Contraception 101 (2020) 199–204

Contents lists available at ScienceDirect

Contraception

journal homepage: www.elsevier.com/locate/con

Effectiveness of clinical decision support to enhance delivery of family planning services in primary care settings ☆,☆☆

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ARTICLE INFO

Article history:
Received 1 August 2019
Received in revised form 31 October 2019
Accepted 5 November 2019

Keywords:
Clinical decision support
Family medicine
Family planning services
Federally qualified health center
Primary care
Screening

ABSTRACT

Purpose: There is a need to improve delivery of family planning services, including preconception and contraception services, in primary care. We assessed whether a clinician-facing clinical decision support implemented in a family medicine staffed primary care network improved provision of family planning services for reproductive-aged female patients, and differed in effect for certain patients or clinical settings.

Methods: We conducted a pragmatic study with difference-in-differences design to estimate, at the visit-level, the clinical decision support's effect on documenting the provision of family planning services 52 weeks prior to and after implementation. We also used logistic regression with a sample subset to evaluate intervention effect on the patient-level.

Results: 27,817 eligible patients made 91,185 visits during the study period. Overall, unadjusted documentation of family planning services increased by 2.7 percentage points (55.7% pre-intervention to 58.4% intervention). In the adjusted analysis, documentation increased by 3.4 percentage points (95% CI: 2.24, 4.63). The intervention effect varied across sites at the visit-level, ranging from a −1.2 to +6.5 percentage point change. Modification of effect by race, insurance, and site were substantial, but not by age group nor ethnicity. Additionally, patient-level subset analysis showed that those exposed to the intervention had 1.26 times the odds of having family planning services documented after implementation compared to controls (95% CI: 1.17, 1.36).

Conclusions: This clinical decision support modestly improved documentation of family planning services in our primary care network; effect varied across sites.

Implications: Integrating a family planning services clinical decision support into the electronic medical record at primary care sites may increase the provision of preconception and/or contraception services for women of reproductive age. Further study should explore intervention effect at sites with lower initial provision of family planning services.

1. Introduction

Provision of high-quality family planning services – contraception and preconception services – is critical for supporting patients in achieving their reproductive goals [1,2]. Federally Qualified Health Centers (FQHC), as safety-net primary care sites, are important providers of family planning services [3]. FQHC clinicians care for populations who often have disproportionately higher rates of unintended pregnancies, higher-risk pregnancies, and maternal and infant morbidities [4,5]. In 2017, clinicians at FQHCs provided primary care to over seven million female patients of reproductive age [6]. However, most FQHCs do not offer comprehensive family planning services [7].

☆ *Declaration of Competing Interest*: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

☆☆ *Funding*: The intervention is supported by grant funding from the New York City Department of Health and Mental Hygiene, New York, NY. The funding source was not involved in the study design; in the collection, analysis, and interpretation of data; in the writing of the report; or in the decision to submit this article for publication. Dr. Shah received salary support from the Empire Clinical Research Investigator Program.

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https://doi.org/10.1016/j.contraception.2019.11.002
0010-7824/

The optimal way to improve delivery of family planning services in primary care settings remains unclear. Organizations have developed tools designed to facilitate provision of family planning services, however few studies have examined the effect of these tools on provision of contraception and/or preconception services in primary care [9–11]. Clinical decision support tools help clinicians identify patients' needs and risks, support clinical decision-making, and have been shown to improve service delivery [12–14]. Enthusiasm exists for incorporating clinical decision support in primary care for various disease prevention areas [14], but it is an understudied strategy for improving delivery of family planning services [15].

Thus, we developed an electronic medical record-based clinical decision support designed to increase family planning services for women of reproductive age in our family medicine staffed FQHC network. In a prior manuscript, we reported that implementing this intervention was feasible at the pilot site and acceptable among our staff [9]. In this manuscript, we evaluated the effectiveness of the clinical decision support to improve provision of family planning services and whether its effect differed for patients with certain characteristics or in distinct clinical settings. We hypothesized the intervention would disproportionately increase family planning services for patients ages 18–34, the age group with the highest pregnancy rate [16], as well as in sites with reproductive health champions and clinical quality metrics above the organizational average.

