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The CORE Service Improvement Programme for mental health Crisis Resolution Teams: results from a cluster-randomised trial

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Keywords:	acute care, crisis resolution, service improvement, mental health, randomised controlled trial

The CORE Service Improvement Programme for mental health Crisis Resolution Teams: results from a cluster-randomised trial

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Abstract

Background: Crisis Resolution Teams (CRTs) offer brief, intensive home treatment for people experiencing mental health crisis. CRT implementation is highly variable; positive trial outcomes have not been reproduced in scaled up CRT care.

Aims: To evaluate a one-year programme to improve CRTs' model fidelity in a non-blind, cluster randomised trial.

Methods: Fifteen CRTs in England received an intervention, informed by the US Implementing Evidence Based Practice project, involving support from a CRT Facilitator, online implementation resources and regular team fidelity reviews. Ten control CRTs received no additional support. The primary outcome was service user satisfaction, measured by the Client Satisfaction Questionnaire (CSQ-8), completed by fifteen service users per team at CRT discharge (N=375). Secondary outcomes: CRT model fidelity, continuity of care, staff wellbeing, inpatient admissions and bed use and CRT readmissions were also evaluated.

Results: All CRTs were retained in the trial. Median follow-up CSQ-8 score was 28 in each group: the adjusted average in the intervention group was higher than in the control group by 0.97 (CI -1.02, 2.97) but this was not significant (p=0.34). There were fewer inpatient admissions, lower inpatient bed use and better staff psychological health in intervention teams. Model fidelity rose in most intervention teams and was significantly higher than in control teams at follow up. There were no significant effects for other outcomes.

Conclusions: The CRT Service Improvement Programme did not achieve its primary aim of improving service user satisfaction. It showed some promise in improving CRT model fidelity and reducing acute inpatient admissions.

Trial Registration Number: ISRCTN47185233

Declaration of interests: None

Keywords: acute care, crisis resolution, service improvement, mental health services, randomised controlled trial

Background: Crisis Resolution Teams (CRTs) are specialist, multi-disciplinary mental health teams which provide short-term, intensive home treatment as an alternative to acute hospital admission[1]. CRTs were implemented nationally in England following the NHS Plan[2] in 2000 and have been established elsewhere in Europe and in Australasia[3]. Trial evidence suggests CRTs can reduce inpatient admissions and improve service users' satisfaction with acute care[4,5]. When CRTs were scaled up to national level in England however, service users reported dissatisfaction with the quality of care[6,7] and CRTs' impact on admission rates has been disappointing[8]. English CRTs' service organisation and delivery is highly variable and adherence to national policy guidance is only partial[9,10]. In initial stages of the CORE research programme (as part of which the trial reported in this was conducted), a measure of model fidelity for CRTs[11] and a service improvement programme for CRTs[12] were developed, following a model for supporting the implementation of mental health complex interventions model widely and successfully used in the USA[13] (but not so far in Europe). The trial reported in this paper evaluated whether the CORE CRT Service Improvement Programme increased model fidelity and improved outcomes in CRT teams over a one-year intervention period.

Methods: A non-blind cluster-randomised trial evaluated whether a CRT Service Improvement Programme improved service users' experience of CRT care, reduced acute service use and improved CRT staff wellbeing. The trial also investigated whether the fidelity scores of CRTs receiving the Service Improvement Programme increased over the one-year intervention period compared to control sites, and whether change in team fidelity score was associated with change in service outcomes. Cluster randomisation was used because the trial involved a team-level intervention. The primary hypothesis was that service users' satisfaction with CRT care, measured using the Client Satisfaction Questionnaire (8-item version)[14] was greater in the intervention group than the control group at end-of-intervention one year follow-up.

The trial was registered with the ISRCTN registry (ref: ISRCTN47185233) in August 2014 and the protocol has been published[12]. This paper reports the main trial results and relationships between teams' model fidelity and outcomes. Economic and process and qualitative

evaluations will be reported elsewhere. Ethical approval was granted by the Camden & Islington Research Ethics Committee [Ref: 14/LO/0107]. Trial reporting in this paper conforms to extended CONSORT guidelines for cluster-randomised trials[15] – see data supplement (DS1). Teams were recruited to the study between September and December 2014, with a one-year trial intervention period.

Setting: The trial involved 25 CRT teams in eight different health regions (NHS Trusts) across Southern England and the Midlands, selected to include inner city and mixed suburban and rural areas. CRT teams were eligible if no other major service reorganisations were planned over the trial period. At least two participating CRTs were required from each NHS Trust, to ensure teams from each Trust could be allocated to each group.

Participants: We recruited: i) CRT service users, ii) CRT staff, and iii) anonymised data about use of acute care from service records.

i) Service user experience outcomes: We aimed to recruit a cohort of recently discharged CRT service users: 15 per team each team (N=375) at baseline, and another cohort, 15 per team (N=375) at follow-up (between months 10-12 of the study period). All participants admitted to the CRT during these 3-month periods were eligible if they: had used the CRT service for at least 7 days; had ability to read and understand English and capacity to provide informed consent; and were not assessed by CRT clinical staff to pose too high a risk to others to participate (even via interview on NHS premises, or by phone).

ii) Staff wellbeing outcomes: All current staff in participating CRTs were invited to complete study questionnaires at baseline and follow-up (months 10-12 of the study intervention period).

iii) Patient records data were collected for two separate cohorts at each time point: a) Anonymised data about all admissions to inpatient services were collected retrospectively from services' electronic patient records at two time points: 6 months prior to study baseline, and months 7-12 of the study intervention period (inpatient service use outcomes); b) for all service users admitted to the CRT during two one-month periods, anonymised data about readmissions to any acute care service (including CRTs or inpatient wards) over a six month period were

collected retrospectively from electronic patient records: the first cohort at six months prior to baseline; the second at month 7 of the study follow-up period (readmission following CRT care outcome).

