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Home treatment for acute mental healthcare: randomised controlled trial

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Background

Home treatment has been proposed as an alternative to acute in-patient care for mentally ill patients. However, there is only moderate evidence in support of home treatment.

Aims

To test whether and to what degree home treatment services would enable a reduction (substitution) of hospital use.

Method

A total of 707 consecutively admitted adult patients with a broad spectrum of mental disorders (ICD-10: F2–F6, F8–F9, Z) experiencing crises that necessitated immediate admission to hospital, were randomly allocated to either a service model including a home treatment alternative to hospital care (experimental group) or a conventional service model that lacked a home treatment alternative to in-patient care (control group) (trial registration at ClinicalTrials.gov: NCT02322437).

Results

The mean number of hospital days per patient within 24 months after the index crisis necessitating hospital admission (primary outcome) was reduced by 30.4% (mean 41.3 *v.* 59.3, $P<0.001$) when a home treatment team was available (intention-to-treat analysis). Regarding secondary outcomes, average overall treatment duration (hospital days + home treatment days) per patient (mean 50.4 *v.* 59.3, $P = 0.969$) and mean number of hospital admissions per patient (mean 1.86 *v.* 1.93, $P = 0.885$) did not differ statistically significantly between the experimental and control groups within 24 months after the index crisis. There were no significant between-group differences regarding clinical and social outcomes (Health of the Nation Outcome Scales: mean 9.9 *v.* 9.7, $P = 0.652$) or patient satisfaction with care (Perception of Care questionnaire: mean 0.78 *v.* 0.80, $P = 0.242$).

Conclusions

Home treatment services can reduce hospital use among severely ill patients in acute crises and seem to result in comparable clinical/social outcomes and patient satisfaction as standard in-patient care.

Declaration of interest

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Keywords

Mental health services; outreach services; in-patient-equivalent treatment; acute treatment.

Home treatment has been proposed as an alternative to acute care on hospital wards for mentally ill patients.[1–3] Mobile and multiprofessional home treatment teams are available around the clock to provide intensive care in the patient's domestic environment, whenever feasible. Such teams may visit patients several times daily. However, their interventions are restricted to acute crises and should not exceed the length of an otherwise indicated hospital stay (typically days or weeks). Unlike other outreach services, such as assertive community treatment or community mental health teams, which provide continuing care for mentally ill patients, intensive home treatment targets patients in episodes of acute crisis. From a clinical perspective, home treatment is intended to be more acceptable to certain patients than hospital admission and may provide better opportunities to address social factors potentially contributing to many crises.[1]

Crisis resolution and home treatment teams have been widely implemented in various mental health systems worldwide.[4–6] However, evidence to support their effectiveness has remained moderate. A recent review identified only eight relatively small randomised controlled studies on crisis resolution/home treatment teams (total $n = 1144$) and found evidence for effects in the main outcomes of interest to be of low to moderate quality.[7] Five of these studies[8–12] were older than 25 years and thus provide little guidance for home treatment services in current mental health systems. In two more recently performed studies, crisis resolution (intervention) teams did not treat patients at home but in home-like acute residential facilities[13] or crisis houses.[14] The last study mentioned in the review examined crisis resolution teams that not only treated patients with an immediate need for hospital admission but also included patients not necessarily requiring admission to hospital (this conclusion was suggested by approximately 30% of the controls not being admitted).[15] If the home treatment approach is to be widely implemented as an 'in-patient-equivalent' alternative to acute hospital care, additional evaluative studies are required.[7,16] To the best of our knowledge, however, no randomised controlled trial has evaluated home treatment services in the context of a contemporary mental healthcare system for a broad spectrum of adult general psychiatry patients who would otherwise have been treated on a hospital ward without exception.

Method

In this pragmatic randomised controlled trial (trail registration at ClinicalTrials.gov: NCT02322437), we tested whether involvement of a home treatment team in patient care would result in fewer hospital bed days within 24 months of the index crisis that originally led to the need for immediate hospital admission (primary outcome). As in previous research,[7] the substitution of hospital bed days was considered the most crucial outcome with regard to mental health services planning and organisation. Secondary outcomes were the number of admissions per patient within 24 months after the index crisis, clinical and social outcomes, patient satisfaction with care and direct costs of treatment compared with conventional services without a home treatment alternative to in-patient care.

