BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FIVE PAGES.**

NAME: Travison, Thomas G.

eRA COMMONS USER NAME: TTRAVISON

POSITION TITLE: Associate Professor, Senior Scientist

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE	Completion Date	FIELD OF STUDY
Skidmore College, Saratoga Springs, NY	BA	06/1997	Mathematics
Johns Hopkins School of Public Health, Baltimore, MD	PhD	05/2002	Biostatistics

A. Personal Statement

This project proposes the renewal of the Boston Pepper Older Americans Independence Center the theme of which is Function Promotion. I have served as the leader of the OAIC's Biostatistics and Data Science Core (**BDSC**) since its inception in 2010, maintain highly productive collaborations with its investigators, and act as mentor for its junior trainees. I am Associate Professor at Harvard Medical School, and Senior Scientist & Director of Biostatistics and Data Sciences at the Hebrew SeniorLife Marcus Institute for Aging Research (ORCID 0000-0002-1030-7175). I co-Director of the Interventional Studies in Aging center at the Marcus Institute. I am associate leader of the Design and Statistics Core for the NIA IMPACT Collaboratory, lead the biostatistical team for the Sarcopenia Definitions and Outcomes Consortium, lead the biostatistics core for the Successful Aging after Surgery studies, and have been an investigator on numerous clinical trials in aging, including the NIA funded STRIDE, OPTIMen, TOM, and TEAAM trials. My quantitative science team – comprising 4 PhD and 10 Masters' level statisticians and data scientists – has extensive experience in collaborative research and in developing tools supporting the reproducibility of biomedical data analysis; has published a substantial number of software and document production tools facilitating reproducible research in aging; has extensive expertise in passive capture of functional data using passive methodologies including wearable and implantable devices; and maintains a CDISC-compliant, harmonized repository of measurement instruments in physical function and other domains. I am a fellow of the Gerontological Society of America and have authored over 200 peer-reviewed publications in aging research, with over 15,000 cumulative citations (H-index 59; i10-index 151). I have served previously as IRB chair at New England Research Institute and on the IRB at Boston University Medical Center, and serve as DSMB member for several large trials nationally and internationally.

Travison TG, Basaria S, Storer TW, Jette AM, Miciek R, Farwell WR, Choong K, Lakshman K, Mazer NA, Coviello AD, Knapp PE, Ulloor J, Zhang A, Brooks B, Nguyen AH, Eder R, LeBrasseur N, Elmi A, Appleman E, Hede-Brierley L, Bhasin G, Bhatia A, Lazzari A, Davis S, Ni P, Collins L, Bhasin S. Clinical meaningfulness of the changes in muscle performance and physical function associated with testosterone administration in older men with mobility limitation. J Gerontol A Biol Sci Med Sci. 2011 Oct;66(10):1090-9. doi: 10.1093/gerona/glr100. Epub 2011 Jun 22. PMID: 21697501; PMCID: PMC3202898.

Bhasin S, **Travison TG**, Manini TM, Patel S, Pencina KM, Fielding RA, Magaziner JM, Newman AB, Kiel DP, Cooper C, Guralnik JM, Cauley JA, Arai H, Clark BC, Landi F, Schaap LA, Pereira SL, Rooks D, Woo J, Woodhouse LJ, Binder E, Brown T, Shardell M, Xue QL, D'Agostino RB Sr, Orwig D, Gorsicki G, Correa-De-Araujo R, Cawthon PM. Sarcopenia Definition: The Position Statements of the Sarcopenia Definition and Outcomes Consortium. J Am Geriatr Soc. 2020 Jul;68(7):1410-1418. doi: 10.1111/jgs.16372. Epub 2020 Mar 9. PMID: 32150289.

Allore HG, Goldfeld KS, Gutman R, Li F, Monin JK, Taljaard M, **Travison TG**. Statistical Considerations for Embedded Pragmatic Clinical Trials in People Living with Dementia. J Am Geriatr Soc. 2020 Jul;68 Suppl 2(Suppl 2):S68-S73. doi: 10.1111/jgs.16616. PMID: 32589276; PMCID: PMC7396162.

