



October 26-28, 2020

Maternal & Infant Health in the Digital World:

Patient-Centered Care During COVID and Beyond

VIRTUAL CONFERENCE

hmhbga.org/event/beyondcovid2020

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Redefining Postpartum Health During COVID-19

*Leveraging artificial intelligence to fill the
gap in postpartum care*



Team



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Learning Objectives

1. How to maintain high-touch clinically accurate and timely care despite shortened hospital stays and stay-at-home guidelines in the COVID-19 era.
2. How to design one platform that can manage symptoms, logistics and milestone tracking for a dyadic patient.
3. How digital health tools like Memora Health can improve the value of care delivery

Maternal Mortality

is a Health Care Crisis



61%

of maternal mortality occurs postpartum

...Most within 42 days of birth

Stories of women affected

Serena Williams: What my life-threatening experience taught me about giving birth



People **EXCLUSIVE**

[View All](#)

Judge Hatchett's Son Seeks Justice After His Wife's Tragic Childbirth Death: 'No One Should Feel This Pain'

"Kira and I talked a lot about raising men that would change the world — and I don't plan to change that goal at all," Charles Johnson tells PEOPLE



Hypertensive disease

Hemorrhage

Mental health

Cardiac disease

Thromboembolism

Infection

Racial inequity

Social determinants of health

Clinical Concerns

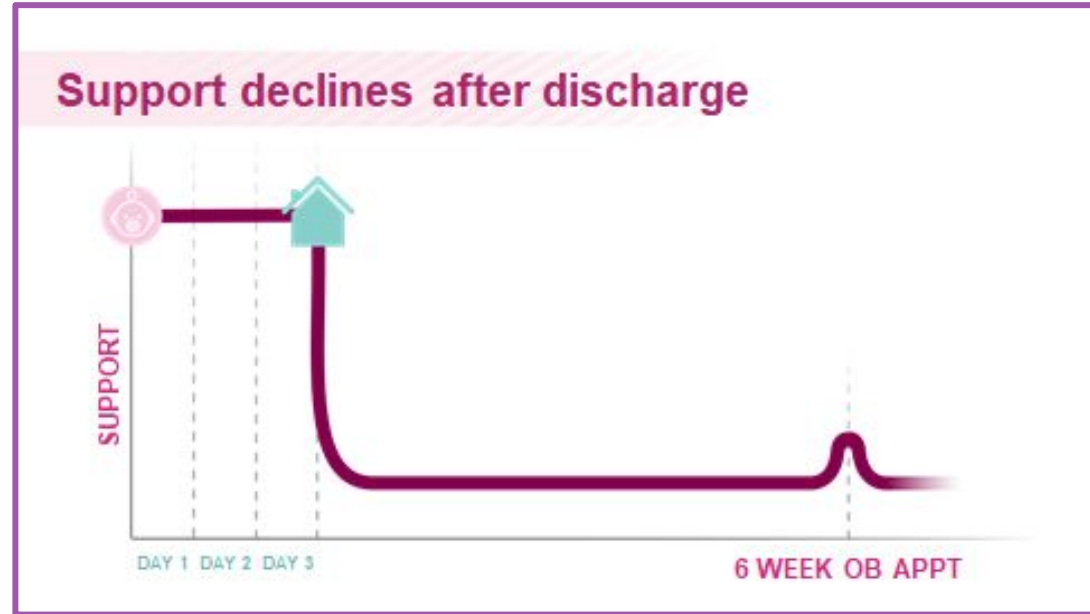
Traditional model of care

Weekly visits the last month of pregnancy



One visit at 4-6 weeks postpartum

Separate care for moms and babies



ACOG COMMITTEE OPINION

Number 736 • May 2018

(Replaces Committee Opinion Number 666, June 2016)

Presidential Task Force on Redefining the Postpartum Visit
Committee on Obstetric Practice

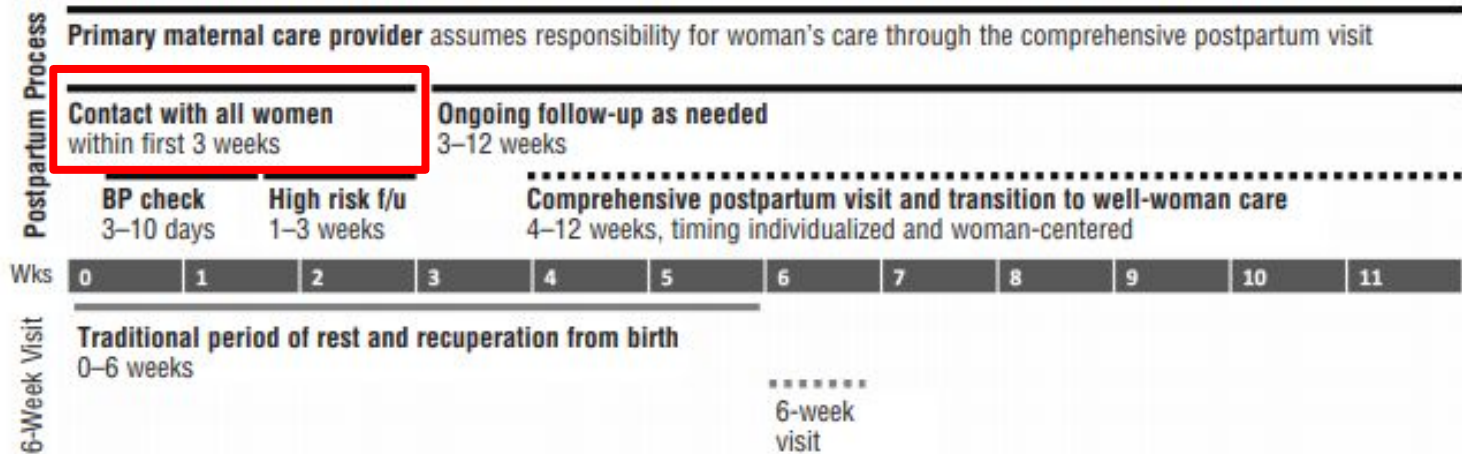


Figure 1. Proposed paradigm shift for postpartum visits. The American College of Obstetricians and Gynecologists' Presidential Task Force on Redefining the Postpartum Visit and the Committee on Obstetric Practice propose shifting the paradigm for postpartum care from a single 6-week visit (bottom) to a postpartum process (top). Abbreviations: BP, blood pressure; f/u, follow-up. ←

