



## MATERNITY CARE AND THE MICROBIOME: HOW BIRTH PRACTICES DICTATE FUTURE HEALTH

Penny Simkin

## The Fastest Growing Area of Study?

The Human Microbiome

## Full Disclosure

This presentation is based on my extensive reading and ruminating on the topic.

I cannot pretend to be an expert, but I want to share with you some of what I have learned about an exciting and highly relevant topic!

When we acknowledge the existence and influence of the microbiome on present and future health and disease, we realize that today's maternity care practices impact us for generations.

## The Human Microbiome Project



"The NIH Common Fund Human Microbiome Project (HMP, launched in 2008) was established with the mission of generating research resources enabling comprehensive characterization of the human microbiota and analysis of their role in human health and disease."

-- <http://commonfund.nih.gov/hmp/overview>

## What is the Human Microbiome?

The human microbiome is the collection of bacteria, viruses, fungi, etc., that live in and on the body.

### Names of Microbes in Various Microbiomes

- **Respiratory System** --Mouth, Pharynx, Lungs (Streptococci, Candida, Neisseria)
- **Skin** (Staphylococcus, Trochosporon)
- **Stomach** (H Pylori, Streptococcus)
- **Intestines** -- the Gut (Lactobacilli, E Coli, C Difficile, Bacteroides)
- **Breast milk** (Streptococcus, Staph, Serratia, Corynebacteria)
- **Urogenital System** -- Bladder, Uterus, Vagina (Lactobacilli)

Adapted from: NIH, Scientific American: Human Microbiome Project

"Bacterial cells outnumber human cells in the body by an estimated factor of 10, with 100 trillion microbes living in the gastrointestinal (GI) tract alone."<sup>\*\*</sup>

Some microbes are beneficial; some harmful.

**Symbiosis** -- a balance among microbes -- leads to optimal health.

**Dysbiosis** -- an imbalance among microbes -- leads to disease<sup>\*\*</sup>

## Microbiome Glossary of Terms

- **Biome** -- a large naturally occurring community of microbes.
- **Diversity of microbiota** – variety of microbes; greater diversity is healthier.
- **Dysbiosis** -- microbial dominance by harmful microbes over helpful ones, causing poor health. It is most commonly reported as a condition in the digestive tract.
- **Microbiome** -- all of the genetic material found within an individual microbe such as a bacterium, fungal cell, or virus.
- **Microbiota** -- the microscopic flora and fauna of a “region”
- **Microbe** – a microorganism, visible only under a microscope. Microbes include bacteria, fungi, viruses, and protozoa.
- **Seeding** the newborn microbiome – transferring bacteria from the environment to the baby through physical contact.
- **Symbiosis** – harmonious balance of gut microbes; health

## Glossary of “biotic” terms

- **Antibiotic**-- A substance, such as penicillin or streptomycin, produced by or derived from certain fungi, bacteria, and other organisms, that can destroy or inhibit the growth of other microorganisms\*
- **Dysbiotic** – relating to “dysbiotic,” bacterial imbalance in the gut, which can compromise the immune system\*
- **Macrobiotic** – “long-lived”\*\*\* ; of a diet comprising only food conforming to the principles of macrobiotics\*\*\*
- **Microbiotic** – “short-lived”\*\*\*
- **Prebiotic** – A therapeutic nutritional preparation used for gut effects favoring growth of normal bacterial flora and not favoring growth of pathogenic organisms\*\*
- **Probiotic** -- a therapeutic preparation that provides bacteria orally resulting in a normalizing effect on the gut\*\*
- **Symbiotic** – living in symbiosis, or having an interdependent relationship\*

## Examples of Diverse Bacteria

The most basic method for identifying bacteria is based on the bacterium's shape and cell arrangement. Three morphological categories into which bacteria fall are - cocci, bacilli, spirilla, and “other.”

## The fetus meets his/her microbial world

1. The fetus and placenta are first colonized in the womb with the pregnant parent’s microbes

## 1. Fetus gains microbes via placenta

Placenta has its own biome, closely resembling mother’s mouth biome

--Aagaard, K, et al. (2014).

## 2. Baby acquires microbes from vagina

- During and shortly after vaginal birth, baby is “seeded” by the mother’s **vaginal and gut microbes**
- While passing through the vagina, the birthing parent’s vaginal microbes collect on baby’s skin.

### 3. Baby acquires mother's skin microbes

When placed skin to skin with the birthing parent, further seeding takes place from her skin microbiome.

### 4. Baby acquires breastmilk microbes

Breast fluid nourishes baby AND its microbes protect baby from pathogens. It contains special sugars that selectively nourish the gut bacteria that infants need.

<http://newborns.stanford.edu/Breastfeeding/>

<http://www.bellyfulbirth.com/breastfeeding-pumping-support/>

# Breastmilk

“a creamy microbial soup”\*

\*Kerry Grens. The Maternal Microbiome. May 21, 2014. The Scientist Magazine

### At birth infant has 4 main sources of microbes

--Bacterial diversity increases as child is exposed to microbes from sources other than parents.  
--By age 2 -3 years, the Microbiome reflects the child's larger world, and is more similar to others' in their world.