Randomisation and masking: The 25 teams were randomised, stratified by NHS Trust, after a baseline fidelity review had been conducted for all teams within each NHS Trust. In order to maximise learning about implementation of the Service Improvement Programme within available study resources, more teams (n=15) were randomly allocated to the Service Improvement Programme than to a control group (n=10). A statistician independent of the study generated allocation sequence lists and conducted randomisations. Researchers and staff in participating services were aware of teams' allocation status in this non-blind trial. Service user participants and Trusts' Informatics Teams providing data from patient records were not informed of teams' allocation status.

The intervention: The team-level Service Improvement Programme supported CRT teams to achieve high fidelity to a model of best practice, defined in the CORE CRT Fidelity Scale[13] and informed by a systematic evidence review[16], a national CRT survey[9] and qualitative interviews with stakeholders[17]. The Service Improvement Programme was delivered over one year and consisted of: i) "fidelity reviews" at baseline, six months and 12 months: teams were assessed and given feedback on adherence to 39 best practice standards for CRTs; ii) coaching from a CRT facilitator (an experienced clinician or manager) 0.1 full time equivalent, who could offer the CRT manager and staff advice and support with developing and implementing service improvement plans; iii) access to an online resource kit of materials and guidance to support CRT service improvement for each fidelity item; and iv) access to two "learning collaborative" events where participating teams could meet to share experiences and strategies for improving services. Structures to support service improvement in each team included: an initial "scoping day" for the whole team to prioritise and plan service improvement goals; and regular meetings of a CRT management group and the CRT Facilitator, to develop and review detailed service improvement plans.

Through these resources and structures, the Service Improvement Programme constituted a sustained, multi-component programme of support to CRTs, which aimed to address the different domains of implementation support identified as contributing to attainment of high fidelity in the US Implementing Evidence-Based Practices Program[18] in a tailored way to meet individual services' needs: prioritisation of the programme, leadership support, workforce development; workflow re-engineering; and practice reinforcement.

Teams in the control group received a fidelity review and brief feedback at baseline and 12-month follow-up, but no other aspects of the study intervention.

Measures:

i) Service user experience outcomes: data were collected using two self-report structured questionnaires: the Client Satisfaction Questionnaire[14], which assesses satisfaction with care; and Continu-um[19], which assesses perceived continuity of care.

ii) Staff wellbeing outcomes: staff burnout was assessed using the Maslach Burnout Inventory[20] (emotional exhaustion, personal accomplishment and depersonalisation sub-scales were scored and reported separately, as recommended[21]); work engagement, using the Work Engagement Scale[22]; general psychological health using the General Health Questionnaire[23]; and psychological flexibility, measured using the Work-Related Acceptance and Action Questionnaire[24].

iii) Team outcomes: participating teams' CRT model fidelity was assessed at baseline and 12 month follow-up using the CORE CRT fidelity scale[11], which scores teams from 1 to 5 on 39 fidelity items in four subscales (referrals and access, content and delivery of care, staffing and team procedures, timing and location of care), yielding a total score ranging from 39-195.

Inpatient admissions: Service use data from patient records for all patients from the catchment area of each participating CRT during baseline and follow-up periods (whether or not they used the CRT itself) were used to generate three team-level outcomes: total number of psychiatric hospital admissions from the catchment area over six months, total number of compulsory psychiatric hospital admissions, and total occupied inpatient bed days.

Readmission following CRT care: Patient records data for all service users admitted to the CRT during baseline and follow-up periods were used to calculate the number of CRT service users accepted for treatment by any acute care service during the six month follow-up, following discharge from the index acute admission.

Procedures: Service user experience and staff wellbeing participants: Service users were screened for eligibility and contacted about the study initially by CRT staff. Research staff attempted to contact all identified potential participants consecutively in the order they were discharged, until the site recruitment target was achieved. An information sheet about the study was sent by researchers and participants provided informed consent before completing questionnaires through face-to-face interview, online questionnaire or by phone. Service user participants were given a thank you gift of £10 cash or vouchers. CRT staff were contacted by study researchers and invited to consent and complete measures using an online questionnaire.

Inpatient admissions and readmission following CRT care: IT staff from participating NHS Trusts provided anonymised data from patient records about all acute service use during data collection periods. Study researchers calculated study outcomes from these raw data (further details in Data Supplement 2).

Fidelity scores were derived for each team from a structured, one-day “fidelity review” audit following a well-defined protocol, involving three independent reviewers from the study team (including at least one clinician and one service user or carer-researcher). Reviewers interviewed the CRT manager, staff, service users and carers and managers from other local services, and conducted a case note audit and review of team policies and procedures: then used the information gathered to score the team on each fidelity item, in accordance with criteria and guidance set out in the measure.

Service user experience and staff wellbeing outcomes data were entered directly into the “Opinio” UCL secure online database, then downloaded as Excel files. Patient records data were

provided by NHS Trusts in Excel or Word files. All data were transferred to Stata 14 software[25] for analysis.

Analysis: The primary hypothesis, that participants' satisfaction with the CRT, measured by the Client Satisfaction Questionnaire[14] is greater in the intervention group teams than control teams, was analysed using a linear random effects model (mixed model) with a random intercept for CRT, controlling for mean baseline Client Satisfaction Questionnaire score by CRT. Service user-reported perceived continuity of care and measures of staff wellbeing were analysed similarly using linear random effects models. Regression coefficients and 95% confidence intervals were reported. The calculated sample size provided 95% power to detect half a standard deviation difference between groups in mean satisfaction measured by the Client Satisfaction Questionnaire (3.5 points assuming a typical SD of 7.0) using a two-sided test, allowing for within-team clustering (ICC = 0.05).