Setting

Treatments were offered in the Federal State of Aargau, which has approximately 650 000 inhabitants and is located in northwestern Switzerland. Psychiatric Services Aargau AG (PDAG) is legally bound to provide mental healthcare to the Aargau population. The PDAG operates one mental hospital located in the middle of the state (128 beds on acute wards for adult general psychiatry) and several day hospitals and out-patient clinics at multiple locations across the service area. The PDAG provides approximately 75% of the hospital bed days in the Aargau. Individuals with severe mental illness, such as schizophrenia, are nearly exclusively (99%) treated in the PDAG.[17] A central triage unit with a highly experienced staff is responsible for gatekeeping for in-patient services.[18] This central intake unit ensures that only patients who require immediate in-patient treatment are hospitalised (day or out-patient treatment is given preference whenever feasible).

In 2015, a mobile and multidisciplinary home treatment team was established at the PDAG's mental hospital to provide acute outreach mental healthcare to the population in the service area 24 h a day and 7 days a week. Organisationally, the home treatment team was closely linked to the central triage unit and could provide intensive acute care at home once an experienced triage unit clinician had deemed in-patient treatment necessary. This procedure ensured that only patients who unequivocally required in-patient treatment were considered for 'in-patient-equivalent' home treatment.

Participants

All patients for whom immediate in-patient treatment was deemed necessary by the central triage unit[18] during the 1-year enrolment period of the study (14 April 2015 to 13 April 2016) were randomised if they further met the following inclusion criteria: (a) 18–64 years old; (b) permanent private address (no residential accommodation), reachable by car within 30 min from the home treatment base at the mental hospital (this criterion applied to approximately 80% of all inhabitants in the service region); (c) one of the following primary diagnoses according to ICD-10:[19] F2, F3, F4, F5, F6, F8, F9, or Z; (d) being referred to the department of general psychiatry (i.e. referrals to specialised wards, such as forensics, were excluded); (e) basic health insurance (patients with supplementary 'private' health insurance plans were treated on different hospital wards); and (f) sufficient German language skill to communicate without a translator. In addition, patients with alcohol, cocaine or opioid dependence and patients with intellectual disability or organic mental disorders were excluded, regardless of whether one of the listed disorders was the primary or secondary diagnosis.

Interventions

In the experimental group, a multidisciplinary home treatment team aimed to manage acute crises at the patients' homes if feasible. The central triage unit and hospital wards could refer patients to home treatment services at any time during acute treatment episodes once in-patient treatment had been deemed necessary by an experienced central triage unit clinician. The 12 home treatment slots were operated by a senior psychiatrist (0.9 full-time equivalent (FTE)), two clinical psychologists (1.6 FTE), nurses (6.5 FTE), a social worker (0.6 FTE) and a team assistant (1.0 FTE). Staff was generally available 24 h (on call from 22.00 h to 08.00 h). Patients were typically visited at home once daily for approximately 1 h, with the option for multiple visits a day (or night) if necessary. Interventions were individually tailored but included typical ingredients of acute care, such as crisis intervention, pharmacotherapy, psychoeducation, brief psychotherapy and social care.

The control group received care only on hospital wards. During episodes with no need for in-patient care, day hospitals and out-patient clinics were available to the patients in both groups.

Randomisation

Patients in acute crises are often unable to make informed decisions, which makes their recruitment for a research trial challenging. Because we wanted to avoid biases (i.e. limited external validity of the findings) potentially resulting from limiting our sample to patients capable of making informed decisions at intake, we used a single randomised consent design, as suggested by Zelen.[20,21] Whenever a patient presenting at our hospital was deemed in need of in-patient treatment by the central triage unit and met all other inclusion criteria (detailed above), they were randomised by an independent researcher using computer-generated random numbers. All patients were randomised without previous agreement and irrespective of their clinical condition and eventual suitability for home treatment. Subsequently, written informed consent was only obtained from patients in the experimental group and only if they were actually offered home treatment (single randomised consent design). Staff was instructed to offer home treatment to experimental patients at intake or any time during the in-patient episode as soon as it appeared clinically appropriate and safe.

By initiating home treatment depending on clinical considerations and preferences of patients and relatives, we intended to mimic processes that would occur under routine clinical conditions. For instance, patients with acute suicidality or unable to make informed decisions at intake were directly admitted to hospital and offered home treatment once they had gained sufficient stabilisation on the ward. If patients refused home treatment (informed consent) or if they were not offered home treatment (for example because of clinical considerations), they were treated exclusively on wards. (The data of these patients were nevertheless allocated to the experimental group for our intention-to-treat (ITT) analyses; see below).

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. All procedures involving patients were approved by the relevant regional ethics committee (EKNZ 2015-041) on condition that our analyses relied exclusively on routinely collected data, whose recording is mandatory for every in-patient episode at Swiss mental hospitals. This study design enabled us to recruit all general psychiatry patients in acute crises who met our inclusion criteria, even those who refused home treatment or lacked decisional capacity at the time of admission, often transiently.

