# Independent Supported Housing vs institutional housing rehabilitation settings for non-homeless individuals with severe mental illness – longitudinal results from an observational study

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## Abstract

**Background** Most individuals with severe mental illness (SMI) strongly prefer independent living over living in an institution. Independent Supported Housing (ISH) provides housing rehabilitation for persons with SMI in their accommodations. However, most individuals who need housing rehabilitation live in institutional housing settings (housing rehabilitation as usual: HAU). We investigated which housing rehabilitation setting is effective on which variable in the long term to support service users to form an informed preference for either housing rehabilitation setting.

**Methods** We conducted a two-year longitudinal observational non-inferiority study to test the effectiveness of ISH in improving participants' social inclusion, quality of life, emotional social support, capabilities, symptom severity, functioning, service utilisation and costs. Participants were assessed at baseline and after six, twelve, and 24 months. Mixed effects models were computed to test between-group and within-group effects.

**Results** The study included 83 participants in ISH ($n = 31$) and HAU ($n = 52$) housing rehabilitation settings with a mean age of 36.2 years. Most participants were male (64%) and had a primary psychotic or schizophrenic (35%) or an affective diagnosis (24%). During the study, ISH participants significantly improved their quality of life ($\beta = 0.54$; 95% CI: 0.26 to 0.82), symptoms ($\beta = -0.32$; 95% CI: -0.60 to -0.03), and capabilities ($\beta = 4.46$; 95% CI: 0.14 to 8.77) and decreased psychiatric hospitalisations ($p = 0.04$). HAU participants improved their quality of life ($\beta = 0.40$; 95% CI: 0.12 to 0.69). Housing and rehabilitation support costs were almost half with ISH than with HAU.

**Conclusion** ISH has been shown to be much less expensive than HAU and was associated with several improvements like reduced psychiatric hospitalisations and improved quality of life. Therefore, our findings strongly argue for a preference-driven provision of housing rehabilitation services and to end the institutionalisation of persons with SMI.

**Trial registration** The study was registered on December 04, 2018, at ClinicalTrials.gov (NCT03815604).

**Keywords** Psychiatric rehabilitation, Independent Supported Housing, Institutional housing rehabilitation, Social inclusion, Longitudinal study

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## Background

People with severe mental illness (SMI) have a high risk for social exclusion [1, 2]. They often suffer from enduring mental illness, which may lead to disabilities in their everyday lives [3]. According to the UN Convention on the Rights of Persons with Disabilities (UN CRPD), each person with a psychosocial or other disability should be allowed to choose their place of residence freely, and they should receive personal assistance and support to obtain and maintain their accommodation and their independent living in the community [4]. Based on the UN CRPD, current treatment guidelines strongly recommend offering outreach support as the first choice and providing housing rehabilitation services according to the service users' preferences [5]. However, the implementation of these recommendations and the UN CRPD is lagging. Although most persons with SMI prefer independent living over living in an institution [6], the traditional continuum approach is still the housing rehabilitation as usual (HAU) setting in many countries [7, 8].

Since the deinstitutionalisation of psychiatric care, two residential rehabilitation approaches for individuals with severe mental illness (SMI) have been established: The traditional continuum of residential care facilities and an Independent Supported Housing (ISH) approach. The traditional approach consists of a continuum of residential care facilities, which are organised as a stepladder to independent housing: Individuals start in more or less intensively supported facilities before they are allowed to move into more independent living arrangements and finally in independent accommodation after having gained the necessary housing skills, a necessary level of functioning, and mental health stability [9]. In contrast, ISH follows the '*Housing First*' approach and trains persons with SMI directly in independent accommodation in housing skills. It provides outreach support in their direct living environment to improve service users' social inclusion in their community.

There is good evidence of the effectiveness of ISH interventions in supporting homeless persons with SMI, which mainly originates from the '*Housing First*' Project in the United States and Canada [10–13]. Several RCTs showed the superiority of '*Housing First*' to traditional continuum settings in reducing homelessness and increasing housing stability. However, ISH services for non-homeless service users target other outcome variables. In addition, the strong preferences of people with SMI for independent living strongly limit the feasibility of RCTs in this field [14–16]. Results from reviews and a recent observational study indicate similar effectiveness of ISH and HAU settings [10, 11, 17]. However, evidence on ISH for non-homeless individuals is still limited.

If the primary outcome of a new intervention (e.g., ISH) is assumed to be not unacceptably worse than (it is 'non-inferior to') the outcome of a standard treatment (e.g., HAU) and is expected to lead to other favourable secondary outcomes such as being less expensive or leading to improved quality of life, then non-inferiority hypothesis testing is more appropriate than testing for superiority [18]. In addition, the proof of non-inferiority of the newer ISH intervention to HAU aligns with the guidelines' recommendations for a preference-driven provision of housing rehabilitation interventions [5]. ISH is aimed at complementing, not replacing, traditional institutionalised housing rehabilitation settings. Therefore, this longitudinal effectiveness study aimed to show which housing rehabilitation setting is effective in the long term on which variable to support service users to form an informed preference for either housing rehabilitation setting.

Despite RCTs being considered a gold standard for effectiveness trials, their feasibility in housing settings for non-homeless persons is limited due to individuals' strong preferences for independent living over living in an institution [6, 16]. Two attempts to conduct an RCT on the effectiveness of ISH for non-homeless persons were undertaken, and both showed major limitations due to participants' strong preferences. The first attempt conducted a comprehensive cohort design but failed to recruit enough participants [14], and the second attempt performed a pragmatic RCT, but a longitudinal study was not possible due to strong preferences for ISH [15, 19]. Observational studies, in contrast, show good feasibility in case of strong preferences due to the naturalistic follow-up of participants, which allows them to use the investigational services based on their (or the referrals') preferences. In addition, the observational study design produced similarly valid results as the RCT design [19, 20]. The present article reports on the results of our two-year longitudinal observational effectiveness study.

## Methods

### Study design

This prospective observational study was part of a two-year, two-centre, non-blinded, parallel-group, non-inferiority cohort field study on the effectiveness of ISH vs HAU for non-homeless persons with SMI. The study was registered (ClinicalTrials.gov: NCT03815604) and approved by the Swiss Association of Research Ethics Committees (Swissethics; 2018–02381). The study was conducted according to the published protocol [21]. The 12-month data have already been published [19]. The present study reports on the longitudinal two-year results.

