A. Specific Aims

Each year, hundreds of thousands of Veterans are hospitalized for new presentations and acute exacerbations of complex chronic conditions,[1,2] such as cardiovascular, pulmonary, neurologic, and substance use disorders. For each of these conditions, there are medications with strong evidence for slowing disease progression and improving clinical outcomes (e.g., quality of life, rehospitalization, and mortality) when prescribed and taken long-term.[3-10] Yet, use of evidence-based long-term medications following hospitalization is often deficient and inequitable, with disparities observed in prescribing by race, ethnicity, rurality, and socioeconomic status, including in VA.[11-20] To date, no studies have systematically assessed the quality and equity of evidence-based prescribing at hospital discharge, a critical time to initiate guideline-recommended care.

Measuring the quality of hospital care is a cornerstone of systems-based healthcare improvement. Performance measurement allows for the comparison of care delivery across VA medical centers (VAMCs) and offers opportunities to target quality improvement initiatives and learn from high performing sites, reflecting a *Learning Health Systems* approach.[21-23] Few metrics of hospital prescribing quality are currently in use, despite their past successes. The exemplar metric, initiation of beta-blockers following an acute myocardial infarction, was so successful that it was retired after 20 years because the practice had become nearly universal.[24] Despite this achievement, currently only one metric – initiation of statins after stroke – is routinely reported for medical hospitalizations.[25] Metrics focused on prescribing quality are inherently actionable, and in many conditions, the use of evidence-based medications has been shown to reduce 30-day readmissions and mortality.

The overall objectives of this proposal are to detect and understand determinants of quality and equity of evidence-based prescribing for hospitalized Veterans and to identify data-informed strategies to improve prescribing. Applying a conceptual framework rooted in pharmacoequity, we will assess hospital prescribing of evidence-based therapies in national VA cohorts with five exemplar common conditions, overall and across four sociodemographic domains. We will assess variation in prescribing quality and equity across VAMCs and Veterans Integrated Service Networks (VISNs), thereby building actionable performance metrics. We will identify common reasons Veterans do not receive evidence-based medications at hospital discharge to inform the selection of intervention strategies to close prescribing gaps. We will then present quantitative data to front-line clinicians and health systems leaders at high and low performing VAMCs to learn how best to address overall and equity-specific practice gaps and identify data-driven implementation strategies for future testing. Our specific aims are to:

1) **Examine the association of sociodemographic factors and receipt of evidence-based medications at hospital discharge across VAMCs.** We will conduct a retrospective cohort study using CDW to assess national and VAMC-level rates of evidence-based medication use (i.e., quality) across hospitalizations for five common complex chronic conditions (alcohol use disorder, atrial fibrillation, chronic obstructive pulmonary disease, heart failure, and ischemic stroke. We will measure equity of prescribing at discharge?? across four domains (sex, race and ethnicity, rurality, and neighborhood deprivation) and assess whether differences are driven by within- or between-VAMC care variation in care.
2) **Determine the common reasons Veterans do not receive evidence-based medications for XXX at hospital discharge.** We will conduct in-depth chart reviews, enhanced with CDW data, for a sample of 1,000 Veterans identified in Aim 1 as not receiving evidence-based medications at discharge, 200 for each exemplar condition, oversampling underrepresented Veteran sociodemographic groups. We will identify the reasons evidence-based medications were not offered or were declined and adjudicate the appropriateness of therapeutic decision-making.
3) **dentify barriers to and facilitators of equitable, high-quality discharge prescribing for XXX.** Guided by the Capability, Opportunity, Motivation – Behavior (COM-B) Model, we will conduct 60 semi-structured interviews with inpatient clinicians and VAMC operations leaders to identify barriers to and facilitators of equitable, high-quality discharge prescribing. Drawing on learning health system principles, interviews will elicit shareholder responses to their own VAMC's performance on quality and equity of hospital prescribing as well as preferred strategies for improving performance and perceived barriers and facilitators to implementation. Additionally, we will engage a shareholder expert panel longitudinally to identify highly rated, feasible intervention strategies.

This **work aligns with cross-cutting Health Systems Research (HSR) priorities** to apply Learning Health Systems foundational methods (data, systems, and implementation science) to achieve **VA Quintuple Aims** of improving outcomes and ensuring equity. Our multidisciplinary team has expertise in health services and qualitative research, health equity, pharmacoepidemiology, hospital medicine, and implementation science. We are partnering with the National Hospital Medicine Program, Office of Health Equity, and Center for Medication Safety – all of these operations partners informed the design of this proposal and will help disseminate our

Commented [MF1]: One issue to consider is the use of the terms prescribed LONGTERM. The reason I bring it up is three fold:

1)I started thinking how long is long-term
2)How long will you be following patients to see if they stay on prescribed meds post dc long term
3)Do the aims get at this long-term issue

Perhaps you have to change the message to something like - if the right meds are never started, it represents a missed opportunity to initiate disease altering medications.

