Impact of integrated district level mental health care on clinical and social outcomes of people with severe mental illness in rural Ethiopia: an intervention cohort study


This version is available from Sussex Research Online: http://sro.sussex.ac.uk/id/eprint/85045/

This document is made available in accordance with publisher policies and may differ from the published version or from the version of record. If you wish to cite this item you are advised to consult the publisher’s version. Please see the URL above for details on accessing the published version.

Copyright and reuse:
Sussex Research Online is a digital repository of the research output of the University.

Copyright and all moral rights to the version of the paper presented here belong to the individual author(s) and/or other copyright owners. To the extent reasonable and practicable, the material made available in SRO has been checked for eligibility before being made available.

Copies of full text items generally can be reproduced, displayed or performed and given to third parties in any format or medium for personal research or study, educational, or not-for-profit purposes without prior permission or charge, provided that the authors, title and full bibliographic details are credited, a hyperlink and/or URL is given for the original metadata page and the content is not changed in any way.

http://sro.sussex.ac.uk
Accepted by Epidemiology and Psychiatric Sciences

https://www.cambridge.org/core/journals/epidemiology-and-psychiatric-sciences

Impact of integrated district level mental health care on clinical and social outcomes of people with severe mental illness in rural Ethiopia: an intervention cohort study

C. Hanlon\textsuperscript{1,2,3\*}, G. Medhin\textsuperscript{4}, M. Selamu\textsuperscript{2}, R. Birhane\textsuperscript{2}, M. Dewey\textsuperscript{1}, K. Tirfessa\textsuperscript{5}, E. Garman\textsuperscript{6}, L. Asher\textsuperscript{7}, G. Thornicroft\textsuperscript{1}, V. Patel\textsuperscript{8,9,10}, C. Lund\textsuperscript{1,6}, M. Prince\textsuperscript{1}, A. Fekadu\textsuperscript{2,3,11}

\textbf{Short title:} District mental health care for people with SMI in Ethiopia

\textbf{Affiliations}

1\textsuperscript{1}King’s College London, Institute of Psychiatry, Psychology and Neuroscience, Health Service and Population Research Department, Centre for Global Mental Health
2\textsuperscript{2}Addis Ababa University, College of Health Sciences, School of Medicine, Department of Psychiatry, Addis Ababa, Ethiopia
3\textsuperscript{3}Centre for Innovative Drug Development and Therapeutic Trials for Africa (CDT-Africa), College of Health Sciences, Addis Ababa University
4\textsuperscript{4}Addis Ababa University, Aklilu Lemma Institute of Pathobiology, Addis Ababa University, Addis Ababa, Ethiopia.
5\textsuperscript{5}Kotebe Metropolitan University, College of Education and Behavioral Studies, Addis Ababa, Ethiopia
6\textsuperscript{6}Alan J Flisher Centre for Public Mental Health, Department of Psychiatry and Mental Health, University of Cape Town, Cape Town, Republic of South Africa
7\textsuperscript{7}University of Nottingham, School of Medicine, Division of Epidemiology and Public Health, Nottingham, UK
8\textsuperscript{8}Harvard Medical School, Department of Global Health and Social Medicine, USA
9\textsuperscript{9}Harvard TH Chan School of Public Health, Department of Global Health and Population, USA

\* Department of Psychiatry, 6\textsuperscript{th} Floor, College of Health Sciences Building, Tikur Anbessa Hospital Compound, PO 9086, Addis Ababa, Ethiopia
Word count: 4000 words
Abstract

Aim

There is limited evidence of the safety and impact of task-shared care for people with severe mental illnesses (SMI; psychotic disorders and bipolar disorder) in low-income countries. The aim of this study was to evaluate the safety and impact of a district level plan for task-shared mental health care on 6 and 12-month clinical and social outcomes of people with SMI in rural southern Ethiopia.

Methods

In the Programme for Improving Mental health care (PRIME), we conducted an intervention cohort study. Trained primary healthcare (PHC) workers assessed community referrals, diagnosed SMI and initiated treatment, with independent research diagnostic assessments by psychiatric nurses. Primary outcomes were symptom severity and disability. Secondary outcomes included discrimination and restraint.

Results

Almost all (94.5%) PHC worker diagnoses of SMI were verified by psychiatric nurses. All prescribing was within recommended dose limits.

A total of 245 (81.7%) people with SMI were re-assessed at 12 months. Minimally adequate treatment was received by 29.8%.

All clinical and social outcomes improved significantly. The impact on disability (standardised mean difference 0.50; 95% confidence interval (CI) 0.35, 0.65) was greater than impact on symptom severity (standardised mean difference 0.28; 95%CI 0.13, 0.44). Being restrained in the previous 12 months reduced from 25.3% to 10.6%, and discrimination scores reduced significantly.

Conclusions
An integrated district level mental health care plan employing task-sharing safely addressed the large
treatment gap for people with SMI in a rural, low-income country setting. Randomised controlled trials
of differing models of task-shared care for people with SMI are warranted.

