Mount Sinai Medical Center
2016 OAIC Annual Directory

Section I. Description of Center

The *Mount Sinai OAIC'* s goal is to stimulate, develop, and fund research directed at improving quality of life and independence of older adults with serious illness and their caregivers. In the first five years, our OAIC became a national resource for research training in geriatric palliative care, as well as a key contributor in the movement to improve quality of care for our nation's sickest patients. The OAIC's specific aims are:

1. To expand a comprehensive transdisciplinary research program focused on: a) improving quality of life, independence, and function and b) developing and testing models of improving care for older adults living with serious illness.
2. To identify, recruit, and train leaders in aging and palliative care research through: a) mentoring relationships with successful investigators; b) strengthening and expanding Mount Sinai's existing research training programs in aging and palliative care; and c) support for pilot projects, statistical and analytic consultation, and instrument development and measurement.
3. To expand a research infrastructure that will a) support new and ongoing research in the care of seriously ill older adults by providing expertise in research design, measurement, and analysis, b) develop and apply innovative research designs, analytic techniques, and measures, and c) apply to aging research methods not currently in widespread use (e.g. item response theory, propensity score methods), but which are highly applicable to geriatrics and gerontology because of the populations studied.
4. To develop a research center that bridges the transdisciplinary specialties of geriatrics and palliative care that will serve as a model for research that has not been well addressed by these two specialties.

   The overall goal of our center is to bring together a diverse, transdisciplinary group of distinguished investigators with a strong history of collaboration and research in pain and other symptoms, functional outcomes, patient-oriented research, research design, biostatistics, and measurement to establish an OAIC focused on palliative care in older adults.

Section II. Research, Resources and Activities

A. Cores

Our OAIC cores are led by 5 scientists with a strong history of collaboration, expertise in the OAIC areas of focus, and leadership experience:

Albert Siu, MD (OAIC leader, Leadership and Administrative Core [LAC] leader) - The Leadership and Administrative Core (LAC) will be housed in the offices of the Chairman of the Mount Sinai Department of Geriatrics. Core staff will be the Center PI and Core Leader (Albert L. Siu, MD), the Leaders of the RCDC (R. Sean Morrison, MD) PESC (Kenneth Boockvar, MD) RC-PRE (Melissa Aldridge, PhD), RD-MDM (Jeanne Teresi, PhD), the Vice-Chair for Education of the Department of Geriatrics (Rosanne Leipzig, MD, PhD) and the Director of the Center to Advance Palliative Care (Diane Meier, MD). Three standing committees advise the Center regarding policy and conduct of its programs: 1) an OAIC Executive Committee (OAIC EC or EC) of OAIC core leaders and institutional leadership; 2) a Research Advisory Committee (RAC) of senior investigators not currently involved in the OAIC as investigators or mentors; and 3) an OAIC External Advisory Board (OAIC EAB) of outside experts which meet annually to review progress.

Nathan Goldstein, MD; R. Sean Morrison, MD; Juan Wisnivesky, MD, PhD (Research Education Component [REC] Core Co-leaders

The purpose of the Mount Sinai Claude D Pepper OAIC's Research Education Component (REC) will be to provide junior faculty with an interest in improving the care of older adults with serious illness the educational activities and training experiences, and to promote the development of future research leaders. The specific objectives of the REC are to:

1. Recruit talented faculty from different disciplines who are committed to academic careers improving the care of older adults with serious illness
2. Provide advanced training in research methodologies needed to conduct high quality, ethical, and multidisciplinary palliative care research for seriously ill older adults
3. Provide multidisciplinary mentorship and individually tailored career development plans
4. Support trainees to conduct and disseminate research studies to assess questions related to the health and independence of older adults or related palliative care issues
5. Facilitate attainment of academic and life skills to sustain long-term success as independent investigators and future leaders in geriatric and palliative care medicine
6. Prepare and assist trainees in obtaining external funding to continue an academic research career.

Kenneth Boockvar, MD (Pilot and Exploratory Studies Core [PESC] leader) – The PESC builds upon a 15-year foundation of research in palliative care, disability, and function at Mount Sinai; an established record of successful mentorship by the OAIC senior investigators, and a strong and consistent track record in conducting collaborative and interdisciplinary research that will accomplish the following specific aims:

1. *Support pilot and exploratory studies that will:* a) examine the relationship of pain and other distressing symptoms to independence, function, and disability; b) develop interventions directed at the treatment of pain and other distressing symptoms in older adults; and c) explore interventions to improve quality of life and promote function and independence for older adults living with serious and chronic illness.
2. *Support the development of junior faculty* by providing a mechanism to obtain mentored, hands-on research training and develop preliminary data in aging and palliative care that will lead to the development of larger federal or foundation funded research projects and career development awards focused on improving care and promoting independence for older adults with advanced illness.
3. *Support senior and mid-level faculty* who are conducting: studies in palliative care and aging and who are embarking on new research projects requiring pilot data; palliative care research in younger populations and who would like to expand or shift their research into aging; or aging research unrelated to palliative care who would like to refocus their work to fit within our OAIC theme.
4. *Foster collaborative research* among investigators from different disciplines, specialties, and institutions.