The procedure and timing of randomisation was set up to conflict as little as possible with everyday economic and organisational circumstances. For economic reasons, we could not afford permanent low occupancy of the 12 home treatment slots. However, at the outset of the new service model, we did not know the proportion of patients for whom home treatment would be feasible or the approximate length of stay in home treatment. To achieve reasonable occupancy of the 12 home treatment slots, we continuously adapted the random allocation ratio (within the range of 5:1–1:3) on a week-by-week basis during the study enrolment period. For each allocation ratio within this range, we randomly varied between two block sizes (for example for a 2:1 allocation ratio, blocks included either three or six patients) to mask the next draw. If immediately starting with home treatment (instead of hospital admission) was considered feasible for a patient, during office hours, the central triage unit could ask the independent research team for immediate randomisation of a newly arriving patient (so-called 'express

randomisation'). All remaining patients, for whom immediately starting home treatment was not considered feasible or who arrived outside office hours, were tentatively admitted to hospital. These patients were then randomised as soon as possible (typically the next day) by the research team.

Data collection

Information on patient sociodemographics and routine clinical diagnoses as well as data on service use and direct treatment costs were drawn from clinical records and from the case register in the medical database of the PDAG. Routine clinical diagnoses were validated with the Structured Clinical Interview for DSM–IV (SCID)[22] in a stratified subsample ($n = 100$) of the study participants.[23] Commonly used clinical examination techniques had good overall agreement with SCID assessments regarding primary diagnoses at the level of the most prevalent ICD-10 main categories (F2, F30–F31, F32–F33, F4; $\kappa = 0.65$).[23]

According to the mandatory assessment schedule of the Swiss National Quality Assessment of Inpatient Psychiatry (ANQ) project,[24] the 12 items of the Health of the Nations Outcome Scales (HoNOS),[25] to elicit staff ratings of risks and severity of clinical and social problems, were assessed every two weeks while patients were on hospital wards or in home treatment. The Brief Symptom Inventory (BSI)[26] to assess symptom severity was completed by patients at intake and at discharge. The 18-item Perception of Care (PoC-18) questionnaire to assess patient satisfaction was assessed at discharge from an in-patient or home treatment episode.[24] Masking researchers, clinicians or patients was not feasible.

Data analysis

Baseline patient characteristics were compared between groups using χ^2, Mann–Whitney or independent-samples *t*-tests. Outcome data were analysed on an ITT basis. Because data on service use (for example hospital bed days) were highly skewed and neither Poisson distributed nor normally distributed after log-transformation, we used Mann–Whitney tests and the Monte Carlo method to estimate *P*-values for group comparisons. Based on previous experiences in the neighbouring Federal State of Lucerne,[27] we expected home treatment services to reduce hospital bed days on average by approximately 30% per patient (primary outcome). At the outset of this study, a very conservatively estimated minimal sample size of at least 500 patients during the 1-year enrolment period was estimated to have 86% power to prove such reduction with a two-tailed alpha of 0.05. A non-parametric bootstrap method was used to test for differences in arithmetic mean costs between groups.[28,29]

HoNOS and BSI scores at discharge were compared using ANCOVA with the group as the fixed factor and baseline scores as the covariate. Missing HoNOS and BSI scores at discharge were substituted using last-observation-carried-forward procedures. If there were multiple treatment cases per patient during the 24-month follow-up period, we calculated the mean HoNOS and BSI scores at intake and discharge across all treatment cases of the patient to avoid artificially inflating the sample size by analysing multiple assessments per patient. PoC-18 scores at discharge were compared using an independent-samples *t*-test. Again, multiple measurements per patient were aggregated within individuals for these analyses. Statistical analyses were performed using SPSS version 24.

Results

Patients excluded before randomisation

During the 1-year enrolment period, 2795 patients were referred to the mental hospital and deemed in need of hospital admission by the central triage unit. After screening for study eligibility, 2088 patients were excluded from the study and directly admitted to the most appropriate hospital ward (Fig. 1).

Participant characteristics

We randomised 707 patients, 412 to the experimental and 295 to the control group (Fig. 1). Random allocation resulted in largely similar groups although patients in the experimental group had significantly more secondary diagnoses at baseline (Table 1).

Use of acute in-patient and home treatment services

Patients in the experimental group used fewer hospital bed days than those in the control group (mean 41.3 *v.* 59.3; −30.4%; $P<0.001$) during the 24 months after the index crisis (ITT analyses; Table 2).

Overall use of acute services (in-patient + home treatment days) during 24 months of follow-up did not differ statistically significantly between the experimental (mean 50.4) and control (mean 59.3) groups ($P = 0.969$). If patients were readmitted to acute services within 24 months after randomisation, the previously mentioned treatment days could originate from multiple treatment episodes (cases). The mean number of admissions per patient during the (individually moving) 24-month study period did not differ statistically significantly between groups (Table 2).

