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Senior/Key Personnel:	*Organization:*	*Role Category:*
Eric Roberts PhD	University of Pittsburgh	PD/PI
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Reference Letters

Ateev Mehrotra	Harvard Medical School	05/19/2021
Alan Zaslavsky	Harvard Medical School	05/19/2021
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PROJECT SUMMARY / ABSTRACT

This AHRQ Mentored Research Scientist Career Development Award (K01) for Dr. Eric T. Roberts, an assistant professor of health policy and management at the University of Pittsburgh Graduate School of Public Health, will establish Dr. Roberts as a health economist with expertise in health insurance and health care policy for aging and low-income populations.

Research proposed for this K01 award will harness natural experiments created by eligibility thresholds and policy variation within Medicare subsidy programs to rigorously evaluate how these programs affect patients' use of care, access to providers, and health. This project will focus on two subsidy programs for low-income Medicare beneficiaries: the Medicare Savings Programs (MSPs), which are *partial* Medicaid benefits that defray out-of-pocket costs for physician services and inpatient care, and the Part D Low-Income Subsidy (LIS), which helps to pay for prescription drugs. Using the Health and Retirement Study linked to Medicare and Medicaid claims, Dr. Roberts will examine how discontinuities in subsidy eligibility affect patients' use of care—including medication adherence, physician visits, and hospitalizations—and health status. Dr. Roberts will also examine the relationship between state Medicaid policies—specifically, provider payment rates and rules for recertifying program eligibility—with MSP enrollment and patients' access to care. Evidence generated from this research can guide reforms to increase the benefits of the MSPs and LIS to low-income Medicare beneficiaries and to the Medicare program.

This project draws on Dr. Roberts' quantitative training, knowledge of Medicare and Medicaid policy, and prior research on health disparities. This work will extend Dr. Roberts' scholarship into the field of aging while incorporating methods in pharmaceutical health services research. Therefore, for this K01 award, Dr. Roberts will engage in training and career development activities that focus on acquiring expertise in aging and pharmaceutical health services research. Through mentorship from health services researchers and clinical experts, Dr. Roberts will also focus on applying training in these content areas to health policy research. This training plan complements the proposed research and will equip Dr. Roberts to establish an independent research program examining policy innovations to improve care for low-income Medicare beneficiaries, quantifying the clinical and economic impacts of policy reforms for patients, payers, and health systems.

PROJECT NARRATIVE

The Medicare Savings Programs and the Part D Low-Income Subsidy are financial assistance programs that help pay for low-income Medicare beneficiaries' premiums, deductibles, and cost sharing for physician services, hospital care, and prescription drugs. Harnessing quasi-experimental variation in the design of these subsidies and in state policies, this project will provide policy makers with evidence about how subsidy programs affect low-income patients' use of care and health, and elucidate the role that state policies play in facilitating patients' access to care and retention of subsidies. Findings from this project can inform policies to improve the structure of subsidy programs for vulnerable older Americans, addressing public health priorities of improving access to care and reducing health disparities in this patient population.

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1. Candidate's Background

I am a health economist whose research examines the provision and financing of health services for low-income patients. My research uses quasi-experimental methods to study the impact of health insurance programs and payment policies on access to care and on health disparities.

My interest in health and public policy first emerged as an undergraduate student at Johns Hopkins University, where I studied housing segregation in Baltimore. Baltimore's history of racial segregation confines many of the city's poorest African Americans to substandard housing and under-resourced neighborhoods. The consequences of this segregation were evident in both the health and academic performance of children and the wellbeing of their parents and grandparents, many of whom I met while volunteering in the city's public schools. Among children, I saw a high prevalence of asthma and missed school days, and among adults, COPD, diabetes, and heart disease, necessitating regular medication use and increasing hospital care as they aged. These snapshots of diminished health across generations fueled my desire to improve public policies aimed at addressing poverty and its consequences through the life course.

Recognizing the importance of addressing the implications of poverty when individuals enter the health care system—where its effects are so often visible—I decided to enroll in the Health Economics and Policy PhD program at Johns Hopkins University's Bloomberg School of Public Health. Supported by an Agency for Healthcare Research and Quality (AHRQ) T32 training grant, I received training in health economics, econometrics, and health services research and launched an early research program examining Medicaid policy and disparities in health care quality. This work culminated in several papers in leading health policy journals, along with a book chapter examining poverty and health in the context of the Medicaid program. Two of these projects received awards from AHRQ and the journal *Medical Care Research & Review* in recognition of their contributions to health policy research*.*

Upon completing my PhD in 2015, I spent two years as a postdoctoral fellow in the Department of Health Care Policy at Harvard Medical School. There, I developed an interest in the implications of health care reform for providers who serve low-income, chronically ill, and aging patients. Guided by my primary mentor, Dr. Michael McWilliams, I developed a research project examining Medicare's value-based payment programs and their consequences for providers serving clinically and socially disadvantaged patients. This project led to a first-authored paper in *Annals of Internal Medicine,* which received AcademyHealth's 2018 Paper of the Year award, as well as an in-progress study examining Medicare's hospital readmissions program. My postdoctoral fellowship advanced my methodological skills as a health economist, exposed me to the unintended consequences of payment reform for health care disparities, and inspired me to study policies that can address the health care needs of low-income individuals as they age. This has become the central theme of my research as an Assistant Professor at the University of Pittsburgh.

2. Career Goals and Objectives

My long-term goal is to become a leading health policy researcher and health economist whose work can guide policies to improve health insurance programs and health care policy for aging and low-income patients.

Towards this end, in the next phase of my work, I aim to study how the provision of financial supports to low-income Medicare beneficiaries affects access to care and health. I will focus on two policies in particular: the Medicare Savings Programs (a "partial" Medicaid benefit for Medicare beneficiaries who meet income and asset tests) and the Part D Low-Income Subsidy (a similarly means-tested program for prescription drugs). For this K01, I will leverage natural experiments created by eligibility thresholds and policy variation in these subsidy programs to evaluate their impacts on access to care and health, and to identify policies that affect take-up and retention of subsidies. These aims unite and build on my prior training and scholarship—including research on health care disparities and Medicare and Medicaid policy—while furthering my goal of conducting rigorous research to guide policy making to improve care for low-income patients.

Although my background in health policy, disparities research, and econometric methods equips me to initiate this line of work, to support my K01 research program and long-term career goals, I would benefit from:

- **Training in aging research,** including the epidemiology of aging and social determinants of health in aging populations, which will enhance my understanding of health risks among low-income, aging patients and clinical outcomes of the policies I will study.
- **Training in pharmaceutical health services research and policy,** which will equip me to measure and assess outcomes of medication use and adherence in the context of the Medicare Part D Low-Income Subsidy (Aim 1). Because I plan to focus future research on models of care financing and coordination for aging and low-income patients with complex health needs, having a solid

understanding of pharmaceutical health services research and its application to Part D claims will equip me to evaluate policy impacts on the range of services received by these patients.

Along with training in these areas, I would benefit from consultation with physicians engaged in primary and geriatric care to improve my understanding of the challenges aging patients face navigating the health care system with limited financial resources and social supports, and to help situate my research findings for the medical community. In the long term, I expect the research, training, and mentoring experiences facilitated by this K01 award will enable me to conduct independent research examining policy innovations to improve care for low-income Medicare beneficiaries. For future R01 proposals, I plan to evaluate payment policies and other reforms that address impediments to health care access and care coordination for low-income Medicare beneficiaries dually enrolled in Medicaid (a subset of the QMB population).

3. Career Development/Training Activities During Award Period

My training plan will equip me with the necessary knowledge and skills to become an independent investigator leading innovative research on care for low-income and aging patients. To meet this objective, my mentors and I have developed a training and career development plan that complements my research aims (see **Figure 1,** below, for an illustration of the linkages between my training and research plans) and advances my long-term career goals. I will commit 75% of my effort to this career development plan and related research activities for the duration of the K01 award period.

Mentor, Co-Mentors, and Consultants

Mentor- Julie Donohue, Ph.D., is a Professor in the Department of Health Policy & Management in the University of Pittsburgh's Graduate School of Public Health (GSPH). Dr. Donohue's research examines insurance and health care delivery, focusing on the use of prescription drugs and behavioral health services in vulnerable populations. She has studied the impact of Medicaid and Medicare policies on access to care and health outcomes, including the Medicare Part D program. Dr. Donohue will provide overall supervision of my training and research activities for this K01 and will provide career development mentoring.

