# Emily Howerton

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## EDUCATION AND ACADEMIC APPOINTMENTS

**Princeton University**, Postdoctoral Research Associate (2024 – Present)

**Pennsylvania State University**, Ph.D., Biology (2018 – 2023)
Dissertation: Quantitative Approaches to Improve the Management of Infectious Disease Outbreaks

**College of Wooster**, B.A., Mathematics and Philosophy (2013 – 2017) Summa Cum Laude
Undergraduate Thesis: On Rationality and Morality: Three Kinds of Approaches

## PUBLICATIONS

### Published and accepted

(* denotes co-first authors)

1. SW Park, B Noble, **E Howerton**, BF Nielsen, SS Jiudice, L Ambroggio, S Dominguez, K Messacar, B Grenfell. 2024. "Predicting the impact of non-pharmaceutical interventions against COVID-19 on Mycoplasma pneumoniae in the United States." *Epidemics* 100808. https://doi.org/10.1016/j.epidem.2024.100808
2. **E Howerton**, TL Langkilde, and K Shea. 2024. "Misapplied management makes matters worse: Spatially explicit control leverages biotic interactions to slow invasion." *Ecological Applications*. e2974. https://doi.org/10.1002/eap.2974.
3. LK Wade-Malone*, **E Howerton***, MC Runge, WJM Probert, C Viboud, and K Shea. 2024. "When do we need multiple models? Agreement between projection rank and magnitude in a multi-model setting." *Epidemics* 47: 100767. https://doi.org/10.1016/j.epidem.2024.100767
4. MC Runge, K Shea, **E Howerton**, K Yan, H Hochheiser, E Rosenstrom, WJM Probert, R Borchering, MV Marathe, B Lewis, S Venkatramanan, S Truelove, J Lessler, C Viboud. 2024. "Scenario design for infectious disease projections: Integrating Concepts from Decision Analysis and Experimental Design." *Epidemics* 100775. https://doi.org/10.1016/j.epidem.2024.100775
5. S-m Jung, S Loo, **E Howerton**, L Contamin, CP Smith, EC Carcelén, K Yan, et al. 2024. "Potential impact of annual vaccination with reformulated COVID-19 vaccines: lessons from the U.S. COVID-19 Scenario Modeling Hub." *PLOS Medicine* 21 (4): e1004387. https://doi.org/10.1371/journal.pmed.1004387
6. C Bay, G St-Onge, JT Davis, M Chinazzi, **E Howerton**, J Lessler, MC Runge, K Shea, S Truelove, C Viboud, and A Vespignani. 2024. "Ensemble$^2$: scenarios ensembling for communication and performance analysis." *Epidemics* 46: 100748. https://doi.org/10.1016/j.epidem.2024.100748
7. C Vanalli, **E Howerton**, F Yang, TN-A Tran, W Hu. 2024. "People and Data: Solving planetary challenges together." *Frontiers in Environmental Science* 12. https://doi.org/10.3389/fenvs.2024.1332844
8. S Loo, **E Howerton**, L Contamin, CP Smith, RK Borchering, et al. 2024. "The US COVID-19 and Influenza Scenario Modeling Hubs: Delivering long-term projections to guide policy." *Epidemics* 46:100738. https://doi.org/10.1016/j.epidem.2023.100738
9. **E Howerton**, L Contamin, LC Mullany, M Qin, et al. 2023. "Evaluation of the US COVID-19 Scenario Modeling Hub for informing pandemic response under uncertainty." *Nature Communications* 14(1):7260. https://doi.org/10.1038/s41467-023-42680-x
   Impact: Invited to write about this research for The Conversation

10. **E Howerton***, K Dahlin*, C Edholm, L Fox, M Reynolds, B Hollingsworth, G Lytle, M Walker, J Blackwood, and S Lenhart. 2023. "The effect of governance structures on optimal control of two-patch epidemic models." *Journal of Mathematical Biology* 87(5):74. https://doi.org/10.1007/s00285-023-02001-8

11. F Yang, TN-A Tran, **E Howerton**, MF Boni, JL Servadio. 2023. "Benefits of near-universal vaccination and treatment access to manage COVID-19 burden in the United States." *BMC Medicine* 21(1): 321. https://doi.org/10.1186/s12916-023-03025-z

12. K Shea, RK Borchering, WJM Probert, **E Howerton**, et al. 2023. "Multiple Models for Outbreak Decision Support in the Face of Uncertainty." *Proceedings of the National Academy of Sciences* 120 (18): e2207537120. https://doi.org/10.1073/pnas.2207537120.