Commented [MF2]: Add citations here?

Commented [MF3]: What timeframe? I assume more long-term? Can this be added?

Commented [MF4]: I wonder if you have to explicitly let the reviewers know that the sociodemographic domains represent your marginalized and non-marginalized patient populations and specifically call them out?

Commented [MF5]: Do you want to name this your expert shareholder panel etc. up front in a way that sets the stage for what you describe in the methods?

Commented [LH6]: Pardon my ignorance --is ischemic stroke a chronic condition? If not, delete "chronic" from the sentence

Commented [MF7R6]: I agree it seems different than the other 4 condition, which are chronic, but can have acute exacerbations.

Commented [MF8]: Are race and ethnicity a single factor or two unique factors? Need to make sure the numbers make sense.

Commented [MF9]: Link to conditions from Aim1

Commented [ASL(SP10]: Offered/prescribed? I'm not clear about the reason for the term offer. I understand the physician would discuss the new medication with the patient/caregiver, but they may not ask the patient if that sounds good or is okay.

Commented [MF11]: Not sure what's meant by longitudinally?

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findings. This project will yield critical evidence to guide research and quality improvement efforts to equitably improve healthcare delivery for hospitalized Veterans.

B. BACKGROUND

B.1. Hospitalizations are increasingly common and costly in VA. Today over 9 million Veterans are enrolled in VA healthcare, individuals who receive their care at 170 VA medical centers (VAMCs) across the country.[26] These VAMCs provide over 2.1 million inpatient hospital bed stays each year, a number that continues to rise due to policies expanding Veteran access to care,[27] as well as the aging of the Veteran population and resulting medical comorbidities.[28] Because the cost of hospitalizations continues to rise,[29] developing strategies to reduce primary hospitalization and readmissions represent an opportunity to advance the quality and efficiency of care for chronic conditions.

B.2 Hospitalizations for common conditions are an important inflection point in Veteran's health trajectories. Hospitalizations for complex chronic conditions, such as heart disease, respiratory illnesses, neurologic disorders, and substance use disorders, often mark a transition from routine outpatient management to more intensive care, reflecting an acute decline in health status that can have more long term implications. These episodes can lead to increased vulnerability to complications, functional decline, or readmissions. For Veterans, who may have unique health challenges related to chronic diseases, these hospital stays represent a pivotal moment where evidence-based treatments can be implemented and have a profound downstream impact. Effective therapeutic management during and after these hospitalizations is essential to improving long-term health outcomes, reducing hospital readmissions, controlling healthcare costs, and enhancing quality of life. By addressing the medical needs of Veterans with chronic diseases at these critical points, we can help improve overall quality of care for this growing patient population.

B.3. Evidence-based prescribing during hospitalizations for complex chronic conditions has the potential to improve clinical outcomes. For several common chronic conditions, there are evidence-based and guideline-recommended therapies that are critical to improving clinical outcomes. These outcomes include reducing symptom burden, hospital readmissions, morbidity and mortality, and improving quality of life. Pharmacotherapies play a critical role in advancing the health of Veterans with chronic diseases, yet our understanding of hospital-based prescribing in limited in VA.

B.4. Despite the ubiquity of hospitalizations for exacerbations of chronic conditions, few contemporary studies have assessed the quality of discharge prescribing in the VA health system. Whereas prior work has described overall quality and efficiency of care metrics for hospitalized patients (e.g., reducing length of stay, hospital acquired infections, and readmissions) few studies have directly examined hospital prescribing for chronic conditions, including in VA. Several VA and non-VA analyses have focused on the management of acute hospitalizations, such as antibiotic prescribing for acute infections (e.g., pneumonia, urinary tract infections) [30-33] or antiplatelet therapy for acute coronary syndrome.[34] An analysis of nearly 10,000 Veterans with stroke or transient ischemic attack (TIA), underutilization of statin therapy, including no treatment or underdosing after stroke, was observed in one-third of Veterans and was associated with higher 1-year mortality.[15] Prior work led by MPI Anderson has examined outcomes related to discharging Veterans with new therapies for hypertension and diabetes management in VA, yet there are opportunities to extend these findings to other common conditions.[35] A previous analysis conducted by MPI Essien and colleagues examined heart failure treatment in VA and reported variation in receipt of guideline-recommended therapies.[36] These findings, using older data from 2013-2019, highlighted important variation in VAMC prescribing for a common chronic condition. However, there was limited understanding of how equity influenced these study outcomes within and between VAMCs. These prior studies demonstrate a gap our work seeks to fill.

