

# 2019 International Symposium on Air Quality and Health



National Institute of Environmental Health Sciences  
National Health Research Institutes

January 30-31, 2019

# **2019 International Symposium on Air Quality and Health**

National Institute of Environmental Health Sciences  
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# *Agenda*

## January 30, 2019

08:20~09:00 Registration

09:00~09:30 Opening Remarks

Hung-Teh Tsai

Deputy Minister

Environmental Protection Administration, Executive Yuan, Taiwan

Ying-Wei Wang, M.D., Ph.D.

Director General

Health Promotion Administration, Ministry of Health and Welfare, Taiwan

Kung-Yee Liang, Ph.D.

President

National Health Research Institutes, Taiwan

09:30~9:50 Break / Group Photo

**Moderator:** Yue-Liang Leon Guo, M.D., Ph.D.

Distinguished Investigator and Director

National Institute of Environmental Health Sciences,

National Health Research Institutes, Miaoli, Taiwan

9:50~10:25 **PM<sub>2.5</sub>: Gap between Science and Policy**

Chang-Chuan Chan, Ph.D.

Professor and Dean

College of Public Health, National Taiwan University, Taipei, Taiwan

10:25~11:00 **Innovative Air Pollution Control Strategies in Taiwan**

Hung-Teh Tsai

Deputy Minister

Environmental Protection Administration

Executive Yuan, Taiwan

11:00~11:45 **Recent Evidence on the Health Effects of Ozone: The Pollutant of the Future**

Michael Jerrett, Ph.D.

Professor and Chair

Fielding School of Public Health

University of California, Los Angeles (UCLA), USA

11:45~13:00 Lunch Break

**Moderator:** Yu-Cheng Chen, Ph.D.

Associate Investigator

National Institute of Environmental Health Sciences

National Health Research Institutes, Miaoli, Taiwan

**13:00~13:45 Measurement and Modeling of Human Exposure to Air Pollution**

H. Christopher Frey, Ph.D.

Professor

Department of Civil, Construction, and Environmental Engineering

North Carolina State University, USA

**13:45~14:20 Differences in PM<sub>2.5</sub> Measurements by FRM and FEM Methods**

Chuen-Jinn Tsai, Ph.D.

Chair Professor

Institute of Environment Engineering

National Chiao Tung University, Hsinchu, Taiwan

**14:20~14:55 Techniques for Exposure and Health Risk Assessment for Chemicals with Chronic Health Effects**

Perng-Jy Tsai, Ph.D.

Distinguished Professor

Department of Environmental and Occupational Health Medical College

National Cheng Kung University, Tainan, Taiwan

**14:55~15:15 Break**

**Moderator:** Tsun-Jen Cheng, M.D., Ph.D.

Professor

Institute of Occupational Medicine and Industrial Hygiene

National Taiwan University, Taipei, Taiwan

**15:15~16:00 Multiple Environmental Exposures in Cities and What Actions to Take to Reduce Them**

Mark J Nieuwenhuijsen, Ph.D.

Research Professor in Environmental Epidemiology

Center for Research in Environmental Epidemiology, Barcelona, Spain

**16:00~16:45 Strategies to Tackle Air Pollution Health Effects in Taiwan**

Yuh-Chin Tony Huang, M.D.

Professor

Department of Medicine

Duke University School of Medicine, USA

**16:45~17:00 Comprehensive Discussion**

**January 31, 2019**

**Moderator:** Pinpin Lin, Ph.D.

Investigator and Deputy Director  
National Institute of Environmental Health Sciences  
National Health Research Institutes, Miaoli, Taiwan

**09:00~09:45 Taiwan PM<sub>2.5</sub> Chemical Speciation Network**

Chung-Te Lee, Ph.D.

Distinguished Professor  
Graduate Institute of Environmental Engineering  
National Central University, Taoyuan, Taiwan

**09:45~10:30 PM<sub>2.5</sub> Exposure and Human Health Study in Taiwan (I)**

Yu-Cheng Chen, Ph.D.

Associate Investigator  
National Institute of Environmental Health Sciences  
National Health Research Institutes, Miaoli, Taiwan

**10:30~11:15 PM<sub>2.5</sub> Exposure and Human Health Study in Taiwan (II)**

Yue-Liang Leon Guo, M.D., Ph.D.

Distinguished Investigator and Director  
National Institute of Environmental Health Sciences  
National Health Research Institutes, Miaoli, Taiwan

**11:15~11:30 Comprehensive Discussion**

**11:30~11:35 Closing Remarks**



*The Speech Abstract  
and  
Keynote Speakers' CV*



09:50-10:25, Wednesday, January 30

## **PM<sub>2.5</sub>: Gap between Science and Policy**

**Chang-Chuan Chan, Ph.D.**

Professor and Dean

College of Public Health,

National Taiwan University, Taipei, Taiwan

# PM<sub>2.5</sub>: Gap between Science and Policy

Chang-Chuan Chan, Ph.D.

## **Abstract:**

Abundant research efforts and literature strive to disseminate proper scientific knowledge on particulate matter (PM), subsequent health risks and disease burden to different populations. Existing toxicological, mechanistic and epidemiological studies performed both internationally and locally in Taiwan and Taipei City were amassed and examined to elucidate current progress and gaps in scientific knowledge. For instance, toxicological animal bioassays reveal that at exposure concentrations lower than the current national air quality standards, PM<sub>2.5</sub> can aggravate those with pre-existing chronic kidney disease. Furthermore, exposure assessment studies identify and estimate the population exposure; epidemiological research reveal associated health risks pose threat to those exposed to PM. My observations are as follows: The first gap that exist between science and policy is evident when we compare available scientific evidence to the statements released by our current administration. Subsequently, the management options are not rooted in evidence-based research findings. The second gap is evident through the debate on how much air pollution can be attributed to transboundary sources (Chinese coastal area). To best bridge the gap in current scientific finding and public policy on air pollution control, a thorough systematic review of the abundant research should be performed. Additionally, education efforts must continue and reach beyond those in the public health and medical community, particularly those in regulatory agencies and municipal government.

## Curriculum Vitae

### **Chang-Chuan Chan, Ph.D.**

#### **Position**

Professor and Dean,  
College of Public Health,  
National Taiwan University, Taipei, Taiwan

E-mail: ccchan@ntu.edu.tw



#### **Education**

- |      |   |
|------|---|
| 1990 | Ph.D., Air Pollution Control, Harvard School of Public Health                               |
| 1987 | M.S., Industrial Hygiene and Air Pollution Control, Harvard School of Public Health         |
| 1982 | B.S., Public Health, Chemistry and Biology, National Taiwan University, College of Medicine |

#### **Professional Experience**

- |                |  |
|----------------|--|
| 2015 - 2017    | <i>Councilor</i> , International Society for Environmental Epidemiology (ISEE)   |
| 2016 - present | <i>Chair</i> , International Society for Environmental Epidemiology – Asia Chapter (ISEE-AC)                                       |
| 2014 - 2016    | <i>Steering Committee Member</i> , Association of Pacific Rim Universities (APRU) Global Health Program                            |
| 2009 - present | <i>Chairman</i> , Taiwan Chapter of Society for Risk Analysis  |
| 2008 - present | <i>President</i> , Society for Risk Analysis in Taiwan   |
| 2008 - 2011    | <i>Councilor</i> , International Society of Exposure Analysis (ISEA)   |
| 2017 - present | <i>Dean</i> , College of Public Health, National Taiwan University   |
| 2011 - 2017    | <i>Associate Dean</i> , College of Public Health, National Taiwan University   |
| 2011 - present | <i>Director</i> , Global Health Center in Taiwan, College of Public Health, National Taiwan University                             |
| 2007 - 2011    | <i>Director</i> , International Health Center in Taiwan, College of Public Health, National Taiwan University                      |
| 1999 - 2005    | <i>Director</i> , Institute of Occupational Medicine and Industrial Hygiene, College of Public Health, National Taiwan University  |
| 1997 - 1998    | <i>Takemi Fellow in International Health</i> , Harvard University  |
| 1997 - 1998    | <i>Fulbright Visiting Scholar</i>  |
| 1996 - present | <i>Professor</i> , Institute of Occupational Medicine and Industrial Hygiene, College of Public Health, National Taiwan University |