### The Newborn's Microbiome

These maternal microbes\* represent the baby's future world.

When the mother is healthy and the birth is normal, this newly seeded mix of microbes will protect the baby from harmful microbes.

### BUT, all too often, . . .

- ❖ . . .the transfer of maternal microbes to the fetus/newborn is disrupted in the perinatal period, and other potentially harmful microbes take the place of the mother's.
- ❖ The newborn microbiome becomes the staging ground for ill health and chronic diseases, such as Type 1 diabetes, intestinal diseases, obesity, asthma, allergies, infection, and others.

## Good & Bad Influences on the Infant's Microbiome

The microbes vary from harmful to helpful. The balance impacts the baby's lifelong health.

## A Challenging Start— all too common

- Premature birth
- Birth by planned or unplanned cesarean
- Antibiotics to mother, baby
- Held first by doctor, midwife, nurse before birthing parent
- Time lapse after birth before mother held baby
- Wrapped in hospital blanket for first contact
- Held by non-parents in first hours after birth
- Early bath
- Fed with formula or glucose water
- Stay in nursery without birthing parent

(See Scorecard?)

## Prematurity

- “The (VLBW) infant is at great risk for marked dysbiosis of the gut microbiome, due to
  - 1) physiological immaturity and a more permeable intestine (“leaky gut”), and
  - 2) external prenatal/ postnatal influences that disrupt the development of normal gut flora.
- Little is known about the development of the microbiota in preterm infants as they grow and mature.”\*

Kangaroo Care—  
The antidote

## Hospital Microbes --Baby's initial seed?

Baby's skin, mouth, digestive tract, are seeded by whatever and whomever they have first contact.

## Cesarean birth effects

- The baby misses out on normal vaginal and “good” gut bacteria, which. . .
  - Aid digestion, provide Vitamins (K & B12)
  - Stimulate development of immune system
  - Regulate bowels
  - Protect against infection
- Cesarean replaces the “good” microbes with harmful hospital microbes
- Increases dysbiosis and the risk of --
  - Allergies, Asthma
  - Obesity, Type 1 Diabetes
  - Cancer, Inflammatory Bowel Disease, . . .
- **(Microbe richness & diversity are higher with in-labor C/S than planned C/S)**

## Restoring the newborn microbiota after cesarean when microbial ecology in the vagina is healthy.

GBS, and HIV negative?

The swabbing **doubled** the number of maternal bacteria that the C-section babies were exposed to, but vaginal birth gave baby **six times as many** bacteria. **Antibiotics**, used at all cesareans, surely reduced the number of bacteria.—Dr. M. G. Dominguez-Bello, in a radio interview on 6/25/14\*

## Antibiotics to newborn. . .

- IV antibiotics to newborn
- Reduce microbial diversity and the number of **harmful and beneficial** bacteria.
  - The impact on the gut microbiota is pronounced, lasting >8 wks when treated in first 48 hrs post partum.
  - The longer the duration of antibiotic treatment, the less complete the recovery of the microbiome.\*

[http://thebidwellkrew.blogspot.com/2010\\_07\\_01\\_archive.html](http://thebidwellkrew.blogspot.com/2010_07_01_archive.html)

## Antibiotics to the pregnant/laboring woman

- The antibiotics can affect the mix of microbes in the mother's placenta, amniotic fluid and vagina.
- This disrupted (dysbiotic) maternal microbiome will then be "inherited" by the baby from their mother.
- Antibiotic resistance – always a concern
- Probiotics?

## Mother/baby separation by blanket and clothing

- Separation (by mother's clothing and/or by wrapping baby in a hospital blanket) prevents seeding by mother's skin microbiome, which represents the baby's future world.
- Mother's microbes are tailored to her and baby's home microbiome, and would provide the "right microbes" for maintaining health.

<http://pitgood.com/mother-holding-newborn-baby-in-hospital.html>

## Removal of infant from mother after birth

- The infant is seeded by microbes on hospital equipment or staff's hands & clothing.
  - Hospital microbiome contains foreign microbes, which are often harmful (e.g. *C.Difficile*).
- The infant's microbiome is left more vulnerable to health challenges from the "wrong" microbes

## Mother/infant separation after birth, cont.

**Should parents bring  
their own baby blankets from home?  
Skin to skin makes most sense!**

## Formula feeding

- Significant differences in infant gut microbes between formula & breastmilk
  - Increased harmful bacteria (e.g., *C difficile*)
  - Decreased helpful bacteria
  - Associated w food allergies, etc.
- Even short-term formula feeding seeds infant microbiome with harmful bacteria.
- The different microbiome may underlie the increased health risks associated with formula.

