Examining fidelity in the INFORM trial, a complex team-based behavioural intervention

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Abstract

Background Fidelity in complex behavioural interventions is underexplored. This study examines fidelity of the INFORM trial and explores the relationship between fidelity, study arm and the trial’s primary outcome – care aide involvement in formal team communications about resident care. We examined fidelity of intervention delivery, receipt, and enactment. The primary outcome in the INFORM study (care aide involvement in formal team communications about resident care) was also included as an outcome in this fidelity study.

Methods A concurrent process evaluation of implementation fidelity was conducted in 33 nursing homes in Western Canada (Alberta and British Columbia). Study participants are from 106 clinical care units clustered in 33 nursing homes randomized to the Basic and Enhanced Assisted Feedback arms of the INFORM trial.

Results Fidelity of the INFORM intervention was moderate to high, with fidelity delivery and receipt higher than fidelity enactment for both study arms. Higher enactment teams experienced a significantly larger improvement in formal team communications between baseline and follow-up than lower enactment teams (\( F (1, 70) = 4.27, p = .042 \)).

Conclusions Overall fidelity enactment was associated with improvements in formal team communications, but study arm was not. This suggests that the intensity with which an intervention is offered and delivered may be less important than the intensity with which intervention participants enact the core components of an intervention. Greater attention to fidelity assessment and publication of fidelity results through studies such as this one is critical to improving the utility of published trials.

Contributions To The Literature
- Although comprehensive models of fidelity assessment exist, recent systematic reviews indicate fidelity frameworks are rarely used and fidelity receipt and enactment are poorly reported.
- By providing a comprehensive, theory-based examination of fidelity in a complex, behavioural intervention (the INFORM trial), this study enhances understanding of how health services interventions are implemented and why they succeed or fail.
- Study findings underscore the need for comprehensive fidelity assessment and suggest more attention needs to be paid to how, and how well, intervention participants can enact a complex intervention than to the intensity of intervention delivery.

**Background**

We invest heavily in interventions designed to improve healthcare delivery or outcomes, yet they often fail[1] or have limited success or declining success when replicated.[2] The theoretical soundness of an intervention can help explain intervention success or failure.[3] Process evaluations, including examination of intervention fidelity, can also enhance understanding of why health services interventions succeed or fail.[4,5] Assessing fidelity (defined as the extent to which an intervention is delivered and implemented as intended or as per protocol[6][1]) helps to make clear the mechanisms of impact in a trial – knowledge that is crucial for replication[7,8] and for drawing unequivocal conclusions about an intervention’s effectiveness.[9] Ignoring fidelity increases the risk of accepting ineffective interventions and of discarding robust interventions that are poorly implemented.

**Concurrent** rather than **retrospective** process evaluation are needed,[10] including concurrent fidelity studies.

In complex interventions, where there may be multiple mechanisms of impact compared to simple interventions, assuring fidelity is challenging[9] and its examination is particularly important. There is, however, little in the published literature regarding fidelity in complex behavioural interventions.[6] The INFORM study[11] (Improving Nursing Home Care Through Feedback On perfoRMance data) is a complex three-arm behavioural trial designed to increase involvement of unregulated care aides in formal team communications about resident care in nursing homes [trial paper is currently under review with Implementation Science as a companion paper to this one]. This paper reports on a mixed-methods study that examines trial fidelity in INFORM and explores the relationship between fidelity, study arm, and the trial’s primary outcome – care aide involvement in formal team communications about resident care.

**Intervention Fidelity**

The effectiveness of interventions depends on providers delivering the intervention as intended and
participants actively engaging with the intervention.[9] Various conceptual models of fidelity exist, [7,12–15] and key dimensions are articulated by Bellg et al. in the treatment fidelity model.[7]

**Fidelity delivery** is about delivering an intervention consistently, as per protocol, and minimizing contamination. **Fidelity receipt** reflects participants’ receipt and understanding of the intervention components and their capacity to use the skills taught. **Fidelity enactment** reflects participants’ actual performance of intervention skills or implementation of the core intervention components in the intended situation. Bellg and colleagues laid out the dimensions of fidelity delivery, receipt, and enactment and suggest a compendium of approaches (including checklists, observation, document analysis, and interviews) suitable for assessing these dimensions. However, recent systematic reviews indicate that fidelity receipt and enactment are generally underexamined and underreported[9,16] and/or poorly reported.[17] According to one of these reviews, only 20% of studies used a fidelity framework.[9] Fewer than half of the studies in the review measured both fidelity delivery and fidelity receipt and enactment.[9] Comprehensive, theory-based examinations of fidelity in complex, contextualized interventions are needed to advance understanding of trial effectiveness.