Real World Challenges

- ❖ Packed clinic schedules
- ❖ Bundled payment for services
- ❖ Routine calls/questions impede focus on more critical concerns
- ❖ Patient information is delivered all at once
- ❖ Mothers view themselves and their infants as one patient

Impact of COVID-19

- ❖ Active push to discharge dyads
- ❖ Women requesting early discharge to decrease risk
 - LOS has decreased 20%
- ❖ “High-risk” dyads are leaving sooner
- ❖ Women are even more isolated than before
- ❖ Less access to peer support
- ❖ Access to in-person visits is more limited

How technology is helping

- ❖ Multidisciplinary collaboration
- ❖ Timely anticipatory guidance
- ❖ 24/7 access to information & triage
- ❖ Alignment with ACOG recommendations
- ❖ Medium that encourages patient honesty
- ❖ Enables focus on critical clinical concerns

Our Solution

How do you leverage technology to streamline postpartum care delivery?



Ongoing Care for Mother and Baby

Upon discharge, new parents can use Penny, a text-based digital assistant



Penny Fills in the Gaps



Timely Reminders

Appointment scheduling reminders & follow up
Anticipatory guidance



Validated Screenings

Depression Screening
Mother-Infant Bonding Scale
Baby weight tracking



FAQ Support

Automated 24/7 responses
Notification of care team if concerns reported

MEMORA HEALTH

SUPPORT BULK MESSAGE UPLOAD PATIENTS + ADD PATIENT LIVE CHAT NOTIFICATIONS

Dashboard Metrics User Directory Settings Patients For Review

- Abby Mandel
- Sohenee Banerjee**
- Melissa McLeod
- David Luk
- Holly Cummings
- Joanna Parga-Beli...
- Jennifer Carter

Severity	Category	Message	Created Date	Actions
Concerning	EPDS Score 9 -12	SOH BAN reported a moderate EPDS score	9/30/2020	Resolve Message
Follow Up	Incision Pain	Patient reports incision pain	9/30/2020	Resolve Message
Follow Up	Unanswered Question	What are the risks of a C-section	10/5/2020	Resolve Message

Edinburgh Postnatal Depression Scale (Scores)

Thought of Self Harm Inability to Laugh Unexcited Self-Blame Anxious/Worried Scared/Panicky Trouble Coping Difficulty Sleeping Sad/Miserable Crying

Score

■ Current Week

5:33

Penny

I'm feeling really nauseous

I understand you are experiencing nausea or changes to your appetite, and am sorry to hear that.

I am going to ask you a few questions to better understand your symptoms.

With your nausea, are you experiencing ANY of the following symptoms:

- Pain
- Vision changes
- Light-headedness
- Dizziness
- Inability to eat or drink fluids
- Vomiting blood
- Fever greater than 100.4F

Please respond 'Y' or 'N'

No

The Postpartum Journey with Penny

Day of Life
1

Depression
Screening

Day of Life
2

Ped Appt
Scheduling
Check in

Day of Life
3

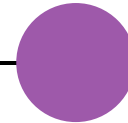
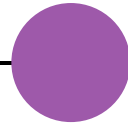
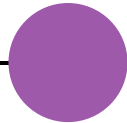
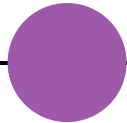
Feeding and
Sleep Check
In

Day of Life
4

Feeding and
Diapers
Check In

Day of Life
5

Umbilical
Advice



continues for
6 weeks...

**At any time, Mom can ask her own
questions, too!**

Penny's Automated Follow Up

Breastfeeding FAQ



Penny >

What color should breast milk be?

The color and consistency of breast milk can vary. It's usually yellow, white, clear, cream or tan and is sometimes thin and watery. It may be blue-tinged, green or orange if you have been eating lots of greens or other colored foods.

Okay awesome! And how often should I be feeding again?

Babies feed 8-12 times a day (both day and night). Make sure you offer the breast at early signs of hunger and leave them on until they appear satisfied, then burp and offer the second breast as "dessert."

Babies need to eat every 2-3 hours. But babies sometimes "cluster" their feedings and eat every hour. This is normal.

If Cassie is never satisfied after feeding, this may be a cause for concern and please seek lactation support at [+1 \(215\) 662-2361](tel:+12156622361)

Is your baby nursing at least 8 times in 24 hours?

Penny can ask follow up questions

Penny's Automated Follow Up

< 1 Penny >

I'm having some swelling in my feet

It sounds like you're worried about the swelling in your legs and feet. I'm sure that is quite uncomfortable. While swelling is common, I'm going to ask you a few more questions about this to make sure there is nothing concerning going on.

Is one side much more swollen than the other?
Please answer with "Yes" or "No"

No, not really

Is there any pain in your calf associated with the swelling?
Please answer with "Yes" or "No"

No

Leg Swelling Triage

Is there any redness of your legs or calf?
Please answer with "Yes" or "No"

Nope!

Great, at this time it doesn't seem like there is a reason to be concerned about your swelling. Most moms experience increased leg swelling (worse than in pregnancy) within the first few days after delivery. They should start to look and feel back to normal by 1-2 weeks!

Try medications like Tylenol and ibuprofen to manage the pain. Wear compression stockings or bandage your legs tightly and keep your feet up when you can should help the fluid go down more quickly.

Penny follows logic & asks additional triage questions

Based on answers, Penny provides anticipatory guidance



Some new moms experience "baby blues" after childbirth, which can include mood swings, crying spells, anxiety and difficulty sleeping. Baby blues can last up to 2 weeks post-delivery. Some new moms experience a more severe, long-lasting form of depression known as postpartum depression.

