

Kayla (Kale) A. Carter, PhD, MPH
Assistant Professor

Center for Advanced Microbiome Research and Innovation, Institute for Genome Sciences
Division of Genomic Epidemiology and Clinical Outcomes, Department of Epidemiology and
Public Health
University of Maryland School of Medicine

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Contact Information

Chosen name: Kale A. Carter
 Legal & publishing name: Kayla A. Carter
 Business Address: Center for Advanced Microbiome Research & Innovation
 Institute for Genome Sciences
 HSF-III, 670 W. Baltimore St, Room 3113
 Baltimore, MD 21201
 Business Phone Number: (410) 706-0885
 Email: kalecarter@som.umaryland.edu

Education

2012 – 2015	BS, Biology, Georgia Institute of Technology (Highest Honors)
2016 – 2018	MPH, Hospital and Molecular Epidemiology, University of Michigan School of Public Health
2018 – 2022	PhD, Epidemiology, University of Washington Thesis Advisor – Jennifer E. Balkus “Integrating epidemiologic and molecular methods to improve vaginal health”

Employment History

2014	Undergraduate Researcher, Department of Biological Sciences, University of Maryland Baltimore County
2014 – 2015	Undergraduate Researcher, Department of Biological Sciences, Georgia Institute of Technology
2015 – 2016	Oak Ridge Institute for Science and Education Biochemical Markers Fellow, Division of Laboratory Sciences, Centers for Disease Control and Prevention
2016 – 2018	Graduate Researcher, Department of Obstetrics and Gynecology, University of Michigan
2017	Infection Prevention Intern, St. Joseph Mercy Hospital, Ypsilanti, MI
2018 – 2022	Predoctoral Research Associate, Department of Epidemiology, University of Washington
2020	Predoctoral Research Associate, Department of Environmental and Occupational Health Sciences, University of Washington
2022 – 2026	Postdoctoral Fellow, Center for Advanced Microbiome Research & Innovation, Institute for Genome Sciences, University of Maryland School of Medicine (UMSOM)

2026 – 2026	Visiting Interim Assistant Professor, Center for Advanced Microbiome Research & Innovation, Institute for Genome Sciences, Division of Genomic Epidemiology and Clinical Outcomes, Department of Epidemiology and Public Health, UMSOM
2026 – present	Assistant Professor, Center for Advanced Microbiome Research & Innovation, Institute for Genome Sciences, Division of Genomic Epidemiology and Clinical Outcomes, Department of Epidemiology and Public Health, UMSOM

Honors and Awards

2015	Graduated with Highest Honors, Georgia Institute of Technology
2016 – 2018	Dean's Scholar, University of Michigan School of Public Health
2017	Epidemiology Dean's Research Award, University of Michigan School of Public Health
2018	Hunein F. Maassab Award for Excellence in Molecular Epidemiology, University of Michigan School of Public Health
2018	Student Poster Prize, Society for Epidemiologic Research Annual Meeting
2018	First Prize and Audience Choice Award, University of Michigan Innovation in Action Social Entrepreneurship Competition
2018 – 2019	Fund for Excellence and Innovation Top Scholar Award, University of Washington Graduate School
2019	Travel Scholarship Recipient, STD & HIV World Congress
2019 – 2022	STD/AIDS Research Training Predoctoral Fellow, University of Washington Center for AIDS and STD
2021	Husky 100 Nominee, University of Washington
2022	Excellence in Teaching Award Nominee, University of Washington
2022 – 2024	Systems-Level Research in Microbial Pathogenesis Postdoctoral Fellow, UMSOM Institute for Genome Sciences
2023	Third Place Best Paper by an Early Career Investigator, <i>Sexually Transmitted Diseases</i> , "Epidemiologic evidence on the role of <i>Lactobacillus iners</i> in sexually transmitted infections and bacterial vaginosis: a series of systematic reviews and meta-analyses"
2024	Best Postdoctoral Fellow-Led Omics Paper, UMSOM Institute for Genome Sciences, "Sexual transmission of urogenital bacteria: whole metagenome sequencing evidence from a sexual network study"
2024 – 2028	NIH Loan Repayment Program Award, National Institute of Allergy and Infectious Diseases, L70AI186137