## Other microbiome-challenging practices

- Held by staff members, family or friends rather than birthing parent in first hours
- Baby in nursery without parent

## What About Father's or Other Parent's Microbiome?

## Skin-to-Skin with Other Parent?

- An extensive literature search of the impact on the newborn's microbiome revealed nothing.
- Of course, many other benefits are reported.
- In the absence of research, we can assume—
  - The baby would receive the other parent's microbiome.
  - It would be similar to the mother's (if they live together).
  - Therefore, either parent holding the baby would be preferable to having others hold the baby.
- More research, please!

## Early first bath

Among other known harms, bath removes

- protective vernix
- vaginal microbiome, other secretions
- newborn's newly seeded skin microbiome

All are replaced by hospital microbes

## "Your Newborn Nursery Experience: What to Expect"

*From a KY hospital website: "After your infant is born, he/she is taken to the transitional nursery where assessments and evaluations are performed. Once your baby is ready, he/she is transferred to the primary care nursery. Your nurse will bring your baby to your room and help you care for and learn about your newborn."*

Averno Queen of Peace Maternal Care Center, Mitchell, SD

**Among the many harms -- disruption in the seeding of the baby's microbiome! How common are such practices today?**

## Ideal "Microbiome-Friendly" Birth

- Spontaneous onset of labor at term
  - No need for medications for pain, progress, illness, or infection
- Adequate labor progress
- Non-pharmacologic means of pain management
- Straight to mother's body, skin-to-skin for unhurried holding and breastfeeding
- Parents' blanket from home covering mother and baby. Non-parents see, don't hold baby for first hours.
- Nurses keep baby in mother's/parents' arms as much as possible for all procedures.
- Only breastmilk fed to baby.
- Baby remains with or near parents all the time.

This new area of study raises many questions. . .

More questions than answers!

## Some unanswered questions

1. If SROM early, can fetus get mother's vaginal microbes from vertical migration? (Or might harmful bacteria have caused the SROM?)
2. What about very fast 2<sup>nd</sup> stage? Is there time to be adequately seeded?
3. What about pushing a long time followed by cesarean? Can fetus be seeded with vaginal microbes by being in the vagina?

## 4. Some unanswered questions, cont.

Can soaking or birthing in water reduce or dilute the vaginal microbiome or rinse away the maternal skin microbiome?

## Some unanswered questions, cont.

5. How do antibiotics for Group B Strep affect other vaginal microbes? Any long-term effects?
6. Should GBS protocols that call for routine antibiotics for women who are GBS+ be revisited in light of antibiotic effects on the microbiome?
7. If babies are

## Some unanswered questions, cont.

7. If a baby is born with intact membranes ("in the caul"), do they miss being seeded by mother's vaginal microbes? \*

*These are just a few of many questions!*

## Conclusions

- Since the late 1990s, new, highly sophisticated DNA sequencing technology has allowed for unprecedented exploration of the world of microbes and their enormous impact on health and disease.
- Study of the microbiome shows that the way women give birth and the way babies are born and fed have a huge impact on their quality of life.
- Numerous common maternity care practices disrupt the infant's microbiome for a very long time.
- Much of today's declining health began generations ago, and has been passed down to today's fetuses.

## Conclusions, cont

- This generation, however, has unintentionally and most rapidly increased the risks to families.
- We have reviewed the state of current knowledge, in hopes that each of us will act to restore healthy birth practices for the betterment of our people.
- It is clear that restricting the use of techniques that alter normal pregnancy, birth, and breastfeeding, and the overuse of antibiotics, will protect the microbiome for most of today's childbearing public and for generations to come.
- Effective treatments to restore a healthy microbiome are in development now!

Penny Simkin

With many thanks and hopes for healthier families!



# Scorecard: Practices that Disrupt the Infant Microbiome

Penny Simkin, PT, CD(DONA)

Check the factors listed below that took place with baby \_\_\_\_\_ during the first 3 (or more days) of life. If you wish, you may add the reason it was done.

## “Microbiome-Friendly” Birth Events and Practices (Check each)

- Spontaneous onset of labor at term
- Adequate labor progress
- Non-pharmacologic means of pain management
- Straight to mother’s body, skin-to-skin for unhurried holding and breastfeeding
- Parents’ blanket from home covering mother and baby. Non-parents see, don’t hold baby for first hours
- Nurses keep baby in mother’s/parents’ arms as much as possible for all procedures
- Baby fed only breastmilk.
- Baby remains with or near parents all the time.

## “Microbiome-Disrupting” Birth Events and Practices

- Premature birth (weeks’ gestation)
- Birth by planned or unplanned cesarean (circle which)
- antibiotics to mother and/or baby (specify who received them)
- Held first by medical staffer before mother (specify who, how long)
- Time lapse after birth before mother held baby (how long? \_\_\_\_\_)
- Wrapped in hospital blanket for first contact with mother
- Held by non-parents (family, friends, staff) in first hours after birth
- Early bath (before 24 hours of age)
- Fed with formula or glucose water
- Stayed in nursery without parent

Conclusions – did this baby have a “Microbiome-Friendly” or a “Microbiome-Disrupted birth?”

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