Each week I will send you a survey that your care team uses to track your risk for postpartum depression. It will be 10-questions long, and should take about 5 minutes to complete!

Please respond with the LETTER associated with the answer that comes closest to how you have felt in the PAST 7 DAYS, not just how you feel today:

[Q1/10]

"I have been able to laugh and see the funny side of things."

- A) As much as I always could
- B) Not quite so much now
- C) Definitely not so much now
- D) Not at all

Penny's Automated Follow Up

Based on these answers, it sounds like you are having a tough time. Feelings like these are common, but some mothers need more support for depression or anxiety.

If you feel you are at risk of harming yourself or your baby, please go to the nearest ER or call the national suicide hotline at [1-800-273-8255](tel:1-800-273-8255).

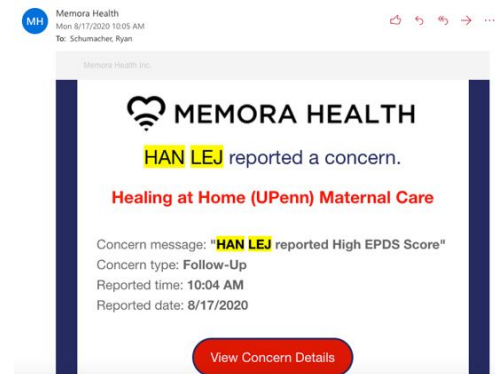
Expect a call from an OB provider today to talk more about how you have been feeling recently.

Some resources in the meantime:
 Postpartum Support International:
bit.ly/PostpartumNet
 MOPS International (a network of parenting support/social groups):
bit.ly/MopsDotOrg

If you want care with a private therapist, you can find in-network providers by checking your insurance by phone or online, or visit www.psychologytoday.com and search for therapists. There is an option for therapists that specialize in perinatal care.

Depression Screening

Penny Automatically Alerts the OB Care Team



Send Penny your questions!

If (or when) you were a new mom, what would you want to know?

Your questions may be used in a live demo later in the presentation!

Use the AccelEvents to send in your questions at any time!

Our Process

How do you train AI to manage postpartum care?



Establish Knowledge Scope: Digitize Evidence-Based Protocols

Edinburgh Postnatal Depression Scale¹ (EPDS)

Name: _____ Address: _____
 Your Date of Birth: _____
 Baby's Date of Birth: _____ Phone: _____

As you are pregnant or have recently had a baby, we would like to know how you are feeling. Please check the answer that comes closest to how you have felt in THE PAST 7 DAYS, not just how you feel today.

Here is an example, already completed.

I have felt happy:
 Yes, all the time
 Yes, most of the time
 No, not very often
 No, not at all

This would mean: "I have felt happy most of the time" during the past week.
 Please complete the other questions in the same way.

In the past 7 days:

1. I have been able to
 Do most of the things I want to do
 Do some of the things I want to do
 Do a few of the things I want to do
 Do very few of the things I want to do
 Not at all

2. Have I lost interest in
 Doing most of the things I used to enjoy
 Doing some of the things I used to enjoy
 Doing a few of the things I used to enjoy
 Doing very few of the things I used to enjoy
 Not at all

SAVE YOUR LIFE:

Call 911 if you have:

- Pain in chest
- Obstructed breathing or shortness of breath
- Seizures
- Thoughts of hurting yourself or someone else

Call your healthcare provider if you have:

- Bleeding, soaking through one pad/hour, or blood clots, the size of an egg or bigger
- Incision that is not healing
- Red or swollen leg, that is painful or warm to touch
- Temperature of 100.4°F or higher
- Headache that does not get better, even after taking medicine, or bad headache with vision changes

Tell 911 or your healthcare provider:

"I gave birth on _____ and I am having _____"

When You Go Home

What goes in, must come out. Look for:

3 pings per day by day 4.
 Change from dark black to green/loose yellow as your milk comes in.
 4 hours/one diaper after day 4.
 Should be pale yellow as your milk comes in.

Choose to share a bed with your baby:

Do not bed away from walls on both sides so the baby get stuck.
 Use firm mattress, not sofa, couch, or pillows.
 Parents should be under the influence of alcohol, drugs or medication that would affect the ability to wake up.
 If sleeping separately, put the baby to sleep on his back.
 Allow the baby to sleep alone on an adult bed, allow anyone except the baby's parents to share with the baby.
 The risk of Sudden Infant Death Syndrome is higher than of suffocation, parents who smoke should not smoke, but may sleep with the baby nearby.

See hospital if you think:

If hospital know if you had a good or bad experience with breastfeeding. Suggest they become Baby-Friendly! You'll be better sooner!

Have questions, persistent pain, or can't latching, ask for help right away!

POST-BIRTH WARNING SIGNS

Most women who give birth recover without problems. But any woman can have complications after giving birth. Learning to recognize these POST-BIRTH warning signs and knowing what to do can save your life.

These post-birth warning signs can become life-threatening if you don't receive medical care right away because:

- Pain in chest, obstructed breathing or shortness of breath could indicate a blood clot in your lungs that can cause a heart attack.
- Seizures can mean you may have had a stroke.
- Thoughts or feelings of wanting to hurt yourself or someone else may mean you have postpartum depression.
- Bleeding through a pad, soaking through a pad, or soaking through two pads in an hour or soaking through more than one pad in an hour could be a sign of a serious complication.
- Incision that is not healing, red or swollen leg, that is painful or warm to touch, or a temperature of 100.4°F or higher could be a sign of a serious infection.
- Bleeding, soaking through one pad/hour, or blood clots, the size of an egg or bigger could be a sign of a serious complication.
- Incision that is not healing, red or swollen leg, that is painful or warm to touch, or a temperature of 100.4°F or higher could be a sign of a serious infection.
- Thoughts or feelings of wanting to hurt yourself or someone else may mean you have postpartum depression.
- Bleeding through a pad, soaking through a pad, or soaking through two pads in an hour or soaking through more than one pad in an hour could be a sign of a serious complication.