2. Material and methods

2.1. Setting

We implemented the clinical decision support at the Institute for Family Health (Institute), a New York State FQHC network that provides medical, dental, and mental health care to over 98,000 patients annually. Institute clinicians, primarily family physicians, provide comprehensive reproductive health services. This includes prescribing or inserting/removing all contraceptives, with same-day placement/removal of intrauterine devices and implantable contraception, preconception care, pregnancy options counseling, prenatal care, management of early pregnancy loss, and other sexual and reproductive health services. The Institute stands out in its provision of reproductive health care, as only 24% of US community health centers provide comprehensive contraception options onsite and 48% provide onsite or by prescription [7]. Prior to the intervention, Institute sites did not routinely screen for need for family planning services. The Institute uses the Epic® electronic medical record. It does not receive Title X funding. This pragmatic study took place between March 2017 and September 2018 at seven, urban general family medicine Institute sites. The Institutional Review Board of the Institute approved this study.

2.2. Intervention

Once the clinician decision support was implemented at a site, the tool appears in the electronic medical record for all medical visits, excluding prenatal visits, for female patients ages 13–44 who do not have a documented hysterectomy or tubal ligation. In brief, the clinical decision support functions as follows: upon rooming, medical assistants ask eligible patients a family planning services screening question, which appears in the best practice advisory section of the electronic medical record – "Would you like your provider to help you with birth control or pregnancy planning today?" The patient's response is documented and appears for the clinician in the best practice advisory section. It is linked to chart documentation tools and order sets that the clinician may use for reproductive health services, including contraception and preconception. Depending on the patient's documented response to the screening question, the clinical decision support reappears at a patient's future visit in three days, three months, six months, or 12 months. Fig. 1 illustrates the logic used to program how the clinical decision support reappears in the electronic medical record.

Prior to implementation, medical assistants and clinicians at each site were trained in all its components and workflow. From March 2017 through September 2017, we implemented the intervention in a phased manner across seven sites, starting with those with the strongest historical capacity to incorporate new workflows.

2.3. Data collection

We abstracted electronic medical record data from all medical visits of females ages 13–44, starting 52 weeks prior to implementation at each site ("pre-intervention") and continuing for 52 weeks after implementation ("intervention"). All medical visits in the intervention period were included in analysis, regardless of whether or not the clinical decision support appeared. Visits with a pregnancy International Classification of Disease (ICD)-10 code were excluded from analysis. We included multiple visits by the same patient.

2.4. Study outcome measures

We measured our primary outcome, provision of family planning services, by electronic medical record-documentation of contraception and/or preconception services at each visit. We operationalized contraception documentation as (1) a contraception management ICD-10 code during the visit, or (2) active prescription on the medication list for: contraceptive pill, patch, ring, injection, implant, or intrauterine device, or (3) tubal ligation, intrauterine device, implant, diaphragm, hysterectomy, or vasectomy listed in the electronic medical record history section at the visit. We defined preconception documentation as (1) a preconception ICD-10 code during the visit or (2) active prescription of folic acid or prenatal vitamin on the medication list. For visits with documentation of both contraception and preconception services, we categorized those as contraception plus preconception. We used SPSS 25 (Armonk, NY) to create the outcome variable.

The following patient variables were abstracted from the electronic medical record: age, self-reported race, ethnicity, health insurance status, and clinical site. If there were multiple visits for a patient during the study period, we utilized data from the patient's initial visit when analyzing age group, insurance status, and site.

2.5. Statistical analysis

We conducted descriptive analyses of age, race, ethnicity, insurance status, and number of visits at each site to compare the balance of these variables between pre-intervention and intervention. We calculated summary statistics of crude family planning services documentation rates between sites, in addition to overall distribution of family planning services types (contraception, preconception, contraception plus preconception, none).