As we address fidelity, it is important to acknowledge ongoing debate about the importance of fidelity versus the need for adaptation.[18] Scholars increasingly suggest that interventions designed for dynamic real world settings need to be contextualized - there is a need “to balance standardization of [intervention] form and content with responsivity to context.”[19] Others point out that interventions are routinely adapted in practice, thus adaptation is an ecological reality though it is not well understood.[18] While acknowledging the importance of this debate in the broader implementation literature, this paper focuses on better understanding of processes important to intervention fidelity.

We suggest that fidelity (and related adaptations) can be understood by assessing whether core components of an intervention are (1) identified based on the intervention’s underlying theory and (2) delivered and implemented as per protocol.[20]

**Study Objectives**

1. To examine fidelity of the INFORM intervention - in particular, to what extent the core components of INFORM were (a) delivered, (b) received, and (c) enacted
according to theory / as per protocol.

2. To examine whether level of intervention intensity (study arm) is associated with (a) fidelity and (b) the perceived value of the intervention.

3. To examine the extent to which fidelity delivery, receipt, and enactment explain variance in improvements in INFORM’s primary outcome: care aide involvement in formal team communications about resident care.

**The INFORM Study**

At least 60% to 80% of the nursing home workforce in the US,[21] Canada,[22] and England[23] is made up of care aides (also called care assistants, support workers or nursing assistants) who provide the vast majority of direct care in these settings.[24] Despite close contact with residents and intimate knowledge of residents’ care needs and preferences,[25] care aides remain a largely unregulated workforce with low levels of education and wages.[24] They are rarely involved in decision making about resident care.[26] Care decisions tend to be the purview of regulated staff, and top-down decision making is the norm. However, strong communication is a hallmark of high-quality care, and communication failures are the single biggest contributor to sentinel events.[27] INFORM is a large cluster-randomised trial designed to increase care aide involvement in formal team communications about resident care.

INFORM has two core components, which are based on goal setting[28] and social interaction theories. (1) **Goal setting activities**: setting specific attainable performance goals to improve care aide involvement in formal team communications about resident care, specifying strategies for goal attainment and measuring goal progress (the feedback element in goal setting theory). (2) **Opportunities for participating teams to interact** throughout the intervention to share progress and challenges and learn effective strategies from one another. In early 2016, baseline data on care aide involvement in formal team communications about resident care and other measures of context was collected and fed back, using oral presentations and a written report, to 201 unit teams in 67 Western Canadian nursing homes. Homes were subsequently randomized to one of three INFORM study arms:
simple feedback (control) that included only the oral and written dissemination already delivered, basic assisted feedback, and enhanced assisted feedback. Units in both assisted arms were invited to attend three workshops over a 10 month period (June 2016 – April 2017). Workshops included a variety of activities to help with goal setting and goal attainment, support from facilitators, progress reporting by participating teams at workshops 2 and 3, and inter-unit networking opportunities. In the enhanced assisted feedback arm, all three workshops were face to face. In the basic assisted feedback arm, the first workshop was face to face and the second and third workshops were conducted virtually using webinar technology (virtual workshops were 1.5 hours – half the length of the face to face workshops). Main trial results showed a statistically significant increase in care aides’ involvement in formal team communications about resident care in both the basic and enhanced assisted feedback arms compared to the Simple Feedback arm. However, no differences were observed between the basic and enhanced assisted feedback arms [main trial results were submitted and are currently under review as a companion to this paper].

[1] Most authors have adopted this definition of fidelity from Dusenbury et al., (2003). Other terms used for fidelity are intervention/treatment fidelity, implementation fidelity (or fidelity of implementation – FOI). We use the term fidelity.

Methods
We conducted a mixed methods, concurrent process evaluation[5,10] during the INFORM trial to assess intervention fidelity and experiences of participant teams. During all three intervention workshops, we collected data using attendance lists, intervention delivery checklists, participant team worksheets, exit surveys, and expert observations.