Service use outcomes at follow up (inpatient admissions, bed days and readmissions following CRT care) were compared between intervention and control groups using Poisson random effects modelling with a random intercept for Trust. For each outcome, baseline score was set as the exposure variable, as it accounts for the baseline population and health of the catchment area as well as local admissions policies. Incidence rate ratios (IRR) and 95% confidence intervals were reported. A second set of analyses was also conducted, using catchment area population as the exposure variable.

At team level, fidelity scores in the intervention and control groups at follow-up were compared, adjusting for baseline scores. The relationship was explored between change in team fidelity score from baseline to 12-month follow-up, and changes in five study outcomes: service user satisfaction, staff work engagement, inpatient admissions, inpatient bed use, and readmission following CRT care. Relationships at team level between change in outcomes and change in fidelity scale subscale scores were also explored. For service user satisfaction and staff work engagement, we fitted linear regression models relating change in outcome (follow-up - baseline) to change in fidelity score (follow-up - baseline). For the remaining outcomes, we used normalised change in outcome ((follow-up - baseline)/square-root (baseline)). To aid

interpretation, we present correlations to summarise these relationships with the corresponding P-values from the regression/correlation analyses.

Results

Trial recruitment: Recruitment to the trial is summarised in the CONSORT diagram in Figure 1. All 25 CRT teams were retained in the trial. We did not achieve our recruitment target of 15 service users per team in six teams at baseline and in one team at follow up. These shortfalls occurred in teams with smaller caseloads, or where eliciting staff help to contact potential participants was problematic. At each time point, 62% of eligible service users whose contact details were provided to researchers agreed to participate (353/567 at baseline; 371/594 at follow-up); however, the proportion of eligible service users in each CRT who were initially approached by CRT staff is unknown. At each time point, 79% of all current staff in trial CRTs participated (441/560 at baseline and 431/544 at follow up). One NHS Trust, covering five participating CRTs, was unable to provide data at follow up from patient records about whether inpatient admissions were compulsory or voluntary; complete patient records data were otherwise obtained.

Figure 1 about here

The characteristics of participants recruited for service user experience and staff wellbeing outcomes are summarised in Table 1 (further information in Data Supplement DS3). More service user participants were male in the control teams than the intervention teams at follow-up (43% compared to 34%); more staff participants were male in control teams than intervention teams at both time points. No other marked differences between groups were apparent. No serious adverse events were identified during participant recruitment or data collection; no study-related harms were reported by participating CRTs.

Table 1 about here

Intervention delivery: Figure 2 describes the implementation of the trial intervention. The CRT manager was unable to organise a scoping day for the whole team in one CRT. Otherwise, all the main components of the intervention were provided in all teams, but not always as promptly or completely as planned. Teams targeted a median of eight fidelity items each (selected as priorities by the team) over the course of the year in their service improvement plans. Further information about the content of intervention group teams' service improvement plans is provided in the data supplement (DS8).

Figure 2 about here

Fidelity scores: Teams' baseline scores for fidelity to a model of good CRT practice ranged from 97 (low fidelity) to 134 (moderate fidelity) – compared to a median score from a 75-team national survey in 2014 of 122[11]. Eleven out of 15 teams in the intervention group improved their fidelity score from baseline to follow-up, including teams from seven of the eight participating Trusts, and teams with higher and lower model fidelity at baseline. The range in change scores on the CORE CRT Fidelity Scale in intervention group teams was from -22 to + 37, with a mean change of 8.1 points. (Mean baseline fidelity score in the intervention teams was 116.4; mean follow up score was 124.5). This contrasts with the control group, where none of the 10 teams increased their fidelity score from baseline to follow-up, with a range in change scores from -20 to 0, with a mean change of -9.7 points. (Mean baseline fidelity score in the control teams was 122.2; mean follow up score was 112.5.) There was a significant difference in outcome fidelity scores between intervention and control groups, adjusting for baseline fidelity scores (p=0.0060). Further details of participating teams' fidelity scores are provided in the data supplement (DS4).

Trial outcomes: There was no significant difference between the intervention and control group teams for the trial's primary outcome of service user satisfaction: regression analysis suggested slightly higher satisfaction in the intervention group (coefficient 0.97 (CI -1.02, 2.97) but this was not significant (p = 0.34). There was also no statistically significant difference between groups in service user-rated continuity of care, or four of the six staff wellbeing measures (with significantly better staff psychological health and psychological flexibility in the

intervention group). The trial outcomes are summarised in Table 2. Descriptive data for service user experience and staff wellbeing outcomes at team level are provided in the data supplement (DS5).

At team level, there were significantly fewer total inpatient admissions and inpatient bed days in the intervention group than the control group over six months, after adjustment for baseline rates, suggesting that admissions were reduced more in intervention teams than in controls during the study period. These results were not replicated in a second analysis that adjusted for catchment area population instead of baseline rates, suggesting that admission rates relative to the size of the local population may not have been significantly lower in intervention teams than controls at follow-up, although we note that this second analysis does not adjust for differences in patient case-mix across areas. There was no difference between groups in rates of compulsory inpatient admissions or in rates of readmission to acute care following an episode of CRT care. Further details are provided in the data supplement (DS6).