To assess intervention effectiveness on documentation of family planning services at the visit-level, we used a generalized difference-in-differences model [17], estimated by a two-level mixed effects logistic regression with random intercept at the patient-level. The model divided time into eight eras. The first era preceded clinical decision support implementation at any site. A new era began with implementation at each site. The final era

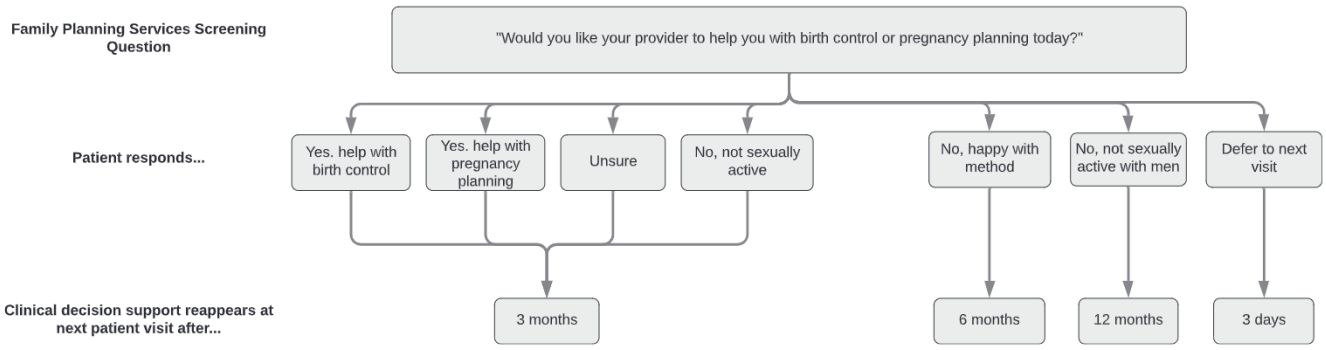

Fig. 1. Frequency at which family planning services clinical decision support reappears in electronic medical record in seven New York City-based FQHC sites.

began with implementation at the last site, at which point all sites had the clinical decision support. At the start of each era except the first, the model calculated the change in rate of documentation of family planning services from before to after at each site. The difference between the change observed in the site that had just initiated the intervention and the change observed in the other sites (where clinical decision support status did not change) is the estimate of the causal effect of the intervention. We then used the coefficient estimates from the logistic regression model to calculate the estimated probability of documentation of family planning services in each site prior and subsequent to implementing the clinical decision support.

The model automatically adjusted for variation in case-mix on all time-invariant attributes of patients and for secular trends that apply to all sites in the same way. Predictor variables included study site, era, and a variable which indicated whether the clinical decision support was in effect at the site for a given observation. Because patient characteristics across pre-intervention and intervention observations were similar, we did not include these as additional predictors in the model. However, we explored the possibility that the effect of the clinical decision support itself varies by age group, race, ethnicity, insurance status, and site in secondary analyses by adding interactions between these variables and the intervention effect in additional random effects logistic regression models.

Uncertainty of estimates was represented by confidence intervals. We used Stata 15.1 MP2 for Windows (College Station, TX: StataCorp LLC) for the above analyses.

Additionally, we explored a subset of our sample to evaluate intervention effectiveness on documentation of family planning services at the patient-level. In this subset analysis, we examined only those eligible patients with a visit within six weeks prior to implementation and did not have documented family planning services at that visit, and who had at least one visit during the 12 months with clinical decision support implementation. We used logistic regression, controlling for age group, race, ethnicity, and site, to compare these patients ("intervention") to a similar group of eligible patients ("control") with visits one year prior to the clinical decision support to assess the difference in documentation of family planning services for patients who had the tool in effect. Like intervention patients, control patients had the same pre and post eligibility criteria. We used SPSS 25 (Armonk, NY, USA) for the subset analysis.

