

BIOGRAPHICAL SKETCH

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NAME: Liu, Christine

eRA COMMONS USER NAME (credential, e.g., agency login): CHLIU@BU.EDU

POSITION TITLE: Instructor of Medicine

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
Brown University, Providence, RI	AB	05/1996	Biology
Temple University School of Medicine, Philadelphia, PA	MD	05/2005	Medicine
Residency in Internal Medicine, Boston University, Boston Medical Center, Boston, MA	Resident	06/2008	Internal Medicine
Fellowship in Geriatric Medicine, Boston University, Boston Medical Center, Boston, MA	Fellow	06/2011	Geriatric Medicine
Boston University School of Public Health, Boston, MA	MS	09/2011	Epidemiology

A. Personal Statement

I am a NIA K23-funded clinician scientist and fellowship-trained geriatrician. The focus of my research is the mobility of older adults with kidney disease. Mobility, or the ability to move safely and reliably, strongly predicts disability and death in older adults. Retaining mobility has been cited by older adults as fundamental to quality to life; yet many older persons with kidney disease, especially those with late stage chronic kidney disease or outright kidney failure, have trouble just walking across the room or transferring to a chair.

My current research focuses on the mobility of older adults undergoing hemodialysis (HD) for kidney failure. While risk factors for poor mobility has been well studied in other older populations, such insights may not be applicable to older persons on HD. They face unique challenges, such as frequent travel for HD treatments and post-HD fatigue. Usual approaches for poor mobility, such as supervised exercise, are physically and logistically difficult for this population. To effectively improve mobility, older adults on HD deserve a treatment approach that befits their unique needs. The World Health Organization states that environmental, personal, and health factors impact mobility. But aside from health factors, to date no systemic investigation of the factors underlying poor mobility in older adults on HD has been undertaken. The knowledge gap of what contributes to poor mobility in older adults on HD impedes our ability to improve quality of life in this highly vulnerable population. My research is at the intersection of geriatrics, nephrology, and rehabilitation; I am one of only a few clinician investigators focusing on this area. Supported by the K23, I am performing a sequential mixed methods study (key informant interviews and a cross-sectional study) to address the knowledge gap regarding what contributes to poor mobility in older HD patients. The data will be used to develop a multifactorial intervention to improve mobility for older adults on HD to be tested in an R-series application.

- a. **Liu, CK**, Ghai S, Waikar SS, Weiner DE. COVID-19 Infection Risk Among Hemodialysis Patients in Long-Term Care Facilities. Accepted to *Kidney Medicine* September 18, 2020.
- b. **Liu, CK**, Afezollu D, Seo J, Sydea H, Zheng S, Folta SC. Perceptions of Physical Activity in African-American Older Adults on Hemodialysis: Themes from Key Informant Interviews. Accepted to *Archives of Rehabilitation Research and Clinical Translation* on March 18, 2020. PMID:pending
- c. **Liu CK**, Milton J, Hsu F-C, Beavers KM, Yank V, Church T, Shegog JD, Kashaf S, Nayfield S, Newman A, Stafford RS, Nicklas B, Weiner DE, Fielding RA, for the LIFE-P Research Group. The Effect of Chronic Kidney Disease on a Physical Activity Intervention: Impact on Physical Function, Adherence, and Safety. *J Clin Nephrology and Renal Care*. 2017; 3(1):21. PMID: 5937279.
- d. **Liu CK**, Lyass A, Massaro JM, D'Agostino RB Sr, Fox CS, Murabito JM. Chronic kidney disease defined by cystatin C predicts mobility disability and changes in gait speed: the Framingham Offspring Study. *J Gerontol A Biol Sci Med Sci* (2014); 69(3):301-7. PMID:3976137.

B. Positions and Honors

Positions and Employment

- 1996-99 Research Assistant, Brown University, Providence, RI
- 1999-2000 Research Assistant, New England Regional Primate Research Center, Harvard Medical School, Southborough, MA
- 2005-08 Resident, Internal Medicine Residency Program, Primary Care Track, Boston University School of Medicine, Boston, MA
- 2008-11 Fellow, Section of Geriatrics, Geriatric Medicine Fellowship, Boston University School of Medicine Boston, MA
- 2009-2020 Adjunct Scientist, Jean Mayer Human Nutrition Center on Aging, Tufts University, Boston, MA
- 2011-2020 Assistant Professor of Medicine, Section of Geriatrics, Department of Medicine, Boston University School of Medicine, Boston, MA
- 2020- Staff Physician, Veterans Affairs Palo Alto Health Care System, Palo Alto, CA
- 2020- Instructor of Medicine, Section of Geriatric Medicine, Division of Primary Care and Population Health, Department of Medicine, Stanford University School of Medicine, Palo Alto, CA