### **Publications** (at least 3 years)

1. Wang CW, Liao KW, **Chan CC**, Yu ML, Chuang HY, Chiang HC, Huang PC: Association between urinary thiodiglycolic acid level and hepatic function or fibrosis index in school-aged children living near a petrochemical complex. *Environ Pollut.* 2019 Jan;244:648-656. doi: 10.1016/j.envpol.2018.10.012. Epub 2018 Oct 6.
2. Ho WY, Tseng KH, Liou ML, **Chan CC**, Wang CH: Application of Positive Matrix Factorization in the Identification of the Sources of PM2.5 in Taipei City. *Int J Environ Res Public Health.* 2018 Jun 21;15(7). pii: E1305. doi: 10.3390/ijerph15071305.
3. Chuang HC, Shie RH, Chio CP, Yuan TH, Lee JH, **Chan CC\***: Cluster analysis of fine particulate matter (PM2.5) emissions and its bioreactivity in the vicinity of a petrochemical complex. *Environ Pollut.* 2018 May;236:591-597. doi: 10.1016/j.envpol.2018.01.067.
4. Chen CF, Chio CP, Yuan TH, Yeh YP, **Chan CC\***: Increased cancer incidence of Changhua residents living in Taisi Village north to the No. 6 Naphtha Cracking Complex. *J Formos Med Assoc.* 2018 Dec;117(12):1101-1107. doi: 10.1016/j.jfma.2017.12.013. Epub 2018 Feb 1.
5. Chen SY, Chu DC, Lee JH, Yang YR, **Chan CC\***: Traffic-related air pollution associated with chronic kidney disease among elderly residents in Taipei City. *Environ Pollut.* 2018 Mar;234:838-845. doi: 10.1016/j.envpol.2017.11.084. Epub 2017 Dec 21.
6. Yuan TH, Shen YC, Shie RH, Hung SH, Chen CF, **Chan CC\***: Increased cancers among residents living in the neighborhood of a petrochemical complex: A 12-year retrospective cohort study. *Int J Hyg Environ Health.* 2018 Mar;221(2):308-314. doi: 10.1016/j.ijheh.2017.12.004. Epub 2017 Dec 14.
7. Pan SC, Huang CC, Lin SJ, Chen BY, **Chan CC**, Leon Guo YL: Gestational diabetes mellitus was related to ambient air pollutant nitric oxide during early gestation. *Environ Res.* 2017 Oct;158:318-323. doi: 10.1016/j.envres.2017.06.005. Epub 2017 Jun 30.
8. Wu CF, Woodward A, Li YR, Kan H, Balasubramanian R, Latif MT, Sahani M, Cheng TJ, Chio CP, Taneepanichskul N, Kim H, **Chan CC**, Yi SM, Withers M, Samet J: Regulation of fine particulate matter (PM2.5) in the Pacific Rim: perspectives from the APRU Global Health Program. *Air Qual Atmos Health.* 2017 Aug; 10:1039. doi:10.1007/s11869-017-0492-x
9. Lo WC, Ku CC, Chiou ST, **Chan CC**, Chen CL, Lai MS, Lin HH: Adult mortality of diseases and injuries attributable to selected metabolic, lifestyle, environmental, and infectious risk factors in Taiwan: A comparative risk assessment. *Popul Health Metr.* 2017 May 3;15(1):17. doi: 10.1186/s12963-017-0134-4.
10. Chen CS, Yuan TH, Shie RH, Wu KY, **Chan CC\***: Linking sources to early effects by profiling urine metabolome of residents living near oil refineries and coal-fired power plants. *Environ Int.* 2017 May;102:87-96. doi: 10.1016/j.envint.2017.02.003. Epub 2017 Feb 24.

11. Chen SY, **Chan CC**, Su TC: Particulate and gaseous pollutants on inflammation, thrombosis, and autonomic imbalance in subjects at risk for cardiovascular disease. *Environ Pollut.* 2017 Apr;223:403-408. doi: 10.1016/j.envpol.2017.01.037. Epub 2017 Jan 31.
12. Chiang TY, Yuan TH, Shie RH, Chen CF, **Chan CC\***: Increased incidence of allergic rhinitis, bronchitis and asthma, in children living near a petrochemical complex with SO<sub>2</sub> pollution. *Environ Int.* 2016 Nov;96:1-7. doi: 10.1016/j.envint.2016.08.009. Epub 2016 Aug 30.
13. Yang YR, Chen YM, Chen SY, **Chan CC\***: Associations between Long-Term Particulate Matter Exposure and Adult Renal Function in the Taipei Metropolis. *Environ Health Perspect.* 2017 Apr;125(4):602-607. doi: 10.1289/EHP302. Epub 2016 Oct 7.
14. Tian TF, Wang SY, Kuo TC, Tan CE, Chen GY, Kuo CH, Chen CS, **Chan CC**, Lin OA, Tseng YJ: Web Server for Peak Detection, Baseline Correction, and Alignment in Two-Dimensional Gas Chromatography Mass Spectrometry-Based Metabolomics Data. *Anal Chem.* 2016 Nov;88(21):10395-10403. Epub 2016 Oct 13.
15. Lee PH, Fu H, Lai TC, Chiang CY, **Chan CC**, Lin HH: Glycemic Control and the Risk of Tuberculosis: A Cohort Study. *PLoS Med.* 2016 Aug 9;13(8):e1002072. doi: 10.1371/journal.pmed.1002072.
16. Withers M, Press D, Wipfli H, McCool J, **Chan CC**, Jimba M, Tremewan C, Samet J: Training the next generation of global health experts: Experiences and recommendations from Pacific Rim universities. *Global Health.* 2016 Jun 23;12(1):34. doi: 10.1186/s12992-016-0162-z.
17. Lin RT, Christiani DC, Kawachi I, Chan TC, Chiang PH, **Chan CC**: Increased Risk of Respiratory Mortality Associated with the High-Tech Manufacturing Industry: A 26-Year Study. *Int J Environ Res Public Health.* 2016 Jun 3;13(6). pii: E557. doi: 10.3390/ijerph13060557.
18. Ho CC, **Chan CC**, Chio CP, Lai YC, Chang-Chien GP, Chow JC, Watson JG, Chen LA, Chen PC, Wu CF: Source apportionment of mass concentration and inhalation risk with long-term ambient PCDD/Fs measurements in an urban area. *J Hazard Mater.* 2016 Nov 5;317:180-187. doi: 10.1016/j.jhazmat.2016.05.059. Epub 2016 May 20.
19. Chen SL, Lee CS, Yen AM, Chen HH, **Chan CC**, Chiu SY, Fann JC, Chang JC: A 10-year follow-up study on suicidal mortality after 1999 Taiwan earthquake. *J Psychiatr Res.* 2016 Aug;79:42-49. doi: 10.1016/j.jpsychires.2016.04.007. Epub 2016 Apr 25.
20. Yuan TH, Chung MK, Lin CY, Chen ST, Wu KY, **Chan CC\***: Metabolic profiling of residents in the vicinity of a petrochemical complex. *Sci Total Environ.* 2016 Apr 1;548-549:260-269. doi: 10.1016/j.scitotenv.2016.01.033. Epub 2016 Jan 21.
21. Lo WC, Shie RH, **Chan CC**, Lin HH: Burden of disease attributable to ambient fine particulate matter exposure in Taiwan. *J Formos Med Assoc.* 2017 Jan;116(1):32-40. doi: 10.1016/j.jfma.2015.12.007. Epub 2016 Feb 10.
22. Lai TC, Chiang CY, Wu CF, Yang SL, Liu DP, **Chan CC**, Lin HH: *Ambient air pollution and risk of tuberculosis: A cohort study.* *Occup Environ Med.* 2016 Jan;73(1):56-61. doi: 10.1136/oemed-2015-102995. Epub 2015 Oct 29.

