Maxwell Murphy

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EDUCATION

University of California, Berkeley   **Berkeley, CA**

Ph.D. Biostatistics   Expected May 2024

M.A. Biostatistics   May 2019

B.A. Molecular and Cellular Biology — Developmental Genetics   May 2013

SKILLS

Computer/Programming:

- Languages | Python, R, Typescript, Javascript, SQL, Java, C++, C, Bash
- Frameworks/Libraries/Tools | Tidyverse, Flask, NumPy, SciPy, MatPlotLib, Pandas, D3.js, TensorFlow, Angular, Git, Docker
- Parallel programming/algorithm implementation, and cloud computing

Statistics:

- Applying causal inference techniques and ensemble machine learning to estimate effects of longitudinal, static, and dynamic interventions
- Developing and applying Bayesian Modeling methodology and using probabilistic programming languages
- Working with large -omics and sequencing datasets such as scRNAseq and microarray data

RESEARCH EXPERIENCE

University of California, Berkeley   **Berkeley, CA**

Center for Targeted Machine Learning and Causal Inference

Accenture Targeted Learning and Causal Inference Fellow   Jan 2020–Aug 2022

Developed software for applying targeted learning and causal inference methodology with a focus on real industry use-cases, 'big data' sets, and cluster trials. Developed novel approach to managing supply chain risk through state of the art survival analysis and machine learning.

University of California, San Francisco   **San Francisco, CA**

Graduate Student Researcher — Principle Investigator: Bryan Greenhouse (Biohub)   Aug 2017–Current

Currently developing statistical models to infer underlying complexity of malaria infections using mixed genetic data and spatial models of population structure to infer origin of clinically detected infections. Providing support to lab members in developing statistical models for various bioinformatics pipelines.

Staff Research Associate II | Lab Manager — Greenhouse Lab/Malaria Elimination Initiative   Apr 2014–Aug 2017

Conducted large scale multiplex and nested PCR experiments to generate genetic data for malaria transmission mapping. Developed data analysis pipeline and graphical user interface for high-throughput analysis of genetic data from malaria causing parasites. Developed applications for tracking clinical samples used in lab, and data visualization tools for analyzing transmission network based data. Carried out administrative duties of lab, managed other members of the lab, conducted PCR experiments on clinical samples, liaised with foreign clinical labs and provided technical support for protocols.

INDUSTRY EXPERIENCE

Accenture   **San Francisco, CA**

Technology Innovation Summer Associate Manager   May 2021–Aug 2021

Developed causal inferential frameworks applying the Targeted Learning methodology to leverage machine learning while maintaining robust statistical inference with applications to problems within supply chain management. Developed a simulation framework in Python to explore performance of various machine learning methods and provide insights to stakeholders.

Verily Life Sciences — Project Debug   **South San Francisco, CA**

Data Science Intern   May 2019–Aug 2019

Developed statistical pipelines to provide realtime estimates of and inference around mosquito abatement techniques. Developed probabilistic spatial models of mosquito dispersal to inform and optimize adaptive mosquito release scheduling. Provided statistical guidance in developing experimental trial design.

CytomX Therapeutics   **South San Francisco, CA**

Database Developer   Oct 2013—Apr 2014

Developed SQL database to organize and make accessible in-vivo data generated by the Pharmacology group. Used VBA to develop an Excel/VBA based front-end to access and upload data for non-technical users. Carried out data analysis on publicly available gene expression data (The Cancer Genome Atlas) and built internal tools for data exploration and use by other members of company.

Pharmacology/Bioinformatics Intern   May 2013–Aug 2013

Performed data analysis on publicly available gene expression data to identify potential targets for cancer therapeutics, then carried out cell cytotoxicity experiments at the bench to validate predictions. Carried out day-to-day tasks in the pharmacology group tasked with characterizing efficacy of novel cancer therapeutics, including maintaining cancerous mammalian cell lines and basic animal husbandry in a BSL 2 lab.

SOFTWARE DEVELOPMENT

moire (https://eppicenter.github.io/moire)

R package for joint Bayesian estimation of allele frequencies and multiplicity of infection from potentially multiply infected malaria samples using genotyping of multi-allelic loci.

MicroSPAT: Microsatellite Parameterized Analysis Tools (https://github.com/EPPIcenter/MicroSPAT)

MicroSPAT is a collection of tools for semi-automated analysis of raw capillary electrophoresis (CE) data output by the ABI 3730. MicroSPAT integrates several features including a plate view for quality checking, automated ladder identification, sample based association of FSA data to keep data organized in a logical manner, automated allele identification using a clustering algorithm, automated artifact correction, automated quantification bias correction, and automated genotyping of samples with the option of manual curation.

