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Improving Gestational Weight Gain Counseling Through Meaningful Use of an Electronic Medical Record

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Abstract The purpose of this study was to test the effectiveness of an intervention to improve the consistency and accuracy of antenatal gestational weight gain counseling through introduction of a "best practice alert" into an electronic medical record (EMR) system. A best practice alert was designed and implemented in the EMR. Based on each patient's pre-gravid body mass index (BMI), fetal number, and 2009 Institute of Medicine (IOM) guidelines, the alert provides an individualized total gestational weight gain goal, the weight gain goal per week of gestation, a template for scripted provider counseling and documentation, and a patient handout containing personalized gestational weight gain information. Retrospective chart reviews of 388 pre-intervention patients and 345 post-intervention patients were used to evaluate effectiveness. Introduction of a gestational weight gain best practice alert into the EMR improved the rate of antenatal gestational weight gain counseling that was consistent with current IOM guidelines ($p < 0.001$). Improvement in IOM-consistent gestational weight gain counseling was seen across all provider types, including obstetricians, family practice physicians, and certified nurse midwives. The intervention also resulted in significant improvement in documentation of pre-gravid weights and BMIs within the EMR. The EMR is an effective tool for improving the consistency and accuracy of antenatal gestational weight gain counseling in accord with 2009 IOM guidelines.

Keywords Pregnancy · Obesity · Gestational weight gain · Prenatal counseling

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Introduction

Excess gestational weight gain increases risk for numerous health problems in both mother and child, including hypertensive disorders in pregnancy, gestational diabetes, cesarean deliveries, fetal macrosomia, large for gestational age infants, maternal postpartum weight retention, long-term maternal obesity, and pediatric obesity [1–8]. To combat the risks associated with excess weight gain during pregnancy, the Institute of Medicine (IOM) updated its gestational weight gain guidelines in 2009 to reflect the different metabolic needs and risk profiles of women based on pre-conception body mass index (BMI) [8]. However, fewer than half of pregnant women in the US gain weight within the IOM guidelines [8–10]. According to the IOM, "The first step in assisting women to gain within these guidelines is letting them know the guidelines exist, which will require educating health care providers and the women themselves" [8]. Consistent with this recommendation, evidence shows that pregnant women whose health care providers counsel them about their individualized gestational weight gain goal are five times more likely to internalize that goal [11]. Yet fewer than half of pregnant women report receiving gestational weight gain counseling that is consistent with the IOM guidelines [12–14].

In the United States, electronic medical record (EMR) systems are becoming a routine part of medical care. Nationally, 72 % of physicians reported using EMR systems in 2012, up from 57 % in 2011 and 48 % in 2009

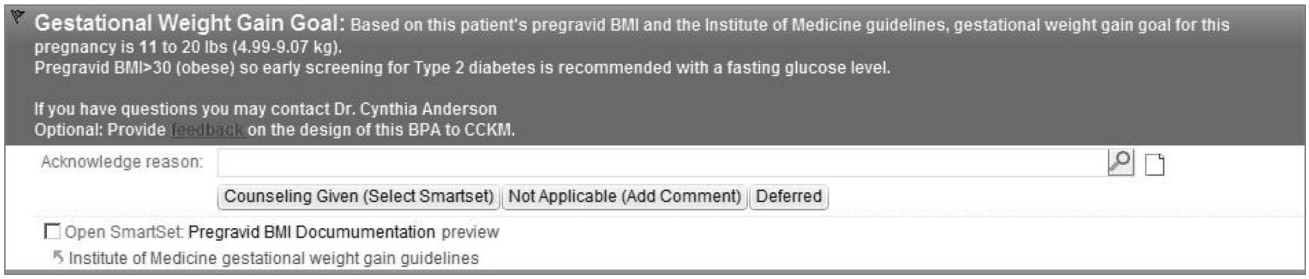

Fig. 1 View of best-practice alert, as seen by ordering physician of a patient with a pre-gravid BMI of 30 or greater

