

Remote Monitoring/Early Diagnosis

Sindhu Srinivas, MD, MSCE
Professor, Vice Chair for Quality and Safety
Department of Obstetrics and Gynecology,
Division of Maternal Fetal Medicine
University of Perelman SOM

Associate Chief Medical Officer -Quality
and Safety, Hospital of the University of
Pennsylvania



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SPORTS

Tori Bowie, an elite Olympic athlete, died of complications from childbirth

June 13, 2023 · 3:58 PM ET

By [Bill Chappell](#)

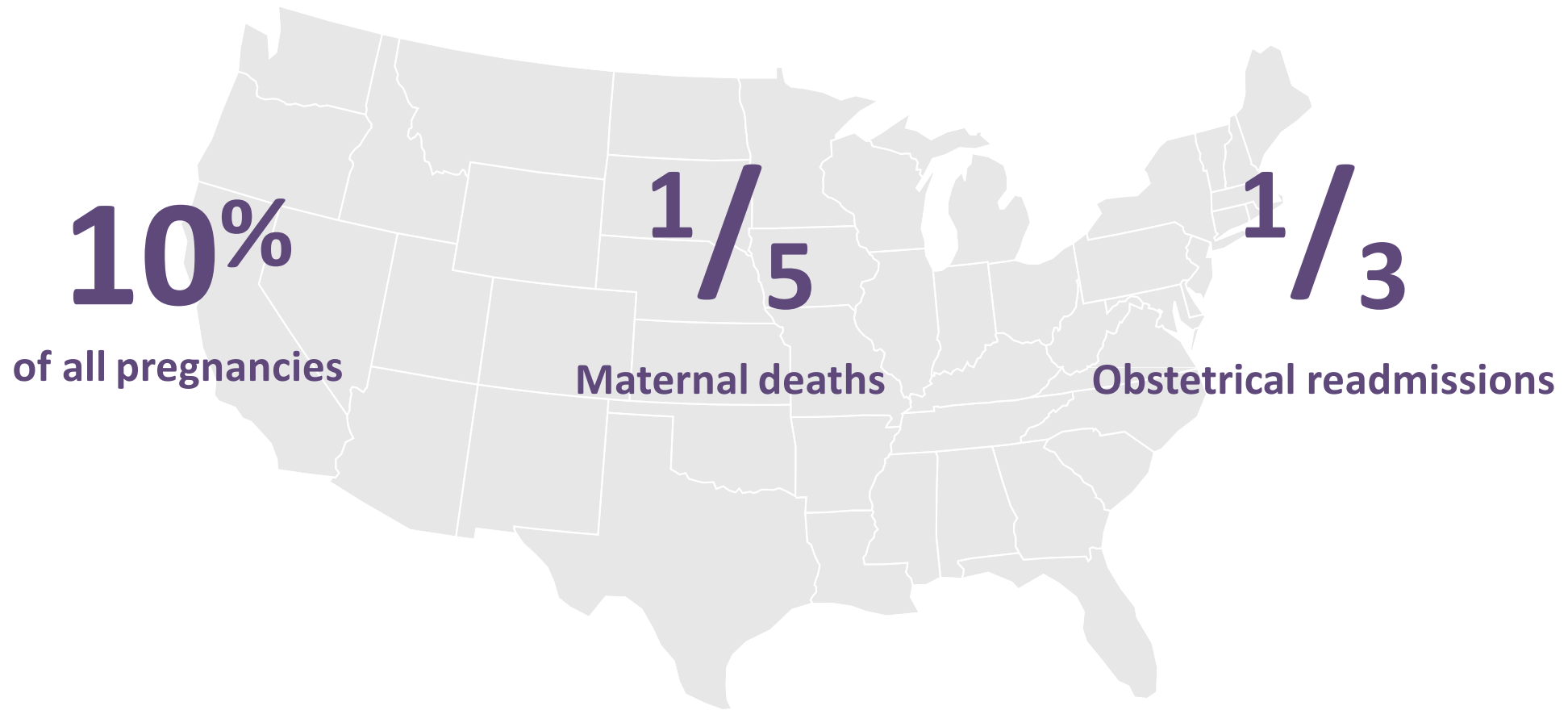


Tori Bowie, who captured gold as a sprinter in the Olympics and the world championships, died at age 32 from complications of childbirth, according to an autopsy report.

