Good morning ▸ thanks: chair, OePROM, AllergoSan ▸ pediatrician, ICZMP Łódź ▸ you know the gut → one floor down ▸ subtitle: we can read them, almost nobody does

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Typical Vaginal Microbiota Communities and their Impact on Women's Health

We can read them. Almost nobody does.



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Invited lecture, Institut AllergoSan

Two questions before we start



1

Who recommended a probiotic for women's urogenital health in the last month?



2

Who has ever tested the vaginal community type of their patients?

Three questions for the next 25 minutes



What lives in the vagina?

Five community state types and a free tool to read them



Does the type matter?

Risk of BV, HPV/CIN, HIV, infertility and pregnancy complications



Why don't we measure it?

What we measure in practice, and what we could measure

Click ▸ let the clip play ▸ First question: what lives in the vagina?

1

The map

What lives in the vagina?



Here, health means low diversity

Gut

Hundreds of species. High diversity = resilience.

Vagina

One *Lactobacillus* species dominates. High diversity = risk.

Estrogen › **Glycogen** › ***Lactobacillus*** › **Lactic acid** › **pH < 4.5**

plus bacteriocins (bacterial "antibiotics") and taking space on the epithelium

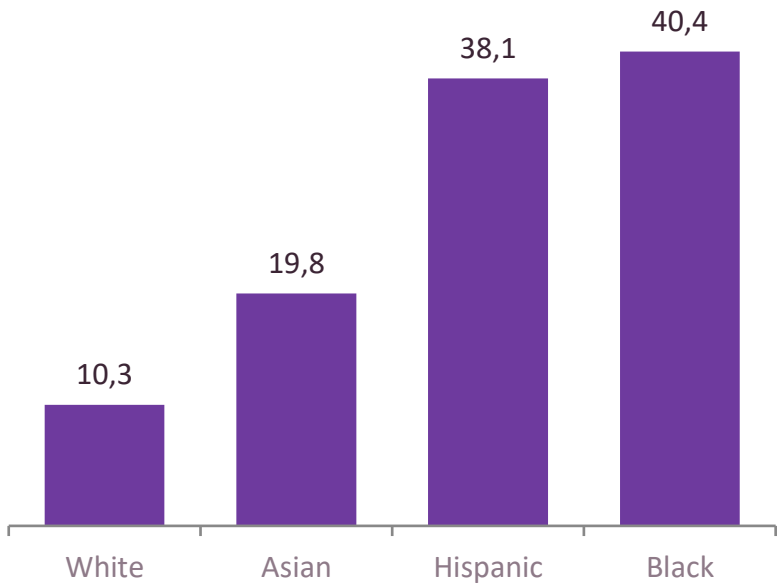
Ravel J et al. PNAS 2011;108 Suppl 1:4680-7

Five community state types

Share of 396 women

I	*L. crispatus*	**26%**
II	*L. gasseri*	**6%**
III	*L. iners*	**34%**
V	*L. jensenii*	**5%**
IV	diverse anaerobes	**27%**

Women with CST IV in each group (%)



Ravel J et al. PNAS 2011;108 Suppl 1:4680-7 (North American women, 4 ethnic groups) · host genetics: Jie Z et al. Nat Genet 2026;58:1595-609

The map legend already exists

13,160 reference profiles

1,975 women

13 sub-CSTs

VALENCIA: matches a sample to the most similar of 13 patterns

- Assigns any 16S profile to a CST in seconds
- Validated in African, adolescent and postmenopausal cohorts
- Open code and reference data
- **2026: VISTA, 25 metagenomic CSTs, 6 distinct *Gardnerella* types**

The 13 sub-CSTs

I-A	I-B	II
III-A	III-B	V
IV-A	IV-B	IV-C0
IV-C1	IV-C2	IV-C3
IV-C4		

France MT et al. VALENCIA. Microbiome 2020;8:166 · Williams A et al. VISTA. mBio 2026;17:e0364525

Not all lactobacilli are equal

L. crispatus

- Produces D- and L-lactic acid
- Most stable community (CST I)
- Linked to term birth

