Dennis L. Chao

Curriculum vitae

October 3, 2023

Personal Data

Dennis L. Chao
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Education

1994 **B.S.E. in Computer Science**
Princeton University • Princeton, NJ

2004 **Ph.D. in Computer Science**
The University of New Mexico • Albuquerque, NM
Dissertation: *Modeling the cytotoxic T cell response*

Postgraduate training

10/2004–6/2008 **Postdoctoral fellow**
Fred Hutchinson Cancer Research Center • Seattle, WA
Supervisors: Brian Reid, Georg Luebeck, and Li Hsu

Recent positions held

7/2020–10/2023 **Senior research scientist**
Bill & Melinda Gates Foundation • Seattle, WA

12/2015–7/2020 **Senior research scientist**
Institute for Disease Modeling • Bellevue, WA

1/2012–11/2015 **Senior staff scientist**
Fred Hutchinson Cancer Research Center • Seattle, WA

7/2008–12/2011 **Staff scientist**
Fred Hutchinson Cancer Research Center • Seattle, WA

Teaching

2014–2017,2019 **Instructor**
I gave lectures at the International Vaccine Institute's Vaccinology course in Seoul, Korea.

2009–2015 **Instructor**
I taught half of the material for *Stochastic Simulation Methods for Infectious Diseases*, a 2.5-day module at the Summer Institute in Statistics and Modeling in Infectious Diseases, University of Washington.

Selected professional activities

2020–2022	**Selection Committee member** *Natural Sciences and Engineering Research Council of Canada (NSERC)*
2015–2019	**Scientific Advisory Panel member** *Scientific Advisory Process for Optimal Research on Typhoid (SAPORT)*
1/2012	**Consultant** I presented and moderated at the *First meeting on typhoid transmission, intervention, disease burden and cost-effectiveness/cost-utility modeling* at the World Health Organization in Geneva.
9/2011	**Consultant** I participated in the *WHO consultation on oral cholera vaccine stockpile strategic framework* at the World Health Organization in Geneva.

Manuscripts in Refereed Journals

1. O'Brien ML, Zimmermann M, Eitmann L, **Chao DL**, Proctor JL. Contraceptive adoption and changes in empowerment in Kenya, Nigeria, and Senegal. Studies in Family Planning. In press. doi: 10.1111/sifp.12250

2. **Chao DL**, Oron AP, Chabot-Couture G, Sopekan A, Nnebe-Agumadu U, Bates I, Piel FB, Nnodu OE. The contribution of malaria and sickle cell disease to anaemia among children aged 6 to 59 months in Nigeria: a cross-sectional study using data from the 2018 Demographic and Health Survey. BMJ Open. 12:e063369. 2022.
doi: 10.1136/bmjopen-2022-063369

3. Nelson EJ, Khan AI, Keita AM, Brintz BJ, Keita Y, Sanogo D, Islam MT, Khan ZH, Rashid MM, Nasrin D, Watt MH, Ahmed SM, Haaland B, Pavia AT, Levine AC, **Chao DL**, Kotloff KL, Qadri F, Sow SO, Leung DT. Improving Antibiotic Stewardship for Diarrheal Disease With Probability-Based Electronic Clinical Decision Support: A Randomized Crossover Trial. JAMA Pediatrics. 176(10):973-979. 2022.
doi: 10.1001/jamapediatrics.2022.2535.

4. Selvaraj P, Wagner BG, **Chao DL**, Jackson ML, Breugelmans JG, Jackson N, Chang ST. Rural prioritization may increase the impact of COVID-19 vaccines in a representative COVAX AMC country setting due to ongoing internal migration: A modeling study. PLOS Global Public Health. 2(1): e0000053. 2022.
doi: 10.1371/journal.pgph.0000053.

5. **Chao DL**. Mathematical modeling of endemic cholera transmission. J Inf Dis. 224(suppl 7):S738-S741. 2021.
doi: 10.1093/infdis/jiab472.

6. Levin R, **Chao DL**, Wenger EA, Proctor JL. Insights into population behavior during the COVID-19 pandemic from cell phone mobility data and manifold learning. Nature Computational Science. 1(9):588-597. 2021.
doi: 10.1038/s43588-021-00125-9.