SampleDB (https://github.com/EPPIcenter/sample_db)

SampleDB is an open source database implementation with graphical user interface to track clinical lab samples and their usage. SampleDB supports tracking of sample specimens by barcoded tubes, for example the Matrix ™ barcoded tube system.

Publications

Huber, J. H., Hsiang, M. S., Dlamini, N., **Murphy, M.,** Vilakati, S., Nhlabathi, N., Lerch, A., Nielsen, R., Ntshalintshali, N., Greenhouse, B. & Perkins, T. A. Inferring Person-to-Person Networks of Plasmodium Falciparum Transmission: Are Analyses of Routine Surveillance Data up to the Task? *Malaria Journal* **21,** 58. ISSN: 1475-2875. `https://doi.org/10.1186/s12936-022-04072-2` (2022) (Feb. 21, 2022).

Roh, M. E., Mpimbaza, A., Oundo, B., Irish, A., **Murphy, M.,** Wu, S. L., White, J. S., Shiboski, S., Glymour, M. M., Gosling, R., Dorsey, G. & Sturrock, H. Association between Indoor Residual Spraying and Pregnancy Outcomes: A Quasi-Experimental Study from Uganda. *International Journal of Epidemiology,* dyac043. ISSN: 0300-5771. `https://doi.org/10.1093/ije/dyac043` (2022) (Mar. 18, 2022).

Tessema, S. K., Hathaway, N. J., Teyssier, N. B., **Murphy, M.,** Chen, A., Aydemir, O., Duarte, E. M., Simone, W., Colborn, J., Saute, F., Crawford, E., Aide, P., Bailey, J. A. & Greenhouse, B. Sensitive, Highly Multiplexed Sequencing of Microhaplotypes from the Plasmodium Falciparum Heterozygome. *The Journal of Infectious Diseases* **225,** 1227–1237. ISSN: 0022-1899. `https://doi.org/10.1093/infdis/jiaa527` (2022) (Apr. 1, 2022).

Briggs, J., Kuchta, A., Murphy, M., Tessema, S., Arinaitwe, E., Rek, J., Chen, A., Nankabirwa, J. I., Drakeley, C., Smith, D., Bousema, T., Kamya, M., Rodriguez-Barraquer, I., Staedke, S., *et al.* Within-household Clustering of Genetically Related Plasmodium Falciparum Infections in a Moderate Transmission Area of Uganda. *Malaria Journal* **20,** 68. ISSN: 1475-2875. `https://doi.org/10.1186/s12936-021-03603-7` (2022) (Feb. 2, 2021).

Jang, I. K., Aranda, S., Barney, R., Rashid, A., Helwany, M., Rek, J. C., Arinaitwe, E., Adrama, H., **Murphy, M.,** Imwong, M., Proux, S., Haohankhunnatham, W., Ding, X. C., Nosten, F., *et al.* Assessment of Plasmodium Antigens and CRP in Dried Blood Spots with Multiplex Malaria Array. *Journal of Parasitic Diseases* **45,** 479–489. ISSN: 0975-0703. `https://doi.org/10.1007/s12639-020-01325-2` (2022) (June 1, 2021).

Hsiang, M. S., Ntshalintshali, N., Kang Dufour, M.-S., Dlamini, N., Nhlabathi, N., Vilakati, S., Malambe, C., Zulu, Z., Maphalala, G., Novotny, J., **Murphy, M.,** Schwartz, A., Sturrock, H., Gosling, R., *et al.* Active Case Finding for Malaria: A 3-Year National Evaluation of Optimal Approaches to Detect Infections and Hotspots through Reactive Case Detection in the Low-Transmission Setting of Eswatini. *Clinical Infectious Diseases: An Official Publication of the Infectious Diseases Society of America* **70,** 1316–1325. ISSN: 1537-6591. pmid: 31095677 (Mar. 17, 2020).

Jang, I. K., Tyler, A., Lyman, C., Rek, J. C., Arinaitwe, E., Adrama, H., **Murphy, M.,** Imwong, M., Proux, S., Haohankhunnatham, W., Barney, R., Rashid, A., Kalnoky, M., Kahn, M., *et al.* Multiplex Human Malaria Array: Quantifying Antigens for Malaria Rapid Diagnostics. *The American Journal of Tropical Medicine and Hygiene* **102,** 1366–1369. ISSN: 0002-9637. pmid: 32189616. `https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7253106/` (2022) (June 2020).