Of the 412 patients in the experimental group, 218 (52.9%) received any home treatment during the 24-month follow-up. The 412 patients in the experimental group accounted for 767 (initial or recurrent) treatment episodes, of which only 35 (4.6%) were provided exclusively in the patient's domestic environment. The vast majority (95.4%) of the treatment episodes in the experimental group also included at least several days on a hospital ward. Treatment episodes with involvement of the home treatment team typically lasted a mean of 11.9 (s.d. = 16.2) days at the hospital before patients were treated at home for another mean 13.2 (s.d. = 7.0) days. The treatment episodes of patients in the experimental group without any home treatment typically lasted a mean of 28.0 (s.d. = 29.4) days and the treatment episodes of patients in the control group typically lasted a mean of 29.7 (s.d. = 30.5) days. Home treatment reduced the number of hospital bed days during the index episode (mean 18.7 *v.* 28.2; $P<0.001$) and during subsequent episodes (mean 26.2 *v.* 33.5; $P = 0.003$), which suggests a sustainable effect over 2 years.

The most frequent reasons for non-initiation of home treatment in cases of patients in the experimental group, as documented by staff, were refusal by the patient (28.4%), rapid discharge before possible involvement of the home treatment team (22.2%) and clinical considerations, such as acute suicidality (16.4%).

Symptom severity and social functioning

HoNOS and BSI scores decreased between intake and discharge in both groups. At discharge, scores did not differ statistically significantly between groups when adjusting for baseline scores (Table 3).

Satisfaction with care

Patient satisfaction with care did not differ statistically significantly between groups in the ITT analyses (Table 3). Only approximately half of the patients completed a PoC-18 questionnaire at discharge (experimental group: 63.6%; control group 56.3%).

Direct treatment costs

The total treatment costs per patient reimbursed by health insurers and the health department during the 24-month follow-up period