23. Huang PC, Liu LH, Shie RH, Tsai CH, Liang WY, Wang CW, Tsai CH, Chiang HC, **Chan CC\***: Assessment of urinary thiodiglycolic acid exposure in school-aged children in the vicinity of a petrochemical complex in central Taiwan. *Environ Res.* 2016 Oct;150:566-572. doi: 10.1016/j.envres.2015.11.027. Epub 2015 Dec 4.
24. Lee JH, Wu CF, Hoek G, de Hoogh K, Beelen R, Brunekreef B, **Chan CC\***: *LUR models for particulate matters in the Taipei metropolis with high densities of roads and strong activities of industry, commerce and construction.* *Sci Total Environ.* 2015 May 1;514:178-84. doi: 10.1016/j.scitotenv.2015.01.091. Epub 2015 Feb 5.
25. Ho CC, **Chan CC**, Cho CW, Lin HI, Lee JH, Wu CF: *Land use regression modeling with vertical distribution measurements for fine particulate matter and elements in an urban area.* *Atmospheric Environ.* 2015 Jan;104. doi:10.1016/j.atmosenv.2015.01.024
26. Chen SY, Wu CF, Lee JH, Hoffmann B, Peters A, Brunekreef B, Chu DC, **Chan CC\***: *Associations between Long-Term Air Pollutant Exposures and Blood Pressure in Elderly Residents of Taipei City: A Cross-Sectional Study.* *Environ Health Perspect.* 2015 Aug;123(8):779-84. doi: 10.1289/ehp.1408771. Epub 2015 Mar 20.
27. Su TC, Hwang JJ, Shen YC, **Chan CC\***: *Carotid Intima–Media Thickness and Long-Term Exposure to Traffic-Related Air Pollution in Middle-Aged Residents of Taiwan: A Cross-Sectional Study.* *Environ Health Perspect.* 2015 Aug;123(8):773-8. doi: 10.1289/ehp.1408553. Epub 2015 Mar 20.
28. Yuan TH, Chio CP, Shie RH, Pien WH, **Chan CC\***: *The distance-to-source trend in vanadium and arsenic exposures for residents living near a petrochemical complex.* *J Expo Sci Environ Epidemiol.* 2016 May-Jun;26(3):270-6. doi: 10.1038/jes.2015.2. Epub 2015 Feb 18.



10:25-11:00, Wednesday, January 30

## **Innovative Air Pollution Control Strategies in Taiwan**

**Hung-Teh Tsai**

Deputy Minister

Environmental Protection Administration

Executive Yuan, Taiwan

# Innovative Air Pollution Control Strategies in Taiwan

Hung-Teh Tsai

## **Abstract:**

Air pollution has been a significant threat to health worldwide. Last October, the WHO estimates that around 7 million deaths a year due to air pollution by 2030 in the First WHO Global Conference on Air Pollution and Health. UNEA also to make a historical call for strengthened action on air quality, and UN listed air pollution control action in its sustainable development goals. As a reasonable inhabitant of the global village and to respond to the UN's call, Taiwan presented our first Voluntary National Review (VNR) in New York in 2017 to explain how we have worked toward achieving the United Nations sustainable development goals including air pollution control. In order to reach Taiwan's sustainable developed goals, we have developed an action plan for air pollution control in December 2017. Further, to control air pollution, maintain the living environment and public health, the Taiwan's Air Pollution Control Act was amended on August 1st, 2018. It's my honor to report that after much effort, Taiwan has successfully reduced the number of reports per year of unhealthy levels of air quality from 831 days in 2015 to 310 days in 2018. Furthermore, Taiwan EPA has cooperate with US EPA and work together with other South and Southeast Asian countries partners toward the ultimate goal of improving the Asia air quality and protecting human health.

## Curriculum Vitae

### **Hung-Teh Tsai**



#### **Position**

Deputy Minister  
Environmental Protection Administration  
Executive Yuan, Taiwan

#### **Education**

1984                    M.S., National Taiwan University  
1977                    B.S., National Taiwan University

#### **Professional Experience**

2018 - present      Deputy Minister, Environmental Protection Administration  
2018 - 2019        Acting Minister, Environmental Protection Administration  
2018                Chief Secretary, Environmental Protection Administration  
2016 - 2018        Director, Department of Air Quality Protection & Noise Control,  
Environmental Protection Administration  
2015 -2016        Director, Department of Environmental Monitoring & Information  
Management , Environmental Protection Administration  
2008 - 2015        Technical Superintendent, and Executive Secretary, Soil and  
Groundwater Remediation Fund Management  
Board ,Environmental Protection Administration  
2008                Technical Superintendent, Environmental Protection  
Administration  
2007 -2008        Deputy Director, Department of Air Quality Protection & Noise  
Control, Environmental Protection Administration  
2004 - 2007        Deputy Director, Department of Supervision & Dispute Resolution,  
Environmental Protection Administration  
2002 - 2004        Deputy Director, Department of Environment Monitoring &  
Information Management  
2002                Deputy Director ,Environmental Analysis Laboratory,  
Environmental Protection Administration



11:00-11:45, Wednesday, January 30

## **Recent Evidence on the Health Effects of Ozone: The Pollutant of the Future**

**Michael Jerrett, Ph.D.**

Professor and Chair

Department of Environmental Health Sciences

Fielding School of Public Health

UCLA

# Recent Evidence on the Health Effects of Ozone: The Pollutant of the Future

Michael Jerrett, Ph.D.

## **Abstract:**

Tropospheric ozone (O<sub>3</sub>) concentrations have increased by twofold since the 19<sup>th</sup> century, due largely to growing O<sub>3</sub> precursor emissions associated with human activity. O<sub>3</sub> exhibits strong spatial and temporal heterogeneity. In the United States nearly 130 million people live in areas that fail to comply with O<sub>3</sub> standards set by the U.S. Environmental Protection Agency (EPA). While other pollutants have shown marked improvement, ozone has not seen nearly the same decreases in many parts of the world. Higher and worsening concentrations have also been observed in densely populated areas of South and East Asia. O<sub>3</sub> is also an important greenhouse gas that contributes substantially to increased radiative forcing and resulting climate change. In the troposphere, ozone can elicit a wide range of adverse effects on human health, including: pulmonary dysfunction, hospitalization for respiratory causes, induction and exacerbation of asthma, and premature mortality from several causes, with high risks observed for diabetic deaths. Ozone is a particularly challenging pollutant to study the health effects. The spatiotemporal variability operates at numerous scales – from micro-street level to regional spatially and diurnally to seasonally temporally. In this presentation, I will focus on recent evidence of the health effects of ozone. In the past five years there has been a dramatic increase in the number of studies linking ozone to various health end points, largely driven by new publications originating from Asia. The recent evidence suggests a wider array of health effects than previously thought, including cardiovascular mortality, diabetes, and mental health outcomes. The talk will evaluate the new evidence with regard to the last Integrated Scientific Assessment conducted by the U.S. Environmental Protection Agency, which made several determinations about the causal evidence that ozone affected various short and long-term health outcomes. The new evidence appears likely to support upgrading the causality determinations for numerous outcomes and could have important public health implications.

## Curriculum Vitae

### **Michael Leo Brennan Jerrett, Ph.D.**

#### **Position**

Professor and Chair  
Department of Environmental Health Sciences  
Fielding School of Public Health, UCLA



Email: [mjerrett@ucla.edu](mailto:mjerrett@ucla.edu)

#### **Education**

1996	Ph.D., Geography, University of Toronto
1988	M.A., Political Science with accredited specialization in Environmental Studies, University of Toronto
1986	B.Sc., Environmental and Resources Sciences, Trent University

#### **Professional Experience**

2014 - present	Full Professor and Chair, Department of Environmental Health Sciences, Fielding School of Public Health, University of California, Los Angeles
2014 - present	Professor-in-Residence, Division of Environmental Health Sciences School of Public Health, University of California, Berkeley
2012 - 2014	Chair, Division of Environmental Health Sciences School of Public Health, University of California, Berkeley
2006 - 2014	Professor, Division of Environmental Health Sciences (Associate Professor 1994 – 2011) School of Public Health, University of California, Berkeley
2008 - 2010	Director, Doctor of Public Health Program in Environmental Health Sciences, University of California, Berkeley
2002 - 2007	Adjunct Associate Professor, Graduate Programs in Population Health, Ontario Veterinary College
2003 - 2006	Associate Professor, University of Southern California
2004 - 2006	Co-Director, Exposure Assessment and GIS Facility Core, Southern California Center for Environmental Health Science
1998 - 2005	Associate Professor, McMaster University
1997 - 1998	Assistant Professor, San Diego State University
1995 - 1997	Teaching Postdoctoral Fellow, Tri-Council Research Environmental Health Program and Department of Geography, McMaster University