Matthias Hangst/Getty Images



The national burden of pregnancy-related hypertension



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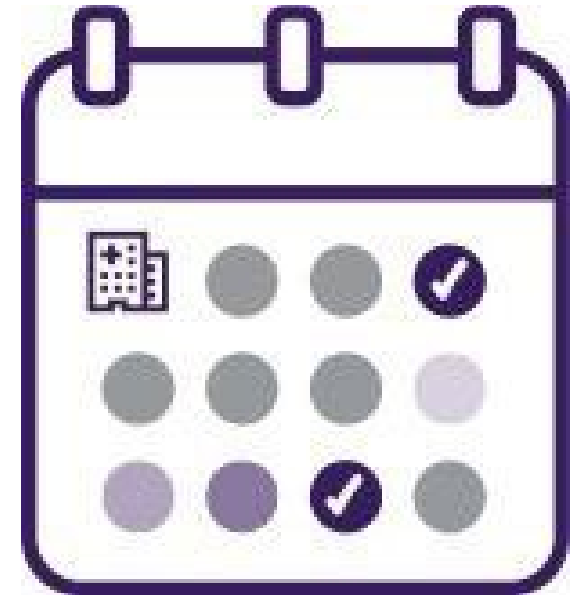
The national burden of pregnancy-related hypertension

- Nearly 75% of maternal deaths associated with hypertensive disorders occur postpartum
- Nearly 40% occur > 48 hours postpartum, often after obstetrical discharge
- The highest risk for postpartum stroke is during the first 10 days after hospital discharge

