

Tim Kam Lun TSANG

Postdoctoral Associate,
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EDUCATION

Ph.D., Epidemiology and Biostatistics, School of Public Health, July 2013 – May 2016

WHO Collaborating Centre for Infectious Disease Epidemiology and Control, School of Public Health,
The University of Hong Kong (HKU), Hong Kong

Supervisors: Prof. Benjamin John Cowling (primary supervisor), Dr Simon Cauchemez, Dr Joseph T. Wu

PhD thesis topic: Transmissibility of influenza viruses in households

M.Phil., Mathematics and Statistics, 2012

Department of Mathematics, Hong Kong University of Science of Technology (HKUST), HK

Supervisor: Prof. Shiqing Ling

M.Phil research topic: Change point model on time series data

B.Sc. Mathematics and Statistics, 2010

Department of Mathematics, Hong Kong University of Science of Technology (HKUST), HK

First Class Honors in undergraduate study, graduate grade point average: 10.85/12

Research topics of final year project: latent class modeling on infant growth trajectories

Supervisor: Prof. Man-yu Wong

RESEARCH EXPERIENCE

Postdoctoral Associate, University of Florida, 2016-present (Advisors: Yang Yang, Ira Longini and Betz Halloran)

1. Developed a competing risk model and data-augmented MCMC algorithm to jointly estimate model parameters, and impute the missing number of prior infection, to explore the effect of exposure history on dengue infection and disease for a pediatric cohort [23].
2. Built a household transmission model to estimate the effect of isolation and water disinfection on controlling a norovirus outbreak in Hunan, China [24].
3. Developed a data-augmented MCMC algorithm to jointly estimate the number of under-reported cases and the parameters in a chain-binomial model, to account for the reporting bias between male and female in Zika case number, and estimate the factors affecting Zika cases.

PhD Candidate, University of Hong Kong, 2013-2016: Household studies of influenza (Advisors: Ben Cowling, Simon Cauchemez and Joe Wu)

1. Developed data-augmented MCMC algorithm to jointly estimate the parameters in the individual-based household transmission models, and impute the missing HAI titers and viral loads, to explore the relationship between antibody titers and protection, and between viral shedding and infectivity [1,2,5].

2. Developed a Bayesian hierarchical model to account for the different timing of sera collection among individuals and missing of sera collection, to estimate the cumulative risk of infection of 2009 pandemic influenza virus outbreak from a community-based cohort study with multiple sera collections [3].
3. Formulated a digraph approach on household cohort data to estimate the indirect effect of protection in household levels, and performed simulation to explore the degree of indirect benefit in different scenarios [22].
4. Performed statistical analyses related to these household studies, including epidemiological comparison of influenza B lineages, and effect of antiviral on transmission [14, 16].

Research assistant, University of Hong Kong, 2013: Data analysis on H7N9 outbreak

1. Made two trips to Beijing, China with Prof. Ben Cowling and colleagues, to assist China CDC in analyzing H7N9 data and building up the evidence base for the public health response.
2. Conducted epidemiologic analyses and real-time estimation of severity of H7N9 infections, that was included in two Lancet papers [8,9].
3. Conducted statistical analyses for avian influenza H7N9, H5N1 and H5N6 viruses, including clinical and epidemiological comparison for these avian influenza viruses, development of prediction rule [6, 7, 10-13, 15, 17, 19-21].

PUBLICATIONS

Publications as first or joint-first author:

1. **Tsang TK**, Cauchemez S, Perera RA, Freeman G, Fang VJ, Ip DK, Leung GM, Peiris JS, Cowling BJ. Association between antibody titers and protection against influenza virus infection within households. *J Infect Dis.* 2014;210(5):684-92.
2. **Tsang TK**, Cowling BJ, Fang VJ, Chan KH, Ip DK, Leung GM, Peiris JS, Cauchemez S. Influenza A virus shedding and infectivity in households *J Infect Dis.* 2015;212(9):1420-8.
3. **Tsang TK**, Fang VJ, Perera RA, Ip DK, Leung GM, Peiris JS, Cauchemez S, Cowling BJ. Interpreting sero-epidemiological studies for influenza in a context of non-bracketing sera *Epidemiology.* 2016;27(1):152-8.
4. **Tsang TK**, Lau LL, Cauchemez S, Cowling BJ. Review of household transmission of influenza virus *Trends Microbiol.* 2016;24(2):123-33
5. **Tsang TK**, Cauchemez S, Fang VJ, Chan KH, Ip DK, Leung GM, Peiris JS, Cowling BJ. Individual correlates of infectivity of influenza virus infections in households *PLoS One.* 2016;11(5):e0154418.
6. **Tsang TK**, Chen TM, Longini IM, Halloran ME, Wu Y, Yang Y. Household transmissibility of noroviruses and its modifiers in a community outbreak in China *Epidemiology.* 2018 May 29. [Epub ahead of print]
7. Qin Y*, Horby PW*, **Tsang TK***, Chen E*, Gao L*, Ou J*, Nguyen TH, Duong TN, Gasimov V, Feng L, Wu P, Jiang H, Ren X, Peng Z, Li S, Li M, Zheng J, Liu S, Hu S, Hong R, Farrar JJ, Leung GM, Gao GF, Cowling BJ, Yu H. Differences in the Epidemiology of Human Cases of Avian Influenza A(H7N9) and A(H5N1) Viruses Infection. *Clin Infect Dis.* 2015;61(4):563-71. **(*Joint first author)**
8. Wang C*, Yu H*, Horby P*, Cao B*, Wu P*, Yang S*, Gao H*, Li H*, **Tsang TK***, Liao Q, Gao Z, Ip DK, Jia H, Jiang H, Liu B, Ni MY, Dai X, Liu F, Kinh NV, Liem NT, Hien TT, Li Y, Yang J, Wu JT,

Zheng Y, Leung GM, Farrar J, Cowling BJ, Uyeki TM, Li L. Comparison of patients hospitalized with influenza A H7N9, H5N1, and 2009 pandemic H1N1. *Clin Infect Dis.* 2014 ;58(8):1095-103. (***Joint first author**)

Other co-authored publications:

9. Yu H, Cowling BJ, Feng L, Lau EH, Liao Q, **Tsang TK**, Peng Z, Wu P, Liu F, Fang VJ, Zhang H, Li M, Zeng L, Xu Z, Li Z, Luo H, Li Q, Feng Z, Cao B, Yang W, Wu JT, Wang Y, Leung GM. Human infection with avian influenza A H7N9 virus: an assessment of clinical severity. *Lancet.* 2013 Jul 13;382(9887):138-45.
10. Cowling BJ, Jin L, Lau EH, Liao Q, Wu P, Jiang H, **Tsang TK**, Zheng J, Fang VJ, Chang Z, Ni MY, Zhang Q, Ip DK, Yu J, Li Y, Wang L, Tu W, Meng L, Wu JT, Luo H, Li Q, Shu Y, Li Z, Feng Z, Yang W, Wang Y, Leung GM, Yu H. Comparative epidemiology of human infections with avian influenza A H7N9 and H5N1 viruses in China: a population-based study of laboratory-confirmed cases. *Lancet.* 2013 Jul 13;382(9887):129-37.
11. Lau EH, Zheng J, **Tsang TK**, Liao Q, Lewis B, Brownstein JS, Sanders S, Wong JY, Mekaru SR, Rivers C, Wu P, Jiang H, Li Y, Yu J, Zhang Q, Chang Z, Liu F, Peng Z, Leung GM, Feng L, Cowling BJ, Yu H. Accuracy of epidemiological inferences based on publicly available information: retrospective comparative analysis of line lists of human cases infected with influenza A(H7N9) in China. *BMC Med.* 2014 May 28;12:88.
12. Liao Q, Ip DK, **Tsang TK**, Cao B, Jiang H, Liu F, Zheng J, Peng Z, Wu P, Huai Y, Lau EH, Feng L, Leung GM, Yu H, Cowling BJ. A clinical prediction rule for diagnosing human infections with avian influenza A(H7N9) in a hospital emergency department setting. *BMC Med.* 2014 Aug 5;12:127.
13. Wu P, Jiang H, Wu JT, Chen E, He J, Zhou H, Wei L, Yang J, Yang B, Qin Y, Fang VJ, Li M, **Tsang TK**, Zheng J, Lau EH, Cao Y, Chai C, Zhong H, Li Z, Leung GM, Feng L, Gao GF, Cowling BJ, Yu H. Poultry market closures and human infection with influenza A(H7N9) virus, China, 2013-14. *Emerg Infect Dis.* 2014;20(11):1891-4.
14. Feng L, Wu JT, Liu X, Yang P, **Tsang TK**, Jiang H, Wu P, Yang J, Fang VJ, Qin Y, Lau EH, Li M, Zheng J, Peng Z, Xie Y, Wang Q, Li Z, Leung GM, Gao GF, Yu H, Cowling BJ. Clinical severity of human infections with avian influenza A(H7N9) virus, China, 2013/14. *Euro Surveill.* 2014;19(49). pii: 20984.
15. Cheung DH, **Tsang TK**, Fang VJ, Xu J, Chan KH, Ip DK, Peiris JS, Leung GM, Cowling BJ. Association of Oseltamivir Treatment With Virus Shedding, Illness, and Household Transmission of Influenza Viruses. *J Infect Dis.* 2015;212(3):391-6.
16. Virlogeux V, Li M, **Tsang TK**, Feng L, Fang VJ, Jiang H, Wu P, Zheng J, Lau EH, Cao Y, Qin Y, Liao Q, Yu H, Cowling BJ. Estimating the Distribution of the Incubation Periods of Human Avian Influenza A(H7N9) Virus Infections. *Am J Epidemiol.* 2015;182(8):723-9.
17. Xu C, Chan KH, **Tsang TK**, Fang VJ, Fung RO, Ip DK, Cauchemez S, Leung GM, Peiris JS, Cowling BJ. Comparative Epidemiology of Influenza B Yamagata- and Victoria-Lineage Viruses in Households. *Am J Epidemiol.* 2015;182(8):705-13.
18. Virlogeux V, Yang J, Fang VJ, Feng L, **Tsang TK**, Jiang H, Wu P, Zheng J, Lau EH, Qin Y, Peng Z, Peiris JS, Yu H, Cowling BJ. Association between the Severity of Influenza A(H7N9) Virus Infections and Length of the Incubation Period. *PLoS One.* 2016;11(2):e0148506.
19. Wong JY, Wu P, Lau EH, **Tsang TK**, Fang VJ, Ho LM, Cowling BJ. Real-time estimation of the hospitalization fatality risk of influenza A(H1N1)pdm09 in Hong Kong. *Epidemiol Infect.* 2016;144(8):1579-83.

20. Wu P, Peng Z, Fang VJ, Feng L, **Tsang TK**, Jiang H, Lau EH, Yang J, Zheng J, Qin Y, Li Z, Leung GM, Yu H, Cowling BJ. Human Infection with Influenza A(H7N9) Virus during 3 Major Epidemic Waves, China, 2013-2015. *Emerg Infect Dis*. 2016;22(6):964-72.
21. Lai S, Qin Y, Cowling BJ, Ren X, Wardrop NA, Gilbert M, **Tsang TK**, Wu P, Feng L, Jiang H, Peng Z, Zheng J, Liao Q, Li S, Horby PW, Farrar JJ, Gao GF, Tatem AJ, Yu H. Global epidemiology of avian influenza A H5N1 virus infection in humans, 1997-2015: a systematic review of individual case data. *Lancet Infect Dis*. 2016. pii: S1473-3099(16)00153-5.
22. Jiang H, Wu P, Uyeki TM, He J, Deng Z, Xu W, Lv Q, Zhang J, Wu Y, **Tsang TK**, Kang M, Zheng J, Wang L, Yang B, Qin Y, Feng L, Fang VJ, Gao GF, Leung GM, Yu H, Cowling BJ. Preliminary Epidemiologic Assessment of Human Infections with Highly Pathogenic Avian Influenza A(H5N6) Virus, China. *Clin Infect Dis*. 2017 Aug 1;65(3):383-388
23. Virlogeux V, Feng L, **Tsang TK**, Jiang H, Fang VJ, Qin Y, Wu P, Wang X, Zheng J, Lau EHY, Peng Z, Yang J, Cowling BJ, Yu H. Evaluation of animal-to-human and human-to-human transmission of influenza A (H7N9) virus in China, 2013-15. *Sci Rep*. 2018 Jan 11;8(1):552.