Melissa Aldridge, PhD (Population Research and Effectiveness (PRE) Core**) -** . The Population Research and Effectiveness (PRE) Core contributes to the goals of the OAIC by providing statistical, methodological and programming expertise, as well as mentoring in those areas, to investigators in the Mount Sinai OAIC. This core has been highly productive in providing consultations and support for numerous OAIC investigators confronted with methodological and analytic issues that occur in the study of older adults with serious illness. Our Core's consultants have a broad range of knowledge regarding research methods to serve as potential consults to

OAIC investigators. Resources and expertise are provided in a variety of ways and throughout all phases of the research process - from design to interpretation and presentation of findings

1. To provide sophisticated, cutting edge methodological, statistical, and programming support to OAIC investigators.
2. To apply advanced research and statistical methodology (e.g., propensity scores, instrumental variable estimation, competing risk analysis) used in other fields but not commonly applied to aging-related research.
3. To collaborate closely with the RCDC and RCDSC to ensure that junior faculty obtain research methods training to advance their current knowledge and expertise.
4. To create and manage a large, population-based dataset to be used by OAIC investigators for research regarding individuals with serious illness (DP-1) and advance the methods to analyze these data (DP-2).

Jeanne Teresi, PhD (Research Core –Measurement and Data Management [RC-MDM]) – A major barrier to research in this field has been the questionnaire burden on patients and family members associated with assessing and measuring symptoms, physical impairment, satisfaction, and caregiver burden. The major goal of the RC-MDM is to address such measurement challenges using item banking and the methods of modern psychometric theory through the following specific aims:

1. To assist OAIC investigators (from this and other Centers) in evaluating measures, and, where appropriate, in the selection, use, and construction of item response theory (IRT) derived measures from existing sources (e.g., the Patient Reported Outcomes Measurement Information System (PROMIS) Roadmap Initiative);
2. To apply psychometric techniques to items from existing palliative care and related data sets to test model assumptions, examine distributions and prepare data for analyses;
3. To conduct IRT analyses using data from ongoing NIH funded palliative care research with the goal of constructing a palliative care item bank as part of a later developmental project in years 3-5 of this OAIC;
4. To provide data management, in coordination with RC-RDA, for studies supported by the other OAIC cores;
5. To disseminate this information to researchers interested in geriatric palliative care through: a) presentations and publications, b) the National Palliative Care Research Center (*www.npcrc.org*) and other major national initiatives; and c) development of a web site with links to PROMIS and related web sites.

B. Research

Improving Adjustment For Selection Bias in Studies of Continuous Treatments (PI: Melissa Garrido, PhD) (DP-1)

Description: This research methods based developmental project seeks to identify improved methods to account for selection bias in observational and quasi-experimental research which is a research priority in the field of geriatric palliative care.[2] Propensity scores are one common and practical way to account for confounding due to selection bias, however, most propensity score guidance focuses on dichotomous treatments despite the fact that many treatments for older adults, such as drug dosage, have continuous values.[7] Artificially dichotomizing continuous treatments can obscure important nonlinear relationships between treatment and outcome, and matching on multiple levels of a continuous treatment is impractical. Weighting may reduce selection bias, however, "best practices" for weighting samples by propensity scores for treatments with continuous values are not well-developed. To address this gap, this project will utilize a Monte Carlo simulation in which a propensity score is estimated parametrically and non-

parametrically. The PI will use inverse probability weights (IPW) based on the estimated propensity scores to adjust for selection bias and estimate treatment effects in scenarios with a continuous treatment. The specific aims are: 1) Evaluate the covariate balance, bias and efficiency of treatment effect estimates obtained after weighting the sample with IPWs from parametric and non-parametric propensity scores; and 2) Determine the minimum sample size necessary to obtain stable treatment effect estimates from a sample weighted by parametric and non-parametric propensity scores. In addition to providing useful data on the relative performance of propensity score weights constructed parametrically and non-parametrically, this study will inform an R21 application (NIA PA: 13-335) to understand the relative performance of propensity score weighting techniques in studies of categorical treatments using both simulated and empirical geriatric palliative care data. Studies of categorical treatments require multiple propensity scores and thus understanding the relative performance of weights based on a single propensity score will be key to understanding their ability to reduce selection bias in models with multiple propensity scores. The RC-PRE will provide expert statistical consultations for this study.

Chris Woodrell, MD: Dr. Woodrell received a Bachelor of Arts in biochemistry from Swarthmore College in 2001 and subsequently worked as a research technician in basic science laboratories working to examine malignant gene expression and cellular mechanisms of wound healing. He received his MD from the Icahn School of Medicine at Mount Sinai in 2011 where he subsequently completed his Internal Medicine residency and fellowship training in Hospice and Palliative Medicine. Dr. Woodrell is currently a research fellow who will be joining the faculty of the Department of Geriatrics and Palliative Medicine at Mount Sinai in July of 2016 as a Clinician Investigator. Dr. Woodrell's research interest is to improve the delivery of palliative care to older adults with Hepatocellular Carcinoma (HCC). His research will identify predictors of inpatient palliative care consult among older patients with HCC by combining two pre-existing datasets of patients at Mount Sinai Hospital to determine which HCC patients receive palliative care and the relationship of demographic and disease characteristics to referral. He will then go on to create a cohort of hospitalized HCC patients referred to palliative care matched with a group of those who did not in order to measure the difference in readmission, Emergency Department visits, and Intensive Care Unit admission. Like Dr. Horton, Dr. Woodrell is at a critical juncture in his career development. He needs funds to protect his time so he can continue his research endeavors and become competitive to apply for his own funding.