Table 2 about here

Relationship between outcomes and model fidelity: There was a weak positive correlation of 0.34 between change in fidelity score and change in patient satisfaction, which corresponds to a mean increase of 0.65 points on the Client Satisfaction Questionnaire Scale for a ten point increase in fidelity score. There was a weak negative correlation (i.e. in the expected direction) of -0.38 between fidelity score and readmissions following CRT care. There was no evidence of associations between change in total fidelity score and change in inpatient admission rates, bed days, or staff work engagement respectively. In post-hoc, exploratory analyses of subscale scores, a relationship between reduction in inpatient admissions and increase in Access and Referrals fidelity subscale score was apparent (correlation = -0.32). Readmissions following CRT care, by contrast, were most closely correlated with the Timing and Location of Care (-0.45), and Content of Care (-0.34) subscales. Service user satisfaction was most closely correlated with the Content of Care subscale (correlation = 0.36). Illustrative graphs are provided in the data supplement (DS7).

Discussion

Main findings: For the primary outcome, service user satisfaction was not significantly greater in teams receiving the programme than in control teams. Model fidelity improved in 11 of 15 teams receiving the CRT Service Improvement Programme over the study period, compared to none of the ten control teams. There was some indication of significantly better results over the study period for the intervention teams compared to controls regarding hospital admission rates and inpatient bed use. Staff psychological health and psychological flexibility were higher at follow up in the intervention group. There were non-significant trends favouring the intervention group teams regarding service user satisfaction, readmission to acute services following CRT care, and staff morale and job satisfaction. There was no evidence that the trial intervention reduced rates of compulsory admissions.

Altogether, this suggests the intervention was insufficient to achieve all its intended service improvements, but did achieve some, notably better model fidelity and reduced inpatient admissions. It may thus help unlock the potential benefits of CRTs in reducing the high costs and negative experience for service users associated with inpatient admissions. Positive results from our study also provide international validation for the process developed by the US Implementing Evidence Based Practice project[13] but not previously trialled in a UK NHS context, as a means to support implementation of complex interventions in mental health care.

Limitations: Three limitations of the study relate to its design. First, other local and national service initiatives which arose during the year of the trial may have influenced CRT implementation and outcomes independently of the trial intervention. Second, because CRTs in each Trust share senior managers and communicate regularly at management level, there is a possibility of contamination, where elements of the trial intervention were also accessed by control teams. Third, the one-year follow-up period may have been too short for teams to fully enact their service improvement plans and to capture all changes in model fidelity and outcomes resulting from the trial intervention.

Four further limitations of the study relate to data collection. First, for service user experience outcomes, the participants recruited were highly satisfied with care, compared with previous studies[4,26], and may well over-represent those who were best engaged and most easily contactable by CRT staff. CRTs may have varied in the proportion of service users they approached and asked about taking part in the trial, with possible resulting bias. There appears to have been a ceiling effect in our sample with the trial primary satisfaction outcome measure (CSQ-8): 26% of participants in the treatment group at follow-up gave a maximum score of 32, compared to 12% in the control group. There may have been differences between groups in service users' satisfaction with CRTs which our evaluation failed to capture. We further note that fidelity gains regarding service organisation or the extent of care, even where achieved, may not have translated into increased patient satisfaction as broadly measured by the CSQ-8, if not accompanied by improvements in staff's clinical competence[27] and reduction in negative interactions with individual staff[28], both of which have been identified as important to patient experience.

Second, data regarding acute service use were provided in anonymised form from NHS patient records and could not be verified as complete by researchers. Information about whether inpatient admissions were compulsory or voluntary was not available for five teams at follow up.

Third, neither fidelity reviewers nor participating services could not be blinded to teams' trial allocation status during follow up CRT fidelity reviews. Intervention group teams may have been more motivated to prepare thoroughly for their review and thus maximise their score. Reviewers may have unconsciously favoured the intervention group when assessing fidelity.

Fourth, it was not possible to confirm wholly accurate data regarding CRTs' catchment area population size, some of which were based on GP registration rather than geographical area (see Data Supplement DS2). This possible measurement error does not affect the results for service use outcomes reported in the main text of this paper - which are in any case better able to assess change in service use (and therefore the impact of the intervention) during the study period, through adjusting for baseline service use in each team - but may have affected the

second analysis of service use outcomes (see Data Supplement DS6), which adjusted for catchment area population.

Implications for research: A future economic evaluation of the study, will explore the cost-effectiveness of the intervention as delivered in this trial. Qualitative and process evaluations (also to be reported separately) will explore in more depth the content of support provided by Facilitators in the project, the focus of teams' service improvement plans, the organisational contexts in which the intervention was delivered, and how these factors may relate to the extent of teams' success in improving model fidelity during the project. This may inform the development, and then evaluation, of a revised, CRT service improvement programme which better targets critical components of care, engages stakeholders and addresses organisational barriers to service change.

Our trial sought to improve outcomes in CRTs through the mechanism of increasing teams' model fidelity, but only weak relationships between changes in teams' overall fidelity score and outcome were established, and not for all outcomes. Three possible reasons for this could be explored in future research. First, the reliability of the CORE CRT Fidelity Scale has not been unequivocally established[13]. In vivo testing of inter-rater reliability is desirable. Second, some critical components of CRTs may not be assessed by the CORE CRT Fidelity Scale. All fidelity scales are better able to audit team organisation and the extent of service provision than to assess the clinical competence with which care is delivered[27], and relationships between fidelity and outcomes are moderate even for the most well established scales[29]. Other methods, possibly involving direct observation of practice; may be required to evaluate clinical competence in CRTs. Third, critical components of effective CRT services may be present but insufficiently weighted in teams' overall fidelity score for it to relate closely to service outcomes. The closer relationships with some outcomes we found for specific fidelity subscales provide some support for this idea. A large observational study, evaluating model fidelity and outcomes across many CRTs, could test hypotheses about the relationship between team outcomes and fidelity scale item or sub-scale scores.