Professional Society Memberships

2017 – present	Society for Epidemiologic Research
2022 – present	International Union Against Sexually Transmitted Infections
2022 – present	American Sexually Transmitted Diseases Association
2023 – present	Infectious Diseases Society for Obstetrics and Gynecology
2023 – present	American Society for Microbiology

Institutional Service

University of Washington

2019 – 2020	Elected Student Representative, Department of Epidemiology Curriculum Committee
2019 – 2022	Volunteer Member, Department of Epidemiology Equity, Diversity, and Inclusion Committee
2020	Volunteer Member, School of Public Health Equity, Diversity, and Inclusion Committee Anti-Racism Training Sub-Committee
2020 – 2022	Volunteer Peer Mentor to Three LGBTQ+-Identifying MPH Students, Department of Epidemiology Epi WEB (Where Everyone Belongs)
2020 – 2022	Volunteer Member, Department of Epidemiology's Curriculum Committee Anti-Racism and Diversity, Equity, and Inclusion Sub-Committee
2020 – 2022	Elected Student Representative, Department of Epidemiology Admissions Committee
2021 – 2022	Volunteer Peer Facilitator, EPIc – Department of Epidemiology Community Safe Space
2022	Invited Member, Department of Global Health 29 th Annual Principles of STI/HIV Research and Public Health Practice Course Curriculum Committee

UMSOM

2023	Invited Member, Institute for Genome Sciences Postdoctoral Fellow Salary Equity Committee
2024 – 2026	Founding Member, Institute for Genome Sciences Postdoctoral Fellow Organization

National Service

2017 – 2021	Co-Founder and Head of Education, BusyBox, LLC
2020 – present	Ad Hoc Reviewer, <i>Scientific Reports</i>
2022 – present	Ad Hoc Reviewer, <i>PLOS Medicine</i>
2023 – present	Ad Hoc Reviewer, <i>American Journal of Obstetrics and Gynecology, BMJ Open, JAMA Network Open, Microbiology Spectrum, mSystems, Nature Medicine</i>
2024	Abstract Pre-Review Mentor, Society for Epidemiologic Research Annual Meeting
2024	Abstract Reviewer, Society for Epidemiologic Research Annual Meeting
2024 – present	Ad Hoc Reviewer, <i>Journal of Women's Health, Nature Communications, npj Biofilms and Microbiomes</i>
2025 – present	Ad Hoc Reviewer, <i>BMC Microbiology, Gut Microbes, Infection and Immunity, mBio, Microbial Genomics, Microbiome, PLOS One</i>
2026 – present	Ad Hoc Reviewer, <i>Cell Reports Methods, Frontiers in Cellular and Infection Microbiology, Frontiers in Microbiomes, iScience, Journal of Applied Microbiology, Microbial Pathogenesis</i>

Teaching Service

Undergraduate Student Teaching, Mentoring, and Advising

2021	Teaching Assistant, UW EPI 360 Exploring the HIV/AIDS Pandemic (5 credits)
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2021 Guest Lecturer, UW EPI 360 Exploring the HIV/AIDS Pandemic
 “The Vaginal Microbiota, Bacterial Vaginosis, and HIV Acquisition”

Graduate Student Teaching, Mentoring, and Advising

2020, 2021 Teaching Assistant, UW EPI 554 Introduction to Epidemic Modelling for Infectious Diseases (3 credits)
 2021 Teaching Assistant, UW EPI 513 Epidemiologic Methods II (4 credits)
 2022 Co-Developer and Co-Instructor, UW EPI 592G Microbiome Research and Data Analysis (1 credit)
 2023, 2024 Guest Lecturer, UMB GPLS 725 Systems-Level Research in Microbial Pathogenesis
 “Integrating metagenomics and epidemiology to improve our understanding of the urogenital microbiome”
 2025 Guest Lecturer, UMB GPLS 725 Systems-Level Research in Microbial Pathogenesis
 “16S rRNA gene amplicon sequencing for characterizing microbiota community composition and structure”