GET HELP

My Healthcare Provider/ Clinic: _____ Phone Number: _____
 Hospital/ Clinic To Go: _____

AWHONN
 American Association of Nurse-Midwives
 1000 North Dearborn Street, Suite 1000, Chicago, IL 60610
 773.462.1000 | www.awhonn.org

1:41

F
Felix >

colostrum, it's generally the right amount for your newborn, whose stomach is very small.

Following this, you should start to produce regular breast milk.

I have a really bad headache. Is that normal?

It sounds like you are having a headache. Headaches are common after giving birth and are often related to lack of sleep, not drinking enough fluids, and hormonal shifts.

Occasionally headaches can be due to a more serious condition, I am going to ask some additional questions to decide if further action is

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Collaborate With Multi-Specialty Care Teams To Design A Standard of Care

Question Theme	Patient Question	Memora Suggested Answer	Clinician Response	Editing H@H Team Member	Notes from H@H Team	Editor H@H
			Peds			
Digestive	My baby has stomach pain/ How do I comfort my baby with an upset stomach?	Babies have weak abdominal (belly) muscles, so their belly often seems bigger compared to their chest. Their belly should be soft if you squeeze it gently. If \$baby_firstName's belly seems hard or has visible blood vessels, if they are spitting up more often, or their behavior seems different, I would recommend calling \$baby_firstName's doctor.				
Digestive	How long should he sit up straight after eating?					
Formula	How do I wash bottles properly / how do I sterilize bottles	You can keep your baby's bottles clean by boiling it or running it through the dishwasher frequently. Make sure you buy a bottle that is dishwasher safe.				
Formula	Can babies drink formula cold?	Some babies will happily drink cold formula. If you would like to heat formula, you can use bottle warmers. You also may try running the bottle under warm water. You shouldn't microwave breast milk or formula.				
Formula	Can I formula feed my baby? / Is formula bad?	The American Academy of Pediatrics recommend breastmilk only for babies until 6 months of age until you introduce solid foods. After 6 months babies should be fed solid food and breastmilk ideally. However, many mothers choose to give formula even if they are breastfeeding, feeding baby any amount of breastmilk provides additional immune benefits. You should choose a feeding plan that is right for you and your baby. If you have other questions, please contact your pediatrician for advice				
Skin	Is baby powder safe?	Most lotions or powders without fragrance are safe for your baby's skin. Aveeno or Eucerin cream are two good examples. Try to avoid lotions with fragrance as they can be irritating to your baby's skin.				
	What kind of soap / shampoo should I use on my baby	Any mild soap or shampoo meant for babies can be used on \$baby_firstName\$. Avoid soaps with scents.				



My baby has a high fever

Is the fever above 100.4F?

No

As long as the fever is not above 100.4F, this is a normal fluctuation in the baby's temperature. Please call your care team with any questions.

Train The AI: Leveraging AI To Digitize Care

“When should the umbilical cord fall off?”

Leveraging AI To Digitize Care

“When should the umbilical cord fall off?”

Leveraging AI To Digitize Care

“When should the umbilical cord fall off?”



Question
'intent'

Leveraging AI To Digitize Care

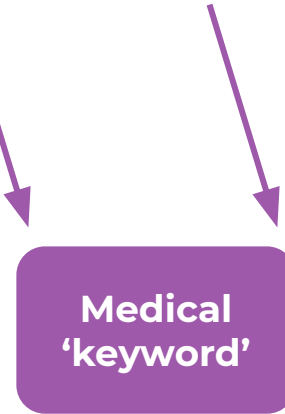
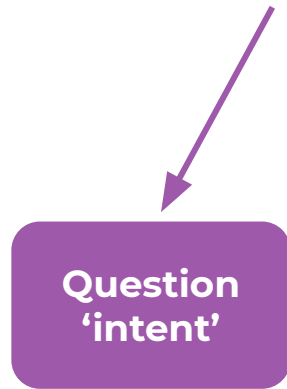
“When should the umbilical cord fall off?”



Question
'intent'

Leveraging AI To Digitize Care

“When should the umbilical cord fall off?”



Crowdsourced Testing Framework: Scaling the NLP

“When should the umbilical cord fall off?”

Is it normal for the umbilical cord to come off so soon
Is it to early for the umbilical cord to fall off now?
Umbilical cord falls off when
Is it normal for his umbilical cord to not have come off yet?
Is it possible for the umbilical cord to come off early ?
how did an umbilical cord falls off
Should the umbilical stay on the belly button for a specific length of time
The umbilical cord just fell off should I be worried
Hey her belly thing is falling off of her an it's almost bleeding...
How long does a baby's umbilical cord usually stay attached to belly button
What is shortest time for cord to remain attached without causing harm
What can I do with her belly button because the umbilical cord has fallen off
What is the usual length of time that an umbilical stays attached to a baby
What do I use to clean my baby's belly button when the cord detaches
What do I do when my daughter's umbilical cord comes off
To come off so soon Is it normal for the umbilical cord
What coming soon to the umbilical cord off
Is it weird for the umbilical cord to come off so soon
How soon should I expect the umbilical cord to come off
When umbilical cord to come off so soon Is it normal
Is it ever too soon for the umbilical cord to fall off
It is normal to the umbilical cord to come off so soon
Is it abnormal for the umbilical cord to come off so soon
When should I be expecting the belly button to come off
About how long does it take for **baby's belly button** to heal?

What happens if it looks like his umbilical cord falls off early ?
What if it falls off before 2 weeks ?
The umbilical cord fell off three days ago
What is the normal time for the umbilical cord to fall off
At what time does the umbilical cord falls off
At what point does the umbilical cord fall off her belly button
How long after birth does the umbilical cord fall off
Is there a "normal" time for **umbilical release**
When precisely does the umbilical cord fall off
How soon should the umbilical cord fall off
What is the normal time frame for umbilical cords to come off
umbilical cord to fall off now When it is easy
If the umbilical cord comes off now is that too early
What was early for the umbilical cord to fall off
Can the umbilical cord fall off too early
Should I be worried if the umbilical cord comes off now
is it too soon for her umbilical cord to come off
it to early for the umbilical cord to fall off now
Is it to early for the umbilical cord to come off
Is the umbilical cord going to fall off sooner
When is it considered too soon for the umbilical cord to drop off
Is the umbilical cord supposed to come off that soon
When the umbilical cord falls off what products do I use to clean the belly
button
Hello, how long does it take for the umbilical cord to fall off my baby's belly
button?