Key words

Community mental health; schizophrenia; bipolar disorder; psychotic disorder; global mental health;
task-sharing
The treatment gap for people with severe mental illness (SMI) is over 90% in most low-income countries (Wang et al., 2007). A ‘full’ task-sharing model whereby primary healthcare (PHC) workers are equipped to deliver all aspects of first-line mental health care, with limited specialist support, is recommended to increase access to care. Full task-sharing is at the heart of the World Health Organisation (WHO)’s mental health Gap Action Programme (mhGAP) (World Health Organization, 2008). However, many studies of task-shared care for SMI have employed a model whereby a mental health specialist makes the diagnosis of SMI, initiates treatment and provides ongoing review, combined with involvement of non-specialists in delivering psychosocial aspects of care (Chatterjee et al., 2014). This ‘partial’ model of task-sharing cannot address the needs of most people with SMI in low-income countries due to the scarcity of mental health professionals. In the few examples of programmes employing a ‘full’ task-sharing approach (Gureje et al., 2015, Ventevogel et al., 2012), there is only limited evidence on whether care can be delivered safely and with sufficient quality to bring about improved outcomes for people with SMD (Jordans et al., 2017, Jordans et al., 2019). This lack of evidence may be fuelling reluctance to embrace the more ambitious task-sharing approach (Hanlon et al., 2016b). To address this evidence gap, we present findings from the Programme for Improving Mental health care (PRIME) (Fekadu et al., 2016). We have shown that PRIME in Ethiopia achieved contact coverage of over 80% for people with SMI in the target population (Hailemariam et al., 2018). The objective of the current study was to investigate the impact of implementing a district level mental health care plan on the 12-month clinical and social outcomes of people with SMI who engaged with primary mental health care in Ethiopia.

Methods
Study design

We conducted an intervention cohort study, with assessments conducted at the baseline of implementation of the district mental health care plan (T0), and six (T1) and 12 months (T2) after initial engagement of people with SMI in the new integrated service.

Setting

The PRIME study was carried out in Sodo district, in the Gurage Zone of the Southern Nations, Nationalities and Peoples’ Region of southern Ethiopia from December 2014 to July 2016. Sodo has an estimated population of around 160,000 people (Hanlon et al., 2014). More than 90% of inhabitants live in rural areas and rely on subsistence farming and small-scale trading. At the time of the study, health services in Sodo comprised 54 health posts, most of which were staffed by two community health extension workers with one year of training in general health promotion and illness prevention, and eight health centres, staffed by nurses, health officers and midwives, who provide basic curative and obstetric care. There were no doctors or mental health specialists in the district. In the nearest town of Butajira, located 30 to 50km from Sodo, there was a psychiatric nurse-led out-patient clinic. The nearest in-patient mental health services were 100-120km away in the capital city, Addis Ababa.

Sample and recruitment procedures

As described previously (Baron et al., 2018), people with possible SMI in the community were identified by community key informants and health extension workers who had received half a day of training in typical presentations of SMI (Shibre et al., 2002). People with possible SMI were referred to the nearest health centre and assessed by PHC workers who had been trained in mental health care for a total of 10 days: five days of classroom-based teaching using adapted mhGAP training materials and five days of
practical clinical training in the Butajira psychiatric clinic. The PHC workers assessed the referrals, made a diagnosis of SMI and initiated treatment according to the evidence-based clinical guidelines in the WHO mhGAP Intervention Guide (World Health Organization, 2016). Independent diagnostic review was carried out with standardised, semi-structured clinical assessments by research psychiatric nurses using the OPerational CRITERia for research (OPCRIT) (McGuffin P et al., 1991). Diagnostic assessments were conducted for all people with PHC worker-diagnosed SMI and wherever the PHC worker was uncertain about the diagnosis. The research psychiatric nurses reviewed the initial treatment plan. Any changes made by the psychiatric nurses were communicated back to the PHC workers.

Eligibility criteria

- Confirmatory research psychiatric nurse diagnosis of a psychotic disorder (including schizophrenia, schizoaffective disorder and depression with psychotic features) or bipolar disorder.
- Providing informed consent, or caregiver permission, to participate in the study if the person with SMI lacked capacity to consent.
- Able to converse in Amharic, the official language of the region.
- Planning to reside in the district for at least 12 months.
- No cognitive or sensory impairment that interfered substantially with the clinical assessment.
- Not acutely physically unwell.

Sample size

The sample size for the PRIME SMI cohorts across countries was calculated to detect a 20% reduction in severity of symptoms at 12 months, with 90% power, two-sided alpha of 0.05 and 20% attrition rate (Baron et al., 2018), leading to a target sample size of 150. However, in the Ethiopia district, all people
who received a confirmatory diagnosis of SMI were included to establish a completely ascertained population cohort.

PRIME intervention for people with SMI

The integrated district mental health care plan for the Ethiopian setting has been described in detail previously (Fekadu et al., 2016), and involved interventions at the level of the health system, PHC facility and community.

Health system interventions

The district health office staff were involved in participatory planning using Theory of Change methodology (Hailemariam et al., 2015). The district health office assigned a focal person for mental health co-ordination. PRIME provided ongoing technical support with medication supply management (including establishing a revolving drug fund and providing assistance with forecasting the amount of psychotropic medication required), building capacity in supervision of mental healthcare (training high-performing general health workers to supervise mental health care) and monitoring and evaluation activities (e.g. aggregating data on facility contacts and feeding back at the advisory board meetings).

PHC facility interventions

All frontline PHC workers in Sodo district (n=128) were trained in mental healthcare. The PHC workers received monthly supervision from a psychiatric nurse trained using the mhGAP supervisor training manual. For rural health centres, supervision was conducted by telephone when weather conditions precluded travel to the facility. PHC workers could also consult the psychiatric nurse for advice. People with confirmed SMI were prescribed an antipsychotic and/or antidepressant medication and/or a benzodiazepine, as indicated. There were no mood-stabiliser medications available, so people with
bipolar disorder received antipsychotic medication as per usual practice in this setting (Fekadu et al., 2015). Almost all service users had to pay for medication.

In addition to prescription of medication, PHC workers were trained to provide psychoeducation, activate social supports, address social stressors, monitor physical health, review response to treatment and refer to specialist mental health care if needed. As prescriptions were usually for a maximum of one month, follow-up appointments with the PHC workers were usually scheduled monthly.