7. Nnodu OE, Oron AP, Sopekan A, Akaba GO, Piel FB, **Chao DL**. Child mortality from sickle cell disease in Nigeria: a model-estimated, population-level analysis of data from the 2018 Demographic and Health Survey. Lancet Haematology. 8:e723-31. 2021.
doi: 10.1016/S2352-3026(21)00216-7.

8. Brintz BJ, Haaland B, Howard J, **Chao DL**, Proctor JL, Khan AI, Ahmed SM, Keegan, LT, Greene T, Keita AM, Kotloff KL, Platts-Mills, JA, Nelson EJ, Levine AC, Pavia AT, Leung DT. A modular approach to integrating multiple data sources into real-time clinical prediction for pediatric diarrhea. eLife. 10:e63009. 2021.
doi: 10.7554/eLife.63009.

9. Lee EC, **Chao DL**, Lemaitre JC, Matrajt L, Pasetto D, Perez-Saez J, Finger F, Rinaldo A, Sugimoto JD, Halloran ME, Longini IM Jr, Ternier R, Vissieres K, Azman AS, Lessler J, Ivers LC. Achieving coordinated national immunity and cholera elimination in Haiti through vaccination. Lancet Glob Health. 8(8):e1081-1089. 2020.
doi: 10.1016/S2214-109X(20)30310-7.

10. Nelson EJ, Grembi JA, **Chao DL**, Andrews JR, Alexandrova L, Rodriguez PH, Ramachandran VV, Sayeed MA, Wamala JF, Debes AK, Sack DA, Hryckowian AJ, Haque F, Khatun S, Rahman M, Chien A, Spormann AM, Schoolnik GK. Gold-standard cholera diagnostics are tarnished by lytic bacteriophage and antibiotics. J Clin Microbiol. 58(9):e00412-20. 2020.
doi: 10.1128/jcm.00412-20.

11. Oron AP, **Chao DL**, Ezeanolue EE, Ezenwa LN, Piel FB, Ojogun OT, Uyoga S, Williams TN, Nnodu OE. Caring for Africa's sickle cell children: will we rise to the challenge? BMC Medicine 18(1):92. 2020.
doi: 10.1186/s12916-020-01557-2.

12. **Chao DL**, Roose A, Roh M, Kotloff KL, Proctor JL. The seasonality of diarrheal pathogens: A retrospective study of seven sites over three years. PLoS Negl Trop Dis. 2019. 13(8):e0007211.
doi: 10.1371/journal.pntd.0007211.

13. Khan AI, Levin A, **Chao DL**, DeRoeck D, Dimitrov DT, Khan JAM, Islam MS, Ali M, Islam MT, Sarker AR, Clemens JD, Qadri F. The impact and cost-effectiveness of controlling cholera through the use of oral cholera vaccines in urban Bangladesh: a disease modeling and economic analysis. PLoS Negl Trop Dis. 2018. 12(10):e0006652.
doi: 10.1371/journal.pntd.0006652.

14. Fong Y, Halloran ME, Park JK, Marks F, Clemens JD, **Chao DL**. Efficacy of a bivalent killed whole-cell cholera vaccine over five years: A re-analysis of a cluster-randomized trial. BMC Inf Dis. 2018; 18:84.
doi: 10.1186/s12879-018-2981-4.

15. Hladish TJ, Pearson CAB, **Chao DL**, Rojas DP, Recchia GL, Gomez Dantes H, Halloran ME, Pulliam JRC, Longini IM. Projected impact of dengue vaccination in Yucatán, Mexico. PLoS Negl Trop Dis. 2016; 10(5): e0004661. PMCID: PMC4882069.
doi: 10.1371/journal.pntd.0004661.

16. **Chao DL**, Dimitrov DT. Seasonality and the effectiveness of mass vaccination. Mathematical Biosciences and Engineering. 2016; 13(2):249–259. PMCID: PMC4843823.
doi: 10.3934/mbe.2015001.

17. Troeger C, Gaudart J, Truillet R, Sallah K, **Chao DL**, Piarroux R. Cholera outbreak in Grande Comore: 1998–1999. The American Journal of Tropical Medicine and Hygiene. 2016; 94(1):76–81. PMCID: PMC4710449.
doi: 10.4269/ajtmh.15-0397.