C. Pilots

Project 1. Development of a cohort of Medicare patients with advanced dementia

Principal investigator: Carolyn Zhu, PhD – Department of Geriatrics and Palliative Medicine, Icahn School of Medicine at Mount Sinai Co-investigators: Christopher Murtaugh, PhD -- Visiting Nurse Services of New York (VNSNY) Center for Home Care Policy and Research; Stanley Moore (Consultant, Programming/Data Management)

Background and Specific Aims: Dementia is a progressive terminal illness with many complications in the advanced stages. At these advanced stages, many patients continue to be treated with aggressive and costly therapies without clear health benefits, exerting substantial strain on the healthcare systems. Our understanding of costs of advanced dementia is mostly based on findings from observational studies of nursing home or hospitalized patients, and often defined by a decedent sample. Estimates from observational studies on the effects of treatments on patient outcomes also may be biased due to potential endogeneity that arises from the non-random assignment of patients to different treatments. While Medicare claims have been used to identify patients with dementia, claims data lack information on disease severity. This pilot study

will explore the feasibility of combing data from several sources (e.g., Medicare claims, assessment data) to identify patients with advanced dementia, and explore the variation in treatment patterns to identify instrumental variables methods to obtain unbiased estimates of treatment on patient outcomes. The specific aims are: 1) To determine the feasibility of identifying patients with advanced dementia by combining Medicare claims data and measures of cognitive and functional impairment and behavioral difficulties available in the Outcome and Assessment Information Set (OASIS); 2) To examine whether patients identified with advanced dementia are associated with worse health outcomes (e.g., higher mortality, institutionalization, hospitalizations, hospice use);
3) To explore variation in treatment patterns (e.g., parenteral therapy) to identify instrumental variables that are predictive of treatment to correct for non-random assignment of patients to treatment groups.

The study uses Medicare administrative, claims and home health patient assessment (i.e. Outcome and Assessment Information Set, or OASIS) data from a previous study of heart failure led by Dr. Murtaugh (VNSNY). The sample will be derived from existing data that include all patients with Medicare fee-for-service hospitalizations discharged to home health care in a one year period (July 2009 through June 2010).

Progress/Status: We have made significant progress toward completing Aims 1 and 2. Specifically, we have successfully obtained the Data Use Agreement Reuse request for the VNSNY Medicare dataset. Working closely with the VNSNY research team led by Dr. Chris Murtaugh and data management consultant, Stanley Moore, we have created a sample of 857,073 Medicare beneficiaries with at least one home health care episode from 7/2009 to 06/2010 who have had at least one OASIS evaluation in 2009 (July-December). The prevalence of Alzheimer's disease, as defined by the CCW chronic condition warehouse from Medicare claims, was 15.5% (n=133,100), and 32.4% with Alzheimer's disease and related dementias (n=278,076).

We used data on symptom and functional status assessment in the OASIS as proxies to clinical staging variables in the Functional Assessment Staging procedure (FAST) and the Global Deterioration Scale (GDS). In individuals with AD, we identified 23,991 patients (18.0%) with Moderately Severe Cognitive Decline (FAST stage 5), and 11,082 with Severe or Very Severe Cognitive Decline (FAST stage 6 and above).

To date, we have completed the descriptive (bivariate) analyses comparing beneficiary characteristics and outcomes by dementia severity. We have estimated initial logistic regression models to examine the relationship between advanced dementia and outcomes. Results in Table below show that after controlling for individual demographics, comorbidities, prior healthcare utilization, and disabilities, more advanced dementia, as measured by the FAST scores, is associated with higher likelihood of death, hospice use, and home health utilization, but relationship between advanced dementia and hospital admissions, use of skilled nursing care, and ED use are less clear. We are currently refining these models.

Table. Logistic regression results of effect of advanced dementia on health outcomes

	Death	Hospitalization	SNF	ED	HHA	Hospice
	OR (SE)	OR (SE)	OR (SE)	OR (SE)	OR (SE)	OR (SE)
Reference group (FAST stage<5)	--	--	--	--	--	--
Moderately Severe Cognitive Decline	1.087***	1.021	1.066**	1.012	1.087***	1.098***

(FAST stage 5)	(0.027)	(0.022)	(0.025)	(0.021)	(0.025)	(0.029)
Severe or very severe Cognitive Decline (FAST stage >=6)	1.166*** (0.038)	0.982 (0.028)	0.988 (0.030)	0.969 (0.026)	1.320*** (0.039)	1.188*** (0.042)
Models controlled for age, gender, race/ethnicity, comorbidities, and prior 6 month health services use						

Future directions: Over the next few months, we expect to complete the remaining analytic tasks. We plan to submit an abstract in February for the Alzheimer's Association International Conference based on our findings to date. By mid-2016, we expect to have prepared a manuscript to submit for publication based on the completed analyses for Aims 1 and 2.