13. FM Castonguay, JC Blackwood, **E Howerton**, K Shea, C Sims and JN Sanchirico. 2023. "Optimal spatial evaluation of a pro rata vaccine distribution rule for COVID-19." *Scientific Reports* 13:2194. https://doi.org/10.1038/s41598-023-28697-8

14. **E Howerton**, MC Runge, TL Bogich, RK Borchering, H Inamine, J Lessler, WJM Probert, CP Smith, S Truelove, C Viboud, and K Shea. 2023. "Context-dependent representation of within- and between-model uncertainty: aggregating probabilistic predictions in infectious disease epidemiology." J*ournal of the Royal Society Interface* 20:198. https://doi.org/10.1098/rsif.2022.0659

15. RK Borchering, LC Mullany, **E Howerton**, M Chinazzi, CP Smith, M Qin, NG Reich, et al. 2023. "Impact of SARS-CoV-2 Vaccination of Children Ages 5-11 Years on COVID-19 Disease Burden and Resilience to New Variants in the United States, November 2021-March 2022: A Multi-Model Study." *The Lancet Regional Health – Americas* 17(January): 100398. https://doi.org/10.1016/j.lana.2022.100398.

16. S Truelove, CP Smith, M Qin, LC Mullany, RK Borchering, J Lessler, K Shea, **E Howerton**, L Contamin, et al. 2022. "Projected resurgence of COVID-19 in the United States in July-December 2021 resulting from the increased transmissibility of the Delta variant and faltering vaccination." *eLife* 11:e73584. https://doi.org/10.7554/eLife.73584

17. **E Howerton**, MJ Ferrari, ON Bjørnstad, TL Bogich, RK Borchering, CP Jewell, JD Nichols, WJM Probert, MJ Tildesley, MC Runge, C Viboud, and K Shea. 2021. "Synergistic interventions to control COVID-19: mass testing and isolation mitigates reliance on distancing." *PLOS Computational Biology* 17 (10): e100 9518. https://doi.org/10.1371/journal.pcbi.1009518.

18. JD Nichols, TL Bogich, **E Howerton**, ON Bjørnstad, RK Borchering, MJ Ferrari, MJ Haran, CP Jewell, KM Pepin, WJM Probert, JRC Pulliam, MC Runge, MJ Tildesley, C Viboud, and K Shea. "Strategic Testing Approaches for Targeted Disease Monitoring Can Be Used to Inform Pandemic Decision-Making." *PLOS Biology* 19 (6): e3001307. https://doi.org/10.1371/journal.pbio.3001307.

    Impact: USGS Briefing to head of US Dept. of Interior and press release; reached 30K+ Facebook users; reported by 10+ news outlets

19. RK Borchering, C Viboud, **E Howerton**, CP Smith, S Truelove, MC Runge, NG Reich, et al. 2021. "Modeling of Future COVID-19 Cases, Hospitalizations, and Deaths, by Vaccination Rates and Nonpharmaceutical Intervention Scenarios — United States, April–September 2021." *Morbidity and Mortality Weekly Report* 70 (19): 719–24. https://doi.org/10.15585/mmwr.mm7019e3.

    Impact: this article is in the top 5% of all research outputs scored by Altmetric; 2-minute report by CDC Director, Dr. Rochelle Walensky, on COVID-19 White House Press Briefing (May 5, 2021); 550+ tweets; reported on 125+ news outlets

20. RD Pasteur, **E Howerton**, P Pozderac, S Young, and J Moore. (2018) "A Flight-Based Metric for Evaluating NFL Punters." *Journal of Sports Analytics* 4 (3): 201–213. https://doi.org/10.3233/JSA-180164

