital treatment as coercive, and they delay or refuse (re-) hospitalisation (Guarda et al., 2007). Moreover, although IP has long been seen as the 'gold standard' for moderately to severely ill patients (Herpertz-Dahlmann, 2017), there is some justified doubt whether it is more effective than other settings (Friedman et al., 2016; Hay et al., 2019). Long-lasting hospital stays contribute to the severe social impairment of patients with AN and add to delayed adolescent development (Treasure, Claudino, & Zucker, 2010). In addition, the financial burden is substantial. In an estimation of direct and indirect costs for the treatment of adult AN in Germany, the largest share of costs resulted from hospitalisation (Stuhldreher et al., 2015). Nevertheless, there are increasing admission rates in several European countries (Cruz et al., 2018; German Federal Statistics, 2019; Holland, Hall, Yeates, & Goldacre, 2016).

Recently, there have been several clinical trials to replace IP with day patient (DP) or outpatient treatment (for a review see Hay et al., 2019). Our team performed a large multi-centre randomised controlled trial (ANDI study) at five university hospitals and a major general hospital for child and adolescent psychiatry including 172 adolescents with AN. After 3 weeks of IP, patients were randomised to either continued IP or DP treatment. At the 1-year follow-up, we could show statistically significant non-inferiority in body mass index (BMI) after DP versus IP; at the 2.5-year follow-up, BMI was even significantly higher and readmissions in the DP arm were less frequent than in the IP arm. Nevertheless, 30% of the DP patients had to undergo a second hospitalisation (Herpertz-Dahlmann et al., 2014; Herpertz-Dahlmann & Dempfle, 2016). In outpatient treatment, the relapse rates are also quite high, even if parents are intensively involved, such as in family-based treatment (FBT). In a 4-year follow-up study, only 30% of patients with AN treated with FBT remained weight restored (Le Grange et al., 2014).

Highlights

- Home treatment after short inpatient stay is feasible and safe for adolescent patients with anorexia nervosa.
- The majority of patients successfully maintained a healthy body weight during a 1-year follow-up.
- Carers' skills to handle their child's eating disorder improved significantly.

In our previous study (Herpertz-Dahlmann et al., 2014) and others, several patients and their parents complained that the transition from hospital to home, either from IP or DP, was too difficult to manage and that they did not feel prepared. In a study about the needs of carers of patients with eating disorders (EDs), the most frequently reported need for support was 'counselling and support by a professional' (Graap et al., 2008). One of the key themes of the young patients and their carers was 'to enhance peer and family support' (Mitrofan et al., 2019).

Consequently, we were looking for a treatment method that would facilitate the transition from hospital to home and could offer more and direct support for patients, as well as for their carers, than previous therapeutic strategies. Moreover, it should assist reintegration of the adolescent patient with AN in everyday life. Models of community care and home treatment (HoT) have been established during recent years in order to reduce hospitalisation and optimise care and rehabilitation within the context of the family and immediate social environment (Sjølie, Karlsson, & Kim, 2010; WHO, 2005). A mobile child mental health service for previously hospitalised patients was proposed by the WHO as a model for more progressive services (WHO, 2005, p. 87). In a systematic review, HoT was judged to be effective in reducing the number of hospitalisations and showed better cost-effectiveness in psychiatric illness for adults, adolescents and children (Sjølie et al., 2010; Boege, Corpus, Schepker, Kilian, & Fegert, 2015). However, there are scarcely any studies that have investigated patients with AN within a sample of patients with various child and adolescent psychiatric disorders (Boege et al., 2015), although the need has been clearly realised (Hannon, Eunson, & Munro, 2017).

It was the aim of this pilot study to apply ED-specific HoT in adolescents with AN, who were all admitted to IP, to investigate its feasibility and to inform the hypotheses and design of larger research trials. The current study was intended to explore the effect of HoT after short IP on BMI, eating and general psychopathology and quality of life in the patients. In addition, we investigated treatment satisfaction in both patients and their carers at the end of IP and the end of HoT. Moreover, the impact of AN-specific HoT on carers' skills and burden was assessed.

2 | METHODOLOGY

2.1 | Study design

This is a single centre, nonrandomised open-label pilot study to evaluate the feasibility, effects and safety of a novel treatment method, 'HoT', on the outcome of adolescent patients with AN and their parents (comparable to a Phase IIa study in drug development) during an observation period of 1 year.

2.2 | Participants

All patients who were consecutively admitted for IP to our ED unit at a university hospital for child and adolescent psychiatry were screened for participation in this study (Figure 1). The decision to admit a patient to the hospital was independent of and made before inclusion in the study and based on the usual admission criteria (e.g., failure of outpatient treatment with insufficient weight gain, severe weight loss and somatic complications). There was a two-step inclusion process with an initial assessment of criteria at admission and a second assessment of final eligibility after 4 to 8 weeks of inpatient stabilisation, prior to the start of HoT.

Inclusion criteria at admission: A diagnosis of AN or atypical AN according to DSM-5, age ≥ 12 years and ≤ 18 years, first or second admission for AN, living with at least one carer within a commute of 60 min and informed consent/assent of carers and patients.

Exclusion criteria at admission: Organic brain disease, other severe psychiatric disorders such as psychotic or bipolar disorder, substance abuse, severe self-injurious behaviour, low intelligence (IQ ≤ 80), severe comorbid somatic disorder, insufficient knowledge of the German language or planned residential treatment.