Table 1
Demographic characteristics of medical visits by non-pregnant females of reproductive age in seven New York City-based FQHC sites in pre-Intervention and intervention periods (N = 91,185).[a]

Characteristic	Pre-Intervention (n = 47,515)	Intervention (n = 43,670)
Age, mean (SD)	29.3 (8.1)	29.3 (8.1)
Age group		
13–17	7.4%	7.6%
18–24	23.6%	23.1%
25–34	40.2%	39.9%
35–44	28.9%	29.4%
Race (N = 82,946)[b]		
Asian	3.3%	3.4%
Black/African American	38.7%	38.9%
Multiracial	2.4%	2.5%
Pacific Islander	2.1%	1.8%
Other	38.5%	39.5%
White	15.1%	13.9%
Ethnicity (N = 86,994)[c]		
Hispanic/Latinx	48.1%	49.1%
Insurance status (N = 88,000)[d]		
Medicaid	57.3%	57.0%
Other	2.8%	3.4%
Private	32.1%	33.0%
Uninsured	7.9%	6.7%
Site		
Site 1	7.3%	7.9%
Site 2	13.1%	15.6%
Site 3	14.8%	14.5%
Site 4	31.0%	28.8%
Site 5	6.1%	6.5%
Site 6	1.9%	2.9%
Site 7	25.7%	23.8%

[a] The Institute for Family Health is a New York State federally qualified health center (FQHC) network that primarily serves medically underserved communities. The intervention was implemented at seven general family medicine Institute sites based in New York City.
[b] Some observations did not have race, ethnicity, and/or health insurance status recorded in the electronic medical record and were assigned as missing. Valid observations for race were n = 43,452 in pre-intervention and n = 39,494 in intervention.
[c] Valid observations for ethnicity were n = 45,408 in pre-intervention and n = 41,586 in intervention periods.
[d] Valid observations for health insurance status were n = 46,426 in pre-intervention and n = 41,574 in intervention periods.

3. Results

3.1. Sample characteristics

During the study period, 27,817 female patients of reproductive age made 91,185 visits to a study site. Table 1 illustrates the distribution of age at first study visit, race, ethnicity, insurance status at first study visit, and number of visits by site in the pre-intervention and intervention periods. These attributes had a similar distribution in both time periods. For patient-level subset analysis, there were 1,360 patients in the control and 1,420 in the intervention groups (N = 2,780).

3.2. Visit-level analysis

Examining site characteristics, heterogeneity at the visit-level was present across sites regarding race, ethnicity, and insurance status of the patient population served (Table A.1), quality metrics, and on-site reproductive health champions (Table 2).

Overall, in unadjusted analysis, documentation of family planning services increased by 2.7 percentage points, from 55.7% (pre-intervention) to 58.4% (intervention). Documentation of contraception reflected the majority of this increase, though documentation of preconception and contraception plus preconception also increased slightly (Fig. 2). Fig. A.1 depicts the unadjusted change in documentation of family planning services at each site between time periods. In the pre-intervention period, 48.8%–65.5% of eligible visits had documentation, compared to 48.2%–70.4% after clinical decision support implementation. The absolute, unadjusted change in documentation at each site ranged from −3.8 to +6.0 percentage points.

In difference-in-differences analysis, visits after implementation had 1.40 times the odds of having documentation of family planning services (95% CI: 1.25, 1.58). The adjusted incidence of overall documentation of family planning services was 53.8% (95% CI: 53.01, 54.60) pre-intervention and 57.2% (95% CI: 56.43, 58.04) with the intervention, a 3.4 percentage point increase (95% CI: 2.24, 4.63). The adjusted change in documentation at each site ranged from −1.2 to +6.5 percentage points (Fig. 3). Three sites increased in documentation of family planning services and two slightly decreased.

There was substantial variation in intervention effect by race, insurance, and site, with group-specific ratios of odds-ratios outside the 0.9 to 1.1 range, but not by age group nor ethnicity. Adjusting for race, insurance, and site in the model, documentation of family planning services increased on average by 2.5 percentage points (95% CI: 1.24, 3.76). Table 3 illustrates the estimated intervention effects on documentation of family planning services by race, insurance, and study site. Variation between subgroups was present. The clinical decision support had a distinctly positive effect among Medicaid and multiracial patients, and at sites 1 and 7. We found a small negative effect among patients with other insurance, and at sites 2 and 5. The confidence intervals around the latter two estimates were wide enough to include change in the opposite direction.

Table 2
Characteristics of seven New York City-based FQHC sites during study period.

