

Lirong Cao

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EDUCATION

- 09/2018-09/2022 The Chinese University of Hong Kong (CUHK)
Ph.D. in Public Health (Biostatistics), Advisor: Prof. Maggie Wang
Thesis: *The Prediction of Vaccine Effectiveness (VE) by Viral Genome Sequence Analysis*
Award for Best PhD Thesis
- 09/2017-08/2018 M.Sc. in Epidemiology and Biostatistics, Advisor: Prof. Xiangqian LAO
Thesis: *Incense Burning and Respiratory Health in School Children*
- 09/2012-07/2017 Sun Yat-Sen University, Guangzhou
M.B. in Preventive Medicine, Advisor: Prof. Caixia Zhang
Thesis: *Association of Gestational Weight Gain and Underweight Newborns*
Award for Outstanding Graduation Thesis
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ACADEMIC APPOINTMENTS

- 10/2022-Current Postdoctoral Fellow, CUHK
- 02/2023-Current Assistant Research Fellow, CUHK Shenzhen Research Institute (SZRI)
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PROFESSIONAL ASSOCIATIONS

- Member of Society for Molecular Biology and Evolution (SMBE)
- Member of International Genetic Epidemiology Society (IGES)
- Young Scientists of The European Scientific Working Group on Influenza (ESWI) Early Career Scientists
- Member of Hong Kong Institute of Science
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RESEARCH INTERESTS

- **Bioinformatics and Statistical Genetics:** *in silico* prediction methods for real-time assessment of vaccine performance against influenza and COVID-19, novel approaches to develop optimal vaccines and assist vaccine antigen design and optimization. *Nature Medicine 2022; Vaccine 2021*
 - **Virus evolution:** identification of key mutations and modelling the patterns of infectious disease epidemics, developing new computational frameworks for predicting evolutionary trajectory. *Nature Communications 2024; Journal of Infection 2021*
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GRANTS

03/2023	Dr. Barbara Kwok Young Postdoctoral Researcher Travel Grants, 25,000 HKD
08/2022 - 08/2023	深圳市科技創新委員會-抗疫專 2022032 針對廣譜長效性新冠抗體和 T 細胞免疫疫苗研發, 4,000,000 RMB (Co-I)
10/2021-01/2022	Collaboration with The University of Hong Kong on eczema project: Family Empowerment Program for Children with Atopic Eczema and their Parents, 50,000 HKD (Co-I)