Project 2. A Descriptive Analysis of Hospice Care for Patients with Advanced Heart Failure: The Role of Implantable Cardiac Devices in Hospice Use and Other Outcomes

Principal investigator: Miriam Ryvicker, PhD – Visiting Nurse Services of New York (VNSNY) Center for Home Care Policy and Research Co-Investigators: 1) Christopher Murtaugh, PhD (Co-Investigator, VNSNY Center for Home Care Policy and Research); 2) Laura Gelfman, MD (Co-Investigator, Department of Geriatrics and Palliative Medicine, Icahn School of Medicine at Mount Sinai); 3) Yolanda Barrón-Vayá, MS (Statistician, VNSNY); 4) Stanley Moore (Consultant, Programming/Data Management)

Background and specific aims: Advanced Heart Failure (AHF) affects nearly 5 million people in the U.S. It is characterized by symptom burden, diminished quality of life (QOL), and high costs. Hospice care has the potential to improve clinical outcomes and QOL for patients with AHF by improving symptom control and clarifying goals of care and treatment preferences. At the same time, treatment modalities such as implantable cardiac devices have the potential to improve heart functioning and thus extend life while reducing symptom burden. However, data on the types of individuals who elect to receive implantable devices and their effect on hospice use and other outcomes is lacking, given that randomized trials are not feasible due partly to ethical concerns about withholding treatment. The specific aims of this study are to: (1) Describe the population of home care patients with AHF who do and do not receive implantable cardiac devices. Sub-aim: Predict who receives an implantable cardiac device with explanatory factors, including patient demographic factors (e.g. age, race/ethnicity), provider-level practice patterns and other measures potentially serving as instrumental variables; (2) Examine the relationship between implantation of a device, hospice use and outcomes such as hospital readmission, nursing home admission, and mortality controlling for baseline patient characteristics. Sub-aim: Examine potential interaction effects between device implantation and hospice use on other outcomes.

The study uses Medicare administrative, claims and home health patient assessment (i.e., Outcome and Assessment Information Set, or OASIS) data from a previous study of home care patients with AHF conducted by Co-Investigator Dr. Gelfman in collaboration with Dr. Murtaugh. The universe of potential study patients includes Medicare beneficiaries who were hospitalized for heart failure and then discharged to home health care between 7/01/2009 and 6/30/2010. Hospice and other health care use as well as mortality are being assessed for comparable groups of patients with and without implantable devices over a period of at least 6 months.

Methods: Project management tasks: We obtained permission from CMS to add Dr. Ryvicker and Ms. Barrón-Vayá to the Data Use Agreement held by Dr. Gelfman for her study of hospice care for AHF patients. We worked closely with programmer/data management consultant Stanley Moore in order to define sample selection criteria, identify patients who received a left ventricular assist device (LVAD), define study variables and configure the analytic dataset with appropriate data documentation. We developed an analytic plan detailing the anticipated approach for addressing each study aim, including a combination of descriptive analysis, logistic regression, propensity score matching, and hazard modeling. Additionally, we initiated a collaboration with Dr. Anu Lala (Mount Sinai), who will review analytic findings and provide specialized input on clinical decision-making related to cardiac devices.

Defining the analytic sample: We identified 270 individuals who received an LVAD during a hospitalization that qualified as an index stay, given that it took place during the timeframe of interest (7/01/2009-6/30/2010) and was followed by admission to home health care and a complete OASIS assessment. We identified a potential comparison group of 105,102 individuals who did not receive an LVAD but were hospitalized for heart failure during the index period, were discharged to home health care and had complete OASIS data. Given the imbalance between the size of the LVAD group and the potential comparison group, we selected a smaller subset of 5,400 patients without an LVAD in order to meet the statistical requirements for a logistic regression predicting a rare event. This allows for a total sample of 5,670 for modeling purposes, with roughly 5% of the sample having received an LVAD. In selecting the smaller subset for comparison, we also adjusted for the fact that the sample of LVAD recipients was skewed toward the younger end of the age distribution, with a much larger proportion receiving Medicare through the disability entitlement than the old age entitlement. We stratified the larger no-LVAD pool of 105,102 by age and randomly selected individuals within "age buckets" in order to generate a comparison group with a similar age distribution as the LVAD group. (In the cases of the youngest age brackets, it was necessary to select nearly all of the no-LVAD patients since there were so few individuals in these age brackets in the larger sample.)

Progress: Given the complexity of defining the sample and some data preparation issues that we have successfully addressed, the overall analytic timeline has been somewhat delayed. To date, we have completed the descriptive (bivariate) analyses comparing the characteristics of the LVAD group (N=270) with the age-stratified comparison group (N=5,400). Additionally, we have estimated logistic regression models to examine predictors of receiving an LVAD; we are currently refining these models and testing for multi-collinearity. Some key findings from the analyses thus far are summarized here.

First, it is notable that the LVAD group had fewer comorbidities that were not directly related to AHF. Presumably, having less clinical complexity in conditions not directly linked with heart failure might make a patient a better candidate for the LVAD procedure. Second, the length of stay for the index hospitalization was markedly longer for the LVAD group, with a mean of 38.8 days (SD=27.4) for the stay in which the LVAD surgery was performed. This is compared to a mean of 5.7 days (SD=4.8) for the HF-related index hospitalization in the no-LVAD group. In the LVAD group, the index hospital stay was less likely to have been initiated in the emergency room (17.4% vs. 75.4%; $p<0.001$), suggesting that most of the LVAD implantations occurred within the context of a planned admission. Third, the LVAD group had a significantly lower proportion who were of a racial minority (31.9% vs. 40.2%; $p=0.006$) and a significantly lower proportion who were eligible for Medicaid (27.0% vs. 53.1%; $p<0.001$). However, in preliminary multivariate logistic regressions, race was not a significant predictor of receiving an LVAD,

whereas patients who were eligible for Medicaid were significantly less likely to receive an LVAD, controlling for other demographic and clinical factors. Thus far, the findings on race and Medicaid eligibility have been consistent across different versions of the models. Finally, LVAD recipients were more concentrated in the Northeast and Midwest U.S. Census regions, with less representation in the South and West compared to non-recipients

Next Steps and Deliverables: Having made significant progress toward completing Aim 1 and having created the outcome variables and analytic plan for Aim 2, we expect to complete the remaining analytic tasks during the first quarter of 2016. In January 2016 we will submit an abstract for the AcademyHealth Annual Research Meeting. By the spring of 2016, we will have prepared a manuscript for publication based on the analyses for Aims 1 and 2.

