# Association of Organizational Culture and Climate With Variation in the Clinical Outcomes of Collaborative Care for Maternal Depression in Community Health Centers

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Research

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# Abstract

Background

Organizational culture and climate may help explain variation in the effectiveness of evidence-based practices implemented in primary care settings; however, this hypothesis has not been well tested. This study tested the relationship between organizational culture and climate and variation in clinical outcomes of the evidence-based collaborative care model (CoCM) for maternal depression implemented in primary care health centers serving low income populations.

Methods

Organizational cultures and climates of ten community health centers providing collaborative care for depression among women in pregnancy and parenting were assessed using the Organizational Social Context (OSC) measure. Three-level hierarchical linear models tested whether variation in culture and climate predicted variation in improvement in depression symptoms from baseline to 6.5 months post-baseline for N=468 women who initiated care in the year before and after the OSC assessment. Depression symptomology was measured using the Patient Health Questionnaire (PHQ-9).

Results

After controlling for patient characteristics, case mix, center size, and implementation support, patients served by health centers with more proficient cultures improved significantly more from baseline to 6.5 months post-baseline than patients served by centers with less proficient cultures (mean improvement = 5.08 vs. 0.14, respectively, $P<.05$), resulting in a large adjusted effect size of $d_{adj} = 0.78$. A similar effect was observed for patients served by centers with more functional climates (mean improvement = 5.25 vs. 1.12, $P<.05$, $d_{adj} = 0.65$). Growth models indicated that, on average, patients served by centers with more proficient cultures recovered after four months of care and remained stabilized below the clinical cutoff at 6.5 months post-baseline, whereas patients served by centers with less proficient cultures improved after four months but then deteriorated to above the clinical cutoff by 6.5 months post-baseline ($P<0.05$). A similar pattern was observed for functional climate.

Conclusions

Variation in clinical outcomes for women from vulnerable populations receiving collaborative care for maternal depression was associated with the organizational cultures and climates of primary care health centers. Implementation strategies that target proficient culture and functional climate may improve the implementation and effectiveness of integrated behavioral health care for depression by reducing this variation.


# Contributions To The Literature

- Many implementation frameworks and theories espouse the importance of organizational culture and climate for influencing the implementation and effectiveness of evidence-based practices in primary care settings; however, empirical studies that test this hypothesis using clinical outcomes as an endpoint are rare.
- This study showed that the extent to which patients benefitted from the evidence-based collaborative care model for depression was related to the prevailing culture and climate of community health centers where they received treatment independent of other factors known to be associated with these outcomes.
- Implementation strategies that target organizational culture (i.e., priorities and expectations for staff) and climate (i.e., quality of working environment) may improve the clinical outcomes of integrated collaborative care models for depression and reduce observed variation in outcomes across these clinics.

# Background

Globally, depression is the greatest cause of disabled years lived and accounts for more than 200 billion USD in annual costs in the US from treatment and lost productivity.[1,2] Maternal depression, including mood disorders occurring in pregnancy and parenting, affects approximately 9-15% of low income and racial/ethnic minority women during the perinatal period and as many as 25% throughout childrearing in the US.[3–5] It is the leading cause of health burden among women of reproductive age from high, middle, and low-income countries.[1,6] This impact is compounded by the myriad negative effects that depression has on infants and families.[7–9] The majority of depression care in the US is delivered in primary care settings, which have been called the “de facto US mental health system.”[10] This is particularly true for low-income patients, who face access barriers to specialty mental health care.[11,12]

The collaborative care model (CoCM) for mental disorders is a complex intervention composed of a multi-disciplinary team with significant clinical benefit and cost-effectiveness for the treatment of adult depression in primary[13–16] and perinatal care.[17,18] This model has been identified as critical to improving the mental health of the US population by the Centers for Medicare & Medicaid Services which have promulgated billing codes for public insurance to support CoCM implementation.[19] Key *care processes* of CoCM include: 1) a dedicated *care manager* on staff at the health center, 2) evidence-based *systematic case finding* using validated tools, 3) a *patient registry* to support patient management, 4) escalation of treatment intensity using a *stepped-care* approach with *evidence-based treatments* (pharmacologic and psychosocial), 5) regular *case review* of patients’ progress by a psychiatric consultant, and 6) review of care quality metrics to identify areas to target in improvement efforts.[14] These processes are supported by appropriate health information technology infrastructure.[20,21] Despite the high level of evidence for the effectiveness of CoCM, it has not been widely implemented.[14,22,23] Moreover, the success of CoCM implementation and sustainment for general adult populations, measured by fidelity and clinical patient benefit, is highly variable.[24,25] The identification of tools and strategies which can increase the rate of

effective implementation of this evidence-based model for depression in primary care settings has high potential to improve population behavioral health.

