

**Delivering perinatal depression care in a rural obstetric setting: a mixed methods analysis
of feasibility, acceptability and effectiveness.**

Amritha Bhat

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Committee:

Jürgen Unützer (Chair)

Susan D. Reed

Anne M. Turner

Jennifer Unger

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Amritha Bhat

University of Washington

Abstract

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Amritha Bhat

Chair of the Supervisory Committee:

Jürgen Unützer, MD, MPH, MA

Professor and Chair, Department of Psychiatry

Introduction: Many obstetric and primary care settings implement universal screening for depression during pregnancy and postpartum, yet mental health follow up rates are low in rural settings. Depression treatment integrated into obstetric settings allows for timely, evidence-based treatment of women with depression. Digital encounters such as text messages can further address barriers to care in perinatal women.

Methods: We conducted an open treatment trial of a screening and intervention program modified from the Depression Attention for Women Now (DAWN) Collaborative Care model in a rural obstetric clinic. Pregnant and postpartum women who screened positive for depression participated. They received Problem Solving Therapy (PST) with or without antidepressants. A care manager (CM) coordinated communication between patient, obstetrician and psychiatric consultant. In between sessions, CMs communicated with patients by two way text messaging. We measured change in the Patient Health Questionnaire 9 (PHQ -9) score; and used surveys

and focus groups to measure patient and provider satisfaction. We analyzed focus groups and text messaging content using qualitative analysis software.

Results: Recruitment (87.1%) and retention (92.6%) rates and depression outcomes (64% with >50% improvement in PHQ 9) were comparable to clinical trials in similar urban populations.

The intervention, including text messaging was well accepted by providers and patients.

Conclusions: DAWN Collaborative Care modified for treatment of perinatal depression in a rural obstetric setting is feasible, acceptable and effective. Behavioral health services integrated into rural obstetric settings could improve care for perinatal depression and text messages are a useful adjunct to this care.

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DEDICATION

To Girish, Krithi and Shruthi – you keep me going!

1. INTRODUCTION

1.1 BACKGROUND AND SIGNIFICANCE

Perinatal depression is highly prevalent in primary care and obstetric settings, affecting 10 to 20% of women.¹⁻³ Perinatal depression is associated with adverse outcomes for women,⁴ families⁵ and children.^{6,7} Given this high prevalence and the burden of untreated perinatal depression, the American Congress of Obstetricians and Gynecologists – ACOG⁸ and United States Preventive Services Task Force – USPSTF⁹ recommend universal screening for perinatal depression (at least once during pregnancy and postpartum). Yet even with wider implementation of depression screening, only 22% of women who screen positive complete a mental health referral.¹⁰ Integrating behavioral treatments into obstetric settings is one way of improving access to care, especially in rural settings where disparities in mental health care access are high,¹¹ and detection and treatment rates for perinatal depression are low.¹² Of several models of care involving integration of mental health care into general medical settings, Collaborative Care (CC) is one of the most evidence-based.¹³ CC is team based, patient centered care most commonly delivered in primary care settings. Patients are offered evidence - based treatment for depression by care managers (CMs) trained in behavioral interventions, such as Problem Solving Therapy (PST)¹⁴ or Interpersonal Therapy (IPT),¹⁵ under the supervision of a psychiatric consultant. The psychiatric consultant oversees the care of the patient and makes recommendations to the patient's primary prescriber for psychotropic medications if needed. CMs coordinate communications between the patient, psychiatric consultant and the primary care provider. This model of care can be applied to obstetrics – gynecology settings - Depression Attention for Women Now (DAWN)¹⁶ - and to perinatal populations in primary care

settings.¹⁷ However, there are unique barriers to treatment during pregnancy and postpartum (decisions regarding antidepressant treatment, child care, lack of time and stigma).¹⁸ Similarly, access to mental health care in rural settings may be limited due to increased travel times, additional stigma due to lack of anonymity, and cultural factors.^{19,20} To our knowledge there have been no evaluations of the feasibility of delivery of CC in a rural obstetric clinic. We modified the Depression Attention for Women Now (DAWN) Collaborative Care intervention²¹ for use in a rural perinatal population by including enhancements such as text messaging and home visits by the CM. We planned to measure feasibility (recruitment rate, retention rates), acceptability (provider and patient perceptions)²² and depression outcomes. We predicted that delivering CC for perinatal depression in a rural obstetric clinic would result in rates of recruitment and retention and reductions in depressive symptoms comparable to those in clinical trials of CC for women.¹⁶

Digital and asynchronous interactions such as text messaging can complement and enhance integrated mental health care delivery systems.²³ Text messaging can be human, computer based or hybrid.²⁴ In hybrid text messaging systems a computer facilitates bulk sending of messages, and a human reads and responds to patient's replies.²⁴

Reports of use of text messaging in the perinatal period are mainly from low and middle income countries. Text messaging services in these reports have improved antenatal care attendance and uptake of facility delivery.^{25,26} In the United States, automated messaging systems such as Text 4 Baby which deliver scheduled text messages to pregnant and postpartum women aim to promote a broad range of maternal and child health behaviors.²⁷ Text messaging has also been used as an adjunct to mental health treatments, such as cognitive behavior therapy²⁸ and to support medication adherence in individuals with psychotic disorders.²⁹ However, there have

been no reports of text messaging used as an adjunct in perinatal mental health treatments. Furthermore, reports of text messaging in the literature are limited to programmatic evaluations and do not report on health outcomes. Therefore we plan to describe the use of text messaging in CC for perinatal depression, in terms of CM's messaging behavior (frequency of use and content) and association of text messaging content with depression outcomes.