### Submitted and in prep

1. **E Howerton**, TC Williams, J-S Casalegno, S Dominguez, R Gunson, K Messacar, CJE Metcalf, SW Park, C Viboud, BT Grenfell. "Using COVID-19 pandemic perturbation to model RSV-hMPV interactions and potential implications in an era of RSV interventions". *Submitted.*
2. L Shandross*, **E Howerton***, Lucie Contamin, Harry Hochheiser, Anna Krystalli, Consortium of Infectious Disease Modeling Hubs, Nicholas G. Reich, Evan L. Ray. "hubEnsembles: Ensembling methods in R". *Submitted.*
3. S Loo, S-m Jung, L Contamin, **E Howerton**, S Bents, *et al.* Scenario projections of COVID-19 hospitalizations and deaths in response to immune escape levels and annual vaccination recommendations—United States, April 2024–April 2025. *In prep.*
4. D Pak, **E Howerton**, WJM Probert, MC Runge, R Li, ON Bjørnstad, and K Shea. "The value of information in age-prioritization of COIVD-19 vaccination." *In prep*.

### Technical documents

1. Coauthor on COVID-19 Scenario Modeling Hub Reports rounds 5-17; reports are provided to the U.S. Centers for Disease Control (CDC). Results have supported key pandemic decision-making:
    a. Informed U.S. Centers for Disease Control (CDC) Advisory Council on Immunization Practices (ACIP) recommendation for vaccination in 5-11 year old children, including results in Evidence to recommendations framework (p. 10)
    b. Informed U.S. CDC ACIP recommendation for booster shots in Fall 2022, including results in Evidence to recommendations framework (p. 49-52), MMWR publication, and corresponding coverage in the New York Times

## AWARDS

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| 2018-2023 | Inaugural Eberly College of Science Barbara McClintock Science Achievement Graduate Fellow |
| 2023 | Penn State University Alumni Association Dissertation Award |
| 2022 | Global Winner, Earnst & Young Building a Better Working World Data Challenge |
| 2021 | Peter J. Hudson Best Student Paper Award |
| | Jeanette Ritter Mohnkern Graduate Student Scholarship in Biology |
| 2020 | National Science Foundation Graduate Research Fellowship, Honorable Mention |
| 2018 | University Graduate Fellowship |
| | NCAA Post-Graduate Scholarship Recipient |
| 2017 | National Science Foundation STEM Scholar (2015-2017) |
| | Women's Golf Coaches Association All American Scholar (2015-2017) |
| | William A. Galpin Award for General Excellence in College Work |
| | David A. Guldin Award in Physical Education |
| | John F. Miller Prize in Philosophy |
| | William H. Wilson Price in Mathematics |
| 2016 | Edward Taylor Prize in Mathematics |
| 2015 | Andrew D. Cronin Emerging Leader Award |
| | Lyman C. Knight Sr. Prize in Mathematics and Physical Education |

## SERVICE AND LEADERSHIP

### Princeton University

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| 2024-Present | Member, Ecology and Evolutionary Biology Climate Committee for All |

2024-2025 Member, Epidemics[10] Scientific Advisory Committee

2023-2023 Mentor and Application Review Committee Member, EEB Scholars Program

### Pennsylvania State University

2020-2023 Member, Eberly College of Science Climate and Diversity Committee

2022 Project mentor, MIDAS Network/Harvard CCDD Conference to Increase Diversity in Mathematical Modeling and Public Health (including pre-conference workshop on effective teaching practices)

2020-2021 Co-president, Center for Infectious Disease Dynamics Graduate Student Association

2019 Co-designer and co-leader, Girl Scout Workshop

Mentor, First Generation Advocates, Penn State University

Volunteer, Discovery Space, State College, PA

## GRANTS AND FUNDING

Center for Infectious Disease Dynamics Graduate Student Association Travel Grant. 2021. $1,000.

National Science Foundation Research Experience for Undergraduates (NSF-REU) Supplement to the EEID grant "US-UK Collab: Adaptive surveillance and control for endemic disease elimination" (PI: Matthew J. Ferrari). National Science Foundation. 5/1/2022-8/1/2022. $7,000.
With Katriona Shea (co-PI), I advised La Keisha Wade Malone to write this proposal to fund a second summer of her research projection.