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## Procedure

The study was conducted in Bern, Switzerland. Recruitment took place between April 2019 and December 2020. Sample size calculation was performed with regard to the non-inferiority hypothesis and yielded a sample size of 28 participants for the intervention group. The control group was intended to be two- to three times larger than the intervention group in order to facilitate matching based on propensity scores [21]. However, for reasons explained in the limitations, we could not apply propensity score methods for the two-year data.

After admission to the respective housing rehabilitation service, participants were consecutively recruited by housing rehabilitation staff (see setting and study conditions below). All service users were asked a few days after their admission to HAU or at the first or second meeting with the ISH coach if they were potentially interested in taking part in the study. The study collaborator then contacted interested participants and asked them for written informed consent. Consenting participants were enrolled in the study and were assessed at baseline (T0), after six months (T1), 12 months (T2) and 24 months (T3). Follow-up assessments were intended to be continued after participants have been discharged from or have moved on to other housing rehabilitation settings. Participants were not financially compensated for their participation; however, care was taken to ensure they did not incur any participation costs (travel, phone costs).

## Setting and study conditions

Independent Supported Housing (ISH) has been provided since 2012 by the Center of Psychiatric Rehabilitation of the University Psychiatric Hospital Universitäre Psychiatrische Dienste (UPD) in Bern, Switzerland. ISH targets non-homeless adult persons with SMI and a need for housing and related daily life support. ISH follows the 'Housing First' paradigm [22] and offers flexible and targeted support according to the service users' individual needs. Support is provided by an outreach coach in service users' independent accommodations, which are chosen and rented by the service users' expenses and are independent of treatment and care services. ISH coaches are mainly non-medical mental healthcare providers with nursing or social work training. ISH is independent of treatment and care, which appropriate external specialists offer. According to the STAX-SA classification [23], ISH corresponds to a type 4 service with no staff on-site providing low to moderate (sometimes also high) support in independent individual accommodations in the area around Bern without emphasis on moving on.

The control condition consisted of different housing rehabilitation as usual (HAU) settings in Bern, Switzerland. These settings provide housing rehabilitation and support according to the traditional continuum rehabilitation approach [9]. Each setting on this continuum aims to help service users stabilise and gain housing skills to enable them to live independently. Some of these settings provide transitional support and seek service users to move along the continuum from higher to lower levels of supported accommodation. In each HAU setting, users have a rental contract with the service that includes housing and support. According to the STAX-SA taxonomy, the control condition included housing rehabilitation services of types 1, 2, and 3, with staff on-site providing moderate to high (sometimes low) levels of support in a congregate setting with limited or strong (sometimes no) emphasis on moving on. In addition, the control condition included host families (not covered in the taxonomy) providing moderate support on-site supported by outreach staff and limited emphasis on moving on.

## Participants

The housing rehabilitation settings in both study conditions (ISH, HAU) target similar populations. The inclusion and exclusion criteria of the study were defined following the requirements of the service providers. Eligible participants were aged between 18 and 65 years, had a psychiatric diagnosis, could communicate in German, were able to take their medication if indicated, had a source of income (including social insurance benefits), and could provide written informed consent. Persons who lacked the capacity to consent and had impaired cognitive abilities that affected the feasibility or validity of the assessments, including intoxication, delirium, and dementia, were excluded.

## Data collection and outcome measures

Assessments consisted of questionnaires and semi-structured interviews using the German versions of each instrument. Assessments took place in person before the Coronavirus pandemic, were continued by phone call assessments during the pandemic, and were completed according to participants' wishes after the pandemic (in person, by phone call). In-person meetings occurred according to participants' wishes in their homes (independent accommodation or HAU setting), in neutral places like parks or restaurants, or in the research office. Questionnaires were completed by the participants or by an interview according to their choice. Following the UN CRPD, which states that service users' social inclusion and participation are the highest priority goal of rehabilitation [4], social inclusion was the primary outcome variable. Secondary outcome variables included self-reported quality of life, psychiatric symptom severity, capabilities, social support, support needs, observer-rated functioning, service utilisation, and housing rehabilitation service provision and costs.

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Demographic and clinical information was also collected through interviews with the participants. Demographic data included participants' age, gender, nationality, highest education, and the number and duration of previous stays in housing rehabilitation settings (see Table 1). Clinical information included the primary psychiatric diagnosis according to ICD-10 categories [24]. Diagnoses were verified using patient medical records where possible. One HAU participant did not allow diagnosis verification; she reported suffering from PTSD.

Social inclusion was measured using the *Social Functioning Scale* (SFS) [25, 26]. The 76-item questionnaire with mostly four-point Likert scales asks for participants' social inclusion and participation among seven subscales (social engagement, interpersonal behaviour, pro-social activities, recreational activities, independence-competence, independence-performance, and employment/ occupation). Raw subscale scores were converted into standardised scale scores with $m=100$ and $SD=15$ [25], and higher scores mean better social inclusion.