Community level interventions

A multi-sectoral ‘community advisory board’ was established to support community awareness-raising and mobilisation, to help with trouble-shooting during the implementation phase and to review project activities and outcomes. A total of 96 community-based health extension workers were trained in case detection, outreach to re-engage people who dropped out of care, identification of medication side effects, community awareness-raising and supporting social reintegration and recovery of people with SMI. In half of the sub-districts, people with schizophrenia who had enduring symptoms or disability after six months received adjuvant community-based rehabilitation, delivered by trained lay workers (n=75) or ongoing PRIME care (n=87), as part of a nested cluster randomised trial (the RISE trial) (Asher et al., 2016). Aside from the additional contacts from CBR workers in the intervention arm (weekly for two to three months and two-weekly for the subsequent five to six months), there were no additional trial-related contacts.

Measures

Primary outcomes
• Clinical symptom severity was measured using the Brief Psychiatric Rating Scale, expanded version (BPRS-E) (Burlingame et al., 2006). The BPRS-E is a 24-item, clinician-rated scale which has been translated into Amharic and shown to have robust psychometric properties and sensitivity to change in Ethiopia (Habtamu et al., 2017).

• Disability was measured using the World Health Organisation Disability Assessment Schedule (WHODAS), version 2.0, 36-item version (Üstün et al., 2010). The WHODAS has been validated for use in people with SMI in Ethiopia and is sensitive to change (Habtamu et al., 2017). The WHODAS was completed by a combination of responses from the person with SMI and the caregiver responses to the proxy-WHODAS at the post-baseline assessments (19.8% of WHODAS scores from caregivers at midline, 24.1% at endline). We used the polytomous summary score of the WHODAS scaled from 0 to 100.

Secondary outcomes

• Experience of discrimination was measured using the ‘unfair treatment’ subscale of the discrimination and stigma scale-12 (DISC-12) (Brohan E et al., 2013). The original DISC-12 subscale has 21 items. Four items lacked face validity or had a low frequency of endorsement, but the remaining 17 items loaded onto a single factor using exploratory factor analysis and were summed.

• Restraint was measured by self-report of whether the person had been ‘restrained, chained or confined’ in the preceding 12 months.

• Alcohol use disorder was measured using the lay interviewer-administered Alcohol Use Disorder Identification Test (AUDIT) (Babor TF et al., 2001). This 10-item scale has been adapted for local drinks in the Ethiopian setting. People scoring ≥8 are considered to have a probable alcohol use disorder.
Depression was measured using a locally validated version of the Patient Health Questionnaire (PHQ-9) (Kroenke and Spitzer, 2002). In the Ethiopian setting, a cut-off of 5 or more is indicative of major depressive disorder (Hanlon et al., 2015).

Suicide attempts in the past three months were assessed using the Mini International Neuropsychiatric Interview (Sheehan et al., 1997).

Potential effect modifiers

**Equity indicators**

- Gender and residence (rural vs. urban).
- Socio-economic status: a poverty index was constructed which loaded onto a unidimensional scale using exploratory factor analysis: roof material made of straw (vs. corrugated iron), unimproved water source, unimproved sanitation, no electricity, no separate room for kitchen, no radio or television, no mobile phone.
- Time to access the nearest health facility, estimated in minutes, whatever the means of travel. This was dichotomised into less than 60 minutes vs. 60 minutes or longer.

**Baseline characteristic**


**Process indicators**

- Receipt of minimally adequate treatment used the definition proposed by Wang et al. (Wang et al., 2002): prescription of medication on at least one occasion combined with at least four follow-up appointments with a health worker trained in mental health. We additionally required
that psychotropic medication should be prescribed at therapeutic levels (World Health Organization, 2016). Data on the number of facility contacts and prescriptions were extracted from the clinical records, cross-referenced with a facility registration book.

- Receipt of community support (measured at T1 and T2): support received with returning to work, remembering to take medication, improving self-care, meeting people and social engagement. Responses were summed and binarized: 0 to 2 types of community support vs. 3 to 5 types of community support.

- Receipt of in-patient care for mental health problems, contact with specialist mental health or general health facilities and traditional or religious healers, and type of care received during primary health care contacts were measured at T1 and T2.

Descriptive baseline characteristics

- Socio-demographic characteristics (age, educational level, marital status).

- Social support was assessed using the three-item Oslo Social Support Scale (OSS-3) (Dalgard OS et al., 2006), which asks about number of close supports, extent of concern from supports and amount of practical support received. The OSS-3 total score was categorised as follows: 3 to 8 “poor support”, 9 to 11 “intermediate support” and 12 to 14 “strong support”.

- Duration of illness, type of illness onset (acute/sub-acute vs. gradual), psychiatric hospitalisation in the past 12 months, presence of co-morbid medical condition and receipt of psychotropic medication at baseline were obtained from the OPCRIT (McGuffin P et al., 1991).

Data collection

The lay interviewers were individuals with an educational level of at least tenth grade who were recruited from the local area and trained for 12 days on the study questionnaires and protocols, including observed practice interviews. The trainers had master’s level qualifications. Degree-level
supervisors monitored data quality in the field. The clinician assessments were conducted by research
psychiatric nurses who were trained for seven days by senior Ethiopian psychiatrists. The OPCRIT
diagnoses were double-checked by an Ethiopian psychiatrist by reviewing the OPCRIT responses and
clinical documentation and conducting verification interviews (n=2) where needed.

Data management and analysis

Data were double-entered using EpiData (Lauritsen and Bruus, 2003) and analysed using Stata version
13.1 (StataCorp LP, 2016). The data were summarised descriptively, with outcome data stratified by
equity indicators (gender, residence, distance from the health facility and poverty status). Comparison of
the characteristics of participants remaining in the cohort with those lost to follow-up at 12 months, as
well as by equity indicators, was conducted using Pearson chi-squared for categorical variables,
Student’s t-test for comparing means in normally distributed variables and Kruskal Wallis equality-of-
populations rank test for non-normal continuous variables.