Data Collection
During the first workshop, teams completed a goal setting worksheet. They outlined their specific INFORM goal to increase care aide involvement in formal team communications about resident care, strategies for goal attainment and measures to provide feedback to teams on goal progress. At the
second and third workshops, each team made a presentation about their activities and goal progress since the previous workshop. Study investigators with expertise in the core components of INFORM carried out structured observations of the presentations. At the end of each workshop, teams also completed an exit survey, and workshop facilitators completed an intervention delivery checklist indicating whether each workshop agenda item was delivered as planned.

**Sample**

This study includes 106 nursing home care units randomized to basic and enhanced assisted feedback arms. These 106 units are clustered in 33 different nursing homes (range of 1–10 units per home, median = 3).

**Measures**

*Intervention fidelity* is measured using 11 items (Table 1) that reflect fidelity delivery (4 items), receipt (4 items), and enactment (3 items). All 11 items show sufficient variation. Three authors (LG, MH, PN) reached consensus that these items reflect delivery, receipt, and enactment of the core components of INFORM described above. Because these items reflect different aspects of fidelity rather than a single fidelity construct, they are not scaled together.

*Perceived value of the intervention.* Four measures of team perception of intervention value are based on exit survey data from the three workshops. These measures include team perceptions for: (1) the value of workshop 1 material (average of 6 items; e.g. *The preworkshop exercise was valuable, the presentation on SMART goals was valuable*, alpha = .89), (2) the value of workshop 1 inter-team activities (average of 2 items; e.g. *Discussions/feedback from other teams helped with setting performance goals*, alpha = .64)[2], (3) the value of workshop 2 (average of 3 items, e.g. *Creating the report back presentation was valuable*, alpha = .86), (4) the value of workshop 3 (average of 3 items, e.g. *Discussion period after report back was valuable*, alpha = .81). All items used a 5-point agreement Likert scale.

*Overall fidelity enactment* reflects expert assessment of a team’s implementation of the core intervention components in the intended situation. We measured it with a single-item enactment rating scale (1 = very low enactment, with no/almost no activities undertaken to improve care aide
involvement in formal team communications about resident care; 5 = very high enactment, with extensive activities undertaken). The rating was provided at the end of workshop 3 jointly by the two individuals who delivered all three INFORM workshops and who were most familiar with each team’s activities. Fidelity enactment is a binary variable, generated by recoding 1–3 as lower enactment and 4 and 5 as higher enactment.

**Outcome:** Care aide involvement in formal team communications about resident care is one of 10 concepts measured by the Alberta Context Tool, a comprehensively validated tool to assess modifiable features of the care unit work environment.[29] We used a modified score for formal team communications, asking care aides how often (in the last typical month) they participated in: (a) team meetings about residents, (b) family conferences, and (c) change-of-shift reports (each item rated from 1 = never to 5 = almost always). The modified score was generated by recoding each item (1 and 2 to 0, 3 to 0.5, 4 and 5 to 1) and summing recoded values (possible range: 0–3). To gather data on formal team communications, we administered the Alberta Context Tool by computer-assisted structured personal interview to a minimum of 10 care aides on each unit participating in the INFORM trial, at baseline (2 months before INFORM) and follow-up (2 months after the last support workshop).

**Analysis**

For study objective 1 we used descriptive statistics to examine the fidelity with which the INFORM intervention was delivered, received, and enacted. For study objective 2 we used chi-square and Fisher’s exact tests to examine whether intervention intensity (study arm) was associated with differences in fidelity. A Shapiro-Wilk test showed the Perceived Intervention Value variables to be non-normally distributed ($p = .000$ for all four variables). The Mann-Whitney U test was therefore used to examine whether the perceived value of the intervention workshops differed by study arm. For study objective 3 we used hierarchical mixed modelling (GLMM ML estimation, SAS), which accounts for clustering of units within facilities. This modelling examines the variance in INFORM’s primary outcome (care aide involvement in formal team communications about resident care) that is explained by each of the 11 fidelity delivery, receipt, and enactment items. The posttest score was the dependent variable with the baseline score entered as a covariate. Lastly, we conducted repeated
measures analysis of variance to examine whether the relationship between time (baseline and follow-up) and care aide involvement in formal team communications about resident care was moderated by overall fidelity enactment. In other words, did improvement in care aide involvement over the study period differ for low and high enactment teams? Our mixed models suggested that the variance explained by facility clustering was small and statistically non-significant (facility-level random intercept = 0.0002, \( p = 0.3733 \), intra-cluster correlation = 0.0411). Therefore, we did not include a random facility-level intercept in our repeated measures model.