Scaling the NLP

“When should the umbilical cord fall off?”



- How long
- How soon
- Which day
- What time
- At what point
- Is there a certain time
- Will this start
- Is it okay
- Is it normal
- How many weeks
- Best time
- Expected time

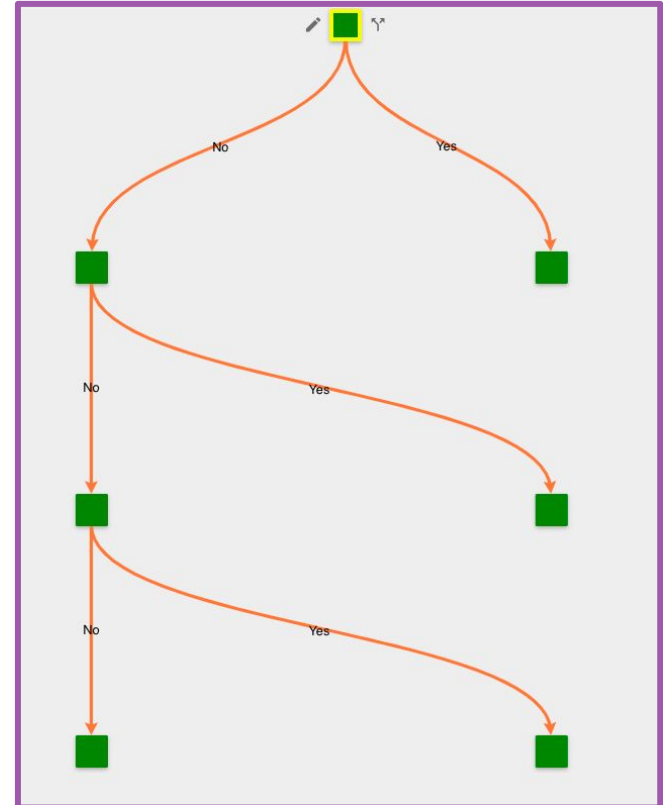
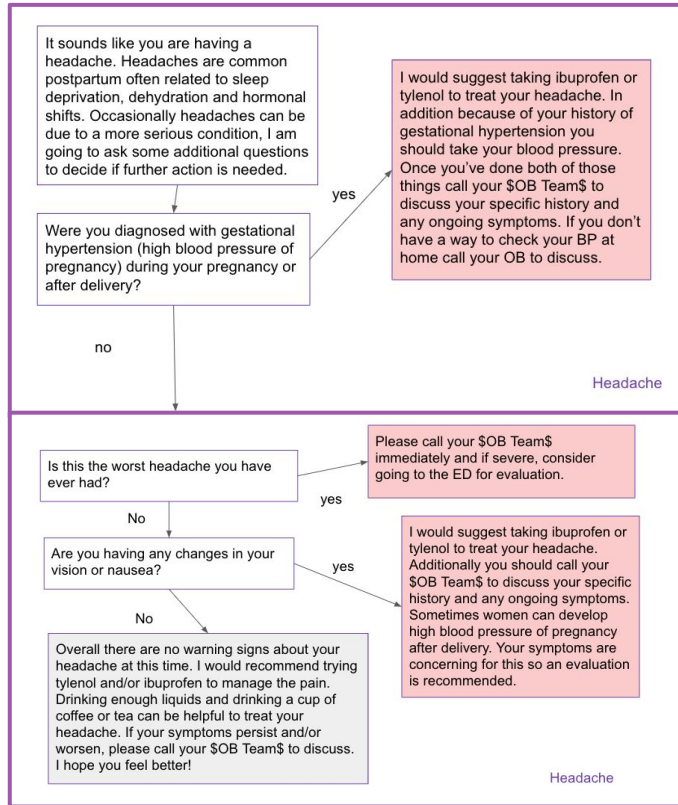


- abdominal thing
- abdomen thing
- tummy thing
- belly thing
- stump
- cord
- belly button
- navel
- omphalic cord
- tummy button
- umbilical
- umbilical cord



- coming off
- coming out
- came out
- came off
- fell off
- fallen out
- fallen off
- falls off
- remain on
- stay on
- intact
- attach

Making Care Algorithmic



Complements In-Person Care

Promoting Honesty

Patients are more forthcoming with digital tools

~

This is especially true with mental health screenings.

~

Penny distributes depression screenings 3 times during the mother's postpartum journey

~

Even more frequently if a patient scores positive for depression or indicates that they need mental health support.

“Maybe you are feeling a certain way, and you may not want to say it, but since it is a text message, people may be more willing to answer honestly.”

— *Anonymous Patient at Hospital University of Pennsylvania*

“A lot of people suffer from postpartum depression and don't know it. This service helps them out a lot by asking those series of questions that can help save a person life!”

— *Anonymous Patient at Hospital University
of Pennsylvania*

Accessibility

95%

of American households earning under \$30,000 have mobile phones

But, in the same demographic, laptop or desktop access is only available to

59%

Completely free for patients.

~

No smartphone is needed.

~

No desktop or laptop is needed.

~

No internet or data is needed.

Focused on Promoting Health Justice

Equity

Penny treats every patient the same regardless of their background or resources

~

Penny can also adapt if a patient needs more attention.

~

Penny has programs for formula feeding moms and breastfeeding moms, to support and celebrate all mothers' feeding choices.

Live Demo!

Implementing Healing at Home

Phase 1: Identify patients suitable for early discharge post uncomplicated vaginal delivery

Both OB/GYN and PEDS clinical partners to create algorithm with pertinent clinical information for both Parent & Baby to be eligible

Challenges:

- Getting consensus from team on algorithm content
- Implementing new workflows to support documentation needs
- Building complex exclusion criteria
- **Linking parent and baby records within EHR**

Healing at Home Care Redesign

Phase 2: Global Pandemic

Patients requesting early discharge

- LOS decreased 20%

Expanded access to the H@H program ahead of schedule

Our Results

Demonstrated feasibility and safety profile



Impact to Date

in the past 6 months...