**Table 1** Sample characteristics at baseline

| | Total Sample | | | | Completers only | | | |
|---|---|---|---|---|---|---|---|---|
| | ISH ($N=31$) | HAU ($N=52$) | Total ($N=83$) | *p-value* | ISH ($N=27$) | HAU ($N=27$) | Total ($N=54$) | *p-value* |
| **Gender** | | | | 0.006 | | | | 0.097 |
| Female | 17 (55%) | 13 (25%) | 30 (36%) | | 14 (52%) | 8 (30%) | 22 (41%) | |
| Male | 14 (45%) | 39 (75%) | 53 (64%) | | 13 (48%) | 19 (70%) | 32 (59%) | |
| **Age (years)** | | | | 0.507 | | | | 0.755 |
| Mean (*SD*) | 37.42 (12.99) | 35.46 (12.58) | 36.19 (12.69) | | 37.44 (13.23) | 38.48 (13.04) | 37.96 (13.02) | |
| **Primary psychiatric diagnoses (ICD-10)** | | | | 0.035 | | | | 0.498 |
| F1 | 1 (3%) | 7 (13%) | 8 (10%) | | 1 (4%) | 4 (15%) | 5 (9%) | |
| F2 | 7 (23%) | 22 (42%) | 29 (35%) | | 7 (26%) | 11 (41%) | 18 (33%) | |
| F3 | 10 (32%) | 10 (19%) | 20 (24%) | | 10 (37%) | 6 (22%) | 16 (30%) | |
| F4 | 6 (19%) | 3 (6%) | 9 (11%) | | 3 (11%) | 2 (7%) | 5 (9%) | |
| F6 | 5 (16%) | 3 (6%) | 8 (10%) | | 4 (15%) | 3 (11%) | 7 (13%) | |
| F7, F8, F9, and F0 | 2 (6%) | 7 (13%) | 9 (11%) | | 2 (7%) | 1 (4%) | 3 (6%) | |
| **Nationality** | | | | 0.722 | | | | 1.000 |
| Swiss | 26 (84%) | 42 (81%) | 68 (82%) | | 24 (89%) | 24 (89%) | 48 (89%) | |
| Other | 5 (16%) | 10 (19%) | 15 (18%) | | 3 (11%) | 3 (11%) | 6 (11%) | |
| **Highest Education** | | | | 0.598 | | | | 0.577 |
| No Graduation | 1 (3%) | 5 (10%) | 6 (7%) | | 1 (4%) | 2 (7%) | 3 (6%) | |
| Elementary school | 10 (32%) | 18 (35%) | 28 (34%) | | 9 (33%) | 8 (30%) | 17 (31%) | |
| Vocational education | 12 (39%) | 21 (40%) | 33 (40%) | | 9 (33%) | 14 (52%) | 23 (43%) | |
| Grammar school | 2 (6%) | 3 (6%) | 5 (6%) | | 2 (7%) | 1 (4%) | 3 (6%) | |
| Technical college | 3 (10%) | 4 (8%) | 7 (8%) | | 3 (11%) | 1 (4%) | 4 (7%) | |
| University | 3 (10%) | 1 (2%) | 4 (5%) | | 3 (11%) | 1 (4%) | 4 (7%) | |
| **Main Source of Income** | | | | 0.008 | | | | 0.006 |
| Salary | 4 (13%) | 0 (0%) | 4 (5%) | | 4 (15%) | 0 (0%) | 4 (7%) | |
| Disability pension | 12 (39%) | 24 (46%) | 36 (43%) | | 11 (41%) | 11 (41%) | 22 (41%) | |
| Social benefit | 10 (32%) | 28 (54%) | 38 (46%) | | 7 (26%) | 16 (59%) | 23 (43%) | |
| Other | 5 (16%) | 0 (0%) | 5 (6%) | | 5 (19%) | 0 (0%) | 5 (9%) | |
| **No. of previous stays in housing rehabilitation settings** | | | | 0.024 | | | | 0.039 |
| Mean (*SD*) | 1.00 (1.61) | 1.88 (2.06) | 1.55 (1.95) | | 0.96 (1.70) | 2.07 (2.18) | 1.52 (2.02) | |
| Min—Max | 0—8 | 0—9 | 0—9 | | 0—8 | 0—7 | 0—8 | |
| **No. of years spent in housing rehabilitation settings** | | | | 0.041 | | | | 0.072 |
| Mean (*SD*) | 1.37 (2.44) | 2.65 (4.30) | 2.17 (3.75) | | 1.34 (2.46) | 3.46 (5.58) | 2.40 (4.41) | |
| Min—Max | 0—9 | 0—23 | 0—23 | | 0—9 | 0—23 | 0—23 | |

Differences between settings were tested using Kruskal–Wallis (numeric) and Chi-square tests (categorical)

*ISH* Independent Supported Housing, *HAU* Housing rehabilitation as usual

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Quality of life was assessed using the *Manchester Short Assessment of Quality of Life* (MANSA) [27]. This questionnaire assesses participants' satisfaction with twelve life domains on a 7-point Likert scale. The overall quality of life was summarised as total mean scores between 1 and 7, with higher values indicating better quality of life.

The subjective severity of psychiatric symptoms was assessed using the 9-item *Symptom Checklist* (SCL-K-9) [28, 29]. The severity of nine symptoms could be rated on a 5-point Likert scale and were summarised as total mean scores between 0 and 4, with higher scores indicating more severe symptoms.

The *Oxford Capabilities Questionnaire – Mental Health* (OxCAP-MH) [30, 31] assessed participants' capabilities among 16 items on a 5-point Likert scale. Total sum scores were translated into standardised scale scores between 0 and 100, with higher scores indicating better capabilities.

Emotional social support was assessed using the *ENRICHD Social Support Inventory* (ESSI-D) [32, 33]. This 5-item questionnaire could be answered on a 5-point Likert scale between 1 and 5, which were summarised as total mean scores. Higher scores indicate more social support.

Observer-rated functioning was rated by participants' key workers using the *Health of the Nation Outcome Scales* (HoNOS) [34–36]. If key workers were non-available due to participants' discharge from their setting or after they moved on to a non-cooperating service, the first author rated participants' functioning based on their answers during the assessment interviews.

Service utilisation encompassed participants' utilisation of inpatient and outpatient psychiatric and somatic treatment, criminal justice contacts and psychotropic medication prescription during the past six (twelve at T3) months. It was assessed by interview using the adapted *Client Sociodemographic and Service Receipt Inventory* (CSSRI) [37].

Service provision and costs of ISH were assessed using the Swiss medical tariff reimbursement tool (TARMED) or the tariff reimbursement tool of the canton Bern, where the duration of contacts with service users and the corresponding support costs will be assessed. Prices for rent and basic needs of ISH participants were estimated based on the guidelines from the local social insurance using the upper limit of the coverage granted to provide a rather conservative comparison of costs between ISH and HAU [38, 39].

To assess the costs of HAU services, heads of included HAU services were asked about the daily flat rates. The daily flat rates usually include housing rehabilitation support, rent, and basic needs. Therefore, the individual amount of support received cannot be estimated separately.

## Statistical methods

Statistical testing of differences in baseline sample characteristics between conditions (ISH, HAU) and between study completers and dropouts were performed using Kruskal–Wallis (numeric) and Chi-square tests (categorical). Scale scores from outcome measures were computed based on averaged available item scores [40, 41] and were descriptively analysed for the total sample and completers only. Descriptive analyses of costs, service utilisation, and move-on rates were conducted based on available data from the total sample. Within-group changes in service utilisation between T1 and T3 were analysed using McNemar's test.

