Fidelity of implementation to a care team redesign and improved outcomes of diabetes care

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Abstract

Objective: We assessed fidelity of implementation (FOI) to the intended features of a primary care team redesign that integrated registered nurse care managers and patient health coaches onto existing care teams. The relation of FOI ranking and improvements in intermediate outcomes of diabetes care was examined.

Design: We assessed FOI by interviewing frontline primary care team members (n = 20). We explored the relation of FOI and outcomes of diabetes care (n = 10,206 patients) over a 3-year period (2010–12). Multilevel, multivariate regression estimated the relation of FOI and improvements in outcomes of diabetes care.

Setting: Five primary care practices in greater Los Angeles, CA, USA.

Participants: Ten thousand, two hundred and six adult patients with diabetes; 20 frontline primary care clinicians and staff.

Main Outcome Measure(s): Blood pressure, hemoglobin A1c (HbA1c) and low-density lipoprotein cholesterol (LDL-C) control among adult diabetic patients.

Results: All practices improved diabetic patients’ LDL-C control over time. In adjusted analyses, the practice with the highest FOI achieved the largest improvement in blood pressure and HbA1c control among diabetic patients. In contrast, the practice with the lowest FOI had the least improvements in blood pressure, HbA1c and LDL-C control. FOI was an inconsistent predictor of intermediate outcomes of diabetes care for other practices.

Conclusions: FOI assessment can be useful for identifying low FOI to a redesign so that technical assistance and resources can be provided to improve team functioning and patient outcomes. High FOI can enable greater improvements in patient outcomes in the context of primary care practice redesign.

Key words: fidelity of implementation, primary care teams, practice redesign, diabetes care, patient outcomes
Background
Interprofessional teams have the potential to improve patient outcomes compared with single physician care [1–6], facilitating their adoption in primary care settings [4, 7–9]. The integration of team-based primary care, however, is an intricate social change influenced by organizational, team and individual factors. To assess the implementation of complex practice changes, recent efforts have been made to better understand the fidelity of implementation (FOI), defined as the degree to which an intervention is successfully executed as intended [10, 11]. FOI assessment may be particularly important as primary care practices undertake major change, and interventions are often adapted to best fit practice culture and resources [12, 13]. Though flexibility is critical for organizational change efforts [14–17], there may be certain critical features of a care team redesign that must be adhered to in a manner that positively impacts patient outcomes [18]. Core components of organizational interventions are sometimes not implemented as intended when implementation guidance is too flexible [19].

Recently, Keith and colleagues [11] developed a methodology to measure both FOI to practice changes and the association between FOI and patient outcomes. Our study uses a similar approach to examine a primary care team redesign among 5 primary care practices selected from 33 practices from a large physician organization, comprised both the integrated medical group and independent practice associations. The five practices implementing the care team redesign serve over 10 000 diverse adult diabetic patients in greater Los Angeles, CA, USA. We study a practice redesign that intended to improve diabetes care outcomes and teamwork by incorporating two new team members into routine care at each of five practices—registered nurse care managers (NCMs) and patient health coaches (PHCs). NCMs ensured the continuity of patient care transitions by working in conjunction with the PCP, whereas the PHC’s responsibilities consisted of engaging in patient advocacy and diabetes self-management support. Senior leadership of the physician organization selected the five practices for implementing the care team approach, because these practices were perceived to represent a range of implementation readiness across the network. Practice site leaders and primary care teams from the five practices were provided the same redesign implementation guidance to integrate the new care team members and reorganize roles and responsibilities. They were given discretion and flexibility to integrate the redesign to best fit local practice stakeholder needs.

Few studies have assessed the effect of FOI on the clinical impacts of practice redesign in primary care settings [11, 20]. We assessed FOI to the intended features of the care team redesign and explored the relation of FOI rankings and improvements in intermediate outcomes of diabetes care. We posit that practices with high FOI will be able to achieve greater improvements on diabetes care outcomes compared with practices with low FOI.

Methods
Study design
To examine the redesign processes and changes on diabetes care outcomes, we use a convergent mixed-methods approach [21, 22] involving interviews and clinical care process and outcomes data. Primary care physician and staff key informant interview data were used to calculate FOI scores for each care team redesign feature for each of the five practices. We then compared site FOI rankings with 3-year changes in individual diabetic patient outcomes.