Exclusion criteria for starting HoT after short IP stay for medical and psychological stabilisation: Persistent

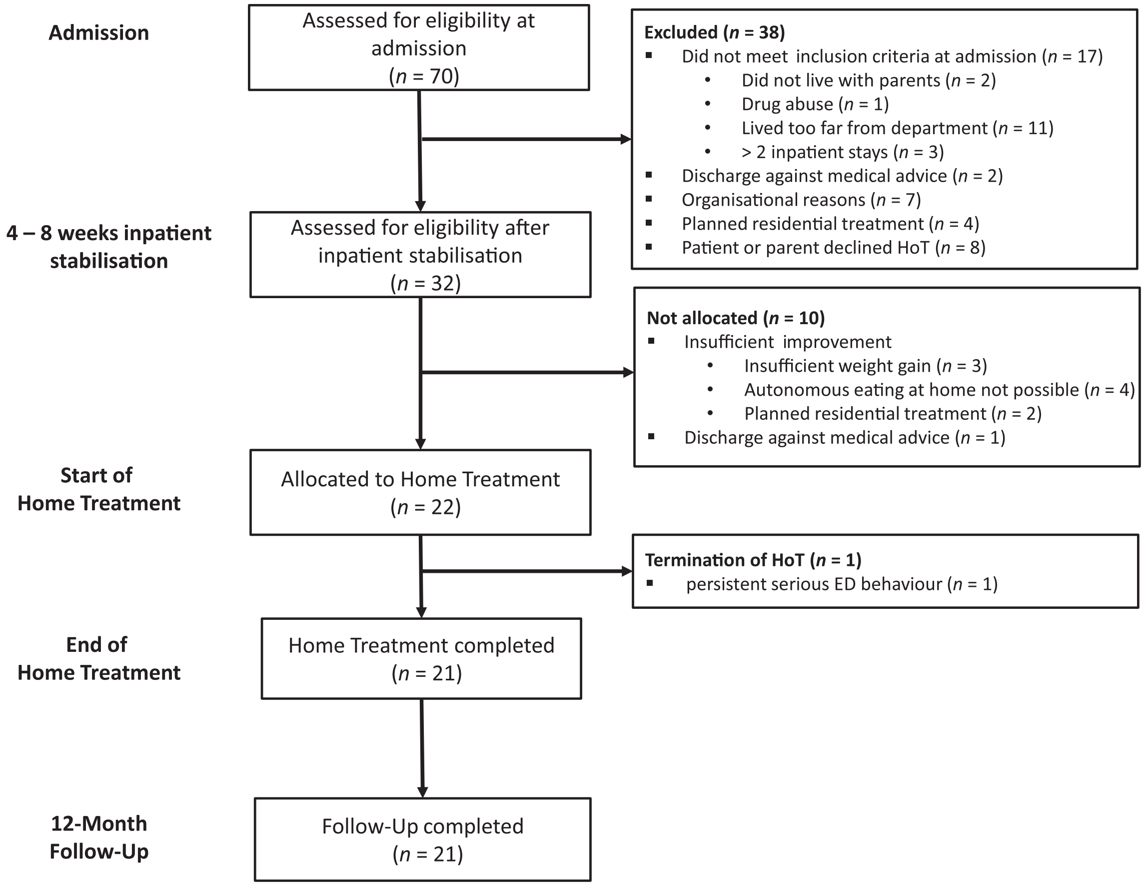

FIGURE 1 Participant flow diagram

severe ED behaviour, such as continued feeding with a nasogastric tube or daily purging, serious somatic or psychiatric comorbidity (e.g., suicidality or severe self-injurious behaviour) or insufficient weight gain (less than 1.5 kg in 4 weeks).

Criteria for premature termination of HoT and subsequent readmission: Severe medical complications of AN, vomiting or laxative abuse more than twice a day for more than a week, weight gain <1 kg over 3 weeks, refusal to eat, or suicidality diagnosed by an experienced child and adolescent psychiatrist.

The costs of HoT were paid by the German national health insurance system; so this treatment was open to any patient with AN covered by a German health insurance company who fulfilled the criteria mentioned above. It was agreed with the health insurance companies that hospital treatment was generally not allowed to exceed 8–9 weeks (otherwise the patient remained in IP).

The study was approved by the local ethics committee and undertaken according to the Declaration of Helsinki and Good Clinical Practice regulations with independent data management. Written informed consent was obtained by all patients and their parents. This trial was registered at the German Clinical Trials Register (DRKS00013075).

2.3 | Procedure

2.4 | Inpatient treatment

All patients received IP for medical surveillance, somatic and psychological stabilisation and improvement of eating behaviour. The minimum stay was determined to be 4 weeks, with a maximum stay of 8–9 weeks. All patients participated in a multidisciplinary treatment programme including weight restoration, nutritional counselling, individual and group psychotherapy based on enhanced cognitive therapy for adolescents (Dalle Grave, 2019) and a family-based approach consisting of a psychoeducation group for parents as well as separate parents' and conjoint family sessions. On average, patients had two individual sessions per week and a parents'/conjoint session every 2 weeks. Pharmacotherapy was added in some patients as appropriate: eight (36.4%) of the patients who were allocated to HoT received antidepressants (SSRIs) before or during IP and/or during HoT. Before the start of HoT, the patient and the family had to take part in family meals on the ward and to manage overnight stays during the weekend with all daily meals at home.

Patients' therapists were child and adolescent psychiatrists and psychologists experienced in the treatment of EDs. One aim during IP was to build up a therapeutic alliance of patients and carers with their therapists.

2.4.1 | HoT intervention

Target weight, defined as a BMI between the 25th and 30th age-adapted percentile, was determined before the start of HoT. The patient was weighed by one member of the team on a calibrated scale throughout HoT at least once a week.

During the first and second month of HoT, patients and their families were usually visited three to four times a week by a member of the multidisciplinary team, comprising an experienced nurse, a nutritional therapist, an occupational therapist and their individual therapist from IP (psychotherapist or child and adolescent psychiatrist). In the third and fourth month of HoT, the number of visits declined to two to one per week. Additionally, the participation in a group programme for adolescents with AN was part of the intervention. The weekly schedule for each individual family was agreed upon in advance on a weekly basis.

At the beginning of HoT, an individualised treatment plan was established. During the first 2 months, the focus of HoT was mostly on parental management of food intake and other ED symptoms to facilitate weight gain. In the third and fourth month, the focus changed to 'social rehabilitation' and 'autonomy' of the patient (e.g., exercising social skills and going back to usual adolescent activities such as participation in sports club and eating outside the home; note that nearly half of our patients suffered from social phobia).