B.5. Measuring the facility-level quality of care is a cornerstone of systems-based healthcare improvement. Performance measurement allows for the comparison of care delivery across VAMCs and VISNs to both learn from high performing sites and set priority targets for national and local quality improvement efforts. The VA currently tracks multiple hospital quality metrics including length of stay, readmissions, surgical outcomes, and infections. However, few metrics of hospital prescribing quality are currently in use, despite their past successes. The exemplar metric, initiation of beta-blockers following an acute myocardial infarction, was so successful that it was retired after 20 years because the practice had become nearly universal.[24] Despite this achievement, currently only one metric – initiation of statins after stroke – is routinely reported for medical hospitalizations.[25] Metrics focused on prescribing quality are inherently actionable, and in many conditions, the use of evidence-based medications has been shown to reduce hospital readmissions and recurrence of acute exacerbations (e.g. guideline directed medical therapy for heart failure).

B.6. Our understanding of inequities in discharge prescribing within and outside VA is limited. Despite extant data describing disparities in medication receipt across various equity domains (e.g., race and ethnicity, sex, rurality, neighborhood deprivation), few have examined equitable discharge prescribing. Prior research, including work led by MPI Dr. Essien through a VA HSR Career Development Award has examined disparities in

Commented [MF13]: They also receive care at x outpatient clinics and y CBOCs among other sites.

Commented [MF14]: What policy increased access to VA inpatient care? May want to focus on the later, seems more relevant.

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Commented [MF16]: Can this sentence about management of acute conditions be better juxtaposed with the first sentence to better make your argument that such work doesn't exist for chronic conditions?

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Commented [MF18]: It may be more effective to describe these in terms of the marginalized patient populations rather than as "equity domains"

stroke-reducing anticoagulant therapy in VA for individuals in the outpatient setting with atrial fibrillation (AF). Such disparities have also been described outside VA in Medicare and condition-specific registries. One such analysis led by MPI Essien examining hospitalized patients with AF was one of the first to show that Black and Hispanic patients were less likely to be discharged from the hospital with stroke-preventing therapies. Refs Treatment disparities have also been described in the management of chronic cardiometabolic diseases both within and outside VA but few of these analyses have described variation in hospital discharge prescribing. Refs Furthermore, there is little evidence of facility-level variation in evidence-based prescribing, data that are critical to implementing care improvement strategies.

B.7. A comprehensive analysis of hospital prescribing quality and equity will add to generalizable knowledge and provide the foundation for evidence-informed quality improvement initiatives across VA. To inform the development of future interventions to equitably improve the quality of hospital prescribing and transitional care delivery, research is needed to systematically assess patterns of prescribing of evidence-based long-term therapies at hospital discharge, across conditions and VAMCs. The prior work of our research team highlights the importance of examining inpatient prescribing quality and equity to improving the care of Veterans. Dr. Anderson has documented gaps in evidence-based prescribing in Medicare[12-14,37] and has validated methods for identifying discharge medication initiation in the VA.[38-40] Dr. Essien has identified inequities and facility variation in evidence-based prescribing for Veterans with atrial fibrillation supported by his VA HSR Career Development Award.[11,16,41] Senior team members have contributed to seminal hospital care quality and equity papers.[42,43]

B.8. Our team is developing the requisite data infrastructure to measure the quality and equity of discharge prescribing for hospitalized Veterans. Through a Dr. Eugene March CHERP Pilot award received by MPIs Drs. Anderson and Essien, we are assembling a national cohort of Veterans hospitalized in 2022 and 2023 to identify the most common conditions for which Veterans are hospitalized as well as the evidence-based therapies these individuals are discharged with. This cohort will be used as the starting point for analyses described in Aim 1.

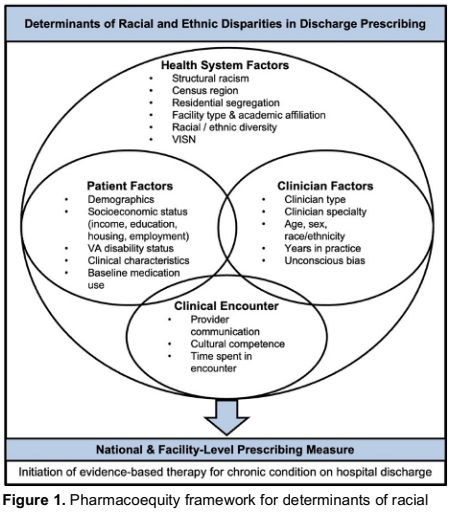

Figure 1. Pharmacoequity framework for determinants of racial and ethnic disparities in evidence-based prescribing on discharge.