Characteristic	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7
Date of intervention roll-out	3/4/17	3/11/17	3/18/17	4/16/17	5/14/17	7/23/17	9/24/17
Dedicated reproductive health procedure sessions[a]		✓	✓	✓			✓
Onsite reproductive health champion[b]		✓	✓	✓		✓	✓
Family medicine residency training site			✓	✓			✓
Above average on FQHC quality metrics[c]	✓		✓				
Total # of unique eligible patients in study period[d]	1,778 (6.7%)	3,445 (13.0%)	3,685 (13.9%)	10,124 (38.3%)	1,634 (6.2%)	844 (3.2%)	6,307 (23.8%)

[a] A "dedicated reproductive health procedure session" entails specific visit times during the week where only reproductive health procedures are scheduled. These procedures include, but are not limited to, intrauterine device/implant insertion or removal, endometrial biopsy, colposcopy, obstetric and non-obstetric pelvic ultrasounds, and early pregnancy loss management.

[b] We defined a site with a "reproductive health champion" as one where at least one individual remained at the clinic during the 12-month intervention period who was responsible for and committed to the adoption, planning, implementation, evaluation, and sustainability of the clinical decision support. This may be a person who represents positions of leadership, administration, or clinical practice.

[c] "Above average" was defined as greater than 3.5 on 5-point scale as reported in the Institute's September 2018 quality metrics report. These metrics remained steady over the pre-intervention and intervention periods.

[d] Study period includes 12 months of observations in pre-intervention and 12 months of observations in intervention time periods at each site.

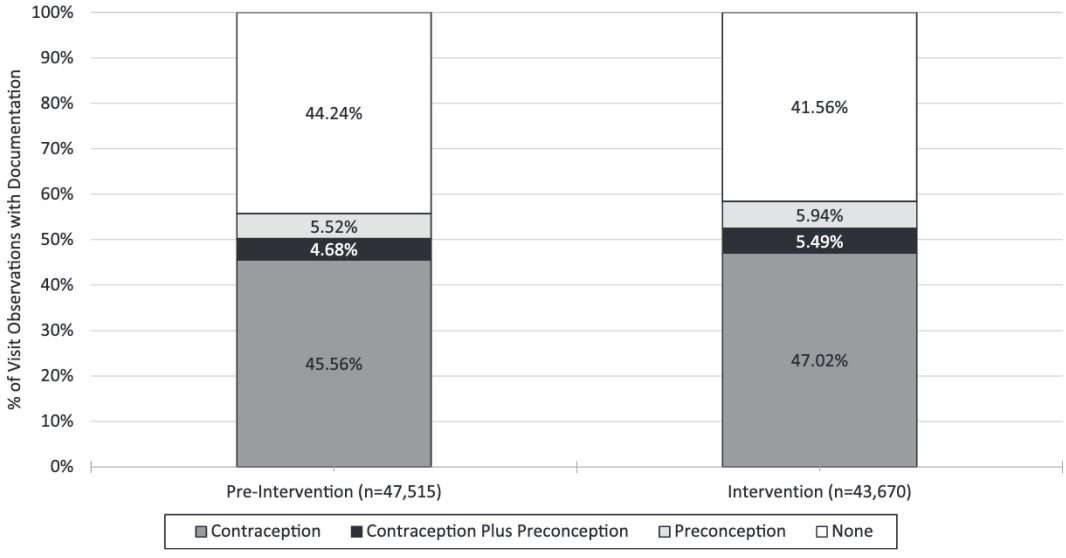

Fig. 2. Overall visit-level documentation of family planning services by type in pre-intervention and intervention periods in seven New York City-based FQHC sites.[a] [a]Due to the large sample size, very small *p*-values can be seen with small differences. All p-values are $p < 0.01$, which may lend undue apparent importance to clinically significant effects.