All professions visited every patient throughout HoT at some treatment stage, but the frequency of the sessions of each profession depended on the individual needs of patients and families. The individual therapist visited the patient weekly. Before the beginning of treatment, carers had to confirm to attend at least one visit per week of the HoT team. Two experienced child and adolescent psychiatrists (B.H.D. and B.D.) conducted weekly supervision meetings with the whole multidisciplinary team.

After discharge from HoT, patients continued with outpatient treatment as usual (in most cases one psychotherapeutic session per week), which was not part of this study.

2.5 | Assessments and measures

The assessments took place at the following time points: after admission for IP, at start and end of HoT and at the 1-year follow-up (12 months after admission).

2.5.1 | Patients

The weight (in underwear) and height of the patients were measured, from which we calculated BMI, age-adjusted BMI percentiles and percentage of expected body weight (%EBW). EBW is the median age-adjusted BMI (50th BMI percentile), and %EBW is calculated as BMI/50th BMI percentile × 100, based on a large German reference set (KIGGS; Schaffrath Rosario, Kurth, Stolzenberg, Ellert, & Neuhauser, 2010).

ED-specific psychopathology was assessed using the Eating Disorder Examination (EDE; Fairburn & Cooper, 1993; validated for adults, adolescents and children from age 9; German version by Hilbert & Tuschen-Caffier, 2016) and the Eating Disorder Inventory-2 (EDI-2; Garner, 1991; German version by Paul & Thiel, 2005, recommended for children and adolescents ≥11 years of age).

All these ED assessment tools are well-known and have good psychometric properties (Micali & House, 2011).

Although the Morgan and Russell Average Outcome Score (MRAOS; Morgan & Hayward, 1988) is a rather traditional outcome instrument, we used it for a detailed assessment of outcome to be able to compare the present results with our previous stepped care/DP approach (see above; Herpertz-Dahlmann et al., 2014). The MRAOS consists of five domains that cover food intake and nutritional status, menstrual state, mental state, psychosexual adjustment and socioeconomic status, resulting in a dimensional score ranging from 0 to 12. Lower scores indicate a higher severity of the ED. The MRAOS is well-established and the most widely used outcome instrument in AN.

A standardised evaluation of comorbid psychiatric disorders was performed using the Mini-International Neuropsychiatric Interview for Children and Adolescents (German version by Plattner, Kindler, Bauer, & Steiner, 2003; Sheehan et al. 2010). The Beck Depression Inventory was used to assess depressive symptoms (BDI-II; German version: Hautzinger, Keller, & Kühner, 2006), which is a self-report questionnaire developed as an indicator for depressive symptoms from the age of 13.

Information on the patient's quality of life was obtained by using the Kidscreen-27 (Ravens-Sieberer et al., 2005; The Kidscreen Group Europe, 2006), both in carers and patients. The Kidscreen-27 assesses health-related quality of life across five dimensions: physical well-being (five items), psychological well-being (seven items), parent relations and autonomy (seven items), social support and peers (four items) and school environment (four items). It has been applied to children and their parents in numerous European countries. Standardised *T* scores were calculated based on published reference data of German girls aged 12–18 years (separate reference data for self-report and parental report).

The treatment satisfaction of the patients was assessed by the ZUF-8 (Schmidt & Nübling, 2002), which is a German questionnaire consisting of eight items with a four-point Likert scale including questions whether patients and carers received the treatment they wished, whether they would recommend this treatment to a friend, whether they would seek the institution's help again in a case with similar problems, whether the treatment met their needs and whether it improved the symptomatology of the disorder. The lower the average score of all items are, the higher the patients' treatment satisfaction.

2.5.2 | Carers

The carer who supported the child for most of the time was asked to fill out questionnaires regarding his/her behaviour towards and the impact of the child's ED symptoms on the parent' life. The assessment included the Accommodation and Enabling Scale for Eating Disorders (AESED; Sepulveda, Kyriacou, & Treasure, 2009), Eating Disorders Symptom Impact Scale (EDSIS; Sepulveda, Whitney, Hankins, & Treasure, 2008) and Caregiver Skills (CASK; Hibbs et al., 2015). All questionnaires were unpublished German versions. A bilingual clinical psychologist experienced in the treatment of EDs and a German-speaking native English speaker translated the original English version into German. The translated versions of the carers' questionnaires were then translated back. Any difference between both versions was discussed and resolved by consensus.

The AESED is a 33-item scale that measures carers' activities, which unintentionally support or fail to discourage the patient's ED-associated behaviour in five domains (avoidance and modifying routine, reassurance seeking, meal ritual, control of family and turning a blind eye) on a five-point Likert scale (range 0–4).

The EDSIS consists of 24 items using a five-point Likert-type scale (range 0–4) based on four factors (guilt, nutrition, dysregulated behaviour and social isolation) and was developed to assess the negative appraisal of specific caregiving aspects for a child with an ED and to monitor the effectiveness of family-based interventions.

The CASK is a 27-item self-report measure of caregiving behaviour towards patients with EDs based on six first-order subscales: bigger picture (referring to concerns about the capacity to accept potential changes), self-care, biting the tongue, insight and acceptance, emotional intelligence and frustration tolerance. Each of the items was scored on a visual analogue scale between 0 and 100. More adaptive caregiving behaviour corresponds to higher numbers. The mean scores of the items included in each subscale are then added up for the total score.

All the instruments described above were shown to be sensitive to change (Hibbs et al., 2015; Sepulveda et al., 2008; Sepulveda et al., 2009).

In addition, the carers' depression scores and satisfaction with treatment was assessed with the same instruments as in the patients (BDI II, ZUF-8).

2.6 | Statistical analysis

The statistical analysis of this study was mostly descriptive; for continuous variables, means and standard deviations (*SD*s; for symmetric distributions) or medians and interquartile ranges (for skewed distributions) are presented for all or subgroups of patients; for categorical variables, numbers and percentages are given. Statistical tests were performed to compare groups of patients (e.g., those allocated to HoT vs. those not eligible for HoT) by Fisher's exact test for categorical variables and the Mann–Whitney *U* test for continuous variables. For comparisons of the patients between assessment time points, appropriate tests for dependent samples (repeated-measures) were used: Friedman test for the overall comparison followed by Wilcoxon tests for comparisons between two time points (admission and start of HoT, start and end of HoT, end of HoT and follow-up, or admission and follow-up). McNemar test was used for binary variables (psychiatric comorbidities). A *p* value below .05 was considered as significant.