[15]. EMR systems have the potential to improve provider communication and patient care [16–19]. According to the Centers for Disease Control and Prevention, clinical decision support systems, one component of meaningful use initiatives, are "applications that assist clinicians in the provision of care by providing prompts through the analysis of clinical data" [20]. The goal of the current study was to evaluate whether the EMR could serve as an effective tool to improve the accuracy and consistency of antenatal gestational weight gain counseling among prenatal care providers, including family physicians, certified nurse midwives, and obstetricians. We examined whether introduction of a best practice alert into an EMR system would improve IOM-consistent antenatal gestational weight gain counseling as an important first step towards improving quality of care, promoting healthy gestational weight gain, and reducing rates of obesity-related adverse maternal and neonatal outcomes.

Methods

Intervention Design

An intervention to facilitate consistent and accurate gestational weight gain counseling was designed in collaboration with all provider types—including certified nurse midwives, family physicians, and obstetricians—that deliver prenatal care through a multi-site health care system in the Midwest. The intervention included addition of an educational "best practice alert" (see Fig. 1) within the "OB Navigator" portion of the health care system's EMR. Within the EMR, pre-gravid body mass index (BMI) is automatically calculated using pre-pregnancy weight and height. Prior to this project, corresponding gestational weight gain goals based on 2009 IOM guidelines were not provided and there was no prompt within the OB Navigator to promote gestational weight gain counseling.

The best practice alert automatically calculates each patient's individualized total gestational weight gain goal and weekly weight gain goal based on pre-gravid BMI, fetal number, and the 2009 Institute of Medicine guidelines. The alert prompts the provider to counsel the patient about gestational weight gain, i.e. to inform her of the appropriate individualized gestational weight gain goal for her pregnancy. The best practice alert provides a template for scripted counseling and documentation within the accompanying "Smart Set." The "Smart Set" also includes commonly indicated diagnosis codes and provides personalized patient instructions about healthy gestational weight gain that auto-populate the patient's after visit summary, which is provided to the patient electronically or in print depending on patient preference. Finally, the best practice alert includes links to the 2009 IOM gestational weight gain guidelines and to the senior investigator to facilitate delivery of provider feedback on the functionality.

Within the best practice alert, providers select "Counseling Given" and use the accompanying "Smart Set" described above when counseling has been delivered. Counseling can be deferred until the next visit by selecting "Deferred." For patients experiencing miscarriage or ectopic pregnancy, providers can select "Not Applicable" and may optionally include a note regarding the reason why gestational weight gain counseling is not relevant. The EMR includes a tracking feature, which could be used to provide individual feedback to providers regarding utilization and quality of care measures.

Prior to implementation of the best practice alert, group meetings were held with certified nurse midwives, obstetricians, and family physicians to pilot the best practice alert and solicit feedback for improvement. This facilitated education regarding the revised 2009 IOM guidelines and the importance of gestational weight gain counseling, prompted development of an improved nursing protocol to input pre-gravid weight and height into the EMR, and established consensus about the need for the project. Provider discomfort in discussing weight issues was identified as a barrier to counseling, so scripted text was developed to ensure a consistent, positive message. Based on provider input, the "Smart Set" was expanded to include a prompt to promote nutrition/dietary referrals for overweight and obese women and a prompt to screen for undetected Type II diabetes in women who enter pregnancy obese

(BMI $\geq$ 30) or overweight (BMI 25–29.9) with a diabetes risk factor (history of gestational diabetes, prior infant weight >9 pounds, first degree relative with diabetes, high risk ethnic group, history of polycystic ovary syndrome or glucose intolerance, medical comorbidity including hypertension or heart disease). Provider education included a Grand Rounds session, which focused on the topic of gestational weight gain and its sequalae and introduced the new best practice alert to prenatal providers prior to implementation. The senior author conducted clinic site visits to answer questions and to assist prenatal providers with use of the new EMR functionality.