Co-Mentor- Lindsay Sabik, Ph.D., is an Associate Professor in the Department of Health Policy & Management at the University of Pittsburgh's GSPH. Dr. Sabik is a health economist whose research examines the impact of state and federal policies on access, utilization, and health outcomes in low-income populations, with a particular focus on state Medicaid programs. Dr. Sabik will mentor me on Aims 1-3 of this project.

Co-Mentor- J. Michael McWilliams, M.D., Ph.D., is a Professor in the Department of Health Care Policy at Harvard Medical School and a practicing general internist at Brigham and Women's Hospital, in Boston, MA. Dr. McWilliams served as my primary mentor during my postdoctoral fellowship, during which time we collaborated on 5 studies that were published in leading clinical and health policy journals. Dr. McWilliams' research spans questions related to health care spending, quality, access, and disparities, with an overarching goal of informing the development of payment and delivery systems, insurance coverage, and policy that support value and equity in health care. Dr. McWilliams will mentor me on Aims 1-3 of this project.

Co-Mentor- Anne Newman, M.D., M.P.H., is Professor and Chair of the Department of Epidemiology at the University of Pittsburgh's GSPH and serves as Director of the University's Center for Aging & Population Health, which provides training in aging research, and as co-Principal Investigator of the NIA-funded Pittsburgh Pepper Older Americans Independence Center. Dr. Newman is a practicing physician whose research focuses on the epidemiology of aging and disability. Dr. Newman will provide clinical expertise supporting my research on Aims 1-3, and will help supervise my training in aging research in coordination with Dr. Donohue.

Consultant- Susan Greenspan, M.D., is a Professor of Medicine at Pitt whose research focuses on treatment modalities for frail and elderly patients, with a focus on aging women. Through twice quarterly meetings with Dr. Greenspan, I will gain insight into issues of care for aging patients and clinical implications of my studies.

Consultant- Walid Gellad, M.D., M.P.H., is an Associate Professor at the University of Pittsburgh's School of Medicine and GSPH, and Director of the University's Center for Pharmaceutical Policy and Prescribing, where he studies the quality, safety, and efficiency of medication use. Dr. Gellad will provide content expertise for Aim 1 of this project, focusing on medication affordability, adherence, and associated clinical outcomes.

Training Activities

My training plan focuses on developing expertise in aging and methods in pharmaceutical health services research, supplemented with consultation from physician-experts in geriatric care, internal medicine, and pharmaceutical prescribing and policy. **Dr. Donohue will oversee my training and research activities via twice-monthly in-person meetings with me and through quarterly communication with my co-mentors.** I will also schedule regular meetings with co-mentors and consultants. I will add additional meetings (as

Candidate Information and Goals for Career Development

appropriate) with mentors and consultants contributing specific content or technical expertise to this research. I currently meet twice per quarter with Dr. Sabik (in person) and with Dr. McWilliams (by telephone) to discuss research development plans, and plan to continue those regular meetings through duration of the K01 award. In addition, Dr. Donohue will provide annual evaluations of my progress in the annual progress report.

Training Goal 1 – Develop expertise in aging research, including the aging process, clinical outcomes of health interventions, and the social determinants of health in aging populations: To meet this training goal, I will take coursework in the epidemiology of aging offered in the University of Pittsburgh's Department of Epidemiology. I will also enroll in summer institutes offered by RAND and the NIH that acquaint social scientists with clinical and policy issues in aging research. Dr. Newman will supervise this component of my training plan in coordination with Dr. Donohue. Dr. Newman will meet with me in person once per quarter to discuss my progress towards this training goal and related research activities.

- **EPIDEM 2900 – Epidemiology of Aging (2 credits).** This course reviews current epidemiologic research on health conditions and geriatric syndromes in aging populations. Emphasis is placed on the pathophysiology of age-related conditions, including Alzheimer's disease, cardiovascular disease, and arthritis. Discussion of research methods is incorporated in course readings and projects.
- **EPIDEM 2950 – Epidemiology of Aging Workshop (1 credit/semester x 2 semesters).** This workshop complements EPIDEM 2900 and is designed to acquaint students with current research on aging epidemiology. The course meets weekly for the duration of the academic year, and alternates in format between faculty/student research presentations and reviews of recent journal articles.
- **EPIDEM 2981 – Epidemiology of Aging – Methods (2 credits).** This course introduces methodological aspects of research in aging, focusing on: study design, sampling, recruitment, retention, and measurement of health outcomes (e.g., comorbidity scores and functional status).
- **RAND Summer Institutes.** I plan to attend two sequentially offered RAND institutes in the summer of 2019. These institutes provide intensive training for researchers studying aging and health policy:
  1. *RAND's "Mini-Medical School for Social Scientists,"* co-sponsored by the National Institute on Aging and the NIH Office of Behavioral and Social Sciences Research, acquaints non-medically trained researchers to the aging process and the medical treatment of elderly populations. Expert clinicians provide lectures on the biology, cognitive function, and care of aging patients during the 2-day class.
  2. *RAND Summer Institute on the Demography, Economics, Psychology, and Epidemiology of Aging.* This 2-day institute is offered after the "Mini-Medical School," and enables attendees to connect with and learn from researchers who study the interrelationship of health, economics, and public policy in the aging field. **This course includes hands-on training in the use of the Health and Retirement Study—the principal dataset I will use in the research component of this project.**
- **National Institute on Aging Butler-Williams Scholars Program.** The Butler-Williams Scholars Program is a weeklong summer institute that provides junior faculty who are new to the field of aging with opportunities to learn about aging research. The Program includes lectures, seminars, and group discussions on health disparities, chronic illness, and research methods. Funding opportunities from the National Institute on Aging are discussed, providing an early-career opportunity to identify future funding sources for my research. I will apply in March 2020 with plans to attend the Summer 2020 Program.
- **Expert clinical consultation.** I will meet in person at least twice per quarter with Dr. Susan Greenspan, an expert in aging and geriatric medicine, to improve my understanding of issues related to health care delivery for aging populations, and to help frame implications of my research for the medical community.

Training Goal 2 – Acquire training in pharmaceutical health services research and policy: To acquire relevant content knowledge for Aim 1, in which I will measure and assess outcomes of medication use and adherence in the context of the Medicare Part D Low-Income Subsidy, I will take coursework in pharmacoepidemioloy, supplemented with structured readings in drug policy and pharmaceutical health services research, to be supervised by Dr. Donohue.

- **EPIDEM 2850 – Pharmacoepidemiology (2 credits).** This course introduces students to epidemiologic methods used to examine the benefits and risks of medications in the population. The course emphasizes the reading and interpretation of the current pharmacoepidemiology literature, the measurement of drug exposures using surveillance and claims data, and the application of epidemiologic study designs to assess impacts of drug exposures on clinical outcomes.
- **Structured readings.** Dr. Donohue will supervise a series of structured readings on pharmaceutical health services research and policy. For the duration of Aim 1 (**Table 1**), Dr. Donohue and I will meet monthly to discuss relevant papers and application of their methods and results to my research.