## Publications (at least 3 years)

1. **Jerrett M**, Donaire-Gonzalez D, Popoola O, Jones R, Cohen RC, Almanza E, de Nazelle A, Mead I, Carrasco-Turigas G, Cole-Hunter T, Triguero-Mas M, Seto E, Nieuwenhuijsen M. Validating novel air pollution sensors to improve exposure estimates for epidemiological analyses and citizen science. *Environ Res.* 2017 Jun 28;158:286-294.
2. Coogan PF, White LF, Yu J, Brook RD, Burnett RT, Marshall JD, Bethea TN, Rosenberg L, **Jerrett M**. Long-Term Exposure to NO<sub>2</sub> and Ozone and Hypertension Incidence in the Black Women's Health Study. *Am J Hypertens.* 2017 Apr 1;30(4):367-372.
3. Curto A, de Nazelle A, Donaire-Gonzalez D, Cole-Hunter T, Garcia-Aymerich J, Martínez D, Anaya E, Rodríguez D, **Jerrett M**, NIEUWENHUIJSEN MJ. Private and public modes of bicycle commuting: a perspective on attitude and perception. *Eur J Public Health.* 2016 Aug;26(4):717-23.
4. Avila-Palencia I, de Nazelle A, Cole-Hunter T, Donaire-Gonzalez D, **Jerrett M**, Rodriguez DA, NIEUWENHUIJSEN MJ. The relationship between bicycle commuting and perceived stress: a cross-sectional study. *BMJ Open.* 2017 Jun 23;7(6):e013542.
5. Weichenthal S, Bai L, Hatzopoulou M, Van Ryswyk K, Kwong JC, **Jerrett M**, van Donkelaar A, Martin RV, Burnett RT, Lu H, Chen H. Long-term exposure to ambient ultrafine particles and respiratory disease incidence in Toronto, Canada: a cohort study. *Environ Health.* 2017 Jun 19;16(1):64.
6. Loh M, Sarigiannis D, Gotti A, Karakitsios S, Pronk A, Kuijpers E, Annesi-Maesano I, Baiz N, Madureira J, Oliveira Fernandes E, **Jerrett M**, Cherrie JW. How Sensors Might Help Define the External Exposome. *Int J Environ Res Public Health.* 2017 Apr 18;14(4).
7. Turner MC, Nieuwenhuijsen M, Anderson K, Balshaw D, Cui Y, Dunton G, Hoppin JA, Koutrakis P, **Jerrett M**. Assessing the Exposome with External Measures: Commentary on the State of the Science and Research Recommendations. *Annu Rev Public Health.* 2017 Mar 20;38:215-239.
8. **Jerrett M**, Brook R, White LF, Burnett RT, Yu J, Su J, Seto E, Marshall J, Palmer JR, Rosenberg L, Coogan PF. Ambient ozone and incident diabetes: A prospective analysis in a large cohort of African American women. *Environ Int.* 2017 May;102:42-47.
9. Turner MC, Cohen A, Burnett RT, **Jerrett M**, Diver WR, Gapstur SM, Krewski D, Samet JM, Pope CA 3rd. Interactions between cigarette smoking and ambient PM<sub>2.5</sub> for cardiovascular mortality. *Environ Res.* 2017 Apr;154:304-310.
10. Allen RT, Hales NM, Baccarelli A, **Jerrett M**, Ezzati M, Dockery DW, Pope CA 3rd. 2016. Countervailing effects of income, air pollution, smoking, and obesity on aging and life expectancy: population-based study of U.S. Counties. *Environmental Health.* 15:86.
11. Donaire-Gonzalez D, Valentín A, de Nazelle A, Ambros A, Carrasco-Turigas G, Seto E, **Jerrett M**, NIEUWENHUIJSEN MJ. 2016. Benefits of mobile phone technology for personal environmental monitoring. *Journal of Medical Internet Research.* 10:e126.



12. Nasari MM, Szyszkowicz M, Chen H, Crouse D, Turner MC, **Jerrett M**, Pope CA 3rd, Hubbell B, Fann N, Cohen A, Gapstur SM, Diver WR, Stieb D, Forouzanfar MH, Kim SY, Olives C, Krewski D, Burnett RT. 2016. A class of non-linear exposure-response models suitable for health impact assessment applicable to large cohort studies of ambient air pollution. *Air Quality and Atmospheric Health*. 9: 961-972.
13. Baccarelli AA, Hales N, Burnett RT, **Jerrett M**, Mix C, Dockery DW, Pope CA. 2016. Particulate air pollution, exceptional aging, and rates of centenarians: A nationwide analysis of the United States, 1980-2010. *Environmental Health Perspectives*. 124:1744-1750.
14. **Jerrett, M.**, Su, J., MacLeod S., Hanning C., Huston, D., and Wolch, J. Safe routes to play? Pedestrian and bicyclist crashes near parks in the Los Angeles Region. *Environmental Research*. 151: 742-755.
15. Su JG, Meng YY, Pickett M, Seto E, Ritz B, **Jerrett M**. 2016. Identification of effects of regulatory actions on air quality in goods movement corridors in California. *Environmental Science and Technology*. 2016 50(16):8687-96.
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13:00-13:45, Wednesday, January 30

## **Measurement and Modeling of Human Exposure to Air Pollution**

**H. Christopher Frey, Ph.D.**

Professor

Department of Civil, Construction,  
and Environmental Engineering  
North Carolina State University, USA

# Measurement and Modeling of Human Exposure to Air Pollution

H. Christopher Frey, Ph.D.

## **Abstract:**

Exposure is the contact of a pollutant with the outer boundary of the body. Exposure is a key link in the continuum between emissions of an air pollutant and adverse effects in exposed populations. Exposure can sometimes be a surrogate for adverse effects, such as when benchmark levels of exposure can be inferred from controlled human studies. For dose-response relationships based on toxicological studies, exposure is often used as a basis for quantifying potential dose. In air pollution epidemiologic studies, measured ambient concentration at fixed site monitors has often been used as a surrogate for exposure concentrations. However, in recent years, more accurate methods for exposure assessment have been incorporated into epidemiologic studies. Implications of exposure error in epidemiologic inference will be briefly discussed. Microenvironmental exposure models, such as the Stochastic Human Exposure and Dose Simulation (SHEDS) model and the Air Pollution Exposure (APEX) model, both developed by the U.S. Environmental Protection Agency, predict inter-individual variability in exposure taking into account heterogeneity in exposure concentrations among microenvironments. Inputs to such models include population demographic data, activity diary data, spatial and temporal variability in ambient air pollution concentration, and data regarding infiltration of ambient air pollution to enclosed microenvironments such as vehicles and homes. With the emergence of low cost and smaller air quality sensor packages, the feasibility of directly measuring exposure concentrations for multiple pollutants over space and time is improving. This presentation will illustrate capabilities and challenges related to measurement and modeling of human exposure to air pollution based on selected examples.

## Curriculum Vitae

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#### **Position**

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#### **Education**

- 1991                      Ph.D., Engineering and Public Policy, Carnegie Mellon University,  
Pittsburgh, PA
- 1987                      M.E., Mechanical Engineering, Carnegie Mellon University,  
Pittsburgh, PA
- 1985                      B.S., Mechanical Engineering, University of Virginia,  
Charlottesville, VA

#### **Professional Experience**

- 1994 - present        Faculty (Assistant Professor, Associate Professor, Professor,  
Distinguished University Professor) in Department of Civil,  
Construction, and Environmental Engineering at North Carolina  
State University, Raleigh, NC
- 2014 - present        Adjunct Professor, Hong Kong University of Science and Technology
- 2016 - 2018            Director (Member), Board of Directors, Air & Waste Management  
Association, Pittsburgh, PA (elected)
- 2015 - 2018            Member, Particulate Matter Review Panel, Clean Air Scientific  
Advisory Committee (CASAC), U.S. Environmental Protection  
Agency. Also member 2007-2011.
- 2012 - 2018            Member, Science Advisory Board, U.S. Environmental Protection  
Agency
- 2012- 2015            Chair, Clean Air Scientific Advisory Committee (CASAC), U.S.  
Environmental Protection Agency (Member 2008 to 2012)
- 2012 - 2014            Chair, Ozone Review Panel, U.S. EPA Clean Air Scientific Advisory  
Committee
- 2006 - 2007            Sabbatical: Exposure Modeling Advisor, National Exposure  
Research Laboratory, U.S. Environmental Protection Agency,  
Research Triangle Park, NC
- 2006                    President, Society for Risk Analysis