B.9. Our research is informed by a novel pharmacoequity framework to understand multilevel determinants of discharge prescribing. We have adapted a Pharmacoequity Framework, established by MPI Dr. Essien and Co-I Dr. Gellad in 2021, which identifies a range of individual, health system, environmental, community, and sociopolitical factors that may contribute to quality and equity in health or health care of vulnerable populations (**Figure 1**).[44,45] This framework will be used to assess potential individual, clinician, and health system determinants of equitable, high-quality prescribing of guideline-recommended therapies to hospitalized Veterans, informing our quantitative, chart review, and qualitative research aims.

B.10. We have assembled an experienced transdisciplinary team to conduct this research. Our team includes core investigators from the Center for Health Equity Research and Promotion (CHERP) and the Center for the Study of Healthcare Innovation, Implementation and Policy (CSHIIP) with complementary research skills in data science, implementation science, qualitative research, pharmacoepidemiology, and health equity. Dr. Anderson and Dr. Essien will serve as MPIs leading the CHERP and CSHIIP sites respectively, as further detailed in the Multi-site Management Plan (**Appendix 6**). The CHERP-based team will lead Aim 1 quantitative analyses, the CSHIIP based team will lead Aim 3 qualitative analyses, and both sites will guide the Aim 2 chart review analyses.

- MPI: Timothy Anderson, MD, MAS is an internist and health services investigator who has led VA research exploring hospital prescribing patterns and post-hospital outcomes. Dr. Anderson has extensive experience studying hospital prescribing, using VA observational data, and examining care variation.
- MPI: Utibe Essien, MD, MPH is a VA hospitalist and health services researcher who has led VA funded research examining racial, ethnic, and socioeconomic inequities in medication prescribing for chronic

Commented [MF19]: What if anything is known about the 5 conditions you propose to study? Making the case for each would be helpful - both in terms of overall frequency of prescribing (quality) and equity of prescribing

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Commented [MF21]: Do you currently have any more data from this pilot that support your choice of the 5 conditions - more data would better help support your case.

diseases. Dr. Essien has led several studies examining pharmacoequity, qualitative research of clinicians around medication prescribing, and is a trained equity-focused implementation scientist.

- Leslie Hausmann, PhD, MSc is a social psychologist and CHERP Associate Director who has devoted her career to improving the health and health care of marginalized Veteran populations through research and quality improvement, including leading the development of the VA Primary Care Equity Dashboard (PCED).
- Michael Fine, MD, MSc is a general internist and the founding co-director of CHERP, who has over 25 years of experience conducting observational cohort studies and clinical trials with the overarching goal to detect, understand, and eliminate disparities in health care among marginalized patient populations.
- Alison Hamilton, PhD, MPH is a psychological and medical anthropologist and health services researcher with expertise in implementation science and integrative mixed methods. Dr. Hamilton serves as the CSHIIP Associate Director for Implementation Science and Qualitative Methods Lead.
- Walid Gellad, MD MPH is a general internist, Associate Chief of Staff for Research & Development at VA Pittsburgh, and health services researcher at CHERP focused on the quality, safety, and value of prescribing and prescription drug use.
- Sherrie Aspinall, PharmD, MSc is a pharmaceutical outcomes and health services researcher at CHERP and national program manager at VA MedSAFE with extensive experience using medication records and other large clinical and administrative databases to answer research questions.
- Maria Mor, PhD is the co-director of the CHERP Biostatistics & Informatics Core with statistical expertise in the analysis of clustered and multilevel data, and vast experience using VA databases. Dr. Mor will supervise statistical analyses performed by Soumik Purkayastha, PhD, a new CHERP biostatistician.

B.11. Along with our research team, we will engage an expert shareholder panel longitudinally across all study research aims. We have recruited a diverse group of VA hospitalists from the Hospital Medicine Academic Collaborative, HMAC (**see Dr. Gunderson / Happe letter of support**) to inform all aims of our research. We have discussed the study design and long-term goals of this project, and as detailed in Aim 3, we will work with this panel to: (1) discuss research findings from quantitative Aim 1, (2) inform our in-depth chart review procedures in Aim 2, and (3) review and prioritize qualitative interview findings in Aim 3 to inform future intervention targets. MPI Dr. Anderson has previously engaged with HMAC to participate in NIH-funded semi-structured interviews on the role of hospitals in chronic disease management.