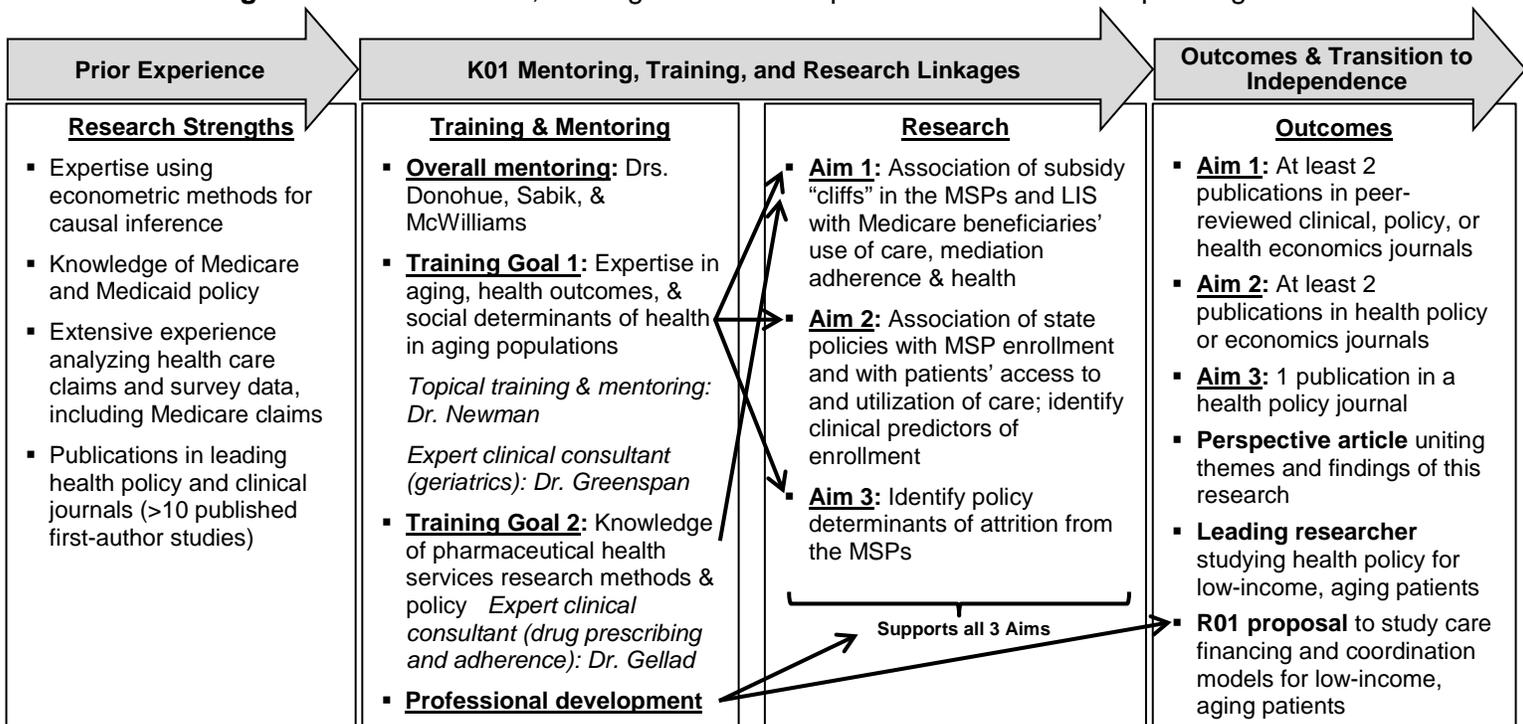Candidate Information and Goals for Career Development

Readings will focus on three topic areas: (1) the Medicare Part D program, including its structure and impacts on medication use and health outcomes; (2) measurement of appropriate medication use and adherence; and (3) clinical and economic outcomes associated with medication non-adherence. We will also discuss techniques to apply measurement methods (e.g., medication adherence) from prior research to my analyses for Aim 1.

- **Expert clinical consultation.** Through twice quarterly in-person consultations with Dr. Walid Gellad, a physician and expert on pharmaceutical prescribing and policy, I will discuss empirical strategies for measuring medication non-adherence in claims data and learn about clinical outcomes of medication non-adherence in aging populations.

<u>**Conferences, seminars, & professional development:**</u> To develop skills as an independent investigator, and in support of my research aims, I will participate in the following seminars, conferences, and courses:

- **Pittsburgh Center for Research on Health Care (CRHC) Seminar.** This is a weekly seminar for health policy research, co-sponsored by the University of Pittsburgh's health sciences schools, the University's CTSI, the Veterans Administration, and the RAND-University of Pittsburgh Health Institute.
- **Gerontological Society of America (GSA) Annual Scientific Meeting.** I will attend and present my research at the GSA's annual meeting. I will also attend pre-conference workshops, which provide training on a rotating panel of topics including: long-term care, chronic illness, and health disparities.
- **National health policy & economics conferences.** I will attend and present my research at Academy Health's Annual Research Meeting (ARM) and at the American Society of Health Economists' annual meeting. At the ARM, I will attend pre-conference interest groups and workshops in health disparities and health economics to receive ongoing training in these areas.
- **CLRES 2050 – Ethics & Responsible Conduct of Research (1 credit x 1 semester).** This in-person course at the University of Pittsburgh provides training in the responsible conduct of research, including privacy, confidentiality, the protection of human subjects, informed consent, and IRB processes.
- **CLRES 2071 & 2072 – Advanced Grant Writing I & II (3 credits x 2 semesters).** This course guides students through the development of NIH grant proposals, culminating in the preparation of a submission-ready R01. I will take this course in the third year of the award period, coinciding with the formulation and submission of my first R01 proposal (see **Table 1,** below).

Figure 1: Links between, training and research plans and career development goals

Prior Experience	K01 Mentoring, Training, and Research Linkages		Outcomes & Transition to Independence
Research Strengths	**Training & Mentoring**	**Research**	**Outcomes**
▪ Expertise using econometric methods for causal inference	▪ <u>**Overall mentoring:**</u> Drs. Donohue, Sabik, & McWilliams	▪ <u>**Aim 1:**</u> Association of subsidy "cliffs" in the MSPs and LIS with Medicare beneficiaries' use of care, mediation adherence & health	▪ <u>**Aim 1:**</u> At least 2 publications in peer-reviewed clinical, policy, or health economics journals
▪ Knowledge of Medicare and Medicaid policy	▪ <u>**Training Goal 1:**</u> Expertise in aging, health outcomes, & social determinants of health in aging populations	▪ <u>**Aim 2:**</u> Association of state policies with MSP enrollment and with patients' access to and utilization of care; identify clinical predictors of enrollment	▪ <u>**Aim 2:**</u> At least 2 publications in health policy or economics journals
▪ Extensive experience analyzing health care claims and survey data, including Medicare claims	*Topical training & mentoring: Dr. Newman*		▪ <u>**Aim 3:**</u> 1 publication in a health policy journal
▪ Publications in leading health policy and clinical journals (>10 published first-author studies)	*Expert clinical consultant (geriatrics): Dr. Greenspan*	▪ <u>**Aim 3:**</u> Identify policy determinants of attrition from the MSPs	▪ **Perspective article** uniting themes and findings of this research
	▪ <u>**Training Goal 2:**</u> Knowledge of pharmaceutical health services research methods & policy *Expert clinical consultant (drug prescribing and adherence): Dr. Gellad*		▪ **Leading researcher** studying health policy for low-income, aging patients
	▪ <u>**Professional development**</u>	**Supports all 3 Aims**	▪ **R01 proposal** to study care financing and coordination models for low-income, aging patients

Table 1 summarizes the timetable of my training, mentoring, and research activities. I anticipate completing these activities over a four-year period, which will be feasible as I have an in-process application for the main dataset (Health and Retirement Study-linked claims) supporting this project and anticipate receiving these data by the beginning of the K01 award period. I will dedicate 75% of my effort to research and the training activities listed below, and 25% to complementary research activities and departmental teaching and service.

Candidate Information and Goals for Career Development

These activities will support my professional development and equip me to become an independent investigator upon completion of the K01.