Data Collection

To evaluate effectiveness, retrospective chart reviews were conducted of women whose prenatal care occurred before and after implementation of the best practice alert in five ambulatory clinics, including two obstetrics clinics, two family practice clinics, and one certified nurse midwife clinic, representing both hospital-based and community-based sites. Clinics chosen for inclusion provide the highest volume of prenatal care within the health system. Billing records were used to generate a list of women seen for postpartum care at one of the five targeted clinics between June 2011 and September 2011, i.e. the pre-intervention sample, and a list of women who initiated new prenatal care at one of the five targeted clinics between April 15, 2012 and July 15, 2012, i.e. the post-intervention sample. Charts were excluded from review if the patient received the majority of her prenatal care outside the health system, if the gestational number was greater than two (i.e. triplets, quadruplets), or if the pregnancy resulted in loss prior to 12 weeks gestation. The project was reviewed and approved as exempt by the University of Wisconsin Health Sciences Institutional Review Board as a quality improvement initiative.

Study data were collected and managed using REDCap electronic data capture tools [21]. REDCap (Research Electronic Data Capture) is a secure, web-based application designed to support data capture for research studies, providing: (1) an intuitive interface for validated data entry; (2) audit trails for tracking data manipulation and export procedures; (3) automated export procedures for seamless data downloads to common statistical packages; and (4) procedures for importing data from external sources.

The University of Wisconsin Institute for Clinical and Translational Research (UW ICTR), Office of Clinical Trials, coordinated data abstraction from each patient's EMR, including data on clinic site, provider type (obstetrics, family practice, midwife), age, race/ethnicity, gravida/parity, gestational number (singleton, twin), pre-pregnancy weight and height, pre-pregnancy BMI, and gestational weight gain counseling. All provider and patient data were de-identified to maintain confidentiality. 10 % of charts were abstracted by two independent reviewers and results compared to ensure agreement. Reviewers had 100 % agreement on most variables and greater than 90 % agreement on all variables.

Gestational Weight Gain Counseling

We anticipated that providers would document counseling related to weight, diet, physical activity, and gestational weight gain in different ways, so a thorough search of each patient's EMR was conducted with attention to the problem list, provider progress notes, prenatal education checklists, telephone encounter notes, and referrals. All instances of provider counseling about diet, exercise, weight, and gestational weight gain were recorded. Patients were then categorized into four levels of gestational weight gain counseling: no counseling; counseling about weight, diet, or physical activity (including safety of particular foods and exercise activities) but not gestational weight gain; gestational weight gain counseling with an IOM-discordant goal; and gestational weight gain counseling with an IOM-consistent goal.

Data Analysis

First, descriptive statistics were computed to characterize the clinical and demographic characteristics of the pre-intervention and post-intervention samples. Then, Chi square analyses were used to examine pre-intervention vs. post-intervention differences in the proportion of patients with pre-gravid heights, weights, and BMIs documented in the EMR. Finally, Chi square analyses were conducted to examine pre-intervention vs. post-intervention differences in antenatal gestational weight gain counseling, overall and among each specific provider type.

Results

Results are based on retrospective chart reviews of 388 patients who delivered prior to the intervention and 345 patients who initiated prenatal care after introduction of the best practice alert into the EMR. Demographic and clinical characteristics of the groups are presented in Table 1. As presented in the table, a majority of both the pre- and post-intervention groups were seen by obstetricians, with smaller proportions seen by midwives or family physicians. Among patients whose pre-gravid BMIs were documented in the EMR, 41.6 % of the pre-intervention sample and 44.1 % of the post-intervention sample were overweight or obese at conception. Prior to the intervention, 91.0 % of