1.2 SPECIFIC AIMS

Perinatal depression and anxiety are common disorders¹ which result in maternal morbidity and mortality³⁰ and are associated with behavioral and emotional problems in children.^{7,31}

Collaborative Care (CC) is a highly evidence-based multi-disciplinary, team-based approach to patient-centered care for depression. A care manager (CM) plays a key role in this strategy, providing care to the patient while communicating with primary care providers (PCPs) and psychiatric consultants. CC is effective in the treatment of maternal depression,³² however the feasibility of delivering such care in a rural obstetric setting has yet been tested. Given the unique barriers to care (poor access, few mental health providers, stigma) experienced by women in rural settings,¹¹ we planned to conduct an open pilot study of CC delivered to women with perinatal depression in a rural obstetric setting. Given the unique barriers to access care in the perinatal period, we also planned to study enhancements such as text messaging designed specifically to improve access to care.

1.2.1 Primary Aims

1. To evaluate the feasibility of delivering perinatal depression care in a rural obstetric setting.
 - We will calculate the percentage of eligible women who enrolled in the program.

- Findings will be compared with known values from an urban setting

Hypothesis: In this trial of CC in a rural setting, rates of recruitment and retention will be similar to those in an urban setting.

2. To evaluate the acceptability of delivering perinatal depression care in a rural obstetric setting.

- We will analyze data from patient surveys and focus groups to assess acceptability of the intervention, including text messages. Aspects of acceptability measured will include patient perceptions on helpfulness in participation in the program, and relative usefulness of different settings for care manager (CM) visits.

Hypothesis: In this trial of CC in a rural setting, patients and obstetric providers will find the intervention acceptable.

1.2.2 Secondary Aims

To summarize preliminary outcome measures (Patient Health Questionnaire – 9; PHQ – 9 scores) for mental health treatment delivered in a rural obstetric setting.

- We will estimate treatment effect sizes over time for changes in clinical outcomes between baseline and study end. We will compare this effect size with that of the intervention arm in a similar trial conducted in an urban setting.

Hypothesis: CC in rural settings will result in depression score improvement comparable to that in urban settings.

To evaluate the content of text message exchanges between CM and patient and the correlation between text messaging usage and depression improvement.

- We will use a mixed methods approach to evaluate text messaging frequency and content and their correlation with PHQ-9 score changes.

2. METHODS

2.1 STUDY SETTING

We conducted an open treatment trial in an obstetric clinic in rural Washington over a six month period from October 2015 through March 2016. The clinic serves ethnically diverse women (48% Hispanic, 44% Caucasian, 5% Native American, and 3% other) of all ages with either public or private insurance (44% Medicaid eligible). In October 2015, based on recent recommendations calling for universal depression screening in the perinatal period,^{8,9} the clinic began administering the Patient Health Questionnaire-9 (PHQ-9)³³ to all pregnant and postpartum (within 1 year of delivery) women or those planning pregnancy. Between October 2015 and December 2015, women were approached to participate in the modified DAWN Collaborative Care intervention²¹ if they screened positive for depression, spoke English, and were 18 years and older. The medical assistant attending to the patient or their obstetric provider introduced the CC model. If the patient expressed interest, the CMs called them within two business days to schedule an intake. If not, they were provided with information to follow up with specialist mental health providers for assessment and treatment. The Institutional Review Board at the University of Washington approved all study procedures.

Figure 1

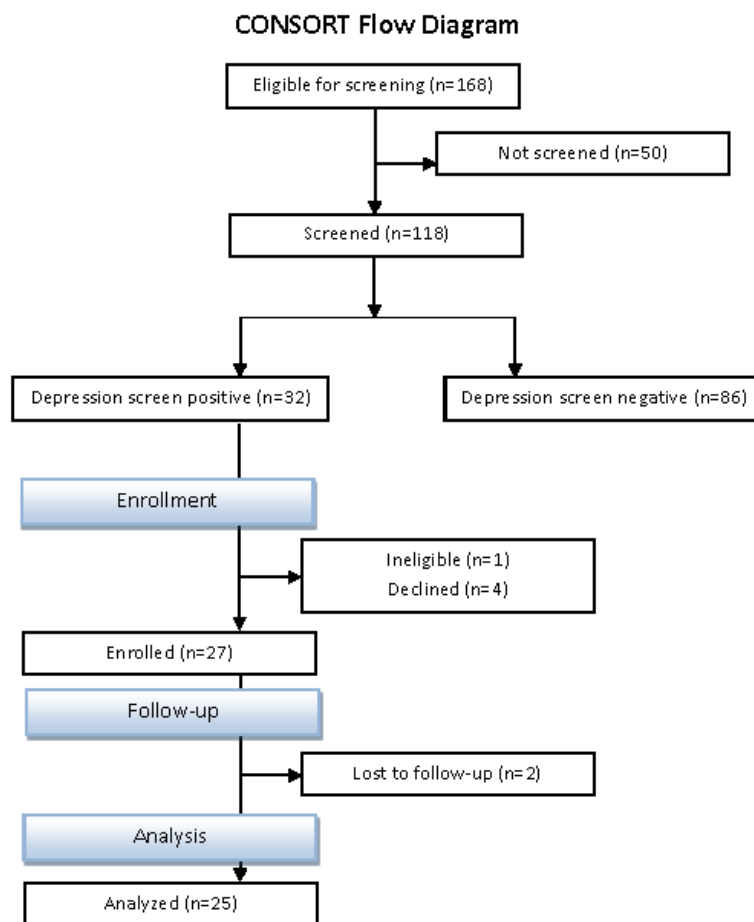


Figure 0.1. CONSORT flow diagram.