Liu, Y., Tessema, S. K., **Murphy, M.,** Xu, S., Schwartz, A., Wang, W., Cao, Y., Lu, F., Tang, J., Gu, Y., Zhu, G., Zhou, H., Gao, Q., Huang, R., *et al.* Confirmation of the Absence of Local Transmission and Geographic Assignment of Imported Falciparum Malaria Cases to China Using Microsatellite Panel. *Malaria Journal* **19,** 244. ISSN: 1475-2875. `https://doi.org/10.1186/s12936-020-03316-3` (2022) (July 13, 2020).

Jang, I. K., Tyler, A., Lyman, C., Kahn, M., Kalnoky, M., Rek, J. C., Arinaitwe, E., Adrama, H., **Murphy, M.,** Imwong, M., Ling, C. L., Proux, S., Haohankhunnatham, W., Rist, M., *et al.* Simultaneous Quantification of Plasmodium Antigens and Host Factor C-reactive Protein in Asymptomatic Individuals with Confirmed Malaria by Use of a Novel Multiplex Immunoassay. *Journal of Clinical Microbiology* **57,** e00948–18. ISSN: 1098-660X. pmid: 30404944 (Jan. 2019).

Pringle, J. C., Tessema, S., Wesolowski, A., Chen, A., **Murphy, M.,** Carpi, G., Shields, T. M., Hamapumbu, H., Searle, K. M., Kobayashi, T., Katowa, B., Musonda, M., Stevenson, J. C., Thuma, P. E., *et al.* Genetic Evidence of Focal Plasmodium Falciparum Transmission in a Pre-Elimination Setting in Southern Province, Zambia. *The Journal of Infectious Diseases* **219,** 1254–1263. ISSN: 1537-6613. pmid: 30445612 (Apr. 8, 2019).

Tessema, S., Wesolowski, A., Chen, A., **Murphy, M.,** Wilheim, J., Mupiri, A.-R., Ruktanonchai, N. W., Alegana, V. A., Tatem, A. J., Tambo, M., Didier, B., Cohen, J. M., Bennett, A., Sturrock, H. J., *et al.* Using Parasite Genetic and Human Mobility Data to Infer Local and Cross-Border Malaria Connectivity in Southern Africa. *eLife* **8** (eds Cooper, B., Ferguson, N. M., Bhatt, S. & Churcher, T. S.) e43510. ISSN: 2050-084X. `https://doi.org/10.7554/eLife.43510` (2022) (Apr. 2, 2019).

Quan, J., Langelier, C., Kuchta, A., Batson, J., Teyssier, N., Lyden, A., Caldera, S., McGeever, A., Dimitrov, B., King, R., Wilheim, J., **Murphy, M.,** Ares, L. P., Travisano, K. A., *et al.* FLASH: A next-Generation CRISPR Diagnostic for Multiplexed Detection of Antimicrobial Resistance Sequences. *Nucleic Acids Research* **47,** e83. ISSN: 0305-1048. `https://doi.org/10.1093/nar/gkz418` (2022) (Aug. 22, 2019).

Roh, M. E., Tessema, S. K., **Murphy, M.,** Nhlabathi, N., Mkhonta, N., Vilakati, S., Ntshalintshali, N., Saini, M., Maphalala, G., Chen, A., Wilheim, J., Prach, L., Gosling, R., Kunene, S., *et al.* High Genetic Diversity of Plasmodium Falciparum in the Low-Transmission Setting of the Kingdom of Eswatini. *The Journal of Infectious Diseases* **220,** 1346–1354. ISSN: 0022-1899. pmid: 31190073. `https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6743842/` (2022) (Oct. 15, 2019).

Taghavian, O., Jain, A., Joyner, C. J., Ketchum, S., Nakajima, R., Jasinskas, A., Liang, L., Fong, R., King, C., Greenhouse, B., **Murphy, M.,** Bailey, J., Galinski, M. R., Barnwell, J. W., *et al.* Antibody Profiling by Proteome Microarray with Multiplex Isotype Detection Reveals Overlap between Human and Aotus Nancymaae Controlled Malaria Infections. *Proteomics* **18.** ISSN: 1615-9861. pmid: 29266845 (Jan. 2018).