Papers in preparation:

24. **Tsang TK**, Fang VJ, Perera RA, Ip DK, Leung GM, Peiris JS, Cauchemez S, Cowling BJ. Are parents and siblings indirectly protected when a child is vaccinated against influenza? (*Under review at Nature Communication*).
25. **Tsang TK**, Ghebremariam S, Gresh L, Gordan A, Halloran ME, Kuan G, Balmaseda A, Rojas D, Sugimoto J, Harris E, Longini IM, Yang Y. Effect of exposure history on dengue infection and pathogenicity: A joint modeling approach. (*In preparation*).
26. **Tsang TK**, Rojas D, Longini IM, Halloran ME, Yang Y. A statistical modeling approach to accounting for under-reporting in Zika surveillance. (*In preparation*).

PRESENTATIONS

1. Effect of Exposure History on Dengue Infection and Disease: A statistical Approach and Its Application to the Dengue Cohort in Nicaragua. *MIDAS Network Meeting, Atlanta, GA, 2017 (Poster Presentation)* and *ASTMH Annual Meeting, Baltimore, MD, 2017 (Poster Presentation)*
2. Household transmission of influenza viruses. *Center for inference and dynamics of infectious disease. Seattle, WA, 2016 (Invited Talk)* and *NYICE Seminar Series in University of Rochester, Rochester, NY, 2017 (Invited Talk)*
3. Individual correlates of infectivity of influenza virus infections in households. *Fifth International Conference on Infectious Disease. Tampa, FL, 2015 (Poster Presentation)* and *Annual Scientific Meeting, Hong Kong College of Community Medicine, Hong Kong, 2015. (Oral Presentation)*
4. Review of household transmission of influenza virus. *Fifth International Conference on Infectious Disease. Tampa, FL, 2015 (Poster Presentation)*
5. Association between antibody titers and protection against influenza virus infection within households. *East-West Alliance Global Symposia, Hong Kong, 2014. (Poster Presentation)*
6. Real-time estimation of severity of a novel influenza strain. *Annual Scientific Meeting, Hong Kong College of Community Medicine, Hong Kong, 2013. (Poster Presentation)*

TEACHING EXPERIENCE

1. Tutor, Introduction of Biostatistics, HKU, 2013-2016. Held tutorial sessions for SPSS
2. Tutor, Advanced Statistical Methods, HKU, 2013-2015. Assisted lecturer for teaching.
3. Teaching Assistant, Time series analysis, HKUST, 2011-2012. Assisted lecturer for teaching. Holding tutorial sessions for SAS
4. Teaching Assistant, Statistical Inference, HKUST, 2011. Holding tutorial sessions for exercises.
5. Teaching Assistant, Data analysis, HKUST, 2010. Holding tutorial sessions for SAS

OTHER RELEVANT EXPERIENCE

1. Referee for Statistical in Medicine, Influenza and other Respiratory Viruses, Scientific Report and PLoS One.
2. Participants in 5th and 9th Summer Institute in Statistics and Modeling in Infectious Diseases, 2013 and 2017. Attended courses about MCMC, Phylogenetic analysis and Spatial modeling
3. Research internship in Mathematical Modelling of Infectious Diseases, Institut Pasteur. 2014 (3 months visit to work under supervision of Dr Simon Cauchemez)

HONORS

1. HKU Faculty Outstanding Research Output Award, 2014 for Cowling et al. 2013 Lancet paper and Yu et al. 2013 Lancet paper
2. HKU L'Oreal Scholarship, 2014
3. HKUST Postgraduate studentship award, 2011-2012
4. HKUST Swire University Scholarship, 2008-2010
5. HKUST Dean's list Award, 2008-2010

REFEREES

Prof. Benjamin John COWLING, Professor and Division Head, Division of Epidemiology and Biostatistics, School of Public Health, The University of Hong Kong, Hong Kong, bcowling@hku.hk, +852 39176711

Dr Simon CAUCHEMEZ, Head, Mathematical Modelling of Infectious Diseases Unit, Institut Pasteur, Paris, France, simon.cauchemez@pasteur.fr, +33 01 44 38 92 53

Dr. Yang YANG, Associate Professor, Department of Biostatistics, College of Public Health and Health Professions, University of Florida, Gainesville, FL, yangyang@ufl.edu, +1 (352) 294-1933