3 | RESULTS

3.1 | Patients

3.1.1 | Participant flow

Figure 1 shows the flow diagram of this study. More than half of the patients admitted for IP could not be included in this study, because they did not fulfil initial inclusion criteria or because of organisational reasons (Figure 1). The majority of carers or patients who declined participation did so when this treatment option was first introduced in the department. Similar to our previous ANDI study (Herpertz-Dahlmann et al., 2014), these patients and their carers were afraid of the experimental design, and after the first patients had successfully finished HoT, there were only few refusals.

3.1.2 | Demographic and clinical characteristics

Table 1 presents the demographic and clinical characteristics of the patients who entered HoT ($n = 22$) and of those who could not change into HoT in the second step of the inclusion process ($n = 10$). Nineteen of those who entered HoT (86.4%) and all but one of those who did not (10%) had been treated as outpatients. Two of the remaining four had been directly admitted from a paediatric ward, two had been admitted because of somatic sequels of severe weight loss in very short time. The mean BMI of the 19 patients with *typical* AN at admission was 16.06 (*SD* 1.11) corresponding to a BMI percentile of 2.28 (*SD* 2.84) and %EWB of 76.84 (*SD* 4.23). All patients still went to school and lived with their parents.

Patients who were not successfully stabilised for HoT had a very similar BMI at admission compared with those who were allocated to HoT and had a similar duration of illness. However, they were significantly older, tended to have more ED symptoms (higher EDE global score), and a higher number had comorbid obsessive–compulsive disorder (OCD; see Table 1).

3.2 | Treatment implementation

For those patients allocated to HoT, the average duration of IP was 7.6 weeks (*SD* 0.9), whereas the average duration of HoT was 15.5 weeks (*SD* 1.2). During the first month, patients were seen on average 4.4 times per week (*SD* 0.7), during the second month 4.7 times per week (*SD* 0.9), the third month 3.7 times per week (*SD* 0.9) and the fourth month 2.4 times per week (*SD* 1.2). Usually, at least one individual therapeutic visit and one parent or family session per week took place.

3.3 | Clinical outcome

3.3.1 | Safety, readmissions and termination of HoT

Three out of 22 patients allocated to HoT (13.6%) had to be readmitted during HoT for a short hospital intervention (1–6 days) because of insufficient weight gain or severe familial conflicts, and all continued HoT afterwards and completed it as planned. In one further patient (4.6%), HoT had to be terminated prematurely because of persistent severe ED symptoms and weight loss. During HoT, one patient (4.5%) showed severe self-injurious behaviour, which was taken care of in the HoT setting without hospitalisation.

TABLE 1 Demographic and clinical characteristics of adolescent patients with AN allocated and not allocated to HoT

Patients' characteristics at admission	HoT, $n = 22$ n (%) or mean (SD), min, max	Non-HoT, $n = 10$ n (%) or mean (SD), min, max	p value
Age (years)	15.06 (1.15), 13.17, 17.03	16.33 (1.13), 14.69, 17.90	.009
Gender (female)	22 (100.0)	10 (100.0)	1.000
Body mass index			
At admission (T1), (kg/m^2)	16.25 (1.15), 14.74, 18.61	16.20 (1.82), 12.93, 18.93	.889
At admission (T1), percentile	3.61 (4.36), 0.01, 14.31	2.80 (3.68), 0.00, 9.79	.235
At admission (T1), EBW [%]	77.99 (4.94), 68.97, 86.52	75.54 (7.90), 62.70, 86.24	.345
AN subtype			
Restrictive type	22 (100.0)	10 (100.0)	1.000
Atypical AN (DSM-5 criteria)	3 (13.6)	1 (10.0)	1.000
Number of inpatient treatments (incl. Current)			.218
1	18 (81.8)	6 (60.0)	
2	4 (18.2)	4 (40.0)	
Duration of illness (weeks)	50.82 (30.75), 3.57, 111.57	54.93 (30.77), 4.86, 100.14	.646
Current family situation			1.000
Living with both parents	20 (90.9)	9 (90.0)	
Living with one parent/patchwork family	2 (9.1)	1 (10.0)	
EDE, global score	4.04 (1.05), 2.28, 5.92	4.88 (0.79), 3.53, 5.70	.052
Psychiatric comorbidities			
At least one comorbidity	18 (81.8)	9 (90.0)	.656
Affective disorder	17 (77.3)	10 (100.0)	.155
Anxiety disorder	10 (45.5)	6 (60.0)	.704
Obsessive compulsive disorder	0 (0.0)	5 (50.0)	.001
Other	3 (13.6)	1 (10.0)	1.000

Note: p values for comparisons between groups (Fisher's exact test or Mann–Whitney U test).
Abbreviations: AN, anorexia nervosa; EBW, expected body weight; EDE, eating disorder examination; HoT, home treatment.

Thus, there were no serious adverse events.

During the 1-year follow-up, two patients (9.5%) relapsed after regular termination of HoT ($n = 21$) and had to be readmitted to the hospital.

4 | PATIENTS

4.1 | Body mass index

Figure 2 depicts the course of BMI at the time points outlined above; there was a significant difference between time points ($p < .001$). The highest weight gain was achieved between admission and beginning of HoT ($p < .001$). Weight continued to increase during HoT ($p < .001$). Between the end of HoT and the 1-year follow-up, weight gain was maintained ($p = .64$).

To evaluate the feasibility of HoT in comparison to DP in terms of weight development, the mean BMI of the DP arm of our previous study (ANDI; Herpertz-Dahlmann et al., 2014) is also depicted.

4.2 | ED symptoms

The change of ED scores from baseline until the 1-year follow-up is shown in Table 2.