B. Employment

1999-2000	Instructor, Johns Hopkins Summer Institute of Epidemiology and Biostatistics, Baltimore, MD
2000-2001	Instructor, Biostatistics, University of Helsinki, Helsinki, Finland
2002-2003	Biostatistician/Senior Biostatistician, Wyeth Research; Cambridge, MA.
2003-2005	Assistant Professor, The New England College of Optometry, Boston, MA
2005-2009	Research Scientist / Senior Research Scientist New England Research Institutes (NERI), Inc., Watertown, MA
2009-2012	Assistant Professor, Departments of Medicine and Biostatistics Boston University Schools of Medicine and Public Health Chief Biostatistician, Section of Endocrinology, Boston Medical Center Lecturer, Harvard Medical School
2012-2014	Chief Biostatistician, Research Program on Men's Health, Aging and Metabolism, Brigham and Women's Hospital, Boston, MA
2014-19	Assistant Professor of Medicine, Harvard Medical School, Boston, MA
2014-	Senior Scientist / Director, Biostatistics and Data Sciences Marcus Institute for Aging Research, Hebrew SeniorLife, Roslindale, MA
2019-	Associate Professor of Medicine, Harvard Medical School, Boston, MA

C. Contributions to Science

Epidemiology of sex steroid changes and androgen insufficiency in older men. My early and ongoing work focuses on patterns of and contributors to aging-associated longitudinal changes in the distribution of circulating sex steroid changes in older people. Our attention to this area resulted in a series of analyses and publications of data from the Massachusetts Male Aging Study, on which I served as an investigator and lead statistician. These include: the first published observation of secular changes in circulating androgen concentrations in American men,[1] a finding since replicated in European cohorts; the first longitudinal study of the progression and remission of symptomatic androgen insufficiency, as defined by the Endocrine Society position statement on its diagnosis;[2] the first quantification of the relative contributions of multimorbidity and health behaviors to within-individual variations in hormone distributions;[3] and the first study examining the and potential and natural remission of erectile functioning in community-dwelling men.[4] More recently we have developed harmonization algorithms permitting multi-cohort estimation of normal and typical ranges for male sex steroid levels using contemporary measurement methodologies.[5,6] Together these and other investigations have advanced our understanding of the epidemiology and endocrinology of aging in adult male populations and informed epidemiological and clinical guidance in this area.

1. **Travison TG**, Araujo AB, O'Donnell AB, Kupelian V, McKinlay JB. A population-level decline in serum testosterone levels in American men. J. Clin. Endocrinol. Metab. 2007 Jan;92(1):196–202.
2. **Travison TG**, Shackelton R, Araujo AB, Hall SA, Williams RE, Clark RV, O'Donnell AB, McKinlay JB. The natural history of symptomatic androgen deficiency in men: onset, progression, and spontaneous remission. J Am Geriatr Soc. 2008 May; 56(5):831–9.
3. **Travison TG**, Vesper HW, Orwoll E, Wu F, Kaufman JM, Wang Y, Lapauw B, Fiers T, Matsumoto AM, Bhasin S. Harmonized Reference Ranges for Circulating Testosterone Levels in Men of Four Cohort Studies in the United States and Europe. J Clin Endocrinol Metab. 2017 Apr 1;102(4):1161-1173. doi: 10.1210/jc.2016-2935. PubMed PMID: 28324103; PubMed Central PMCID: PMC5460736.
4. Bhasin S, Pencina M, Jasuja GK, **Travison TG**, Coviello A, Orwoll E, Wang PY, Nielson C, Wu F, Tajar A, Labrie F, Vesper H, Zhang A, Ulloor J, Singh R, D'Agostino R, Vasan RS. Reference ranges for testosterone in men generated using liquid chromatography tandem mass spectrometry in a community-based sample of healthy nonobese young men in the Framingham Heart Study and applied to three geographically distinct cohorts. J Clin Endocrinol Metab. 2011 Aug;96(8):2430-9. doi: 10.1210/jc.2010-3012. Epub 2011 Jun 22. PubMed PMID: 21697255; PubMed Central PMCID: PMC3146796.

Observational studies of frailty and falls risk in older men and women. A parallel interest in my work has been on the epidemiology of frailty, physical functioning, and musculoskeletal health in older men. The contributions of androgen changes and sensitivity to the development and progression of frailty – a generalized vulnerability to loss of homeostasis with aging that is related to but conceptually independent of multimorbidity – has been one focus of this work.[7,8] More recently, we have conducted detailed analyses of subcohort

variation in fall risk in community-dwelling older individuals[9] and the potential for antihypertensive medication use to modify this risk.[10] These investigations have collectively advanced our understanding of the incidence and progression of physical frailty and dismobility.