C. SIGNIFICANCE

C.1. This proposal will fill three knowledge gaps in the delivery of high-quality care to hospitalized Veterans aligned with VA Quintuple Aims of improving outcomes and ensuring equity. First, we will generate contemporary national and facility-level data on the prescribing of evidence-based therapies, which have been shown to improve post-hospital outcomes – thus providing metrics which are upstream and more actionable than current inpatient quality metrics, which are heavily focused on hospital readmissions. **Second**, we will comprehensively describe the equity of prescribing for hospitalized Veterans in x marginalized patient populations identified as high priority by HSR and the Office of Health Equity and assess how observed inequities vary across VAMCs and VISNs. **Third**, we will characterize the clinical decision-making leading to Veterans not receiving evidence-based therapies at hospital discharge and extend the current literature by identifying potentially modifiable factors driving decision making. In filling each of these gaps, we will be able to provide front-line clinicians and operational leaders with a reproducible approach to generate national and facility-level metrics of hospital prescribing quality and equity. While this proposal focuses on 5 common conditions, we anticipate our findings and the resultant strategies identified to address quality and equity gaps in care will be generalizable to other common medical conditions requiring hospitalization..

C.2. This proposal addresses cross-cutting HSR research priorities by applying Learning Health Systems foundational methods to evaluate quality and equity of care in a high-risk Veteran population with complex chronic disease. The **long-term goal** of our investigative team is to maximize the quality and equity of prescribing for Veterans hospitalized in VAMCs by providing evidence to identify and address gaps in delivery of guideline-recommended care to front-line clinicians and operational leaders. To do so, we will use **data science, systems science, and implementation science methods** to examine national and facility-level hospital prescribing practice patterns for common, treatable, costly conditions which are aligned with the priorities of our VA operational partners and the **HSR topic areas** of quality, safety and value, complex chronic disease management, and health equity. Furthermore, our proposal is aligned with **VA Office of Research & Development strategic priorities** of increasing the substantial real-world impact of VA research (through alignment of research with operational partners) and putting VA data to work for Veterans (linking together VA, Medicare, and VA-funded community care data to generate novel insights).

Commented [MF22]: Important but will you at some point show relevance to this study of hospital-based equity?

Commented [MF23]: All other blurbs were 1 sentence - can it be condensed?

Commented [LH24]: Spell out or introduce the abbreviation when the Center is first mentioned in the aims

Commented [MF25]: Consider breaking into 2 separate sentences - quite long as written.

Commented [MF26]: Are each of the conditions that you plan to study considered chronic complex diseases?

Commented [MF27]: May also want to highlight alignment w VHA priorities or strategic plans.

C.3. The combined outcomes of this proposal will provide a novel framework to optimize hospital prescribing quality and equity in the VA. Consistent with Learning Health System approaches, we will work with our VA operational partners, front-line hospitalists from the VA Hospital Medicine Academic Consortium (HMAC), clinical and operational leaders from individual VAMCs, and Veteran Engagement Team to achieve each aim. With this nascent Learning Community, we will identify high-priority targets for local quality improvement initiatives and national equity-informed programs. We will also learn from high-performing VAMCs the effective strategies that are currently implemented locally to achieve equitable and high-quality prescribing. Together this will allow us to identify promising local practices to improve hospital prescribing that are amenable to widespread testing and scaling. We anticipate this proposal will lead directly to a subsequent Merit or QUERI proposal to apply hybrid effectiveness implementation designs to test the effectiveness and enhance the uptake (across VAMCs), scalability (within VAMCs across conditions), and sustainability of effective programs to improve quality and equity of hospital prescribing of evidence-based therapies.

D. INNOVATION AND IMPACT

Our proposal is innovative in the following three ways:

1. **This research moves beyond disease-specific silos to examine evidence-based prescribing practices as a cross-cutting concept for hospitalized Veterans.** The management of acute presentations of chronic conditions is typically led by general medicine and hospital medicine services in VHA, yet studies of inpatient care typically focus on a single disease or organ system. By examining a set of the most common hospitalizations for complex chronic conditions within VA, our research will develop new insights into how evidence-based care delivery differs across conditions within the same setting. Identification of condition-specific variation may help identify local best practices or strategies, which could be scaled within a VAMC. Conversely, if VAMCs are found to be largely consistent in care delivery across conditions, this may inform national efforts to apply insights from globally high-performing VAMCs to lower performing sites. VA HSR is uniquely positioned to support such cross-cutting work given its commitment to funding research beyond a single clinical area or condition.
2. **This research evaluates prescribing quality with an explicit health equity lens and novel framework.** Consistent with the HSR research priority to address health disparities, our proposal places equitable care as an essential dimension of high-quality care for Veterans and uses a novel **pharmacoequity framework** (**Figure 1**) established by MPI Dr. Essien and co-I Dr. Gellad. This proposal focuses on underserved, marginalized Veteran populations designated high-priority by HSR and the Office of Health Equity, including racially and ethnically minoritized individuals, women , and those living in rural settings, and/or disadvantaged neighborhoods. We anticipate the methods developed in this proposal will be adaptable to other underserved populations. The explicit focus on equity will allow for the development of health equity quality metrics (Aim 1) which can be adapted into tools to inform local quality improvement initiatives. This approach has been pioneered by Co-I Dr. Hausmann who led development of the VA's Primary Care Equity Dashboard, but to date no similar tools have been established in the hospital setting.
3. **We will use a complementary set of rigorous health services research methods to understand the underlying reasons for gaps in the quality and equity of prescribing and develop strategies with stakeholders to close gaps.** By combining large administrative and clinical database methods to identify care gaps with enhanced chart reviews to understand the decision-making leading Veterans to not receive evidence-based therapies, our proposal utilizes the unique data architecture of the VHA health system and advances the state of current literature, which has been limited to descriptive trends. Understanding the reasons for gaps in prescribing, including identifying times when prescribing gaps may be clinically appropriate, will directly inform subsequent equity-informed quality implementation efforts.

Commented [LH28]: Are you referring here to the existing pharmacoequity framework or a new framework?

Commented [MF29]: Why are the local efforts quality focused and the national efforts equity focused. Cant you argue that equity s a key dimension of quality and emphasize that dimension locally and nationally?

Commented [LH30]: Effectiveness of what? The medications? Or implementation strategies to increase use of medications? Or both?

Commented [MF31]: Not entirely sure what you mean by "health equity quality metric measures"?

Commented [LH32]: Systems?

The sum impact of this proposal will be the foundational data needed to initiate a Learning Health System Translation-to-Policy (T2P) Learning Cycle.[46-48] This proposal will involve each step of the T2P learning cycle and lead directly to a future Merit or QUERI proposal to test the implementation of evidence-based strategies to improve quality and equity of prescribing at hospital discharge. As depicted in the T2P Cycle in **Figure 2**, Aim 1 will involve practice to date (P2D) and data to knowledge (D2K) steps, Aim 2 will involve integrating evidence and interpreting reasons for identified prescribing gaps, and Aim 3 will start the knowledge to performance (K2P) process by presenting shareholders with this novel evidence to inform the co-design of implementation strategies for testing in future QUERI and Merit proposals. In addition to providing hospital-based quality and equity metrics to advance care provision by frontline clinicians and hospital administrators, this study will have future impact on the quality of care for hospitalized Veterans with chronic conditions and will position VA as a model for quality and equity of inpatient care across cross-cutting conditions nationally.

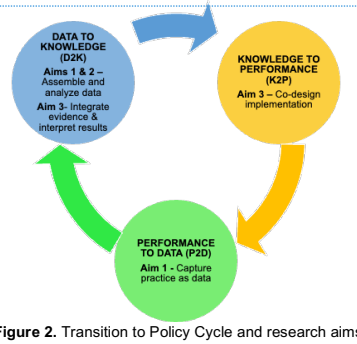

Figure 2. Transition to Policy Cycle and research aims.

Commented [LH33]: I love this. Nice!

E. RESEARCH DESIGN AND METHODS

E.1. Aim 1: To examine the association of sociodemographic factors with receipt of evidence-based medications at hospital discharge across VAMCs.

E.1.1 Overview. The objective of Aim 1 is to identify performance gaps in the current state of discharge prescribing quality and equity for hospitalized Veterans. To inform implementation efforts to equitably improve prescribing quality for all Veterans we will describe 4 key metrics:

1. National rates of discharge prescribing quality across 5 common complex chronic conditions. *Hypotheses: Rates of evidence-based discharge prescribing will differ across conditions, with higher rates for cardiovascular conditions than other studied chronisc conditions.*
2. National rates of discharge prescribing equity across 4 equity domains. *Hypothesis: Historically disadvantaged Veteran groups (minoritized racial-ethnic groups, women, rural, and those living in economically deprived areas) will have lower-rates of receiving evidence-based therapies.*
3. Attribution of inequities to differences in prescribing for disadvantaged groups within-VAMCs versus between-VAMCs. *Hypothesis: Observed hospital prescribing disparities will be primarily driven by differences in care between VAMCs (versus care within VAMCs).*
4. VAMC-level and VISN-level performance metrics for equitable discharge prescribing. *Hypothesis: Wide variation will exist between VAMCs and VISNs in quality and equity of discharge prescribing.*

Commented [LH34]: See prior comment about whether stroke should be lumped in with chronic conditions

E.1.2 Data Sources. All data sources are presented in **Table 1**. We will analyze all files from 2020-2025.