Table 1: Mentoring, Training, and Research Timetable

Year 1	Year 2	Year 3	Year 4
Overall training & research mentoring (years 1-4):			
▪ Meet twice per month with Dr. Donohue ──────────────────────────────────▶			
▪ Meet twice per quarter with Drs. Sabik & McWilliams ────────────────────────▶			
Training Goal 1: Develop expertise in aging research, including the aging process, clinical outcomes of health interventions, and the social determinants of health in aging populations			
▪ **Competencies I will gain:** Understand the aging process, health conditions, and outcomes of health care use in low-income, aging populations. This training will prepare me to analyze clinical conditions and outcomes of health care use, which may be affected by premium and cost-sharing subsidies in the Medicare Savings Programs and the Part D Low-Income Subsidy.			
▪ **Related research activities:**			
▪ **Aim 1**: Identify clinical conditions sensitive to utilization of care and associated health outcomes			
▪ **Aims 2 and 3:** Identify clinical and social factors associated with enrollment in vs. attrition from the MSPs and LIS			
Coursework and training institutes:			
▪ **RAND Summer Institute** (1 week in summer 2019) ▪ **EPIDEM 2900:** Epi. of Aging (2 credits x 1 semester) ▪ **EPIDEM 2950:** Epi. of Aging Workshop (1 credit x 2 semesters)	▪ **National Institute on Aging Butler-Williams Scholars Program** (1 week in summer 2020) ▪ **EPIDEM 2981:** Epi. of Aging-Methods (2 credits x 1 semester)		
Supervision of aging training (years 1-4): Quarterly meetings with Dr. Newman ───────────────▶			
Expert clinical consultation (years 1-4): Consultation with Dr. Greenspan (2x per quarter) ──────▶			
Training Goal 2: Acquire training in pharmaceutical health services research and policy			
▪ **Competencies I will gain:** Measure medication utilization and adherence in claims data and identify clinical outcomes associated with adherent vs. non-adherent medication use; gain an understanding of policy research on the Medicare Part D program.			
▪ **Related research activities:**			
▪ **Aim 1:** Measure medication use/adherence in claims and associated clinical outcomes in the context of Part D subsidies			
Coursework and structured readings:			
▪ **EPIDEM 2850:** Pharmacoepidemiology (2 credits x 1 semester) ▪ **Structured readings** in pharmaceutical health services research & policy (monthly with Dr. Donohue)	▪ **Structured readings** in pharmaceutical health services research & policy (monthly with Dr. Donohue)	▪ **Structured readings** in pharmaceutical health services research & policy (monthly with Dr. Donohue)	
Expert clinical consultation (years 1-3): Consultation with Dr. Gellad (2x per quarter) ──────▶			
Conferences, Seminars, and professional development: I will take courses and participate in university seminars and national conferences to enhance my research skills and to present in-progress work on **Aims 1-3.**			
Coursework:			
▪ **CLRES 2050:** Ethics & responsible conduct of research (1 crdt. x 1 sem.)		▪ **CLRES 2071 & 2072:** Advanced Grant Writing I & II (3 credits x 2 semesters)	
Research seminars and national conferences/scientific meetings (Years 1-4): ──────────────────▶			
▪ University of Pittsburgh's Center for Research on Health Care Seminar (weekly seminar; present 1-2x per year) ▪ Gerontological Society of America (GSA) Scientific Meeting (annual conference; present in years 2-4) ▪ AcademyHealth Annual Research Meeting (annual conference; present in years 2-4) ▪ American Society of Health Economists (annual conference*; present in years 2-4) [* Annual beginning in 2019]			
Research Timetable, Output, & Milestones:			
▪ **Aim 1** ◀────────────────────────────▶			
▪ **Aim 2** ◀────────────────────────────▶			
▪ **Aim 3** ◀────────────────────────────────▶			
▪ **Develop R01 / Transition to independence** ◀──────────────────────────▶			
	▪ Publish Aim 1 Paper #1 ▪ Publish Aim 2 Paper #1	▪ Publish Aim 1 Paper #2 ▪ Publish Aim 2 Paper #2 ▪ Develop/submit R01 to study care financing and coordination models for low-income, aging patients	▪ Publish Aim 3 Paper ▪ Publish perspective article ▪ Revise and resubmit R01 (if necessary) ▪ **Transition to independence as a researcher**

Candidate Information and Goals for Career Development

SPECIFIC AIMS

Owing to social disadvantages and frailty, many low-income Medicare beneficiaries have recurring needs for care but limited means to pay for services that Medicare does not cover in full.[1-4] The Medicare Savings Programs (MSPs) and the Part D Low-Income Subsidy (LIS) were established to reduce patients' out-of-pocket health care costs by subsidizing premiums, cost-sharing, and co-payments for Medicare services.[5] Together, these programs can defray $4,500 or more in annual costs for recipients.[4,6,7]

Although an important source of assistance, several features of the MSPs and LIS leave many aging and disabled Americans vulnerable to high out-of-pocket costs and with potentially limited access to care.[5,8,9] First, eligibility for these programs is restricted to individuals whose income and assets are below specific thresholds. Individuals just above these thresholds qualify for substantially less—or in some cases no—assistance, creating subsidy "cliffs" that may limit access to care and have adverse consequences for health.[7,10-12] Policy makers have recommended raising and aligning eligibility limits for the MSPs and LIS,[1,5,13] but lack evidence about how the programs' current structure affects use of care and health.

Second, differences in state Medicaid policy may affect patients' enrollment in and access to care via the MSPs, which are "partial" Medicaid benefits. One source of policy variation that may affect these outcomes is the amount state Medicaid programs reimburse providers for care. States with low Medicaid payment rates may reimburse providers for only some—or in some cases none—of Medicare Part B cost-sharing and deductibles, which are waived for recipients of the Qualified Medicare Beneficiary (QMB) program (the largest of the MSPs).[9,14-16] Little research has examined the relationship of payment rates with access to care and with QMB enrollment, which may be mediated by provider access. Another salient area of policy variation is the degree to which states have simplified Medicaid recertification rules for patients, which may affect the continuity of MSP coverage.[17-19] Because MSP recipients are automatically eligible for the LIS, variation in Medicaid payment and re-enrollment policies could similarly affect participation in the LIS.[20]

To evaluate how subsidy cliffs in the MSPs and LIS affect patients' use of care and health, and to assess the impact of state policies on health care access, subsidy enrollment, and subsidy retention, I will use the Health and Retirement Study (HRS) linked to Medicare and Medicaid claims to address the following Aims:

Aim 1 – Assess the association of subsidy "cliffs" in the MSPs and LIS with use of care and health. I will use a quasi-experimental regression discontinuity design that compares individuals just above vs. below eligibility thresholds for the MSPs and LIS, whom I will identify using detailed income and asset data in the HRS. Using linked claims, I will assess differences in patients' use of and adherence to prescribed medications, visits with physicians, hospital utilization, and health status associated with subsidy cliffs.
    Hypothesis: Abrupt reductions in financial support at MSP/LIS eligibility thresholds are associated with lower drug adherence, fewer physician visits, increased hospital use, and poorer health.

Aim 2 – Estimate the association between states' physician payment rates and MSP/LIS enrollment and access to care. Using published fee schedules and HRS-linked Medicaid claims, I will construct a longitudinal database of states' payment rates for Part B cost-sharing and deductibles in the QMB program. I will estimate the relationship between changes in states' QMB payment rates and QMB enrollment, as well as changes in access to care and visits with physicians, safety net providers (e.g., FQHCs), and hospital EDs.
    Hypothesis 1: Lower QMB payments are associated with a lower likelihood of QMB enrollment, particularly among healthier patients.
    Hypothesis 2: Lower payments lead to reduced access to physicians and to greater safety net and ED use.

Aim 3 – Estimate the association between state policies and MSP disenrollment. Using enrollment data for HRS respondents linked to state policy measures, I will conduct multivariable survival analyses to assess the association of state Medicaid policies with disenrollment from the MSPs, including policies intended to simplify program recertification. Supplementary analyses will examine attrition from the LIS.
    Hypothesis: Policies that streamline MSP enrollment and recertification are associated with lower attrition.

This research will quantify the impacts of subsidy cliffs, provider payment policies, and recertification rules on low-income Medicare beneficiaries' access to care, receipt of care, and retention of subsidies. Study findings can guide reforms to improve the structure and accessibility of subsidy programs to address vulnerable patients' health needs and to reduce health care disparities. This research and accompanying training will equip me to lead future studies examining policy innovations to improve access to and coordination of care for Medicare beneficiaries dually enrolled in Medicaid (a subset of the QMB population).

RESEARCH PLAN

1. Significance

Nearly 25% of Medicare beneficiaries have household incomes below 150% of the Federal Poverty Level (equivalent in 2017 to $24,360 for a family of two), and of these beneficiaries, half have annual health care costs exceeding $5,400.[21] Although the Medicare program constitutes an important source of insurance for elderly and disabled persons, it does not cover all health care costs for enrollees.[4,22,23] For example, for Part B services, beneficiaries face annual premiums of $1,600, a $180 annual deductible, and co-insurance (20% of Part B charges after the deductible is met). For Part D coverage, beneficiaries incur an annual premium, a $400 deductible, and co-payments, which can exceed $100 for some brand-name drugs.[4,5,19]

The economic rationale for insurance deductibles and cost-sharing is that these policies promote efficient health care use by requiring consumers to bear responsibility for a portion of their health care spending.[24] However, a large body of research shows that income- and asset-limited individuals broadly curtail spending on care—including medically necessary prescription drugs and preventive care—when exposed to higher out-of-pocket costs.[10,12,25-28] Poor medication adherence and deferred preventive care could have unintended consequences, resulting in untreated health conditions, poor health, and increased needs for acute care, the cost of which falls disproportionately on Medicare.[10,29,30]

The **Medicare Savings Programs (MSPs)**—encompassing the Qualified Medicare Beneficiary (QMB), Specified Low-Income Medicare Beneficiary (SLMB) and Qualified Individual (QI) programs—and the **Part D Low-Income Subsidy (LIS)** were established to reduce low-income patients' out-of-pocket costs of care. Implemented at different times and with varying eligibility requirements, these programs constitute a "patchwork" of financial supports.[2,5,7,8,19,20] A consequence of this patchwork is that the level and type of financial assistance to which Medicare beneficiaries are entitled differs abruptly at specific thresholds of income and assets—creating subsidy "cliffs"—even though individuals' financial resources differ minimally from below to above these thresholds.