2.2 STUDY SUBJECTS

Women were enrolled if their PHQ-9 score was 10 or greater, and if they consented to participation. The PHQ-9 has established reliability and validity in various populations including pregnant and postpartum women.³³ We obtained written informed consent from all subjects. Recruitment proceeded until 27 patients began treatment.

2.3 INTERVENTION

2.3.1 Collaborative Care protocol

The rural obstetric clinic administered the DAWN Collaborative Care intervention, with modifications such as text messaging and home visits by the CM. CMs were trained in an engagement session (manualized), PST, text messaging protocols and general information on perinatal mental health and pharmacotherapy. Encounters with CMs were in the obstetric clinic or in the patient's home. The first encounter was an engagement interview,³⁴ designed to address practical, psychological and cultural barriers to care. Subsequent sessions were six to eight weekly sessions of PST if chosen by the patient. Between sessions, CMs communicated with patients via text messaging. Content of text messages included appointment reminders and information about depression, antidepressants and parenting, with both standardized templates and customized messages for individual patients. We customized psychiatric consultation for the perinatal population, with additional support provided to obstetric providers and CMs to conduct informed consent discussions regarding psychotropic medications during pregnancy. Videoconferencing between the psychiatric consultant and the patient was available if there was a need for additional diagnostic confirmation and/or further informed consent discussions.

Suicidal ideation (SI) was reported as a study adverse event. All SI was handled according to study protocol guidelines.

2.3.2 Text messaging communication protocol

Between sessions, CMs communicated with patients via text messaging. CMs used text messaging to send appointment reminders and information about depression, antidepressants and parenting. We provided CMs with semi-structured guidelines for the content of text messages, but encouraged them to be responsive to the unique needs of their patients with regard to frequency and follow up of text messages. CMs also told patients that they could initiate text messages at any time with their CM. CMs informed patients that they would be available only during working hours, and gave patients frequent reminders that this number was not an appropriate number to contact in case of emergency. CMs emphasized that the CM phones were password protected and not shared, that patients should use similar caution and that despite this, there were limits to confidentiality of text message exchanges. CMs uploaded the messages to a Microsoft Excel workbook and then deleted them from their phones.

2.4 MEASURES

2.4.1 Depression severity measures

The PHQ-9 was measured at baseline, study end, and at every CM visit. We also measured the Edinburgh Postnatal Depression (EPDS) score³⁵ at baseline and final visits. We collected information on text messaging frequency and content throughout the study. Primary outcome measures were change in PHQ-9 score from baseline to study end, rates of

depression remission (end of study PHQ-9 <5), response (end of study PHQ-9 <10) and proportion of patients who had a >50% reduction in their PHQ-9 scores.

2.4.2 Surveys (providers and patients) and end of study focus groups (patients and CMs)

Obstetric providers in the clinic completed surveys before the study began, and at study end. All patients who completed the study were given a 22 question survey regarding their experiences with the intervention, and suggestions for improvement. The last question in the patient survey asked if they would be interested in participating in a focus group. Nine patients expressed interest, and we conducted two patient focus groups with six and three participants each. An experienced investigator independent of the study team conducted the 90 minute focus group. Participants received a \$50 gift card at the end of the focus group. In the focus groups, we used open-ended probes informed by a literature review to elicit participants' opinions regarding treating perinatal depression treatment in an obstetric clinic. We also conducted an end of study focus group among the three CMs. We recorded, transcribed and checked the focus groups for accuracy.

2.5 DATA ANALYSIS

2.5.1 Depression treatment process and outcomes

We summarized patient demographics and survey results using descriptive statistics. We report baseline characteristics on 27 enrolled women, and process and outcome measures on the 25 women who had at least two PHQ-9 scores recorded. We measured effect sizes using Hedge's *g* for change between baseline and end depression scores. As we did not have a control arm, we

planned to compare our effect sizes with those of the intervention arm in the original DAWN randomized controlled trial.¹⁶

2.5.2 Text messages

We calculated the total number of text messages each CM sent and received. We had access to the time stamped text message communications between CMs and their patients throughout the trial. AB and JM coded these text messages. We began by reading the text message transcripts line by line, and coding each text message exchange. We used a combination of a priori coding (based on our knowledge of what the CMs used text messaging for), and emergent coding. We developed a codebook (available on request) with definitions and coding rules. We used Microsoft Excel as our primary data analysis tool for the text messaging analysis, to record the codes assigned to the text messages.

1) We used a pilot coding period to refine our code book. In this pilot coding period, we used text messages from all 27 patients enrolled in the trial. We assigned codes to the first text message in every text message exchange between patient and CM. We defined a text message exchange as an interchange of text messages (initiated by either CM or patient) that was continuous with regard to content. Each exchange contained between 1 (a text message with no response) and 18 (an exchange regarding prescription drug use during breastfeeding) individual text messages, and was spread over a period of two to three days. This supported asynchronous but content continuous communication.²⁹ There were 502 exchanges in total. In this first round of coding, AB and JM both assigned codes to 29.7% (149/502) of the text message exchanges, compared codes, resolved differences through discussion, and achieved 90% agreement on codes. At each discussion, we further refined the codebook, identifying conceptual categories within the text messages, and modifying definitions of codes where necessary. We used constant

comparisons throughout the process.³⁶ AB and JM then separately assigned codes to an additional 70.3% (353/502) of text message exchanges, meeting regularly to discuss the process and resolve coding discrepancies through consensus. Between AB and JM, all 502 text message exchanges from the duration of the trial were assigned a code.

For further analyses, we used data only from 25 patients for whom we had more than one PHQ-9 measurement, i.e., we excluded two patients who dropped out after baseline assessment.

We calculated percentages for all CM and patient codes and organized codes by themes and subthemes.