Table 1: Data sources

Dataset:	Data elements and use in analyses:
VA Corporate Data Warehouse (CDW)	▪ Demographic data (Aims 1+2) ▪ Inpatient and outpatient care in VA facilities (Aims 1+2) ▪ All prescription drugs ordered and filled in VA pharmacies (Aims 1+2) ▪ Ejection Fraction Natural Language Processing (Aim 1) ▪ Text Integration Utilities (TIU) discharge summary documentation (Aim 2)
VA Compensation and Pension Record Interchange (CAPRI)	▪ Chart reviews of Veteran index hospitalization (Aim 2)
Program Integrity Tool (PIT) files	▪ Prescriptions paid via Choice/MISSION but dispensed at non-VA pharmacies (Aims 1+2)
Medicare enrollment, claims & encounter files	▪ Enrollment and claims data (inpatient, outpatient, and medication use) for Veterans with traditional Medicare and Medicare Advantage (Aims 1+2)

E.1.3 Cohort Creation. Analyses for Aim 1 will employ CDW data to construct a cohort of all acute hospitalizations of Veterans in VAMCs in FY2023 and FY2024. From this underlying population, we will construct 5 exemplar condition-based cohorts of Veterans using the following 5 criteria:

1. Condition is highly prevalent among Veterans
2. Condition carries substantial morbidity or mortality (complex chronic condition)
3. Condition commonly leads to hospitalization for new presentations and acute exacerbations
4. Condition has guideline-recommended medications for improving long-term clinical outcomes

5. Condition has evidence of sociodemographic disparities in outcomes in VA or community settings

Informed by preliminary data from our CHERP pilot grant and feedback from operational partners, we have selected 5 exemplary conditions meeting these criteria: alcohol use disorder (AUD), atrial fibrillation, chronic obstructive pulmonary disease (COPD), heart failure with reduced ejection fraction (HFrEF), and ischemic stroke.

We will identify cohorts using inpatient CDW discharge diagnosis codes, focusing on the principal (primary) discharge diagnosis. For the COPD, HFrEF, and ischemic stroke cohorts, we will use pre-existing algorithms as applied by VA and the Centers for Medicare and Medicaid Services (CMS) for hospital readmission and mortality quality metrics. As current diagnosis-code based heart failure algorithms do not distinguish between patients with preserved and reduced ejection fraction, we will use previously established CDW variables for left ventricular ejection fraction, which are extracted from clinical notes and echocardiography using natural language processing,[49-51] to identify all Veterans with an ejection fraction of less than 50%. We will identify alcohol use disorder and atrial fibrillation hospitalizations based upon Agency for Healthcare Research and quality Clinical Classifications Software grouping algorithms.[52]

Our analysis will focus on Veterans discharged to the community. We will exclude hospitalizations in which the Veteran died or was discharged with hospice care. We will also exclude hospitalizations resulting in transfer to a long-term acute care facility or skilled nursing facility, as medication use cannot be reliably assessed in these settings. Our unit of analysis is the hospitalization; thus, one Veteran may contribute multiple observations within and across condition-specific cohorts.

For each condition, evidence-based medications were identified through national practice guidelines. **Table 2** depicts the medications and underlying guidelines supporting chosen metrics for each condition.

Table 2. Selected Conditions, Evidence-Based Medication Classes and Primary Guideline Source

Condition (No. Acute Hosp. Stays in VA 2023)	Evidence-Based Medication Class(es)	Primary Guideline Source(s)
Alcohol Use Disorder (~36,000)	**Medications for alcohol use disorder (MAUD)**: naltrexone or topiramate (first-line); acamprosate[53-55] or disulfiram (second-line)	VA/DOD (2021); American Psychiatric Association (2018)
Chronic Obstructive Pulmonary Disorder (~15,000)	**Long-acting combination inhaler therapy**: long-acting muscarinic antagonist/long-acting beta-agonist (LAMA/LABA) or inhaled corticosteroid/LAMA/LABA (ICS/LAMA/LABA)	VA/DOD (2021); American Thoracic Society (2020)[56]
Atrial fibrillation/flutter (~13,000)	**Anticoagulation:** warfarin, dabigatran, apixaban, rivaroxaban, or edoxaban	American College of Cardiology/ American Heart Association (2023)[4]
Heart Failure with Reduced Ejection Fraction (~26,000)	1) **Renin-angiotensin system inhibitor (RASi)**: angiotensin receptor-neprilysin inhibitor, angiotensin-converting enzyme inhibitor, or angiotensin II receptor blocker 2) **Beta-blocker**: bisoprolol, carvedilol, or sustained-release metoprolol succinate 3) **Mineralocorticoid receptor antagonist (MRA)**: spironolactone or eplerenone 4) **Sodium-glucose cotransporter-2 inhibitor (SGLTi):** empagliflozin, dapagliflozin, or canagliflozin	American College of Cardiology/American Heart Association (2022)[6]
Ischemic Stroke (~6,000)	1) **Lipid lowering therapy** – statin (preferred); ezetimibe or PCSK9 inhibitor (statin-intolerant patients) 2) **Antithrombotic therapy** – antiplatelet (aspirin, clopidogrel, dipyridamole) or anticoagulant (warfarin, dabigatran, apixaban, rivaroxaban, or edoxaban)	American Heart Association/American Stroke Association (2021)[9]