Chen, I., Diawara, H., Mahamar, A., Sanogo, K., Keita, S., Kone, D., Diarra, K., Djimde, M., Keita, M., Brown, J., Roh, M. E., Hwang, J., Pett, H., **Murphy, M.,** *et al.* Safety of Single-Dose Primaquine in G6PD-deficient and G6PD-normal Males in Mali without Malaria: An Open-Label, Phase 1, Dose-Adjustment Trial. *The Journal of Infectious Diseases* **217,** 1298–1308. ISSN: 1537-6613. pmid: 29342267 (Mar. 28, 2018).

Coutrier, F. N., Tirta, Y. K., Cotter, C., Zarlinda, I., González, I. J., Schwartz, A., Maneh, C., Marfurt, J., **Murphy, M.,** Herdiana, H., Anstey, N. M., Greenhouse, B., Hsiang, M. S. & Noviyanti, R. Laboratory Challenges of Plasmodium Species Identification in Aceh Province, Indonesia, a Malaria Elimination Setting with Newly Discovered P. Knowlesi. *PLoS neglected tropical diseases* **12,** e0006924. ISSN: 1935-2735. pmid: 30500828 (Nov. 2018).

Jang, I. K., Das, S., Barney, R. S., Peck, R. B., Rashid, A., Proux, S., Arinaitwe, E., Rek, J., **Murphy, M.,** Bowers, K., Boadi, S., Watson, J., Nosten, F., Greenhouse, B., *et al.* A New Highly Sensitive Enzyme-Linked Immunosorbent Assay for the Detection of Plasmodium Falciparum Histidine-Rich Protein 2 in Whole Blood. *Malaria Journal* **17,** 403. ISSN: 1475-2875. `https://doi.org/10.1186/s12936-018-2545-5` (2022) (Nov. 1, 2018).

McCreesh, P., Mumbengegwi, D., Roberts, K., Tambo, M., Smith, J., Whittemore, B., Kelly, G., Moe, C., Murphy, M., Chisenga, M., Greenhouse, B., Ntuku, H., Kleinschmidt, I., Sturrock, H., *et al.* Subpatent Malaria in a Low Transmission African Setting: A Cross-Sectional Study Using Rapid Diagnostic Testing (RDT) and Loop-Mediated Isothermal Amplification (LAMP) from Zambezi Region, Namibia. *Malaria Journal* **17,** 480. ISSN: 1475-2875. `https://doi.org/10.1186/s12936-018-2626-5` (2022) (Dec. 19, 2018).

Chang, H.-H., Worby, C. J., Yeka, A., Nankabirwa, J., Kamya, M. R., Staedke, S. G., Dorsey, G., **Murphy, M.,** Neafsey, D. E., Jeffreys, A. E., Hubbart, C., Rockett, K. A., Amato, R., Kwiatkowski, D. P., *et al.* THE REAL McCOIL: A Method for the Concurrent Estimation of the Complexity of Infection and SNP Allele Frequency for Malaria Parasites. *PLOS Computational Biology* **13,** e1005348. ISSN: 1553-7358. `https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1005348` (2022) (Jan. 26, 2017).

Ranadive, N., Kunene, S., Darteh, S., Ntshalintshali, N., Nhlabathi, N., Dlamini, N., Chitundu, S., Saini, M., **Murphy, M.,** Soble, A., Schwartz, A., Greenhouse, B. & Hsiang, M. S. Limitations of Rapid Diagnostic Testing in Patients with Suspected Malaria: A Diagnostic Accuracy Evaluation from Swaziland, a Low-Endemicity Country Aiming for Malaria Elimination. *Clinical Infectious Diseases: An Official Publication of the Infectious Diseases Society of America* **64,** 1221–1227. ISSN: 1537-6591. pmid: 28369268 (May 1, 2017).

Katrak, S., **Murphy, M.,** Nayebare, P., Rek, J., Smith, M., Arinaitwe, E., Nankabirwa, J. I., Kamya, M., Dorsey, G., Rosenthal, P. J. & Greenhouse, B. Performance of Loop-Mediated Isothermal Amplification for the Identification of Submicroscopic Plasmodium Falciparum Infection in Uganda. *The American Journal of Tropical Medicine and Hygiene* **97,** 1777–1781. ISSN: 0002-9637, 1476-1645. `https://www.ajtmh.org/view/journals/tpmd/97/6/article-p1777.xml` (2022) (Oct. 9, 2017).