Mixed effects linear regression with random intercept was used to model the change in symptom
severity, disability and depressive symptoms over time. We tested for improvement in model fit using
likelihood ratio tests after adding random slopes. We also tested for any significant difference in the
mean change between T0 and T1 or between T1 and T2. Mixed effects ordinal regression was used to
model change in discrimination score over time. A prevalence ratio was calculated for change from T0 to
T2 in probable alcohol use disorder (AUDIT ≥ 8), suicide attempt in the preceding three months or
restraint in the preceding 12 months.

For the primary outcomes, we calculated standardised mean difference (Borenstein et al., 2009) and
examined effect modification by the equity indicators, diagnosis (primary psychotic disorder vs. affective
disorder), process indicators (receipt of minimally adequate treatment and community support) and by
the community-based rehabilitation intervention group for the RISE trial. This was done by adding an
interaction term into the model and testing for improved model fit using a likelihood ratio test. Multiple linear regression analysis was conducted to examine the association between baseline duration of illness and type of illness onset with 12 month outcomes.

Ethical considerations

Ethical approval was obtained from the Institutional Review Board of the College of Health Sciences, Addis Ababa University (No. 084/11/Psy). Informed consent was obtained where possible. If the person lacked capacity and did not refuse, the accompanying caregiver was invited to give permission on the person’s behalf.

Results

Of the 294 people diagnosed by PHC workers as having SMI, 279 were confirmed to have SMI, giving a positive predictive value for PHC worker diagnosis of 94.9%. A further 21 people referred by PHC workers to psychiatric nurses for diagnostic review were also found to have SMI, giving a total of 300 participants. See Figure 1.

Baseline characteristics

See Table 1. At baseline there was no significant difference in symptom severity score, disability, discrimination or depressive symptoms by gender. The proportion with an alcohol use disorder ($\chi^2(1)$ 48.6750; $p < 0.001$) or who had been restrained ($\chi^2(1)$ 5.1154; $p=0.024$) was higher in men. Baseline disability ($t=2.1012; p=0.04$) and restraint ($\chi^2(1)$ 3.9058; $p=0.048$) were significantly higher in those with
low socioeconomic status. Perceived negative discrimination at baseline was higher in urban residents ($\chi^2(1) = 3.986; \ p = 0.049$) and people of low socioeconomic status ($\chi^2(1) = 4.195; \ p = 0.04$).

Cohort follow-up

A total of 247 (82.3%) people were assessed at T1 (mean 7.4 months; SD 1.49) and 245 (81.7%) at T2 (mean 12.3 months; SD 1.12). See Figure 1. There was no evidence of differential loss to follow-up based on baseline characteristics (Supplementary File 1). During the follow-up period, 11 participants died.

Facility-based intervention

After review by psychiatric nurses, the medication initiated by PHC workers was unchanged or changed within the same medication class for 184 (67.7%) participants. Psychiatric nurses increased the dose or added another medication for 46 (16.9%), stopped or reduced the dose in 15 (5.9%), changed the class of medication in 15 (5.5%) and stopped a prescription of depot antipsychotic medication in 5 (1.8%).

Participants attended a median of two PHC appointments during the follow-up period (IQR 2,4; minimum 1 and maximum 12). Supplementary File 2. Minimally adequate treatment was received by 89 (29.8%). Supplementary File 3. There was no evidence of prescribing above recommended limits and only one occurrence of antipsychotic polypharmacy. Admission for in-patient care was very low (1.4% at T1 and 2.0% at T2) and less than 10% of participants had direct contact with a mental health specialist. A high proportion reported receiving psychosocial support and explanation about medication (Supplementary File 4).

Community-based interventions

Most people with SMI reported receiving support with medication adherence and to improve self-care. More than half received support to get back to work, but less than a quarter were supported to get involved in social activities and less than 10% had support with meeting people. Almost all support was
reported to come from the family. A small proportion reported contact with traditional or religious healers: 13.0% at T1 and 11.6% at T2.

Impact on clinical and social outcomes

There was a significant improvement in all clinical (symptom severity score, depressive symptoms, suicide attempts, alcohol use disorder) and social (functioning, discrimination, restraint). Tables 2 and 3.

The standardised mean difference for symptom severity was 0.18 (95% confidence interval (CI)) 0.02, 0.34) between T0 and T1 and 0.28 (95%CI 0.13, 0.44) from T0 to T2. For disability, the standardised mean difference was larger at both time-points: T0 to T1: 0.27 (95%CI 0.13, 0.41), T0 to T2: 0.50 (95%CI 0.35, 0.65). The test for interaction between the RISE trial intervention group and the main outcomes (symptom severity and functioning) at 12 months was non-significant.

For symptom severity and functioning, the magnitude of the change did not differ between T0 and T1 compared to T1 and T2. The reduction in depressive symptoms was significantly greater between T0 and T1 than between T1 and T2 ($\chi^2(1) 4.26; p=0.039$); similarly for change in perceived discrimination ($\chi^2(1) 3.75; p=0.053$).

There was no statistically significant effect modification by the equity indicators, diagnosis or process indicators for the primary outcomes. At T1, higher receipt of community support had a borderline statistical association with greater reduction in symptom severity ($p=0.19$) and disability ($p=0.09$).

Supplementary Files 5 and 6. There was no association between duration of illness or type of illness onset and the mean improvement in the primary outcomes.

Discussion
In this community-ascertained intervention cohort of clinician-confirmed people with SMI, there was a significant improvement in clinical and social outcomes after implementation of a district level mental health care plan. PHC workers diagnosed SMI accurately, prescribed psychotropic medication safely and were reported to have delivered psychoeducation and provided support to most people with SMI. The findings from this study are generalizable to similar rural settings of low-income countries.