Organizational culture and climate have been proposed to influence the effective implementation and clinical outcomes of complex clinical interventions within agencies providing mental health services[26,27] including primary care health centers.[28] Glisson and colleagues define organizational culture as the shared expectations and behavioral norms that guide and direct providers' care-related behaviors within the organization, including the level of expectation that providers will: (a) prioritize responsiveness to patients' needs over competing organizational goals (e.g. optimization of billable units) and maintain competence in up-to-date treatment models (referred to as proficient culture), (b) maintain the status quo and resist new ways of working (referred to as resistant culture), and (c) adhere to centralized decision-making (referred to as rigid culture).[29] This model defines organizational climate as providers' shared perceptions of the impact of the work environment on their personal well-being, including: the extent to which providers understand their role in the organization and receive the cooperation and support they need from colleagues and supervisors to perform their job well (functional climate), the extent to which providers are able to remain personally invested in their work (engaged climate), and the extent to which providers experience role conflict and role overload (stressful climate). Prior research has linked these dimensions of culture and climate to service outcomes in social service agencies[30,31] and has shown that interventions targeting these dimensions are associated with improved social service outcomes.[32,33] Furthermore, studies in specialty mental health settings have shown that therapists' use of evidence-based psychotherapy techniques is higher in clinics with more proficient cultures and more functional climates[34,35] and that these dimensions of culture and climate are related to practitioners' level of fidelity to evidence-based practice models in schools.[36] This stream of research compliments a growing number of empirical studies linking variation in organizational culture and climate to variation in implementation outcomes, such as adoption of evidence-based practices and fidelity to evidence-based practice models.[37–40]

Despite the growing number of studies linking variation in organizational culture and climate to variation in implementation outcomes, a recent systematic review found few or no studies have tested whether variation in organizational culture and climate explain variation in the clinical outcomes of evidence-based practices implemented in primary care settings.[37] This is an important knowledge gap given the centrality of clinical outcomes to the goals of implementation science.[41] Assessing the clinical importance of culture and climate as constructs related to care improvement and their independence from other factors influencing implementation and outcomes is needed to guide further work in this area. Given evidence that culture and climate vary across primary care health centers which serve vulnerable populations, we wished to test whether this variation could help explain variation in patient clinical outcomes of the evidence-based CoCM for perinatal depression.[28] We hypothesized that patients served by centers with more proficient cultures and more functional climates would experience superior clinical outcomes of CoCM. Evidence for this hypothesis would support organization-level strategies for the

implementation and sustainment of complex, team-based interventions for common mental disorders and other chronic illnesses.

# Methods

## Study Setting

This study made use of clinical and survey data collected from July 2013 to July 2015 in the course of routine care of women participating in the High Risk Mothers program, a part of the Mental Health Integration Program of Washington State in the US. Funded by the State of Washington and King County and administered by the Community Health Plan of Washington State, this program provides behavioral health services for women in pregnancy and with children in thirteen community health centers (Federally Qualified Health Centers and Look-Alikes), in King County. Details of the program are described elsewhere but briefly, women in pregnancy or with children who are identified in participating health centers with elevated depression symptomatology are offered the team-based CoCM model.[42,43] The interdisciplinary team caring for the patient consists of the primary care provider, a care manager, and a psychiatric consultant. In accordance with the CoCM model and quality metrics for depression care, treatment typically lasts 6 to 8 months and occurs in phases.[44,45] During the initial diagnosis and treatment decision phase, interventions are selected and implemented based on the clinical assessment. During the acute care phase, treatment trials of different therapeutic modalities (non-pharmacologic and pharmacologic), treatment doses, and pharmacologic agents are applied until a significant improvement is seen. Response to treatment is monitored by assessing depression symptoms at intake and at every subsequent contact in order to guide care.

Clinical data used in this study (i.e., depression symptomology as described below) was collected via an internet-based electronic care management software system designed to support the delivery of CoCM.[20] This system is utilized by care managers and data from the system have been used to evaluate outcomes in several previous studies of CoCM.[42,43,46,47] The present study was reviewed and approved by the Institutional Review Board of the University of Washington.

## Independent and Dependent Variables

*Organizational culture and climate.* The organizational culture and climate of participating health centers were assessed using the 105-item Organizational Social Context (OSC) measure.[29] The reliability, factor validity, criterion-related validity, and predictive validity of the OSC have been supported in numerous studies including two national studies in specialty mental health and child welfare settings, respectively, as well as randomized controlled trials.[29–32,48–53]

Organizational culture is defined by the OSC as the norms and expectations that govern the way work is done in an organization and is assessed along three dimensions of proficiency, rigidity, and resistance.[29,30] Proficient organizational cultures are characterized by norms and expectations that

clinicians will be responsive to client needs and maintain competence in up-to-date treatment practices. Rigid cultures are characterized by norms and expectations that clinicians will have limited flexibility and discretion in carrying out work tasks, minimal input into important management decisions, and high compliance with rules and regulations. Resistant cultures expect clinicians to maintain the status quo.

Organizational climate is defined by the OSC as clinicians' shared perceptions of the impact of the work environment on their personal well-being and is assessed along three dimensions of engagement, functionality, and stress.[29,30] Clinicians in engaged climates perceive they are able to sustain personal concern for their clients and accomplish many personally meaningful goals in their work. Clinicians in functional climates perceive they receive the support and cooperation they need from colleagues to effectively do their job and have a clear understanding of their role and how it fits into the organization. Clinicians in stressful climates perceive they are overloaded in their work role and pulled in conflicting directions (role conflict). Alpha reliabilities for the six OSC dimensions in the present sample were as follows: proficiency ($\alpha = 0.90$), rigidity ($\alpha = 0.68$), resistance ($\alpha = 0.77$), engagement ($\alpha = 0.80$), functionality ($\alpha = 0.92$), and stress ($\alpha = 0.92$).

The OSC conceptualizes culture and climate as the shared perceptions of treatment team members; consequently, the perceptions of individuals who are directly involved in delivering care are the most informative for understanding how culture and climate influence treatment delivery. Thus, individual OSC surveys were administered to members of the clinical teams involved with the High Risk moms program at each participating health center. In order to ensure candid responses to the surveys, supervisors were not present when care team members completed surveys. Responses were collected by study staff who were not known to care team members personally and surveys were placed in sealed envelopes before leaving the survey locations.