Implications for policy and practice: In general for the control teams in our trial, fidelity scores dropped, readmissions following CRT care rose, and inpatient service use outcomes were worse than for the intervention group teams. This suggests that there is a pressing need for effective CRT service improvement support. This trial suggests that considerable input is needed to improve service quality in CRTs: our successfully implemented, multi-component programme of sustained support for CRTs did not demonstrate improved service user satisfaction, and only partially achieved its aims. The CORE CRT Service Improvement Programme provides a useful starting point for developing future CRT service improvement initiatives however, having achieved improvements in model fidelity in teams from varied geographical and provider-Trust contexts and a range of baseline levels of fidelity, and having some evidence of effectiveness in reducing admissions and inpatient service use.. It is informed by a model of implementing complex interventions in mental health settings with prior evidence of effectiveness in US contexts[13] which now also has evidence of applicability to English services, with potential usefulness beyond CRTs. The CORE service improvement structures and the online CRT Resource Pack[30] are publically available and provide guidance, materials and case examples to support good practice in CRTs. Clear specification of a CRT service model and development of effective resources to support CRT service improvement can help consistent provision of acceptable and effective home treatment for people experiencing mental health crisis be fully achieved.

Additional Files

Additional File DS1: CORE CRT Service Improvement Trial: CONSORT Checklist

Additional File DS2. Patient records data operational definitions and eligibility

Additional File DS3. Service user experience and staff wellbeing: participant recruitment and characteristics

Additional File DS4. CRT team fidelity scores

Additional File DS5. Service user experience and staff wellbeing: outcomes data

Additional File DS6. Inpatient admissions and Readmissions following CRT care: outcomes data

Additional File DS7: Relationships between changes in team fidelity scores and outcomes

Additional File DS8: Fidelity items targeted in teams' service improvement plans

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Authors' contributions

SJ led the CORE Study.

SJ, DO, GA, LM, RH, OM, CH, NM, FN, SO and BLE contributed to the design of the study.

SJ, DO, GA, LM, RH, OM, BLE and DL formed a Trial Management Group, which oversaw the conduct of the study.

SO and EJ led the development of the CORE Service Improvement Programme.

OM, SS and KK acted as site leads in NHS Trusts where the CORE Service Improvement Programme was implemented.

GA and LM conducted the statistical analyses for the study.

GB provided external consultancy on developing implementation resources and fidelity measurement.

DL, MC, KF, JP, RF, EM and MD recruited participants, and collected and managed study data.

BLE led writing this paper.

All authors contributed to drafting the final version of this paper, approve the final version, and agree to be accountable for all aspects of the work.

Declarations of interest

No authors have declarations of interest to report

References

1. Department of Health "*Crisis Resolution/Home Treatment Teams. The Mental Health Policy Implementation Guide*" UK Department of Health. 2001 (web resource) http://webarchive.nationalarchives.gov.uk/20130107105354/http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_4058960.pdf

2. Department of Health "*The NHS Plan: a plan for investment, a plan for reform"* UK Department of Health 2000 (web resource)

http://webarchive.nationalarchives.gov.uk/20130107105354/http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/@ps/documents/digitalasset/dh_118522.pdf

3. Johnson, S. "Crisis resolution and home treatment teams: an evolving model" *Br J Psychiatry*. 2013; 19 (2):115-123

4. Johnson S, Nolan F, Pilling S, et al. "Randomised controlled trial of acute mental health care by a crisis resolution team: the north Islington crisis study" *BMJ*. 2005; 331(7517):599

5. Murphy SM, Irving CB, Adams CE, Waqar M. (2015) "Crisis intervention for people with severe mental illnesses" *Cochrane Database of Systematic Reviews* Issue 12. Art. No.: CD001087. DOI: 10.1002/14651858.CD001087.pub5.

6. Hopkins C. & Niemiec S. "Mental health crisis at home: service user perspectives on what helps and what hinders" *Journal of Psychiatric and Mental Health Nursing* 2007, 14(3):310-318

7. MIND *"Listening to experience: An independent inquiry into acute and crisis mental healthcare"* 2011; MIND, London

8. Jacobs R. & Barrenho E. "The Impact of Crisis Resolution and Home Treatment Teams on Psychiatric Admissions in England" *Journal of Mental Health Policy and Economics* 2001; 14:S13.

9. Lloyd-Evans,B. Paterson,B. Onyett,S. Brown,E. Istead,H. Gray,R. et al. "National implementation of a mental health service model: A survey of Crisis Resolution Teams in England" *International Journal of Mental Health Nursing* 2017; published online 11/01/2017 DOI: 10.1111/inm.12311

10. Lloyd-Evans,B. Lamb,D. Barnby,J. Eskinazi,M. Turner,A. Johnson,S. (2018) "Mental health crisis resolution teams and crisis care systems in England: a national survey" *BJPsych Bulletin* published online first view 24th May 2018 https://doi.org/10.1192/bjb.2018.19

11. Lloyd-Evans,B. Bond,G. Ruud,T. Ivanecka,A. Gray,R. Osborn,D. et al. "Development of a measure of model fidelity for mental health Crisis Resolution Teams" *BMC Psychiatry* 2016; 16:427

12. Lloyd-Evans,B. Fullarton,K. Lamb,D. Johnston,E. Onyett,S. Osborn,D. et al. (2016) "The CORE Service Improvement Programme for mental health crisis resolution teams: study protocol for a cluster-randomised controlled trial" *BMC Trials* 2016; 17:158

13. McHugo GJ, Drake RE, Whitley R Bond,G. Campbell,K. Rapp,C. et al. "Fidelity outcomes in the National Implementing Evidence-Based Practices Project" *Psychiatr Serv*. 2007;58:1279–84

14. Atkisson C, Zwick R. "The Client Satisfaction Questionnaire: Psychometric Properties and Correlations with Service Utilisation and Psychotherapy Outcome" *Evaluation and Programme Planning* 1982; 5:233-237

15. Campbell MK, Piaggio G, Elbourne DR, Altman DG for the CONSORT Group. "Consort 2010 statement: extension to cluster randomised trials" *BMJ*. 2012 Sep 4;345:e5661.