1. **Travison TG**, Nguyen AH, Naganathan V, Stanaway FF, Blyth FM, Cumming RG, Le Couteur DG, Sambrook PN, Handelsman DJ. Changes in reproductive hormone concentrations predict the prevalence and progression of the frailty syndrome in older men: the concord health and ageing in men project. J Clin Endocrinol Metab. 2011 Aug;96(8):2464-74. doi: 10.1210/jc.2011-0143. Epub 2011 Jun 15. PubMed PMID: 21677041.
2. **Travison TG**, Shackelton R, Araujo AB, Morley JE, Williams RE, Clark RV, McKinlay JB. Frailty, serum androgens, and the CAG repeat polymorphism: results from the Massachusetts Male Aging Study. J Clin Endocrinol Metab. 2010 Jun;95(6):2746-54. doi: 10.1210/jc.2009-0919. Epub 2010 Apr 21. PubMed PMID: 20410235; PubMed Central PMCID: PMC2902073.
3. Tchalla AE, Dufour AB, **Travison TG**, Habtemariam D, Iloputaife I, Manor B, Lipsitz LA. Patterns, predictors, and outcomes of falls trajectories in older adults: the MOBILIZE Boston Study with 5 years of follow-up. PLoS One. 2014 Sep 3;9(9):e106363. doi: 10.1371/journal.pone.0106363. eCollection 2014. PubMed PMID: 25184785; PubMed Central PMCID: PMC4153626.
4. Lipsitz LA, Habtemariam D, Gagnon M, Iloputaife I, Sorond F, Tchalla AE, Dantoine TF, **Travison TG**. Reexamining the Effect of Antihypertensive Medications On Falls in Old Age. Hypertension. 2015 May 4. pii: HYPERTENSIONAHA.115.05513. [Epub ahead of print] PubMed PMID: 25941341.

Relation of male testosterone levels, androgen insufficiency, and androgen supplementation to cardiometabolic health and physical function. Following our work eliciting secular and within-subject trends in androgens and androgen insufficiency, we have assessed the relation between circulating androgen concentrations and downstream diabetes and other illnesses,[11-13] as well as their role in insulin resistance.[14]

1. Bhasin S, Pencina M, Jasuja GK, **Travison TG**, Coviello A, Orwoll E, Wang PY, Nielson C, Wu F, Tajar A, Labrie F, Vesper H, Zhang A, Ulloor J, Singh R, D'Agostino R, Vasan RS. Reference ranges for testosterone in men generated using liquid chromatography tandem mass spectrometry in a community-based sample of healthy nonobese young men in the Framingham Heart Study and applied to three geographically distinct cohorts. J Clin Endocrinol Metab. 2011 Aug;96(8):2430-9. doi: 10.1210/jc.2010-3012. Epub 2011 Jun 22. PubMed PMID: 21697255; PubMed Central PMCID: PMC3146796.
2. Storer TW, Miciek R, **Travison TG**. Muscle function, physical performance and body composition changes in men with prostate cancer undergoing androgen deprivation therapy. Asian J Androl. 2012 Mar;14(2):204-21. doi: 10.1038/aja.2011.104. Epub 2012 Feb 27. Review. PubMed PMID: 22367184; PubMed Central PMCID: PMC3735097.
3. Bhasin S, **Travison TG**, Storer TW, Lakshman K, Kaushik M, Mazer NA, Ngyuen AH, Davda MN, Jara H, Aakil A, Anderson S, Knapp PE, Hanka S, Mohammed N, Daou P, Miciek R, Ulloor J, Zhang A, Brooks B, Orwoll K, Hede-Brierley L, Eder R, Elmi A, Bhasin G, Collins L, Singh R, Basaria S. Effect of testosterone supplementation with and without a dual 5α-reductase inhibitor on fat-free mass in men with suppressed testosterone production: a randomized controlled trial. JAMA. 2012 Mar 7;307(9):931-9. doi: 10.1001/jama.2012.227. PubMed PMID: 22396515.
4. Bhasin S, Jasjua GK, Pencina M, D'Agostino R Sr, Coviello AD, Vasan RS, **Travison TG**. Sex hormone-binding globulin, but not testosterone, is associated prospectively and independently with incident metabolic syndrome in men: the framingham heart study. Diabetes Care. 2011 Nov;34(11):2464-70. doi: 10.2337/dc11-0888. Epub 2011 Sep 16. PubMed PMID: 21926281; PubMed Central PMCID: PMC3198304.