We used simple logistic regression to examine the association of different text message codes with 50% improvement in depression score (defined as reduction in PHQ-9 score by at least 50% from baseline to study end).

2.5.3 Focus groups (patients and CMs)

Patient and CM focus groups were analyzed using modified grounded theory approach³⁶ in qualitative analysis software (<http://atlasti.com/>). We discussed emergent themes and codes related to our research question regarding acceptability we resolved coding discrepancies by discussion. For analysis of text messages, we used thematic content analysis with both within group and between group comparisons.

3. RESULTS

3.1 RECRUITMENT AND RETENTION

During the period of active recruitment, 118 of 168 (70.2%) women with second trimester/postpartum visits received the depression screen. Of those women who were screened for depression through the period of enrollment, 32 (27.1 %) had a PHQ-9 score of 10 or more. Of those who screened positive, one was ineligible due to being less than 18 years of age. Of eligible women, four (12.9%) declined treatment or did not follow through after initial contact. In all, 27 women (87.1%) enrolled in treatment. Of these 27 women, 25 (92.6%) completed more than one study visit (Figure 1).

3.2 DEMOGRAPHIC AND BASELINE CLINICAL CHARACTERISTICS

Our study population was young and ethnically diverse, with a mean age of 29 (± 6.5). Fourteen of the 27 women (51.9%) were pregnant. The mean baseline PHQ-9 score of 15.3 (± 4.0) is indicative of moderate depression. Fifty two percent of all enrolled women (42.9% of pregnant women) chose antidepressant treatment with or without PST, while others chose only PST. Patients received an average of 5.8 (SD 3.4, range 1 to 16) clinic visits, 1.9 (SD 1.7, range 0 to 5) phone calls, 18.6 (SD 12.9, range 2 to 56) text messages and one (SD 2, range 0 to 7) home visit throughout the study duration.

Table 1: Baseline Characteristics (n=27)

Characteristics	
Age, Mean (SD)	29 (6.5)
Race / Ethnicity, N (%)	
American Indian/Alaska Native	5 (18.5%)
Black or African American	1 (3.7%)
White	14 (51.9%)
Hispanic or Latino	7 (25.9%)
Pregnancy status, N (%)	
Pregnant	14 (51.9%)
Postpartum	10 (37.0%)
Planning conception	2 (7.4%)
Post abortion	1(3.7%)

3.3 TREATMENT OUTCOMES

PHQ-9 scores declined from a baseline score of 15.3 ± 4.0 to 6.2 ± 4.4 for an effect size of 2.1 (95% CI 1.1 – 3.3, $p < 0.001$), over an average time in treatment of 14.4 weeks (SD 4.8, range 5.7 to 23.1). Two patients reported suicidal ideation on the PHQ-9, one at baseline and one at week 4 of treatment. At study end, 80% (n=20) of patients had PHQ – 9 scores of less than 10, 64% (n=16) of enrolled patients had 50% or more decrease in their PHQ – 9 score, and 32% (n = 8) attained PHQ – 9 scores of less than 5.

Table 2: Treatment Outcomes (n=25)

Baseline depression score, Mean (SD)	
PHQ-9 score	15.3 (4.0)
EPDS score	16.3 (5.8)
Final depression score, Mean (SD)	
PHQ-9 score	6.3 ± 4.4
EPDS score	9.7 ± 5.3
Other depression outcome measures, N (%)	
Response (Final PHQ-9 <10)	20 (80%)
≥50% improvement PHQ-9	16 (64%)
Remission (Final PHQ-9 <5)	8 (32%)

3.4 ACCEPTABILITY (SURVEY AND FOCUS GROUP RESULTS)

3.4.1 Patients

Seventeen of the 25 patients (68%) responded to the study completion survey. All women surveyed reported that they would recommend the intervention to family/friends. In rating the helpfulness of different types of visits with the CM, 83% (n=14) of patients found clinic visits to be ‘helpful’ or ‘very helpful’, as compared to 88% (n=15) for text messaging, 60% (n=10) for phone calls and 29% (n=5) for home visits. Analysis of

focus group content revealed a common theme of the appropriateness of receiving depression care in an obstetric clinic. Patients expressed a preference for their depression treatment to be considered a part of regular prenatal care: “Well, I would say that it's depression care, but it's trying to incorporate different aspects of your healthcare into one program. Instead of differentiating your pregnancy from your depression,one stop shop kind of approach” and “it was convenient, and, uh, well, a lot of people don't think to even talk to them about this, and it's part of your – it's part of your prenatal care”.

3.4.2 Obstetric providers

In a pre-intervention survey of 10 obstetric providers in the clinic, a majority 70% (n= 7) felt they had the appropriate training to identify depression, but only 30% (n=3) felt they had the appropriate training to treat depression. Most providers 70% (n=7) were dissatisfied with the resources available to treat depression in their practice before the DAWN Collaborative Care intervention. In a post-intervention survey of 6 obstetric providers in the clinic, 83% (n=5) of providers felt that that DAWN Collaborative Care had improved clinical outcomes in their patients. CC was found to be most helpful in: 1) treatment and proactive follow-up, and 2) monitoring of progress.

3.4.3 Care managers

Analysis of CM focus groups revealed that CMs identified several strengths to the CC approach: team work (better for patients: “so many more people advocating” and better for CMs “never felt like we were on our own”), access to psychiatric consultation, and training in evidence-based behavioral interventions. CMs identified challenges, including administrative limitations, little time for paperwork, not being integrated into

the clinic and lack of regular discussions with individual obstetric providers regarding their patients.