## **Publications** (selected 30 of 120 journal papers)

1. Che, W., **H.C. Frey**, Z. Li, X. Lao, A.K.H. Lau, "Indoor Exposure to Ambient Particles and Its Estimation Using Fixed Site Monitors," *Environmental Science and Technology*, published 11/6/18 as Just Accepted"paper. DOI: 10.1021/acs.est.8b04474.
2. Tanvir, S., **H.C. Frey**, and N.M. Roupail, "Effect of Light Duty Vehicle Performance on a Driving Style Metric," *Transportation Research Record*, published online September 7, 2018 (in press). <http://journals.sagepub.com/doi/abs/10.1177/0361198118796070>
3. **Frey, H.C.**, "2018 Critical Review: Trends in Onroad Transportation Energy and Emissions," *Journal of the Air & Waste Management Association*, 68(6):514-563 (2018). DOI: 10.1080/10962247.2018.1454357. 50 pages
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9. **Frey, H.C.**, M. Delavarrafiee, and S. Singh, "Real-World Freeway and Ramp Activity and Emissions for Light Duty Gasoline Vehicles," *Transportation Research Record*, 2627:17-25 (2017). <https://doi.org/10.3141/2627-03>.
10. Li, Z., W. Che, **H.C. Frey**, A.K.H. Lau, "Characterization of PM2.5 Exposure Concentration in Transport Microenvironments Using Portable Air Monitors," *Environmental Pollution*, 228:433-442 (2017).
11. Graver, B.M., **H.C. Frey**, and J. Hu, "Effect of Biofuels on Real-World Emissions of Passenger Locomotives," *Environmental Science and Technology*, 50(21):12030-12039 (2016).
12. Graver, B.M., and **H.C. Frey**, "Highway Vehicle Emissions Avoided by Diesel Passenger Rail Service Based on Real-World Data," *Urban Rail Transit*, 2(3-4):153-171 (2016).
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14. Hu, J., **H.C. Frey**, and S.S. Washburn, "Comparison of Vehicle-Specific Fuel Use and Emissions Models Based on Externally and Internally Observable Activity Data," *Transportation Research Record*, 2570:30-38 (2016).

15. Khan, T., and **H.C. Frey**, "Evaluation of Light Duty Gasoline Vehicle Rated Fuel Economy Based on In-Use Measurements," *Transportation Research Record*, 2570:21-29 (2016).
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17. Liu, B., and **H.C. Frey**, "Variability in Light Duty Gasoline Vehicle Emission Factors from Trip-Based Real-World Measurements," *Environmental Science & Technology*, 49(20):12525-12534 (2015).
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21. Jiao, W., and **H.C. Frey**, "Method for Measuring the Ratio of In-Vehicle to Near-Vehicle Exposure Concentrations of Airborne Fine Particles," *Transportation Research Record*, 2341:34-42 (2013).
22. Mannshardt, E., K. Susic, W. Jiao, F. Dominici, **H.C. Frey**, B. Reich, and M. Fuentes, Comparing Exposure Metrics for the Effects of Fine Particulate Matter on Emergency Hospital Admissions, *Journal of Exposure Science and Environmental Epidemiology*, 23:627-636 (doi:10.1038/jes.2013.39). (2013).
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13:45-14:20, Wednesday, January 30

## **Differences in PM<sub>2.5</sub> Measurements by FRM and FEM Methods**

**Chuen-Jinn Tsai, Ph.D.**

Chair Professor

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# Differences in PM<sub>2.5</sub> Measurements by FRM and FEM Methods

Chuen-Jinn Tsai, Ph.D.

## Abstract:

Both Federal Reference Method (FRM) PM<sub>2.5</sub> manual samplers and Federal Reference Method (FEM) automatic monitors are compliance monitors which use size-selective inlets followed by a filter to collect PM<sub>2.5</sub> for further analysis. However, PM<sub>2.5</sub> concentrations are under-estimated by the FRM samplers due to evaporation loss of semi-volatile aerosol materials (SVMs), while the measurement uncertainties exist in the FEM monitors due to water content in aerosols which is removed by aerosol heating. The biases between PM<sub>2.5</sub> FEM and FRM concentrations were found to increase with decreasing PM<sub>2.5</sub> concentrations and varied with ambient conditions in field comparison tests conducted at National Chiao Tung University (NCTU) and four Taiwan EPA monitoring stations with a total of 266 daily samples collected for collocated BAM-1020 and TEOM-FDMS, and FRM samplers. The ratios of the PM<sub>2.5</sub> concentrations of the monitors and samplers are within 0.9 to 1.1 when PM<sub>2.5</sub> concentrations are higher than 35  $\mu\text{g m}^{-3}$ , but they are increased to 0.7 to 1.3 (BAM-1020 vs FRM), or 0.8 to 1.5 (TEOM vs FRM) when PM<sub>2.5</sub> concentrations are decreased to 10  $\mu\text{g m}^{-3}$ . To reduce the biases between FEM monitors and FRM sampler, empirical equations based on PM<sub>2.5</sub> concentrations and ambient T and RH(%) were derived. The biases are decreased from  $1.77 \pm 12.49\%$  to  $0.00 \pm 3.57\%$  for BAM-1020 and from  $13.94 \pm 14.53\%$  to  $-0.02 \pm 3.08\%$  for TEOM-FDMS.

To improve the accuracy of PM<sub>2.5</sub> sampling and monitoring, PM inlets and aerosol conditioning method during filter sampling were studied and improved further. The US EPA PM<sub>10</sub> inlet and PM<sub>2.5</sub> inlet, including the well impactor ninety-six (WINS) and the very sharp cut cyclone (VSCC) were found to have particle bounce or particle overloading problems, which change the cutoff characteristics and PM concentrations. The grease-coated substrate of the PM<sub>10</sub> inlet was replaced by an oil-soaked glass fiber filter to capture particles effectively. The impaction surface of the PM<sub>2.5</sub> WINS was re-designed to allow a small amount of water or vacuum oil to inject upward to wash deposited particles off the plate. The modified PM inlets eliminated particle bounce and particle overloading effectively with small errors during long-term sampling. A chilled filter sampler followed by a Nafion dryer was found to suppress the evaporation loss of semi-volatile inorganic materials (SVIM)

effectively due to a small amount of water vapor condensation during sampling and conditioning processes. The total evaporation loss of SVIM in  $PM_{2.5}$  measured by chilled filter sampler was effectively reduced and the accuracy of  $PM_{2.5}$  sampling was significantly improved after correcting for the amount of condensed water determined empirically. These improvements lead to accurate  $PM_{2.5}$  data that can be related to health effects meaningfully and used to calibrate widely used low-cost  $PM_{2.5}$  sensors reliably.