18. **Chao DL**, Park JK, Marks F, Ochiai RL, Longini IM, Halloran ME. The contribution of neighbours to an individual's risk of typhoid outcome. Epidemiology and Infection. 2015; 143(16):3520–3527. PMCID: PMC4619120.
doi: 10.1017/S0950268815000692.

19. Merler S, Ajelli M, Fumanelli L, Gomes MFC, Pastore y Pontti A, Rossi L, **Chao DL**, Longini IM, Halloran ME, Vespignani A. Spatio-temporal spread of the Ebola 2014 outbreak in Liberia and the effectiveness of non-pharmaceutical interventions: a computational modelling analysis. Lancet Infectious Diseases. 2015; 15(2):204–211. PMCID: PMC4409131.
doi: 10.1016/S1473-3099(14)71074-6.

20. Dimitrov DT, Troeger C, Halloran ME, Longini IM, **Chao DL**. Comparative effectiveness of different strategies of oral cholera vaccination in Bangladesh: A modeling study. PLoS Negl Trop Dis. 2014; 8(12):e3343. PMCID: PMC4256212.
doi:10.1371/journal.pntd.0003343.

21. Troeger C, Sack DA, **Chao DL**. Evaluation of targeted mass cholera vaccination strategies in Bangladesh: A demonstration of a new cost-effectiveness calculator. The American Journal of Tropical Medicine and Hygiene. 2014; 91(6):1181–1189. PMCID: PMC4257645.
doi:10.4269/ajtmh.14-0159.

22. Poletto C, Gomes MFC, Pastore y Piontti A, Rossi L, Bioglio L, **Chao DL**, Longini IM, Halloran ME, Colizza V, Vespignani A. Assessing the impact of travel restrictions on international spread of the 2014 West African Ebola epidemic. Eurosurveillance. 2014; 19(42):Article 2. PMCID: PMC4415609.
doi:10.2807/1560-7917.ES2014.19.42.20936.

23. Gomes MFC, Pastore y Piontti A, Rossi L, **Chao DL**, Longini IM, Halloran ME, Vespignani A. Assessing the international spreading risk associated with the 2014 West African Ebola Outbreak. PloS Currents: Outbreaks. 2014. PMCID: PMC4169359.

24. Gog JR, Ballesteros S, Viboud C, Simonsen L, Björnstad ON, Shaman J, **Chao DL**, Khan F, Grenfell BT. Spatial transmission of 2009 pandemic influenza in the US. PLoS Comput Biol. 2014 Jun;10(6):e1003635. PMCID: PMC4055284.
doi:10.1371/journal.pcbi.1003635.

25. **Chao DL**, Longini IM Jr, Halloran ME. The effects of vector movement and distribution in a mathematical model of dengue transmission. PLoS ONE. 2013; 8(10):e76044. PMCID: PMC3804532.
doi:10.1371/journal.pone.0076044.

26. Willem L, Van Kerckhove K, **Chao DL**, Hens N, Beutels P. A nice day for an infection? Weather conditions and social contact patterns relevant to influenza transmission. PLoS ONE. 2012; 7(11):e48695. PMCID: PMC3498265.
doi:10.1371/journal.pone.0048695.

27. **Chao DL**, Halstead SB, Halloran ME, Longini IM Jr. Controlling dengue with vaccines in Thailand. PLoS Negl Trop Dis. 2012; 6(10):e1876. PMCID: PMC3493390.
doi:10.1371/journal.pntd.0001876.

28. **Chao DL**, Bloom JD, Kochin BF, Antia R, Longini IM Jr. The global spread of drug-resistant influenza. J R Soc Interface. 2012; 9(69):648–56. PMCID: PMC3284134.
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30. **Chao DL**, Matrajt L, Basta NE, Sugimoto JD, Dean B, Bagwell DA, Oiulfstad B, Halloran ME, Longini IM Jr. Planning for the control of pandemic influenza H1N1 in Los Angeles County and the United States. Am J Epidemiol. 2011;173(10):1121–30. PMCID: PMC3121321.
doi:10.1093/aje/kwq497.

31. **Chao DL**, Halloran ME, Longini IM Jr. Vaccination strategies for epidemic cholera in Haiti with implications for the developing world. Proc Natl Acad Sci U S A. 2011; 108(17):7081–5. PMCID: PMC3084143.
doi:10.1073/pnas.1102149108.