In accordance with best practices, care team members' individual responses to the OSC were aggregated (i.e., averaged) to the health center level in order to measure health center culture and climate.[54–56] Aggregation is guided by the use of composition models which describe how items must be worded in order to justify aggregation and establish empirical criteria for evaluating the construct validity of aggregated variables.[56] Aggregation of individual scores to the center-level is justified when there is a high level of inter-rater agreement on each culture/climate dimension within each health center. We evaluated inter-rater agreement using the $r_{wg(j)}$ index which ranges from 0 to 1 (higher values indicate greater agreement).[57] A cutoff of 0.7 on the $r_{wg(j)}$ index is recommended to support aggregation of individual culture/climate scores to the unit level.[58,59] Examination of the $r_{wg(j)}$ values for all 10 health centers in the sample on all six OSC dimensions indicated no values fell below $r_{wg(j)} = 0.91$. This provided a high level of support for clinicians' agreement on their perceptions of culture and climate within each center. Aggregate raw scores were converted to T scores based on a national sample of 100 mental health centers with a $\mu = 50$ and $\sigma = 10$.[29]

*Depression symptom level*. Patients' depression symptom level at intake and at each subsequent contact was assessed during usual clinical care using the Patient Health Questionnaire-9 (PHQ-9), a widely used instrument that is valid for use in pregnancy as well as a wide range of adult populations for screening and monitoring depression symptom change over time.[60–62] Total scores are calculated by summing the 9 items. Using standard conventions, we made use of the cut score of 10 or above to identify women with likely depression and with moderate to severe symptom levels.[61]

## Control Variables

Because of known associations with the primary independent and dependent variables, and in order to adjust models for differences across health centers,[63,64] we included the following variables as covariates in all analyses: center size (number of patients served), patient ethnicity (Latina vs. not Latina), patient race (Black/African American vs. not Black/African American), patient age at enrollment into care, and patient history of prior psychiatric treatment as reported by the patient (yes/no).[43] Because level of implementation support is associated with variation in patient outcomes at the site level among the clinics we included type of implementation support (i.e., Basic vs. Enhanced) as a control variable. While this is described in detail elsewhere, briefly *Basic support* included in person team training and access to implementation tools while *Enhanced support* added prolonged external practice facilitation.[24]

## Statistical Analysis

As a preliminary analysis, we tested whether there was variation in rates of clinically significant improvement in PHQ-9 scores from baseline to 6.5 months post-baseline across health centers. This time period corresponds to standard quality metrics for depression care.[44] Clinically significant improvement was defined using the Jacobson and Truax reliable and clinically significant change criterion c which has performed well in other research.[65] According to this criterion, patients were deemed to have achieved clinically significant improvement if their PHQ-9 Total Score improved by 6.76 points or more from baseline to their last follow-up and if their final follow-up score was below the clinical cutoff of 10. Analysis of variance (ANOVA) tested whether health centers differed on the mean proportion of patients who achieved clinically significant improvement based on this criterion.

The relationships between health center culture and climate and growth in patients' depression symptoms from baseline to 6.5 months post-baseline were tested using three-level hierarchical linear models (HLM).[63,66] Hierarchical linear models are ideal for longitudinal data that are clustered within health centers because they make use of all available measurements, generate unbiased parameter estimates when unobserved values are missing at random, adjust standard errors for nesting at both the patient and health center levels, and do not require uniform spacing of observations across patients.[67] In the analyses, patients' PHQ-9 Total Score at intake and at each subsequent observation point was modeled as a function of growth parameters (time and time-squared) at level 1, patient characteristics at level 2, and health center characteristics (including culture or climate) at level 3. Models incorporated random effects at the patient and health center levels to account for the nesting of time within patient

and patient within health center. All patient and center covariates were grand mean centered to facilitate model interpretation and to adjust for differences across health centers in case mix.[64] There were no missing data on health center characteristics or patient covariates included in the models. Models were estimated via maximum likelihood estimation in HLM 8 software.[68] The models estimate the unique effect of each of the six dimensions of culture and climate on growth in patients' symptom scores for depression from baseline to 6.5 months post-baseline, over and above the effects of patient-level characteristics (i.e., patients' ethnicity, race, age at entry, and prior history of treatment), variation in patient characteristics across sites (i.e., case mix), center size, and type of implementation support.[63]

Separate models were estimated for each of the six dimensions of culture and climate in order to identify which dimensions were most closely associated with variation in clinical outcomes. The Benjamini-Hochberg false discovery procedure was used to control for multiple comparisons.[69] Concerns regarding multicollinearity prohibited estimation of a single model with multiple dimensions of culture and climate included simultaneously;[70] the average correlation among the culture and climate dimensions was $r$ = 0.70 in this sample. As a sensitivity analysis, we tested the effects of each culture/climate dimension on growth in patients' depression symptoms with and without control variables and the results were substantively similar; consequently, only analyses with control variables are presented.