National Science Foundation Research Experience for Undergraduates (NSF-REU) Supplement to the EEID grant "US-UK Collab: Adaptive surveillance and control for endemic disease elimination" (PI: Matthew J. Ferrari). National Science Foundation. 5/1/2020-8/1/2020. $6,000.
With Matthew J. Ferrari (PI) and Katriona Shea (co-PI), I helped write and was the named graduate student on this grant to mentor an undergraduate student in summer research.

Embracing uncertainty in COVID-19 management (PI: Katriona Shea). Huck Institutes of the Life Sciences Coronavirus Research Seed Fund (CRSF). 3/11/2020 - 3/10/2021. $73,785.
With advisor Katriona Shea, I co-wrote and was the named graduate student on this grant.

## PRESENTATIONS

(* denotes presenter)

### Invited oral presentations

1. Informing public health response in the face of uncertainty: Lessons from the US Scenario Modeling Hub. **E Howerton*** C Viboud, and J Lessler on behalf of the COVID-19 Scenario Modeling Hub. Isaac Newton Institute Modelling and inference for pandemic preparedness - a focussed workshop. August 5-9, 2024.
2. Synergistic interventions to control COVID-19. **E Howerton***, MJ Ferrari, ON Bjørnstad, TL Bogich, RK Borchering, CP Jewell, JD Nichols, WJM Probert, MJ Tildesley, MC Runge, C Viboud, and K Shea. Joint Mathematics Meetings. Invited oral presentation. April 6-8, 2022.
3. Synergistic interventions to control COVID-19. **E Howerton***, MJ Ferrari, ON Bjørnstad, TL Bogich, RK Borchering, CP Jewell, JD Nichols, WJM Probert, MJ Tildesley, MC Runge, C Viboud, and K Shea. Department of Biology, Pennsylvania State University. Invited oral presentation by the Jeanette Ritter Mohnkern award winner. August 24, 2021.

## Oral presentations

4. Modeling the impact of RSV interventions on hMPV burden and dynamics. **E Howerton.** Fogarty International Center EPS Modeling Seminar, National Institutes of Health. October 16, 2024.
5. An introduction to Human Metapneumovirus. **E Howerton**. Life course immunity: a multi-pathogen perspective. February 9, 2024.
6. Informing pandemic response in the face of uncertainty: An evaluation of the US COVID-19 Scenario Modeling Hub. **E Howerton***, C Viboud, and J Lessler on behalf of the COVID-19 Scenario Modeling Hub. Epidemics9. November 28, 2023.
7. What does it mean to evaluate a scenario projection? Lessons from the COVID-19 Scenario Modeling Hub. **E Howerton***, J Lessler, C Viboud on behalf of the COVID-19 Scenario Modeling Hub contributors. Royal Society meeting on forecasting infectious disease incidence. March 15, 2023.
8. Collaborative open hubs for infectious disease modeling. C Viboud*, **E Howerton**, A Vespignani, J Lessler, on behalf of the COVID-19 Scenario Modeling Hub and Ebola Forecast Challenge contributors. Royal Society meeting on forecasting natural and social systems. March 14, 2023.
9. Optimizing management decisions for control of infectious disease outbreaks. **E Howerton*** Northeastern University. February 6, 2023.
10. A look back at fifteen rounds of SMH: Evaluation. **E Howerton*** COVID-19 Scenario Modeling Hub Meeting 2022 – Past, Present, and Future of Scenario Modeling for the US. September 14, 2022.
11. Looking back at one year of the COVID-19 Scenario Modeling Hub. **E Howerton***, on behalf of the COVID-19 Scenario Modeling Hub Team. MIDAS Annual Meeting. September 8, 2022.
12. Misapplied management makes matters worse: Spatially explicit control strategies that leverage biotic interactions may more effectively prevent invader spread. **E Howerton***, T Langkilde, and K Shea. August 17, 2022.
13. How to get the best out of multiple disease models. **E Howerton***, MC Runge, TL Bogich, RK Borchering, H Inamine, J Lessler, LC Mullany, WJM Probert, CP Smith, S Truelove, C Viboud, K Shea. Ecology and Evolution of Infectious Diseases. June 6-9, 2022.
14. Scenario Modeling Hub round 13 preview and evaluation. J Lessler* and **E Howerton*** on behalf of COVID-19 Scenario Modeling Hub. United States Centers for Disease Control Council of State and Territorial Epidemiologists. April 5, 2022.
15. Comparing aggregation methods for COVID-19 Scenario Modeling Hub. **E Howerton*** COVID-19 Scenario Modeling Hub Weekly Meeting. June 18, 2021.