L. iners

- L-lactic acid only, small genome
- Makes inerolysin, a toxin that makes pores in epithelial cells
- Often a transition state towards CST IV

"Lactobacillus present" on a lab report is not enough: the species matters

Witkin SS et al. mBio 2013;4:e00460-13 · Petrova MI et al. Trends Microbiol 2017;25:182-91 · Kindinger LM et al. Microbiome 2017;5:6

Communities change: one swab shows one moment



Menstrual cycle

Shifts towards diversity during menses, then recovery

Pregnancy

More stable, *Lactobacillus*-dominated; fewer CST IV

Postpartum

Sharp shift to diversity, may last up to a year

Menopause

Fewer lactobacilli (more later today, Prof. Kamenov)

Gajer P et al. Sci Transl Med 2012;4:132ra52 · Romero R et al. Microbiome 2014;2:4 · DiGiulio DB et al. PNAS 2015;112:11060-5

Click ▸ let the clip play ▸ Second question: does the type matter?

2

The risk

Does the type matter?



One map, many outcomes

58%

BV recurrence within 12 months after metronidazole

>4×

risk of HIV infection with mixed anaerobes (not *Gardnerella*) vs *L. crispatus* dominance

OR 0.5

half the odds of GBS carriage when culture shows *L. crispatus* (1,860 swabs)

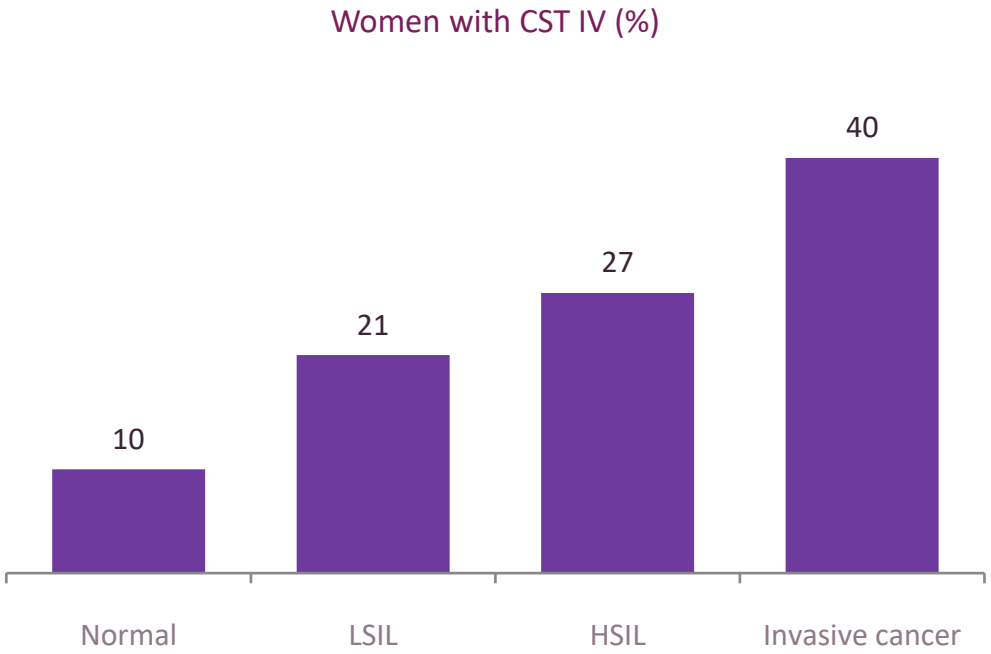
32 / 34

women with an unfavourable vaginal profile did not conceive after IVF

At embryo transfer, L. crispatus: 47% vs 19% of the community (pregnant vs not, n = 76)

Bradshaw CS, J Infect Dis 2006 · Gosmann C, Immunity 2017 · Starc M, Pathogens 2022 · Koedooder R, Hum Reprod 2019 · Väinämö S, Microbiol Spectr 2023