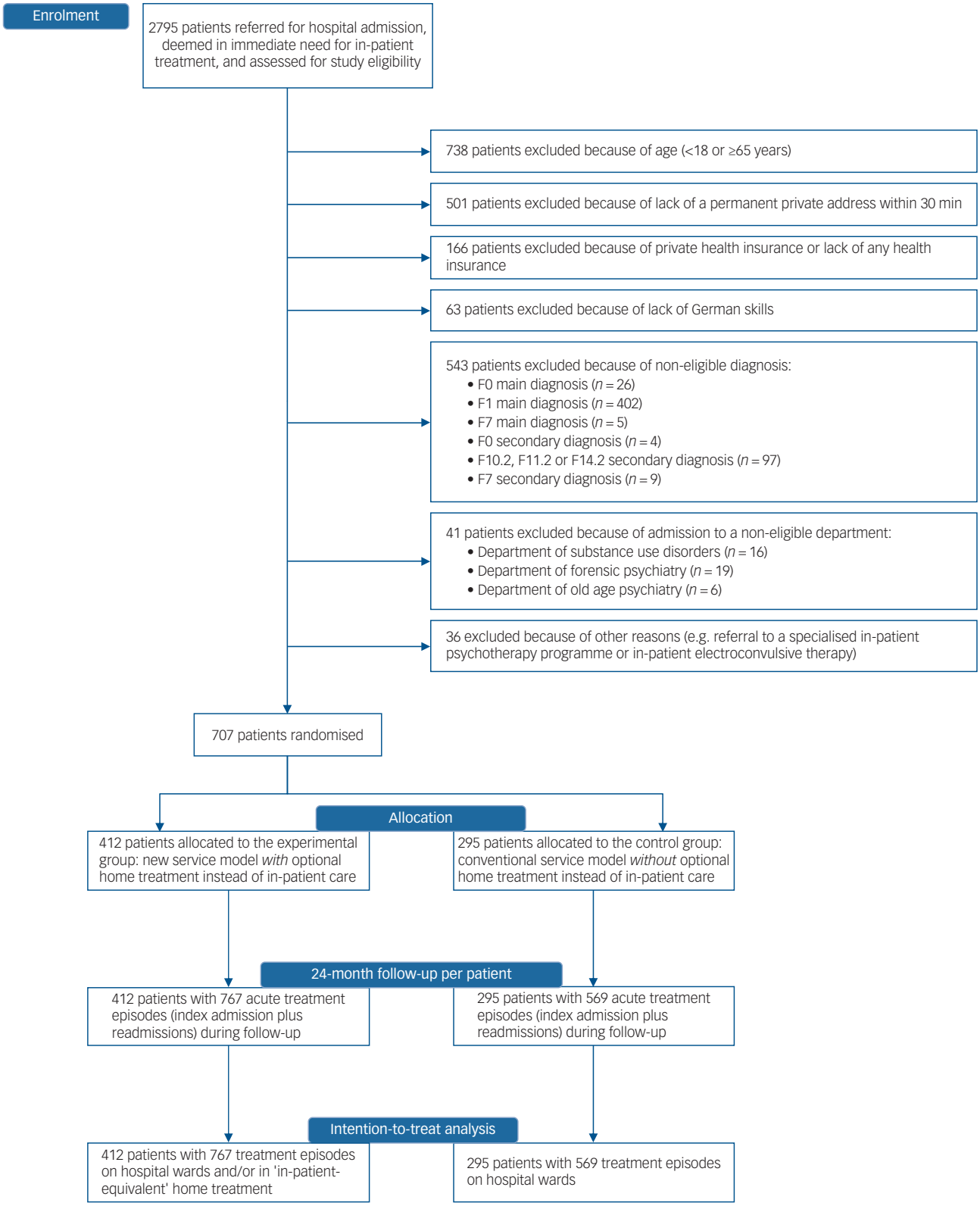

Fig. 1 Patient flow.

were not statistically significant lower in the experimental group than in the control group (Swiss francs (CHF) −6823; Great Britain pounds (GBP) −5256; −15.7%; 95% CI of the difference: CHF −13 640 to 79; $P = 0.051$) (Table 2).

Adverse events

There were three completed suicides during the 24-month study period, two in the experimental and one in the control group. All suicides occurred while patients were hospitalised on wards (no

Table 1 Characteristics of experimental and control groups

Characteristic	Experimental group ($n = 412$)	Control group ($n = 295$)	P
Men, *n* (%)	176 (42.7)	145 (49.2)	0.090[a]
Age, years: mean (s.d.)	39.3 (12.5)	39.7 (12.9)	0.675[b]
Single, divorced or widowed, *n* (%)	276 (67.0)	189 (64.1)	0.419[a]
Swiss citizenship, *n* (%)	331 (80.3)	237 (80.3)	0.999[a]
Living alone,[c] *n* (%)	127 (31.4)	80 (27.9)	0.314[a]
Education,[d] *n* (%)			0.399[a]
No school graduation	9 (3.4)	15 (6.7)	
Mandatory schooling	49 (18.8)	43 (19.2)	
Vocational training	177 (67.8)	147 (65.6)	
University or other higher education	26 (10.0)	19 (8.5)	
Employed in open market or pursuing education,[e] *n* (%)	189 (47.5)	128 (44.6)	0.454[a]
Compulsory admission, *n* (%)	88 (21.4)	74 (25.1)	0.245[a]
Primary clinical diagnosis (ICD-10), *n* (%)			0.338[a]
F2 (Schizophrenia or schizoaffective disorder)	107 (26.0)	93 (31.5)	
F30/F31 (Bipolar affective disorder)	35 (8.5)	26 (8.8)	
F32/F33 (Unipolar affective disorder)	154 (37.4)	88 (29.8)	
F4 (Anxiety, stress-related or somatoform disorder)	85 (20.6)	66 (22.4)	
F6 (Personality disorder)	23 (5.6)	14 (4.7)	
Other disorder (F5/F8/F9/Z)	8 (1.9)	8 (2.7)	
Number of secondary diagnoses, mean (s.d.)	0.48 (0.77)	0.43 (0.98)	0.019[f]
Comorbid personality disorder (F6), *n* (%)	26 (6.3)	17 (5.8)	0.764[a]
Health of the Nation Outcome Scales (HoNOS) at admission, mean (s.d.)[g]			
Total score	13.9 (6.5)	14.2 (7.1)	0.655[b]
Behavioural problems	2.1 (2.3)	2.3 (2.3)	0.266[b]
Impairment	1.2 (1.5)	1.1 (1.5)	0.615[b]
Symptomatic problems	5.8 (2.1)	5.6 (2.2)	0.232[b]
Social problems	4.9 (3.6)	5.1 (4.0)	0.361[b]
Brief Symptom Inventory (BSI) at admission, mean (s.d.)[h]			
Global Severity Index	1.55 (0.75)	1.58 (0.84)	0.665[b]

If there were multiple admissions per patient in the 24 months after the psychiatric crisis that necessitated immediate in-patient care, the figures relate to the first admission (index case).
a. χ^2-test.
b. Independent-samples *t*-test.
c. Data on living situation were missing for $n = 8$ patients in the experimental group and $n = 8$ patients in the control group.
d. Data on education were missing for $n = 151$ patients in the experimental group and $n = 71$ patients in the control group.
e. Data on employment were missing for $n = 14$ patients in the experimental group and $n = 8$ patients in the control group.
f. Mann–Whitney test.
g. Data on the HoNOS were missing for $n = 26$ patients in the experimental group and $n = 20$ patients in the control group.
h. Data on the BSI were missing for $n = 206$ patients in the experimental group and $n = 127$ patients in the control group.

suicide occurred in home treatment). One patient in the control group unexpectedly died from cardiac arrest. In addition, there were 22 suicide attempts, 13 in the experimental group (2 during home treatment, 11 on hospital wards) and 9 in the control group. There was no report of violence against home treatment staff.