Subsidy cliffs have substantial consequences for patients (Figure 2).[5] For example, beneficiaries with income below 100% of the Federal Poverty Level (FPL) are eligible for subsidies for Part B cost-sharing and for Part A & B deductibles, whereas those above this income level are not, resulting in a potential annual subsidy cliff of $1,800 (see figure notes for details). Above 135% of the FPL, patients are no longer eligible for the Part B premium subsidy and face modest Part D premiums, deductibles, and co-payments.[7] Patients with income exceeding 150% of the FPL do not qualify for any LIS subsidies.[31] The impact of these subsidy cliffs may be greater for sicker patients in need of recurring, high-cost care.

The structure and alignment of subsidies across the MSPs and LIS is the subject of ongoing debate.

Figure 2: Illustration of Subsidy Cliffs in the MSPs and Part D LIS
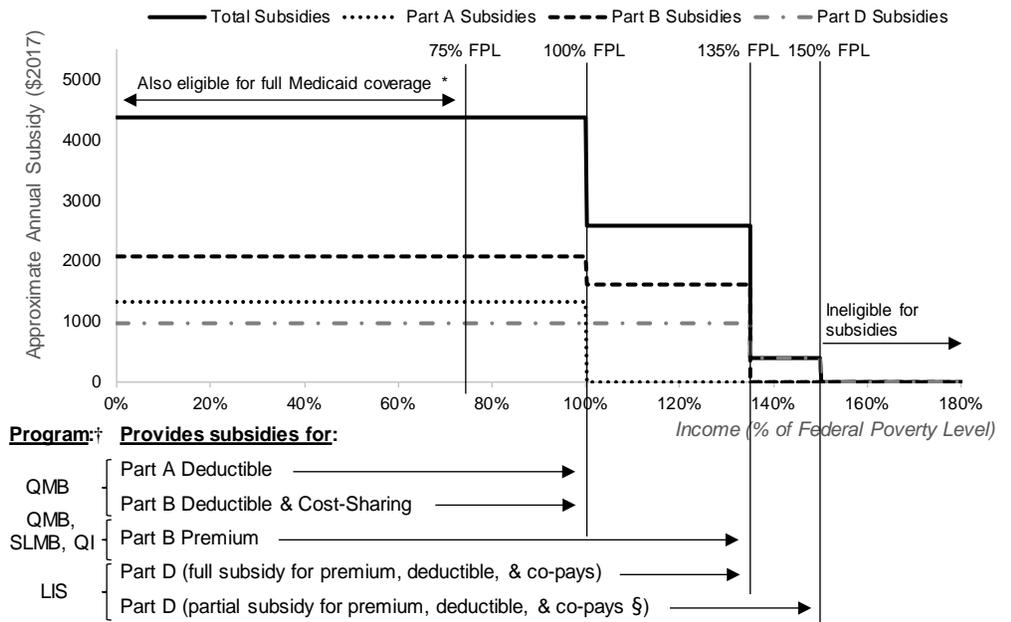
Note: Calculations of potential subsidy cliffs are based on 2017 Medicare Part B and Part D premiums (assuming enrollment in a benchmark Part D plan), cost-sharing requirements applied to national estimates of median annual expenditures for Part B and Part D services for Medicare beneficiaries in the Medical Expenditure Panel Survey, and assuming one annual hospital admission (subject to the Part A deductible). The potential value of the subsidy cliffs could be higher or lower depending on a patient's needs for care.
* Beneficiaries with incomes below the SSI limit (75% of the FPL) or state-specific income limits qualify for full Medicaid coverage, which in addition to premium, cost-sharing, and co-payment subsidies covers Medicaid-insured services (e.g., nursing home stays and dental care).
† Program eligibility requires meeting income *and* asset tests. Only income limits are depicted in the Figure.
§ Sliding-scale premium, reduced deductible ($80), and 15% co-payments.

The Medicare Payment Advisory Commission has called for raising the income limit for Part B premium subsidies to 150% of FPL to align with the LIS.[1,13] Other experts have recommended increasing eligibility further—to as high as 200% of the FPL—citing the continued vulnerability of near-poor Medicare beneficiaries to high out-of-pocket health care costs.[5] However, policy makers lack evidence about how the current structure of MSP and LIS subsidies affects patients' access to care, use of services, and health. Such evidence is essential for guiding changes to policy and for illuminating

the consequences of proposed reforms for patients, the Medicare program, and states, which administer the MSPs and share financing of their costs with the federal government.

A further concern is that enrollment in the MSPs and LIS is low and that attrition is high. Fewer than one-half of eligible individuals receive are enrolled in the MSPs and LIS,[17,20,32] and a sizeable proportion of recipients periodically lose subsidy coverage.[33] Moreover, studies have reported wide variation in rates of MSP and LIS participation across states,[20,32] suggesting the potential for differences in state policy to contribute to differences in enrollment and retention.

Two aspects of state Medicaid policy may contribute to differences in enrollment and retention in the MSPs (the MSPs are "partial" Medicaid benefits). _First,_ a substantial body of research shows that Medicaid enrollment increases when the program facilitates greater access to care.[12,34-37] For Medicare beneficiaries enrolled in the Qualified Medicare Beneficiary (QMB) program—the largest of the MSPs—states' Medicaid programs pay for deductibles and cost-sharing for Part B services.[15] The 1997 Balanced Budget Act gave states the option of paying providers for less than the full value of these Part B subsidies when the state's Medicaid fee schedule was lower than Medicare's (as is the case in most states).[14,38] The relationship between these changes in payment policy, access to care, and enrollment in the QMB program is not well known. _Second,_ some states have adopted policies to streamline the process by which patients recertify their eligibility for Medicaid programs, including the MSPs. Changes have included the use of simplified re-certification forms, verification of income and assets from other administrative sources, and the use of outreach workers to facilitate renewals.[17,18,39] To the extent these changes affect MSP enrollment and retention, they could also affect LIS participation, as MSP recipients are automatically "deemed" eligible for the LIS.[20]

Policy significance and impact – Improving low-income patients' access to care is a policy priority and recognized as critical to remedying health care disparities.[40] Safety net programs, including Medicaid, the MSPs ("partial" Medicaid benefits), and the LIS are intended to facilitate such access, but may not eliminate barriers to care for some patients. A common feature of these programs is that their level of assistance declines discontinuously in income and assets, creating subsidy cliffs. Patients caught in these cliffs face the predicament of being "too well off" to qualify for help, yet having too few resources to afford care on their own.[41] _Aim 1_ will assess whether there are unintended consequences of structuring safety net programs with subsidy cliffs, versus gradually tapering benefits as household income and resources rise. This work will provide evidence needed to guide changes to the structure of safety net programs to increase their benefits to low-income patients. In addition, safety net programs including the MSPs and LIS have difficulty enrolling and retaining eligible individuals, which can result in "churning" and disruptions in care.[42-44] _Aims 2 & 3_ will examine the role of state policy in facilitating take-up and retention of the MSPs and LIS, including the impact of payment policy on subsidy receipt and access to care. Study findings will identify state-level reforms that may increase enrollment in Medicare subsidy programs.

In summary, these studies will enhance policy makers' understanding of the impacts of subsidy structure, payment policy, and enrollment and recertification rules on patients' receipt of financial assistance and use of care. Evidence generated from this research can guide reforms to increase the benefits of these subsidies to low-income Medicare beneficiaries and to the Medicare program.