Because of the considerable amount of study dropouts in the control condition (48.1%), we did not impute outcome data of withdrawn participants. However, we imputed scale scores of missing data at baseline (one single data point) and of completers who missed single assessments ($n = 3$) or instruments ($n = 1$) without dropping out from the study (7.4% of study completers). Imputation of missing scale scores was performed by multiple imputation [42] using the *R* package *mice* [43], applying the predictor matrix *quickpred* (mincor = 0.3) and performing $m = 5$ iterations.

Mixed-effects models for repeated measures were conducted with the multiply imputed datasets to analyse the long-term effects of conditions and between-group differences at each time point. Mixed-effects models were performed on the dependent variables social inclusion (SFS), quality of life (MANSA), symptom severity (SCL-K-9), capabilities (OxCAP), social support (ESSI-D), and functioning (HoNOS). Variance across participants was modelled as random effects. Study conditions (ISH, HAU), assessment time points (T0, T1, T2, T3), and the interaction of condition*time points were modelled as fixed effects. Longitudinal within-group and between-group effect sizes for each dependent variable are presented as the model-derived fixed-effect parameters and 95% Confidence intervals (95% CI). Mixed-effects analyses were conducted using the *lmer* function of the *R* package *lme4* via Maximum Likelihood estimation [44]. Between-group differences were tested by hypothesising the non-inferiority of ISH to HAU regarding the primary outcome of *social inclusion*. The non-inferiority margin was pre-defined to be 15, which refers to one standard deviation on the SFS (for details on the non-inferiority margin and sample size calculation, see [21]). All statistical analyses were performed using the statistical software

*R* version 4.0.3 [45]. The significance level was set to $\alpha = 0.05$ for all analyses.

## Results

The flow chart (Fig. 1) shows participants' recruitment and follow-up. The study included 83 participants at baseline (ISH: $n = 31$; HAU: $n = 52$; response rate 52%). During the two-year study period, 12.9% ($n = 4$) of ISH participants and 48.1% ($n = 25$) of HAU participants dropped out. Dropout reasons were being no longer motivated to participate ($n = 8$), leaving or changing housing setting ($n = 8$), lost to follow-up ($n = 7$), deceased ($n = 1$), suicide ($n = 2$), and other reasons ($n = 3$). Some participants missed single assessments without dropping out from the study (T1: $n = 4$; T2: $n = 1$) because of mental health issues or because they refused assessments by phone during the pandemic.

At baseline, participants had a mean age of 36.2 ($SD = 12.7$) years. Most participants were of male gender (64%, one person with transgender background), had a Swiss nationality (82%), had at least a vocational education (59%), received a disability pension (43%) or social benefits (46%), and had a primary psychotic or schizophrenic (35%) or an affective diagnosis (24%). Before admission to the housing rehabilitation setting, participants had lived on average 1.55 ($SD$ 1.95) times for a mean of 2.17 ($SD = 3.75$) years in housing rehabilitation settings. In the control condition, most
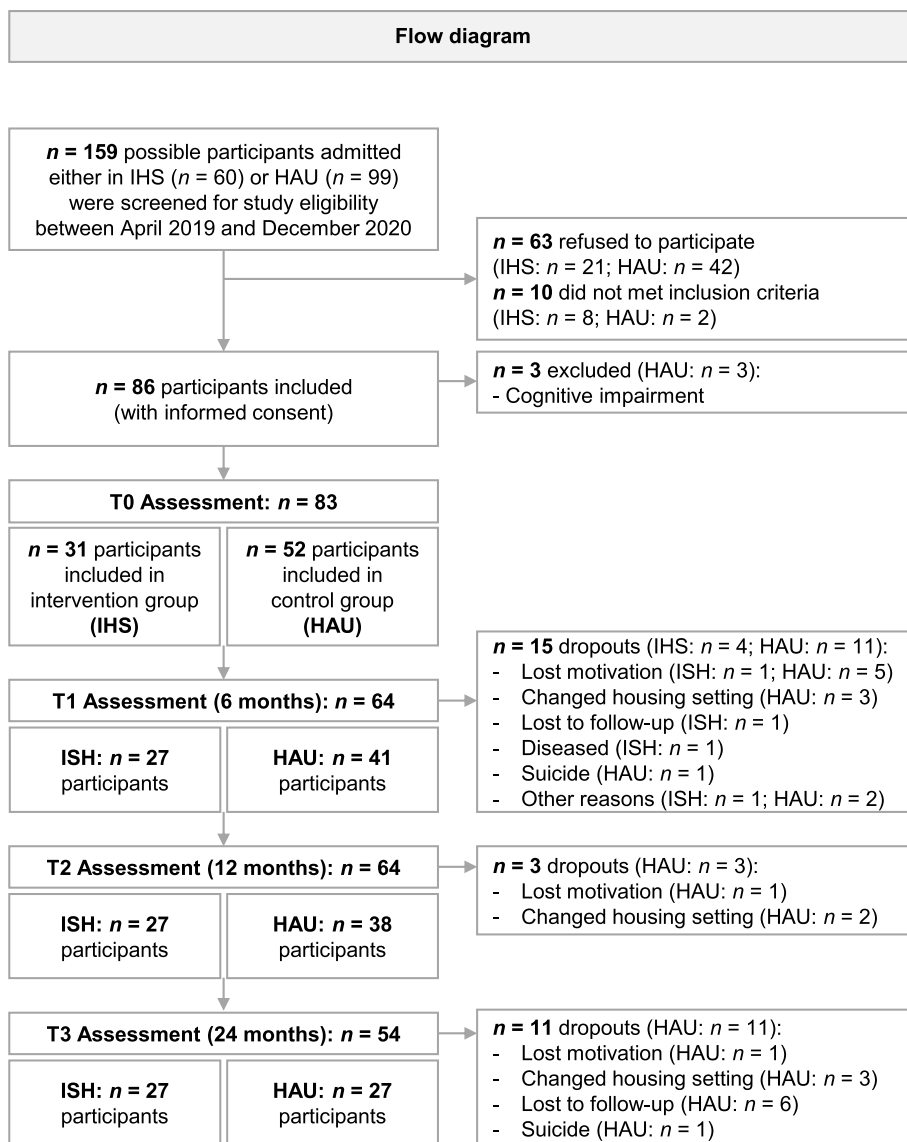


**Fig. 1** Flow Diagram of participants' recruitment and follow-up

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participants lived in a moderate support residential care setting (71%; Table 1). There were significant differences between the conditions (ISH, HAU) in terms of participants' gender, psychiatric diagnoses, source of income, and the number and duration of previous stays in housing rehabilitation ($p < 0.05$). Considering only the sample of completers (Table 1, right side), participants significantly differed between the settings in terms of their source of income and the number and duration of previous stays in housing rehabilitation ($p < 0.05$).