Discussion

Availability of a home treatment team reduced the use of hospital bed days by 30.4% within 24 months after the original crisis leading to the need for hospital admission even though the home treatment team was actually involved in the treatment of only 52.9% of the patients and despite a higher number of secondary diagnoses in the experimental group. Overall treatment length (hospital bed days + home treatment days) and the number of admissions did not differ statistically significantly between service models (with or without home treatment). Similarly, clinical and social outcomes and patient satisfaction with care did not differ statistically significantly between service models. Overall treatment costs for health insurers and the health department were not statistically significantly lower in the service model with home treatment services ($P = 0.051$).

Limitations

We successfully performed a randomised trial with a large number of severely ill general psychiatry patients in acute emergency situations requiring immediate hospital admissions (the CONSORT checklist can be found in supplementary Table 1 available online at https://doi.org/10.1192/bjp.2019.31). However, studying a sample that included involuntary admissions and patients unable to make informed decisions came at the cost of limited clinical and social outcome parameters because of ethical requirements. The responsible ethics committee approved the study's single randomisation before consent (Zelen's) design on condition that we did not collect any additional data specifically for our study. That is, we had to rely exclusively on routinely and mandatorily recorded data. According to assessment procedures prescribed by the mandatory Swiss ANQ initiative, the HoNOS were not rated by independent and masked clinicians but clinical staff members.[24] However, our primary outcome parameters, such as hospital bed days or admissions, can be considered 'hard' indicators of treatment outcomes as opposed to subjective ratings.

Swiss data protection laws made it impossible to evaluate service use by our patients of other mental health systems. However, the PDAG had a quasi-monopoly on acute mental healthcare in the Federal State of Aargau (private hospitals account for approximately 25% of the hospital bed days but have a strong focus on non-acute psychotherapy treatments).[17,18] In addition, random allocation of our patients to the service models under examination made systematic between-group differences in mental health service use outside the PDAG unlikely.

To achieve reasonable occupancy of the 12 home treatment slots, the allocation ratio was adapted weekly and equalled up to 5:1 during the enrolment period. We thus cannot rule out that synchronously occurring changes in the allocation ratio and the composition of the patient population biased our findings. However,

Table 2 Use of mental health services and costs of treatment in the 24 months after the psychiatric crisis that necessitated immediate in-patient care

Use of mental health services/costs of treatment	Experimental group (*n* = 412)	Control group (*n* = 295)	*P* (95% CI)
Bed days on hospital wards			
Mean (s.d.)	41.3 (53.8)	59.3 (73.4)	<0.001 (<0.001 to <0.001)[a]
Median (IQR)	19.8 (51.3)	35.0 (70.0)	
Days in home treatment			
Mean (s.d.)	9.1 (12.3)	–	–
Median (IQR)	5.3 (14.5)	–	–
Bed days on hospital wards plus days in home treatment			
Mean (s.d.)	50.4 (54.8)	59.3 (73.4)	0.969 (0.969 to 0.970)[a]
Median (IQR)	31.0 (53.0)	35.0 (70.0)	
Admissions to hospital wards/home treatment (including index admission)			0.523[b]
1, *n* (%)	239 (58.0)	171 (58.0)	
2, *n* (%)	94 (22.8)	64 (21.7)	
3, *n* (%)	35 (8.5)	27 (9.2)	
4, *n* (%)	19 (4.6)	15 (5.1)	
5, *n* (%)	9 (2.2)	4 (1.4)	
6, *n* (%)	10 (2.4)	4 (1.4)	
7, *n* (%)	1 (0.2)	6 (2.0)	
8, *n* (%)	2 (0.5)	1 (0.3)	
9, *n* (%)	1 (0.2)	1 (0.3)	
11, *n* (%)	2 (0.5)	1 (0.3)	
15, *n* (%)	0 (0.0)	1 (0.3)	
Mean (s.d.)	1.86 (1.47)	1.93 (1.69)	0.885 (0.884 to 0.886)[a]
Median (IQR)	1 (1)	1 (1)	
Days in day hospitals			
Mean (s.d.)	9.9 (22.7)	7.9 (18.6)	0.542 (0.541 to 0.543)[a]
Median (IQR)	0 (2)	0 (1)	
Treatment costs (in Swiss francs),[c] mean (s.d.)			
In-patient care,	26 814 (34 947)	38 533 (47 691)	<0.001[d]
Home treatment	3739 (5058)	–	–
Day hospital care	3846 (8839)	3076 (7243)	0.198[d]
Out-patient care	2171 (3654)	1784 (3463)	0.153[d]
All services	36 570 (39 258)	43 393 (50 044)	0.051[d]