Project 3: Prospectively Identifying Older Adults with Serious Illness at Risk for High Healthcare Utilization

Principal Investigator: Amy Kelley, MD, MSHS – Department of Geriatrics and Palliative Medicine, Icahn School of Medicine at Mount Sinai Co-Investigators: RS Morrison, MD; K Ornstein, PhD, and E Bollens-Lund, MA (Department of Geriatrics and Palliative Medicine, Icahn School of Medicine at Mount Sinai) ; P Deb, PhD (Department of Economics, Hunter College)

Background and Specific Aims: Many healthcare reforms in the U.S. are focused on a small proportion of the population with the highest healthcare costs. Notably, the majority (>80%) of these patients are not in the last year of life. Despite the high spending among these complex patients, care is often poorly coordinated, marked by inadequate symptom control, characterized by low patient and family satisfaction, and frequently at odds with personal goals and preferences. While high cost treatment may be entirely appropriate for some patients with serious illness, it is a marker of poor quality for others. Predicting who is at risk for high cost, poor quality care, however, has proven extremely difficult.

Building upon our prior work with the Health and Retirement Survey (HRS), and utilizing a conceptual definition of serious illness derived from a recent survey of palliative care experts, we developed operational descriptors of serious illness using combinations of medical conditions, functional measures and prior healthcare utilization. These basic definitions performed well in a preliminary analysis predicting high Medicare costs and hospital use over 1 year, but lacked the precision to identify the subgroup of patients with persistently high utilization and the highest costs. Notably, these basic definitions did not include several clinical and social elements (e.g., symptom burden, caregiver burden) that may be key predictors of high-cost, high-intensity treatment. Therefore, this project specifically aims to:1) Examine a wide range of clinical and social factors that may predict high-cost, high-intensity treatment within the nationally-representative Health and Retirement Study (HRS), which contains extensive clinical, social and financial survey data, and the National Health and Aging Trends Study (NHATS), which contains a greater breadth of physical function and caregiver measures; and 2) Use innovative statistical models to identify the most parsimonious, yet effective, set of predictors.

Progress/Status

This project has received funding from the National Palliative Care Research Center (NPCRC), through the Pilot Project Support Grants Program. This grant will support 2 years of work, beginning May 2015, including $77,000 in year 1 and $77,000 in year 2. Our preliminary work

on the basic definitions of serious illness has been accepted for publication in Health Services Research: Kelley AS, Covinsky KE, Gorges R, Bollens-Lund E, McKendrick K, Morrison RS, Ritchie CS. *Identifying People with Serious Illness: a Critical Step toward Improving the Value of Healthcare.* Health Services Research. (*in press*).

Human Subjects and Data Protection reviews: This project requires the use of personal Medicare claims data and restricted elements of survey data. We have submitted our proposal for review and received approval from the Mount Sinai IRB, NHATS Data Confidentiality Committee, and the Centers for Medicare and Medicaid Data Privacy Board. We have received the restricted data elements from both NHATS and CMS and have successfully merged these data into a single analytic file.

Data Cleaning and Crosswalk: We are currently working on data cleaning steps and developing a code book and crosswalk file of variables in HRS and NHATS. Given our prior work with HRS, we are first comparing the HRS items the available items in NHATS and identifying those variables that are exact matches. When exact matches are not available, we are assessing candidate variables for construct validity and frequency, to select the closest match. Through this process, we are translating the basic HRS definitions to an NHATS definition item by item. In next steps, content areas such as caregiving, where NHATS offers measures beyond that available in HRS, candidate variables will be considered as a refinement or improvement to the specified definition.

Next Steps and Deliverables: Data Cleaning and Variable Identification: Once we have completed the data cleaning and crosswalk between HRS and NHATS data, we will replicate the basic definitions and sampling strategy used in HRS in the new NHATS cohort. We will compare these cohorts' 1 year outcomes of hospitalization, Medicare costs, and mortality. Next, we will return to our conceptual definition of serious illness and explore additional variables in NHATS (i.e., caregiver measures, quality of life and symptom measures) that may improve upon the basic serious illness definition.

Analyses: We will then use the complete HRS and NHATS datasets and innovative statistical model techniques, including finite mixture and grade of membership models, to develop a parsimonious, yet effective definition of serious illness. The ultimate goal is to determine an efficient set of clinically applicable predictors to prospectively identify those seriously ill individuals who are most likely to benefit from specialized geriatric and palliative care services.

Deliverables: We plan to prepare 2 additional peer-reviewed publications to disseminate these results.

Project 4: Hospitalization-related stress and risk for adverse events after discharge

Principal investigators: Deena Goldwater, MD, PhD and Fred Ko, MD – Department of Geriatrics and Palliative Medicine, Icahn School of Medicine at Mount Sinai

Background and specific aims: After discharge from the hospital from either a medical or surgical admission, patients face a transient period of increased risk for adverse events such as rehospitalization and death, as well as enhanced susceptibility to infections, cardiovascular events, progressive deconditioning, debility, frailty, and cognitive decline. Allostasis defines a system functioning within normal stress-response parameters.