Data collection: qualitative
Key informant interviews of clinicians and staff were conducted in person at each of the five practices between July and August 2012, ~1 year after the redesign’s implementation. To elicit a range of responses, a random quota sampling approach was used to recruit one practice member per care team role at each site. We outreached to 34 individuals, of which 22 (response rate = 65%; 4–5 participants per practice) participated in an interview. The final participants included one care team member role per practice, including primary care physicians, NCMs, PHCs and medical assistants. Due to multiple volunteers with similar job titles, this study analyzed one unique individual per job title by practice, resulting in the review of 20 interviews. Each interview was conducted in person, recorded digitally with the verbal consent of each participant and later electronically transcribed. The interview guide was based on a review of patient-centered medical home (PCMH) implementation literature [17, 23], FOI research [11], team effectiveness research [1, 24] and unstructured interviews of organization’s leadership stakeholders.

Data collection: quantitative
To assess the effectiveness of the care team redesign, we used encounter-level data for patients enrolled within each of the five practices from the organization’s electronic health record. These data included information on patient gender, age, identified co-morbidities (including any diagnose codes related to heart disease, respiratory diseases and mental illnesses), body mass index (BMI), blood pressure (BP) outcomes, hemoglobin A1c (HbA1c) outcomes and LDL-C outcomes. Of 10 883 patients with a diabetes diagnosis (defined as any patient with a ICD-9 diagnosis code of or within 250.00–0.93, 357.2, 362.01–0.07, 366.10–0.19 and 648.00–0.04), we restricted the sample to 10 206 unique diabetic patients of at least 18 years of age and with at least two primary care physician encounters between 1 January 2010 and 31 December 2012. Since the care team redesign was implemented in 2011, using patient data from 2010 allowed for a baseline estimate of each site’s performance on the diabetes care outcome measures prior to the implementation of the care team redesign. The diabetes care outcome measures included HbA1c, BP and LDL-C control [25].

Data analysis: qualitative
The redesign aimed to integrate two new team members at each practice onto existing teams comprised primary care physicians, including internists and family practitioners, and medical assistants. These new roles included registered NCMs and PHCs. Assessment of the redesign was based on the following six general components and experiences as reported by clinicians and staff:

I. High integration of NCMs and PHCs as members of each of the practice’s care teams: As part of the team design, existing staff were made aware of the new team roles and their intended contributions. We examined the extent to which key informants considered NCMs and PHCs as members of their team.

II. Care teams have routine structured team meetings that include the NCM and PHC: A key feature of the care team redesign involved creating regularly scheduled, structured bimonthly or monthly meetings that incorporated the new team members and physicians to discuss complex care treatment plans of high-risk patients.

III. Specific actions are taken to improve awareness of NCM roles as part of the care of complex and chronically ill patients: The NCM’s primary role was designed to ensure the continuity
of care in both inpatient and outpatient settings by working in conjunction with the care team and PCP as a care team leader, facilitating in the follow up of high-risk patients, improving patient self-management, medication adherence, improving patient safety, and coordinating and overseeing treatment plans. Successful integration included existing care team members’ understanding of the responsibilities and the appropriate use of NCM and PHC team members.

IV. Clear communication and understanding of the distinctions of the PHC and NCM roles and their relationships to one another: The PHC’s role was designed to complement that of the NCM, by incorporating responsibilities that included assisting the care team in disease management of a target population, engaging in patient advocacy, empowering patients to take leadership in their health care, serving as an expert educator in selected chronic diseases, and providing and receiving ongoing follow-up information to relay back to the care team on patient progress. Analogous to integration of the NCM into routine practice, successful integration was identified by team members’ clear understanding of the PHC’s responsibilities.

V. Provision of care team communication trainings: Midway through the redesign, practices engaged in communication training workshops, which aimed to motivate teamwork and impart effective team collaboration techniques. This also served to identify and mitigate any potential communication barriers between already existing and new team members. We assessed their experiences and utility of the training.

VI. Strong leadership support and facilitation of the care team implementation: We assessed the extent to which local leadership supported teams and the transition of new team roles into routine practice by providing details of training documents, including scenario training, simulations and delineated duties and responsibilities for both roles.

A codebook was developed based on the key informant interview guide that directed the coding process, delineating coding practices to ensure consistency. Coding was compared for consistency between two researchers (H.P.R. and S.M.G.) during regular team meetings where discrepancies were identified and resolved. Using the analysis feature of Dedoose [26], each interview was first analyzed to examine patterns of care team implementation. We then examined the redesign FOI to redesign features. We examined the frequencies of both positive and negative assessments of each of the six redesign components for each key informant interview.