a. Mann–Whitney test (95% CIs for *P*-values were estimated using Monte Carlo methods based on 1 000 000 samples).
b. χ^2-test.
c. Direct treatment costs for health insurance and the health department were calculated based on fixed daily rates for in-patient care (CHF 650 or GBP 500 per day), home treatment (CHF 410 or GBP 315), and day hospitals (CHF 390 or GBP 300) in the Federal State of Aargau. Out-patient services were reimbursed on a performance-related basis.
d. Non-parametric bootstrap *t*-test with 10 000 samples.

only 4.7% of patients were randomised with a 5:1 ratio, limiting potential bias as a result of reduced uncertainty regarding patient allocation. In addition, the randomisation procedure was set up to conflict as little as possible with everyday organisational circumstances. This approach might have resulted in underestimation of the full potential of home treatment services to substitute in-patient days for two reasons. First, all patients who arrived out of office hours were tentatively admitted to hospital wards because there was no possibility for express randomisation by the research team at night or at weekends. Second, the triage team might have hesitated to request express randomisation in certain cases even during office hours because it required extra effort compared with directly admitting patients to hospital wards. However, both of these disruptive factors would have resulted in underestimation of the full potential of home treatment services to substitute in-patient days.

As a result of the lack of a German fidelity scale, we had to perform a self-evaluation with the English CORE Crisis Resolution Team Fidelity Scale.[30] The total fidelity score was slightly higher for our model (129) than the sum of item median scores (124) for 75 crisis resolution teams in the UK.[30] Finally, the generalisability of our findings is limited by exclusion criteria (such as living in remote areas or being homeless, lack of sufficient German language proficiency, or primary or severe substance use disorder) and by the distinctive characteristics of the mental health services system in the Federal State of Aargau and in Switzerland. However, inclusion of a broad spectrum of general psychiatry patients in immediate need of in-patient treatment strengthened the external validity of our findings and facilitated a particularly stringent test of the effectiveness of home treatment services in a population in which reducing use of in-patient facilities is particularly challenging.

Comparison with other studies

In line with previous findings,[8–10,12,15] our home treatment team reduced the use of hospital bed days by approximately 30%. However, home treatment team involvement entirely prevented hospital admission for only relatively few patients (4.6%). Most patients were initially admitted to hospital for several days before being referred to home treatment services. This finding is contradictory to previous trials, which reported reduced admission rates when crisis resolution/home treatment teams were available.[8,9,11,12,15] The failure to prevent hospital admissions at a higher rate might be explained by the strict gatekeeping of our central triage unit and by the study's Zelen design. Together, these features might have resulted in a particularly acute and severely ill patient sample compared with previous studies. The triage site determined that all patients were in immediate need of in-patient treatment, and the Zelen design enabled randomisation of all patients irrespective of their condition. In contrast, older trials were typically restricted to less severely ill patients (for example by excluding patients who were suicidal or involuntary admissions)[8,10,12,15] or also included patients without an immediate

Table 3 Clinical and social outcomes and patient satisfaction with care at discharge