## Curriculum Vitae

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#### **Education**

1990 Ph.D., Mechanical Engineering, University of Minnesota  
1986 M.S., Mechanical Engineering, University of Minnesota  
1977 B.S., Mechanical Engineering, National Taiwan University

#### **Professional Experience**

2011 - 2017 Distinguished Professor, Institute of Environmental Engineering, National Chiao Tung University  
2015 Fellow, Asian Association Research Assembly  
2015 Distinguished Engineering Professor, Chinese Institute of Engineers  
2012 Fellow, Taiwan Association for Aerosol Research (TAAR)  
2011 - 2013 Coordinator, Environmental Engineering Program, National Science Council  
2010 Ho Chin Tui Distinguished Award  
2009 - 2012 NSC Distinguished Research Project  
2006 International Aerosol Fellow Award  
2002 - 2003 Research Professor, Environmental Engineering Science, Washington University in St. Louis  
2004, 2012, 2017 Distinguish Research Award, National Science Council  
1996 - 1998, Chairman, Institute of Environmental Engineering, National Chiao Tung University  
2006 - 2012  
1995 Professor, Institute of Environmental Engineering, National Chiao Tung University

### Publications (at least 3 years)

1. Thi-Cuc Le, Krishna Kumar Shukla, Jung-Che Sung, Ziyi Li, Huajun Yeh, Wei Huang, **Chuen-Jinn Tsai**. (2018). Sampling Efficiency of Low-Volume PM10 Inlets with Different Impaction Substrates, *Aerosol Science and Technology* (published on-line)
2. Bo-Xi Liao, Neng-Chun Tseng and **Chuen-Jinn Tsai**, 2018, The Accuracy of the Aerosol Particle Mass Analyzer for Nanoparticle Classification, *Aerosol Science and Technology*, 52(1): 19–29. (Jan. 2018)
3. Bo-Xi Liao, Neng-Chun Tseng, Ziyi Li, Yingshu Liu, Jen-Kun Chen, **Chuen-Jinn Tsai**. (2018). Exposure Assessment of Process By-product Nanoparticles Released during the Preventive Maintenance of Semiconductor Fabrication Facilities, *Journal of Nanoparticle Research*, 20 (7):203 (2018, July).
4. Thi-Cuc Le and **Chuen-Jinn Tsai**, 2017, Novel non-bouncing PM2.5 impactor modified from well impactor ninety-six, *Aerosol Science and Technology*, Volume 51, Issue 11, 1287-1295. (Nov., 2017)
5. Ziyi Li, Yingshu Liu, Yujie Lin, Sneha Gautam, Hui-Chuan Kuo, **Chuen-Jinn Tsai\***, Huajun Yeh, Wei Huang, Shih-Wei Li, Guo-Jei Wu, 2017, Development of an Automated System (PPWD/PILS) for Studying PM2.5 Water-Soluble Ions and Precursor Gases: Field Measurements in Two Cities, Taiwan. *Aerosol and Air Quality Research*, 17(2): 426-443.
6. Li, Z. Y., Liu, Y.S., Yang, X., Xing, Y., **Tsai, C. J.**, Wang, Z. Y., Yang, Q., Yang, R. T., 2016. Desorption of Polycyclic Aromatic Hydrocarbons on Mesoporous Sorbents: Thermogravimetric Experiments and Kinetics Study, *Ind. Eng. Chem. Res.*, 55, 1183–1191.
7. Chih-Liang Chien, Aditya Prana Iswara, Yi-Ling Liou, Bing-Tsai Wang, Jui-Chiao Chang, Yi-Hung Hung, **Chuen-Jinn Tsai \***, 2015, A real-time monitoring system for soluble gas pollutants and it's application for determining the control efficiency of packed towers, *Separation and Purification Technology*, Vol. 154, pp. 137-48. (Nov. 2015)
8. Chih-Liang Chien, Chi-Yu Tien, Chun-Nan Liu, Huajun Ye, Wei Huang, **Chuen-Jinn Tsai\***, 2015, Design and testing of the NCTU micro-orifice cascade impactor (NMCI) for the measurement of nanoparticle size distributions m, *Aerosol Science and Technology*, Vol. 49, pp. 41009-1018. (Oct. 2015)
9. Ziyi Li, Yingshu Liu, Yi Xing, Thi-Minh-Phuong Tran, Thi-Cuc Le, and **Chuen-Jinn Tsai \***, 2015, Novel Wire-on-Plate Electrostatic Precipitator (WOP-EP) for Controlling Fine Particle and Nanoparticle Pollution, *Environmental Science and Technology*, Vol. 49 (14), 8683-8690. (July, 2015)



14:20-14:55, Wednesday, January 30

## **Techniques for Exposure and Health Risk Assessment for Chemicals with Chronic Health Effects**

**Perng-Jy Tsai, Ph.D.**

Distinguished Professor

Department of Environmental and Occupational Health Medical College

National Cheng Kung University, Tainan, Taiwan

# Techniques for Exposure and Health Risk Assessment for Chemicals with Chronic Health Effects

Perng-Jy Tsai, Ph.D.

## **Abstract**

Previous chemical exposure and health risk assessment studies were mainly on the cross-sectional basis. But for those chemicals with chronic health effects, conducting long-term exposure and health risk assessments are needed. Considering the cost constraints in both samplings and sample analyses, the development of techniques for establishing a long-term exposure data bank become important in the environmental and occupational field. To date, both the surrogate methods and exposure predicting models have been widely used for predicting pollutant concentrations in the environmental and occupational field over a long period of time. The use of surrogate method allows us to measure the pollutant concentrations in a cheaper and easier way, which will enable researchers to collect vast amount of exposure data over a long period of time. On the other hand, the use of exposure predicting models would help researchers to predict exposure concentrations even without conducting field samplings, though the collection of long-term exposure predicting parameters are needed. In this presentation, the use of noise measurements as a surrogate for determining aerosol exposure concentration, and TOVC measurements for multiple chemical exposures are demonstrated. Finally, the feasibility of using the near/far zone models on chemical exposure concentrations is also discussed.



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**Education**

- |      |  |
|------|--|
| 1995 | Ph.D., Environmental and Occupational Health, University of Minnesota, USA |
| 1985 | M.S., Environmental, National Cheng Kung University Engineering, Taiwan    |
| 1981 | B.A., Environmental, National Chung Hsing University Engineering, Taiwan   |

**Professional Experience**

- |                |  |
|----------------|--|
| 2010 - present | Distinguished Professor of Dept. Environ. & Occup. Health, College of Medicine, National Cheng Kung University                         |
| 2011 - 2013    | Dean/Professor of School of Public Health, China Medical University  |
| 1995 - 2011    | Lecturer/Associate Professor/Professor/Director of Dept. Environ. & Occup. Health, College of Medicine, National Cheng Kung University |
| 2003 - 2006    | President of Taiwan Occupational Hygiene Association   |
| 1986 - 1991    | Governmental industrial hygiene inspector  |

### Publications (Last 5 years)

1. Chen, J.-Y., Kuo, Y.-C., Wu, K.-J., Wang, S.-M., Chen, Y.-C., **Tsai, P.-J.\***, Techniques for predicting exposures of polycyclic aromatic hydrocarbons (PAHs) emitted from cooking processes for cooking workers. *Aerosol and Air Quality Research*, 2019, In press.
2. Lin, C.-Y., **Tsai, P.-J.**, Lin, K.-Y., Chen, C.-Y., Chung, L.-H., Wu, J.-L., Guo, Y.-L., Will daytime occupational noise exposures induce nighttime sleep disturbance? *Sleep Medicine*, 2018, 50: 87-96.
3. Lin, M.-Y., Guo, Y.-X., Chen, Y.-C., Chen, W.-T., Young, L.-H., Lee, K.-J., Wu, Z.-Y., **Tsai, P.-J.\***, An instantaneous spatiotemporal model for predicting traffic-related ultrafine particle concentration through mobile noise measurements. *Science of The Total Environment*, 2018, 636: 1139-1148
4. Wang, Y.-F., Wang, S.-M., Kuo, Y.-C., Yoon, C., Wang, Y.-F., **Tsai, P.-J.\***, Long-term multiple chemical exposure assessment for a thin film transistor liquid crystal display (TFT-LCD) Industry. *Aerosol and Air Quality Research*, 2017, 17: 2891–2900.
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6. Chen, W.-Y., Juang, Y.-J., Hsieh, J.-Y., **Tsai, P.-J.\***, Chen C.-P., Estimation of Respiratory Heat Flows in Prediction of Heat Strain among Taiwanese Steel Workers. *International Journal of Biometeorology*, 2017, 61: 115–125.
7. Ham, S., Kim, S., Lee, N., Kim, P., Eom, P., Eom, I., Lee, B., **Tsai, P.-J.**, Lee, K., Yoon, C., Comparison of Data Analysis Procedures for Real-time Nanoparticle Sampling Data Using Classical Regression and ARIMA Models. *Journal of Applied Statistics*, 2017, 44: 685-699.
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15:15-16:00, Wednesday, January 30

## **Multiple Environmental Exposures in Cities and What Actions to Take to Reduce Them**

**Mark J Nieuwenhuijsen, Ph.D.**

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# Multiple Environmental Exposures in Cities and What Actions to Take to Reduce Them

Mark J Nieuwenhuijsen, Ph.D.