PUBLICATIONS

1. Lou J*, Liang W*, **Cao L***, Hu I, Zhao S, Chen Z, Chan RW, Cheung PPH, Zheng H, Liu C, Li Q, Chong MKC, Zhang Y, Yeoh EK, Chan PKY, Zee BCY, Mok CKP, Wang MH. Predictive evolutionary modelling for influenza virus by site-based dynamics of mutation. **Nature Communications**. 2024 Mar 21;15(1):2546. IF=16.6. Rank 7/134 in Multidisciplinary Sciences (*Co-first author)
2. **Cao L**, Lou J, Chan SY, Zheng H, Liu C, Zhao S, Li Q, Mok KP, Chan SY, Chan RWY, Chong MKC, Wu WKK, Chen Z, Wong ELY, Chan PKY, Zee BCY, Yeoh EK, Wang MH. Rapid evaluation of COVID-19 vaccine effectiveness against symptomatic infection with SARS-CoV-2 variants by analysis of genetic distance. **Nature Medicine**. 2022 Jun 16:1-8. IF=87.244. Rank 1/139 in Medicine, Research and Experimental
3. Wang MH*, Lou J*, **Cao L***, Zhao S, Chan RW, Chan PK, Chan MC, Chong MK, Wu WK, Wei Y, Zhang H, Zee BC, Yeoh EK. Characterization of key amino acid substitutions and dynamics of the influenza virus H3N2 hemagglutinin. **Journal of Infection**. 2021 Dec 1;83(6):671-7. IF=38.637. Rank 4/95 in Infectious Diseases
4. **Cao L**, Zhao S, Lou J, Zheng H, Chan RW, Chong MK, Chen Z, Chan PK, Zee BC, Wang MH. Differential Influence of Age on the Relationship between Genetic Mismatch and A (H1N1) pdm09 Vaccine Effectiveness. **Viruses**. 2021 Apr;13(4):619. IF=5.818. Rank 14/37 in Virology
5. **Cao L***, Lou J*, Zhao S*, Chan RW, Chan M, Wu WK, Chong MK, Zee BC, Yeoh EK, Wong SY, Chan PK, Wang MH. In silico prediction of influenza vaccine effectiveness by sequence analysis. **Vaccine**. 2021 Feb 12;39(7):1030-4. IF=4.169. Rank 73/139 in Medicine, Research and Experimental
6. **Cao L***, Zhao S*, Li Q*, Ling L, Wu WKK, Zhang L, Lou J, Chong MKC, Chen Z, Wong ELY, Zee BCY, Chan MTV, Chan PKS, Wang MH. A Bayesian method for synthesizing multiple diagnostic outcomes of COVID-19 tests. *Royal Society open science*. 2021 Sep 15;8(9):201867. IF=3.653. Rank 30/74 in Multidisciplinary Sciences
7. **Cao, L**, J. Lou, Q Li, H Zheng, CKP Mok, Z. Chen, RWY Chan, PPH Cheung, MKC Chong, EK Yeoh, WKK Wu, J Yu, PKS. Chan, BCY Zee and MH Wang. Improving in silico prediction of influenza vaccine effectiveness by genome analysis incorporating epitope information. 2023 medRxiv: 2023.2002.2014.23285900.
8. Zhao S, Lou J, **Cao L**, Zheng H, Chen Z, Chan RWY, Zee BCY, Chan PKS, Chong MKC, Wang MH. An early assessment of a case fatality risk associated with P.1 SARS-CoV-2 lineage in