Table 1 Patient Characteristics

Characteristic	Pre-intervention (n = 388)	Post-intervention (n = 345)
Maternal age (years)	31.07 ± 4.81	29.93 ± 5.35
Maternal race[a]		
White	296 (78.1)	235 (83.3)
Asian	36 (9.5)	25 (8.9)
Non-Hispanic Black	22 (5.8)	14 (5.0)
Hispanic/Latina	22 (5.8)	6 (2.1)
American Indian/Pacific Islander	3 (0.8)	2 (0.7)
Number of prior deliveries		
0	171 (44.1)	167 (48.4)
1	146 (37.6)	111 (32.2)
2	49 (12.6)	44 (12.8)
3 or more	21 (5.4)	23 (6.7)
Pre-gravid BMI classification[a]		
Underweight	13 (4.2)	9 (2.9)
Normal weight	168 (54.2)	167 (53.0)
Overweight	71 (22.9)	74 (23.5)
Obese	58 (18.7)	65 (20.6)
Provider type		
Obstetrician	263 (67.8)	238 (70.8)
Family practice	56 (14.4)	59 (17.6)
Certified nurse midwife	69 (17.8)	39 (11.6)

Data are mean ± SD or n (%)

BMI body mass index, *EMR* electronic medical record

[a] Maternal race and pre-gravid BMI classifications are for patients whose race/ethnicity and pre-gravid BMI were documented in the EMR. Race was unspecified in the EMRs of 9 (2.3 %) patients in the pre-intervention group and 63 (18.3 %) patients in the post-intervention group. Pre-gravid BMI was missing from the EMRs of 78 (20.1 %) patients in the pre-intervention group and 30 (8.7 %) patients in the post-intervention group

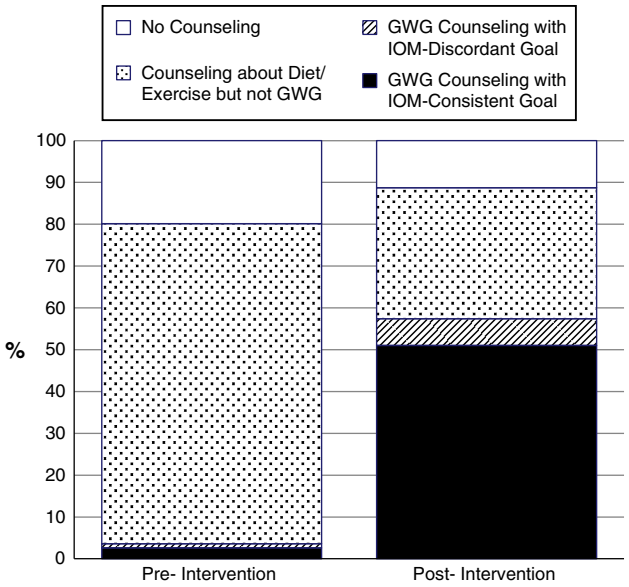

Fig. 2 Gestational weight gain (GWG) counseling rates, before and after implementation of a best-practice alert in the EMR

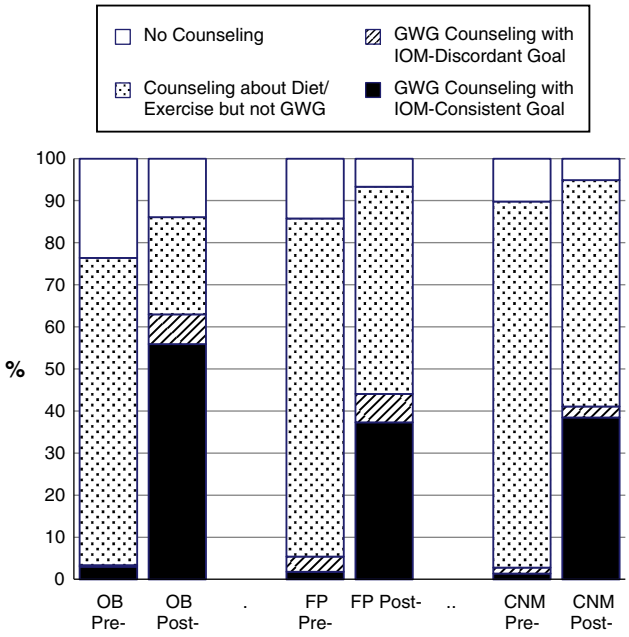

Fig. 3 Gestational weight gain (GWG) counseling rates for obstetricians (OB), family physicians (FP), and certified nurse midwives (CNM), before and after implementation of a best-practice alert in the EMR