## **Abstract:**

Over 50% of the world's population is living in cities and this is expected to rise to 70% over the next few decades. Cities are society's predominant engine of innovation and wealth creation, but also main sources of crime, pollution, and disease. Partly due to poor urban and transport planning, or the lack thereof, we have cities that are too car dominated. All the urban planning in the world seems for cars; People do not matter. This has led to high air pollution and noise levels, heat island effects and lack of green space and physical activity that are all detrimental to health. For example, a recent health impact assessment in Barcelona estimated that 20% of premature mortality was due to urban and transport related exposures. Electric cars and/or autonomous vehicles have been mentioned as possible solutions, but they are unlikely to be, and solutions need to be sought elsewhere. A new long term visioning of healthy urban future is needed that bring health, sustainability and livable at the forefront of urban and transport planning. Systemic approaches to the current problems and e.g. a shift away from our grey car centric cities towards cities with more public and active transportation and green space are urgently needed. Collaboration between e.g. urban and transport planners, environmentalists and public health professionals is essential to create healthy sustainable and livable cities.

## Curriculum Vitae

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#### **Education**

- 1993 Ph.D., Occupational Hygiene/Epidemiology, Department of Occupational and Environmental Medicine, National Heart and Lung Institute, University of London
- 1989 B.Sc/MSc., Environmental Science, Agricultural University of Wageningen, Wageningen, Holland (Specializing in Occupational Hygiene and Epidemiology)

#### **Professional Experiences**

- 2007- present Research Professor at ISGlobal, formerly the Centre for Environmental Epidemiology(CREAL), Barcelona
- 2005 - 2006 Reader at the Department of Epidemiology and Public Health, and Health risk assessment, management and policy option convenor, Imperial College of Science, Technology and Medicine, London.
- 2005 Visiting researcher, Municipal Institute of Medical Research (IMIM), Barcelona (sabbatical April-December)
- 2003- 2005 Reader at the Department of Environmental Science and Technology, and Health risk assessment, management and policy option convenor, Imperial College of Science, Technology and Medicine, London.
- 2000- 2003 Senior Lecturer at the Department of Environmental Science and Technology, and Health risk assessment, management and policy option convenor, Imperial College of Science, Technology and Medicine, London.
- 1996- 2000 Lecturer at the TH Huxley School of Environment, Earth Sciences and Engineering, and Health risk assessment, management and policy option convenor, Imperial College of Science, Technology and Medicine, London.

1994-1996 Post Doctoral Researcher, Department of Epidemiology and Preventive  
Medicine, University of California Davis, Davis, CA. USA.

1989-1994 Research Assistant, Department of Occupational and Environmental  
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## Publications (at least 1 years)

1. de Keijzer C, Tonne C, Sabia S, Basagaña X, Valentín A, Singh-Manoux A, Antó JM, Alonso J, **Nieuwenhuijsen MJ**, Sunyer J, Davdand P. Green and blue spaces and physical functioning in older adults: Longitudinal analyses of the Whitehall II study. *Environ Int.* 2018 Nov 28. pii: S0160-412
2. van Veldhoven K, Kiss A, Keski-Rahkonen P, Robinot N, Scalbert A, Cullinan P, Chung KF, Collins P, Sinharay R, Barratt BM, **Nieuwenhuijsen MJ**, Rodoreda AA, Carrasco-Turigas G, Vlaanderen J, Vermeulen R, Portengen L, Kyrtopoulos SA, Ponzi E, Chadeau-Hyam M, Vineis P. Impact of short-term traffic-related air pollution on the metabolome - Results from two metabolome-wide experimental studies. *Environ Int.* 2018 Dec 3;123:124-131
3. Tamayo-Uria I, Maitre L, Thomsen C, **Nieuwenhuijsen MJ**, Chatzi L, Siroux V, Aasvang GM, Agier L, Andrusaityte S, Casas M, de Castro M, Dedele A, Haug LS, Heude B, Grazuleviciene R, Gutzkow KB, Krog NH, Mason D, McEachan RRC, Meltzer HM, Petraviciene I, Robinson O, Roumeliotaki T, Sakhi AK, Urquiza J, Vafeiadi M, Waiblinger D, Warembourg C, Wright J, Slama R, Vrijheid M, Basagaña X. The early-life exposome: Description and patterns in six European countries. *Environ Int.* 2018 Dec 6;123:189-200
4. **Nieuwenhuijsen MJ**, Gascon M, Martinez D, Ponjoan A, Blanch J, Garcia-Gil MDM, Ramos R, Foraster M, Mueller N, Espinosa A, Cirach M, Khreis H, Davdand P, Basagaña X. Air Pollution, Noise, Blue Space, and Green Space and Premature Mortality in Barcelona: A Mega Cohort. *Int J Environ Res Public Health.* 2018 Oct 30;15(11). NIEUWENHUIJSEN M.J. (1997) Exposure assessment for occupational epidemiological studies; measuring present exposures with an example of a study of occupational asthma. *Int Arch Occup Environ Health.* 70:295-308
5. Milà C, Salmon M, Sanchez M, Ambrós A, Bhogadi S, Sreekanth V, **Nieuwenhuijsen MJ**, Kinra S, Marshall JD, Tonne C. When, Where, and What? Characterizing Personal PM2.5 Exposure in Periurban India by Integrating GPS, Wearable Camera, and Ambient and Personal Monitoring Data. *Environ Sci Technol.* 2018 Nov 20;52(22):13481-13490
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7. Zijlema WL, Avila-Palencia I, Triguero-Mas M, Gidlow C, Maas J, Kruize H, Andrusaityte S, Grazuleviciene R, **Nieuwenhuijsen MJ**. Active commuting through natural environments is associated with better mental health: Results from the PHENOTYPE project. *Environ Int.* 2018 Oct 12;121(Pt 1):721-727.
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  10. Avila-Palencia I, Int Panis L, Dons E, Gaupp-Berghausen M, Raser E, Götschi T, Gerike R, Brand C, de Nazelle A, Orjuela JP, Anaya-Boig E, Stigell E, Kahlmeier S, Iacorossi F, **Nieuwenhuijsen MJ**. The effects of transport mode use on self-perceived health, mental health, and social contact measures: A cross-sectional and longitudinal study. *Environ Int*. 2018 Aug 8;120:199-206.
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20. Forns J, Sunyer J, Garcia-Esteban R, Porta D, Ghassabian A, Giorgis-Allemand L, Gong T, Gehring U, Sørensen M, Standl M, Sugiri D, Almqvist C, Andiarena A, Badaloní C, Beelen R, Berdel D, Cesaroni G, Charles MA, Eriksen KT, Estarlich M, Fernandez MF, Forhan A, Jaddoe VWV, Korek M, Lichtenstein P, Lertxundi A, Lopez-Espinosa MJ, Markevych I, de Nazelle A, Raaschou-Nielsen O, **Nieuwenhuijsen MJ**, Pérez-Lobato R, Philippat C, Slama R, Tiesler CM, Verhulst FC, von Berg A, Vrijkkotte T, Nybo Andersen AM, Heude B, Krämer U, Heinrich J, Tiemeier H, Forastiere F, Pershagen G, Brunekreef B, Guxens M. Air pollution exposure during pregnancy and symptoms of attention deficit and hyperactivity disorder in children in Europe. *Epidemiology.* 2018
21. Khreis H, de Hoogh K, Zietsman J, and **Nieuwenhuijsen MJ**. The Impact of Different Validation Datasets on Air Quality Modeling Performance. *Transportation Research Record* 2018; 1–10
22. Gidlow C, van Kempen E, Smith G, Triguero-Mas M, Kruize H, Gražulevičiene R, Ellis N, Hurst G, Masterson D, Cirach M, van den Berg M, Smart W, Dédelé A, Maas J, **Nieuwenhuijsen MJ** Development of the natural environment scoring tool (NEST). *Urban Forestry & Urban Greening* 2018; 29: 322-333

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34. Gascon M, Sánchez-Benavides G, Dadvand P, Martínez D, Gramunt N, Gotsens X, Cirach M, Vert C, Molinuevo JL, Crous-Bou M, **Nieuwenhuijsen MJ**. Long-term exposure to residential green and blue spaces and anxiety and depression in adults: A cross-sectional study. *Environ Res*. 2018 Jan 19;162:231-239.
35. Curto A, Donaire-Gonzalez D, Barrera-Gómez J, Marshall JD, **Nieuwenhuijsen MJ**, Wellenius GA, Tonne C. Performance of low-cost monitors to assess household air pollution *Environ Res* 2018;163:53-63



16:00-16:45, Wednesday, January 30

## **Strategies to Tackle Air Pollution Health Effects in Taiwan**

**Yuh-Chin Tony Huang, M.D.**

Professor

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Duke University School of Medicine, USA

# Strategies to Tackle Air Pollution Health Effects in Taiwan

Yuh-Chin Tony Huang, M.D.