[2] 8-items used to measure the value of workshop 1 were factor analyzed (EFA with oblimin rotation) and loaded on these two factors: value of the workshop material and value of the inter-team activities. The value of workshops 2 and 3 was assessed using three items each so were not factor analyzed.

Results

**Fidelity delivery (Table 2).** Fourteen percent of units (15/106) did not participate in any workshop while 63% of units participated in all three workshops. There were no statistically significant differences by study arm (chi-square = 3.44, df = 3, \( p = .33 \)). Of the 87 units that participated in more than one workshop, 79% had continuity of representation at workshops (the same unit representative attended more than 1 workshop), with no statistically significant differences by study arm (\( p = .41 \), Fisher’s exact test). At the second workshop, Inter-team activities were delivered to all 34 teams in the enhanced assisted feedback arm that attended but to only 69% of teams in the basic assisted feedback arm (\( p = .000 \), Fisher’s exact test). At the third workshop, inter-team activities were delivered to 89% of enhanced assisted feedback arm teams but to only 72% of teams in the basic assisted feedback arm (not significant).

**Fidelity receipt (Table 2).** All 91 teams that attended the first workshop agreed or strongly agreed that workshop content was relevant to their day-to-day work. A higher proportion of teams in the enhanced assisted feedback arm strongly agreed than teams in the basic assisted feedback arm (80% versus 62%, \( p = .05 \), Fisher’s exact test). Of 80 teams that submitted a goal setting worksheet at the
end of workshop 1, expert assessment of fidelity receipt was high: 93% of teams defined an appropriate goal, 98% defined strategies for goal attainment, and 85% defined measures to track goal progress. Only goal definition differed significantly by study arm: 84% of teams in the enhanced assisted feedback arm defined appropriate goals compared to 98% of teams in the basic assisted feedback arm ($p = .03$, Fisher’s exact test).

**Fidelity enactment (Table 2).** Nearly all teams in both study arms (90/91) completed the preworkshop 1 exercise. At workshop 2, 67% of teams in both study arms had measured the impact of changes put in place to increase care aide involvement in formal team communications about resident care. At workshop 3, managers in the basic assisted feedback arm reported spending fewer hours per week on INFORM-related activities (62% spent <1 h/week, 2% spent 3+ h/week) than managers in the enhanced assisted feedback arm (14% spent <1 h/week, 31% spent 3+ h/week, chi-square (2, N = 63) =18.3, $p = .000$).

**Perceived Value of the Intervention (Table 2).** Results of the Mann-Whitney U test show that teams found workshop 1 to be valuable, with no significant difference between study arms (Table 2). While teams in both arms rated the value of the second and third workshops highly, teams in the enhanced assisted feedback arm had significantly higher scores than teams in the basic assisted feedback arm for workshop 2 (4.8 versus 4.3, $U = 374$, $p = .000$) and for workshop 3 (4.8 versus 4.3, $U = 228$, $p = .000$) with large effect sizes (approximately 1 standard deviation). Hierarchical mixed model results show that, after controlling for pretest formal team communications scores, higher ratings of relevance of the goal setting workshop (strongly agree vs agree) are associated with higher posttest formal team communications scores ($F = 4.7$, $p = 0.04$). The variable reflecting whether teams measured the impact of changes designed to improve formal team communications between the first two workshops was also associated with posttest formal team communications scores. However, the fixed effects estimates show that teams who presented on their progress between the first two workshops (whether or not they measured the impact of changes designed to improve formal team communications) had significantly lower posttest formal team communications scores than teams that were not present at the second workshop ($t = -2.5$, $p = 0.02$)
for the group of units that did not measure the impact of changes; t = -2.1, p = 0.04 for the group of units that measured the impact of changes). None of the other fidelity delivery, receipt, or enactment items have an effect on posttest formal team communications scores when all items are entered into the same model (Table 3).