16. Wheeler,C. Lloyd-Evans,B. Churchard,A. Fitzgerald,C. Fullarton,K. Mosse,L. et al. "Implementation of the Crisis Resolution Team model in adult mental health settings: a systematic review" *BMC Psychiatry* 2015; 15:74

17. Morant, N. Lloyd-Evans,B. Lamb,D. Fullarton,K. Brown,E. Paterson,B. et al. "Crisis resolution and home treatment: stakeholders' views on critical ingredients and implementation in England" *BMC Psychiatry* 2017; 17:254

18. Torrey WC, Bond GR, McHugo GJ, Swain K. Evidence-based practice implementation in community mental health settings: The relative importance of key domains of implementation activity. Admin Policy Ment Health. 2012;39:353–64.

19. Rose D, Sweeney A, Leese M, Clement,S. Burns,T. Catty,J. et al. "Developing a user-generated measure of continuity of care: brief report" *Acta Psychiatr Scand.* 2009.119:320–324.

20. Maslach, C. Jackson, S.E. "The measurement of experienced burnout" *J.Organ. Behav.* 1981; 2:99-113

21. Maslach, C., & Jackson, S. (1981). "*The Maslach Burnout Inventory*" Consulting Psychologists Press, Palo Alto California, US

22. Schaufeli, W. and Bakker, A. "The measurement of work engagement with a short questionnaire" *Educational and Psychological Measurement.* 2006; 66:701-716

23. Goldberg, D. and Williams, P. *"The General Health Questionnaire"* Windsor, UK: NFER-Nelson; 1988

24. Bond F, Lloyd J, Guenole N "The Work-related Acceptance and Action Questionnaire (WAAQ): Initial psychometric findings and their implications for measuring psychological flexibility in specific contexts" *Journal of Occupational and Organisational Psychology* 2013. 86(3) 331-347

25. StataCorp. 2015. *Stata Statistical Software: Release 14*. College Station, TX: StataCorp LP.

26. Johnson S, Nolan F, Hoult J. White,R. "Outcomes of crises before and after introduction of a crisis resolution team" *Br J Psychiatry*. 2005; 187(1):68-75

27. Bond, G. R., & McGovern, M. P. "Measuring organizational capacity for integrated treatment" *Journal of Dual Diagnosis,* 2013; *9*, 165-170.

28. Sweeney,A. Fahmy,S. Nolan,F. Morant,N. Fox,Z. Lloyd-Evans,B. et al. "The Relationship between Therapeutic Alliance and Service User Satisfaction in Mental Health Inpatient Wards and Crisis House Alternatives: A Cross-Sectional Study" *PLOS1* 9(7) e100153

29. Kim, S. J., Bond, G. R., Becker, D. R., Swanson, S. J., & Reese, S.L. "Predictive validity of the Individual Placement and Support Fidelity Scale (IPS-25): a replication study" *Journal of Vocational Rehabilitation,* 2015; *43*, 209-216.

30. CORE CRT Resource Pack: web resource https://www.ucl.ac.uk/core-resource-pack [Accessed 14th June 2017]

Table 1: Service user Experience and Staff Wellbeing participant characteristics –CORE CRT Service Improvement Programme Trial

	Baseline		Follow-Up	
	Control teams (n=10)	**Intervention teams (n=15)**	**Control teams (n=10)**	**Intervention Teams (n=15)**
Service User experience participants				
Gender n/N (%)				
male	56/141 (40%)	85/212 (40%)	66/152 (43%)	74/218 (34%)
female	84/141 (60%)	126/212 (59%)	84/152 (55%)	143/218 (66%)
transgender	1/141 (1%)	1/212 (0.5%)	2/152 (1%)	1/218 (0.5%)
Age: mean (sd)	44 (15)	42 (15)	42 (14)	42 (13)
Ethnicity n/N (%)				
White	121/141 (86%)	184/212 (87%)	121/152 (80%)	179/219 (82%)
Asian	12/141 (9%)	10/212 (5%)	9/152 (6%)	12/219 (5%)
Black	6/141 (4%)	14/212 (7%)	14/152 (9%)	16/219 (7%)
Mixed or Other	1/141 (1%)	4/212 (2%)	8/152 (5%)	12/219 (6%)
Episodes of CRT care n/N (%)				
One	59/141 (42%)	81/212 (38%)	57/151 (38%)	92/219 (42%)
2-5	58/141 (41%)	89/212 (42%)	72/151 (48%)	90/219 (41%)
More than 5	24/141 (18%)	42/212 (19%)	22/151 (15%)	37/219 (17%)
Previous hospital admission n/N (%)				
Yes	47/141 (33%)	63/212 (30%)	46/152 (30%)	62/219 (28%)
No	94/141 (67%)	149/212 (70%)	106/152 (70%)	157/219 (72%)
Years since first contact with mental health services n/N (%)				
<1	53/141 (38%)	77/212 (36%)	38/152 (25%)	64/219 (29%)
1-5	32/141 (23%)	43/212 (20%)	44/152 (29%)	44/219 (20%)
6-10	11/141 (8%)	24/212 (11%)	20/152 (13%)	32/219 (15%)
>10	45/141 (32%)	68/212 (32%)	50/152 (33%)	79/219 (36%)
Length of index CRT period of support n/N (%)				
<2 weeks	46/141 (32%)	48/212 (23%)	45/150 (30%)	70/219 (32%)
2 weeks – 1 month	32/141 (23%)	62/212 (29%)	48/150 (32%)	55/219 (25%)
1-2 months	28/141 (20%)	63/212 (30%)	41/150 (27%)	63/219 (29%)
>2 months	35/141 (25%)	39/212 (18%)	16/150 (11%)	31/219 (14%)
Staff wellbeing participants				
Gender n/N (%)				
male	69/175 (39%)	79/266 (30%)	70/166 (42%)	85/252 (34%)
female	106/175 (61%)	187/266 (70%)	94/166 (58%)	167/252 (66%)
Age: mean (sd)	43 (10)	42 (10)	45 (10)	43 (10)
Ethnicity n/N (%)				
White	118/175 (67%)	181/266 (68%)	107/164 (65%)	165/252 (65%)
Asian	18/175 (10%)	29/266 (11%)	24/164 (15%)	26/252 (10%)
Black	28/175 (16%)	45/266 (17%)	25/164 (15%)	50/252 (20%)
Mixed or Other	11/175 (7%)	11/266 (4%)	8/164 (5%)	11/252 (4%)