Das, S., Jang, I. K., Barney, B., Peck, R., Rek, J. C., Arinaitwe, E., Adrama, H., **Murphy, M.,** Imwong, M., Ling, C. L., Proux, S., Haohankhunnatham, W., Rist, M., Seilie, A. M., *et al.* Performance of a High-Sensitivity Rapid Diagnostic Test for Plasmodium Falciparum Malaria in Asymptomatic Individuals from Uganda and Myanmar and Naive Human Challenge Infections. *The American Journal of Tropical Medicine and Hygiene* **97,** 1540–1550. ISSN: 1476-1645. pmid: 28820709 (Nov. 2017).

Posters

Murphy, M., Vickers, E. N., Aranda-Diaz, A., Conteh, B., Ahmad, A., Ndiath, M. O., D'Alessandro, U., Erhart, A., Moreno, M., Drakely, C., Bousema, T., Nielsen, R. & Greenhouse, B. *A Method for the Detection of Fine Scale Transmission Network Structure from Genetic, Epidemiological, and Spatio-Temporal Data* in *American Journal of Tropical Medicine and Hygiene* (2022).

Murphy, M., Tessema, S., Mupiri, A.-R., Tambo, M., Smith, J. L., Bennett, A., Sturrock, H. J., Gosling, R., Mumbengegwi, D., Hsiang, M. S., Noviyanti, R., Trimarsanto, H., Price, R., Rodríguez-Barraquer, I., *et al.* *Geographic Assignment of P. Falciparum and P. Vivax Infections Using Genetic Data* in *American Journal of Tropical Medicine and Hygiene* (2018).

Jang, I. K. E., Kahn, M., Barney, B., Kalnoky, M., Das, S., Peck, R., Tyler, A., Lyman, C., Rek, J., **Murphy, M.,** *et al. Development of a Multiplex Assay for Simultaneous Quantification of Plasmodium Vivax and p. Falciparum Infection* in *American Journal of Tropical Medicine and Hygiene* (2017).

Kuchta, A., Crawford, E., Quan, J., Wilheim, J., **Murphy, M.,** Tessema, S. K., Derisi, J. & Greenhouse, B. *Cas-9 Based Sequencing Enrichment for Malaria Genotyping* in *American Journal of Tropical Medicine and Hygiene* (2017).

Kuchta, A., **Murphy, M.,** Arinaitwe, E., Rek, J., Chen, A., Wilheim, J., Tessema, S. K., Bousema, T., Kamya, M., Staedke, S., *et al. Population Structure of Plasmodium Falciparum Is Detectable at Small Spatial Scales in Kihihi, Uganda* in *American Journal of Tropical Medicine and Hygiene* (2017).

Sudathip, P., Cotter, C., Kitchikarn, S., Rattanapairoj, O., Zelman, B., Maneesiri, R., Sugaram, R., Schwartz, A., **Murphy, M.,** Greenhouse, B., Gonzalez, I. J., Vorster, L., Imwong, M., Gosling, R. D., *et al. Malaria Elimination in Thailand: Using LAMP in Reactive Case Detection to Increase Infection Detection.* in *American Journal of Tropical Medicine and Hygiene* (2017).

Tessema, S., **Murphy, M.,** Mupiri, A.-R., Smith, J. L., Chen, A., Wilheim, J., Hsiang, M. S., Sturrock, H. J., Mumbengegwi, D. & Greenhouse, B. *Fine-Scale Population Genetics of Plasmodium Falciparum in Northern Namibia* in *American Journal of Tropical Medicine and Hygiene* (2017).

Hamre, K. E., Tessema, S. K., **Murphy, M.,** Ayodo, G., Tran, T. M., Schwartz, A., John, C. C. & Greenhouse, B. *Changes in Population Genetic Parameters of Plasmodium Falciparum before and after a Period of Low or Interrupted Malaria Transmission in Kenyan Highlands* in *American Journal of Tropical Medicine and Hygiene* (2016).

Roh, M., **Murphy, M.,** Tessema, S., Ntshalintshali, N., Saini, M., Prach, L., Maphalala, G., Nhlabathi, N., Mkonta, N., Kunene, S., Hsiang, M. & Greenhouse, B. *Influence of Malaria Importation on p. Falciparum Population Genetic Diversity: A Study from Pre-Elimination Setting of Swaziland* in *American Journal of Tropical Medicine and Hygiene* (2016).

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Murphy, M., Schwartz, A., Liu, Y., Kemere, J., Hsiang, M. & Greenhouse, B. *Automated Methods for High-Throughput Analysis of Plasmodium Microsatellite Genotyping Data* in *American Journal of Tropical Medicine and Hygiene* (2015).