## Poster presentations

16. Cross-protection and the lags between RSV and Human Metapneumovirus outbreaks. E Howerton*, TC Williams, J-S Casalegno, CJE Metcalf, SW Park, BT Grenfell. Ecology and Evolution of Infectious Disease Dynamics. June 25, 2024.
17. Informing pandemic response in the face of uncertainty: An evaluation of the US COVID-19 Scenario Modeling Hub. **E Howerton***, K Shea, C Viboud, and J Lessler on behalf of the COVID-19 Scenario Modeling Hub. Ecology and Evolution of Infectious Disease Dynamics. May 23, 2023.
18. Theory of combining probabilistic projections with applications in epidemiology. **E Howerton***, MC Runge, TL Bogich, RK Borchering, H Inamine, J Lessler, LC Mullany, WJM Probert, CP Smith, S Truelove, C Viboud, K Shea. Epidemics8. Poster. November 29 - December1, 2021.

19. Synergistic interventions to control COVID-19: mass testing and isolation mitigates reliance on distancing. **E Howerton***, MJ Ferrari, ON Bjørnstad, TL Bogich, RK Borchering, CP Jewell, JD Nichols, WJM Probert, MJ Tildesley, MC Runge, C Viboud, and K Shea. Ecology and Evolution of Infectious Diseases. Poster. June 14-17, 2021.

## TEACHING

### Pennsylvania State University

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|---|---|---|
| TA | Ecological and Environmental Problem Solving | Spring 2020, Spring 2021 |

### College of Wooster

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| TA | First Year Seminar | Fall 2014, Fall 205 |
| | Calculus with Algebra A | Fall 2014, Fall 2015, Fall 2016 |
| | Calculus with Algebra B | Spring 2015, Spring 2016, Spring 2017 |
| | Logic & Philosophy | Spring 2015 |
| Tutor | Math Center (Pre-calculus – Calculus III) | Spring 2015 – Spring 2017 |

## MENTORSHIP

Emily Zhang (Fall 2025 – present), Catalina Posada (spring 2024 – fall 2024); La Keisha Wade-Malone, NSF-REU funding (summer 2021 – fall 2022)

## WORKSHOP PARTICIPATION

Isaac Newton Institute "Modelling and inference for pandemic preparedness - a focused workshop". University of Cambridge. August 5-9, 2024. Invited and funded participant.

Communication Arts & Sciences Summer Symposium "Viral Movements". Pennsylvania State University. May 15-16, 2024. Invited and funded participant.

The Royal Society Satellite Meeting "Forecasting infectious disease incidence for public health". Royal Society, London, UK. March 15-16, 2023. Invited and funded participant.

Ecology and Evolution of Infectious Disease Dynamics Workshop "Pandemic Scenario Modeling and Science Communication". June 3-6, 2022. Invited and funded participant.

American Mathematical Society "Dynamics of Infectious Diseases: Ecological Models Across Multiple Scales" Mathematics Research Community. May 30-June 5, 2021. Invited and funded participant.

National Science Foundation "Advancing Ecological Theory" workshop. Pennsylvania State University. October 23-25, 2019.

## PROFESSIONAL MEMBERSHIPS

Ecological Society of America, American Association for the Advancement of Science, American Mathematical Society, Phi Beta Kappa Academic Honor Society

## REVIEWING ACTIVITY

American Journal of Epidemiology, BMC Medical Information and Decision Making, BMC Public Health, Communications Biology, eLife, Epidemics, Epidemiology and Infection, Lancet Digital Health, Lancet Regional Health – Americas, Mathematical Biosciences, Mathematical Biosciences and Engineering, PLOS Computational Biology, PLOS One, Royal Society Open Science, Science Advances, Scientific Reports