Study dropouts significantly differed from study completers in terms of their nationality ($p = 0.025$). Among completers, 98% had a Swiss nationality, compared to 69% of the dropouts. In the HAU condition, dropouts tendentially differed from completers regarding their psychiatric diagnosis ($p = 0.067$). Participants with substance abuse diagnoses more often completed participation (21% of completers, 4% of dropouts), whereas those

with 'other' psychiatric diagnoses (F7, F8, F9, and F10) more often dropped out (26% of dropouts, 3% of completers). There were no significant differences in other sample characteristics (all $p > 0.05$) between dropouts and completers of the whole sample and among HAU participants only.

Table 2 shows the descriptive results of the scale values of ISH and HAU participants of the total sample and completers only. The scale values of completers were similar to the scale values in the total sample at each time point.

At each time point, ISH was non-inferior to HAU in participants' social inclusion (lower end of the 95% CI < 15; Table 3). Between-group comparisons showed significantly higher symptom severity and lower functioning in ISH than in HAU participants at baseline. These differences were no longer significant during follow-up; symptoms and functioning improved in ISH participants and remained stable in the HAU condition. Within-group effects in HAU

**Table 2** Mean (*SD*) scale values of the total sample and completers only

| | | **Total sample** | | | | **Completers only** | | | |
| | | **ISH** | | **HAU** | | **ISH** | | **HAU** | |
| | **Variable** | *N* | mean (*SD*) | *N* | mean (*SD*) | *N* | mean (*SD*) | *N* | mean (*SD*) |
| **T0** | SFS | 31 | 110.42 ( 9.35) | 52 | 107.89 (10.60) | 27 | 109.99 ( 8.85) | 27 | 107.68 (12.47) |
| | MANSA | 31 | 4.43 ( 1.08) | 52 | 4.78 ( 0.99) | 27 | 4.40 ( 1.04) | 27 | 4.66 ( 1.05) |
| | SCL-K-9 | 31 | 1.56 ( 0.85) | 51 | 1.04 ( 0.75) | 27 | 1.60 ( 0.86) | 27 | 1.07 ( 0.71) |
| | OxCAP | 31 | 69.03 (12.05) | 52 | 69.33 (11.76) | 27 | 69.04 (12.07) | 27 | 68.94 (11.45) |
| | ESSI | 31 | 18.84 ( 5.51) | 51 | 18.96 ( 4.39) | 27 | 18.78 ( 5.74) | 26 | 18.69 ( 4.04) |
| | HoNOS | 31 | 1.04 ( 0.40) | 52 | 0.78 ( 0.48) | 27 | 1.01 ( 0.35) | 27 | 0.77 ( 0.48) |
| **T1** | SFS | 26 | 110.17 ( 9.23) | 38 | 111.79 ( 8.60) | 26 | 110.17 ( 9.23) | 26 | 111.38 ( 9.66) |
| | MANSA | 26 | 4.99 ( 0.73) | 38 | 4.91 ( 0.92) | 26 | 4.99 ( 0.73) | 26 | 4.88 ( 0.96) |
| | SCL-K-9 | 26 | 1.37 ( 0.98) | 38 | 0.85 ( 0.77) | 26 | 1.37 ( 0.98) | 26 | 0.97 ( 0.86) |
| | OxCAP | 26 | 71.63 (12.04) | 38 | 72.31 (12.06) | 26 | 71.63 (12.04) | 26 | 74.13 (13.14) |
| | ESSI | 26 | 19.89 ( 4.74) | 38 | 18.29 ( 4.87) | 26 | 19.89 ( 4.74) | 26 | 18.12 ( 5.01) |
| | HoNOS | 26 | 0.89 ( 0.41) | 37 | 0.90 ( 0.48) | 26 | 0.89 ( 0.41) | 26 | 0.86 ( 0.44) |
| **T2** | SFS | 26 | 110.89 ( 9.70) | 38 | 109.57 ( 8.67) | 26 | 110.89 ( 9.70) | 27 | 109.47 ( 9.48) |
| | MANSA | 26 | 4.85 ( 0.87) | 38 | 4.92 ( 0.87) | 26 | 4.85 ( 0.87) | 27 | 4.87 ( 0.86) |
| | SCL-K-9 | 26 | 1.36 ( 0.77) | 37 | 1.09 ( 0.74) | 26 | 1.36 ( 0.77) | 27 | 1.18 ( 0.82) |
| | OxCAP | 26 | 69.27 (12.53) | 37 | 70.32 (13.68) | 26 | 69.27 (12.53) | 27 | 72.69 (14.43) |
| | ESSI | 26 | 19.50 ( 4.31) | 37 | 17.30 ( 4.69) | 26 | 19.50 ( 4.31) | 27 | 17.30 ( 4.50) |
| | HoNOS | 26 | 0.77 ( 0.44) | 38 | 0.79 ( 0.44) | 26 | 0.77 ( 0.44) | 27 | 0.81 ( 0.46) |
| **T3** | SFS | 27 | 111.79 ( 9.07) | 27 | 109.87 (10.98) | 27 | 111.79 ( 9.07) | 27 | 109.87 (10.98) |
| | MANSA | 27 | 4.93 ( 1.05) | 27 | 5.07 ( 0.95) | 27 | 4.93 ( 1.05) | 27 | 5.07 ( 0.95) |
| | SCL-K-9 | 27 | 1.29 ( 0.69) | 27 | 1.06 ( 0.95) | 27 | 1.29 ( 0.69) | 27 | 1.06 ( 0.95) |
| | OxCAP | 27 | 73.50 (11.94) | 27 | 72.09 (14.04) | 27 | 73.50 (11.94) | 27 | 72.09 (14.04) |
| | ESSI | 27 | 19.74 ( 4.70) | 27 | 17.96 ( 5.17) | 27 | 19.74 ( 4.70) | 27 | 17.96 ( 5.17) |
| | HoNOS | 27 | 0.91 ( 0.48) | 27 | 0.82 ( 0.44) | 27 | 0.91 ( 0.48) | 27 | 0.82 ( 0.44) |