charts contained a documented pre-gravid weight compared to 95.4 % after the intervention, $\chi^2(1) = 5.42$, $p = 0.02$. Documentation of pre-gravid height was statistically unchanged, present in 94.1 % of pre-intervention charts and 95.7 % of post-intervention charts, $\chi^2(1) = 0.93$, $p = 0.34$. The proportion of women with a documented pre-gravid BMI increased from 79.9 to 91.3 % through the study period, $\chi^2(1) = 18.92$, $p < 0.001$.

As illustrated in Fig. 2, the intervention was associated with significant change in the overall pattern of gestational weight gain counseling, $\chi^2(3) = 259.63$, $p < 0.001$. The rate of gestational weight gain counseling consistent with 2009 IOM guidelines improved from 2.6 % before the intervention to 51.0 % after the intervention, $\chi^2(1) = 226.26$, $p < 0.001$. Only 3.6 % of charts in the pre-intervention sample contained a numerical weight gain goal for pregnancy compared to 57.4 % after introduction of the best practice alert, $\chi^2(1) = 256.96, p < 0.001$. Among those who received a numerical gestational weight gain goal, 71.4 % in the pre-intervention group received a gestational weight gain goal that was consistent with the 2009 IOM guidelines compared to 93.6 % after the intervention, $\chi^2(1) = 8.80$, $p = 0.003$.

As seen in Fig. 3, gestational weight gain counseling patterns differed across provider types at both pre-intervention, $\chi^2(6) = 12.90$, $p = 0.05$, and post-intervention, $\chi^2(6) = 26.71$, $p < 0.001$. However, rates of gestational weight gain counseling consistent with 2009 IOM guidelines improved among all prenatal provider types. Among obstetricians, the rate of IOM-consistent counseling increased from 3.0 % before the intervention to 55.9 % after, $\chi^2(1) = 172.50$, $p < 0.001$. Among family physicians, the rate of IOM-consistent counseling increased from 1.8 % before the intervention to 37.3 % after, $\chi^2(1) = 22.63$, $p < 0.001$. Among certified nurse midwives, the rate of IOM-consistent counseling increased from 1.4 % before the intervention to 38.5 % after, $\chi^2(1) = 27.05$, $p < 0.001$.

Discussion

Introduction of an educational best practice alert into the EMR resulted in significant improvement in rates of antenatal gestational weight gain counseling consistent with 2009 IOM guidelines. Improvement was seen among all prenatal care provider types, including family physicians, certified nurse midwives, and obstetricians.

Although the current study focused on a low-risk prenatal population in a single health care system, the finding that an EMR alert was sufficient to substantially improve gestational weight gain counseling over a period of months highlights the potential of EMRs to improve patient care via meaningful use initiatives. Our findings reinforce previous research demonstrating the utility of EMRs to improve practice in obstetrics and gynecology [16–19]. Although previous research has indicated low rates of counseling about gestational weight gain [12–14], research has also identified enthusiasm among obstetrics providers for "EMR-based supports, such as a reference for recommended gestational weight gain for each patient based on pre-pregnancy body mass index… [and] features which many felt would remind them to counsel patients about excessive weight gain" [22]. The current study builds on that research by demonstrating that such interventions are both feasible and effective.

We do not yet know whether improvements in gestational weight gain counseling, such as those seen in this current study, are sufficient to affect patients' actual gestational weight gain. Nevertheless, giving providers tools to address weight gain during prenatal visits and making guidance about gestational weight gain a routine part of prenatal care is an important endpoint in its own right. As the Institute of Medicine noted, it is an important first step toward helping women achieve healthy weight gain in pregnancy [8].

