

**BIOGRAPHICAL SKETCH**

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NAME: Liu, Enju

eRA COMMONS USER NAME (credential, e.g., agency login): ELIU95

POSITION TITLE: Assistant Professor of Pediatrics

EDUCATION/TRAINING (*Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.*)

INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date MM/YYYY	FIELD OF STUDY
Shanghai Medical University, Shanghai, China	MBBS	06/1995	Medicine
Fudan University, Shanghai, China	MS	12/2000	Biostatistics and Epidemiology
Tufts University, Boston	PhD	05/2008	Nutritional Epidemiology

**A. Personal Statement**

Dr. Liu has a broad background in medicine, biostatistics and epidemiology with specific training in nutrition and statistical methods. She has extensive experience in the design, analysis and conduct of observational studies and randomized controlled trials. She has collaborated with investigators in many research projects sponsored by National Institute of Health, Gates Foundation, and World Health Organization in United States and international settings. Through her work at Harvard T.H. Chan School of Public Health and Boston Children's Hospital, she has provided statistical support, guidance, and training to research fellows, postdocs and junior level statisticians. Her research focuses on preventive and therapeutic effect of dietary factors, nutritional supplement, and other intervention and treatment on health outcome and disease progression. My efforts in the field have resulted in dozens of publications in peer reviewed scientific journals. In summary, my expertise and experience have prepared me to make significant contribution as a biostatistician for this research proposal

- a. Dhingra U, Kisenge R, Sudfeld CR, Dhingra P, Somji S, Dutta A, Bakari M, Deb S, Devi P, **Liu E**, Chauhan A, Kumar J, Semwal OP, Aboud S, Bahl R, Ashorn P, Simon J, Duggan CP, Sazawal S, Manji K. Lower-Dose Zinc for Childhood Diarrhea - A Randomized, Multicenter Trial. *N Engl J Med*. 2020 Sep 24;383(13):1231-1241. doi: 10.1056/NEJMoa1915905. PMID: 32966722
- b. **Liu E**, Pimpin L, Shulkin M, Kranz S, Duggan CP, Mozaffarian D, Fawzi WW. Effect of Zinc Supplementation on Growth Outcomes in Children under 5 Years of Age. *Nutrients*. 2018 Mar 20; 10(3). PMID: 29558383.
- c. **Liu E**, Duggan C, Manji KP, Kupka R, Aboud S, Bosch RJ, Kisenge RR, Okuma J, Fawzi WW. Multivitamin supplementation improves haematologic status in children born to HIV-positive women in Tanzania. *J Int AIDS Soc*. 2013;16(1):18022. PMID: PMC3744818.
- d. **Liu E**, Spiegelman D, Chalamilla G, Hertzmark E, Kibao A, Hawkins C, Semu H, Mehta S, Mtasiwa D, Fawzi WW. Nutritional status and mortality among HIV-infected patients receiving antiretroviral therapy in Tanzania. *Journal of Infectious Diseases* 2011; 204:282-90. PMID: 21673040.
- e. **Liu E**, Armstrong C, Spiegelman D, Chalamilla G, Njelekela M, Hawkins C, Hertzmark E, Li N, Aris E, Muhhi A, Semu H, Fawzi W. First-line antiretroviral therapy and changes in lipid levels over 3 years among HIV-infected adults in Tanzania. *Clin Infect Dis*. 2013;56(12):1820-8. PMID: 23449270.

## B. Positions and Honors

### Positions and Employment

1995–1997 Teaching Assistant, Shanghai Medical University, Shanghai, China  
2000–2004 Research Epidemiologist, Shanghai Cancer Institute, Shanghai, China  
2008–2011 Research Associate, Harvard School of Public Health, Boston, MA  
2011–2015 Research Scientist, Harvard T.H. Chan School of Public Health, Boston, MA  
2015– Senior Biostatistician, Boston Children’s Hospital, Boston, MA  
2016– Assistant Professor, Harvard Medical School, Boston, MA

### Other Experience and Professional Memberships

2002 Visiting Fellow, National Cancer Institute, Bethesda, MD  
2008– American Society of Nutrition

### Honors

2007 Student Travel Award from the Office of Dietary Supplements (ODS) of the National Institutes of Health to attend the conference, Vitamin D and Health in the 21st Century: An Update  
2007 Second Place for presenting abstract entitled: “Association of Plasma 25-hydroxyvitamin D with Glucose Tolerance and Surrogate Markers of Insulin Resistance in the Framingham Offspring Study”, the 5<sup>th</sup> Annual World Congress on the Insulin Resistance Syndrome.