Absence from a workshop leads to identical missing patterns for variables measured at that workshop. As a result, missing cases are completely collinear for two bundles of variables in Table 3 (8, 9, and 10; 5 and 11) and between variables 3, 6, and 11. Parameters could therefore not be estimated for the missing groups for variables 3, 5, 9, and 10. Variables in each bundle remain independent and we have therefore retained all of them in the mixed model.[30,31]

Mixed ANOVA (GLM repeated measures) was used to determine the effect of overall fidelity enactment (low or high) and time (baseline to follow-up) on formal team communications (INFORM’s primary outcome). The interaction between time and degree of enactment is significant (F(1, 70) = 4.27, p = .042), indicating that improvement in formal team communications between baseline and follow-up differed for low and high enactment teams. High enactment teams showed a larger improvement (increased by more than ½ a standard deviation from 1.25 at baseline to 1.42 at follow up) (Figure 1).

Discussion
We found that fidelity of the INFORM intervention was moderate to high. Core components of INFORM were successfully delivered to most units. Fidelity receipt was reasonably high, with >85% of teams defining (1) appropriate goals to improve care aide involvement in formal team communications, (2) strategies for goal attainment, and (3) measures to give feedback to teams on goal attainment. Data on key markers suggest high levels of fidelity enactment at intervention start and moderate enactment at workshops 2 and 3. Study arms had few differences in extent of fidelity delivery, receipt, and enactment. This helps us understand INFORM trial results: basic and enhanced assisted feedback arms had significantly higher follow-up team communication scores than the simple feedback arm, but the two assisted feedback arms did not differ in scores.

We examined whether variance in follow-up scores for formal team communications was explained by
fidelity delivery, receipt, and enactment items (entering all 11 variables in the same model). Few
individual fidelity elements were significantly associated with our main study outcome (care aide
involvement in formal team communications about resident care), after controlling for differences in
baseline scores. Despite low variance in perceived relevance of the initial goal setting workshop, units
with the highest perceived relevance ratings had higher formal team communications scores at
follow-up. Most important are repeated measures results showing that high enactment teams saw a
significantly larger improvement in formal team communications between baseline and follow-up than
lower enactment teams (Figure 1).

Perhaps most novel are our results that overall fidelity enactment is associated with improvements in
formal team communications, but study arm is not. This suggests that intervention intensity is less
important than the intensity with which intervention participants enact the core components of an
intervention. Best outcomes may come from scaling back the intensity of delivering complex
behavioural interventions, instead using scarce resources to support fidelity enactment (i.e. helping
teams to successfully implement an intervention). Ways to strengthen enactment may also achieve
longer-term sustainment of practice changes in an intervention. We encourage further research on
the enactment-sustainment relationship, given that sustainability continues to be a key translational
research problem.[32,33]

Study strengths and weaknesses

Fidelity measures tend to be intervention-specific and may lack rigorous psychometric testing.
[16,34,35] A strength of our study is multiple data collection methods to assess fidelity, including the
gold standard - observation.[9] We established content validity of items using theory and expert
agreement. We found a relationship between fidelity enactment and intervention outcomes that
supports predictive validity of our overall enactment score.

The need to “balance standardization of [intervention] form and content with responsiveness to
context”[19] encapsulates the fidelity-adaptation debate. We needed to be lenient in assessing
aspects of fidelity in teams, which reduced variation on some fidelity items. For example, 92.5% of
teams were judged to have defined an appropriate goal at the close of workshop 1, and 97.5% had
defined strategies for goal attainment. This may reduce explanatory power of these fidelity receipt variables in our hierarchical mixed model. Our mixed model may also have low statistical power. This paper assesses fidelity quantitatively, although qualitative approaches can give greater depth of understanding and reveal important aspects of complex organizational environments for interventions. We conducted focus groups only across teams, preventing analysis at team level.

**Contributions to the fidelity & implementation literature**

Assessing fidelity is key to understanding care delivery interventions, revealing how and why interventions succeed or fail.[5,36] However, most trials do not report comprehensive fidelity assessments.[9,16,35,37] This study assesses fidelity delivery, receipt, and enactment, responding to calls for fidelity substudies in audit and feedback trials specifically[38] and to calls for robust, comprehensive, and quantitative evaluations of fidelity in intervention studies more generally.[7,37] This study also responds to broader calls for theory-based, concurrent process evaluations of complex trials,[10] amidst a landscape of process evaluation work that is mainly retrospective and often not theory-guided.[39]