## **Abstract:**

Exposure to particulate matter (PM) is consistently associated with increased morbidity and mortality attributable in part to acute and chronic respiratory illness. These adverse effects include declines in lung function, increased incidence and duration of respiratory symptoms, increased hospital admissions for respiratory disease, increased asthma attacks, and increased cardiopulmonary mortality. A 2016 report from WHO indicated that more than 80% of people living in urban areas that monitor air pollution are exposed to air quality levels that exceed the WHO limits. Air pollutants kill 7 million people every year. Causes for premature deaths included ischemic heart disease and strokes (80%), COPD or acute lower respiratory infections (14%) and lung cancer (6%). There are patient populations that are more susceptible to the adverse effects of PM<sub>2.5</sub>. These populations include asthma, COPD, CAD, CHF/cardiomyopathy, DM, obesity, metabolic syndrome X, elderly and children.

In Taiwan, the three sources for PM include point source (power plants, chemical plants etc), mobile source (automobiles and motorcycles) and smog from mainland China. To address the health effects caused by PM exposure, one needs to be able to determine the relative contribution of each source, which has significant regional and seasonal variations. One also need to identify populations that are constantly exposed to high concentrations of PM (i.e., high risk populations), such as taxi drivers, bus drivers, traffic-directing policemen and cooks of grilled and fried stands in night markets. The governments should streamline traffic patterns, offer incentives for gas efficient modes of transportation, such as hybrid cars and motorcycles, and provide adequate funding for research that focuses on innovative strategies for decreasing PM<sub>2.5</sub> exposure and its impact on health. At the personal level, some strategies for reducing personal exposure should be considered, such as staying inside during poor air quality days, avoiding exercise along busy roads, turning off vent (recirculation) on busy roads, wearing protective devices such as N95/N99 particle and fume mask and installing air purifiers with HEPA filters for home and office. Clinicians should further emphasis on medication compliance to their patients. Only through this concerted effort can the quality of air be improved and its adverse health effects be reduced.



## Curriculum Vitae

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#### **Education**

- 1983 - 1984 M.S., Department of Environmental Health Sciences,  
Bloomberg School of Public Health, Johns Hopkins University,  
Baltimore, Maryland
- 1976 - 1983 M.D., College of Medicine: National Taiwan University, Taipei,  
Taiwan

#### **Professional Experience**

- 2007 - present Professor of Medicine (tenured), Division of Pulmonary,  
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- 2006 - present Intensivist, Critical Care Unit., Duke Regional Hospital, Durham,  
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- 2006 - present Visiting Scientist, Clinical Research Branch, Human Studies Division  
US Environmental Protection Agency, Chapel Hill, North Carolina
- 1991 - 2017 Staff Physician, Section of Pulmonary and Critical Care Medicine  
Durham VA Medical Center, Durham, North Carolina
- 2005 - 2006 Adjunct Associate Professor, Curriculum in Toxicology, University of  
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- 2001 - 2007 Clinical Associate Professor, Division of Pulmonary and Critical Care  
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### **Publications** (at least 5 years)

1. Wang Z, M He, E Bier, B Soher, J Mammarrappallil, S Rajagopal, **YC Huang**, and B Driehuys. Hyperpolarized <sup>129</sup>Xe Gas Transfer MRI: The Transition from 1.5 to 3 Tesla. *Magnetic Resonance in Medicine*, in press, 2018.
2. Wang Z, SH Robertson, J Wang, M He, RS Virgincar, GM Schrank, EA Bier, S Rajagopal, **YC Huang**, T O'Riordan C Rackley, HP McAdams, B Driehuys. Quantitative Analysis of Hyperpolarized <sup>129</sup>Xe Gas Transfer MRI. *Medical Physics*, 44(6):2415-2428, 2017. PMID: 28382694
3. Mahmood K, L Ebner, M He, SH Robertson, Z Wang, HP McAdams, MM Wahidi, SL Shofer, **YCT Huang** and B Driehuys. Novel magnetic resonance imaging for assessment of bronchial stenosis in lung transplant recipients. *Am J Transplantation*, in press, 2017.
4. Peng CK, SF Wu, SH Yang, CF Hsieh, CC Huang, **YCT Huang** and CP Wu. Correlation between Transition Percentage of Minute Volume (TMV%) and Outcome of Patients with Acute Respiratory Failure. *J Crit Care* 39:178-181, 2017. PMID: 28278435
5. Nett RJ, J Cox-Ganser, AF Hubbs, A Ruder, K Cummings, **YCT Huang**, and K Kreiss. Occupational Exposure to Styrene and Non-malignant Respiratory Disease-A Systematic Review of the Evidence. *Am J Ind Med* 60:163-180, 2017. PMID: 28079275
6. He M, B Driehuys, LG Que and **YCT Huang**. Using hyperpolarized <sup>129</sup>Xe MRI to quantify the pulmonary ventilation distribution. *Acad Radiol*, 23:1521-1531, 2016. PMID: 27617823
7. Evans R, D Prezant and **YCT Huang**. Hydraulic fracturing (fracking) and the Clean Air Act (editorial). *Chest*, 148(2):298-300. 2015. PMID: 26238825
8. Moitra S, R Puri, D Paul and **YCT Huang**. Global perspectives of emerging occupational and environmental lung diseases. *Curr Opin Pulm Med* 21:114-120, 2015.
9. Chao TT, CY Wang, YL Chen, CC Lai, FY Chang, YT Tsai, CHH Chao, CW Shiau, **YCT Huang**, CJ Yu and KF Chen. Afatinib induces apoptosis in NSCLC without EGFR mutation through Elk-1-mediated suppression of CIP2A, Oncotarget 6:2164-2179, 2015.
10. Yang Z, **YC Huang**, H Koziel, MPG de Crom, H Ruetten, P Wohlfart, RW Thomsen, JA Kahlert, HT Sorensen, A Imrich, L Kobzik. Female resistance to pneumonia identifies lung macrophage nitric oxide synthase-3 as a therapeutic target. *eLife* Oct 15;3, 2015.
11. **Huang YCT**. Outdoor air pollution: a global perspective. *J Occup Environ Med* 56 Suppl 10:S3-7, 2015.
12. Chao TT, CY Wang, CC Lai, YL Chen, FY Chang, PT Chen, HI Lin, **YCT Huang**, CW Shiau, CJ Yu and KF Chen. TD-19, an erlotinib derivative, induces EGFR wild-type NSCLC apoptosis through CIP2A-mediated pathway. *J Pharmacol Exp Ther* 351:352-358, 2014.
13. **YCT Huang** and WM Tsuang. Health effects associated with faulty application of spray polyurethane foam in residential homes. *Environ Res* 134:295-300, 2014.

14. Wang CY, TT Chao, FY Chang, YL Chen, YT Tsai, HI Lin, **YCT Huang**, CW Shiau, CJ Yu and KF Chen. CIP2A mediates erlotinib-induced apoptosis in non-small cell lung cancer cells without EGFR mutation. *Lung Cancer* 85:152-160, 2014.
15. Alexis NE, **YCT Huang**, AG Rappold, H Kehrl, RB Devlin, DB Peden. Asthmatics demonstrate airway inflammation following exposure to concentrated ambient particulate matter. *Am J Respir Crit Care Med* 190:235-237, 2014.
16. Yen H, **YC Huang**, LM Hurwitz, MJ Miller and WM Tsuang. A pulmonary arteriovenous malformation growing for 35 years comes to an end. *Am J Respir Crit Care Med* 189:356-357, 2014.
17. Huang JJ, JM Soukup, AJ Ghio and **YCT Huang**. Host and environmental factors affect pulmonary responses measured in bronchoalveolar lavage. *Inhal Toxicol* 26:30-35, 2014.