## C. Contributions to Science

- 1. Child nutrition, growth and health.** Working with colleagues and collaborators at Tanzania, I was involved in several studies focused on the associations of nutrient supplements or nutritional status with child growth, morbidity and mortality. Through our research in HIV-unexposed infants, we found that the high risk of environmental enteric dysfunction is associated with poor child growth and high risk of morbidity. Our findings demonstrated that longer duration of exclusive breast feeding was associated with a lower risk of infant morbidity, mother-to-child HIV transmission, and mortality in Tanzania. These findings support the new WHO guideline (2013) on HIV and exclusive breastfeeding.
  - a. McDonald CM, Manji KP, Tran H, **Liu E**, Kisenge R, About S, Fawzi WW, Gewirtz AT, Duggan CP. Elevations in serum anti-flagellin and anti-lipopolysaccharide immunoglobulins are related to growth faltering in young Tanzanian children. *Am J Clin Nutr.* 2016;103(6):1548-54. PMID: 27121948.
  - b. Locks LM, Mwiru RS, Mtisi E, Manji KP, McDonald CM, **Liu E**, Kupka R, Kisenge R, Aboud S, Gosselin K, Gillman M, Gewirtz AT, Fawzi WW, Duggan CP. Infant Nutritional Status and Markers of Environmental Enteric Dysfunction are Associated with Midchildhood Anthropometry and Blood Pressure in Tanzania. *J Pediatr.* 2017;187:225-233.e1. PMID: 28499715.
  - c. Kamenju P, Liu E, Hertzmark E, Spiegelman D, Kisenge RR, Kupka R, Aboud S, Manji K, Duggan C, Fawzi WW. Complementary Feeding and Diarrhea and Respiratory Infection Among HIV-Exposed Tanzanian Infants. *J Acquir Immune Defic Syndr.* 2017; 1;74(3):265-272. PMID: PMC5303142.
  - d. Natchu UC, Liu E, Duggan C, Msamanga G, Peterson K, Aboud S, Spiegelman D, Fawzi WW. Exclusive breastfeeding reduces risk of mortality in infants up to 6 mo of age born to HIV-positive Tanzanian women. *Am J Clin Nutr.* 2012;96(5):1071-8. PMID: PMC3471196.
- 2. HIV-related nutrition and health.** My research in nutritional status and health outcomes among HIV-infected patients has been impactful. Using data collected through the PEPFAR-sponsored HIV care and treatment clinics in Dar es Salaam, Tanzania, I found that HIV patients starting antiretroviral therapy (ART) with poor nutritional status were associated with a significant higher risk of death, especially in the first year of treatment. My research also demonstrated that patients receiving ART had a significantly reduced risk of tuberculosis compared to patients not on ART, and poor nutritional status significantly increased risk of incident tuberculosis after adjusting for potential confounders. With the increasing concern on cardiovascular risk in HIV-infected population, I investigated the prevalence of dyslipidemia and its risk factors among HIV-infected ART naïve population. I further examined the changes in lipid profile following ART initiation and the effects of different ART regimens on lipid parameters. These findings provide evidence for nutritional intervention and selection of lipid.

- a. Armstrong C, Liu E, Okuma J, Hawkins C, Spiegelman D, Chalamilla C, Njelekela M, Grinspoon S, Fawzi W. Dyslipidemia in an HIV-positive Antiretroviral Treatment-Naïve population in Dar es Salaam, Tanzania. *J Acquir Immune Defic Syndr* 2011; 57:141-5. PMID: PMC3125454.
  - b. **Liu E**, Makubi A, Drain P, Spiegelman D, Sando D, Li N, Chalamilla G, Sudfeld C, Hertzmark E, Fawzi W, Tuberculosis incidence rate and risk factors among HIV-infected adults with access to antiretroviral therapy in Tanzania. *AID* 2015; 29(11):1391-1399. PMID: PMC4576970.
  - c. **Liu E**, McCree M, Mtisi E, Fawzi W, Aris E, Andrews I, Hertzmark E, Chalamilla G, Li N, Vermund S, Spiegelman D. Prevalence and risk factors of cervical squamous intraepithelial lesions among HIV-infected women in Dar es Salaam. *Int J STD & AIDS* 2015
  - d. Li N, Sando M, Spiegelman D, Hertzmark E, Liu E, Sando D, Machumi L, Chalamilla G, Fawzi W. Antiretroviral Therapy in Relation to Birth Outcomes among HIV-infected Women: A Cohort Study. *Journal of Infectious Diseases* 2015. PMID: 26265780
3. **Vitamin D, dietary patterns, and diabetes:** My research projects for Ph.D. dissertation at TUFTS focused on the associations of vitamin D status, dietary patterns with insulin-resistant phenotypes and type 2 diabetes. Using data from Framingham Offspring Study, I found that higher vitamin D status was associated with lower level of insulin resistance and a reduced risk of type 2 diabetes. The importance of these findings is that it not only established strong evidence to support the belief that vitamin D play a role in the development of insulin resistance and type 2 diabetes, but also strengthened the rationale for next-step randomized controlled trials of vitamin D among high risk population. In addition, I made important contribution to dietary pattern research in U.S. population. Using cluster analysis, I derived 4 dietary patterns in the Framing offspring cohort, and found that a healthy, low-fat diet of fruits, vegetables, and whole grains helped to prevent phenotypes that are insulin-resistant, whereas unhealthy, high-fat diets with sugar and refined grains actually increased the prevalence of insulin-resistant phenotypes. The finding confirms that poor diet increases the risk of cardiovascular diseases and diabetes through insulin resistance pathway.
- a. **Liu E**, Meigs JB, Pittas AG, McKeown NM, Economos CD, Booth SL, Jacques PF. Plasma 25-hydroxyvitamin D is associated with markers of the insulin resistant phenotype in nondiabetic adults. *J Nutr* 2009; 139(2):329-34. PMID: PMC2646208.
  - b. **Liu E**, McKeown NM, Newby PK, Meigs JB, Vasan RS, Quatromoni PA, D'Agostino RB, Jacques PF. Cross-sectional association of dietary patterns with insulin-resistant phenotypes among adults without diabetes in the Framingham Offspring Study. *Br J Nutr* 2009; 16:1-8. PMID: PMC3785063.
  - c. **Liu E**, Meigs JB, Pittas AG, Economos CD, McKeown NM, Booth SL, Jacques PF. Predicted 25-Hydroxyvitamin D Score and incident type 2 Diabetes in the Framingham Offspring Study. *Am J Clin Nutr* 2010; 91:1627-33. PMID: PMC2869511.
  - d. **Liu E**, Meigs JB, Pittas AG, Economos CD, McKeown NM, Booth SL, Jacques PF. Predicted 25-hydroxyvitamin D Score and Fasting Plasma Glucose in the Framingham Offspring Study. *European Journal of Clinical Nutrition* 2012; PMID: PMC3796766