To translate the qualitative key informant interview results into FOI rankings, we analyzed each coded transcript by occupation and then by practice, where individuals were scored on a scale of 1–5 based on the extent to which each of the six core redesign components was addressed, ranging from ‘no compliance/lack of understanding of redesign among key informants/lack of perception of leadership’ to ‘committed/full understanding/excellent perception’ (Supplementary material). Following Keith et al. [11], an overall summary score was then calculated for each practice by averaging the individual respondent scores (Table 2). As one of the objectives of the analysis is to clarify the relationship of FOI to redesign effectiveness, we ranked the practice sites (from 1 to 5) based on their average FOI score to determine the level of FOI relative to other sites (Table 2).

Data analysis: quantitative
We stratified the patient data by practice site and used χ² and t-test statistics to compare differences in patient characteristics for categorical and continuous measures. To assess the relationship between FOI and the effectiveness of the care team redesign, we estimated three-level, mixed-effects, multilevel regression models (XTMIXED, STATA 11.2) for each of the continuous diabetes care outcome measures. Mixed-effects regression models accounted for the clustering of observations within individual respondents over time within practices using both patient and practice random effects. Following Keith et al. [11], each practice site’s FOI rank was used in the model as a dummy variable, where the site with the highest FOI ranking (rank = 1) served as the reference group. Each model included terms to capture the differences over time, the differences among the sites and the differences in changes over time among the sites. Patient-level covariates included patient gender, age, total number of office visits across all years and total number of clinical co-morbidities.

We generated a dummy variable to denote whether each patient’s values were in the ‘control’ range (coded as ‘0’) or ‘uncontrolled’ (coded as ‘1’) per current quality improvement definitions for US medical groups [27]. Control is defined as a HbA1c score of <9%, a systolic BP of <140 mmHg and a diastolic BP of <90 mmHg, and LDL-C of <100 mg/dl. For each outcome measure, we also examined the extent to which the redesign increased the likelihood of moving patients from ‘uncontrolled’ to ‘control’ (0, 1) using adjusted, mixed-effects, logistic regression analyses. The research study was approved by the UCLA Institutional Review Board (IRB no.11-002347 and IRB no. 13-000813).

Results
At baseline, the diabetic patient case mix varied considerably across the five practices. Patients differed in terms of gender (P < 0.001), age (P < 0.001), co-morbidities (range: 1.0–1.8, P-value < 0.001) and diabetes control (Table 1). Sites A, B and C had a significantly greater proportion of older adults than Sites D and E. The sites ranged in their total number of diabetic patients (range: 1148–3369). Across the sites, a majority of diabetic patients’ HbA1c scores (P-value < 0.001) and LDL-C levels (P-value < 0.001) were considered ‘uncontrolled’, whereas a smaller proportion of diabetic patients had ‘uncontrolled’ BP (P-value < 0.001).

Table 2 summarizes the FOI scores for each redesign component and the overall FOI score for each of the five practices. The Supplementary material presents a summary of the scoring of each key informant interview based on participants’ experiences and perceptions of each of the six core redesign components.

Relationship of FOI and patient outcome improvements
All practices improved patients’ LDL-C control over time (Table 3). In adjusted analyses, the practice with the highest FOI score (Site A) had greatest clinical improvement over time on three of the HEDIS measures, including BP and HbA1c. In contrast, the practice with the lowest FOI score (Site E) had the least improvements over time for three of the outcome measures—BP, HbA1c and LDL-C. Site E’s performance deteriorated significantly over time. However, all practices were able to improve BP control among diabetic patients over 3 years except for Site E (the lowest FOI).

Sites B and C (FOI ranking 2 and 3, respectively) had modest improvements that were statistically significant over time, though the changes were inconsistent with the practice’s relative FOI. Site D clinical improvements (FOI Rank 4) were fairly consistent with the relatively modest patient improvements. Overall, FOI only seems to be modestly correlated with patient outcome improvements. Site A (FOI Rank 1) often achieved the most improvement over time
compared with the lower FOI practice sites, though not always. Site E (FOI Rank 5), however, consistently had the least improvement.

Table 4 presents the proportion of patients with ‘control’ over time. All sites improved HbA1c control (range: –3.5 to –14%) and LDL-C control (range: –15 to –5%). Site A consistently achieved greater improvement than other practices.