300

Mothers Enrolled

8,000

Questionnaires Sent

1,000

Questions Asked

25%

**At Risk Depression
Screens**

6

Critical EPDS

77%

Correctly Answered

Impact to Date

Patients Love Penny

"I was telling my girlfriends, and they were saying they hope they could have a program like this wherever they deliver. If I were to have another child, I would use this again."

"The service was a great support postpartum esp during Covid! It was easy to use and extremely informative! I am very appreciative that this service was provided. Thank you!"

"Great knowing as new parents we weren't left on our own for our first baby. A quick text with a fast response put my husband and my mind at ease"

Q: What is the **top** question new mom's
have after leaving the hospital?

Most Common Question:

A: Baby Poop Frequency/Color

B: Umbilical Cord Care

C: Breast Engorgement

D: Jaundice

E: Baby Hiccups

Most Common Question:

A: Baby Poop Frequency/Color (5.1%)

B: Umbilical Cord Care (8.2%)

C: Breast Engorgement (2.1%)

D: Jaundice (1.9%)

E: Baby Hiccups (1.7%)

Most Common Question:

A: Baby Poop Frequency

B: Umbilical Cord Care

C: Breast Engorgement

D: Jaundice

E: Baby Hiccups

DOL4: Outbound Message

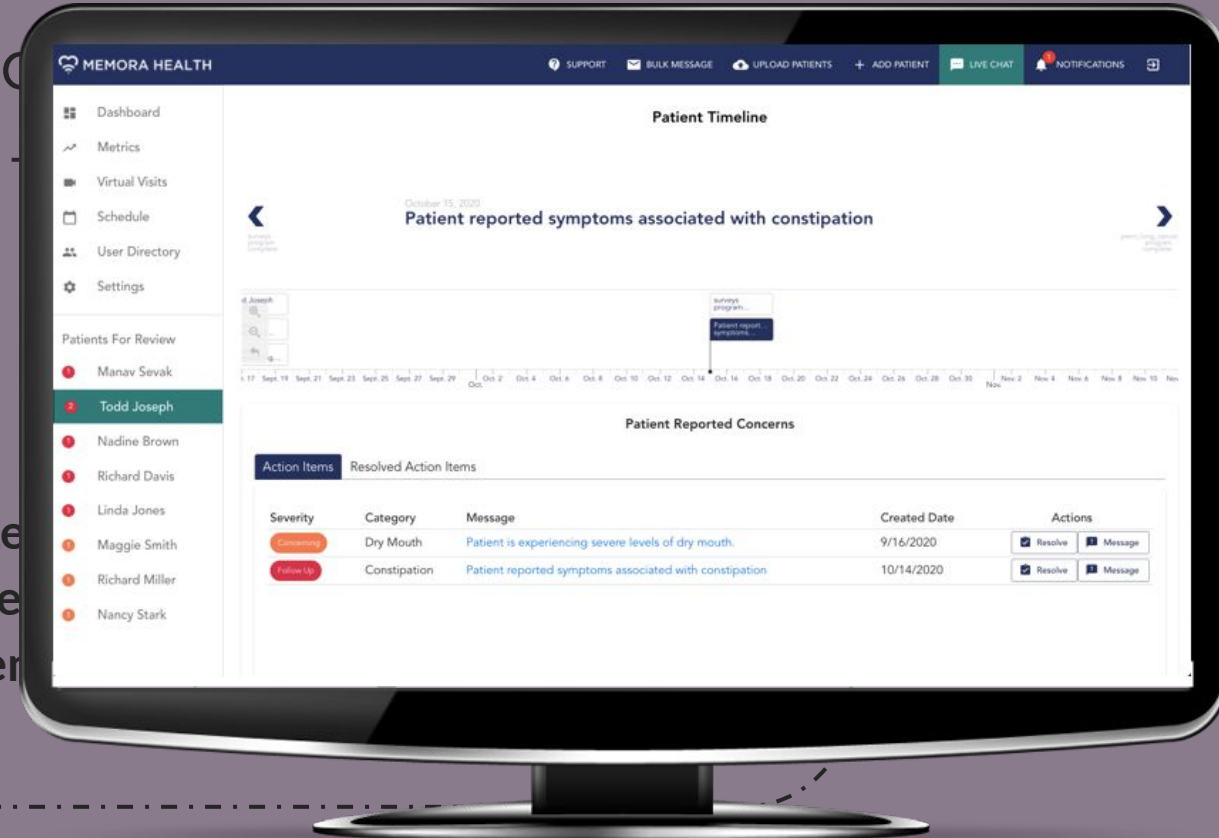
[baby_name]'s umbilical cord may have already fallen off, which is totally normal! If it hasn't, it will fall off in the next 1-2 weeks. You shouldn't pull it off, but let it fall off on its own.

Most Common Category:

Category	Count
Pediatrics	47.03%
Lactation	16.53%
Obstetrics	8.90%
Escalation, Leg Swelling	7.20%
Escalation, Pediatrics, Vomiting	2.12%
Non-Emergent. Latch, Challenge	1.69%

Automated Routing to Care Teams:

- **OB/GYN**
 - 31 possible emergency situations triaged
- **PEDS**
- **Lactation**
 - 18 real-time referrals to lactation consultants
- **Social Work**



Engagement Rates

Race **AVERAGE of Survey Completion Rate**

White	47.19%
East Indian	40.00%
Black / White	38.35%
Patient Declined	35.85%
Black	33.79%
Other	31.53%
Asian	30.90%
Unknown	24.35%
HLW - Hipanic Latino/White	23.42%
Grand Total	36.98%

Race **AVERAGE Questions/% Total**

Unknown	5	(3.73%)
HLW	4	(2.99%)
Other	4	(8.96%)
Black	3.95	(64.9%)
White	2.17	(19.4%)