Grant Support

Active Grants

4/24/2026 – 3/31/2031 PI, 75%
“Host-pathogen-microbiome interactions in Mycoplasma genitalium infection, pathology, and treatment: experiments in a 3D organotypic cervical epithelium model to strengthen clinical guidelines”
 National Institute of Allergy and Infectious Diseases, K01AI196239
 Annual Direct Costs: \$144,345
 Total Direct Costs: \$721,725

Completed Grants

9/16/2019 – 9/15/2022 Trainee on NIH-funded training grant (PI: Lukehart)
“STD/AIDS Research Training Grant”
 National Institute of Allergy and Infectious Diseases, T32AI007140
 9/26/2022 – 7/31/2024 Trainee on NIH-funded training grant (PI: Dunning Hotopp)
“Systems-Level Research in Microbial Pathogenesis”
 National Institute of Allergy and Infectious Diseases, T32AI162579
 8/1/2024 – 9/25/2025 PI, 100%
“Prospective contributions of the vaginal microbiome and immune milieu to spontaneous Chlamydia trachomatis clearance”
 National Institute of Allergy and Infectious Diseases, F32AI181170
 9/26/2025 – 4/23/2026 PI, 100%
 MPower Early Scholars Investment Fund Postdoctoral Bridge Funding
 University of Maryland Strategic Partnership: MPowering the State

Publications

Peer-Reviewed Journal Articles

1. Beury DW, Parker KH, Nyandjo M, Sinha P, **Carter KA**, Ostrand-Rosenberg S. Cross-talk among myeloid-derived suppressor cells, macrophages, and tumor cells impacts the

- inflammatory milieu of solid tumors. *J Leukoc Biol.* 2014;96:1109-1118. PMID: PMC4226789
2. Beury DW, **Carter KA**, Nelson C, Nyandjo M, Fitzgerald P, Sinha P, *et al.* Myeloid-derived suppressor cell survival and function are regulated by the transcription factor Nrf2. *J Immunol.* 2016;196:3470-3478. PMID: PMC4821672
 3. Kuklenyik Z, Jones JI, Gardner MS, Schieltz DM, Parks BA...**Carter K**, *et al.* Core lipid, surface lipid and apolipoprotein composition analysis of lipoprotein particles as a function of particle size in one workflow integrating asymmetric flow field-flow fractionation and liquid chromatography-tandem mass spectrometry. *PLoS One.* 2018;13(4): e0194797. PMID: PMC5892890
 4. **Carter KA**, Malani AN. Laxative use and testing for *Clostridium difficile* in hospitalized adults: an opportunity to improve diagnostic stewardship. *Am J Infect Control.* 2019;47(2):170-174. PMID: 30301657
 5. Gardner MS, Kuklenyik Z, Lehtikoski A, **Carter KA**, McWilliams LG, Kusovschi J, *et al.* Development and application of a high throughput one-pot extraction protocol for quantitative LC-MS/MS analysis of phospholipids in serum and lipoprotein fractions in normolipidemic and dyslipidemic subjects. *J Chromatogr B Analyt Technol Biomed Life Sci.* 2019;1118-1119:137-147. PMID: PMC713845
 6. Balkus JE, **Carter KA**, McClelland RS. Lessons from suppressive therapy and periodic presumptive treatment for bacterial vaginosis. *Curr Infect Dis Rep.* 2019;21(10):34. PMID: 31473820 ~~‡~~
 7. McKee KS, **Carter KA**, Bassis C, Young V, Reed B, Harper DM, *et al.* The vaginal microbiota, high-risk human papillomavirus infection, and cervical cytology: results for a population-based study. *Gynecol Pelvic Med.* 2020;3:18. PMID: PMC8896808
 8. Tiwari R, Wang J, Han H, Kalu N, Sims LB...**Carter KA**, *et al.* Sexual behaviour change following HIV testing services: A systematic review and meta-analysis. *J Int AIDS Soc.* 2020;23(11):e25635. PMID: PMC7649006
 9. **Carter KA**, Simpson CD, Raftery D, Baker MG. Short report: Using targeted urine metabolomics to distinguish between manganese exposed and unexposed workers in a small occupational cohort. *Front Public Health.* 2021;9:666787. PMID: PMC8172780
 10. **Carter KA**, Srinivasan S, Fiedler TL, Anzala O, Kimani J, Mochache V, *et al.* Vaginal bacteria and risk of incident and persistent infection with high-risk subtypes of human papillomavirus: a cohort study among Kenyan women. *Sex Transm Dis.* 2021;48(7):499-507. PMID: PMC8184569
 11. **Carter KA**, Balkus JE, Anzala O, Kimani J, Hoffman NG, Fiedler TL, *et al.* Associations between vaginal bacteria and bacterial vaginosis signs and symptoms: a comparative study of Kenyan and American women. *Front Cell Infect Microbiol.* 2022;12:801770. PMID: PMC8931342
 12. **Carter KA**, Fischer MD, Petrova MI, Balkus JE. Epidemiologic evidence on the role of *Lactobacillus iners* in sexually transmitted infections and bacterial vaginosis: a series of systematic reviews and meta-analyses. *Sex Transm Dis.* 2023;50(4):224-235. PMID: PMC10006306 **[Third Place Best Paper by an Early Career Investigator]**
 13. Holm JB, **Carter KA**, Ravel J, Brotman RM. *Lactobacillus iners* and genital health: molecular clues to an enigmatic vaginal species. *Curr Infect Dis Rep.* 2023;25:67-75. PMID: PMC10209668 ~~‡~~
 14. **Carter KA**, Fodor AA, Balkus JE, Zhang A, Serrano MG, Buck GA, *et al.* Vaginal microbiome metagenome inference accuracy: differential measurement error according to community composition. *mSystems.* 2023;8(2):e01003-22. PMID: PMC10134888
 15. **Carter KA**, France MT, Rutt L, Bilski L, Martinez-Greife S, Regan M, *et al.* Sexual transmission of urogenital bacteria: whole metagenome sequencing evidence from a sexual