Preliminary analyses confirmed there was significant clustering of PHQ-9 depression scores at the health center level (ICC(1) = 0.09, $p < 0.001$) and patient level (ICC(1) = 0.36, $p < 0.001$) and that growth in depression symptoms was best represented by a quadratic growth model at level 1 rather than by a linear growth model ($\chi^2 = 155.29$, df = 1, $p < 0.001$). In quadratic growth models, change in symptoms is described by two parameters (1) the instantaneous growth rate (represented by the time parameter), which differs at each time point and indicates the direction and magnitude of change at that time (e.g., at baseline), and (2) the rate of acceleration (represented by the time-squared parameter), which remains constant across all time points and indicates the magnitude and direction of change *in the rate of change* across the entire study period. Significant associations between culture/climate and the rate of acceleration indicate that culture/climate explains variation in patients' overall change in depression from baseline to the study endpoint (6.5 months post-baseline). Significant associations between culture/climate and the instantaneous rate of change at a specific time point provide insight into when culture/climate begin to differentially influence depression outcomes (e.g., at 4 months post-baseline).

To facilitate interpretation of the model results, effect sizes were calculated representing the standardized mean difference in PHQ-9 Total Scores at 6.5-month post-baseline between patients served by health centers with high values of the culture/climate dimension (i.e., average of the upper quartile) versus patients served by health centers with low values of the culture/climate dimension (i.e., average of the lower quartile).[71] The standardized mean difference is reported as a Cohen's d[72] which is commonly interpreted as small (d=0.2), medium (d=0.5) and large (d=0.8). In addition, we calculated an adjusted Cohen's $d$, $d_{adj}$,[73] which represents the standardized mean difference between the groups in their *change* in PHQ-9 Total Score from baseline to 6.5 months post-baseline.

# Results

OSC surveys were collected from 13 FQHCs from June 2014 to September 2014. Survey results from clinical teams at 10 FQHCs were included in the analyses because three teams did not have clinical outcome information during the study period. There were no differences in care team member characteristics between FQHCs included in the analyses versus those excluded ($p > 0.05$). Furthermore, there were no differences in care team member characteristics among the 10 clinics included in the study sample ($p > 0.05$). Table 1 presents characteristics of the FQHCs and care team members who were included in the study. Across FQHCs, the average number of care team members who responded to the OSC was 5.4 (range 3 to 9). Culture and climate scores for participating primary care health centers were consistent with national validation studies (see Table 2).

Change in depression symptoms, measured using the PHQ-9 total score, was assessed for 468 women in pregnancy or with children enrolled in the High Risk mothers' program in participating FQHCs from July 2013 to July 2015 (a year prior to administration of the OSC to one year after). Within the study period, a total of $N = 675$ women had one or more episodes of care for depression at a participating FQHC. Of these, $n = 207$ were excluded from analyses because their intake PHQ-9 score for the episode was less than the cut score of 10, resulting in a total sample of $N = 468$ women with $N = 1{,}455$ PHQ-9 observations (average $N$ of observations per participant = 3.1, $SD = 2.4$). The average number of patients included in the analyses per health center was n = 46.8 ($SD = 37.6$). As is shown in Table 1, the sample was comprised of women (mean age = 33 years) of diverse race/ethnicity. The mean and range of initial depression symptomatology level (mean = 16.2, SD = 4.69; range = 10-27), included patients in the moderate (PHQ-9 score of 15-19) and severe (20-27) range; a high percentage of women reported suicidal ideation (28.2%). There were significant differences among the 10 participating health centers on patients' mean age at baseline, proportion of patients of Latina ethnicity, proportion of patients of Black/African American race, and proportion of patients with a history of prior treatment ($P<.05$); all of these were included as control variables in the analyses to adjust for differences in case mix.

### Variation in Clinical Outcomes across Health Centers

On average, 42% of patients achieved clinically significant improvement in their PHQ-9 Total Score from baseline to their last follow-up based on the clinically significant improvement criterion described above. There was significant variation across health centers in their rates of clinically significant improvement, $F=2.39$, df = 9, 313, $p=0.012$, with a range of 17% to 57% of patients improved at each health center.

### Association of Health Center Culture and Climate with Improvement in Depression

Results of the hierarchical linear models testing the relationships between each dimension of culture/climate and growth in mothers' depression symptoms, adjusted for center characteristics, type of implementation support, and patient characteristics, indicated that two dimensions of culture/climate were related to significantly greater improvement in depression symptoms from baseline to the end of the 6.5-month period (see Table 3). Patients served by FQHCs with more proficient cultures improved

significantly more from baseline to 6.5 months post-baseline than patients served by FQHCs with less proficient cultures ($B$ = -0.01, $SE$ = 0.00, $p$ = 0.020), resulting in a large effect size of $d$ = 0.95 (95% CI = 0.28 to 1.62) when comparing patients served by centers with highly proficient cultures (average of upper quartile) versus centers with less proficient cultures (average of lower quartile) at 6.5 months (see Figure 1). On average, patients served by health centers with highly proficient cultures improved by 5.08 points from baseline to 6.5 months post-baseline, compared to an average improvement of 0.14 points for patients served by centers with less proficient cultures. This represents a large difference in change scores of $d_{adj}$ = 0.78. (95% CI = 0.10 to 1.45).