Discussion
We found a modest relationship between FOI to a primary care team redesign and improved diabetic patient outcomes over 3 years. FOI rankings appeared to be consistent with change in diabetes care outcomes for practices with the highest (Site A) and lowest (Site E) FOI.
For example, Site E (FOI Rank 5) consistently had the least improvement over time, if any. Site A (FOI Rank 1) consistently improved on all clinical outcomes over time as expected, while also achieving the most patient improvement relative to the other practices on all but one clinical outcome (LDL-C). This may be due to the practice’s higher proportion of older diabetic patients and the difficulty in improving cholesterol management among complex patients [28, 29], though we did control for age and co-morbidity count in our adjusted analyses. Underlying patient characteristics may need to be considered along with FOI rankings when using FOI data to understand practice-level improvements stemming from implementation of team-based approaches.

### Table 3 Diabetes clinical performance measures, mean performance by practice site and year

<table>
<thead>
<tr>
<th>Measure</th>
<th>FOI ranking</th>
<th>Site</th>
<th>Year</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>2010</td>
<td>2011</td>
</tr>
<tr>
<td>Systolic blood pressure (mmHg)</td>
<td>1</td>
<td>A</td>
<td>137 (14.0)</td>
<td>136 (14.2)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>C</td>
<td>132 (13.1)</td>
<td>132 (13.7)</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>D</td>
<td>133 (13.2)</td>
<td>134 (12.9)</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>B</td>
<td>131 (13.5)</td>
<td>133 (13.9)</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>E</td>
<td>130 (13.2)</td>
<td>130 (14.0)</td>
</tr>
<tr>
<td>Diastolic blood pressure (mmHg)</td>
<td>1</td>
<td>A</td>
<td>76 (8.6)</td>
<td>76 (8.5)</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>B</td>
<td>77 (8.4)</td>
<td>77 (8.4)</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>D</td>
<td>76 (8.3)</td>
<td>76 (8.3)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>C</td>
<td>75 (8.1)</td>
<td>75 (7.9)</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>E</td>
<td>77 (8.2)</td>
<td>77 (8.6)</td>
</tr>
<tr>
<td>Glycosylated hemoglobin (HbA1c)</td>
<td>1</td>
<td>A</td>
<td>7.1 (1.5)</td>
<td>7.0 (1.5)</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>D</td>
<td>6.8 (1.4)</td>
<td>6.8 (1.4)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>C</td>
<td>6.8 (1.4)</td>
<td>6.8 (1.4)</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>E</td>
<td>6.5 (1.5)</td>
<td>6.5 (1.6)</td>
</tr>
<tr>
<td>LDL-C</td>
<td>2</td>
<td>B</td>
<td>101.3 (31.6)</td>
<td>97.5 (30.7)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>C</td>
<td>101.0 (29.8)</td>
<td>97.2 (31.1)</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>D</td>
<td>98.3 (30.4)</td>
<td>94.9 (30.2)</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>A</td>
<td>99.2 (30.7)</td>
<td>96.6 (30.6)</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>E</td>
<td>101.3 (33.8)</td>
<td>100.1 (33.4)</td>
</tr>
</tbody>
</table>

Site A served as reference group for all reporting years, because it had the highest overall FOI rank (1).

**P-value < 0.05 compared with Site A.

### Table 4 Proportions of uncontrolled diabetic patients by year and practice site

<table>
<thead>
<tr>
<th>Measure</th>
<th>FOI ranking</th>
<th>Site</th>
<th>Year</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>2010</td>
<td>2011</td>
</tr>
<tr>
<td>Blood pressure (&gt;140/90 mmHg)</td>
<td>2</td>
<td>B</td>
<td>36%</td>
<td>29%</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>A</td>
<td>28%</td>
<td>24%</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>D</td>
<td>28%</td>
<td>26%</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>C</td>
<td>21%</td>
<td>19%</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>E</td>
<td>23%</td>
<td>22%</td>
</tr>
<tr>
<td>Glycosylated hemoglobin (HbA1c)</td>
<td>5</td>
<td>E</td>
<td>47%</td>
<td>35%</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>A</td>
<td>53%</td>
<td>45%</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>C</td>
<td>52%</td>
<td>42%</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>B</td>
<td>50%</td>
<td>43%</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>D</td>
<td>50%</td>
<td>42%</td>
</tr>
<tr>
<td>LDL-C (&gt;100 mg/dl)</td>
<td>3</td>
<td>C</td>
<td>59%</td>
<td>51%</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>E</td>
<td>61%</td>
<td>59%</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>A</td>
<td>57%</td>
<td>53%</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>D</td>
<td>60%</td>
<td>56%</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>B</td>
<td>75%</td>
<td>72%</td>
</tr>
</tbody>
</table>

Site A served as reference group for all reporting years since it had the highest FOI rank (1).