3.5 TEXT MESSAGE ANALYSIS

3.5.1 Text messaging frequency and content

We report on data for 25 patients who completed more than one assessment. Over the course of the study period, there were a total of 494 text message exchanges, of which CMs initiated 422 exchanges (85.4%) and patients initiated 72 exchanges (14.6%). We found that CMs most frequently used text messaging for appointment reminders and “check-ins” (39.2%; 347/886), followed by text messages regarding medication dose, side effects and logistics of picking up prescriptions (14.9%; 132/886). Patients most frequently used text messages to discuss medications (18.5%; 53/286) and to describe how they were feeling (19.6%; 56/286). (See Table 3 for themes, subthemes and examples). Only 13.1% (116/886) of CM initiated text messages did not receive a response. One patient expressed SI via text message despite our frequent reminders to use an alternate number for emergencies. The CM was able to respond to her message in a timely manner and encourage her to seek emergency care.

Table 3: Text Messaging Content Themes

Themes	Categories	Definition	Examples
<i>Need a name for this theme</i>	Appointment reminder	<ul style="list-style-type: none"> Reminder of upcoming appointment 	“Just a reminder we are scheduled to meet at 9 am today. Let me know if anything comes up. Otherwise I will see you soon”
	Check in	<ul style="list-style-type: none"> General “check in” other than appointment / medication / depression 	“Checking in to see how you are doing. Would it be okay if I call you on Friday morning to see how things are going with your medication and to do the depression screen?”
Treatment	Depression	<ul style="list-style-type: none"> Symptoms of depression (sadness, fatigue, sleep, appetite, lack of interest, suicidal ideation) 	“How is your sleep? How many hours are you getting a night.”
	Medication	<ul style="list-style-type: none"> Checking on compliance (taking the medication) Instructions on how to pick up prescription Information on medication 	“The doctor said you can definitely try Wellbutrin and it can increase energy but it is important to know that Wellbutrin can also increase anxiety.”
	PST	<ul style="list-style-type: none"> Behavioral activation Homework Steps, goals 	“if you can do something for yourself each day that brings you joy, it will help to break the downward spiral of depression. Even something small, whatever that may be for you, taking a walk, having time with a friend.”
Support	Behavioral	<ul style="list-style-type: none"> Any recommendations for improving depression that is not medication and not part of a recognized psychotherapy like PST. E.g. – practice self-affirmations, do the things that bring you joy. 	“NEST: nutrition, exercise, sleep, time to self!”
	Validation	<ul style="list-style-type: none"> Acknowledging the patients feelings or actions or experience “it can be hard” 	I know this is hard for you and you are doing a good job helping yourself

		etc.	through this. I support you trying this without medication. I'll check in on you again tomorrow”
	Encouragement	<ul style="list-style-type: none"> • “keep doing it” “keep it up” 	“Great job for doing it even though you are sick!” (referring to a patient doing their PST homework)
Information	Depression information	<ul style="list-style-type: none"> • Information about depression symptoms 	“Sleep and emotional health are so closely intertwined - try your best to get good rest!” “How are you feeling? I hope you have been able to enjoy some of the sunshine we've had in these last few days. Exposure to bright light is so helpful for mood.”
	Parenting	<ul style="list-style-type: none"> • Anything related to parenting – classes, sibling rivalry. 	“Yes but he just want more attention 😊 and it not working. But I am trying” (referring to older child’s sibling rivalry and CM’s earlier suggestions)
	Obstetric information	<ul style="list-style-type: none"> • Anything related to pregnancy – breastfeeding, premature labor, pelvic rest, pre-eclampsia 	“How did everything go with the birth? Breastfeeding? Let me know how I can support you.”
	Other information		“Yes, the prenatal yoga classes are at that same location and are taught by the greatest teacher. I think you would like it! And it's a great way to connect with other pregnant moms.”
Affect / Emotion <i>Need a better name for this theme</i>		<ul style="list-style-type: none"> • Descriptive verbiage that goes beyond response to “check in”. • Gives detail regarding mood or feeling 	“Like a roller coaster lol one minute I'm fine the next I'm crying and x tells me to knock it off then I'm yelling lol first trimester all over again :)”

3.5.2 Association of text messaging content with depression outcomes

We conducted exploratory analyses of association of text messaging content themes (appointment reminders, treatments, support, and information) 50% improvement in PHQ – 9 score, and did not find any significant association.

3.5.3 Care Manager and Patient Focus group content

CMs reported experiencing some challenges in the use of text messaging, such as maintaining boundaries – both in terms of defining limits to the work day, and setting interpersonal boundaries with their patients. They remarked that text messaging is usually considered a means to communicate with friends and this led to blurring of boundaries if a health care provider communicated with text messages. Patients, on the other hand, greatly appreciated the CM's availability for text messages in between appointments and after. Patients found the after-hours availability and asynchronous nature of text messages particularly useful as they had multiple competing priorities such as childcare. Focus group findings corroborated our analysis of content themes, in that CMs reported using text messages to remind patients about interventions and for appointment reminders.