32. Wang P, **Chao DL**, Hsu L. Learning oncogenic pathways from binary genomic instability data. Biometrics. 2011;67(1):164-73. PMCID: PMC3020238.
doi:10.1111/j.1541-0420.2010.01417.x.

33. **Chao DL**, Halloran ME, Longini IM Jr. School opening dates predict pandemic influenza A (H1N1) epidemics in the United States. J Infect Dis. 2010;202(6):877–80. PMCID: PMC2939723.
doi:10.1086/655810.

34. **Chao DL**, Halloran ME, Obenchain V, Longini IM Jr. FluTE, a publicly available stochastic influenza epidemic simulation model. PloS Computational Biology. 2010; 6(1):e1000656. PMCID: PMC2813259.
doi:10.1371/journal.pcbi.1000656.

35. Yang Y, Sugimoto JD, Halloran ME, Basta NE, **Chao DL**, Matrajt L, et al. The transmissibility and control of pandemic influenza A (H1N1) virus. Science. 2009;326(5953): 729–733. PMCID: PMC2880578.
doi: 10.1126/science.1177373.

36. Basta NE, **Chao DL**, Halloran ME, Matrajt L, Longini IM Jr. Strategies for pandemic and seasonal influenza vaccination of school children in the US. Am J Epidemiol. 2009;170:679–686. PMCID: PMC2737588.
doi: 10.1093/aje/kwp237.

37. Paulson TG, Maley CC, Li X, Li H, Sanchez CA, **Chao DL**, Odze RD, Vaughan TL, Blount PL, Reid BJ. Chromosomal instability and copy number alterations in Barrett's esophagus and esophageal adenocarcinoma. Clin Cancer Res. 2009;15(10):3305–3314. PMCID: PMC2684570.
doi: 10.1158/1078-0432.CCR-08-2494.

38. **Chao DL**, Eck JT, Brash DE, Maley CC, Luebeck EG. Pre-neoplastic lesion growth driven by the death of adjacent normal stem cells. Proc Natl Acad Sci U S A. 2008;105(39):15034–15039. PMCID: PMC2567488.
doi: 10.1073/pnas.0802211105.

39. **Chao DL**, Sanchez CA, Galipeau PC, Blount PL, Paulson TG, Cowan DS, Ayub K, Odze RD, Rabinovitch PS, Reid BJ. Cell proliferation, cell cycle abnormalities, and cancer outcome in patients with Barrett's esophagus: A long-term prospective study. Clin Cancer Res. 2008 Nov 1;14(21):6988–95. PMCID: PMC2587072.
doi: 10.1158/1078-0432.CCR-07-5063.

40. **Chao DL**, Maley CC, Wu X, Farrow DC, Galipeau PC, Sanchez CA, Paulson TG, Rabinovitch PS, Reid BJ, Spitz MR, Vaughan TL. Mutagen sensitivity and neoplastic progression in patients with Barrett's esophagus: A prospective analysis. Cancer Epidemiol Biomarkers Prev. 2006 Oct;15(10):1935–40.
doi: 10.1158/1055-9965.EPI-06-0492.

41. **Chao DL**, Davenport MP, Forrest S, Perelson AS. The effects of thymic selection on the range of T cell cross-reactivity. Eur J Immunol. 2005 Nov 14;35(12):3452–3459. PMCID: PMC1857316.
doi: 10.1002/eji.200535098.

42. Davenport MP, Ribeiro RM, **Chao DL**, Perelson AS. Predicting the impact of a nonsterilizing vaccine against human immunodeficiency virus. J Virol. 2004 Oct;78(20): 11340–51. PMCID: PMC521856.
doi: 10.1128/JVI.78.20.11340-11351.2004.

43. **Chao DL**, Davenport MP, Forrest S, Perelson AS. A stochastic model of cytotoxic T cell responses. J Theor Biol. 2004 May 21;228(2):227–240.
doi: 10.1016/j.jtbi.2003.12.011.

44. **Chao DL**, Davenport MP, Forrest S, Perelson AS. Modelling the impact of antigen kinetics on T-cell activation and response. Immunol Cell Biol. 2004 Feb;82(1):55–61.
doi: 10.1111/j.1440-1711.2004.01207.x.

45. **Chao DL**, Forrest S. Information immune systems. Genetic Programming and Evolvable Machines. 2003;4(4):311–331.
doi: 10.1023/A:1026139027539.