Extended stress exposure, however, results in abnormal hypothalamic-pituitary-adrenal (HPA) axis and autonomic nervous system (ANS) activation, disrupting the finely tuned mechanisms of mind-body balance. This maladaptive state, termed allostatic overload, leads to cognitive deterioration, cardiovascular and immune system dysfunction, and functional decline, all components of post-hospital vulnerability. Allostatic load has been operationalized as the summation of a variety of hemodynamic, hormonal and metabolic factors, including blood pressure, lipid profile, glycosylated hemoglobin, cortisol and catecholamine levels and inflammatory markers. We hypothesize that a summative measure of hospitalization-related stress burden will provide insight into which patients are at highest risk for adverse outcomes post-discharge. Specific aim: to test the correlation between stress biomarkers during hospitalization and risk for rehospitalization and functional decline after discharge.

Methods: This pilot study will assess allostatic load as a composite index of known stress biomarkers. It will utilize a subset of data gathered by Dr. Sean Morrison and Dr. Fred Ko for a hip fracture study called Improving Pain and Function in Hip Fracture. This cohort is composed of individuals over 60 years of age who presented with an acute hip fracture to the emergency department and were admitted to the hospital for planned surgical repair. Stress biomarkers will be measured in blood serum samples previously collected on POD3. Concentrations of inflammatory (IL-6, TNF-alpha, fibrinogen, and CRP), metabolic (albumin) and hormonal (cortisol) biomarkers will be measured using Luminex multiplex technology. All of the biomarkers with the exception of glucose will be processed by the Human Immune Monitoring Core (HIMC) facility at Mount Sinai School of Medicine. Glucose levels will be assessed with a glucometer by the applicant. A modified allostatic load score will be determined as follows: results for each of the 7 biomarkers will be divided into quartiles; the score will be a sum of the number of parameters for which an individual has a value placing them in the top quartile (or bottom quartile for albumin) of that parameter within the cohort. This proposed study's primary outcome is hospital readmission within 90 days of hospital discharge. The secondary outcomes are functional status 6 weeks post-operatively. Hospital readmission data were obtained from an electronic medical record database query. Functional status data were previously gathered by Dr. Ko. Functional status was measured preoperatively and 6 weeks post-operatively using the Function Independence Measure (FIM-motor).

Significance/Products: This proposed pilot study is the first to consider a summative measure of hospital-related stress and its relationship to post-discharge outcomes. The development of a tool to quantify hospital-induced allostatic overload may identify patients highly susceptible to adverse events after discharge, facilitate targeted post-discharge intervention, and ultimately improve outcomes. Project findings can be used in an NIH or federal application to proceed to next steps in testing of the approach (e.g., a multi-site trial or trial planning grant).

Project 5: Describing treatment-related symptom burden and determining patient- and provider-level factors associated with palliative care referral in older patients with advanced cancer undergoing palliative radiation therapy

Principal Investigator: Kavita V. Dharmarajan, MD, MSc, Assistant Professor, Radiation Oncology and Palliative Medicine Department of Radiation Oncology, Mount Sinai Hospital

Background and specific aims:

Palliative radiation treatment (RT) is commonly used in the setting of advanced cancer to alleviate cancer- related symptoms, improve function, and allow better quality of life. It may, however, also be associated with temporary periods of worsened symptoms as a result of acute treatment-related side effects. This may be particularly challenging in older patients leading to a higher number of ED visits, hospitalizations, and decreased quality of life. Access to palliative care resources within the timeframe of acute symptom development may add a layer of support that helps lesson the burden of symptoms related to palliative RT in these individuals, yet little is known about the characteristics and severity of symptoms experienced among older patients shortly after treatment or the current referral patterns to palliative care. In this proposal, I outline a descriptive pilot study to ascertain the burden of symptoms leading to ED visits and hospitalizations among older patients after a course of palliative RT as well as the factors impacting referral to palliative care services among these patients. Findings from these projects will inform future work that leads to designing and testing pilot interventions, in the context of NIH-funded K23 and later R01 trials, that leads to better quality of life of older patients with advanced cancer receiving palliative RT. My goal is to become an independent clinician-investigator at the intersection of aging, palliative care, and radiation oncology whose work improves the lives of older, advanced cancer patients undergoing palliative RT.

Specific aims: Between 2010 and 2030, a 67% increase in cancer incidence is anticipated for patients 65 years or older (1.0 million to 1.6 million instances). In approximately 30% of these, radiation treatment (RT) will be given in a palliative setting.[1] RT can improve tumor-related symptoms and functional outcomes, but may also
be associated with significant adverse outcomes such as fatigue, worsened pain, long hospital stays, and reduced independence, especially in the period immediately after radiation when patients experience acute toxicities.[2] Some of these toxicities may be unexpectedly more pronounced in older individuals.[3] Many patients may also hold unrealistic expectations of cure.[4,5] The American Society of Radiation Oncology (ASTRO) has thus urged radiation oncologists to discuss goals of treatment, provide primary palliative care, and consider referral to specialty-level palliative care when initiating RT.[6] Palliative care resources, when applied in conjunction with RT, may especially permit older patients undergoing palliative RT to maintain their quality of life and functional independence. Despite its clear strengths, palliative care services are underutilized for older patients with cancer.[7] Moreover, little is known about the extent to which palliative care is accessed among older patients undergoing palliative RT. The goal of this project is to describe the burden of symptoms and consequent health care service utilization (such as ED visits and hospitalization) experienced by older patients after palliative RT and to determine the factors associated with the current referral practice to palliative care services for older patients receiving palliative RT. Pilot data generated through this investigation will lead to a more complete understanding of older patients' unique experiences with palliative RT and inform optimal time points for palliative care referrals for these individuals.