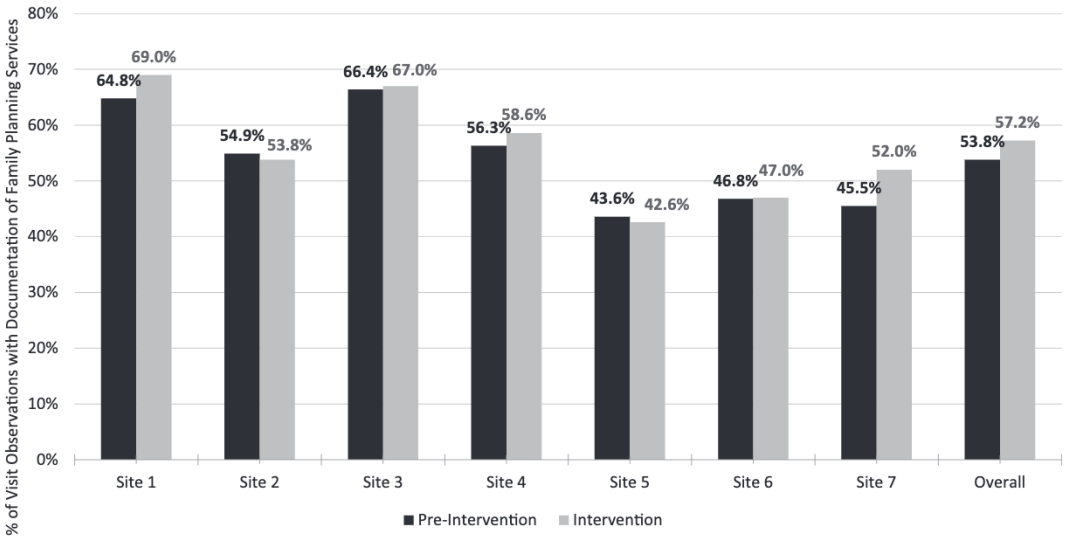

Fig. 3. Change in visit-level documentation of family planning services across seven New York City-based FQHC sites from pre-intervention to intervention periods, adjusted.[a,b] [a]Estimates are adjusted for race and insurance status. [b]Sites 1, 4, 7, and Overall $p < 0.01$; Site 2 $p = 0.26$; Site 3 $p = 0.36$; Site 5 $p = 0.49$; Site 6 $p = 0.93$.

Table 3
Effect modification of patient demographic characteristics on visit-level documentation of family planning services in seven New York City-based FQHC sites.

Subgroup	Effect estimate (percentage points)	95% Confidence interval	
Race			
Asian	2.36	−1.28	6.00
Black/African American	1.63	0.10	3.16
Multiracial	7.23	3.40	11.05
Pacific Islander	2.52	−1.52	6.56
White	2.17	0.20	4.14
Other	3.32	1.94	4.70
Insurance status			
Medicaid	3.45	2.13	4.78
Private	1.06	−0.04	2.57
Other	−1.45	−5.03	2.13
Uninsured	3.04	0.42	5.66
Site			
Site 1	4.20	2.53	5.87
Site 2	−1.18	−3.24	0.89
Site 3	0.64	−0.72	1.99
Site 4	2.31	0.57	4.06
Site 5	−0.92	−3.53	1.69
Site 6	0.18	−3.96	4.32
Site 7	6.55	4.80	8.29

3.3. Patient-level analysis

On the patient-level, in the "intervention" group, 21.9% of patients (311/1,420) with no record of family planning services in the visit prior to clinical decision support implementation had documented family planning services at their next visit with implementation. This compared to 18.2% of controls (247/1,360) who went from no record of family planning services to having documentation of family planning services at their next visit. In unadjusted regression analysis, we found that those exposed to the clinical decision support had 1.26 times the odds (95% CI: 1.17, 1.36) of having documentation of family planning services after implementation compared to controls. This association did not change after adjusting for age group, race, ethnicity, and site; adjusted odds ratio = 1.35 (95% CI: 1.25, 1.45).

4. Discussion

We integrated an electronic medical record-based clinical decision support at an urban family medicine staffed FQHC network and found, with one year of implementation, an overall modest increase in documentation of family planning services for female patients of reproductive age, at both the visit-level and patient-level. This intervention increases the likelihood that individuals receive family planning services. Our results align with evaluations of other clinical decision support tools showing modest effectiveness in improving health care delivery [8,13,14]. Given the number of people served in FQHCs and the frequency with which they may need family planning services, implementing this clinical decision support may help increase preconception and/or contraception service delivery for many.