Our concurrent fidelity analysis helps us interpret the main results of the INFORM trial. Our results enhance understanding of impact mechanisms in complex trials. Our findings raise questions about the relative importance of intervention intensity and intensity with which participants enact the core components of the intervention. The fidelity-outcomes relationship has been examined in only a few settings,[20] and results are inconsistent. A systematic review of health promotion and prevention programs found that level of implementation fidelity affects outcomes,[20] but a systematic review of psychotherapy outcomes in youth found only a very modest link between fidelity and outcomes.[40] The first review examines fidelity with a strict construct definition, while the second does not explore aspects of fidelity enactment. Our results fill knowledge gaps[41] in how specific aspects of fidelity such as delivery, receipt, and enactment contribute to intervention outcomes, but knowledge gaps on fidelity assessment in complex trials remain and require further exploration.

**Conclusions**

This concurrent fidelity evaluation demonstrates (1) implementation of the INFORM trial largely as
intended, with few differences across study arms and (2) lower levels of fidelity enactment than fidelity delivery and receipt across study arms. Our evaluation highlights the relationship between fidelity enactment and intervention outcomes, and the need for additional research on how best to support intervention enactment. Our findings help explain the main INFORM trial results, strengthening conclusions on INFORM’s effectiveness and helping to make clearer its mechanisms of impact. This is valuable for replication. Future work on fidelity assessment would ideally combine quantitative and qualitative approaches for both breadth and depth of understanding on ways that interventions are delivered, received, and enacted. Fidelity to core components of interventions is important, but further research must answer precise questions about how, when, and what type of intervention adaptation can positively influence trial effectiveness. Greater attention to fidelity assessment, fidelity measurement, and publication of fidelity results through studies such as this one are critical for improving the utility of published trials.

**Abbreviations**

INFORM
Improving Nursing Home Care Through Feedback On perfoRMance data

TREC
Translating Research in Elder Care

**Declarations**

**Ethics approval**

This study was approved by the Research Ethics Boards of the University of Alberta (Pro00059741), Covenant Health (1758), University of British Columbia (H15-03344), Fraser Health Authority (2016-026), and Interior Health Authority (2015-16-082-H). Operational approval was obtained from all included facilities as required. All TREC facilities have agreed and signed written informed consent to participate in the TREC observational study and to receive simple feedback (our control group, details below). Facilities randomized to the two higher intensity study arms were asked for additional written informed consent. Managerial teams and care team members were asked for oral informed consent before participating in any primary data collection (evaluation surveys, focus groups, interviews).

**Consent for publication**
Availability of data and materials

The data used for this article are housed in the secure and confidential Health Research Data Repository (HRDR) in the Faculty of Nursing at the University of Alberta (https://www.ualberta.ca/nursing/research/supports-and-services/hrdr), in accordance with the health privacy legislation of participating TREC jurisdictions. These health privacy legislations and the ethics approvals covering TREC data do not allow public sharing or removal of completely disaggregated data from the HRDR, even if de-identified. The data were provided under specific data sharing agreements only for approved use by TREC within the HRDR. Where necessary, access to the HRDR to review the original source data may be granted to those who meet pre-specified criteria for confidential access, available at request from the TREC data unit manager (https://trecresearch.ca/about/people), with the consent of the original data providers and the required privacy and ethical review bodies. Statistical and anonymous aggregate data, the full dataset creation plan, and underlying analytic code associated with this paper are available from the authors upon request, understanding that the programs may rely on coding templates or macros that are unique to TREC.

Competing interests

All authors declare no competing interests.

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Authors contributions

LG co-led the study with CE, MH and PN; LG in collaboration with MH, AE, PN, CE, EA, RA, LC, HL, and LW developed the workshop materials and evaluations and oversaw the intervention implementation and data collections. MH attended all study workshops; LG, AE, MH, EA, LC, HL, and LW carried out the process evaluation data collection. LG in collaboration with MH, AE, PN developed the statistical analysis plan, oversaw the analysts, and interpreted the analyses. LG drafted all figures and tables,
and wrote the first draft of the manuscript. All authors revised the paper critically for intellectual content and approved the final version.