*SFS* Social Functioning Scale, *MANSA* Manchester Short Assessment of Quality of Life, *SCL-K-9* 9-item Symptom Checklist, *OxCAP* Oxford Capabilities Questionnaire – Mental Health, *ESSI* ENRICHD Social Support Inventory, *HoNOS* Health of the Nation Outcome Scales, *ISH* Independent Supported Housing, *HAU* Housing rehabilitation as usual, *N* Sample size

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**Table 3** Mixed-model estimates of within-group and between-group differences in scale values between ISH and HAU completers

| | Baseline Estimates (Intercept) | | | | | |
|---|---|---|---|---|---|---|
| | ISH | | HAU | | Difference ISH – HAU | |
| | Marginal estimate | 95% CI | Marginal estimate | 95% CI | Marginal estimate | 95% CI |
| SFS | 109.99 | 106.29 to 113.70 | 107.68 | 103.97 to 111.38 | 2.32 | -2.92 to 7.55 |
| MANSA | 4.40 | 4.04 to 4.75 | 4.66 | 4.31 to 5.02 | -0.27 | -0.77 to 0.24 |
| SCL-K-9 | 1.60 | 1.30 to 1.91 | 1.07 | 0.76 to 1.38 | **0.53** | **0.10 to 0.97** |
| OxCAP | 69.04 | 64.30 to 73.78 | 68.94 | 64.20 to 73.67 | 0.10 | -6.59 to 6.80 |
| ESSI | 18.78 | 16.99 to 20.57 | 18.43 | 16.62 to 20.23 | 0.35 | -2.19 to 2.89 |
| HoNOS | 1.01 | 0.84 to 1.17 | 0.77 | 0.61 to 0.93 | **0.24** | **＋0.00 to 0.47** |
| | Change from baseline to 6 months | | | | | |
| | ISH | | HAU | | Difference ISH – HAU | |
| | Marginal estimate | 95% CI | Marginal estimate | 95% CI | Marginal estimate | 95% CI |
| SFS | -0.10 | -3.71 to 3.52 | 3.33 | -0.28 to 6.94 | -1.11 | -6.41 to 4.19 |
| MANSA | **0.51** | **0.23 to 0.80** | 0.22 | -0.06 to 0.51 | 0.02 | -0.48 to 0.53 |
| SCL-K-9 | -0.22 | -0.51 to 0.07 | -0.12 | -0.41 to 0.17 | 0.43 | -0.01 to 0.88 |
| OxCAP | 2.12 | -2.24 to 6.49 | **5.27** | **0.90 to 9.63** | -3.04 | -9.81 to 3.72 |
| ESSI | 1.06 | -0.25 to 2.37 | -0.46 | -1.78 to 0.87 | 1.87 | -0.68 to 4.42 |
| HoNOS | -0.11 | -0.28 to 0.06 | 0.10 | -0.07 to 0.27 | 0.02 | -0.21 to 0.26 |
| | Change from baseline to 12 months | | | | | |
| | ISH | | HAU | | Difference ISH – HAU | |
| | Marginal estimate | 95% CI | Marginal estimate | 95% CI | Marginal estimate | 95% CI |
| SFS | 0.97 | -2.64 to 4.58 | 1.80 | -1.77 to 5.36 | 1.49 | -3.77 to 6.76 |
| MANSA | **0.40** | **0.11 to 0.68** | 0.21 | -0.08 to 0.49 | -0.07 | -0.58 to 0.43 |
| SCL-K-9 | -0.22 | -0.51 to 0.07 | 0.11 | -0.18 to 0.39 | 0.21 | -0.23 to 0.65 |
| OxCAP | -0.45 | -4.81 to 3.92 | 3.75 | -0.56 to 8.07 | -4.09 | -10.83 to 2.64 |
| ESSI | 0.43 | -0.88 to 1.74 | -1.13 | -2.44 to 0.18 | 1.91 | -0.63 to 4.45 |
| HoNOS | **-0.24** | **-0.41 to -0.08** | 0.04 | -0.13 to 0.20 | -0.04 | -0.28 to 0.19 |
| | Change from baseline to 24 months | | | | | |
| | ISH | | HAU | | Difference ISH – HAU | |
| | Marginal estimate | 95% CI | Marginal estimate | 95% CI | Marginal estimate | 95% CI |
| SFS | 1.79 | -1.78 to 5.36 | 2.20 | -1.37 to 5.77 | 1.91 | -3.33 to 7.15 |
| MANSA | **0.54** | **0.26 to 0.82** | **0.40** | **0.12 to 0.69** | -0.13 | -0.63 to 0.37 |
| SCL-K-9 | **-0.32** | **-0.60 to -0.03** | -0.01 | -0.30 to 0.28 | 0.23 | -0.21 to 0.67 |
| OxCAP | **4.46** | **0.14 to 8.77** | 3.16 | -1.15 to 7.47 | 1.40 | -5.30 to 8.10 |
| ESSI | 0.96 | -0.33 to 2.25 | -0.46 | -1.77 to 0.84 | 1.78 | -0.75 to 4.31 |
| HoNOS | -0.10 | -0.26 to 0.07 | 0.05 | -0.11 to 0.22 | 0.09 | -0.14 to 0.32 |

*SFS* Social Functioning Scale, *MANSA* Manchester Short Assessment of Quality of Life, *SCL-K-9* 9-item Symptom Checklist, *OxCAP* Oxford Capabilities Questionnaire – Mental Health, *ESSI* ENRICHD Social Support Inventory, *HoNOS* Health of the Nation Outcome Scales, *ISH* Independent Supported Housing, *HAU* Housing rehabilitation as usual, *N* Sample size

showed a significant increase in capabilities between baseline and six months. This increase was no longer statistically significant after 12 months. Quality of life significantly increased between baseline and T3 in HAU. In ISH, quality of life improved after baseline. This increase was significant during the entire follow-up period (T1-T3). After one year, there was a significant improvement in HoNOS functioning in ISH participants and a significant group*time interaction (95% CI 0.04 to 0.52). After two years, ISH participants showed significantly higher quality of life, lower symptom severity and more capabilities than at baseline.