Currently, Medicare and Medicaid EHR Incentive Programs provide payments to physicians as they demonstrate "meaningful use" of EMR technology. In 2012, two-thirds of office-based physicians report that they planned to apply or had already applied for meaningful use incentives [15]. As the adoption of EMRs become more widespread and the underlying technology becomes more sophisticated, interventions such as the one described in this study may have greater reach. Educational best practice alerts regarding health topics like the risk of excessive gestational weight gain are an attractive target for meaningful use of the EMR. Accompanying suggested practices, such as nutrition referrals and early diabetes screening, could provide clinical decision support via such meaningful use initiatives. Evaluation of these aspects of our best practice alert are ongoing.

Involvement of all provider types, including nursing staff, in the development of the intervention was essential to its success, because it allowed us to identify and address gaps in workflow that prevented entry of patients' pregravid BMIs into the EMR, a prerequisite to accurate antenatal gestational weight gain counseling. Although there were differences in gestational weight gain counseling patterns across the provider types, all provider types showed marked improvement in gestational weight gain counseling consistent with 2009 IOM guidelines. Importantly, this study prompted collaboration and communication across departments, which has led to ongoing efforts to coordinate and improve prenatal care across all provider types in our health system.

Another strength of the current study was its use of universal, scripted counseling and documentation via the best practice alert. Provider discomfort discussing weight issues was identified as a barrier to counseling during study development, a finding in keeping with other research on this topic [23]. Interdisciplinary, collaborative development of scripted counseling focusing on a positive message was vital in overcoming provider concerns about the sensitivity of discussing weight with patients. Despite other evidence that provider advice about diet can be effective in impacting birth outcomes [24], counseling alone is not anticipated to be sufficient to ensure healthy gestational weight gain. The EMR tool is only a first step toward promoting consistent provider knowledge of current guidelines, promoting improved education for patients, providing individual feedback to providers regarding utilization and quality of care measures, and identifying women who may benefit from more intensive interventions to promote healthy gestational weight gain.

Although this study had a number of strengths, it also has limitations that suggest questions for further research. First, to maximize effectiveness of the intervention, the study design intentionally combined technological

innovation via implementation of a best practice alert in the EMR with educational initiatives that exposed providers to the current IOM guidelines. Thus, the Hawthorne effect, a learning effect, and demand characteristics were all intentionally used to improve provider behavior regarding antenatal gestational weight gain counseling. The lack of control group prevents us from knowing definitively that the observed changes were a result of the intervention rather than some other change in the environment. Future research will be necessary to disentangle whether the best practice alert alone will result in sustained improvement in gestational weight gain counseling. The use of retrospective chart reviews to assess gestational weight gain counseling limited our outcome measure to counseling that was documented in the EMR. This may partially explain why counseling rates in this study were lower than has been found in some previous studies, i.e. the counseling rates reported here may under-report providers' actual counseling rates to the extent that gestational weight gain is discussed but not documented. Future research should assess correspondence between provider behavior and documentation. Previous studies also have shown a discrepancy between providers' and patients' reports of gestational weight gain counseling [25]. Therefore, a further test of effectiveness would be to examine whether documented counseling using the best practice alert is linked to increased patient knowledge and internalization of gestational weight gain goals. Finally, provider fatigue regarding electronic notifications may have limited the uptake and use of the current intervention [26], in part explaining why post-intervention counseling was not universal.

Next steps should include testing whether the EMR intervention is linked to improvements in measurable patient screening rates and outcomes such as increasing nutrition referrals and early diabetes screening for overweight/obese gravidas, increasing the proportion of women achieving healthy gestational weight gain, and improving key pregnancy-associated maternal and child health outcomes.

Conclusions

Introduction of an educational best practice alert into the EMR resulted in significant improvement in rates of antenatal gestational weight gain counseling consistent with 2009 IOM guidelines. This study suggests that the EMR is an effective tool for improving the consistency and accuracy of antenatal gestational weight gain counseling and highlights the potential of EMRs to improve patient care via meaningful use initiatives.

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Conflict of interest The authors have nothing to disclose.

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