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Tables

Table 1 – Intervention fidelity items

| Data Source                          | Fidelity DELIVERY Items                                                                 |
|--------------------------------------|-----------------------------------------------------------------------------------------|
| Workshop attendance records         | Number of workshops attended: 0–3                                                       |
|                                      | Continuity of representation at workshops (at least one team member attended more than zero workshops): Y/N binary item |
|                                      | Interteam activities delivered to team at workshop 2 (more than one facility participated in their workshop): Y/N binary variable |
|                                      | Interteam activities delivered to team at workshop 3 (more than one facility participated in their workshop): Y/N binary variable |
| Workshop 1 exit survey              | Goal setting workshop content was relevant to my day-to-day work: 5-point agreement scale |
| Goal setting worksheet              | Expert assessment of whether team defined a challenging but attainable, specific, and measurable goal: Y/N binary variable |
|                                      | Expert assessment of whether team defined strategies for goal attainment: Y/N binary variable |
|                                      | Expert assessment of whether team defined measures for tracking goal progress: Y/N binary variable |

| Data Source                          | Fidelity RECEIPT Items                                                                    |
|--------------------------------------|------------------------------------------------------------------------------------------|
| Workshop 1 exit survey              | Goal setting workshop content was relevant to my day-to-day work: 5-point agreement scale |
| Goal setting worksheet              | Expert assessment of whether team defined a challenging but attainable, specific, and measurable goal: Y/N binary variable |
|                                      | Expert assessment of whether team defined strategies for goal attainment: Y/N binary variable |
|                                      | Expert assessment of whether team defined measures for tracking goal progress: Y/N binary variable |

| Data Source                          | Fidelity ENACTMENT Items                                                                  |
|--------------------------------------|-------------------------------------------------------------------------------------------|
| Workshop 1 exit survey              | Completed preworkshop 1 exercise: Y/N binary variable                                      |
| Workshop 2 observer rating          | Team measured impact of changes designed to improve formal team communications: Y/N binary variable |
| Workshop 3 exit survey              | Unit manager time spent planning INFORM activities: 1 = <1 h/week, 2 = 1-2 h/week, 3 = 3+ h/week on average |

Table 2 – Intervention fidelity & experience descriptives
|                                | All Units | Study Arm: Basic assisted feedback | Study Arm: Enhanced assisted feedback |
|--------------------------------|-----------|------------------------------------|--------------------------------------|
| Number of workshops attended   | 0         | 14.2% (15/106)                     | 14.8% (9/61)                         |
|                                | 1         | 3.8% (4/106)                       | 6.6% (4/61)                          |
|                                | 2         | 18.9% (20/106)                     | 19.7% (12/61)                        |
|                                | 3         | 63.2% (67/106)                     | 59% (36/61)                          |
|                                |           |                                    | 13.3% (6/45)                         |
|                                |           |                                    | 0% (0/45)                            |
|                                |           |                                    | 17.8% (8/45)                         |
|                                |           |                                    | 68.9% (31/45)                        |
| Continuity of representation at workshops - % yes | 79.3% (69/87) | 81.3% (39/48) | 76.9% (30/39) |
| Interteam activities delivered (workshop 2) - % yes | 81.7% (67/82) | 68.8% (33/48) | 100% (34/34) |
| Interteam activities delivered (workshop 3) - % yes | 80.6% (58/72) | 72.2% (26/36) | 88.9% (32/36) |
| **Fidelity RECEIPT**            |           |                                    |                                      |
| Relevance of first workshop content | % agree  | 30.8% (28/91)                      | 38.5% (20/52)                        |
|                                | % strongly agree | 69.2% (63/91) | 61.5% (32/52) | 20.5% (8/39) | 79.5% (31/39) |
| % of teams that defined an appropriate goal at close of workshop 1 | 92.5% (74/80) | 98% (48/49) | 83.9% (26/31) |
| % of teams that defined strategies for goal attainment at close of workshop 1 | 97.5% (78/80) | 100% (49/49) | 93.5% (29/31) |
| % of teams that defined measures for tracking goal progress at close of workshop 1 | 85% (68/80) | 89.8% (44/49) | 77.4% (24/31) |
| **Fidelity ENACTMENT**         |           |                                    |                                      |
| % of teams that completed preworkshop 1 exercise | 98.9% (90/91) | 100% (52/52) | 97.4% (38/39) |
| % of teams that measured impact of changes designed to improve formal team communications at workshop 2 | 67.1% (55/82) | 66.7% (32/48) | 67.6% (23/34) |
| Average h/week manager spent planning INFORM activities: | <1 | 39.7% (25/63) | 61.8% (21/34) | 13.8% (4/29) |
|                                | 1-2       | 44.4% (28/63)                      | 35.3% (12/34)                        |
|                                | 3+        | 15.9% (10/63)                      | 2.9% (1/34)                          |
|                                |           |                                    | 13.8% (4/29)                         |
|                                |           |                                    | 55.2% (16/29)                        |
|                                |           |                                    | 31.0% (9/29)                         |
| % of teams rated as higher enactment at workshop 3 | 61.4% (44/72) | 55.6% (20/36) | 66.7% (24/36) |
| **Perceived Intervention Value: Mean (standard deviation)** |       | -                                  | -                                    |
| Value of Workshop 1 material   | 4.43 (0.50) | 4.36 (0.51)                      | 4.51 (0.48)                          |
| Value of Workshop 1 interteam/researcher interactions | 4.49 (0.53) | 4.39 (0.59)                      | 4.63 (0.43)                          |
| Value of Workshop 2            | 4.53 (0.48) | 4.33 (0.47)                      | 4.78 (0.35)                          |
| Value of Workshop 3            | 4.52 (0.48) | 4.25 (0.46)                      | 4.78 (0.34)                          |