Figure 1 shows the covariate-adjusted mean PHQ-9 Total Scores from baseline to 6.5 months post-baseline for patients served by centers with high versus low proficiency cultures. As is shown in the figure, on average, patients served by centers with highly proficient cultures recovered after four months (i.e., PHQ-9 Total Score < 10) and remained stabilized below the clinical cutoff of 10 at 6.5 months post-baseline ($M$ = 9.71); however, patients served by centers with less proficient cultures improved after four months but then deteriorated to well above the clinical cutoff by 6.5 months post-baseline ($M$ = 15.74). The instantaneous rate of change coefficients ($B_1$) in Table 3 show exactly *when* outcomes began to diverge for patients served by clinics with more and less proficient cultures. Specifically, at 4 months post-baseline, patients served by clinics with *less* proficient cultures began *deteriorating* significantly faster than patients served by clinics with more proficient cultures ($B$ = -0.04, $SE$ = 0.02, $p$ = 0.041)—a trend that continued to the end of the study and resulted in the large difference in outcomes.

Patients served by FQHCs with more functional climates also improved significantly more from baseline to 6.5 months post-baseline than patients served by FQHCs with less functional climates ($b$ = -0.01, $SE$ = 0.00, $p$ = 0.044), resulting in a large effect size of $d$ = 0.81 (95% CI = 0.32 to 1.31) when comparing patients served by centers with low versus high functionality climates at 6.5 months post-baseline (see Figure 1). As is shown in Figure 1, after adjusting for covariates, patients served by centers with high functionality climates improved by 5.25 points on average compared to an improvement of 1.12 points among patients served by centers with low functionality climates. This resulted in a medium difference in change scores of $d_{adj}$= 0.65 (95% CI = 0.16 to 1.15) at 6.5 months post-baseline. Similar to the results for proficient culture, patients served by centers with both high and low functionality climates improved on average from baseline to ~4 months post-baseline; however, at 4 months post-baseline patients served by centers with less functional climates began experiencing significantly greater deterioration in depression symptoms compared to patients served by centers with more functional climates ($B$ = -0.03, $SE$ = 0.01, $p$ = 0.037). By 6.5 months post-baseline, patients served by centers with highly functional climates remained below the clinical cutoff ($M$ = 9.56) whereas patients served by centers with less functional climates were well above the clinical cutoff ($M$ = 14.74). Both the effects of proficient culture and functional climate remained statistically significant after adjusting for multiple comparisons using the Benjamini-Hochberg procedure with a false discovery rate of 0.15.

# Discussion

In this study of clinical outcomes for economically vulnerable patients with maternal depression treated by the evidence-based CoCM in 10 primary care health centers, we found that depression outcomes varied significantly by center. An assessment of health center culture and climate was associate with this variation in patients' improvement in clinical depression from baseline to 6.5 months post-baseline independent of other factors known to be associated with this variation including level of implementation support.[25] Specifically, at 6.5-months post-baseline, patients who received the CoCM in primary care health centers with highly proficient cultures improved in their depression symptoms on average by 5.08 points compared to an average improvement of only 0.14 points among patients served by centers with less proficient cultures. This resulted in a large adjusted effect size of $d = 0.78$. Patients served by centers with more functional climates also exhibited greater improvement in their depression symptoms at 6.5 months post-baseline, resulting in a medium adjusted effect size of $d = 0.65$ when compared to patients served by centers with less functional climates. These results support the hypothesis that organizational culture and climate independently contribute to variation in the clinical outcomes of CoCM for depression as implemented in primary care health centers. These findings offer some of the first evidence linking organizational culture and climate to variation in the clinical outcomes of evidence-based practices implemented in primary care. Given the prominence of culture and climate within implementation frameworks, these findings represent an important advance for implementation theory and practice.

Importantly, patients served by centers with more proficient cultures and more functional climates only began exhibiting superior clinical outcomes at four months post-baseline. Prior to four months, patients in all centers improved, on average, to depression levels below the clinical cutoff; however, beginning at four months post-baseline, patients served by centers with less proficient cultures and less functional climates began to worsen significantly even as their peers continued to improve or worsened at a significantly slower rate. This resulted in a large difference in depression outcomes at 6.5 months post-baseline: patients in centers with more proficient cultures and more functional climates remained at or below the clinical cutoff, whereas their peers in centers with less proficient cultures and less functional climates were well above the clinical cutoff and thus had worse depression outcomes. The medium to large effect sizes observed in this study provide exciting evidence suggesting that culture and climate plays a role in shaping not only the implementation but also the clinical effectiveness of evidence-based practices implemented in routine care settings. Further work is needed to identify the mechanism for this difference but CoCM relies on systematic proactive and sustained follow up of patients to ensure sustained improvement and it is plausible that this varies by health center culture and climate.

Studies have posited that organizational culture and climate influence practice change and the implementation of effective interventions in health care; however, little previous work has tested the association of organizational culture and climate with variation in the clinical outcomes of evidence-based practices implemented in primary care. In one study of six FQHCs similar to those included in the current research, qualitative assessments supported the construct validity of the culture and climate dimensions assessed by the OSC and also showed that health centers varied in their cultures and climates.[28] A high level of variation in clinical outcomes across sites that implement CoCM has been

found.[25] We have extended this work by showing that two OSC dimensions (proficient culture and functional climate) are associated with variation in clinical outcomes of patients independent of other factors known to be associated with this variation. .

Most studies of variation in clinical outcomes of CoCM have focused on patient-level characteristics or policy interventions to incentivize care delivery as predictors.[42,43] The health centers included in our study varied in the rates of clinically significant patient improvement by approximately three fold, from 17% to 57%, showing the need to look at health center-level factors influencing outcomes for this complex intervention for chronic disease. Given the difficulty of implementing CoCM, including creating new clinical relationships and workflows across distinct providers and staff, it is not surprising that patient improvement was associated with health center-level measures of culture and climate even after adjusting for a range of patient and health center characteristics including case mix. A high level of organizational support is needed to carry out the practice changes required to implement and sustain CoCM.