	Baseline		Follow-Up	
	Control teams (n=10)	**Intervention teams (n=15)**	**Control teams (n=10)**	**Intervention Teams (n=15)**
Professional Group n/N (%)				
Nurse	100/175 (57%)	127/266 (48%)	81/165 (49%)	112/252 (44%)
Occupational Therapist	3/175 (2%)	5/266 (2%)	3/165 (2%)	8/252 (3%)
Psychiatrist	12/175 (7%)	19/266 (7%)	16/165 (10%)	20/252 (8%)
Psychologist	4/175 (2%)	7/266 (3%)	4/165 (2%)	6/252 (2%)
Social Worker	12/175 (7%)	26/266 (10%)	8/165 (5%)	22/252 (9%)
Support worker	30/175 (17%)	49/266 (18%)	37/165 (22%)	55/252 (22%)
Other	14/175 (8%)	33/266 (12%)	16/165 (10%)	29/252 (12%)
Length of time worked in current team n/N (%)				
<1 year	31/175 (18%)	58/265 (22%)	26/173 (15%)	54/258 (21%)
1- <2 years	30/175 (17%)	43/265 (16%)	25/173 (14%)	40/258 (16%)
2- <5 years	48/175 (27%)	74/265 (28%)	71/173 (41%)	73/258 (28%)
5 - <10 years	45/175 (26%)	60/265 (23%)	36/173 (21%)	52/258 (20%)
>10 years	21/175 (12%)	30/265 (11%)	25/173 (14%)	39/258 (15%)

Table 2: CORE CRT Service Improvement Trial Results - Service user, staff and service use outcomes

Measure	Control (n=10 CRTs)	Intervention (n=15 CRTs)	Adjusted Analysis (Coefficient, CI)[2]
Service user experience outcomes			
Client Satisfaction Questionnaire (Satisfaction with CRT service - Primary outcome) (median, IQR)	baseline: 27 (22, 30) follow up: 28 (23, 31)	baseline: 27 (22, 31) follow up: 28 (24, 32)	0.97 (-1.02, 2.97), p=0.34
Continu-um (Perceived Continuity of Care) (mean, s.d)	baseline: 42 (10) follow up: 40 (9)	baseline: 43 (10) follow up: 40 (10)	-0.06 (-2.78, 2.66), p=0.97
Staff wellbeing outcomes			
Maslach Burnout Inventory Emotional Exhaustion) (mean, s.d)	baseline: 18 (10) follow up: 20 (11)	baseline: 18 (10) follow up: 18 (11)	-1.92 (-4.30, 0.46), p=0.11
Maslach Burnout Inventory (Personal Accomplishment) (mean, s.d)	baseline: 37 (7) follow up: 36 (8)	baseline: 38 (7) follow up: 37 (8)	0.19 (-1.39, 1.78), p=0.81
Maslach Burnout Inventory (Depersonalisation) (mean, s.d)	baseline: 5 (4) follow up: 5 (4)	baseline: 4 (4) follow up: 4 (5)	-0.26 (-1.13, 0.60), p=0.55
Utrecht Work Engagement Scale (Work Engagement) (mean, s.d)	baseline: 39 (8) follow up: 38 (9)	baseline: 40 (8) follow up: 40 (8)	1.07 (-0.81,2.96), p=0.27
General Heath Questionnaire (Health) (mean, s.d)	baseline: 10 (5) follow up: 12 (6)	baseline: 11 (5) follow up: 11 (5)	-1.29 (-2.38, -0.20), p=0.020
Work-related Acceptance and Action Questionnaire (mean, s.d)	baseline: 39(6) follow-up: 38 (6)	baseline: 40 (5) follow-up: 40 (5)	1.16 (0.07, 2.25), p=0.037
Inpatient Service Use outcomes			
Inpatient Admissions: N (median, IQR[4])	baseline: 170 [129, 245] follow-up: 170 [121, 236]	baseline: 152 [60, 219] follow up: 119 [42, 179]	IRR[3] = 0.88 (0.83. 0.94), p=000018
Compulsory admissions: N (median, IQR)[1]	baseline:70 [26, 77] follow up: 56 [32, 72]	baseline: 54 [19, 77] follow up: 42 [23, 42]	IRR[3] = 1.03 (0.91, 1.17), p=0.63
Inpatient bed days: N (median, IQR)	baseline: 6061 [4331, 6683] follow up: 4685 [2846, 9296]	baseline: 4294 [2614, 5703] follow up: 3830 [2356, 6161]	IRR[3] = 0.96 (0.95, 0.97), p<0.00001
Readmission following CRT care outcome			
Readmissions following CRT care: N (median, IQR)	baseline: 16 [10, 22] follow up: 22 [8, 31]	baseline: 12 [7, 16] follow up: 12 [3, 25]	IRR[3] = 0.87 (0.72, 1.06), p=0.17