More severe lesions, more diverse communities



- Independent of HPV status
- *Lactobacillus* abundance falls as severity rises
- *L. gasseri* CST: fastest HPV clearance; CST IV-B: slowest

Mitra A et al. Sci Rep 2015;5:16865 (n = 169) · Brotman RM et al. J Infect Dis 2014;210:1723-33

Preterm birth: the signal depends on the population

Kindinger 2017	161 high-risk women, UK	*L. iners* at 16 wk → PTB < 34 wk (PPV 69%); *L. crispatus* → term (PPV 98%)
Callahan 2017	Two US cohorts	*L. crispatus* protective in both; low-*Lactobacillus* signal only in the low-risk cohort
Fettweis 2019	Mostly African ancestry	Lower *L. crispatus*, more BVAB1, *Sneathia*, *Prevotella* in PTB
Romero 2014	Nested case-control, US	No difference in CSTs between preterm and term

Kindinger LM, Microbiome 2017;5:6 · Callahan BJ, PNAS 2017;114:9966-71 · Fettweis JM, Nat Med 2019;25:1012-21 · Romero R, Microbiome 2014;2:18

New in 2026: the community and labour

Hu S et al. AJOG 2026 · 635 women, balloon induction at term, metagenomics

- More *L. iners*: lower chance of delivery within 24 h and a longer balloon-to-delivery time (P = 0.002)
- Rats given vaginal bacteria from women who delivered fast also delivered fastest
- Surprise: caesarean section was more likely with more *L. crispatus* (P = 0.03)

No "good" or "bad" species in every context: we need data

Hu S et al. Am J Obstet Gynecol 2026, doi:10.1016/j.ajog.2026.01.026

Click ▸ let the clip play ▸ Third question: why don't we measure it?

3

The gap

Why don't we measure it?



We look for the intruder, not the household

Test	Question it answers	Community type?
Amsel criteria	Is this BV today?	**No**
Nugent score	How many *Lactobacillus*-like rods?	**No species**
Culture	Is GBS or *Candida* present?	**No**
Molecular BV panels	Are selected BV taxa present?	**Partly**
16S / metagenomics + VALENCIA	Which community lives here?	**Yes**

Ravel J et al. PNAS 2011 · France MT et al. Microbiome 2020

Why so few of us measure it

No guideline asks for it

BV is still diagnosed with Amsel or Nugent

Tests are not validated

Direct-to-consumer vaginal tests “lack analytical and clinical validity”

No CST-guided treatment yet

Few trials use the community type as an endpoint

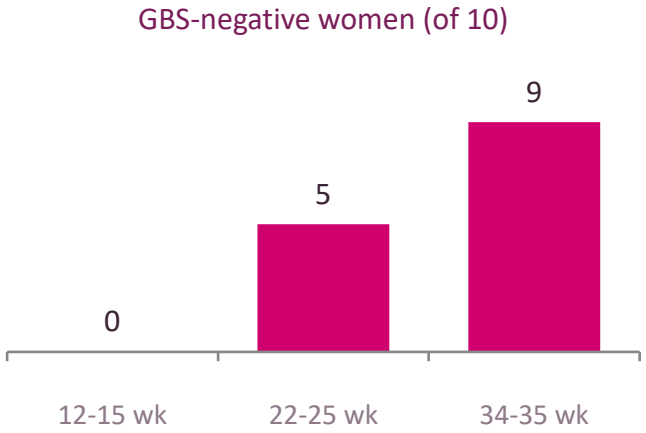
But:

- Swabs can be self-collected
- The classifier is free
- Research does it on thousands of samples

Hoffmann DE et al. J Law Biosci 2025;12:lsaf024 · Bradshaw CS et al. Nat Rev Dis Primers 2025;11:43 · France MT et al. Microbiome 2020