4. DISCUSSION

Screening for perinatal depression is now endorsed as part of routine prenatal care, with several agencies such as the United States Preventive Services Task Force,⁹ and the American College of Obstetricians and Gynecologists⁸ recommending universal screening during pregnancy and postpartum. While it is relatively easy to screen for depression in an obstetric setting using

standardized screening instruments, obstetricians may be reticent to implement universal screening due to concerns regarding availability of follow up mental health care for women who screen positive. Depression treatment programs integrated into obstetric settings can not only address these concerns, but they are also responsive to patient preference for obtaining depression care in primary care and obstetric settings.³⁷

We report on the implementation of a screening and intervention program for depression - Depression Attention for Women Now or DAWN Collaborative Care - in a rural obstetric clinic. Only 70.2% of eligible women in the clinic were screened for depression. This is a low rate and worth improving upon in a setting that calls for universal screening. Integration of the screening instrument into the electronic medical record may result in higher rates of screening.³⁸ However, previous “real world” studies looking at implementation of universal screening for depression in primary care settings have reported screening completion rates of about 70% even with high levels of clinic support (such as a research assistant to ensure screening implementation).³⁹

The prevalence of women with positive depression screens in this clinic was relatively high at 27.1%, but not surprising for a clinic that serves many high risk women, including racial and ethnic minorities and low income women.⁴⁰ It is unlikely that our screening instrument could have contributed to these high rates as the PHQ-9 is validated for use in the perinatal population.⁴¹ One possible explanation for the high rates of positive depression screens, especially given that not all women were screened, is selective screening, i.e., providers were more likely to hand the screening instrument to women who appeared to have depression.

Overall, we found that it is feasible to integrate perinatal depression treatment into an obstetric clinic. Only four of the 31 women who were eligible within the enrollment period declined participation, resulting in a recruitment rate of 87.1%. Rates of retention in treatment were similarly high at 92.6% and comparable to those of randomized controlled trials in similar populations.^{16,42} These recruitment and retention rates are very encouraging considering that we did not offer any material incentives for completion of CM visits (patients received \$50 gift cards for participation in focus groups). CMs scheduled most of their visits in the clinic immediately before or after the patient met their obstetric provider, or scheduled home visits according to the patients' preference. In addition, CMs contacted their patients regularly via text messages. This may have contributed to the high retention rates.

Our calculated effect size for change over time of 2.1 (95% CI 1.1 – 3.3, $p < 0.001$) for PHQ-9 and 1.01 (95% CI 0.38 – 3.1) for EPDS is comparable to the effect size of 1.1 (95% CI 1.016 – 1.204) at 6 months in the intervention arm of the original DAWN study.¹⁶ Although this comparison is between populations from different studies, the sampling frames and outcome measures are similar. The two patients who reported suicidal ideation on the PHQ-9, on detailed evaluation, were deemed appropriate to continue in the intervention and went on to have a reduction in suicidal ideation and depressive symptoms.

All providers perceived DAWN Collaborative Care for perinatal depression to be feasible, acceptable, and not disruptive. CMs were not direct employees of the clinic and identified this as a challenge, but this was also used to their advantage in the delivery of patient care. For example, two of the CMs were part of the county maternal child health home visiting program and they

were able to utilize their knowledge of resources in order to connect their patients with additional services and to provide continuity after the end of the DAWN Collaborative Care intervention.

Limitations of this study include the fact that we did not have a randomly assigned control group and we cannot rule out that the improvement in symptoms was due to spontaneous improvement in depression, regression to the mean or nonspecific treatment effects. In our analysis of the survey and focus group responses, we cannot entirely rule out other confounding variables such as self-selection or social desirability. Our results are based on data obtained from a small number of participants in a rural obstetric clinic and may not be generalizable to other populations. Mean follow-up period was short at 14.4 weeks, and we cannot comment on sustained improvement in depression with this intervention. Due to small numbers, we could not conduct separate analysis on the women who received home visits to determine if their needs were different in any way. We also do not have demographic or baseline depression data on the women who declined to participate in CC.

In our analysis of text messaging usage by CMs and patients in a perinatal CC program, we found that both patients and CMs found it acceptable and helpful to use text messages as an adjunct to regular care manager meetings. Previous studies found that 96% of women have a favorable attitude toward receiving text messages about prenatal care²⁵ and our qualitative work on attitudes to receiving text messages during perinatal depression treatment found similar high levels of interest.

Overall, patients initiated text messages less frequently than CMs. Patients initiated only 14.6% of total text message exchanges. Previous studies have reported that each participant sent 0.46 messages per week over 7 to 8 months of antenatal care.²⁴ In our study the mean number of patient initiated text messages over the course of a mean 14.6 weeks in treatment was 2.9. Further studies are needed to investigate whether the rate of text messages initiated by a patient can be used as a metric of engagement in care, or if it is related to depression outcomes.

Although we provided preliminary guidance on suggested content for text messages, CMs included additional topics in their text messages. Our content analysis revealed that, in addition to the suggestions for behavioral activation, medication reminders and depression information that were provided by study investigators, they also used text messages frequently for appointment reminders, validation, encouragement, and obstetric and parenting information. At study completion, patients reported via survey that they used text messages most frequently for scheduling and rescheduling appointments, perhaps reflecting their response to CMs appointment reminders. However content analysis results suggest that when patients initiated a text message exchange, they most frequently used it to discuss medications, and how they were feeling (both psychiatric and obstetric symptoms). Text messages are useful for information exchange as preliminary studies have shown that text messages with informational content can decrease anxiety in the perinatal period.⁴³ However, CMs were frequently called upon to answer text message questions about topics in which they had no formal training on (such as obstetric information and in some instance, parenting questions). It is therefore important to have in place systems for supervision of this content or a protocol to address questions that may fall outside a CM's zone of expertise. We did not find a significant association between any one type of text

message content and depression improvement. It is possible that we did not detect an association due to the small sample size. It is worth examining this issue further in a larger study, to inform the content of text messages that correlate most strongly with depression improvement.