There was a significant improvement in both EDE and EDI scores (overall $p = .002$ for EDI across time points); the largest change took place between admission and the end of HoT, with an important decline in EDI scores both between admission and start of HoT ($p = .05$) and during HoT ($p = .03$). Between the end of HoT and the 1-year follow-up, this improvement was maintained ($p = .06$ for EDI).

4.3 | Morgan and Russell average outcome scales

The most remarkable increase in total score and all subscales of the MRAOS occurred between admission and the end of HoT, with another minor increase between the end of HoT and the 1-year follow-up (Table 2).

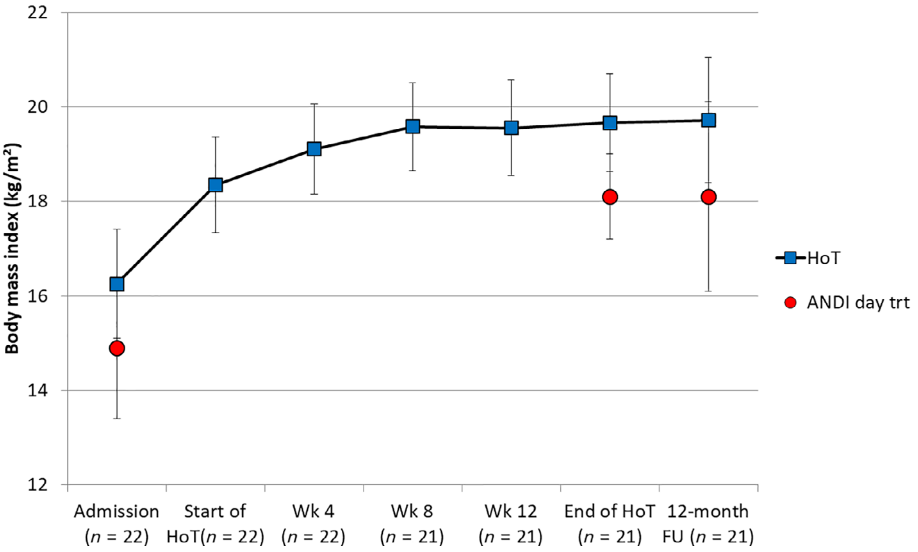

FIGURE 2 Development of patients' BMI from admission to the 1-year follow-up. Blue square symbols: HoT pilot study; red circle symbols: day treatment arm of ANDI study (Herpertz-Dahlmann et al., 2014). Symbols are mean values, and error bars denote standard deviations. BMI, body mass index; HoT, home treatment

4.4 | Menstruation

Most of the patients had resumed menses; also all three patients on contraceptives at the 1-year follow-up had resumed menses before. More than half of the patients had experienced more than three regular cycles within the 1-year follow-up (Table 2).

4.5 | General psychopathology

At discharge from HoT and the 1-year follow-up, the prevalence of psychiatric comorbidities had significantly declined, especially the prevalence of affective disorders.

Accordingly, the depression scores of patients continuously went down (overall $p = .001$ between all time points), with a sharp decline between admission and the beginning of HoT ($p = .008$) and a further decrease during HoT ($p = .04$) which was maintained until follow-up ($p = .77$; Table 2).

5 | CARERS

5.1 | Psychological outcomes

Although mothers (only one father took part in the assessments) had, on average, only slightly elevated BDI scores at admission, which at the most could be interpreted as mild depression, they demonstrated an impressive decrease of symptoms with the largest reduction between admission and the end of HoT and stabilisation during follow-up (Table 3).

5.2 | Carers' skills and burden

Most measurements assessing the negative impact of the patient's disorder on the carers demonstrated a marked improvement. The mothers (and one father) showed significantly less accommodation of ED symptoms in their children demonstrated by a decline in the AESED scores, lower levels of general and specific caregiving difficulties (decreasing EDSIS scores) and slightly improved skills in handling their child with an ED (increasing CASK scores without statistical significance). The most important change took place between admission and the end of HoT (Table 3).

6 | CARERS AND PATIENTS

6.1 | Health-related quality of life

There was a significant improvement in the patients' quality of life, especially in the domains of physical and psychological well-being (Table 4).

6.2 | Treatment satisfaction

Treatment satisfaction was a little bit more pronounced in carers versus patients, but nevertheless, high in both groups at the end of IP and of HoT.

6.3 | Costs

The direct costs of 17 weeks of IP usually practiced for adolescent AN in Germany (Jaite et al., 2019) were

TABLE 2 Development of patients' ED psychopathology during the two treatment phases and at the 1-year follow-up