2. Innovation

First study to assess impacts of subsidy cliffs in the MSPs and LIS – The structure of eligibility thresholds and subsidy cliffs in the MSPs and LIS have been the subject of ongoing debate,[1,5,13] but no research has examined the impact of subsidy differences on access to care, use of services, or health status. To inform policy making, this study will use a regression discontinuity design to quantify the impact of subsidy cliffs on these outcomes. This design is innovative because it isolates the association of subsidy differences from other factors, enabling unbiased inferences. _Further, by using discontinuities in subsidy eligibility as an identification strategy, this will be the first study to estimate the causal impact of MSP and LIS eligibility on health outcomes._ **Robust analysis of the association of physician payment with QMB enrollment, use of care, and access to care –** No research has examined whether changes in states' payment policies are linked with QMB enrollment or characteristics of enrollees (e.g., selective take-up among sicker vs. healthier patients). Moreover, the few studies that have assessed the relationship between QMB payments and utilization may have produced biased estimates by failing to account for selection effects.[9,45] I will address this limitation by using detailed patient characteristics in the HRS to test for patient selection into QMB when states change their payment policies. Furthermore, I will use these patient-level variables to adjust estimates of the relationship between payment rates in the QMB program and patients' use of care. This approach will provide a richer understanding of how changes in provider payments affect QMB enrollment and use of care.

Detailed analysis of policy determinants of disenrollment from the MSPs – Prior analyses documented high rates of attrition from the MSPs,[33,46] but no studies have examined the relationship of state policies with disenrollment. This will be the first study to empirically assess policy-level determinants of disenrollment.

3. Approach

All analyses will use the Health and Retirement Study (HRS) linked to Medicare & Medicaid claims, through a DUA with the University of Michigan and CMS. These data do not contain confidential patient identifiers.

Aim 1 – Assess the association of subsidy "cliffs" in the MSPs and LIS with use of care and health.

Eligibility thresholds in the MSPs and LIS create subsidy "cliffs," whereby small increases in income or assets make someone eligible for much less—or in some cases no—financial support. Aim 1 will employ a regression discontinuity design ("RDD") to investigate the effects of these subsidy cliffs on Medicare beneficiaries' use of care and health. The RDD is well-suited to this analysis, as it harnesses the fact that beneficiaries just above vs. below specific thresholds are eligible for different subsidies, but are unlikely to differ on other determinants of health or use of care, creating quasi-random variation in exposure to subsidies.[47-49]

Using a cross-section of HRS respondents linked to fee-for-service Medicare claims, I will estimate the association of subsidy cliffs with health outcomes at 3 thresholds of income: (1) from below to above 100% of the FPL, when beneficiaries no longer qualify for subsidies for Part B cost-sharing or for Part A and B deductibles; (2) from below to above 135% of the FPL, when Part D subsidies decline and beneficiaries no longer qualify for the Part B premium subsidy; and (3) from below to above 150% of the FPL, when beneficiaries no longer qualify for any Part D subsidies (see **Figure 2**). The outcomes I will assess, and the data sources and conceptual motivation for these measures, are detailed in the table below:

Table 2: Aim 1 Outcomes

Outcome:	Data Source and Variable Description:	Rationale and Notes:
Use of disease-appropriate drugs	**Part D claims** – Assess whether patients received disease-appropriate medications in a study year.	Patients facing increased out-of-pocket liability for prescription drug costs have lower rates of drug fills and adherence.[26,29,50] Given the prevalence of hypertension, hyperlipidemia, diabetes, asthma, and depression in the Medicare population, and evidence that drug adherence for these conditions is sensitive to out-of-pocket costs,[10] I will conduct sub-analyses among patients with these conditions.
Medication adherence	**Part D claims** – Among beneficiaries meeting a minimum threshold of drug use, I will assess the proportion of days covered (=days prescribed/total days) and gaps in days of medication supplied.[51]	
Cost-related medication non-adherence	**HRS** – Assessed from HRS survey questions that ask about delayed/skipped medication use due to prohibitive out-of-pocket costs.	
Physician visits	**Part B (Carrier file) claims** – I will assess visits with primary care/specialist physicians.	Higher out-of-pocket costs may cause patients to delay or forego needed care.[52]
Access to a physician for usual care	**HRS** – Assessed from HRS survey questions that ask about having a physician for usual care and financial impediments to having a usual source of care.	Out-of-pocket payments for Part B services may impede access to physicians, including those who would serve as a usual care source.
Inpatient and skilled nursing facility use, and spending	**MedPAR file** for inpatient and skilled nursing facility claims and **outpatient facility claims** for ED visits. Associated spending will also be measured.	Lack of preventive care and/or poor medication adherence may increase patients' acute care needs.[10,11] The effect of subsidy cliffs on hospital use may be most pronounced at income levels (135% and 150% of FPL) where subsidies for Part B & D services decline without associated changes in Part A subsidies.
Health status	**HRS** – Patient-reported indices of general health and mental health status.	Poor medication adherence, resulting from high out-of-pocket prescription drug costs, is linked with worse health and increased mortality.[10]
Mortality	**Beneficiary summary file** – Date of death.	

For each outcome and for each of the above-referenced eligibility thresholds, I will estimate a patient-level linear regression discontinuity model of the form:

$$y_i = \alpha + \delta * Threshold_i + \eta * Income_i + X_i'\beta + \mu_s + \varepsilon_i \tag{1}$$

where $Threshold_i$ is a binary indicator for whether patient *i* exceeded an eligibility threshold. Because the MSPs and LIS require individuals to meet income *and* asset tests, individuals exceeding the income eligibility threshold will not qualify for subsidies, while most below the threshold will qualify (conditional on having sufficiently low assets). This enables me to identify discontinuities in subsidy exposure based solely on income thresholds, and to adjust for residual differences in assets in the regression model (covariates denoted X_i).

The RD model assumes the outcome (*y*) would have trended smoothly through the eligibility threshold in the absence of a subsidy cliff,[47,49] such that δ is the difference in *y* attributable to the difference in subsidies from below to above the threshold. To enhance power, I will pool data from individuals within ranges of

thresholds (e.g., ±15/±25 percentage points of the FPL) and conduct sensitivity analyses to assess the robustness of estimates to the range of data used. To improve precision, I will adjust for demographic variables and established health conditions from Medicare data, and for additional measures of health socioeconomic status from the HRS (covariate vector X_i). I will adjust for a linear trend in income to account for the independent association of income with use of care and health ($Income_i$), and for state fixed effects (μ_s) to account for differences in certain MSP eligibility rules (e.g., asset limits) across states.[19] I will adjust estimates for survey weights and standard errors for the complex sampling frame of the HRS.

I hypothesize that abrupt reductions in financial support at MSP and LIS eligibility thresholds will be associated with lower medication use and adherence, fewer physician visits and a lower likelihood of having a usual physician for care, greater acute care use (particularly for non-elective services), and poorer health. To evaluate whether the impact of subsidy cliffs is pronounced for sicker patients, who often have high recurring health care costs,[3,52] I will conduct sub-analyses among patients with multiple comorbidities (e.g., concurrent hypertension, diabetes, and cardiovascular disease) in the Medicare Chronic Condition Data Warehouse.