Utilisation of psychiatric treatments was high in both study conditions during the entire study period (Fig. 2). Many participants were psychiatrically hospitalised before admission to the housing rehabilitation services (ISH: 52%; HAU: 77%). The different hospitalisation rates between the settings before baseline may either reflect a different level of needs between the conditions, or it may reflect a selection bias as a result of referral preferences of the psychiatric hospitals. For this reason, we did not consider the significant reduction of hospitalisations between T0 and T1, as it may reflect a regression
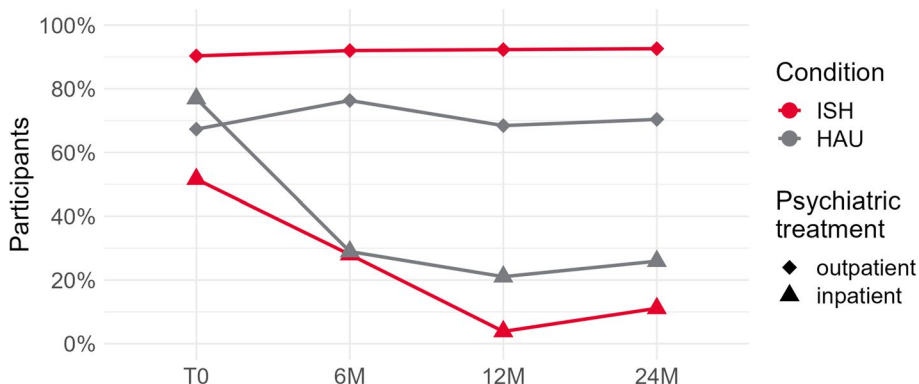
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**Fig. 2** Psychiatric treatment utilisation in ISH and HAU

towards the mean instead of an effect of the housing settings. During the study period, however, between 21% and 29% of HAU participants and 4% to 28% of ISH participants needed psychiatric hospitalisation. Statistically significant changes in hospitalisation rates occurred in ISH between T1 and T2 ($p = 0.041$). In contrast, outpatient psychiatric treatment utilisation rates were higher in ISH (> 90%) than in HAU participants (< 76%) at each assessment.

After two years (T3), 33.3% ($n = 9$) of ISH users and 40.7% ($n = 11$) of HAU residents lived independently without housing rehabilitation support. Figure 3 shows the costs of housing and rehabilitation service utilisation in ISH and HAU. The daily flat rates of the cooperating HAU settings amount to 224 Swiss francs in most cases (modus = residential care) and range from 135 (host

family, residential care) to 333 Swiss francs (high-support residential care). Because housing costs could not be tracked after participants moved to non-cooperating settings, we used a relatively low daily flat rate estimate of 200 Swiss francs to provide a conservative comparison of costs between ISH and HAU. In ISH, on average, participants received about six hours of housing rehabilitation support per month. The amount of invoiced support ranged between 0.31 and 19.95 h per month. ISH support led to monthly costs of between 657 and 795 Swiss Francs. After adding costs for rent and basic needs (Fig. 3: ISH housing), both the monthly (ISH: about 2,760; HAU: about 6,000 Swiss Francs; Difference: about 3,240) and the total costs (ISH: 57,341; HAU: 94,459; Difference: 37,118; see Fig. 3) of housing and rehabilitation support with ISH are almost half of the costs of living in a HAU facility.
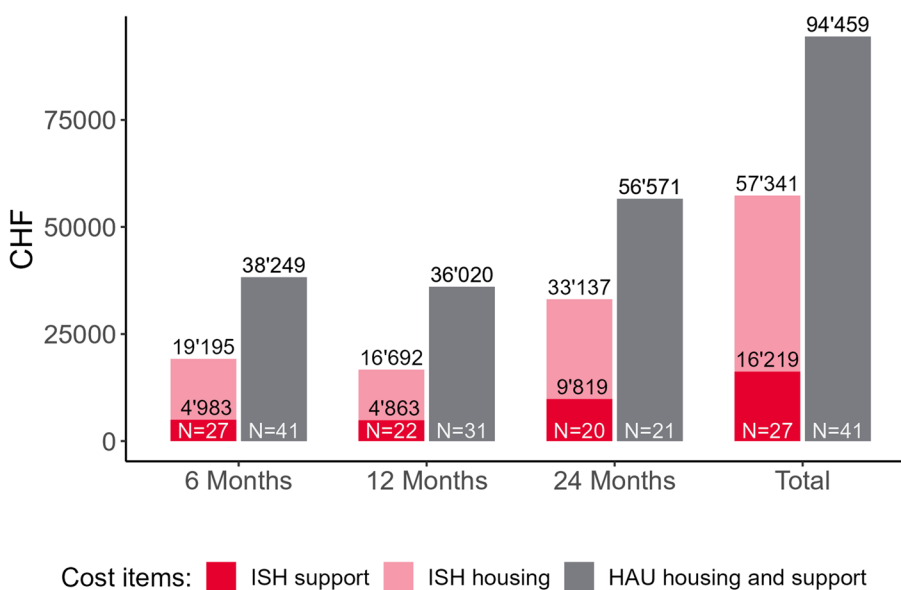


**Fig. 3** Housing and support costs in ISH and HAU

## Discussion

The findings of this two-year observational study on ISH vs HAU in the housing rehabilitation of non-homeless individuals with SMI show promising effectiveness results of Independent Supported Housing (ISH). During two years, ISH was found to be non-inferior to HAU settings at the two year follow-up in regards to social inclusion as measured with the SFS. Within-group comparisons showed ISH was associated with reductions in inpatient psychiatric treatments and improvements in quality of life, psychiatric symptoms, and capabilities. In addition, ISH support and housing costs were much lower than living in a HAU facility. At baseline, ISH participants showed higher overall symptom severity and lower functioning. During the study, symptoms and functioning improved in ISH participants and remained stable in HAU participants. HAU was associated only with improvements in quality of life. However, many HAU participants had withdrawn from study participation (HAU dropout rate: 48%).

Our study's results align with a similar observational study from Germany, which included more than 250 participants and was conducted before the Coronavirus pandemic. They found significant improvements in ISH and HAU participants regarding social inclusion, psychiatric symptoms, and quality of life and a significant decrease in psychiatric hospitalisations, with no significant between-group differences [17]. In our study, there was no significant improvement in social inclusion in both conditions and no significant improvement in the psychiatric symptoms of HAU participants. However, the study by Dehn et al. [17] had a much lower dropout rate and included larger samples. Our results are also similar to those we found with the RCT on ISH for non-homeless persons, which showed tendentially better outcomes for ISH than for control participants. The RCT further showed strong and persisting preferences of control participants to use ISH [15]. Our results align with various systematic reviews on housing rehabilitation for homeless and non-homeless persons with SMI, most showing promising results with ISH [10–12].