Outcome	Experimental group ($n = 412$)			Control group ($n = 295$)			Within-group differences between baseline and discharge				Between-group differences at discharge (experimental versus control groups)			
							Experimental group		Control group		Unadjusted		Adjusted[a]	
	n	Baseline, mean (s.d.)	Discharge, mean (s.d.)	*n*	Baseline, mean (s.d.)	Discharge, mean (s.d.)	Mean difference (95% CI)	*P*	Mean difference (95% CI)	*P*	Mean difference (95% CI)	*P*	Mean difference (95% CI)	*P*
HoNOS[b]														
Total score	399	14.4 (5.8)	9.9 (5.3)	281	14.4 (6.3)	9.7 (5.5)	−4.5 (−5.0 to −4.0)	<0.001	−4.7 (−5.4 to −4.0)	<0.001	0.2 (−0.7 to 1.0)	0.679	0.2 (−0.6 to 0.9)	0.652
Behavioural problems	399	2.3 (2.1)	1.4 (1.6)	281	2.4 (2.2)	1.3 (1.7)	−1.1 (−1.3 to −0.9)	<0.001	−1.1 (−1.3 to −0.9)	<0.001	−0.1 (−0.4 to 0.1)	0.316	−0.1 (−0.3 to 0.1)	0.316
Impairment	399	1.3 (1.4)	1.0 (1.1)	281	1.3 (1.5)	0.9 (1.2)	−0.3 (−0.4 to −0.2)	<0.001	−0.3 (−0.5 to −0.2)	<0.001	0.0 (−0.2 to 0.2)	0.779	0.0 (−0.1 to 0.2)	0.862
Symptomatic problems	399	5.8 (1.9)	3.9 (1.7)	281	5.5 (1.9)	3.6 (1.8)	−1.9 (−2.1 to −1.7)	<0.001	−1.9 (−2.2 to −1.7)	<0.001	0.3 (0.0 to 0.6)	0.038	0.2 (−0.1 to 0.4)	0.146
Social problems	399	5.1 (3.3)	3.9 (3.0)	281	5.3 (3.5)	4.0 (3.0)	−1.2 (−1.5 to −0.9)	<0.001	−1.3 (−1.7 to −1.0)	<0.001	−0.1 (−0.5 to 0.4)	0.789	0.0 (−0.4 to 0.4)	0.912
BSI[c]														
Global Severity Index	263	1.49 (0.73)	1.12 (0.77)	189	1.54 (0.81)	1.19 (0.83)	−0.37 (−0.43 to −0.30)	<0.001	−0.36 (−0.45 to −0.27)	<0.001	−0.06 (−0.21 to 0.09)	0.407	−0.02 (−0.12 to 0.08)	0.683
PoC-18														
Total score	262	–	0.78 (0.22)	166	–	0.80 (0.18)	–	–	–	–	−0.02 (−0.06 to 0.02)	0.242	–	–

HoNOS, Health of the Nation Outcome Scales; BSI, Brief Symptom Inventory; PoC-18, Perception of Care 18.
If there were multiple treatment cases (readmissions) per patient in the 24 months after the psychiatric crisis that necessitated immediate in-patient care, scores were aggregated across all completed treatment episodes of the patient to avoid artificially inflating the sample size by analysing multiple assessments per patient.
a. Adjusted for baseline scores on the respective scale (ANCOVA).
b. HoNOS: modified intention-to-treat with last observation carried forward (LOCF). Analyses included all patients with available HoNOS intake ratings by staff. Missing values at discharge were substituted using LOCF procedures.
c. BSI: modified intention-to-treat with LOCF. Analyses included all patients with available BSI self-ratings at intake. Missing values at discharge were substituted using LOCF procedures.

need for in-patient care (the latter was suggested by a considerable number of controls who were not admitted to hospital despite the lack of home treatment services).[9,11,15] Thus, the focus of our intensive home treatment was on reducing hospital days by rapid and facilitated discharge rather than on preventing hospital admissions altogether. In the future, optimising procedures in this complex system and better training of triage staff might eventually help achieve a higher rate of direct admissions to home treatment services.

Clinical and social outcomes, patient satisfaction at discharge and the number of adverse events were very similar in both service models. Both groups exhibited large improvements in clinical and social outcomes (HoNOS and BSI scores), and the large majority of patients was satisfied with the received treatment. The effects of our home treatment on these outcome parameters were smaller than might have been expected based on previous studies that indicated better clinical and social outcomes and more positive views of crisis teams.[9,12,15] The use of brief and global outcome measures after relatively short treatment episodes possibly failed to capture subtle variations in clinical outcomes and patient views. In addition, only 60.5% of the patients returned a satisfaction questionnaire, potentially restricting the variance in the responses. However, certain patients who received home treatment may also have had general reservations regarding home treatment, which has been criticised for a lack of continuity of care.[31]

The response rate in the BSI[26] was similarly rather low (63.9%). The patients who were severely ill in our study were often unable to complete a symptom questionnaire at intake. Unfortunately, the particularly low response rate of relatives in the specifically developed satisfaction questionnaire (6.9%) precluded analysis and interpretation of these data.

Directions for future research

In conclusion, intensive home treatment can represent an equivalent alternative to acute in-patient care for a broad spectrum of highly acute and severely ill patients who would otherwise be treated on general psychiatry hospital wards. However, better clinical and social outcomes, higher patient satisfaction and lower treatment costs should not be expected from home treatment services. Future research in other countries and healthcare systems should evaluate a broader range of more specific clinical outcome variables and test the generalisability of our findings to other mental healthcare systems. Similarly, future research should examine home treatment services for other patient groups, such as those with severe addictions, and identify which patient subgroups benefit most from home treatment.

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Supplementary material

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