Patients' characteristics	Admission *n* = 22 *n* (%) or mean (*SD*); min; max	Start of home treatment *n* = 21 *n* (%) or mean (*SD*); min; max	End of home treatment *n* = 21 *n* (%) or mean (*SD*); min; max	One-year follow-up *n* = 21 *n* (%) or mean (*SD*); min; max	*p* value (admission vs. FU)
BMI	16.26 (1.15); 14.74; 18.61	18.35 (1.01); 16.78; 20.29	19.66 (1.03); 17.57; 21.15	19.72 (1.32); 17.09; 21.91	<.001
BMI percentile	3.61(4.36); 0.01; 14.31	17.29 (10.56); 2.38; 41.06	31.19 (10.17); 12.18; 44.77	28.96 (14.98); 3.87; 62.30	<.001
%EBW	77.99 (4.94); 68.98; 86.52	87.68 (4.40); 79.91; 96.70	93.28 (3.76); 86.71; 98.14	92.52 (5.72); 80.77; 105.15	<.001
EDE, global score	4.04 (1.05); 2.28; 5.92	—	1.72 (1.01); 0.31; 3.65	1.53 (1.15); 0.03; 4.50	<.001
Restraint	4.19 (1.24); 1.80; 6.00	—	0.88 (1.08); 0.00; 4.00	0.90 (1.23); 0.00; 4.20	
Eating concern	3.20 (1.34); 1.20; 6.00	—	1.11 (1.13); 0.00; 4.00	0.91 (0.88); 0.00; 2.60	
Weight concern	4.22 (1.45); 1.00; 6.00	—	1.95 (1.26); 0.00; 5.00	1.79 (1.43); 0.00; 5.80	
Shape concern	4.56 (0.92); 3.13; 5.88	—	2.95 (1.35); 0.75; 5.63	2.50 (1.44); 0.13; 6.00	
EDI-2, global score	280.68 (53.21); 149.00; 387.00	261.71 (57.37); 148.00; 352.00	244.90 (52.91); 169.00; 334.00	222.43 (52.23); 128.00; 295.00	.005
BDI-II, sum score	21.50 (11.25); 1.00; 37.00	14.95 (11.14); 0.00; 35.00	11.00 (9.70); 0.00; 32.00	10.29 (9.71); 0.00; 44.00	.003
Psychiatric comorbidities					
At least one comorbidity	18 (81.8)	—	14 (66.7)	12 (57.1)	.031
Affective disorder	15 (68.2)	—	6 (28.6)	7 (33.3)	
Anxiety disorder	9 (42.9)	—	7 (33.3)	3 (14.3)	
Obsessive compulsive disorder	0 (0.0)	—	2 (9.5)	1 (4.8)	
Other	2 (9.5)	—	3 (14.3)	3 (14.3)	
Morgan–Russell, global score	4.28 (1.39); 1.48; 7.48	—	7.97 (1.67); 3.13; 10.04	8.72 (1.60); 5.14; 10.91	<.001
Food intake	2.33 (1.38); 0.00; 4.33	—	8.56 (2.15); 1.67; 11.33	9.36 (1.74); 5.33; 11.67	
Menstrual state	2.68 (3.34); 0.00; 12.00	—	6.05 (4.09); 0.00; 12.00	7.52 (5.06); 0.00; 12.00	
Mental state	4.77 (1.45); 2.00; 8.00	—	8.05 (2.29); 4.00; 12.00	7.86 (1.85); 5.00; 12.00	
Psychosexual adjustment	5.79 (2.56); 1.25; 10.75	—	8.31 (2.53); 4.00; 12.00	9.76 (2.63); 3.75; 12.00	
Socioeconomic status	5.84 (1.93); 2.20; 8.80	—	8.88 (1.68); 5.60; 11.40	9.10 (1.89); 4.80; 11.60	
Menstruation in the last 3 months					<.001
More than three regular cycles	1 (4.5)		8 (38.1)	7 (33.3)	
Irregular	4 (18.2)		7 (33.3)	6 (28.6)	
Amenorrhea	17 (77.3)		6 (28.6)	4 (19.0)	
Oral contraceptive use	0 (0.0)		0 (0.0)	4 (19.0)	

Note: p values for comparisons between admission and follow-up time points (Wilcoxon or McNemar test for dependent samples).
Abbreviations: BDI, Beck depression inventory; BMI, body mass index; EBW, expected body weight; ED, eating disorder; EDE, eating disorder examination; FU, follow-up.

TABLE 3 Development of parents' characteristics and skills during treatment and at the 12-month follow-up

Parents' characteristics	Admission $n = 22$ Mean (*SD*); min; max	End of home treatment $n = 21$ Mean (*SD*); min; max	One-year follow-up $n = 21$ Mean (*SD*); min; max	*p* value (admission vs. FU)
BDI-II, adult version, sum score	12.45 (8.18); 0.00; 38.00	7.76 (7.13); 0.00; 25.00	5.85 (5.38); 0.00; 18.00	<.001
EDSIS, global score	57.45 (13.58); 33.00; 85.00	41.76 (11.46); 28.00; 63.00	39.00 (13.31); 25.00; 71.00	<.001
CASK, total score	198.64 (26.34); 136.00; 244.00	204.52 (27.19); 128.00; 266.00	207.00 (33.56); 124.00; 261.00	.188
AESED, overall score	39.32 (17.34); 4.00; 67.00	28.14 (15.49); 4.00; 80.00	24.76 (18.83); 5.00; 86.00	.021

Note: The AESED total scale has a range from 0 to 132, and a higher score is associated with higher family accommodation to eating disorder symptoms. The EDSIS total scale has a range from 0 to 96, and a higher score means more negative appraisals on specific aspects of caregiving. The CASK scale ranges from 0 to 600. The raw scores for each of the six CASK domains are obtained as the mean score of the items included in each subscale, and higher scores mean better coping with the child's ED. *p* values for comparisons between admission and follow-up time points (Wilcoxon test for dependent samples).

Abbreviations: AESED, Accommodation and Enabling Scale for Eating Disorders; BDI, Beck depression inventory; CASK, Caregiver Skills; ED, eating disorder; EDSIS, Eating Disorders Symptom Impact Scale; FU, follow-up.

compared with the health care insurance costs for the sum of the average duration of IP (7.6 weeks) and HoT (15.5 weeks) in this study. At the study site, health care insurance costs for 17 weeks of full-time hospital treatment were approximately 56.000 €, whereas the stepped care approach amounted to approximately 41.000 €, which is about 25% lower.

7 | DISCUSSION

This was a pilot study to examine the feasibility and acceptability of HoT in adolescent patients with AN after a comparatively short IP stay and to estimate the potential size of improvements in both patients' and carers' physical and psychological well-being. To our knowledge, this is the first investigation that systematically explored the impact of HoT on the course of AN for 1 year after medical and psychological stabilisation in this age group. Although the results of a pilot study are not at all equivalent to those of an RCT, we tried to contrast the results with those of our DP study (ANDI; Herpertz-Dahlmann et al., 2014, see above) to get an impression of the effectiveness of HoT in comparison to a more intensive treatment strategy.