Clinical trials to promote physical function and cardiometabolic health in older adults. Our interventional work has focused on the development of function-promoting therapies for use in older adults. My collaborative work in this area has focused on the design and analysis of clinical trials and on the estimation of anchor-based clinically meaningful differences denoting patient-important functional improvement. Collectively these investigations have greatly advanced the development of anabolic and other therapies for functional improvement in older adults;[15-17] substantially broadened our understanding of the safety and efficacy of the use of anabolic agents in older populations;[18] demonstrated the need for and feasibility of the use of multimodal intervention strategies for the promotion of physical function and falls prevention;[19-21] and investigated the use of nutritional interventions for improvements in body composition and strength.[22-23]

1. **Travison TG**, Basaria S, Storer TW, Jette AM, Miciek R, Farwell WR, Choong K, Lakshman K, Mazer NA, Coviello AD, Knapp PE, Ulloor J, Zhang A, Brooks B, Nguyen AH, Eder R, LeBrasseur N, Elmi A, Appleman E, Hede-Brierley L, Bhasin G, Bhatia A, Lazzari A, Davis S, Ni P, Collins L, Bhasin S. Clinical meaningfulness of the changes in muscle performance and physical function associated with testosterone administration in older men with mobility limitation. J Gerontol A Biol Sci Med Sci. 2011 Oct;66(10):1090-9. Doi 10.1093/gerona/glr100. Epub 2011 Jun 22. PubMed PMID: 21697501; PubMed Central PMCID: PMC3202898.
2. Bhasin S, **Travison TG**, Storer TW, Lakshman K, Kaushik M, Mazer NA, Ngyuen AH, Davda MN, Jara H, Aakil A, Anderson S, Knapp PE, Hanka S, Mohammed N, Daou P, Miciek R, Ulloor J, Zhang A, Brooks B, Orwoll K, Hede-Brierley L, Eder R, Elmi A, Bhasin G, Collins L, Singh R, Basaria S. Effect of testosterone supplementation with and without a dual 5α-reductase inhibitor on fat-free mass in men with suppressed testosterone production: a randomized controlled trial. JAMA. 2012 Mar 7;307(9):931-9. doi: 10.1001/jama.2012.227. PubMed PMID: 22396515.
3. Basaria S, **Travison TG**, Alford D, Knapp PE, Teeter K, Cahalan C, Eder R, Lakshman K, Bachman E, Mensing G, Martel MO, Le D, Stroh H, Bhasin S, Wasan AD, Edwards RR. Effects of testosterone replacement in men with opioid-induced androgen deficiency: a randomized controlled trial. Pain. 2015 Feb;156(2):280-8. doi: 10.1097/01.j.pain.0000460308.86819.aa. PubMed PMID: 25599449
4. Ganz DA, Siu AL, Magaziner J, Latham NK, **Travison TG**, Lorenze NP, Lu C, Wang R, Greene EJ, Stowe CL, Harvin LN, Araujo KLB, Gurwitz JH, Agrawal Y, Correa-De-Araujo R, Peduzzi P, Gill TM; STRIDE Investigators. Protocol for serious fall injury adjudication in the Strategies to Reduce Injuries and Develop Confidence in Elders (STRIDE) study. Inj Epidemiol. 2019 Apr 15;6:14. doi: 10.1186/s40621-019-0190-2. eCollection 2019. PubMed PMID: 31245263; PubMed Central PMCID: PMC6582694.

Complete List of Published Work:
https://www.ncbi.nlm.nih.gov/myncbi/browse/collection/48043636/?sort=date&direction=descending

D. Research Support

Ongoing

2P30AG031679 (Travison) 07/01/2016 – 06/30/2021
NIH/National Institute on Aging
Boston OAIC: Biostatistical Design and Analysis Core. **Core Leader / PI.**
The BDAC facilitates the development of function-promoting therapies the training of data scientists in aging research, and by providing quantitative and analytic resources and expertise to OAIC–affiliated projects.