"Fuzzy" RDD – Model (1) yields an "intention-to-treat" estimate of exposure to subsidy cliffs. Because a sizeable proportion of eligible Medicare beneficiaries do not enroll in the MSPs or LIS,[17,20,32] intention-to-treat estimates will be diluted by the presence of non-participants meeting eligibility criteria. To estimate the association of *receiving* subsidies with health outcomes (i.e., "treatment on treated" estimates), I will employ a *"fuzzy RD"* design that treats eligibility thresholds as Instrumental Variables (IV) for subsidy receipt.[47]

Tests of study assumptions – The RDD approach assumes that the only systematic difference between patients just above vs. below eligibility thresholds is their exposure to cost-sharing and premium subsidies. Thus, the validity of the study design hinges on the assumption that patients do not sort systematically on either side of a threshold in ways that might be related to their need for, or potential use of, care.[47,48] I will test these assumptions by checking for discontinuities in patient characteristics, and by examining "heaping" in the distribution of patients around eligibility thresholds, which would indicate potential bias from sorting.[53]

Sensitivity analyses – I will conduct the following sensitivity analyses: (1) examine an interaction between subsidy eligibility thresholds and sex to explore gender as a biological variable; (2) assess the sensitivity of RDD estimates to the range of observations used by pooling data from wider vs. narrower income ranges around income eligibility thresholds; (3) conduct analyses among Medicare beneficiaries on fixed incomes to mitigate the impact of measurement error on assessments of subsidy eligibility; and (4) check for potentially spurious findings by comparing RDD estimates to placebo estimates conducted at arbitrary income thresholds where no subsidy cliffs exist. Importantly, these placebo analyses will enable me to assess for Type I error, which could arise from multiple hypothesis testing and comparisons across multiple eligibility thresholds.[49]

Sample Size & Power – Analyses will be performed on a cross-section of HRS respondents with linked Medicare claims, among whom I will compare patients above vs. below eligibility thresholds for the MSPs and LIS. In the most recent survey wave of the HRS, there were 1,257 Medicare-linked respondents with incomes between 75% and 125% of FPL (encompassing the subsidy cliff at 100% of the FPL), and 1,299 respondents with incomes between 135% and 200% of the FPL (for the subsidy cliff at 150% of FPL). Conservatively assuming a sample of 1,200 patients and a clustered survey design (intra-class correlation=0.1), I expect to be able to detect an effect size of 0.2 (i.e., 0.2 standard deviations of the dependent variable) with 92.4% power assuming a two-sided Type I error rate of 5%. Assuming the same sample, I expect to be able to detect an equivalent effect size with 80.6% power assuming a 1% Type I error rate.

Limitations – My empirical strategy will address several potential limitations. Income in the HRS is assessed from survey data and may be missing or reported with error. To reduce missing data, I will use imputed income measures developed by RAND, which are publicly available and linkable to the core HRS dataset.[54] To mitigate measurement error—which may arise from misreported income or unreported changes in income across survey waves—I will conduct sub-analyses among patients with fixed incomes (e.g., whose predominate income source is Social Security). I will also conduct analyses excluding individuals in the immediate vicinity of thresholds, for whom small differences in actual vs. reported income are most likely to impact assessments of subsidy eligibility. A further concern is that individuals above vs. below thresholds may differ in unobserved ways that are related to the outcomes of interest. Tests of heaping and discontinuities in patient characteristics around eligibility thresholds will allow me to assess for and address this bias.

Aim 2 – Association of states' physician payment rates with MSP/LIS enrollment and access to care.

QMB is the largest of the MSPs, enrolling 7.2 million Medicare beneficiaries in 2016. The program is administered by states, which "buy in" to Medicaid on behalf of recipients.[8] Because QMB is a "partial"

Medicaid benefit, states may use their Medicaid fee schedules as a basis for reimbursing providers for Part B cost-sharing payments and deductibles for QMB recipients, for whom these out-of-pocket costs are waived. In the last 20 years, a growing number of states have opted to pay providers less than the full amount of these subsidies when the state's Medicaid fee schedule was lower than Medicare's.[14,15,55] The impact of these payment changes on access to care and on QMB enrollment remain poorly understood.

To track changes in payments to providers, I will assemble a longitudinal dataset of states' reimbursement of providers for QMB recipients' Part B cost-sharing and deductibles during 1999-2016 (the years for which I will have contemporaneous HRS-linked Medicare and Medicaid claims). I will construct this dataset using payment policies catalogued by the Medicaid and CHIP Payment Advisory Commission[1] and the Urban Institute/Kaiser Family Foundation.[15,16,56-58] I will empirically verify these data and impute missing observations using HRS-linked Medicaid claims, which include a field for Medicaid co-insurance payments for services where Medicare was the primary payer. I will use these claims to annually assess QMB payments for a "basket" of prevalent Part B services (e.g., office visits for new/established patients), with which I will estimate the proportion of waived Part B costs that states' QMB programs reimburse providers.[59] *I expect to find substantial variation in states' QMB payment rates, as a large number of states have changed their QMB payment policies, and since policies including the Affordable Care Act's Medicaid fee "bump" exogenously changed states' Medicaid fee schedules during the study period.[60,61]* Using this dataset, I will conduct two sets of analyses, as follows:

- **Estimate the relationship between states' QMB payment rates and QMB and LIS enrollment, including associated changes in the characteristics (e.g., health status) of subsidy recipients.**

Economic theory posits that an individual will enroll in an insurance program if its expected benefit exceeds the cost of enrolling.[62] Although there is no direct cost of participating in QMB, Medicare beneficiaries who do not receive Supplemental Security Income must apply annually for the program and demonstrate sufficiently low income and assets to receive subsidies in each enrollment period.[2,63] These application rules constitute an implicit cost of obtaining coverage, which may deter participation among individuals for whom the potential benefit of the QMB subsidy is low.[64] I hypothesize that QMB's potential benefit is tied, in part, to physicians' economic incentives to see QMB patients: all else equal, physicians receiving lower payments have fewer incentives to see QMB patients, reducing access to care and thus the implicit value of the subsidy.[58,65-67]

Prior studies have linked physician payment rates for pediatric, obstetric, and primary care services with Medicaid take-up among children, pregnant women, and non-elderly adults, respectively.[34,35,37] However, no analyses have assessed the relationship between states' QMB payments and enrollment. Using within-state variation in states' QMB payments as a source of exogenous variation, I will estimate the following model:

$$\Pr(Enroll_{it} = 1) = \alpha + \theta Payment_{st} + \beta X_{it} + \phi S_{lt} + \varphi P_{st} + \mu_s + \eta_t + \varepsilon_{it} \tag{2a}$$

where θ captures the average association of within-state changes in QMB payments with enrollment. I will adjust for: (1) patients' health and socioeconomic status ($X_{i,t}$); (2) time-varying local-level measures of provider supply, including the availability of physicians and FQHCs per capita (S_{lt}); (3) time-varying state factors governing the ease of applying for and retaining QMB coverage (P_{st}, discussed further in Aim 3); and (4) state and year fixed effects (μ_s, η_t). *I expect the probability of QMB enrollment will be greater in states with higher provider reimbursements ($\theta > 0$).*

To assess whether changes in QMB payments are associated with differences in enrollment among more vs. less clinically complex patients, I will extend model (2a) as follows[68]:

$$\Pr(Enroll_{it} = 1) = \alpha + \gamma Payment_{st} + \delta(Payment_{st} \times Complex_i) + \beta X_{it} + \phi S_{lt} + \varphi P_{st} + \mu_s + \eta_t + \varepsilon_{it} \tag{2b}$$

I will compare patients on various clinical complexity measures—e.g., more vs. fewer chronic conditions, higher vs. lower HCC risk scores, and with vs. without disability. The interaction coefficient δ captures the differential likelihood of QMB enrollment among more clinically complex patients in states increasing vs. lowering payments. *I hypothesize that QMB enrollment among healthier/less complex patients will be <u>more</u> responsive to variation in physician payments—and their attendant effects on access to care—than among more medically complex patients, whose greater needs for care make them consistently more likely to have QMB coverage (i.e., $\delta < 0$).* Such a result would have key policy implications, as it would show that states reducing provider payments tend to attract sicker—and thus costlier to insure—patients to the QMB program.

Since individuals with QMB are deemed eligible for the LIS,[20] I will replicate regressions (2a) and (2b) to estimate the probability of LIS enrollment as a function of QMB payments. I expect to find a positive "spillover" effect of higher QMB reimbursements on LIS enrollment.

- ▪ **Assess whether changes in states' QMB payment rates are linked with changes in QMB recipients' access to and receipt of care from physicians, safety net providers, and EDs.**

Numerous studies have linked Medicaid physician fees to health care access and utilization among children and nonelderly adults.[35,64,66,69] However, analysis of the association of states' QMB payments with access to and receipt of care has been more limited. One prior study used data from 9 states and a difference-in-differences design to compare changes in physician visits among Medicare beneficiaries with vs. without QMB coverage in states with vs. without payment changes over a 3-year period (1996 to 1998). It found small reductions in the primary care visits, but no changes in specialist visits, associated with lower reimbursements to providers.[45] However, because the study adjusted for few patient characteristics, its results for physician visits could have been biased to the null if patients with QMB in states reducing payment rates were sicker on average than patients in higher-payment states.[36] (Sicker patients, who use more physician services, are more likely to benefit from QMB coverage even if fewer physicians in their state participate in the program due to lower payments, attenuating differences in utilization between QMB enrollees in low vs. high payment states.)