Other Experience and Professional Memberships

- 2008- Member, American Geriatrics Society
- 2011- Member, Gerontological Society of America
- 2013- Member, American Society of Nephrology
- 2013- Ad hoc reviewer, *Journal of Gerontology Series A: Biological and Medical Sciences*
- 2014- Ad hoc reviewer, *American Journal of Kidney Diseases*
- 2014- Ad hoc reviewer, *Journal of the American Geriatrics Society*
- 2015- Ad hoc reviewer, *BioMed Central Nephrology*
- 2015- Member, Coalition for Supportive Care of Kidney Patients
- 2015- Member, Exercise in Chronic Kidney Disease Working Group
- 2016- Ad hoc reviewer, *Calcified Tissue International*
- 2016 Abstract Category Chair, *Cognitive Dysfunction, Depression, and Quality of Life*, American Society of Nephrology
- 5/2019- Co-Chair, Older Adults Facing Chronic Kidney Disease and/or Kidney Failure Special Interest Group, American Geriatrics Society
- 10/2019- Associate Editor, *BMC Nephrology*
- 6/2020- Long Term Care Reopening Workgroup, Executive Office of Health and Human Services, Commonwealth of Massachusetts

Honors

- 2004 Alpha Omega Alpha, Temple University School of Medicine
- 2008 John Noble Travel Award, Section of General Internal Medicine, Department of Medicine, Boston University School of Medicine,
- 2009 Travel Grant Award, Bench-to-Bedside Conference on Inflammation and Nutrient Metabolism, John A. Hartford Foundation, and the National Institute on Aging
- 2013 Early Career Women Faculty Professional Development Seminar, American Association of Medical Colleges
- 2013 Faculty Development and Diversity Grant, Department of Medicine, Boston University School of Medicine
- 2013 Academy for Faculty Development, Boston University School of Medicine
- 2014 John A. Hartford Interdisciplinary Communications Conference, John A. Harford Foundation
- 2015 Grant Writing Workshop, Boston University School of Medicine
- 2015 Chronic Renal Insufficiency Cohort Study Research Workshop Travel Award
- 2015-16 Geriatric Nephrology Advisory Group, American Society of Nephrology
- 2016 K Writing Seminar, Boston University Clinical and Translational Science Institute
- 2019-20 Pathways to Research Independence and Mentoring Excellence, Boston University Clinical & Translational Science Institute

C. Contributions to Science

1. Key factors that influence the development of frailty and sarcopenia. When an older adult has impaired physical function, one of the contributors may be frailty or sarcopenia. Frailty is a condition of limited physiological resilience to medical insults, while sarcopenia is a condition of extreme skeletal muscle loss. In this line of research, I am determining if oxidative stress and physical activity are important elements in the development of these two inter-related conditions. Using data from the Framingham Heart Study, I demonstrated that the oxidative stress biomarkers lipoprotein phospholipase A2 and osteoprotegerin predict future frailty. I also found that the benefits of increased physical activity did not change significantly in the presence of sarcopenia.

- a. Trombetti A, Hars M, Hsu FC, Reid KF, Church TS, Gill TM, King AC, **Liu CK**, Manini TM, McDermott MM, Newman AB, Rejeski WJ, Guralnik JM, Pahor M, Fielding RA; LIFE Study Investigators. Effect of Physical Activity on Frailty: Secondary Analysis of a Randomized Controlled Trial. *Ann Intern Med* 2018;168(5):309-316. PMID: 29310138.
- b. **Liu CK**, Lyass A, Larson MG, Massaro JM, Wang N, D'Agostino RB Sr, Benjamin EJ, Murabito JM. Biomarkers of oxidative stress are associated with frailty: the Framingham Offspring Study. *Age* (2016); 38:1. PMID:PMC5005887.
- c. **Liu CK**, Leng X, Hsu FC, Kritchevsky SB, Ding J, Earnest CP, Ferrucci L, Goodpaster BH, Guralnik JM, Lenchik L, Pahor M, Fielding RA. The impact of sarcopenia on a physical activity intervention: the Lifestyle Interventions and Independence for Elders Pilot Study (LIFE-P). *J Nutr Health Aging* (2014); 18(1):59-64. PMID:PMC4111145.