- Brazil: an ecological study. **Journal of travel medicine**. 2021 Oct 11;28(7):taab078. IF=39.194. Rank 3/95 in Infectious Diseases
9. Zhao S, Lou J, **Cao L**, Zheng H, Chong MK, Chen Z, Chan RW, Zee BC, Chan PK, Wang MH. Quantifying the transmission advantage associated with N501Y substitution of SARS-CoV-2 in the UK: an early data-driven analysis. **Journal of travel medicine**. 2021 Mar;28(2):taab011. IF=39.194. Rank 3/95 in Infectious Diseases
 10. Zhao S, Lou J, **Cao L**, Chen Z, Chan RW, Chong MK, Zee BC, Chan PK, Wang MH. Quantifying the importance of the key sites on haemagglutinin in determining the selection advantage of influenza virus: Using A/H3N2 as an example. **Journal of Infection**. 2020 Sep 1;81(3):452-82. IF=38.637. Rank 4/95 in Infectious Diseases
 11. Lou J, Zhao S, **Cao L**, Chong MK, Chan RW, Chan PK, Zee BC, Yeoh EK, Wang MH. Predicting the dominant influenza A serotype by quantifying mutation activities. *International Journal of Infectious Diseases*. 2020 Nov 1;100:255-7. IF=7.759. Rank 19/95 in Infectious Diseases
 12. Lou J, Zheng H, Zhao S, **Cao L**, Wong EL, Chen Z, Chan RW, Chong MK, Zee BC, Chan PK, Yeoh EK, Wang MH. Quantifying the effect of government interventions and virus mutations on transmission advantage during COVID-19 pandemic. *Journal of Infection and Public Health*. 2022 Mar;15(3):338-342. IF=7.537. Rank 20/95 in Infectious Diseases
 13. Zhao S, Lou J, **Cao L**, Chong KC, Zee BCY, Chan PKS, Wang MH. Differences in the case fatality risks associated with SARS-CoV-2 Delta and non-Delta variants in relation to vaccine coverage: An early ecological study in the United Kingdom. *Infection Genetics and Evolution*. 2022 Jan;97:105162. IF=4.393. Rank 47/95 in Infectious Diseases
 14. Zhao S, Lou J, Chong MKC, **Cao L**, Zheng H, Chen Z, Chan RWY, Zee BCY, Chan PKS, Wang MH. Inferring the Association between the Risk of COVID-19 Case Fatality and N501Y Substitution in SARS-CoV-2. *Viruses*. 2021 Apr 8;13(4):638. IF=5.818. Rank 14/37 in Virology
 15. Zhao S, Hu I, Lou J, Chong MKC, **Cao L**, He D, Zee BCY, Wang MH. The mechanism shaping the logistic growth of mutation proportion in epidemics at population scale. *Infect Dis Model*. 2022 Dec 26;8(1):107-121. IF=8.8.
 16. Zhao S, Lou J, **Cao L**, Zheng H, Chong MKC, Chen Z, Chan RWY, Zee BCY, Chan PKS, Wang MH. Real-time quantification of the transmission advantage associated with a single mutation in pathogen genomes: a case study on the D614G substitution of SARS-CoV-2. *BMC Infect Dis*. 2021 Oct 7;21(1):1039. IF=3.7. Rank 51/96 in Infectious Diseases
 17. Zhao S, Lou J, **Cao L**, Zheng H, Chong MKC, Chen Z, Zee BCY, Chan PKS, Wang MH. Modelling the association between COVID-19 transmissibility and D614G substitution in SARS-CoV-2 spike protein: using the surveillance data in California as an example. *Theor Biol Med Model*. 2021 Mar 9;18(1):10. IF=2.432. Rank 26/58 in Mathematical and Computational Biology
 18. Lou J, Zhao S, **Cao L**, Zheng H, Chen Z, Chan RWY, Chong MKC, Zee BCY, Chan PKS, Wang MH. Temporal Patterns in the Evolutionary Genetic Distance of SARS-CoV-2 during the COVID-19 Pandemic. *Public Health Genomics*. 2022 Jan 5:1-4. IF=1.7. Rank 141/171 in Genetics and Heredity
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AWARDS

- 02/2024 Nominations of the **Young Female Scientist Scheme**, Hong Kong and Macao Affairs Office of the State Council
- 07/2023 **Young Scholars Thesis Award**, CUHK
- 03/2023 Dr. Barbara Kwok Young Postdoctoral Researcher Travel Grants
- 11/2022 **Best PhD Thesis Award**, Faculty of Medicine
- 09/2022 **Outstanding Students Awards**, CUHK
- 06/2017 Outstanding Graduation Thesis Award, Sun Yat-sen University
- 05/2016 Excellent Student Leader, Sun Yat-sen University
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PROFESSIONAL SERVICE

- Reviewer of IEEE/ACM Transactions on Computational Biology and Bioinformatics (IF=4.5, rank 16/77 in Biochemical Research Methods)
- Reviewer of Computers in Biology and Medicine (IF=7.0, rank 7/109 in Biology)
- Reviewer of Virus Evolution (IF=6.9, rank 7/36 in Virology)
- Reviewer of AIMS Allergy and Immunology
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MEDIA COVERAGE

- 2024 CUHK develops a state-of-the-art computational model to accurately forecast viral genetic evolution and facilitate improvement of influenza vaccines' protective effects. Media: China Daily, The Standard, Medical Inspire, SingTao, 明報, etc.
- 2022 CUHK develops bioinformatics methods to estimate vaccine effectiveness real time, aiding hospital resources allocation. Media: HK01, HKET, Reuters, RTHK, TVB, Phoenix TV, China News, CRHK, 明報, 香港經濟日報, etc.
- 2021 CUHK develops AI algorithms to predict influenza virus mutation and aid vaccine antigen. Media: HK01, am730, 大公報, 東方日報, 香港新聞網, 星島日報.