Call to action



ACOG
The American College
Of Obstetricians &
Gynecologists



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Heart Safe Motherhood

Remote BP texting and monitoring for 10 days after discharge





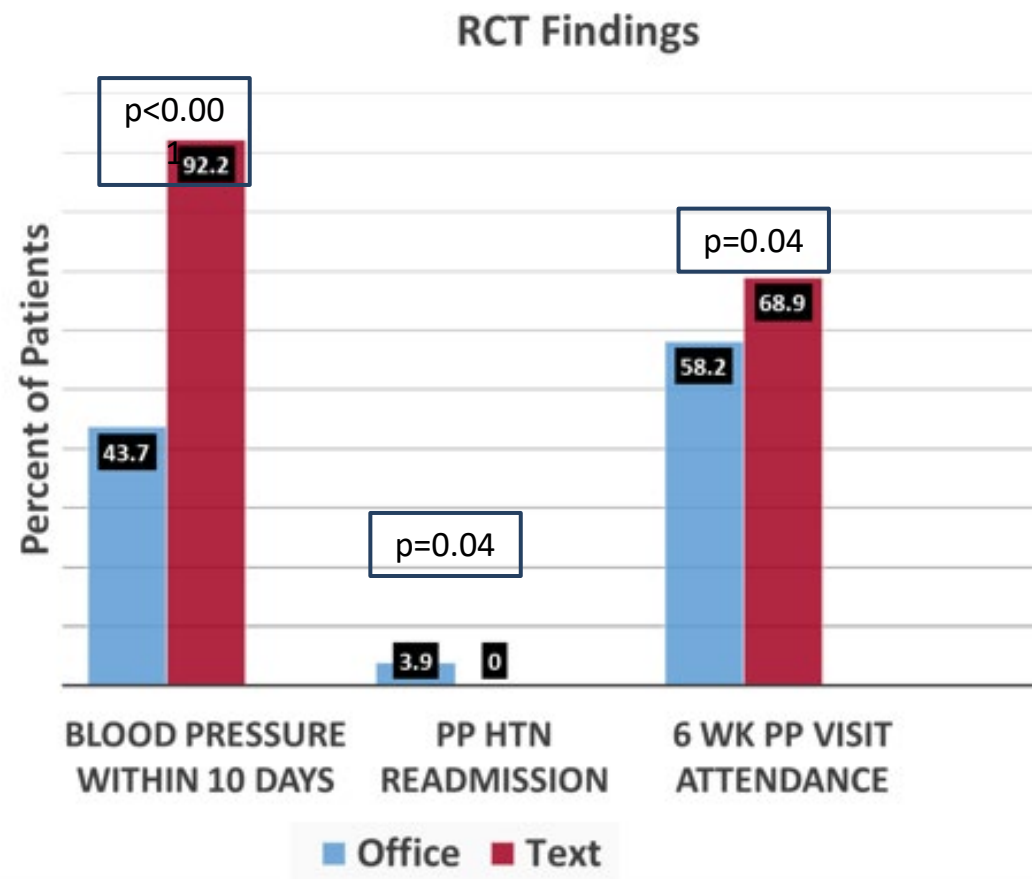
Heart Safe Motherhood

ORIGINAL RESEARCH

Comparing standard office-based follow-up with text-based remote monitoring in the management of postpartum hypertension: a randomised clinical trial