We formulated a non-inferiority hypothesis following the recommendations of a preference-driven supply of housing rehabilitation settings and the existing evidence base. This is attractive if the new intervention is expected not to be unacceptably worse than the standard treatment and less expensive than the standard treatment or leads to improved quality of life [18]. This is precisely what the present study has shown. ISH has been neither non-inferior nor superior to HAU regarding the main rehabilitation goal of *social inclusion* [4]. At the same time, ISH was much less expensive than HAU settings, was associated with a reduction of costly psychiatric hospitalisations, and, with this, with an indirect prevention of further social exclusion of participants [2], and was associated with improved quality of life, symptoms, and capabilities. With these results, ISH showed several advantages over HAU services, of which the latter are still provided as standard services for the housing rehabilitation of persons with SMI in many countries. Accordingly, the results of the present study support the political requirement and treatment guideline recommendations of a completely preference-driven provision of housing rehabilitation [4, 5, 46]. Our results support that ISH is well feasible and advantageous for many persons with SMI who need housing rehabilitation and prefer independent living over living in an institution. The fact that people with SMI are still often accommodated in such high-cost and high-support HAU services must be questioned, and more community-based alternatives like ISH services must be created that better promote independent living.

### Limitations

Some limitations need to be considered when interpreting the results. Firstly, it cannot be ruled out that the social inclusion of our participants was significantly impaired by the Coronavirus pandemic, which broke out while the study was being conducted. However, the data showed no impairment in participants' social participation subscale scores either. In addition, it was also due to the pandemic that we were unable to achieve the targeted two- to three-times larger sample size in the control group [21]. Secondly, the study was conducted as an observational study of two different forms of housing support. Participants significantly differed between the study conditions at baseline in terms of gender, diagnoses, source of income, years in housing rehabilitation settings, hospitalisation rates, symptom severity and functioning. Psychiatric diagnoses furthermore significantly differed between completers and dropouts, and there were many more dropouts in the control condition than in the ISH condition. Although baseline values in the severity of symptoms and impairment of functioning were not higher in the control condition at baseline, it cannot be completely ruled out that the services cater for people with different needs and that the comparison of outcomes in the two groups may be subject to confounding. Furthermore, the control group consisted of different HAU institutions, which refer to different types of supported accommodation (STAX-SA types 1, 2, 3; [23]). Therefore, whether the different HAU services serve people with different needs cannot be ruled out. In addition, it is possible that the analysis of completers excluded a subpopulation of HAU residents with higher needs. However, the characteristics of the completers did

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not significantly differ and indicate that the completers in the HAU condition may have had similar support needs as the ISH participants.

Thirdly, the dropout rates amounted to almost 50% in the HAU condition. A large amount of control participants got lost to follow-up after T2. As noted in Goering et al. [47], shorter follow-up intervals than one year likely maintained the contact better in the HAU condition, as before the T2 assessment. Because (multiple or any) imputation of missing data is not recommended if the proportions are large [48], we only performed the mixed-model analysis based on study completers' data. For the same reason, we did not apply a propensity score-based method to balance the sample characteristics between the study conditions in the analyses, as initially intended [19, 21]. Propensity scores allow unbiased estimation of an intervention's effectiveness by statistically balancing confounding covariates [49, 50]. In the one-year results of our study, the inverse probability of treatment weighting procedure (IPTW) introduced a very good balance in the sample characteristics [19]. However, the large dropout rate in the control condition would bias any balancing effect of propensity score-based methods. Fourthly, the mixed-models analysis of completers' data mainly showed within-group effects, and there were hardly any between-group effects during the follow-up. Furthermore, all estimates have wide confidence intervals. This limits the robustness of the results and only provides an exploratory impression of the effectiveness of the two housing rehabilitation settings for the completers of the target group. Nevertheless, considering all the mentioned limitations, the findings show the potential benefits of ISH compared to several institutional HAU services. More research is needed on the effectiveness of ISH for non-homeless persons, addressing the mentioned limitations.

## Conclusions
Overall, the longitudinal results of the present study show that ISH is non-inferior to HAU in terms of social inclusion, and ISH is a much less expensive intervention than HAU in the housing rehabilitation of non-homeless persons with SMI. In line with previous research, ISH further was associated with significant reductions of psychiatric hospitalisations, lower housing and rehabilitation costs, and improved quality of life, while HAU was associated only with improved in quality of life. Considering the strong preferences of persons with SMI for independent living [6, 15], our results strongly argue for a preference-driven provision of housing rehabilitation services, as is recommended by current policies and guidelines [4, 5]. To make this possible, however, there is a strong need for increased implementation of ISH services. Only with enough alternatives to HAU settings will we be able to provide housing rehabilitation based on service users' preferences.

## Abbreviations
ISH       Independent Supported Housing
HAU       Housing rehabilitation as usual
SMI       Severe mental illness
UN CRPD   UN Convention on the Rights of Persons with Disabilities

## Authors' contributions
Conceptualisation [MJ], [DR]; Data Curation [ChA]; Formal Analysis [ChA]; Funding Acquisition [MJ], [DR]; Investigation [ChA]; Methodology [ChA], [SM], [MJ], [DR]; Project Administration [MJ], [DR]; Supervision [MJ], [DR]; Visualisation [ChA]; Writing – Original draft preparation [ChA]; Writing – Review and editing [SM], [MJ], [DR].

## Authors' information
Not applicable.

## Availability of data and materials
The datasets generated and analysed during the current study are not publicly available due to possible privacy violations and ethical and legal obligations to study participants. The datasets are available from the corresponding author upon reasonable request after a written agreement between the authors and researchers who wish to access the data.

## Declarations

### Ethics approval and consent to participate
This study received ethical approval from the Swiss Association of Research Ethics Committees (swissethics), Reference No. 2018–02381. All participants provided written informed consent for participation.

### Consent for publication
Not applicable.

### Competing interests
ChA, SM and DR are affiliated with the institution where the research was conducted. MJ declares that no competing interests exist.

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## Publisher's Note