Focus groups revealed that patients particularly welcomed the asynchronous nature of text messaging, and also the fact that CMs were available after hours and on weekends. The unique challenges of the perinatal period such as childcare and transportation were reasons cited for appreciating the flexibility and accessibility of text messaging as a means of communication. It is worth noting that our text messaging protocol very clearly stated that text messaging was only for use on weekdays and during working hours, but this boundary was not maintained by either the CMs or the patients. Two way text messaging protocols in the treatment of perinatal depression should take into account time spent by CMs on text messaging activities and emphasize the need to maintain boundaries. Hybrid systems are one way to scale up text messaging without increasing burden on CMs.²⁴

There was some concern that women who received automated messages from other services could not distinguish the source of text messages, but overall the women were more responsive to messages they perceived as being sent by a human as opposed to being computer generated. Although an analysis of Text4baby data found that higher levels of text message exposure predicted favorable behavior change in terms of lower self-reported alcohol consumption,⁴⁴ our qualitative analysis suggested that women tended to ignore frequent messages from an automated service.

5. CONCLUSIONS

Our finding that it is feasible and acceptable to deliver CC for perinatal depression in a rural obstetric clinic is especially significant in light of the recent announcement by Center for Medicare and Medicaid Services (CMS). CMS has established new payment codes for CC consistent with the model we tested in this pilot study. It is also finalizing payment for a new code that describes behavioral health integration for practices which are not yet ready to implement CC. Behavioral health services integrated into obstetric settings using the CC model can significantly improve care for perinatal depression.

In addition, text messaging is an acceptable and feasible means of digital synchronous or asynchronous communication between CM and patients being treated for perinatal depression. Digital asynchronous communication such as text messaging is an important means of improving access to health care²³ especially given the fact that rates of texting are higher among traditionally underserved populations such as race / ethnic minorities and low income populations.⁴⁵ Particularly in the perinatal population with multiple barriers to access, text messaging can serve as a useful adjunct to mental health treatment delivery. However there is a need for clear guidelines surrounding extent of use, use in emergencies and security of data. Future research should evaluate the impact of hybrid systems which can increase the capacity of CMs by combining the automated sending of personalized messages to patient with the CM's ability to respond to specific questions or requests from patients.

REFERENCES

1. Gavin NI, Gaynes BN, Lohr KN, Meltzer-Brody S, Gartlehner G, Swinson T. Perinatal depression: a systematic review of prevalence and incidence. *Obstetrics and gynecology*. 2005;106(5.1):1071-1083.
2. Marcus SM, Flynn HA, Blow FC, Barry KL. Depressive symptoms among pregnant women screened in obstetrics settings. *Journal of Women's Health*. 2003;12(4):373-380.
3. Stowe ZN, Hostetter AL, Newport DJ. The onset of postpartum depression: Implications for clinical screening in obstetrical and primary care. *American journal of obstetrics and gynecology*. 2005;192(2):522-526.
4. Shadigian E, Bauer S, T. Pregnancy-Associated Death: A Qualitative Systematic Review of Homicide and Suicide. *Obstetrical & gynecological survey*. 2005;60(3):183.
5. Goodman JH. Paternal postpartum depression, its relationship to maternal postpartum depression, and implications for family health. *Journal of Advanced Nursing*. 2004;45(1):26-35.
6. Goodman SH, Gotlib IH. Risk for psychopathology in the children of depressed mothers: a developmental model for understanding mechanisms of transmission. *Psychological review*. 1999;106(3):458.
7. O'Donnell KJ, Glover V, Barker ED, O'Connor TG. The persisting effect of maternal mood in pregnancy on childhood psychopathology. *Development and psychopathology*. 2014;26(02):393-403.
8. Committee on Obstetric Practice. The American College of Obstetricians and Gynecologists Committee Opinion no. 630. Screening for perinatal depression. *Obstetrics and gynecology*. 2015;125(5):1268-1271.
9. Siu AL, U. S. Preventive Services Task Force, . Screening for depression in adults: US preventive services task force recommendation statement. *JAMA*. 2016;315(4):380-387.
10. Byatt N, Levin LL, Ziedonis D, Moore Simas TA, Allison J. Enhancing Participation in Depression Care in Outpatient Perinatal Care Settings: A Systematic Review. *Obstetrics and gynecology*. 2015;126(5):1048-1058.
11. Roll JM, Kennedy J, Tran M, Howell D. Disparities in unmet need for mental health services in the United States, 1997–2010. *Psychiatric Services*. 2013.
12. Geier ML, Hills N, Gonzales M, Tum K, Finley PR. Detection and treatment rates for perinatal depression in a state Medicaid population. *CNS spectrums*. 2015;20(1):11-19.
13. Unützer J, Harbin H, Schoenbaum M, Druss B. The collaborative care model: An approach for integrating physical and mental health care in Medicaid health homes. *Health Home, Information Resource Center*. 2013:1-13.
14. Mynors-Wallis LM, Gath DH, Day A, Baker F. Randomised controlled trial of problem solving treatment, antidepressant medication, and combined treatment for major depression in primary care. *BMJ*. 2000;320.
15. Grote NK, Swartz HA, Geibel SL, Zuckoff A, Houck PR, Frank E. A randomized controlled trial of culturally relevant, brief interpersonal psychotherapy for perinatal depression. *Psychiatric Services*. 2009;60(3):313-321.
16. Melville JL, Reed SD, Russo J, et al. Improving care for depression in obstetrics and gynecology: a randomized controlled trial. *Obstetrics and gynecology*. 2014;123(6):1237-1246.