Adi Hirshberg, Katheryne Downes, Sindhu Srinivas

BMJ Qual Saf 2018; 27(11):871-877

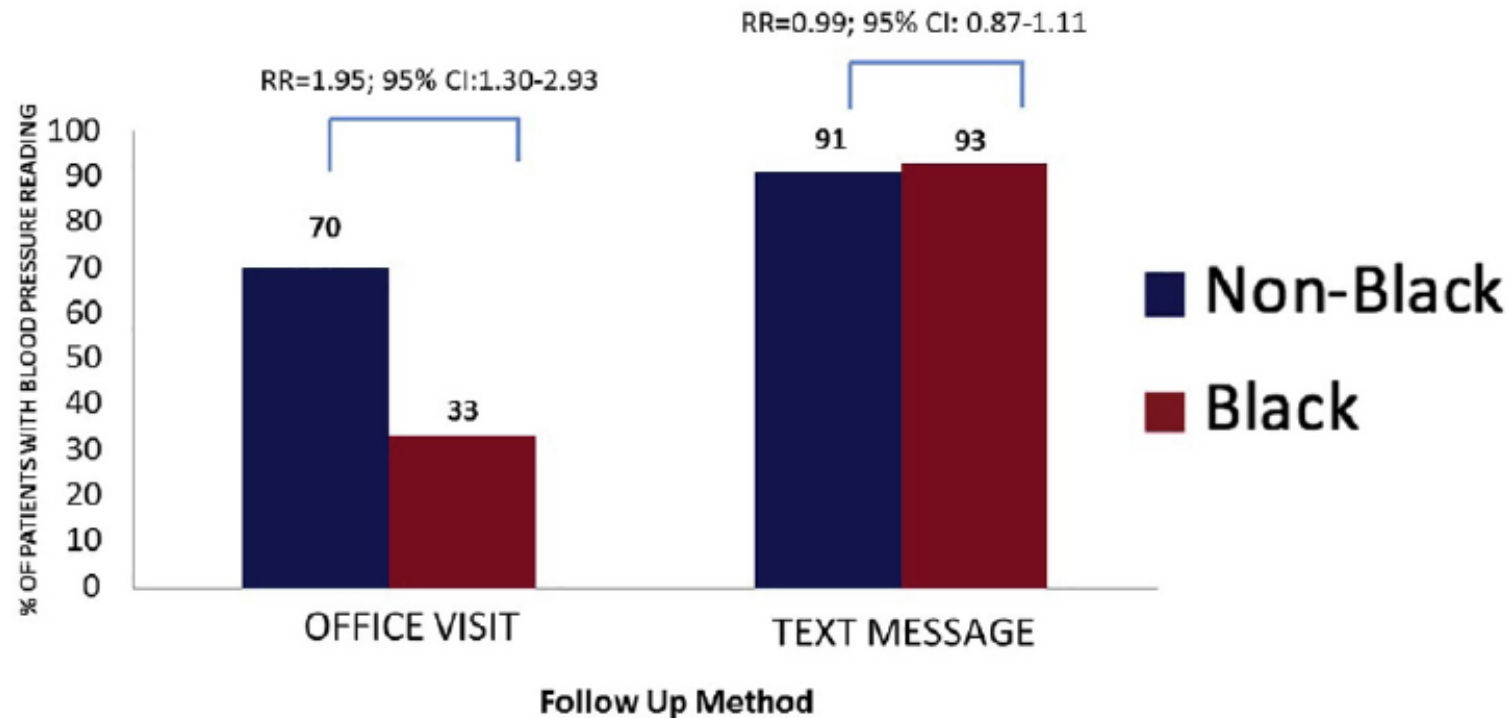


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TextBP-RCT: Reduction in racial disparities

FIGURE

Postpartum blood pressure ascertainment by race and follow-up method



CI, confidence interval; RR, relative risk.

Hirshberg. Text messaging remote blood pressure monitoring. *Am J Obstet Gynecol* 2019.

About the program

Heart Safe Motherhood is a text-message based, remote monitoring program for postpartum women with pregnancy-related hypertension and chronic hypertension during pregnancy. *Our goal is to provide convenient, safe care for women in the immediate postpartum period.*

Heart Safe Motherhood is an evidence-based approach to patient identification, engagement, and early intervention developed at Penn Medicine.

It is enabled by a bi-directional, text-based platform that generates automated, real-time feedback to patient-reported blood pressure readings while alerting providers to values that require intervention.



Scalable monitoring-Diagnostic Excellence

☐ 1000021406

| | 11/01 | 11/02 | 11/03 | 11/04 | 11/05 | 11/06 | 11/07 | 11/08 | 11/09 | 11/10 |
|--------------------------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Morning Blood Pressure | | 123/77 | | 120/74 | 126/79 | 118/76 | 126/82 | 126/78 | 126/82 | 126/82 |
| Lunch Coverage | | | 116/76 | | | | | | | |
| Afternoon Blood Pressure | | 118/74 | 124/76 | 118/76 | 124/82 | | 118/74 | | 124/78 | 124/76 |
| Night Coverage | | | | | | 124/78 | | 120/78 | | |

☐ 1000021319

| | 10/31 | 11/01 | 11/02 | 11/03 | 11/04 | 11/05 | 11/06 | 11/07 | 11/08 | 11/09 |
|--------------------------|--------|--------|--------|----------|----------|--------|--------|--------|--------|----------|
| Morning Blood Pressure | | 148/98 | | 139/95 | 150/1... | | 140/97 | 133/94 | | |
| Lunch Coverage | | | 157/94 | | | 147/97 | | | 149/97 | |
| Afternoon Blood Pressure | 152/96 | 155/98 | | 146/1... | | 143/99 | 143/97 | 143/90 | 139/92 | 151/1... |
| Night Coverage | | 155/98 | | | | | | | | |

☐ 1000021331

| | 10/31 | 11/01 | 11/02 | 11/03 | 11/04 | 11/05 | 11/06 | 11/07 | 11/08 | 11/09 |
|--------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Morning Blood Pressure | 143/88 | 128/86 | 123/87 | 144/89 | | 135/88 | 132/84 | 120/76 | 126/80 | 119/78 |
| Lunch Coverage | | | | | | | | | | |
| Afternoon Blood Pressure | 149/86 | 134/85 | 132/88 | 146/91 | 119/77 | 128/85 | | | | 121/76 |
| Night Coverage | | | | | | | | | 128/86 | |



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The Heart Safe Motherhood experience



**A diagnosis of
pregnancy related
hypertension**



**Getting engaged and
empowered**



**An early warning and
timely response**



**Staying safe
from home**



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Adverse Outcomes-Long term impact