Despite similar rollout, the intervention effect varied across sites. This is not surprising as other evaluations of health system interventions demonstrate similar variable differences in intervention effect, as pragmatic studies inherently involve a diversity of settings [18,19]. Interestingly, the patient age and site characteristics that we hypothesized would portend a larger effect from the clinical decision support did not correlate with the intervention effect. Sites 1, 7, and 4 experienced the highest increases in documentation of family planning services; yet, site 7 had clinical quality metrics lower than our organizational average and site 1 did not possess an onsite reproductive health champion. Sites 1 and 7 had the highest and lowest unadjusted baseline documentation of family planning services and the strongest and weakest historical capacity to integrate new workflows, respectively. The positive effect on delivery of family planning services at these varied sites suggests that this intervention may be effective in many different primary care settings with factors beyond what we hypothesized affect outcomes. Implementing and evaluating this clinical decision support in additional primary care networks may elucidate setting-level factors that enhance the intervention effect.

While increasing provision of family planning services is important for supporting patients' reproductive goals, some women experience pregnancy ambivalence [20–22], do not want to use preconception or contraception services [23,24], and/or are not at risk of pregnancy. Therefore, reaching 100% documentation of family planning services is neither a realistic nor desirable goal. A recent CDC report found 64.9% of reproductive-aged women currently use contraception. This includes 8.7% using condoms (a method excluded from our analysis). Additionally, 7.5% are either pregnant, postpartum, or seeking pregnancy [25]. If we assume that one-third of this group are seeking pregnancy (therefore could have preconception documentation), approximately 58.7% of

women in the national study meet our criteria for documentation of family planning services. Thus, our high overall baseline documentation of 55.7% already approximated the national average use of family planning services. Our baseline documentation of contraception also met or far exceeded the documentation of contraception outcomes reported from other family planning services clinical decision support tools in primary care practices [8,15]. This may explain the attenuated effect of our clinical decision support. It would be worthwhile to explore the intervention effect at community health centers with lower baseline documentation of family planning services, as most have lower provision of contraception services than the Institute for Family Health [7].

This study had limitations. We were unable to calculate the proportion of our sample at risk for pregnancy (able to get pregnant and having vaginal-penile intercourse), thus our denominator included women who did not need family planning services for pregnancy prevention. Additionally, we relied on electronic medical record data recorded during clinical encounters, which are not designed for research and subject to information bias. While developing our data pull, we identified issues in the documentation of condoms, emergency contraception, and withdrawal, thus excluded them from our definition of family planning services. Therefore, our results may underestimate the proportion of our sample with family planning services. By utilizing documentation of family planning services as an outcome measure, we missed any undocumented discussions around contraception and preconception. This clinical decision support was adapted based on clinic staff and clinician input. As a result, the intervention may not relate to patients' unique experiences and beliefs around contraception and preconception services. This could be an area for future study. Lastly, as this study took place at sites within one organizational network, the results may not be generalizable.

Notwithstanding these limitations, our study demonstrates that this clinical decision support was not only acceptable to staff and feasible to implement [9], but also modestly improved delivery of family planning services in a family medicine staffed FQHC. Prior assessments of tools designed to improve provision of family planning services in primary care and family planning settings have assessed acceptability and feasibility [8,9,26–28], patient knowledge of preconception and contraception [29–31], contraceptive counseling [31,32], and self-reported receipt of contraception [29]. Ours is one of few studies that examines a direct service outcome of electronic medical record documentation [8–10], which more accurately reflects delivery of family planning services. It seems worthwhile to explore the clinical decision support's effect at sites with lower initial provision of family planning services and elucidate site-specific contextual factors that affect outcomes.

Acknowledgements

The authors thank Lisa Maldonado and the Reproductive Health Access Project for supporting the team with expertise and office space throughout the implementation and evaluation of this project.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.contraception.2019.11.002.

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