17. Grote NK, Katon WJ, Russo JE, et al. Collaborative care for perinatal depression in socioeconomically disadvantaged women: a randomized controlled trial. *Depression and anxiety*. 2015.
18. Goodman JH. Women's Attitudes, Preferences, and Perceived Barriers to Treatment for Perinatal Depression. *Birth*. 2009;36(1):60-69.
19. Hauenstein EJ, Petterson S, Rovnyak V, Merwin E, Heise B, Wagner D. Rurality and mental health treatment. *Administration and Policy in Mental Health and Mental Health Services Research*. 2007;34(3):255-267.
20. Rost K, Smith GR, Taylor JL. Rural-urban differences in stigma and the use of care for depressive disorders. *J Rural Health*. 1993;9(1):57-62.
21. LaRocco-Cockburn A, Reed SD, Melville J, et al. Improving depression treatment for women: integrating a collaborative care depression intervention into OB-GYN care. *Contemp Clin Trials*. 2013;36(2):362-370.
22. Lancaster GA, Dodd S, Williamson PR. Design and analysis of pilot studies: recommendations for good practice. *J Eval Clin Pract*. 2004;10(2):307-312.
23. Fortney JC, Burgess Jr JF, Bosworth HB, Booth BM, Kaboli PJ. A re-conceptualization of access for 21st century healthcare. *Journal of general internal medicine*. 2011;26(2):639-647.
24. Perrier T, Dell N, DeRenzi B, et al. Engaging Pregnant Women in Kenya with a Hybrid Computer-Human SMS Communication System. Paper presented at: Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems 2015.
25. Cormick G, Kim NA, Rodgers A, et al. Interest of pregnant women in the use of SMS (short message service) text messages for the improvement of perinatal and postnatal care. *Reproductive health*. 2012;9(1):9.
26. Lund S, Hemed M, Nielsen BB, et al. Mobile phones as a health communication tool to improve skilled attendance at delivery in Zanzibar: a cluster-randomised controlled trial. *BJOG: An International Journal of Obstetrics & Gynaecology*. 2012;119(10):1256-1264.
27. text4baby. 2016; <https://www.text4baby.org/>. Accessed December 9, 2016.
28. Aguilera A, Muñoz RF. Text Messaging as an Adjunct to CBT in Low-Income Populations: A Usability and Feasibility Pilot Study. *Professional psychology, research and practice*. 2011;42(6):472-478.
29. Aschbrenner KA, Naslund JA, Gill LE, Bartels SJ, Ben-Zeev D. A Qualitative Study of Client–Clinician Text Exchanges in a Mobile Health Intervention for Individuals With Psychotic Disorders and Substance Use. *Journal of dual diagnosis*. 2016;12(1):63-71.
30. Pregnancy-Associated Death: A Qualitative Systematic Review of Homicide and Suicide. *Obstetrical & gynecological survey*. 2005;60(3):183.
31. Goodman SH, Rouse MH, Connell AM, Broth MR, Hall CM, Heyward D. Maternal depression and child psychopathology: a meta-analytic review. *Clin Child Fam Psychol Rev*. 2011;14(1):1-27.
32. Grote NK, Katon WJ, Russo JE, et al. COLLABORATIVE CARE FOR PERINATAL DEPRESSION IN SOCIOECONOMICALLY DISADVANTAGED WOMEN: A RANDOMIZED TRIAL. *Depression and anxiety*. 2015.
33. Kroenke K, Spitzer RL. The PHQ-9: a new depression diagnostic and severity measure. *Psychiatric annals*. 2002;32(9):509-515.

34. Grote NK, Zuckoff A, Swartz H, Bledsoe SE, Geibel S. Engaging women who are depressed and economically disadvantaged in mental health treatment. *Soc Work*. 2007;52(4):295-308.
35. Cox JL, Holden JM, Sagovsky R. Detection of postnatal depression. Development of the 10-item Edinburgh Postnatal Depression Scale. *The British journal of psychiatry*. 1987;150(6):782-786.
36. Corbin J, Strauss A. *Basics of qualitative research: Techniques and procedures for developing grounded theory*. Sage publications; 2014.
37. Byatt N, Biebel K, Friedman L, Debordes-Jackson G, Ziedonis D, Pbert L. Patient's views on depression care in obstetric settings: how do they compare to the views of perinatal health care professionals? *General hospital psychiatry*. 2013;35(6):598-604.
38. Rowan P, Greisinger A, Brehm B, Smith F, McReynolds E. Outcomes from implementing systematic antepartum depression screening in obstetrics. *Archives of women's mental health*. 2012;15(2):115-120.
39. Valenstein M, Dalack G, Blow F, Figueroa S, Standiford C, Douglass A. Screening for Psychiatric Illness with a Combined Screening and Diagnostic Instrument. *Journal of General Internal Medicine*. 1997;12(11):679-685.
40. Zhang S, Cardarelli K, Shim R, Ye J, Booker KL, Rust G. Racial disparities in economic and clinical outcomes of pregnancy among Medicaid recipients. *Maternal and child health journal*. 2013;17(8):1518-1525.
41. Sidebottom AC, Harrison PA, Godecker A, Kim H. Validation of the Patient Health Questionnaire (PHQ)-9 for prenatal depression screening. *Archives of women's mental health*. 2012;15(5):367-374.
42. Grote NK, Katon WJ, Russo J, et al. A Randomized Trial of Collaborative Care for Perinatal Depression in Socio-Economically Disadvantaged Women: The Impact of Comorbid PTSD. (*under review*). 2015.
43. Jareethum R, Titapant V, Tienthai C, Viboonchart S, Chuenwattana P, Chatchainoppakhun J. Satisfaction of healthy pregnant women receiving short message service via mobile phone for prenatal support: A randomized controlled trial. *Medical journal of the Medical Association of Thailand*. 2008;91(4):458.
44. Evans W, Nielsen PE, Szekely DR, et al. Dose-Response Effects of the Text4baby Mobile Health Program: Randomized Controlled Trial. *JMIR mHealth and uHealth*. 2015;3(1):e12.
45. Smith A. Americans and text messaging. *Washington, DC: Pew Research Center*. 2011.