The identification of an association between proficient culture and variation in the clinical outcomes of CoCM for depression is consistent with preliminary research showing that proficient culture explains variation in implementation outcomes such as evidence-based practice adoption across community healthcare organizations.[34] This finding is also consistent with the substantive focus of proficient culture which addresses the extent to which treatment providers perceive they are expected to prioritize patient well-being and maintain competence in effective treatment models above competing organizational priorities. Such norms and expectations likely prompt, support, and reinforce care team members for embracing new evidence-based practices such as CoCM, developing expertise in their use, and applying them in a responsive manner that contributes to patient well-being. Relatedly, clinicians in functional climates perceive that they receive the support and cooperation they need from colleagues to effectively do their job and have a clear understanding of their role and how it fits into the organization's larger mission. Proficient culture and functional climate are also most closely related to implementation outcomes for evidence-based practices in other settings.[36,38]

Results from this study suggest that the implementation of evidence-based practices such as CoCM for depression may be improved by implementation strategies that generate proficient cultures and functional climates. Glisson and colleagues have shown that proficient cultures and functional climates can be generated in social service and specialty mental health organizations through organizational interventions that engage treatment staff in collaborative monitoring of quality and outcomes to identify and remove service barriers.[32,52,53,74] However, there are likely many strategies that can contribute to proficient cultures and functional climates within health care organizations and research is needed to develop and test implementation strategies that act on these targets.[75]

While the current study supports the linkage between health center culture and climate and variation in patient outcomes of CoCM, there are a number of limitations. First, this is an observational study that does not provide a basis for causal inference. Clinical outcomes of CoCM are undoubtedly influenced by

many factors and it was not possible to control for all of these variables in the present study. Additional research that replicates these findings and rules out alternative confounds—perhaps by including organizational culture and climate as a treatment moderator in an implementation-effectiveness trial of CoCM for depression—is needed. In addition, the OSC measure was assessed at one time in the middle of the study period which raises issues related to temporality. Although the measurement of culture/climate did not precede all measurements of patients' clinical outcomes in time, there is evidence that culture and climate can be stable in the absence of intervention; consequently, we believe an argument can be made that the cultures and climates of these clinics were in place prior to the actual measurement period and remained in place during the months following measurement. Furthermore, the use of a single measurement may actually increase the robustness of the results as remote measurement of culture/climate relative to clinical outcomes should reduce (not increase) the likelihood of statistically significant relations between these variables. Further, while the results of this study must be limited to the patient population and health centers included in the sample, we believe these findings are likely to generalize to patients with common mental disorders and other chronic diseases. The evidence-based principles of effective chronic care of diseases are reflected in the CoCM and likely apply to other disorders. Finally, the study included a small health center sample (N=10) and a relatively small patient sample (N=468); larger studies are needed to confirm this work.

# Conclusions

The current study tested whether variation in clinical outcomes of CoCM as implemented in primary care health centers could be in part explained by variation in the centers' cultures and climates. We found that parenting women with depression were more likely to experience clinical improvement and maintain this improvement if they were treated in health centers with higher levels of proficient culture and functional climate independent of center,patient, and other implmentation covariates associated with outcomes. Because of evidence that interventions targeting organizational culture and climate support improved outcomes in other contexts[32,33,76], it will be important to explore whether similar interventions can improve depression outcomes and reduce their variation in health centers. Additional research is also needed to determine if differences in fidelity and sustainment of CoCM for depression can be explained by organizational measures of culture and climate.

# Abbreviations

CoCM: Collaborative care model

ICC: Intraclass correlation coefficient

OSC: Organizational social context

PHQ-9: Patient health questionnaire-9

# Declarations

***Ethics approval and consent to participate**:* This study was reviewed and approved by the Institutional Review Board of the University of Washington.

***Consent for publication**:* Not applicable

***Availability of data and materials**:* The dataset used and/or analyzed for this study are available from Dr. Ian Bennett (ibennett@uw.edu) on reasonable request.

***Competing interests**:* The authors declare that they have no competing interests.

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***Authors' contributions**:* IMB conceived and oversaw the overall study, including conceptualization of the study hypotheses, interpreting the data, writing the manuscript, editing the manuscript, and securing funding for the study. NJW led the conceptualization of study hypotheses, analyzed and interpreted the data, and led the writing of the manuscript. JR contributed to data analysis and interpretation as well as editing the manuscript. TG, PG, EP, and AB contributed to conceptualizing the study, interpreting the data, and editing the manuscript. JU obtained funding for this research and contributed to study design and editing the manuscript. All authors read and approved the final manuscript.

***Reporting Standards**:* The Standards for Reporting Implementation Studies (StaRI) checklist was followed in preparation of this manuscript.