Project 6: Palliative Care for Patients with Hepatocellular Carcinoma

Principal Investigator: Christopher Woodrell, MD, Brookdale Department of Geriatrics and Palliative Medicine

Background and specific aims:

The specific palliative care needs of patients with end-stage liver disease have not been well described. Patients with hepatocellular carcinoma (HCC) are an important subgroup of this population, as HCC is difficult to treat, carries a high rate of mortality, and has a rapidly rising incidence. Because most of these patients also have cirrhosis, the disease trajectory is difficult to predict. Further studies are needed to design models of care to meet the unique palliative care needs of this population. Mount Sinai Hospital, with a robust palliative care service and the largest HCC program in the country, provides the ideal platform to carry out this study. A secondary analysis of clinical databases will be performed, to determine which HCC patients were seen by palliative care and the demographic and disease severity characteristics associated with a palliative care consult. Rates of healthcare utilization will be measured for HCC patients who received an inpatient palliative care consult and for a matched group of patients who did not. Hospital readmission, intensive care unit admission, and emergency department visits will be measured at 30 days for comparison. This pilot study will aid in the design of a future prospective palliative care intervention for HCC patients. The work will be accompanied by career development activities, including mentorship and focused coursework, to facilitate the principal investigator's development as an independent researcher.

Little is known about the palliative care needs of patients with hepatocellular carcinoma (HCC), which is difficult to treat and has a very poor overall five-year survival (15%). Curative treatments are limited to surgical resection and transplant in early-stage disease, though two-thirds of cases are identified at later stages.[1] Furthermore, HCC has the fastest rising incidence of any solid cancer in the United States, attributable to the aging hepatitis C-infected cohort and rising rates of nonalcoholic steatohepatitis (NASH). Annual deaths from primary liver cancer (85–90% HCC)[1] are projected to increase from 20,000 in 2010 to 51,000 by 2030, making liver cancer the third-highest cause of cancer-related death in the country.[2] Driven in part by the increasing prevalence of HCC, the average age of patients awaiting liver transplant has risen dramatically in recent years. Increasing age is associated with higher pre- and post-transplant mortality.[3] Almost all patients with HCC in the United States also have cirrhosis,[1] thus the disease trajectory is likely an amalgamation of that of end-stage organ failure and cancer. This makes HCC unique and particularly difficult to predict and necessitates earlier palliative care involvement. In addition, care is often delivered by hepatologists and transplant surgeons, with whom supportive and palliative care programs have not been widely developed or implemented. In order to better integrate palliative care into the care of this growing population, it is important to effectively design models tailored for patients with HCC. The goal of this project is to lay the groundwork for future funding to implement a palliative care intervention to meet the needs of the aging population of patients with HCC. To this end, this pilot project will have two specific aims:

Specific Aim 1: Identify characteristics associated with patients with HCC receiving a palliative care consult. Methods: Combine two pre-existing Mount Sinai datasets to determine which HCC patients receive inpatient palliative care consults and the relationship of demographic and disease characteristics to referral.

Hypothesis 1: HCC patients are seen by palliative care in the setting of advanced age and late stage disease, as compared to those not seen by palliative care.

Relevance: These data will help determine the patient-based factors associated with HCC patients being referred to palliative care and thus help better tailor future interventions to meet these patients' needs.

Specific Aim 2: Examine the effect of inpatient palliative care consultation on number of and time to readmissions, Emergency Department (ED) visits, and Intensive Care Unit (ICU) admission.

Methods: Use the dataset defined in aim 1 to create a cohort of hospitalized HCC patients referred to palliative care, propensity-score matched with a group of those who did not, and compare rates of healthcare utilization. Hypothesis 2: Patients who receive a palliative care consult will have fewer and longer times to readmissions, ED visits, and ICU admissions. Relevance: Describing healthcare utilization patterns of patients with HCC will help define the benefit of palliative care for this population and support a future palliative care intervention to improve their care.

Section III. Career Development

Analgesic Safety and Effectiveness in Older Veterans with Arthritis (EP-1)**;** PI: Ula Huang; VA Merit Award

The Impact of Mental Illness on Veterans' Palliative Care Access and Outcomes (EP-2) PI: Melissa Garrido; VA Career Development Award

Effects of 30-day Bundled Payment of Hospital at Home on Outcomes, Satisfaction and Costs (EP-3). PI: Al Siu; CMMI innovation Award

Section IV. Publications:

Publications:

Weerahandi H, Goldstein N, Gelfman LP, Jorde U, Kirkpatrick JN, Marble J, Naka Y, Pinney S, Slaughter MS, Bagiella E, Ascheim DD. A cohort study of patients with ventricular assist devices to determine their religiosity and psychological symptoms. Circulation. Submitted for Review.

Weerahandi H, Goldstein N, Gelfman LP, Jorde U, Kirkpatrick JN, Marble J, Naka Y, Pinney S, Slaughter MS, Bagiella E, Ascheim DD. A cohort study of Patients with Ventricular Assist Devices to determine their physical symptoms. Circulation. Submitted for Review.