On the horizon for Healing at Home

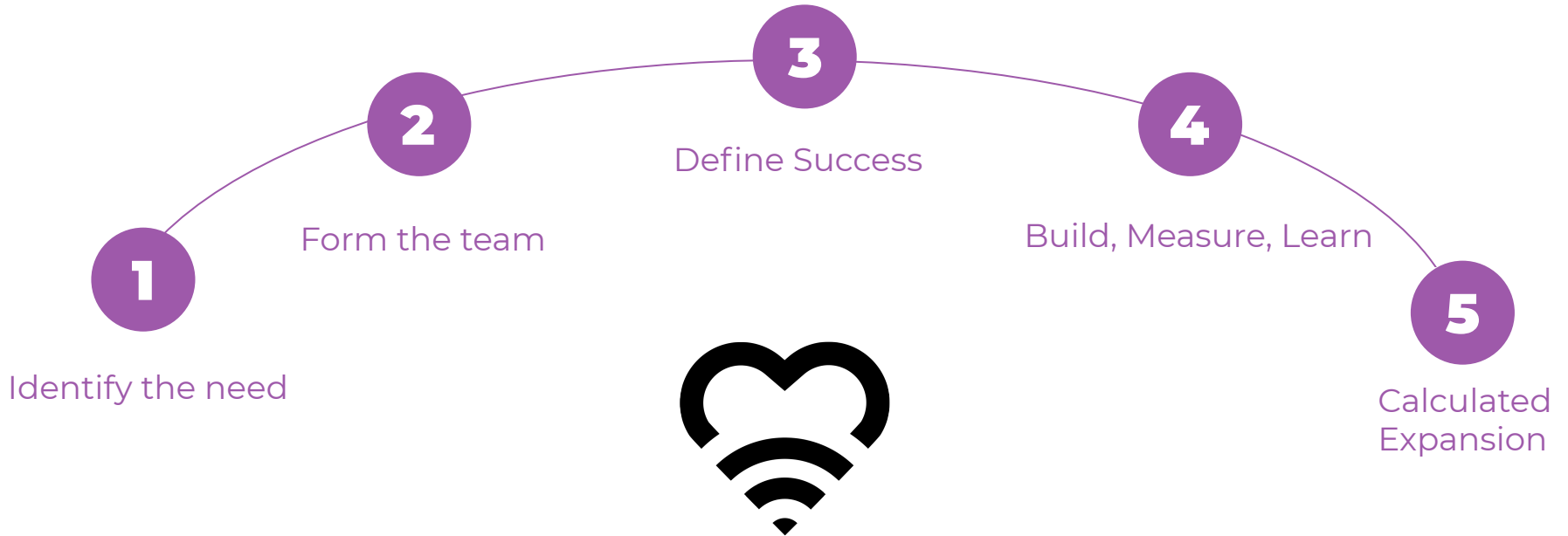
Build and evaluate care pathways to support moms in “high-risk” categories:

- C-section deliveries
- NICU babies/parents
- Healthcare utilization research

COVID 19 is the forcing function for rapid adoption of digital health technologies.



Implementing Memora Health

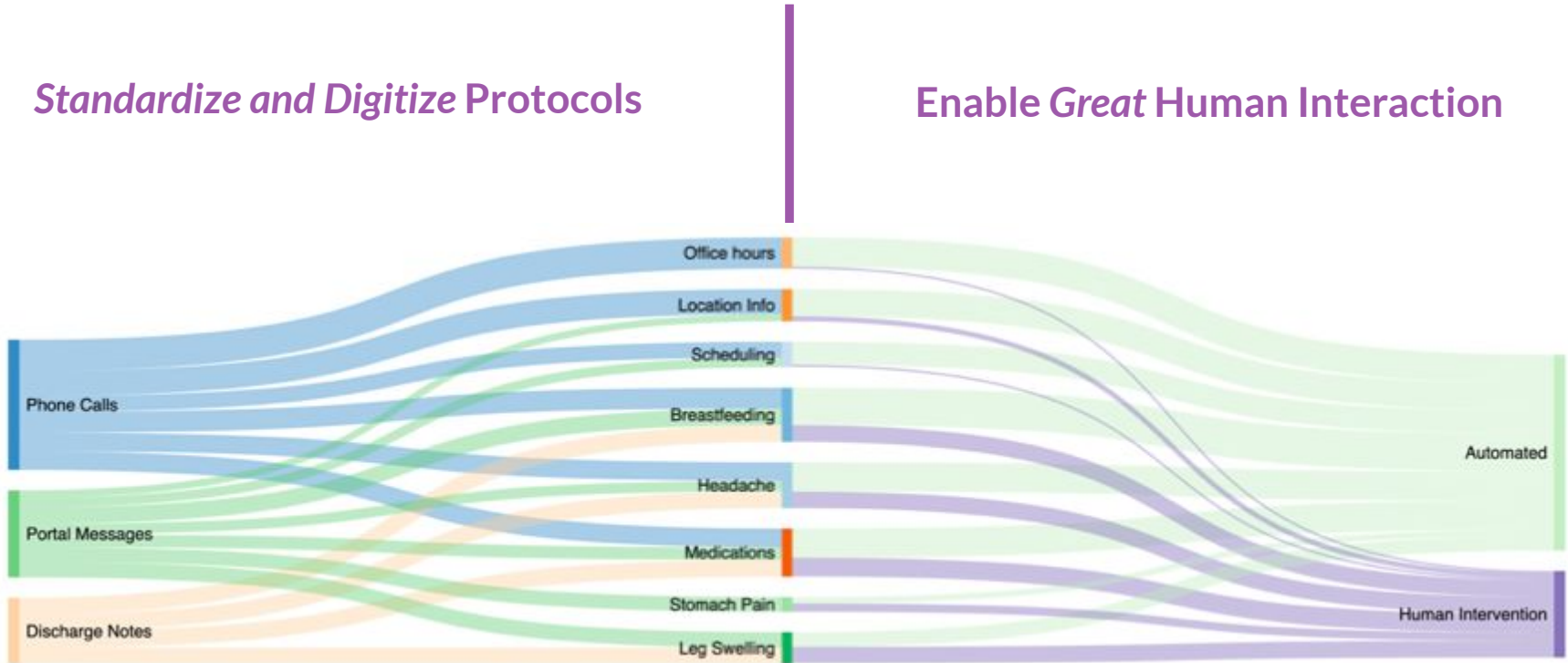


MEMORA HEALTH

THE OPERATING SYSTEM FOR CARE DELIVERY

Standardize and Digitize Protocols

Enable Great Human Interaction



Thanks!