Although PHC workers prescribed safely (low polypharmacy and no doses above the recommended therapeutic range), the psychiatric nurses did consider that it was necessary to change the initial prescriptions of psychotropic medication in 30.1% of cases. This reinforces the need for task-shared care to be supported by input by mental health specialists, either through regular supervision or through timely review of newly diagnosed cases.

We are only aware of two previous studies, both from Nepal, where the impact of a ‘full’ task-sharing model on clinical and social outcomes of people with SMI was evaluated (Jordans et al., 2017, Jordans et al., 2019). Both studies found a significant reduction in symptom severity, disability and caregiver burden but had sample sizes under 100 and included extensive community-based psychosocial interventions (Jordans et al., 2019). Our larger study, which included a more representative population of people with SMI and a task-sharing intervention more closely based on mhGAP, provides more definitive evidence of important clinical and social benefits from the recommended WHO mhGAP approach.

In our study, the impact of the district mental health care plan care on psychotic symptoms was less marked than the reductions seen in the social outcomes, with a reduction of 4.8 on the BPRSE being less than that usually considered to be clinically significant (Hanlon et al., 2016a). In previous intervention studies for people with SMI in LMIC settings, a key factor for clinical improvement has been enhanced adherence to antipsychotic medication (Chatterjee et al., 2014), but only 30% of people with SMI in our
study received ‘minimally adequate treatment’ over the follow-up period. Our process data indicate that engagement waxed and waned over time, rather than people dropping out of care altogether, and lends support to the acceptability of care provided as well as providing explanation for the limited impact on symptom improvement at cross-sectional assessment. In-depth interviews with study participants with SMI who had disengaged from care indicated that most had experienced symptomatic improvement, but that affordability of medication and side effects of medications was a barrier to continuous engagement (Hailemariam et al., 2018). This is supported by quantitative data from the same sample, indicating high levels of poverty and out-of-pocket healthcare costs compared to the general population (Hailemichael et al., 2019). Mechanisms to reduce out-of-pocket healthcare costs for people with SMI are needed to achieve improved access to mental health care (Hanlon, 2019).

Although disability is closely linked to symptom severity, our previous work in this community indicates that stigma, discrimination and poverty also make important contributions (Habtamu et al., 2018). The borderline significant effect modification indicating greater improvements in disability in people with higher receipt of community support may reflect the impact of reduced social exclusion. We observed a significant decline in perceived negative discrimination in people with SMI. The PRIME mental health care plan included a cascade model of training of community-based health extension workers to raise community awareness and reduce stigma against mental health problems (Fekadu et al., 2016); however, the extent of implementation is not known. The growing community and family awareness of the treatability of SMI, arising from the local availability of a treatment service and bearing witness to the clinical improvement of people with SMI who were well-known to the community, might have also reduced stigmatising attitudes, social exclusion and the need for people to be restrained (Hailemariam et al., 2018). Furthermore, the Community Advisory Board members were selected due to their level of community influence and their endorsement of mental health care helped to reduce stigma and misconceptions about mental illness in the study site. In a recent trial in Ghana, restraint was not
reduced by short-term provision of psychiatric care to people with SMI who were receiving faith healing in prayer camps (Ofori-Atta et al., 2018). In our study, the follow-up period was longer, which may have allowed family members and the community to gain confidence in the beneficial effects of treatment and the PRIME intervention incorporated community and system level interventions as well as task-shared facility-based care.

Alternative approaches to expanding access to care for people with SMI in rural populations in LMICs have been reported. One model is to utilise outreach clinics staffed by mental health specialists who diagnose, prescribe and monitor clinical progress, combined with community-level interventions by non-specialists to promote social inclusion and functional recovery (Chatterjee et al., 2014, Chatterjee et al., 2009, Srinivasa Murthy et al., 2005). Another ‘back-referral’ model is for mental health specialists to provide initial assessment and development of a care plan which is then implemented by non-specialist health workers in the local area combined with task-shared psychosocial interventions (Xiang M et al., 1994). Augmenting the PRIME model with more intensive and systematic community-based rehabilitation delivered by non-specialists may help to address some of the gaps identified in our study by strengthening engagement with PHC and supporting livelihoods (Asher et al., 2016), although the affordability and sustainability of such approaches needs evaluation. There are no published reports of these task-sharing service models being successfully, safely and sustainably taken to scale and we have no evidence regarding their relative impact on effective treatment coverage for people with SMI. In the future, randomised controlled trials comparing task-shared models of care for people with SMI are needed to inform policy decisions (Hanlon et al., 2016a).

Limitations

PHC workers were informed of the research psychiatric nurse diagnosis and changes in treatment plan. For diagnosis the concordance was high and so this is unlikely to have affected the outcome, but the
treatment plan reflected task-shared care with support from a mental health specialist. We only collected data on the positive and not the negative predictive value of the PHC worker diagnosis. Calculating the negative predictive value would be an important focus for future studies. Due to ethical concerns, there was no comparison group of people with SMI receiving ‘usual care’, which would have amounted to no access to evidence-based care for most people. However, outcomes in people with untreated schizophrenia (who formed the majority of our cohort) have been shown to be poor (Ran et al., 2001). Given the chronicity and severity of SMI at baseline, spontaneous improvement is unlikely. This is supported by the lack of an association between baseline duration of illness or type of illness onset and outcomes in our study.