Xie K, Gelfman LP, Horton JR, Goldstein NE. Current State of Research on Palliative Care in Heart Failure as Evidenced by Published Literature, Conference Proceedings and NIH Funding. Circulation. Submitted for Review.

Ouchi K, Knabben V, Rivera-Reyes L, Ganta N, Gelfman L, Sudore R, Hwang U. Preparing Older Adults with Serious Illness to Formulate Their Goals for Medical Care in the Emergency Department. Journal of Palliative Medicine. Submitted for Review.

Yim CK, Barron-Vaya Y, Moore S, Murtaugh C, Lala-Trindade A, Aldridge M, Goldstein N, Gelfman LP. Demographics, Patterns of Hospice Use and Healthcare Utilization of Medicare Beneficiaries with Advanced Heart Failure who Enrolled in Hospice. Circulation: Heart Failure. Submitted for Review.

Book Chapters:

Ganta N, Gelfman L. Communicating with Special Populations- COPD and Heart Failure. In: Wittenberg-Lyles E, ed. Textbook for Palliative Care Communication. Oxford University Press, 2015.

Gelfman LP, Goldstein NE. Palliative Care Services for Patients with Heart Failure. In: Miriam Johnson, Lehman Richard, and Karen J. Hogg, eds. Heart Failure and Palliative Care: A Team

Approach, Second Edition, CRC Press, 2015.

Horton, J.R., Morrison, R.S., Capezuti, E., Hill, J., Lee, E.J., Kelley, A.S. (Submitted). Impact of inpatient palliative care on treatment intensity for patients with serious illness. Journal of Palliative Medicine.

Gray, N.A., Horton, J.R., Smith, C., Dionne-Odom, J.N., & Johnson, K. (Accepted). Update in hospice and palliative care. Journal of Palliative Medicine.

Woodrell C, Weiss J, Branch A, Gardenier D, Krauskopf K, Kil N, Paredes H, Bichoupan K, Sigel K. Primary Care-Based Hepatitis C Treatment Outcomes with First-Generation Direct Acting Agents. Journal of Addiction Medicine. 2015 Oct; 9(5): 405-410. PMID: 26291545.

Teresi, J. A., & Jones, R. N. (in press). Methodological Issues in Examining Measurement Equivalence in Patient Reported Outcomes Measures: Methods Overview to the Two-Part Series, "Measurement Equivalence of the Patient Reported Outcomes Measurement Information System (PROMIS) Short Form Measures". *Psychological Test and Assessment Modeling.*

Kleinman, M., & Teresi, J. A. (in press). Differential Item Functioning Magnitude and Impact Measures From Item Response Theory Models. *Psychological Test and Assessment Modeling.*

Teresi, J. A., Ocepek-Welikson, K., Cook, K. F., Kleinman, M., Ramirez, M., Reid, M. C., & **Siu, A**. (in press). Measurement equivalence of the Patient Reported Outcomes Measurement Information System (PROMIS) Pain short-forms in Ethnically Diverse Cancer and Palliative Care Populations. *Psychological Test and Assessment Modeling.*

Teresi, J. A., Ocepek-Welikson, K., Kleinman, M., Ramirez, M., Kim, G. (in press). Psychometric properties and performance of the Patient Reported Outcomes Measurement Information System® (PROMIS®) depression short forms in ethnically diverse groups. *Psychological Test and Assessment Modeling.*

Teresi, J. A., Ocepek-Welikson, K., Kleinman, M., Ramirez, M., Kim, G. (in press). Measurement equivalence of the Patient Reported Outcomes Measurement Information System® (PROMIS®) Anxiety short form scale in ethnically diverse groups. *Psychological Test and Assessment Modeling*

Section V. External Advisory Board

The EAB consists of the following individuals:

1. Christine Ritchie, MD, MSPH - Harris Fishbon Distinguished Professor in Clinical Translational Research and Aging in the Division of Geriatrics, Department of Medicine at the University of California San Francisco (UCSF). (5 years)

2. Vincent Mor, PhD - Florence Pirce Grant Professor of Community Health in the Public Health Program of the Brown University School of Medicine. (5 years)

3. Jay Magaziner, PhD - Department Chair and Professor of Epidemiology and Preventative Medicine and Director, Division of Gerontology at University of Maryland School of Medicine (5 years)

4. Arnold Potosky, PhD - Professor of Oncology, Director of Health Services Research, Cancer Control Program, Lombardi Comprehensive Cancer Center, Georgetown University Medical Center, Washington, DC (4 years)

Recognition and Awards:

The Bronx VA GRECC – Received a $1.3 million grant from the VA Office of Rural Health to sustain *GRECC Connect* in 2015-2016, a project to educate and provide clinical support to rural providers to improve geriatric care via telehealth means. The Bronx GRECC will continue to lead as the coordinating center for the project. Participating sites include Madison, WI; Rochester, NY; Seattle/Puget Sound, WA; Pittsburgh, PA; Bedford, MA; Durham, NC and San Antonio, TX, with a new site in Little Rock, AR. **William Hung, MD, MPH** directs the multisite project; other key staff includes **Judith L. Howe, PhD; Kenneth S. Boockvar, MD; Ab Brody, PhD and Daniel Sun.** October, 2015.

Nathan E. Goldstein, MD – Awarded an Endowed Professorship: *Gerald J. and Dorothy R. Friedman Chair in Palliative Care*. Presented to Dr. Goldstein at Convocation 2015, hosted by Dean Charney. October 1, 2015.