Get in touch!

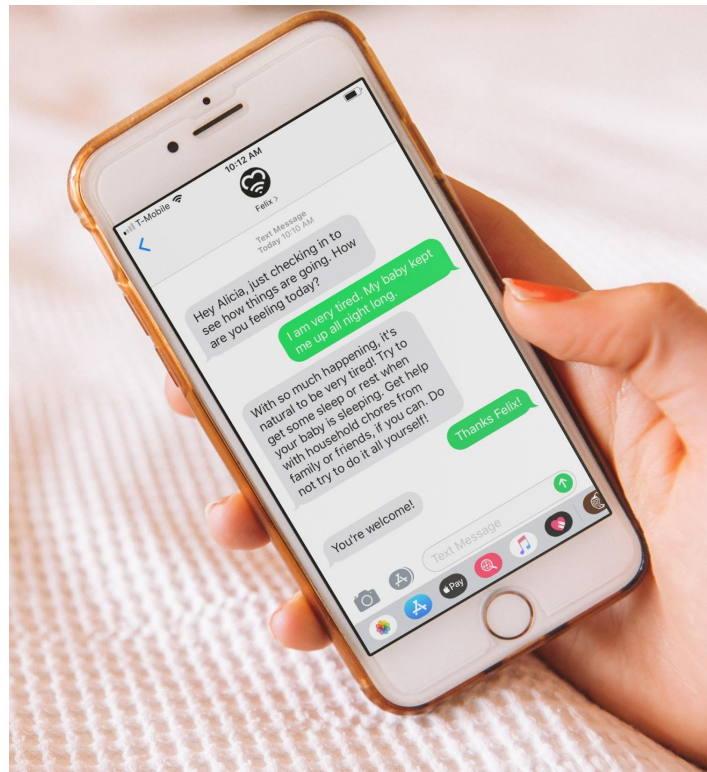
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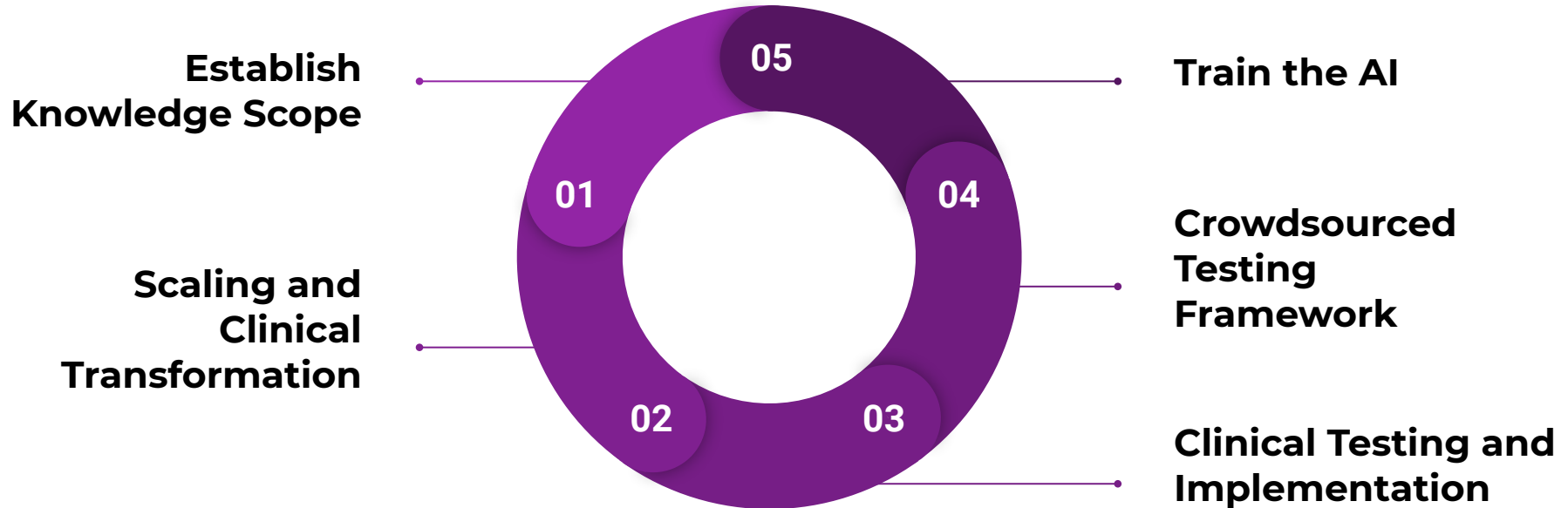


Appendix

Answers Designed By Clinicians

Day 1	Parent: “What creams are good for diaper rash?”	Penny recommends zinc oxide cream, advises when to be concerned about rash
Day 3	Parent: “My baby won’t latch”	Penny asks follow up questions and learns that the baby's latch isn't deep enough. Sends a video and detailed instructions on latching
Day 6	Parent: “When can I start exercising again?”	Penny advises light stretches and exercises, gives timeline for more intense workouts

Designing Penny: A Virtual, Postpartum Assistant



Technology Designed For Clinical Workflows

Day 7	Parent reports increase in bleeding	Penny asks follow up questions, immediately alerts OB team if bleeding is abnormal
Day 9	Parent: “How do I produce more breastmilk?”	Penny advises increasing feeding frequency and fluid intake, connects mom to a lactation consultant
Day 10	Parent: “My baby can’t breathe”	Penny instructs mother to go to the ER , follows up 3 hours later to check in