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# Tables

**Table 1. Characteristics of Participating FQHCs, Care Team Members, and Patients**

| Characteristic | *Mean* (*N*) | *SD* (%) | Min | Max |
|---|---|---|---|---|
| **Care Team Members (*N* = 54)** | | | | |
| Years of experience | 19.06 | 11.39 | 2 | 40 |
| Years in current health center | 9.41 | 7.75 | 1 | 33 |
| Age in years | 46.73 | 12.55 | 25 | 67 |
| Position | | | | |
| Direct care provider | 28 | 51.9 | | |
| Supervisor | 8 | 14.8 | | |
| Management | 4 | 7.4 | | |
| Other (e.g., Quality Improvement Officer) | 10 | 18.5 | | |
| Highest Education Completed | | | | |
| High school graduate | 3 | 5.6 | | |
| Associate degree | 6 | 11.1 | | |
| Bachelor's degree | 11 | 20.4 | | |
| Master's degree | 15 | 27.8 | | |
| Doctoral degree | 19 | 35.2 | | |
| Race | | | | |
| Asian | 7 | 13.0 | | |
| Black or African American | 2 | 3.7 | | |
| White | 33 | 61.1 | | |
| Other | 9 | 16.6 | | |
| More than one race | 3 | 5.6 | | |
| Hispanic/Latino(a) | 12 | 22.2 | | |
| Female | 46 | 85.2 | | |
| **Patients (*N* = 468)** | | | | |
| Age in years | 33.47 | 8.39 | 15 | 69 |
| PHQ-9 total score at baseline | 16.21 | 4.69 | 10 | 27 |
| Endorsed suicidal ideation (PHQ item 9) | 132 | 28.2 | | |
| Prior history of psychiatric treatment | 135 | 28.8 | | |

| | | |
|---|---|---|
| Hispanic/Latina | 223 | 47.6 |
| Race | | |
| American Indian/Alaskan Native | 2 | 0.4 |
| Asian | 44 | 9.4 |
| Black or African American | 47 | 10.0 |
| Native Hawaiian or Other Pacific Islander | 5 | 1.1 |
| White | 109 | 23.3 |
| More than one race | 40 | 8.5 |
| Unknown or Not Reported | 221 | 47.2 |

**Table 2. Organizational Social Context Scale Measures for Health Centers (*N* = 10)**

| T scores | *Mean* (*N*) | *SD* (%) | Min | Max |
|---|---|---|---|---|
| Proficient culture (μ=50, σ=10) | 54.32 | 12.05 | 30.70 | 70.67 |
| Rigid culture (μ=50, σ=10) | 56.26 | 6.40 | 44.57 | 65.16 |
| Resistant culture (μ=50, σ=10) | 58.59 | 11.00 | 40.22 | 73.64 |
| Engaged climate (μ=50, σ=10) | 53.92 | 14.31 | 26.84 | 74.08 |
| Functional climate (μ=50, σ=10) | 64.99 | 11.81 | 43.99 | 82.21 |
| Stressful climate (μ=50, σ=10) | 52.15 | 9.64 | 38.63 | 66.69 |

**Table 3. Effects of Culture and Climate on Change in Depression Symptoms (PHQ-9 Total Score)**

| Culture/Climate Dimension | Effect on Instantaneous Growth Rate at Time $t_i$ | | | Effect on Rate of Acceleration across Times $t_0 - t_4$ | | |
|---|---|---|---|---|---|---|
| | $B_1$ | *SE* | *p* | $B_2$ | *SE* | *p* |
| Proficient Culture | | | | | | |
| Baseline ($t_0$) | 0.05 | 0.03 | 0.118 | -0.01* | 0.00 | 0.020 |
| 2-months ($t_1$) | 0.00 | 0.01 | 0.791 | | | |
| 4-months ($t_2$) | -0.04* | 0.02 | 0.041 | | | |
| 6-months ($t_3$) | -0.09* | 0.04 | 0.043 | | | |
| 6.5-months ($t_4$) | -0.10* | 0.04 | 0.044 | | | |
| Rigid Culture | | | | | | |
| Baseline ($t_0$) | 0.06 | 0.04 | 0.228 | -0.00 | 0.01 | 0.542 |
| 2-months ($t_1$) | 0.03 | 0.02 | 0.059 | | | |
| 4-months ($t_2$) | 0.02 | 0.03 | 0.504 | | | |
| 6-months ($t_3$) | -0.00 | 0.05 | 0.995 | | | |
| 6.5-months ($t_4$) | -0.00 | 0.06 | 0.941 | | | |
| Resistant Culture | | | | | | |
| Baseline ($t_0$) | 0.02 | 0.03 | 0.574 | 0.00 | 0.00 | 0.750 |
| 2-months ($t_1$) | 0.02 | 0.01 | 0.075 | | | |
| 4-months ($t_2$) | 0.03 | 0.02 | 0.124 | | | |
| 6-months ($t_3$) | 0.03 | 0.03 | 0.348 | | | |
| 6.5-months ($t_4$) | 0.04 | 0.04 | 0.385 | | | |
| Engaged Climate | | | | | | |
| Baseline ($t_0$) | 0.01 | 0.02 | 0.552 | -0.01 | 0.00 | 0.123 |
| 2-months ($t_1$) | -0.01 | 0.01 | 0.249 | | | |
| 4-months ($t_2$) | -0.04* | 0.01 | 0.037 | | | |
| 6-months ($t_3$) | -0.06 | 0.03 | 0.076 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 6.5-months ($t_4$) | -0.07 | 0.03 | 0.083 | | | |
| Functional Climate | | | | | | |
| Baseline ($t_0$) | 0.03 | 0.02 | 0.223 | -0.01* | 0.00 | 0.044 |
| 2-months ($t_1$) | -0.00 | 0.01 | 0.830 | | | |
| 4-months ($t_2$) | -0.03* | 0.01 | 0.037 | | | |
| 6-months ($t_3$) | -0.07 | 0.03 | 0.053 | | | |
| 6.5-months ($t_4$) | -0.07 | 0.03 | 0.055 | | | |
| Stressful Climate | | | | | | |
| Baseline ($t_0$) | 0.01 | 0.03 | 0.789 | 0.00 | 0.01 | 0.548 |
| 2-months ($t_1$) | 0.02 | 0.01 | 0.111 | | | |
| 4-months ($t_2$) | 0.04 | 0.02 | 0.111 | | | |
| 6-months ($t_3$) | 0.05 | 0.04 | 0.265 | | | |
| 6.5-months ($t_4$) | 0.05 | 0.04 | 0.290 | | | |