46. Wagner D, Brown MJF, Broun P, Cuevas W, Moses LE, **Chao DL**, Gordon DM. Task-related differences in the cuticular hydrocarbon composition of the harvester ant, *Pogonomyrmex barbatus*. Journal of Chemical Ecology. 1998;24(12):2021–2037.
doi: 10.1023/A:1020781508889.

BOOK CHAPTERS

1. Pastore y Piontti A, Zhang Q, Gomes MFC, Rossi L, Poletto C, Colizza V, **Chao DL**, Longini IM, Halloran ME, Vespignani A. Real-Time Assessment of the International Spreading Risk Associated with the 2014 West African Ebola Outbreak. In: Chowell G, Hyman, JM, editors. Mathematical and Statistical Modeling for Emerging and Re-emerging Infectious Diseases. Berlin: Springer–Verlag; 2016. p. 39–56.

2. **Chao DL**, Longini IM Jr, Morris JG Jr. Modeling Cholera Outbreaks. In: Nair GB, Takeda Y, editors. Current Topics in Microbiology and Immunology: Cholera Outbreaks. vol. 379. Berlin: Springer–Verlag; 2014. p. 195–209.

NON-REFEREED PUBLICATIONS

1. **Chao DL**, Oron AP, Srikrishna D, Famulare M. Modeling layered non-pharmaceutical interventions against SARS-CoV-2 in the United States with Corvid. medRxiv. 2020.
doi: 10.1101/2020.04.08.20058487.

2. **Chao DL**. Modeling the global transmission of antiviral-resistant influenza viruses. *Proceedings of Influenza Antivirals: Efficacy and Resistance (2011)*. Influenza and Other Respiratory Viruses. 2013;7(Suppl 1):58–62. PMCID: PMC3747505.

3. Galipeau PC, **Chao DL**, Li X, Arnaudo JD, Kissel HD, Sanchez CA, Reid BJ. Barrett's esophagus and esophageal adenocarcinoma epigenetic biomarker discovery using Infinium methylation. San Diego, CA: Illumina, Inc.; 2008.

4. **Chao DL**. Computer games as interfaces. interactions. 2004;11(5):71–2.

5. **Chao DL**, Levin SA. Herding behavior: The emergence of large-scale phenomena from local interactions. In: Ruan S, Wolkowicz GSK, Wu J, editors. Differential Equations with Applications to Biology. vol. 21 of Fields Institute Communications. Providence, Rhode Island: American Mathematical Society; 1999. p. 81–95.

PATENTS

1. **Chao DL**. Color-patch sheet registration. U.S. Patent 6,404,517. Issued June 11, 2002.

2. Li C, Pascovici A, Shu J, **Chao DL**. On-line ink-duty reduction. U.S. Patent 5,799,136. Issued August 25, 1998.

CONFERENCE PROCEEDINGS

1. **Chao DL**, Balthrop J, Forrest S. Adaptive Radio: Achieving consensus using negative preferences. In K. Schmidt, M. Pendergast, M. Ackerman, and G. Mark, editors, *Group '05: Proceedings of the 2005 International ACM SIGGROUP Conference on Supporting Group Work*. pp 120-3. ACM Press, New York, 2005.

2. **Chao DL**, Davenport MP, Forrest S, Perelson AS. Stochastic stage-structured modeling of the adaptive immune system. *Proceedings of the IEEE Computer Society Bioinformatics Conference (CSB 2003)*, pp 124-131. IEEE Press, Los Alamitos, California, 2003.

3. **Chao DL**, Forrest S. Generating biomorphs with an aesthetic immune system. In R. Standish, M. A. Bedau, and H. A. Abbass, editors, *Artificial Life VIII: Proceedings of the Eighth International Conference on the Simulation and Synthesis of Living Systems*, pages 89-92. MIT Press, Cambridge, Massachusetts, 2003.

4. **Chao DL**, Forrest S. Information immune systems. In J. Timmis and P. J. Bentley, editors, *Proceedings of the First International Conference on Artificial Immune Systems*, pages 132-40. University of Kent at Canterbury Printing Unit, Canterbury, England, 2002.

5. **Chao DL**. Doom as an interface for process management. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI Letters 3, 1)*, pages 152-7. ACM Press, New York, 2001.