In terms of the effectiveness of this novel intervention, the majority of patients successfully gained weight and maintained their target weight until the 1-year follow-up. Moreover, after a regular termination of HoT, there were only few readmissions to the hospital. Hospital stays were much shorter than the average stay of 17 weeks for children and adolescents with AN in Germany (Jaite et al., 2019) and thus associated with lower costs. ED symptoms and general psychopathology improved considerably during HoT and stabilised thereafter. Moreover, carers' skills to handle their child's ED increased, and caregiving burden declined significantly. Both carers and patients reported high treatment satisfaction, and patients experienced a notable amelioration of their health-related quality of life. Moreover, with this stepped care approach, we had no relevant safety problems. Discussions with the professional team revealed that, after some time of adaptation, this new treatment method was experienced as well-feasible, and the interaction with the patient and her family as more gratifying than in IP. Moreover, the team members appreciated to be more aware of the patients' and parents' needs in everyday life associated with AN and thus being able to provide a more effective coaching. However, every team member volunteered to take part in this new treatment approach and was highly motivated. More detailed studies are necessary to assess the effect of HoT on a 'typical' health care team.

Previous reports analysed the effectiveness of HoT in children and adolescents with different mental health disorders (Lamb, 2009; Boege et al., 2015; Ougrin, Zundel, Corrigall, Padmore, & Loh,2013), which was mostly found to be similar to IP. However, with the exception of the trial by Boege et al. (2015), who included five patients with AN after discharge from the hospital, HoT has not been applied to this patient group.

There are significant differences in health care systems, and hence, in availability and accessibility of treatment options for patients with AN, which have an important impact on research questions and clinical trials. IP is often preferred in central European countries in contrast to outpatient services in the United Kingdom or the United States (Brockmeyer, Friederich & Schmidt, 2018). Nevertheless, we think that our findings are relevant across different health care systems.

TABLE 4 Patients' quality of life and parents' and patients' satisfaction with treatment

	Admission **$n = 22$** **n (%) or mean (*SD*); min; max**	**Start of home treatment** **$n = 21$** **n (%) or mean (*SD*); min; max**	**End of home treatment** **$n = 21$** **n (%) or mean (*SD*); min; max**	**12-month follow-up** **$n = 21$** **n (%) or mean (*SD*); min; max**	***p* value (admission vs. FU)**
KIDSCREEN, self-rating					
Physical well-being	30.04 (10.75); 8.70; 48.30	—	44.27 (9.32); 24.60; 61.90	47.82 (11.51); 21.20; 65.20	<.001
Psychological well-being	29.05 (17.46); 3.00; 65.20	—	40.16 (12.27); 3.00; 58.30	44.67 (13.76); 3.00; 65.20	.010
Parent relations and autonomy	52.34 (7.85); 37.60; 63.70	—	53.77 (7.82); 39.80; 63.70	56.56 (8.75); 33.30; 63.70	.023
Social support and peers	41.95 (11.86); 16.20; 58.40	—	46.19 (8.22); 30.30; 61.90	51.54 (11.47); 12.70; 61.90	.008
School environment	50.14 (9.61); 31.50; 67.20	—	54.60 (8.49); 31.50; 67.20	56.48 (10.68); 31.50; 67.20	.078
KIDSCREEN, parental rating		—			
Physical well-being	28.81 (10.31); 11.00; 48.10	—	42.20 (12.54); 21.10; 61.60	46.37 (11.32); 21.10; 65.00	<.001
Psychological well-being	20.44 (13.89); 2.00; 48.00	—	37.90 (13.46); 12.50; 59.90	41.84 (14.69); 12.50; 68.80	<.001
Parent relations and autonomy	46.73 (12.55); 3.00; 61.30	—	47.63 (13.10); 3.00; 67.40	51.43 (8.42); 36.90; 64.40	.102
Social support and peers	36.21 (14.64); 3.00; 52.60	—	45.22 (15.59); 3.00; 64.30	45.04 (14.51); 3.00; 68.20	.080
School environment	44.77 (14.25); 3.00; 64.40	—	51.59 (16.68); 3.00; 68.30	55.36 (10.92); 28.60; 68.30	.007
ZUF-8, patients	—	1.77 (0.39); 1.25; 2.63	1.64 (0.41); 1.00; 2.38	—	
ZUF-8, parents	—	1.36 (0.38); 1.00; 2.50	1.44 (0.42); 1.00; 2.50	—	

Note: *T* scores with mean of 50 and *SD* of 10 in a German female reference population 12 to 18 years of age. Higher values indicate better quality of life. *p* values for comparisons between the admission and follow-up time points (Wilcoxon test for dependent samples).

There has been a significant increase in demand for intensive treatment of AN in the United Kingdom (e.g., Holland et al., 2016) and other European countries (Cruz et al., 2018; German Federal Statistics, 2019). The rates of hospital admissions for AN are still on the rise, which stands in sharp contrast to other mental disorders such as schizophrenia, bipolar disorder and depression (Green & Griffiths, 2014). Most importantly, Beat, the UK's leading charity for those affected by EDs, has called on the National Health Service to develop new models of 'intensive care and home-based treatment' (Beat, 2019). In the United States, residential programme growth rates have increased dramatically over the last decades with very long durations of stay (Frisch, Herzog, & Franko, 2006; Attia, Blackwood, Guarda, Marcus, & Rothman, 2016; https://www.nytimes.com/2016/03/15/health/eating-disorders-anorexia-bulimia-treatment-centers.html, retrieved January 1, 2020). However, there is insufficient evidence which treatment setting is superior for treating patients with moderately severe AN (Hay et al., 2019).

In our sample, patients with *typical* AN according to the criteria of DSM-5 had a similar BMI percentile and %EBW at admission to the patients in the DP arm of our previous ANDI study (mean BMI percentile: 1.8; mean %EBW: 74.4, Herpertz-Dahlmann et al., 2014) and to the inpatients in the study by Madden et al. (2015) hospitalised for medical stabilisation or weight restoration (mean %EBW: 78.3). Moreover, the weight data of our patients at the beginning of hospital treatment corresponded to the mean admission BMI of a representative sample of inpatients in Germany (Bühren et al., 2017). The average absolute BMI and the BMI percentile in our sample (atypical and typical) were slightly lower than in the outpatient treatment sample of the study by Hodsoll et al. (2017; mean absolute BMI: 16.9) and in the investigation by Lock et al. (2010; mean BMI percentile: 6.2). Severity of ED symptoms measured by the EDE global score was higher than in the latter study (Lock et al., 2010; values between 1.5 and 2.1) or Madden et al. (2015; mean global EDE score: 3.07). In addition, EDI scores were slightly higher in the current trial than in the DP arm of the ANDI study (Herpertz-Dahlmann et al., 2014; mean global EDI score: 249). Thus, the severity of AN in our HoT sample was comparable to other treatment trials in adolescents with AN either in IP, DP or outpatient setting.