Adverse Event Counts and Percentages 6 Months Post discharge, Program Participants Compared With Those in the Asynchronous Comparison Cohort

| Outcome | Program (n=1,021) | Cohort A (n=1,021) | Difference (% Difference) | P | OR (95% CI) |
|-------------------------------|-------------------|--------------------|---------------------------|------|---------------------|
| Composite adverse outcome | 30 (2.9) | 48 (4.7) | −18 (38) | .038 | 0.61 (0.40–0.98) |
| Individual outcomes | | | | | |
| Stroke | 2 (0.20) | 4 (0.39) | −2 | | |
| DIC | 1 (0.10) | 3 (0.30) | −2 | | |
| Eclampsia | 3 (0.30) | 6 (0.59) | −3 | | |
| Pulmonary edema | 5 (0.49) | 9 (0.88) | −4 | | |
| Renal injury or liver failure | 8 (0.78) | 10 (0.10) | −2 | | |
| HELLP syndrome | 4 (0.39) | 7 (0.69) | −3 | | |
| Myocardial infarction | 3 (0.30) | 4 (0.39) | −1 | | |
| Cardiomyopathy | 4 (0.39) | 5 (0.49) | −1 | | |

Cohort A, asynchronous comparison group; OR, odds ratio; DIC, disseminated intravascular coagulation; HELLP, hemolysis, elevated liver enzymes, and low platelet count.

Data are n (%) unless otherwise specified.

OBSTETRICS & GYNECOLOGY

[Association of a Remote Blood Pressure Monitoring Program With Postpartum Adverse Outcomes](#)

Hirshberg, Adi et al. Obstetrics & Gynecology June 2023.

Long-Term Impact and Cost Savings

Table 4. Health Care Utilization and Cost Outcomes 6 Months Postdischarge, Program Participants Compared With Those in the Asynchronous Comparison Cohort

| Outcome | Program (n=1,021) | Cohort A (n=1,021) | Difference (% Difference)* | P | OR (95% CI) |
|------------------------|-------------------|--------------------|----------------------------|-------|------------------|
| Cardiologist visits | 122 (11.9) | 93 (9.1) | 29 (31.9) | .037 | 1.35 (1.02–1.08) |
| Specialist visits | 802 (78.5) | 725 (71.0) | 77 (10.6) | <.001 | 1.50 (1.22–1.83) |
| ED visits | 14 (1.4) | 26 (2.5) | –12 (–44.0) | .055 | 0.53 (0.28–1.02) |
| Inpatient readmissions | 12 (1.2) | 23 (2.2) | –11 (–50.0) | .060 | 0.52 (0.26–1.04) |

Cohort A, asynchronous comparison group; OR, odds ratio; ED, emergency department.

Data are n (%) unless otherwise specified.

* The % difference shows the percentage differences in the number of visits between the treatment and comparison cohorts.

†Cardiologist visits, specialist visits, ED visits, and inpatient readmissions measure the total number of visits 6 months postdischarge.

Table 5. Health Care Utilization and Cost Outcomes 6 Months Postdischarge, Program Participants Compared With Those in the Contemporaneous Comparison Cohort

| Outcome | Program (n=1,276) | Cohort C (n=1,276) | Difference (% Difference)* | P | OR (95% CI) |
|------------------------|-------------------|--------------------|----------------------------|-------|------------------|
| Cardiologist visits | 152 (11.9) | 108 (8.4) | 44 (41.7) | .004 | 1.46 (1.13–1.90) |
| Specialist visits | 869 (68.1) | 783 (61.4) | 86 (10.9) | <.001 | 1.34 (1.14–1.58) |
| ED visits | 21 (1.6) | 36 (2.8) | –15 (–42.9) | .044 | 0.58 (0.33–0.99) |
| Inpatient readmissions | 17 (1.3) | 38 (3.0) | –21 (–56.7) | .005 | 0.44 (0.25–0.78) |

Cohort C, contemporaneous comparison group; OR, odds ratio; ED, emergency department.

Data are n (%) unless otherwise specified.

* The % difference shows the percentage differences in the number of visits between the treatment and comparison cohort.

†Cardiologist visits, specialist visits, ED visits, and inpatient admissions measure the total number of visits 6 months postdischarge.

Conclusion -Remote Monitoring /Early Diagnosis

”Diagnostic Excellence-Getting the Right Diagnosis at the right time”

- Patient engagement
- Empowerment
- Scalability to other conditions in pregnancy and postpartum
- Impact on long term health