5U01AG048270-02 (Bhasin) 07/01/2016 – 06/30/2021
NIH/National Institute on Aging and PCORI
Randomized trial of a multifactorial fall prevention strategy. **Investigator**.
The proposed multi-site, adaptive, cluster-randomized clinical trial - a collaboration among investigators, patients, and other key stakeholders from the fourteen Claude D. Pepper Older Americans Independence Centers (OAICs) and eleven healthcare systems where patients will be recruited - will determine the effectiveness of an evidence-based, multifactorial standardly-tailored Intervention to reduce the risk of serious Fall injuries among non-institutionalized older persons.

2R01AG025037-09A1 (Lipsitz) 02/01/2015-01/31/2020
NIH/National Institute on Aging
Health Outcomes of Tai Chi in Subsidized Senior Housing. **Investigator.**
The proposed study aims are to determine the effects of Tai Chi exercises conducted at least twice weekly over a 1 year period on 1) functional performance measured by the Short Physical Performance Battery and 2) health care utilization and costs determined from Medicare claims data in poor, multiethnic, elderly residents of low income housing facilities.

R01 AG041398 (Kiel)
NIH/NIA; Risk Factors for Age Related Bone Loss
Based on the growing epidemic of obesity, and conflicting data regarding the role of visceral adiposity on musculoskeletal health, in this continuation of the Framingham Osteoporosis Study, we will determine the role

of visceral adipose tissue (VAT) on bone density, microarchitecture, and strength, as well as on muscle density, and fracture

R01AR073019- (Bouxsein) 09/14/18 – 08/31/23
Influence of Spinal Loading on Vertebral Fracture
Vertebral fractures are the most common fracture among older adults, and cause significant pain and increased risk of death. We posit that current methods used to identify those at risk for vertebral fracture are inadequate because they consider only bone strength and ignore spinal loading. We propose to validate state- of-the-art models for estimating spinal loading, and then determine the contribution of spinal loading to vertebral fracture, and identify the factors that influence spinal loading in a multiethnic sample of older adults.
Role: Co-Investigator

Recently completed

5U01AG048270-02 (Bhasin) 09/30/2015 – 04/30/2019
NIH/NIA and PCORI; Randomized trial of a multifactorial fall prevention strategy
The proposed multi-site, adaptive, cluster-randomized clinical trial - a collaboration among investigators, patients, and other key stakeholders from the fourteen Claude D. Pepper Older Americans Independence Centers (OAICs) and eleven healthcare systems where patients will be recruited - will determine the effectiveness of an evidence-based, multifactorial standardly-tailored Intervention to reduce the risk of serious Fall injuries among non-institutionalized older persons.

R01AG044518 (Inouye) 06/15/2014-02/28/2019
NIA; Development and Validation of a Delirium Severity Toolkit
The goal of this study is to develop a Delirium Severity Toolkit, a dynamic set of six new measures developed with expert clinical judgment and patient/family/nurse input using modern psychometric theory.

P01 AG031720 (Inouye) 04/01/2014 – 03/31/2016 .
NIH/National Institute on Aging
Interdisciplinary Study of Delirium and its Long Term Outcomes
This Program Project seeks to elucidate novel risk factors and to examine the contribution of delirium to long term cognitive and functional decline.

R01 AG041658 (Samelson) 09/30/2011 – 08/31/2016
NIH/NIA
Mechanisms and Clinical Importance of Hyperkyphosis: The Framingham Study
Hyperkyphosis (forward thoracic curvature) in older adults is an important, common problem, associated with significant disability, morbidity, and mortality, and will increase with the aging of the population. The purpose of this project is to determine the natural history, risk factors and clinical outcomes of hyperkyphosis. A greater understanding of the factors that contribute to progression of kyphosis will help lead to interventions to prevent and treat this complex condition.

Policy Analysis, Inc. (Hannan) 10/01/2014-12/31/2016
Short-Term Risk-Prediction Models for Osteoporotic Fracture in Postmenopausal Women, Based on Data from Framingham Heart Study
This project will involve the development of statistical models to predict short-term risk of hip fracture and non-vertebral fracture respectively, in women of advanced age with osteoporosis