1. Compulsory admissions data missing for 5 teams at follow up (all from the same NHS Trust: 3 in the intervention group and two in the control group) 2. Staff and service user analysis: mixed modelling (CRT as random effect) 3. IRR (Incidence Rate Ratio) baseline score on outcome measure as exposure variable, (Trust as random effect) 4. IQR = Inter Quartile Range

Figure 1: CORE CRT Service Improvement Programme Cluster Randomized Trial - CONSORT Flow Diagram

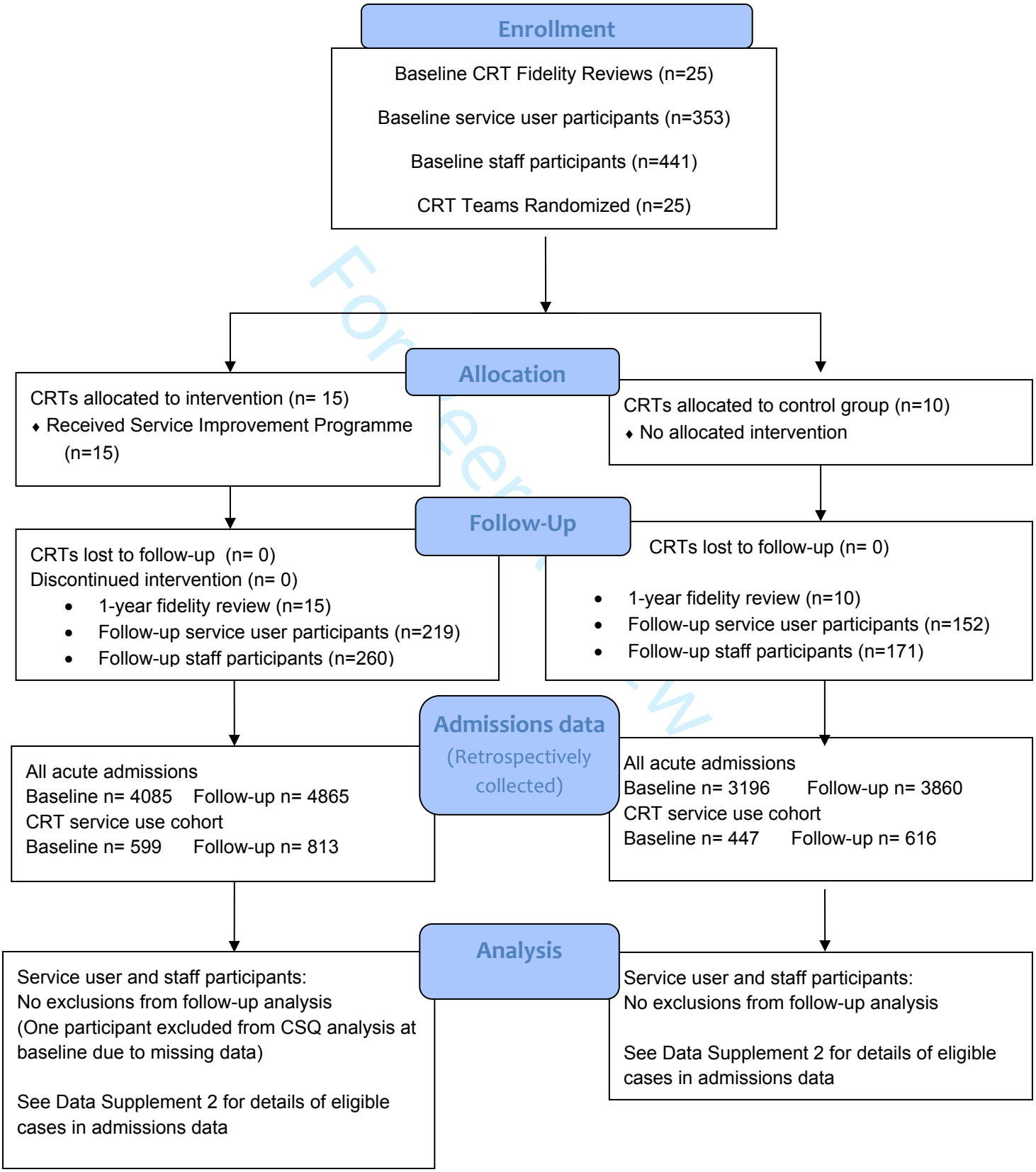

Figure 2: Implementation of the CRT Service Improvement Programme trial intervention

Team	Trust	Facilitator in post	Team scoping day	SIP made	SIP reviewed regularly	Interim fidelity review	Attendance at learning collaboratives	Team fidelity change (Baseline to follow up)
3	1							+1
4	1							+37
5	1							-13
6	1							-22
8	2							13
9	2							-18
11	3							11
13	4							22
15	5							12
16	5							18
19	6							24
20	6							19
21	6							19
23	7							-5
25	8							4

Facilitator in post: Green = Yes, throughout. Amber = Yes, but with a change in Facilitator during intervention year. Red: No Facilitator for full year
Team scoping day: Green = Held within first three months. Amber = held later than three months. Red = Not held
Service Improvement Plan (SIP) made: Green = within first 3 months. Amber = later than 3 months. Red = plan not made
SIP reviewed regularly: Green = reviewed at least 3 times during study year; Amber = reviewed fewer than three times; Red = not reviewed
Interim fidelity review: Green = Held in month 6 or 7. Amber = Held later than month 7. Red = no interim fidelity review
Attendance at learning collaboratives: Green = Facilitator and CRT team members attended events. Amber = Just facilitator attended