Conclusions

An integrated district level mental health care plan employing a task-sharing approach safely addressed the large treatment gap for people with SMI in a rural, low-income country setting, resulting in improved clinical and social outcomes and reduced human rights abuses. Training and supporting PHC workers to provide mental health care has great potential as a sustainable and feasible approach to the care of people with SMI in resource-poor settings.
Table 1: Baseline characteristics of the severe mental disorder cohort stratified by gender

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Total</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N (%)</td>
<td>N (%)</td>
<td>N (%)</td>
</tr>
<tr>
<td>Age (years) Mean (Standard Deviation)</td>
<td>300 (100.0)</td>
<td>172 (57.3)</td>
<td>128 (42.7)</td>
</tr>
<tr>
<td>Educational level (n=299)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No formal education</td>
<td>157 (52.5)</td>
<td>79 (46.2)</td>
<td>78 (60.9)</td>
</tr>
<tr>
<td>Primary education</td>
<td>112 (37.5)</td>
<td>75 (43.9)</td>
<td>37 (28.9)</td>
</tr>
<tr>
<td>Secondary and above</td>
<td>30 (10.0)</td>
<td>17 (9.9)</td>
<td>13 (10.2)</td>
</tr>
<tr>
<td>Religious affiliation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orthodox Christian</td>
<td>270 (90.0)</td>
<td>154 (89.5)</td>
<td>116 (90.6)</td>
</tr>
<tr>
<td>Muslim</td>
<td>10 (3.3)</td>
<td>7 (4.1)</td>
<td>3 (2.3)</td>
</tr>
<tr>
<td>Protestant Christian</td>
<td>19 (6.3)</td>
<td>10 (5.8)</td>
<td>9 (7.0)</td>
</tr>
<tr>
<td>None</td>
<td>1 (0.3)</td>
<td>1 (0.6)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gurage</td>
<td>284 (94.7)</td>
<td>162 (94.2)</td>
<td>122 (95.3)</td>
</tr>
<tr>
<td>Other</td>
<td>16 (5.3)</td>
<td>10 (5.8)</td>
<td>6 (4.7)</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>111 (37.0)</td>
<td>66 (38.4)</td>
<td>45 (35.2)</td>
</tr>
<tr>
<td>Single</td>
<td>136 (45.3)</td>
<td>83 (48.3)</td>
<td>53 (41.1)</td>
</tr>
<tr>
<td>Divorced or widowed</td>
<td>53 (17.7)</td>
<td>23 (13.4)</td>
<td>30 (23.4)</td>
</tr>
<tr>
<td>Household size (n=298)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 to 2</td>
<td>34 (11.4)</td>
<td>19 (11.1)</td>
<td>15 (11.8)</td>
</tr>
<tr>
<td>3 to 4</td>
<td>85 (28.5)</td>
<td>46 (26.9)</td>
<td>39 (30.7)</td>
</tr>
<tr>
<td>5 to 6</td>
<td>92 (30.9)</td>
<td>47 (27.5)</td>
<td>45 (35.4)</td>
</tr>
<tr>
<td>7 or more</td>
<td>87 (29.2)</td>
<td>59 (34.5)</td>
<td>28 (22.1)</td>
</tr>
<tr>
<td>Children in household (n=287)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>138 (48.1)</td>
<td>89 (54.3)</td>
<td>49 (39.8)</td>
</tr>
<tr>
<td>≤ 5 years</td>
<td>67 (23.3)</td>
<td>33 (20.1)</td>
<td>34 (27.6)</td>
</tr>
<tr>
<td>5 to 15 years</td>
<td>58 (20.2)</td>
<td>35 (21.3)</td>
<td>23 (18.7)</td>
</tr>
<tr>
<td>16 years and older</td>
<td>24 (8.4)</td>
<td>7 (4.3)</td>
<td>17 (13.8)</td>
</tr>
<tr>
<td>Socio-economic status (n=297)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher (poverty index ≤ 3)</td>
<td>177 (59.6)</td>
<td>100 (58.5)</td>
<td>77 (61.1)</td>
</tr>
<tr>
<td>Lower (poverty index &gt;3)</td>
<td>120 (40.4)</td>
<td>71 (41.5)</td>
<td>49 (38.9)</td>
</tr>
<tr>
<td>Residence (n=299)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>60 (20.1)</td>
<td>36 (20.9)</td>
<td>24 (18.9)</td>
</tr>
<tr>
<td>Rural</td>
<td>239 (79.9)</td>
<td>136 (79.1)</td>
<td>103 (81.1)</td>
</tr>
<tr>
<td>Social support (n=298)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strong social support</td>
<td>56 (18.8)</td>
<td>31 (18.2)</td>
<td>25 (19.5)</td>
</tr>
<tr>
<td>Intermediate support</td>
<td>151 (50.7)</td>
<td>83 (48.8)</td>
<td>68 (53.1)</td>
</tr>
<tr>
<td>Poor support</td>
<td>91 (30.5)</td>
<td>56 (32.9)</td>
<td>35 (27.3)</td>
</tr>
<tr>
<td>Travel time to nearest health facility (n=299)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 60 minutes</td>
<td>192 (64.2)</td>
<td>115 (67.3)</td>
<td>77 (60.2)</td>
</tr>
<tr>
<td>61 to 120 minutes</td>
<td>60 (20.1)</td>
<td>32 (18.7)</td>
<td>28 (21.9)</td>
</tr>
<tr>
<td>≥121 minutes</td>
<td>47 (15.7)</td>
<td>24 (14.0)</td>
<td>23 (18.0)</td>
</tr>
<tr>
<td>Diagnosis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Affective psychosis/bipolar disorder</td>
<td>44 (14.7)</td>
<td>21 (12.2)</td>
<td>23 (18.0)</td>
</tr>
<tr>
<td>Schizophrenia &amp; other psychoses</td>
<td>256 (85.3)</td>
<td>151 (87.8)</td>
<td>105 (82.0)</td>
</tr>
<tr>
<td>Duration of illness (years) (n=270)</td>
<td>Median (Interquartile range; IQR)</td>
<td>5 (2.8, 10)</td>
<td>5 (2.8, 10)</td>
</tr>
<tr>
<td>Onset of illness (n=271)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute/sub-acute</td>
<td>100 (36.9)</td>
<td>55 (35.5)</td>
<td>45 (38.8)</td>
</tr>
<tr>
<td>Gradual</td>
<td>171 (63.1)</td>
<td>100 (64.5)</td>
<td>71 (61.2)</td>
</tr>
<tr>
<td>Psychiatric admission</td>
<td>In past 12 months</td>
<td>11 (3.7)</td>
<td>5 (2.9)</td>
</tr>
<tr>
<td>Treatment at recruitment (n=261)</td>
<td>Prescribed medication at baseline</td>
<td>69 (26.4)</td>
<td>35 (23.5)</td>
</tr>
<tr>
<td>Co-morbid medical disorder (n=286)</td>
<td>Diagnosed medical condition</td>
<td>18 (6.3)</td>
<td>13 (8.1)</td>
</tr>
</tbody>
</table>