Chi-square test; † Fisher’s exact test; ‡ Mann-Whitney U test
Table 3 – Estimates of fixed effects for the outcome of posttest formal team communications score

| Fixed Effects† | Level | Estimate (standard error) | P     | 95% Confidence Interval |
|----------------|-------|---------------------------|-------|-------------------------|
| 1. Baseline formal team communications score | Continuous | 0.24(0.10) | 0.02* | 0.03 to 0.44 |
| 2. Study arm | Basic assisted feedback | 0.11(0.07) | 0.14 | -0.04 to 0.25 |
| | Enhanced assisted feedback | Reference | . |
| 3. Number of workshops attended | 2 | . |
| | 3 | . |
| 4. Continuity of representation at workshops | No | 0.02(0.08) | 0.76 | -0.14 to 0.19 |
| | Yes | Reference | . |
| 5. Interteam activities delivered (workshop 2) | No | -0.09(0.08) | 0.30 | -0.26 to 0.08 |
| | Missing | . |
| | Yes | Reference | . |
| 6. Interteam activities delivered (workshop 3) | No | -0.01(0.10) | 0.95 | -0.20 to 0.19 |
| | Missing | 0.09(0.16) | 0.58 | -0.23 to 0.42 |
| | Yes | Reference | . |
| 7. Relevance of 1st workshop content: | Agree | -0.16(0.08) | 0.04* | -0.31 to -0.01 |
| | Strongly Agree | Reference | . |
| 8. Team defined an appropriate goal at close of workshop 1 | No | 0.18(0.14) | 0.21 | -0.10 to 0.46 |
| | Missing | 0.03(0.10) | 0.78 | -0.17 to 0.23 |
| | Yes | . |
| 9. Team defined strategies for goal attainment at close of workshop 1 | No | 0.14(0.23) | 0.55 | -0.32 to 0.60 |
| | Missing | . |
| | Yes | . |
| 10. Team defined measures for tracking goal progress at close of workshop 1 | No | -0.20(0.15) | 0.17 | -0.49 to 0.09 |
| | Missing | . |
| | Yes | . |
| 11. Team measured impact of changes designed to improve formal team communications at workshop two | No | -0.34(0.14) | 0.02* | -0.62 to -0.07 |
| | Missing | Reference | . |
| | Yes | -0.27(0.13) | 0.04* | -0.52 to -0.01 |
| 12. Average h/week manager spent planning INFORM activities: | <1 hour per week | -0.01(0.10) | 0.91 | -0.22 to 0.20 |
| | 1-2 hours per week | -0.06(0.10) | 0.52 | -0.26 to 0.13 |
| | Missing | 0.01(0.15) | 0.93 | -0.29 to 0.32 |
| | ≥ 3 hours per week | Reference | . |

†The variable % of teams that completed preworkshop 1 exercise was excluded from the mixed model due to very low variance – see Table 2.

Figures
Figure 1 – Interaction between *Time* and *Fidelity Enactment*

![Graph showing interaction between time and study arm]

**Figure 1**

Interaction between time and study arm

**Supplementary Files**

This is a list of supplementary files associated with this preprint. Click to download.

*STROBE_Checklist for INFORM fidelity paper.pdf*