network study. *mSphere*. 2024;9(3):e00030-24. PMCID: PMC10964427. **[Best Postdoctoral Fellow-Led Omics Paper]** §

16. **Carter KA**, Tuddenham S, Brotman RB. Dequalinium Chloride: An Emerging Option in the Sparse Landscape of Bacterial Vaginosis Therapies? *JAMA Network Open*. 2024;7(5):e248606. PMCID: PMC11423866. ‡

‡Invited commentary/review.

§Selected for commentary, editorial, or as Editor's Pick.

Non-Peer-Reviewed Journal Articles

1. Eastman AJ, Sack D, Chai D, Bassis CM, **Carter KA**, Young VB, *et al*. Effects of the copper IUD on composition of the vaginal microbiota in the olive baboon. *bioRxiv* 720185; doi: <https://doi.org/10.1101/720185>.

Abstracts

1. **Carter KA**, McKee KS, Bassis CM, Bell JD, Young VB, Reed BD, *et al*. The vaginal microbiota, high risk human papillomavirus infection, and cervical intraepithelial neoplasia in a population-based study. Poster presentation at the 2018 Society for Epidemiologic Research Annual Meeting, Baltimore, MD, USA. **[Student poster prize]**
2. **Carter KA**, Bassis CM, McKee K, Bullock KA, Eastman AJ, Young VB, *et al*. The impact of tampon use on the vaginal microbiota across four menstrual cycles. Oral presentation at the 2018 Infectious Diseases Society for Obstetrics and Gynecology Annual Meeting, Philadelphia, PA, USA.
3. **Carter KA**, Srinivasan S, Kimani J, Anzala O, Kabare E, Shafi J, *et al*. Vaginal bacteria and risk of incident and persistent infection with high-risk subtypes of human papillomavirus. Oral presentation at the STI & HIV 2019 World Congress, Vancouver, Canada.
4. **Carter KA**, Balkus JE, Anzala O, Kimani J, Hoffman NG, Fiedler TL, *et al*. Associations between vaginal bacteria and bacterial vaginosis signs and symptoms: a comparative study of Kenyan and American cisgender women. Oral presentation at the STI & HIV 2021 World Congress, Amsterdam, Netherlands.
5. **Carter KA**, Fischer MD, Petrova MI, Balkus JE. *Lactobacillus iners* in sexual health: systematic reviews and meta-analyses. Poster presentation at the 2021 Keystone eSymposium Global Priorities in Vaginal Health: Microbes, Mucosal Immunity and Interventions.
6. **Carter KA**, France MT, Rutt L, Regan M, Brotman RM, Ravel J. Sexual transmission of urogenital bacteria in heterosexual partners: whole metagenome sequencing evidence from a sexual network study. Oral presentation at STI & HIV 2023 World Congress, Chicago, IL, USA.
7. **Carter KA**, Brown SE, Tuddenham S, Shardell MD, Ghanem KG, Ravel J, *et al*. Exploring associations of the vaginal microbiome and STI co-infections with spontaneous clearance of urogenital *Chlamydia trachomatis*. Oral presentation at 2024 International Union Against STI World Congress, Sydney, Australia.