*Poverty index = roof material made of straw (vs. corrugated iron), unimproved water source, unimproved sanitation, no electricity, no separate room for kitchen, no radio or television, no mobile phone.*
### Table 2: Mixed effects modelling of primary outcomes stratified by equity indicators

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Baseline (T0)</th>
<th>T0 to T1 mean difference (95% confidence intervals)</th>
<th>T0 to T2 mean difference (95% confidence intervals)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMI symptoms (BPRS-E)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total sample</td>
<td>N=294</td>
<td>48.5 (15.6)</td>
<td>-2.6 (-4.8, -0.4)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>N=247</td>
<td>47.9 (16.3)</td>
<td>-2.2 (-5.2, 0.9)</td>
</tr>
<tr>
<td>Female</td>
<td>N=247</td>
<td>49.4 (14.7)</td>
<td>-3.2 (-6.3, -0.04)</td>
</tr>
<tr>
<td>Residence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>N=245</td>
<td>47.4 (16.5)</td>
<td>-4.0 (-9.3, 1.2)</td>
</tr>
<tr>
<td>Rural</td>
<td>N=245</td>
<td>48.9 (15.4)</td>
<td>-2.3 (-4.7, 0.1)</td>
</tr>
<tr>
<td>Health care access</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;60 minutes</td>
<td>N=247</td>
<td>48.2 (16.2)</td>
<td>-2.1 (-4.8, -0.7)</td>
</tr>
<tr>
<td>≥ 60 minutes</td>
<td>N=247</td>
<td>49.3 (15.6)</td>
<td>-3.9 (-7.5, -0.3)</td>
</tr>
<tr>
<td>Socio-economic status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher</td>
<td>N=245</td>
<td>49.2 (16.0)</td>
<td>-3.5 (-6.6, -0.5)</td>
</tr>
<tr>
<td>Lower</td>
<td>N=245</td>
<td>47.4 (15.1)</td>
<td>-0.8 (-3.9, 2.4)</td>
</tr>
<tr>
<td>Disability (WHODAS 2.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total sample</td>
<td>N=296</td>
<td>52.2 (22.0)</td>
<td>-6.2 (-9.3, -3.1)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>N=246</td>
<td>52.3 (21.5)</td>
<td>-7.8 (-11.8, -3.8)</td>
</tr>
<tr>
<td>Female</td>
<td>N=246</td>
<td>52.1 (22.7)</td>
<td>-4.2 (-9.0, 0.6)</td>
</tr>
<tr>
<td>Residence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>N=245</td>
<td>49.2 (22.3)</td>
<td>-7.4 (-14.0, -0.7)</td>
</tr>
<tr>
<td>Rural</td>
<td>N=245</td>
<td>53.1 (21.9)</td>
<td>-6.2 (-9.7, -2.7)</td>
</tr>
<tr>
<td>Health care access</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;60 minutes</td>
<td>N=245</td>
<td>50.4 (22.5)</td>
<td>-4.8 (-8.7, -0.8)</td>
</tr>
<tr>
<td>≥ 60 minutes</td>
<td>N=245</td>
<td>55.9 (20.7)</td>
<td>-8.9 (-13.9, -3.8)</td>
</tr>
<tr>
<td>Socio-economic status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higher</td>
<td>N=245</td>
<td>50.0 (21.8)</td>
<td>-6.9 (-11.1, -2.7)</td>
</tr>
<tr>
<td>Lower</td>
<td>N=245</td>
<td>55.3 (22.1)</td>
<td>-4.7 (-9.3, -0.1)</td>
</tr>
</tbody>
</table>
Table 3: Secondary clinical and social outcomes in people with SMI stratified by gender