Harnessing within-state variation in states' payment of providers for Part B cost sharing, I will assess the association of payment changes with the outcomes listed in **Table 3**. To mitigate bias from selection effects correlated with payment changes, I will use detailed patient characteristics in the HRS and findings from the prior analysis to control for patient factors

Table 3: Aim 2 Utilization Outcomes

Outcome Variable:	Data Source and Rationale:
Physician visits	**Part B claims (visits) and HRS (usual care) –** Lower payment rates may discourage physicians from serving QMB recipients.[69]
Patient has access to a physician for usual care	
Visits to safety-net providers	**Outpatient facility claims –** Safety-net providers, including FQHCs, provide care to vulnerable patients who would otherwise lack access.[9,70]
Visits to hospital Emergency Departments	**Outpatient facility claims –** Patients lacking access to ambulatory care may rely on hospital EDs for care.[9]

associated with selection into the QMB program when states change their payment rates. Adjusting for these confounders, I will assess changes in utilization and access associated with changes in states' QMB payments in the following difference-in-differences model:

$$Y_{it} = \alpha + \pi Payment_{st} + \lambda QMB_{it} + \delta Payment_{st} \times QMB_{it} + \beta X_{it} + \varphi P_{st} + \phi S_{lt} + \mu_s + \eta_t + \varepsilon_{it} \qquad (2c)$$

where δ captures the differential change in utilization/access comparing QMB enrollees to non-enrollees in states enacting larger vs. smaller (or no) payment changes. The other covariates are as described for (2a). *I hypothesize that QMB enrollees in states lowering payments will use fewer outpatient physician services and have higher rates of FQHC and ED use, while reporting greater difficulty accessing physicians for usual care.*

Sensitivity analyses and robustness tests – In robustness tests, I will re-estimate model 2(c) with propensity score weights to balance observed characteristics of patients across states with vs. without payment changes.[71,72] Analyses stratified by sex will be conducted to explore sex as a biological variable.

Sample Size & Power – Analyses for Aim 2 will be conducted on a panel of HRS respondents with linked Medicare claims who met QMB eligibility criteria. With the exception of a few states (e.g., Maine, Connecticut and DC), QMB eligibility is limited to individuals with income <100% of FPL and sufficiently low assets. Annually, there are approximately 1,200 HRS respondents who meet these eligibility criteria, whom I will follow before and after state payment changes. For this sample, I expect to have 91.0% power (with 5% Type I error) to detect an effect size of 0.2 SDs associated with a change in states' provider reimbursements.

Limitations – Provider payments may vary for different services and specialties, such that the payment changes I measure may be more salient for patients receiving some services but not others. I will assess rates for prevalent primary care services, and to the extent data permit, will conduct analyses using payments for specialty services. It is also possible that changes in state policies coinciding with, but distinct from, payment policies could independently affect QMB enrollment and utilization. To isolate the effects of payment changes, I will control for potentially confounding time-varying state factors (P_{st}), including variables identified in Aim 3.

Aim 3 – Association of state policies with MSP disenrollment.

Recipients of the MSPs must periodically recertify eligibility to remain enrolled in these programs. Beyond factors that directly affect eligibility—e.g., changes in income, assets, or family structure—state policies governing the administrative ease of recertifying eligibility for Medicaid programs and the generosity of coverage may affect retention[2] (the MSPs are partial Medicaid benefits). The LIS is federally administered, and the Social Security Administration makes eligibility determinations that are uniform across states.[63]

Prior analysis of the determinants of disenrollment from Medicare subsidy programs is limited. One study found that 23% of QMB enrollees had ≥1 coverage gap during a 36-month period,[33] but did not identify policies that contribute to attrition. Since low enrollment may be driven in part by low retention, identifying drivers of attrition can help inform changes in policy to increase coverage.[6]

I will examine the association of state policies with disenrollment from the MSPs. Drawing from reports published by the Kaiser Family Foundation and complementary sources, I will catalogue policies governing the ease of re-certifying program eligibility and the generosity of MSP coverage, as the latter may affect patients' incentives to re-apply for subsidies (**Table 4**). In a cohort of community-dwelling Medicare beneficiaries with MSP enrollment in a baseline period, I will estimate Cox proportional hazard (survival) models to assess the association of these policies with the likelihood of disenrollment[74]:

$$\lambda(t|Z,X,H) = \lambda_0(t) \exp\{\theta Z_s + \beta X_i + \varphi H_{it}\}$$

where $\lambda_0(t)$ is the population's baseline hazard of disenrollment in time period t, and the explanatory variables include: (1) state policies in **Table 4** (Z_s); (2) baseline patient characteristics (X_i, including age, sex, and health characteristics); and (3) time-varying measures of income, wealth, and family structure, which affect ongoing eligibility (H_{it}). I will adjust estimates for survey weights and standard errors to account for the complex HRS sampling frame.

Table 4: Policy determinants of MSP renewal

Recertification policies:
- Shortened/pre-populated recertification forms[17,19,39]
- Eligibility verification using the administrative records of other safety net programs (e.g., food stamps), termed *ex parte* enrollment[17,18]
- Outreach workers to facilitate renewals[8]
- Reconsideration periods to expedite renewals following a termination of coverage[19]
- States automatically enroll SSI recipients in the MSPs ('1634' states)[73]

Policies affecting coverage generosity:
- QMB payments to providers (Aim 2)
- Liberalized or waived asset limits[19]
- Eligibility limits for 'full' Medicaid benefits (e.g., above the SSI eligibility limit vs. more restrictive criteria in '209(b) states')[19]

Sensitivity Analyses – Since individuals may shift between eligibility for different MSPs (e.g., from QMB to SLMB), but not out of MSP eligibility altogether, I will compare models of disenrollment from specific MSPs and from any MSP.[8] Further, given the potential for some policies (e.g., reconsideration periods) to expedite renewals following a loss of coverage, I will assess the risk of both short (≤90 day) and long (>90 day) periods without coverage.[19] I will also examine the association of state policies with disenrollment from the LIS.

Sample Size & Power – Analyses will be conducted in a cohort of HRS Medicare beneficiaries enrolled in one of the MSPs or LIS at least once over a 3-year period. In the HRS, 3,166 individuals had incomes below 150% of FPL. Assuming 50% were enrolled in the MSPs or LIS at least once during a 3-year period, I expect a baseline cohort of 1,583 persons, providing 97.0% power to detect an effect size of 0.2 with 5% Type I error.

Limitations – Analyses in this Aim have potential limitations, which I will address as follows. First, there is potential for omitted variable bias if unobserved state policies are correlated with observed factors included in the regression model. I will attempt to mitigate this bias by controlling for a range of relevant policy variables. Second, to the extent states liberalized re-enrollment rules or enhanced outreach to reduce high rates of MSP attrition, estimates of the association of state policies with disenrollment may be biased to the null due to policy endogeneity (i.e., reverse causality). Findings will be interpreted with appropriate caution and not as causal estimates. Third, changes to federal policy may have led to changes in MSP enrollment and retention over time. For example, the Medicare Improvement & Patient Providers Act required all states by 2010 to use federal LIS enrollment records to screen patients for the MSPs.[75] To account for these changes, I will perform analyses in separate patient cohorts with distinct follow-up periods (e.g., before vs. after 2010).

Dissemination – I anticipate that this project will result in at least 5 first-authored manuscripts in peer-reviewed clinical, health policy, or health economics journals, along with presentations at national conferences. I will also synthesize policy implications of this work by writing a perspective article for a leading clinical journal.

Timetable and Future Directions – The research phase of this K01 will occur over a 4-year period, aligning with my training plan (see **Table 1** for a timetable and anticipated outcomes). I plan to complete this project over a 4-year period, as my application for HRS-linked claims has already been submitted and preliminarily approved by the University of Michigan (approval letter enclosed in the *Protection of Human Subjects* section). This data application is now under review at ResDAC for linked claims. I expect final data approvals and an executed DUA by fall 2018, allowing me to begin analyses shortly thereafter. In the third year of the award period, I plan to develop and submit an R01 proposal to evaluate payment reforms to improve care delivery and coordination for patients dually enrolled in Medicare and Medicaid (a very low-income subset of the QMB population). This K01 will equip me to evaluate a range of clinical and economic outcomes associated with payment and delivery system innovations tailored to this high-need patient population.