**P-value < 0.001.

**P-value < 0.01.

*P-value < 0.05.

For example, Site E (FOI Rank 5) consistently had the least improvement over time, if any. Site A (FOI Rank 1) consistently improved on all clinical outcomes over time as expected, while also achieving the most patient improvement relative to the other practices on all but one clinical outcome (LDL-C). This may be due to the practice’s higher proportion of older diabetic patients and the difficulty in improving cholesterol management among complex patients [28, 29], though we did control for age and co-morbidity count in our adjusted analyses. Underlying patient characteristics may need to be considered along with FOI rankings when using FOI data to understand practice-level improvements stemming from implementation of team-based approaches.
Keith and colleagues found FOI rankings of four practice sites to be more strongly related to patient outcomes [11] compared with our study of primary care practices serving diverse and clinically complex patients. Given each practice had latitude to integrate the care team redesign to best fit local needs, it is not surprising that the impacts of the team-based redesign had variable impacts on diabetic patient outcomes. FOI rankings seem to be able to predict implementation effectiveness only in the most extreme (highest and lowest FOI) cases. Similarly, the modest impact of FOI on the proportion of uncontrolled diabetic patients over time (Table 4) may suggest that the practice redesign benefited the most extreme patients to return within ‘controlled’ ranges of the diabetes care outcome measures, but it had a less measurable impact on mean outcomes in the patient population studied. Though the improvements in the proportion of controlled diabetic patients may appear to be small, it is worthy that high-risk patients benefited the most and that these patients were targeted by care team members for management.

FOI assessment enables frontline primary care practice members to voice their perceived barriers and facilitators of successfully undergoing complex practice changes, which has value for fostering organizational change. Future research should examine FOI to core features of primary care redesigns in broader sets of primary care practices across multiple networks to clarify how FOI impacts improvement across a range of outcome indicators.

Our results should be viewed in light of important limitations. First, the key informant interviews were semi-structured, so while each redesign feature was assessed for each informant, the depth of detail differed across interviews. Each interview transcript was coded and thoroughly analyzed, however, to improve qualitative interpretation of responses to questions posed to all informants. Second, the interview respondents’ experiences may not represent the full range of perspectives of clinicians and staff within each practice site. Respondents were randomly recruited by role, however, to reduce potential biases of interviewing volunteers. Socio-economic status and patient race and ethnicity data were incomplete and could not be used in the analyses. These patient-level factors may be correlated with patient outcomes [30] and could also influence FOI by care team members. Finally, the time frame may have been insufficient to capture the gains of transitioning patients from ‘uncontrolled’ to ‘controlled’.

The improvements are an encouraging support of the positive impacts of FOI to core features of primary care team redesign.

Conclusion

Redesigning primary care teams to support patient-centered primary care while simultaneously improving patient outcomes is central to implementing team-based primary care. Integrating new team members is a complex social and technical change that is inhibited and promoted by many factors, including FOI. We followed Keith et al.’s approach to FOI assessment and demonstrated that FOI measures can be used to assess how well a primary care team redesign is implemented and identify the facilitators and barriers to implementing team-based primary care approaches. Importantly, our analyses reveal that underlying patient complexity may influence expected relationships of FOI and outcomes improvement.

Our results suggest that FOI assessment may be most useful for predicting outcomes of a practice redesign in the most extreme cases, i.e. highest vs. lowest FOI. As interview-based approaches to FOI assessment are time and resource intensive, more research is needed to better understand the utility of FOI for predicting the performance of more than just the extreme implementers, i.e. highest vs. lowest FOI. FOI assessment may also be a promising method for identifying practices with low FOI so that technical assistance can be targeted to improve the impact of primary care team redesign efforts on outcomes of chronic illness care. Similarly, FOI assessment can aid in the identification of adaptations that aid primary care practice stakeholders in integrating new care team member roles and responsibilities to improve outcomes of chronic care.

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Supplementary material

Supplementary material is available at INTQHC online.

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