2. Contributing factors to common conditions in older adults with poor physical function. In this work, I have explored the positive or negative impact of different factors in conditions highly prevalent in older adults with impaired physical function.

- a. Vaz Fragoso CA, Beavers DP, Anton SD, **Liu CK**, McDermott MM, et al. Effect of structured physical activity on respiratory outcomes in sedentary elderly adults with mobility limitations. *J Am Geriatr Soc* 2016;64(3):501-9. PMID:PMC4806401.
- b. Vaz Fragoso CA, Miller ME, King AC, Kritchevsky SB, **Liu CK**, Myers VH, Nadkarni NK, Pahor M, Spring BJ, Gill TM; Lifestyle Interventions and Independence for Elders Study Group. Effect of structured physical activity on sleep-wake behaviors in sedentary elderly adults with mobility limitations. *J Am Geriatr Soc* (2015);63(7):1381-90. PMID: PMC4892176.
- c. Kirn DR, Koochek A, Reid KF, von Berens Å, Trivison TG, Folta S, Sacheck J, Nelson M, **Liu C**, Phillips E, Åberg AC, Nydahl M, Gustafsson T, Cederholm T, Fielding RA. The Vitality, Independence, and Vigor in the Elderly 2 Study (VIVE2): Design and methods. *Contemp Clin Trials* 2015;43:164-71. PMID: 26044464.
- d. Mankowski RT, Aubertin-Leheudre M, Beavers DP, Botosaneanu A, Buford TW, Church T, Glynn NW, King AC, **Liu C**, Manini TM, Marsh AP, McDermott M, Nocera JR, Pahor M, Strotmeyer ES, Anton SD; LIFE Research Group. Sedentary time is associated with the metabolic syndrome in older adults with mobility limitations - The LIFE Study. *Exp Gerontol* (2015);70:32-36. PMID:PMC4600654.

Complete list of published work in MyBibliography:

<https://www.ncbi.nlm.nih.gov/sites/myncbi/1pq1rJ7rhfmki/bibliography/40005474/public/?sort=date&direction=ascending>

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

No number

09/01/2019-08/30/2021

Loan Repayment Program, National Institutes of Health/National Institute of Aging

Mobility of older hemodialysis patients

The goal of this award is to provide additional funds to repay the education debt of physician scientists.

Role: PI

K23AG057813

09/01/2018-06/30/2023

National Institute of Aging

Liu, Christine (PI)

Mobility of older hemodialysis patients

Using a mixed methods approach, the goal of this study is to investigate how caregiver support, the home environment, cognition, anxiety, depression, and self-efficacy affect the mobility of older hemodialysis patients.

Role: PI

R01DK115562

07/01/2018-6/30/2021

National Institute of Diabetes and Digestive and Kidney Diseases

Coca, Steve and Shlipak, Michael (co-PIs)

Impact of Exercise on Kidney Function and Injury among Elders in the LIFE Trial

The goal of this study is evaluate the impact of kidney health, utilizing specimens that have been serially collected from a randomized controlled trial of exercise in older adults.

Role: Co-investigator

Completed Research Support (past 3 years)

No number

10/01/2018-6/30/2020

Department of Medicine Career Investment Award, Boston University School of Medicine

Liu, Christine (PI)

Mobility of older hemodialysis patients

The goal of this award is to support Dr. Liu's K23 research through the NIA through support for her salary.

Role: PI

200-2012-5370

10/01/2016-09/30/2019

Centers for Disease Control

Barnett, Elizabeth (PI)

Safety of adjuvanted versus high-dose inactivated influenza vaccines in older adults

The goal of the project was to compare the safety and immunogenicity of FLUAD™ (adjuvanted) versus Fluzone® (high-dose) influenza vaccines, both of which were developed for older adults.

Role: Co-investigator

200-2016-91946

10/01/2016-03/19/2018

Centers for Disease Control

Kassam, Zain (PI)

Randomized controlled trial of autologous microbiome reconstitution to prevent colonization by antibiotic resistant bacteria

The goal of the study was to determine if autologous transplantation of the fecal microbiome can prevent incident infection with multi-drug resistant organisms in nursing home patients.

Role: Site PI

No number

07/01/2016-12/31/2017

KL2 Mentored Career Development Program,

Boston University Clinical and Translational Science Institute

Liu, Christine (PI)

Decreasing risk factors for falls in older hemodialysis patients

The goal of the study was to determine the feasibility of an intervention for fall prevention in older hemodialysis patients.

Role: PI