At the end of HoT and 1-year follow-up, BMI and %EBW had increased significantly. BMI and %EBW were a bit higher than at the 1-year follow-up of the ANDI-study; change in %EBW was comparable to the Madden et al. (2015) study (14.43 vs. 16.70 in the Australian sample). In relation to outpatient treatment, they were similar to the data by Lock et al. (2010); in our study BMI at admission had been slightly lower; hence weight gain somewhat higher. However, it is difficult to compare our study to so-called 'outpatient' studies, because a varying number of their participants undergo IP during the study phase (e.g., Lock et al., 2010). In addition to the changes in BMI and %EBW, ED symptoms improved substantially during treatment, with major changes between admission and the end of HoT. At the 1-year follow-up, patients had very similar MRAOS scores to the DPs of the ANDI trial, which were already more ameliorated than at the 1-year follow-up of adolescent inpatients and outpatients in the study by Gowers et al. (2007). Moreover, they showed at least a similar improvement of their ED symptoms, as documented by lower EDI-2 global scores as compared with the ANDI trial. Changes in EDE at the 1-year follow-up were more pronounced than in the Madden study. However, note that the maintenance of symptom reduction seems to be especially important after the end of treatment, because the probability of a relapse seems to be lower in patients who do not present for rehospitalisation within the first year after discharge (Avnon et al., 2018).

In contrast to studies with adult patients, the impact of the child's ED on carers in our adolescent group was more severe demonstrated by the results of several instruments assessing caregiver′s burden (Sepulveda et al., 2008, 2012) in our study. However, carers of younger patients are probably more involved in the supervision of their child (e.g., in providing meals and direct support with the consequence of more fear and social isolation, Hodsoll et al., 2017). Moreover, in the phase of onset of AN, questions of guilt might be of greater relevance than in parents of patients with a longer duration of illness, which has also been demonstrated in previous studies (Priestley & McPherson, 2016). However, the intensive involvement of carers during HoT was rewarded with a significant improvement in parents' skills and well-being. At the 1-year follow-up, the carers in our study scored in a similar range on the EDSIS, as carers of adults after special training to improve their coping strategies and attitudes towards their child with an ED (Sepulveda et al., 2008).

In our opinion, there are two important mechanisms that might contribute to the effectiveness of HoT. First, several years ago Schmidt and Treasure (2006) developed the so-called 'cognitive interpersonal maintenance model' comprising cognitive, socioemotional and interpersonal factors, which both cause and maintain EDs. The interpersonal element of this model implies that the responses of carers towards their child's illness may unintentionally contribute to the perpetuation of the illness. At an early stage of the illness (as in our study), interventions targeting the interpersonal components and enhancing the caregiver's coping strategies to manage the illness might be especially helpful to improve the outcomes of adolescent AN. In addition and complimentary to the family involvement, which is required in all models of care in juvenile AN and a characteristic feature of FBT or systemic family therapy, HoT includes practical instructions for the family members. Those comprise, amongst other things, accompanying family meals, support in adequate food choices, assistance to siblings to deal with the sister's ED and help in medical and youth welfare service affairs. These might be important adjuncts to mainly dialogue-oriented strategies. Moreover, many difficulties of our families in dealing with an eating disordered child were not realised and reported by family members and became only apparent in the home environment.

Second, in comparison to IP and DP, HoT might be more effective to prevent a chronic course of AN, because it probably inhibits the formation of ED habits in the patient's home environment at a very early time point of the illness process. Walsh, Steinglass and their group (Uniacke, Walsh, Foerde, & Steinglass, 2018) have pointed out that habit-related neural circuits may play a major role in the development of a full-blown ED. Habit strength measured in different tasks was a significant predictor for the severity of food restriction and ED-related functional impairment (Coniglio et al., 2017; Uniacke et al., 2018). Professionals experienced in the treatment of adolescent AN may help patients and carers with this new family-centred intervention to interrupt rigid restrictive food intake and other behaviours typically associated with AN, before they become 'automatic' and resistant to change.

In line with our expectation, HoT is not appropriate for all adolescent patients with AN. About one third of the original patients could not be admitted to this treatment setting. Those patients were characterised by a higher age, more severe ED symptoms as recorded in the EDE and a higher comorbidity with other mental disorders. Comorbidity with OCD was especially associated with exclusion from HoT. Thus, patients with more complex forms of AN might not benefit from a home-based treatment approach.

This study has several limitations that should be noted.

First, we did not assess all measures again at the beginning of HoT, so that we cannot always differentiate between the effect of IP and that of HoT. However, those which were assessed (BMI, EDI and BDI) showed a significant change between beginning and end of HoT. Second, the power and informative value of this pilot study are limited by the small sample size and the lack of a randomised control group. Thus, comparisons with well-powered trials, such as the ANDI study or the study by Madden et al. (2015), are of limited value. Larger randomised trials at several sites are necessary to generalise these results for a broader group of patients and to confirm the efficacy of this treatment strategy compared with usual treatment (IP or DP) for adolescents with AN. However, there are important strengths in this study such as the participation of patients *and* their parents, a follow-up 1 year after admission and practically no drop outs.

In conclusion, IP often creates a feeling of being detached from the outside world and from normality, preventing adolescents' autonomy and participation in everyday life, which might in turn lead to withdrawal and recurring re-hospitalisations (Bezance & Holliday, 2013). Moreover, the patients' parents often feel guilty and discouraged to cope with the illness of their child.

HoT is probably a new option to make our patients feel more empowered and responsible for their own recovery with the support of their parents, who are equipped with better knowledge and skills to manage their child's ED.

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CONFLICT OF INTEREST

B.H.-D. reports receiving a speaker's fee from Ferring for a disease state presentation. The other authors declare no potential conflict of interest.

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