8. **Carter KA**, Brown SE, Rutt L, Barrett C, Jindal R, Shardell MD, *et al*. Contribution of the cervicovaginal microbiome to *Chlamydia trachomatis* spontaneous clearance: Evidence from a longitudinal study. Oral presentation at STI & HIV 2025 World Congress, Montreal, Canada.
9. **Carter KA**, Brown SE, Holm JB, Macintyre AN, Rutt LS, Barrett C, *et al*. *Lactobacillus crispatus*-dominated cervicovaginal microbiomes coupled with distinct immune profiles are associated with spontaneous clearance of *Chlamydia trachomatis*. Poster presentation at the 2026 Mid-Atlantic Microbiome Meet-Up Annual Meeting, College Park, MD, USA.

10. **Carter KA**, Brown SE, Holm JB, Macintyre AN, Rutt LS, Barrett C, *et al.* *Lactobacillus crispatus*–dominated cervicovaginal microbiomes coupled with distinct immune profiles are associated with spontaneous clearance of *Chlamydia trachomatis*. Poster presentation at the 2026 Microbes in Women's Health Congress, Valencia, Spain.
11. **Carter KA**, Macintyre AN, Brown SE, Holm JB, Shardell MD, Manabe YC, *et al.* The cervicovaginal immune milieu and microbiome jointly influence *Chlamydia trachomatis* spontaneous clearance. Poster presentation at the 2026 American Society for Microbiology Microbe ASM Health Annual Meeting, Washington DC, USA.

Invited Presentations

Local/Regional

1. **Carter KA**. Quantitative LC-MS/MS analysis of lipoprotein sub-class composition, Centers for Disease Control and Prevention Division of Laboratory Sciences Summer Symposium, Atlanta, GA, 2016.
2. **Carter KA**. Examining the impact of tampon use on the vaginal microbiota across multiple menstrual cycles, University of Michigan Center for Microbial Systems Seminar, Ann Arbor, MI, 2017.
3. **Carter KA**. Examining the impact of tampon use on the vaginal microbiota across multiple menstrual cycles, University of Michigan Hospital and Molecular Epidemiology Seminar, Ann Arbor, MI, 2018.
4. **Carter KA**. Vaginal bacteria and risk of incident and persistent infection with high-risk subtypes of human papillomavirus: a retrospective cohort study among Kenyan women, University of Washington Kenya Research and Training Center Seminar, Seattle, WA, 2020.
5. **Carter KA**. Associations between vaginal bacteria and bacterial vaginosis signs and symptoms: a comparative study of Kenyan and American women, 18th Annual University of Washington Center for AIDS and STD AIDS & STD Research Symposium, Seattle, WA, 2021.
6. **Carter KA**. Exploring associations of the vaginal microbiome and STI co-infections with spontaneous clearance of urogenital *Chlamydia trachomatis*, 11th Annual Cross-Talk University of Maryland Baltimore/University of Maryland College Park Microbiology and Immunology Research Symposium, Baltimore, MD, 2024.