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Baseline (T0)</th>
<th>Follow-up (T2)</th>
<th>T0 to T2 change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>Mean difference</td>
</tr>
<tr>
<td>Depression symptoms (PHQ-9)</td>
<td>N=300</td>
<td>N=245</td>
<td></td>
</tr>
<tr>
<td>Total sample</td>
<td>12.8 (5.43)</td>
<td>7.2 (4.80)</td>
<td>-5.6 (-6.3, -4.8)</td>
</tr>
<tr>
<td>Male</td>
<td>12.9 (5.64)</td>
<td>7.4 (4.84)</td>
<td>-5.4 (-6.5, -4.4)</td>
</tr>
<tr>
<td>Female</td>
<td>12.8 (5.15)</td>
<td>7.0 (4.75)</td>
<td>-5.7 (-6.8, -4.6)</td>
</tr>
<tr>
<td>Discrimination (DISC-12)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total sample</td>
<td>2 (0, 7)</td>
<td>0 (0, 3)</td>
<td>0.4 (0.3, 0.5)</td>
</tr>
<tr>
<td>Male</td>
<td>2 (0, 7)</td>
<td>0 (0, 4)</td>
<td>0.5 (0.3, 0.8)</td>
</tr>
<tr>
<td>Female</td>
<td>3 (0, 7)</td>
<td>0 (0, 2)</td>
<td>0.2 (0.1, 0.4)</td>
</tr>
<tr>
<td>Alcohol use disorder (AUDIT≥8)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total sample</td>
<td>87 (29.0)</td>
<td>40 (16.3)</td>
<td>0.6 (0.5, 0.8)</td>
</tr>
<tr>
<td>Male</td>
<td>77 (44.8)</td>
<td>34 (25.2)</td>
<td>0.6 (0.4, 0.8)</td>
</tr>
<tr>
<td>Female</td>
<td>10 (7.8)</td>
<td>6 (5.5)</td>
<td>0.7 (0.3, 1.4)</td>
</tr>
<tr>
<td>Suicide attempts past 3 months</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total sample</td>
<td>42 (14.0)</td>
<td>12 (4.9)</td>
<td>0.3 (0.2, 0.6)</td>
</tr>
<tr>
<td>Male</td>
<td>20 (11.6)</td>
<td>8 (5.9)</td>
<td>0.5 (0.2, 1.0)</td>
</tr>
<tr>
<td>Female</td>
<td>22 (17.2)</td>
<td>4 (3.6)</td>
<td>0.2 (0.1, 0.5)</td>
</tr>
<tr>
<td>Restrained past 12 months</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total sample</td>
<td>76 (25.3)</td>
<td>26 (10.6)</td>
<td>0.4 (0.3, 0.6)</td>
</tr>
<tr>
<td>Male</td>
<td>52 (30.2)</td>
<td>13 (9.6)</td>
<td>0.3 (0.2, 0.5)</td>
</tr>
<tr>
<td>Female</td>
<td>24 (18.8)</td>
<td>13 (11.8)</td>
<td>0.6 (0.3, 1.0)</td>
</tr>
</tbody>
</table>
References


Lauritsen JM, Bruus M (2003). Epidata (Version 3). A comprehensive tool for validated entry and documentation of data. . The Epidata Association,, Odense, Denmark,.


StataCorp LP (2016). Stata version 13.1. Texas, USA.


524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560
Required statements

Acknowledgements

We would like to express our thanks to the study participants for generously giving their time and energy to complete interviews, and to the field staff who worked tirelessly to ensure the smooth running of the project.

Financial support

This study was funded by the UK Department for International Development (DFID) [201446], as part of the Programme for Improving Mental health care (PRIME). The views expressed in this article do not necessarily reflect the UK Government’s official policies. CH is supported by the National Institute of Health Research (NIHR) Global Health Research Unit on Health System Strengthening in Sub-Saharan Africa, King’s College London (GHRU 16/136/54). The views expressed are those of the author and not necessarily those of the NHS, the NIHR or the Department of Health and Social Care. CH, CL, VP, AF and GM are supported by PRIME. CH additionally receives support from AMARI as part of the DELTAS Africa Initiative [DEL-15-01]. GT is supported by the National Institute for Health Research (NIHR) Collaboration for Leadership in Applied Health Research and Care South London at King’s College London NHS Foundation Trust. The views expressed are those of the author(s) and not necessarily those of the NHS, the NIHR or the Department of Health. GT acknowledges financial support from the Department of Health via the National Institute for Health Research (NIHR) Biomedical Research Centre and Dementia Unit awarded to South London and Maudsley NHS Foundation Trust in partnership with King’s College London and King’s College Hospital NHS Foundation Trust. GT is supported by the European Union Seventh Framework Programme (FP7/2007-2013) Emerald project. GT also receives support from the National Institute of Mental Health of the National Institutes of Health under award number
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.

Availability of Data and Materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request. The PRIME datasets will be made publicly available during 2019 (via www.prime.uct.ac.za).

Supporting information captions

Supplementary file 1

File format: WORD

Title: Characteristics of participants assessed at 12 months compared to those lost to follow-up
Description: Table displaying baseline characteristic of people with SMI who were re-assessed at the 12-month follow-up time-point compared to those who were lost to follow-up.

Supplementary file 2
File format: WORD (embedded tiff figure).

Title: Pattern of engagement with primary care mental health care
Description: Figure showing number of primary care contacts for mental health care for each 3 month period of follow-up.

Supplementary file 3
File format: WORD
Title: Psychotropic medication prescribed to cohort participants
Description: Descriptive summary of % of people receiving different types of psychotropic medication.

Supplementary file 4
File format: WORD
Title: Receipt of community and facility level care over the follow-up period
Description: Types of care received by the participants over the 12 month follow-up period.

Supplementary file 5
File format: WORD
Title: Tests for effect modification of change in outcome variables between T0 and T1
Description: Table presenting statistical testing of effect modification between T0 and T1.
Title: Tests for effect modification of change in outcome variables between T0 and T2

Description: Table presenting statistical testing of effect modification between T0 and T2.

Supplementary file 7

File format: WORD

Title: STROBE checklist

Description: STROBE checklist for reporting of this study
Figure 1: flow chart of study participants

Referrals
HEW: n=467
Others: n=566

Adult population of district* N=79,680

Total referred with probable SMI or epilepsy; N=1035

Did not attend n=61

Total assessed; N=972

Age < 18: n=203
Epilepsy: n=304
No SMI n=115
Refused n=2
Language n=3
Other follow-up n=6
Remission n=9
Other n=15
Psychiatric nurse diagnosis of SMD=21

PHC worker diagnosis of SMI; n=294

Psychiatric nurse diagnostic confirmation; n=279
Additional 21 diagnosed = T0 n=300 with SMI

28 lost to follow-up at T1 assessed at T2

T1 assessment; N=247
7 died
29 did not attend
1 at holy water
15 not traceable
1 missed in error

T2 assessment; N=245
4 died
14 did not attend
2 at holy water
12 not traceable