*Note:* Coefficients were estimated using 3-level hierarchical linear models with time points ($N$ = 1,455) nested within patients ($N$ = 468) nested within health centers ($K$ = 10). All models control for center size, level of implementation support, patient age at baseline, race, ethnicity, and prior history of psychiatric treatment. Statistically significant $B_1$ coefficients indicate culture/climate had an effect on patients' instantaneous growth rate in depression at that specific time $t_i$; negative coefficients indicate greater improvement in depression. Statistically significant $B_2$ coefficients indicate culture/climate had an effect on patients' overall acceleration, or change, in depression across the entire study period; negative coefficients indicate greater improvement from baseline to the study endpoint.

*$p < 0.05$

# Figures

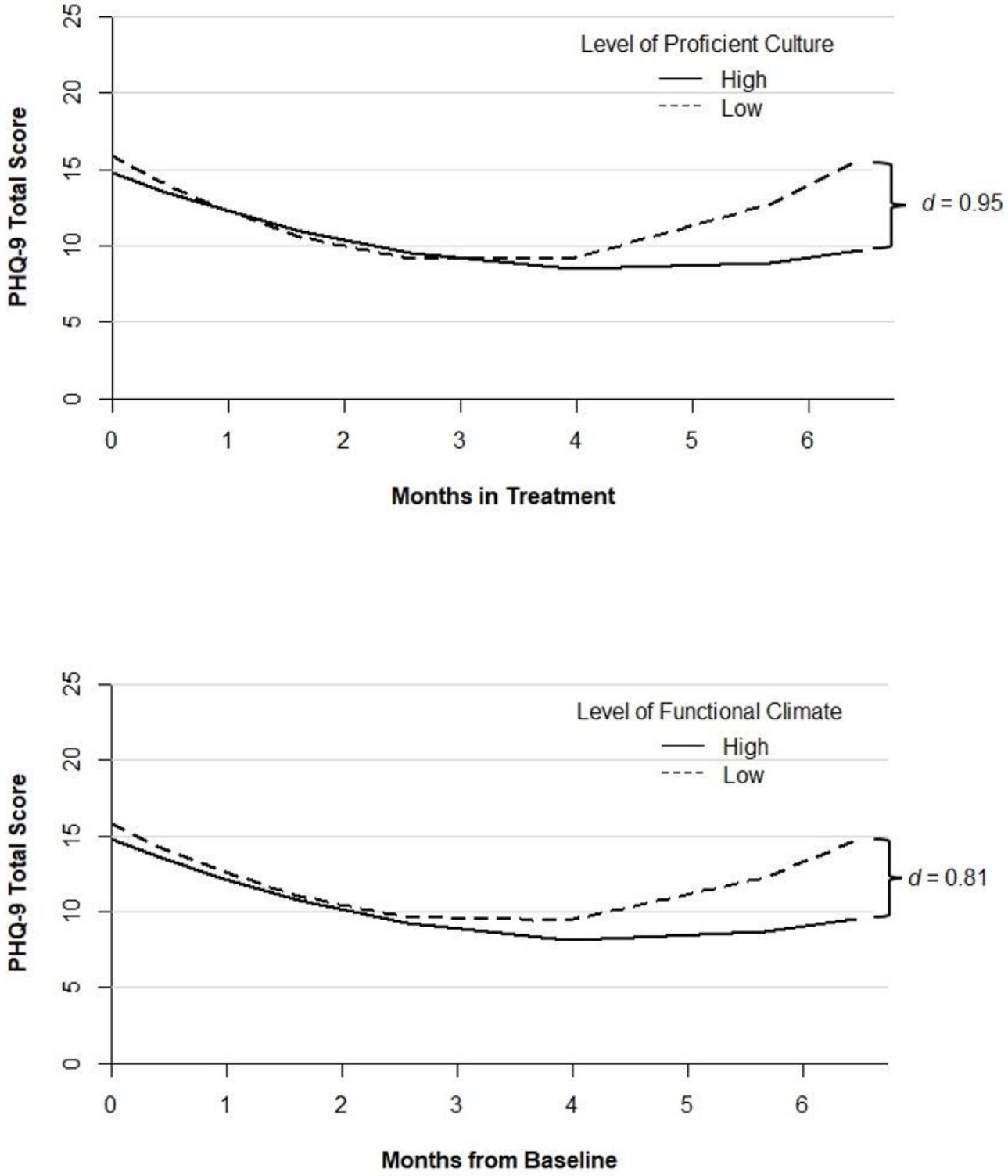


**Figure 1**

Relations between Proficient Organizational Culture and Functional Climate with Change in Patient Depression. Note: N = 1,455 observations, N = 468 patients, K = 10 FQHCs. Low = average value of lower quartile. High = average value of upper quartile. Lines show the covariate-adjusted, average

# Supplementary Files

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