Our own pilot: what we measured, and what we missed





Measured: culture

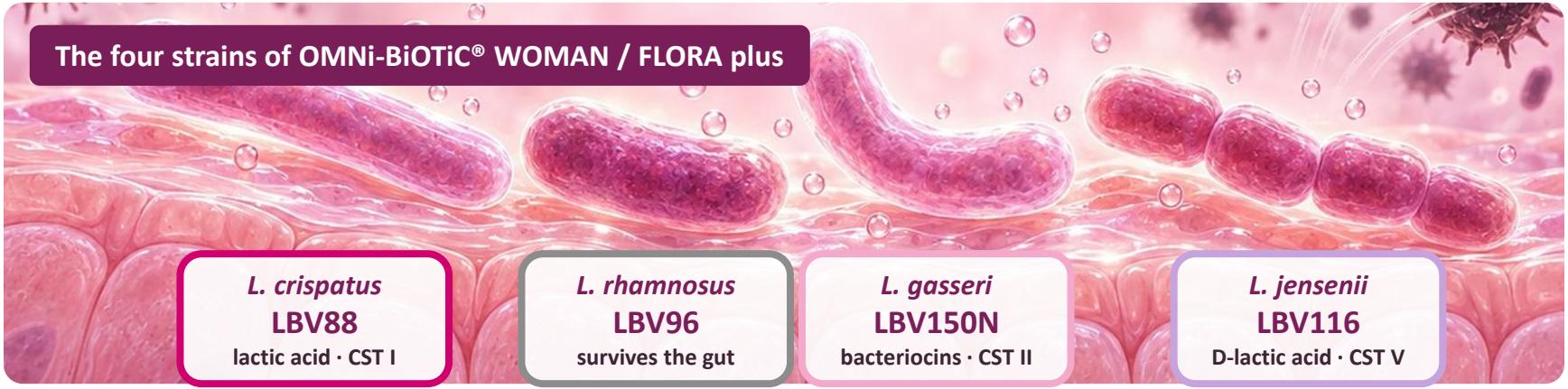
Oral multi-strain probiotic from week 15, single arm, n = 10. Median 8.6 weeks to the first negative swab.

Missed: the community

No CST before or after, no control group. 14/46 untreated GBS-negative women turned positive. Two RCTs, no significant effect on GBS: other strains from week 30 (n = 267), and the same 4 strains for 2 weeks at weeks 33-37 (n = 82).

Zych-Krekora K, Sylwestrzak O, Krekora M. J Clin Med 2026;15:1113 · Menichini D et al. EJOGRB 2025 · Farr A et al. Sci Rep 2020;10:19745

One soldier or a whole army?



pH ↓ + bacteriocins + D-lactic acid + gut survival = several layers of protection

127 vaginal isolates → 4 strains, tested in 5 randomised trials: BV · surgically reconstructed vagina · breast-cancer chemotherapy · late pregnancy · infertility. With metronidazole, 4 weeks in a yoghurt drink: BV in 0 of 17 women vs 6 of 17 on placebo.

Schematic illustration · Domig KJ et al. Benef Microbes 2014 · Laue C et al. Benef Microbes 2018 · Kaufmann U et al. EJOGRB 2014;172:102-5 · Ravel J et al. PNAS 2011

The starting community is linked to the response

NEW · 2026 · exploratory re-analysis of an RCT (NEJM 2020)

30% vs 9%

L. crispatus: dominant at week 12 probiotic vs placebo

213 women · 1 strain, given vaginally · multi-omics

Who responded? It depends on the starting community

Gardnerella-dominated	**benefited**
Prevotella-dominated	**benefited**
BVAB1-dominated (Ca. *Lachnocurva vaginae*)	**little or no improvement**

Same probiotic, different community, different result. Measure first.

Bloom SM, ..., Kwon DS. Cell Host Microbe 2026, doi:10.1016/j.chom.2026.03.003 · original trial: Cohen CR et al. NEJM 2020;382:1906-15

Take-home messages

1. **The map exists**

   Five CSTs, 13 sub-types, a free classifier

2. **It is linked to risk**

   BV, HPV/CIN, HIV, IVF, preterm birth, labour; strength depends on the population

3. **We rarely read it**

   A comparison will help us understand how well our probiotics work



Before we change a community, let's learn to read it.

Thank you

Which community am I treating?



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