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Remote Patient Monitoring for Diabetes in Pregnancy Improves Outcomes

Learning Objectives

- Describe how implementation of remote patient monitoring (RPM) for outpatient management of diabetes in pregnancy can improve maternal and neonatal outcomes
- Illustrate the application of technological solutions using the electronic health record platform and mobile health apps to complement remote patient monitoring services and improve care

Background

- Diabetes affects 6-10% of pregnancies in the U.S. and is associated with maternal and neonatal morbidities[1,2]
- Close maternal glycemic monitoring and timely treatment mitigates these risks
- **Barriers**: Patients are typically diagnosed in 3rd trimester and need to attain proficiency in diabetes management within a limited time frame
  - Clinicians rely on patient-reported glucose logs for surveillance and management
- Traditional management utilizes paper logs of glucose values that patients periodically bring into office for review
- Remote patient monitoring is a telehealth modality that allows clinicians to monitor, report, and analyze a patient's acute or chronic condition from outside the hospital or clinic setting
  - Critical enabler to home-based care
- **Goal:** Transition from paper-based monitoring to RPM for management of diabetes at NYU Langone Hospital Long Island Diabetes In Pregnancy Program
  - Improve patient experience
  - Facilitate easier glycemic surveillance
  - Improve maternal and neonatal clinical outcomes

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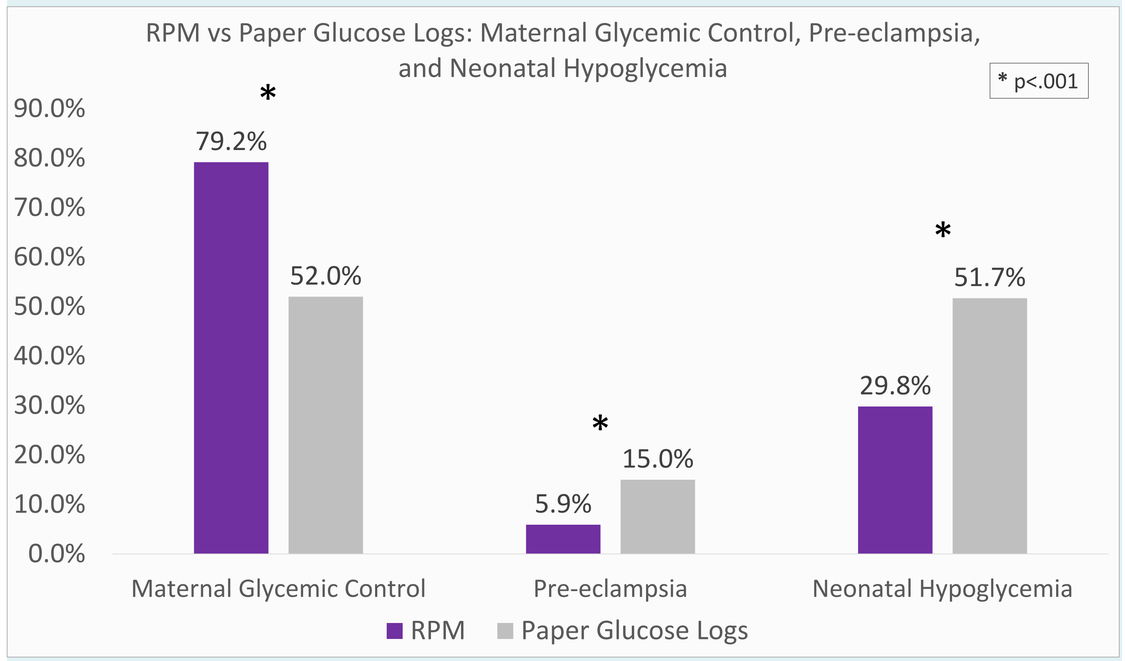
Using remote patient monitoring technology to manage diabetes in pregnancy improves maternal glycemic control and decreases neonatal hypoglycemia.



SCAN ME

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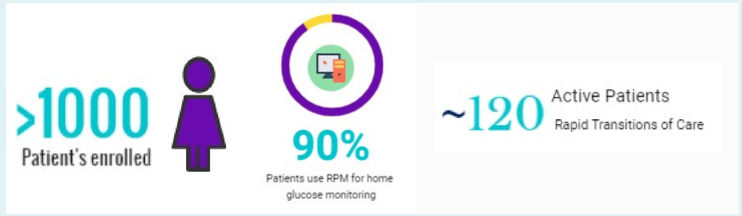
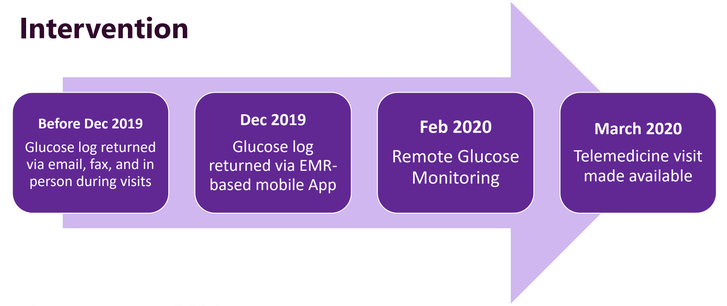


Intervention



- Implemented RPM technology for glycemic surveillance in pregnancy
- Established an operational workflow for enrollment, education, surveillance, management, and tracking of patients
- Partnered with Health System IT to augment the existing EHR-based RPM platform, including creation of provider pools, enhanced RPM documentation encounters, and reporting tools
- Built-in safety features:
  - Abnormal value warning
  - Triggers for more expeditious review
- Leveraged device integration and telemedicine to augment services

Outcome

Patients managed with RPM:

- Were more likely to achieve glycemic control (**79.2%** vs 59.0%)
- Submitted more glucose values (**177** vs 146)
- Achieved glucose in target range sooner (**3.3 weeks** vs 4.1 weeks)
- Had a decreased rate of preeclampsia (**5.8%** vs 15%)
- Gave birth to neonates less likely to experience hypoglycemia (**29.8%** vs 51.7%)

Lessons Learned

- RPM for diabetes in pregnancy is superior to a paper-based approach
- Partnership with the Medical Center Information Technology team is critical to success of RPM programs
- Combining clinical expertise with innovative technological solutions is key

Key Takeaways

Application of remote patient monitoring to pregnancy-related conditions is integral to improving maternal and neonatal outcomes

References

1. Diabetes During Pregnancy. Centers for Disease Control and Prevention, Division of Reproductive Health. Updated June 12, 2018. Accessed November 27, 2022. https://www.cdc.gov/reproductivehealth/maternalinfanthealth/diabetes-during-pregnancy.htm
2. Committee on Practice Bulletins—Obstetrics. Practice Bulletin 190: Gestational diabetes mellitus. Obstet Gynecol 2018;131(2):e49-e64.

Glycemic control characteristics of study groups: standard diabetic management with paper glucose logs vs remote patient monitoring

Characteristics	Remote Patient Monitoring (n=360)	Paper glucose logs (n=173)	*P* value
Percentage of mothers who achieved glycemic control	285 (**79.2%**)	90 (52.0%)	<.0001
Number of blood glucose values recorded	**177** (116–260)	146 (95–235)	.008
Mean number of glucose values per week	22.6 (17.5–26.2)	22.3 (18.4–25.8)	.685
Number of encounters for management of diabetes:			
In-person	0 (0–1)	2 (2–3)	<.0001
Telemedicine	3 (1–3)	0 (0–0)	<.0001
Phone calls or messages	9 (6–14)	5 (3–9)	<.0001
Total	12 (9–17)	8 (5–12)	<.0001
Number of weeks until glycemic control achieved	**3.3** (2.1–5.5)	4.1 (2.6–6.8)	.025
Gestational age when glycemic control achieved (weeks)	32.7 (30.3–34.7)	32.8 (30.4–35.9)	.472
Percentage of mothers started on metformin	100 (27.8%)	48 (27.8%)	.994
Percentage of mothers started on insulin	103 (28.7%)	49 (28.3%)	.930
Number of changes to glycemic management	4 (2–10)	4 (2–8)	.455

Pregnancy, delivery, and maternal outcomes

Outcomes	Remote Patient Monitoring (n=360)	Paper glucose logs (n=173)	P value
Antenatal corticosteroids	26 (7.2%)	9 (5.2%)	.378
Gestational hypertension	21 (5.8%)	5 (2.9%)	.201
Preeclampsia	21 (**5.8%**)	26 (15.0%)	.0008
Gestational age at delivery (wk)	38.3±1.7	38.4±1.5	.543
Induction of labor	136 (37.8%)	58 (33.5%)	.340
Mode of delivery:			
NSVD	187 (51.9%)	82 (47.4%)	
Operative delivery	6 (1.7%)	6 (3.5%)	.451
Cesarean delivery	162 (45.0%)	82 (47.4%)	
VBAC	5 (1.4%)	3 (1.7%)	
Third- or fourth-degree laceration	7 (1.9%)	3 (1.7%)	1.000
Shoulder dystocia	2 (0.6%)	2 (1.2%)	.599
Chorioamnionitis or endometritis	6 (1.7%)	7 (4.1%)	.131
Postpartum hemorrhage requiring blood transfusion	5 (1.4%)	3 (1.7%)	.719
Postpartum hysterectomy	0	0	1.000
Wound infection or separation	0	0	1.000
VTE	0	0	1.000
Maternal admission to ICU	1 (0.28%)	0 (0.0%)	1.000

Neonatal outcomes

Outcomes	Remote Patient Monitoring (n=360)	Paper glucose logs (n=173)	P value
Birthweight (g)	3184.9±535.4	3264.1±507.3	.104
Birthweight percentile	45.5 (23–73)	56 (26–78)	.048
Ponderal index	3.0±7.1	2.5±0.3	.283
LGA	43 (11.9%)	23 (13.3%)	.658
Apgar, 1 min	9 (9–9)	9 (9–9)	.643
Apgar, 5 min	9 (9–9)	9 (9–9)	.406
First neonatal glucose:			
<30	16 (4.5%)	4 (2.3%)	
30–45	65 (18.1%)	41 (23.8%)	.173
>45	278 (77.4%)	121 (73.8%)	
Neonatal hypoglycemia	107 (**29.8%**)	89 (51.7%)	<.0001
Hyperbilirubinemia requiring phototherapy	47 (13.1%)	33 (19.1%)	.069
Umbilical cord pH <7.00	1 (0.3%)	2 (1.5%)	.205
5 min Apgar <7	3 (0.8%)	1 (0.6%)	1.000
Respiratory morbidity	24 (6.7%)	16 (9.3%)	.294
Meconium aspiration	0 (0.0%)	0 (0.0%)	1.000
Intraventricular hemorrhage	3 (0.9%)	2 (1.2%)	.662
Necrotizing enterocolitis	1 (0.3%)	0 (0.0%)	1.000
Sepsis	1 (0.3%)	1 (0.6%)	.544
Pneumonia	0 (0.0%)	1 (0.6%)	.323
Seizures	0 (0.0%)	0 (0.0%)	1.000
Hypoxic ischemic encephalopathy	0 (0.0%)	1 (0.6%)	.325
Trauma	1 (0.3%)	2 (1.2%)	.248
Brain or body cooling	0 (0.0%)	1 (0.6%)	.325
NICU admission	66 (18.3%)	39 (22.5%)	.524