### Complete List of Published Work in MyBibliography:

<http://www.ncbi.nlm.nih.gov/pubmed/?term=enju++liu>

### D. Additional Information: Research Support and/or Scholastic Performance

#### Ongoing Research Support

R01AR071342

Jacobsen (PI)

09/01/2018-06/30/2023

The LRP5 Pathway and Osteoblast Function In Osteogenesis Imperfecta

A Phase I/II, double blinded, placebo controlled, single-center Study of Fecal Microbiota Transplant (FMT) for the Treatment of Active Pediatric Ulcerative and Crohn's Colitis

Role: Biostatistician

Fecal Microbiome Transplant Kahn (PI) 03/01/2017-02/28/2022  
American Gastroenterological Association

The primary aim is to assess safety and feasibility of a weekly FMT maintenance therapy. A total of 10 patients with active UC (as defined by PUCAI score of > 9) and 10 patients with active Crohn's colitis (as defined by PCDAI score of > 10) will be enrolled and receive FMT or placebo (study treatment).

Role: Biostatistician

R21DK123636-01 Duggan (PI) 09/21/2019-7/31/2021

Assessing the relationship between environmental enteric dysfunction and poor growth via a newly developed 11-plex assay We aim to determine the association between maternal and infant EED and subsequent birth, growth, and neurodevelopmental outcomes using innovative EED assessment methods, with the aim of improving upon and standardizing current screening approaches.

Role: Biostatistician

K24DK104676 Duggan (PI) 09/01/2015-05/31/2020

Patient-Oriented Research in Pediatric Diarrheal Diseases

The major goals of this project are to mentor junior colleagues in the fields of pediatric nutrition, gastroenterology and global health.

Role: Biostatistician

WHO 2016/636533-0 Duggan (PI) 06/15/2016-03/30/2020  
Bill and Melinda Gates Foundation

Establishing the optimal dose of therapeutic zinc supplementation for the treatment of acute diarrhea in under five children – a dose response trial in South Asian and a sub-Saharan African setting

The major goals of this project are to perform a multicenter clinical trial to determine the optimal dose of supplementary zinc to improve outcomes in children with acute diarrhea.

Role: Biostatistician

### **Completed Research Support**

Bill and Melinda Gates Foundation Dari (PI) 2013-2016

Global Dietary Database—Global Dietary Intakes, Diseases, and Policies among Children, Women, and Men  
This project addressed crucial gaps in knowledge by building upon and substantially expanding our prior work to (1) update and expand data on dietary intakes in adults, including of new nutritional risk factors, from new primary data sources, and in subgroups by rural/urban and income status; (2) assess global dietary intakes in youth (from infancy to adolescence) and pregnant/nursing mothers, including of foods/nutrients implicated in deficiency conditions and relevant for diet quality; (3) evaluate and quantify the health impact of specific dietary factors throughout the lifespan, with a particular focus on maternal, pregnancy, and infant/child health outcomes relevant in Africa and Asia; and (4) characterize and compare cost-effectiveness of specific diet policy interventions to reduce the identified burdens.

Role: Co-investigator for aim 3

5U2GPS001966-05 CDC Fazwi (PI) 2010-2015  
The President's Emergency Plan for AIDS Relief (PEPFAR)

The purpose of this project was to strengthen the provision of integrated high-quality HIV care and support aimed at extending and optimizing quality of life for people living with HIV from the time of diagnosis throughout the continuum of illness, by providing a comprehensive package of HIV care and support services in Tanzania.

Role: Biostatistician for program analyses and evaluation.