Commented [LH35]: Figure 3 text is too small. With all the white space, you should be able tomake the text larger. I'm also having a hard time interpreting what the y axis is supposed to represent—is there something qualitatively different about the hospitalization entries that warrants them being higher?

E.1.2 Identification of Evidence-Based Medication Use. We will use CDW, Medicare Part D and PIT pharmacy fill data to identify pre- and post-hospitalization medication use based upon methods to identify cross-sectional medication use validated previously in VA by Dr. Anderson.[20,38,57,58] Medications will be identified and grouped into classes using generic names and VA Drug Class codes. We will define medication classes in use at the time of hospitalization as those filled between 120 days and 1 day prior to hospitalization (120-day look back period) (**Figure 3**). This approach accounts for the common use of 90-day prescriptions in VA and the potential for transient non-adherence leading to gaps between fills.

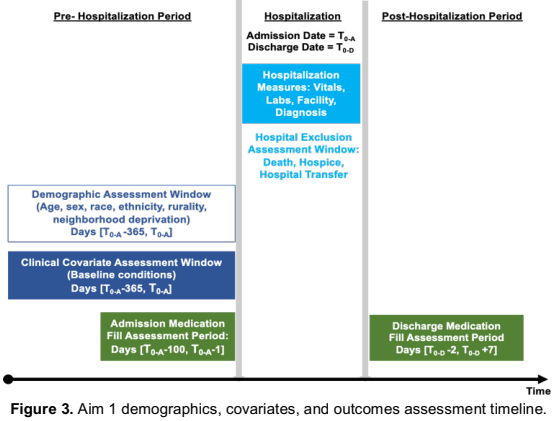

Figure 3. Aim 1 demographics, covariates, and outcomes assessment timeline.

We will examine two prespecified alternative definitions of baseline medication use to test the robustness of our primary approach: a less stringent 180-day look back period and more stringent approach in which admission medications are defined as those for which the most recent pharmacy fill provided adequate days supply to last to the admission date.

Second, consistent with prior examinations of discharge medication prescribing in VA, we will define discharge medications as those with a pharmacy fill between 2 days prior to hospitalization (to account for VA medications filled prior to a delayed discharge) and 7 days following hospitalization (to account for Veteran delays in picking up pharmacy medications). Third, for each medication class, we will classify a patient as receiving evidence-based therapy if they were either receiving the medication class at hospital admission OR received a discharge fill of the medication class (**primary outcome**). As a sensitivity analysis to test robustness of approach, we will examine the rate of subsequent fills of admission medication classes in the 90 days following discharge.

E.1.3 Equity Domains. We will obtain patients' sociodemographic characteristics from the VA Health Enrollment Files including characteristics on **four core domains which will be the focus of equity analyses**: sex (i.e., female or male), race and ethnicity, rurality, and geographic social vulnerability. Race and ethnicity categories include: American Indian or Alaska Native, Asian, Black or African American, Hispanic, Native Hawaiian or other Pacific Islander, White, multiracial, and unknown.[59] Rurality will be identified based on 5-digit zip code-based measure of rural-urban commuting area (RUCA) and will be grouped as rural versus urban consistent with VA Office of Rural Health measures.[60] Geographic social vulnerability will be identified by national area deprivation index (ADI) and grouped into quartiles. ADI is a validated measure of neighborhood disadvantage that comprises 17 components of socioeconomic status, including income, education, housing quality, and employment.[61] This variable has been used by our research team in analyses led by MPI Essien to examine variation in evidence-based prescribing for patients with chronic atrial fibrillation.[62]

E.1.4 Covariates. Our assessment of baseline patient and hospital-level covariates is guided by a Pharmacoequity Framework (**Figure 1**) and our clinical understanding of the factors that influence medications prescribing in the hospital setting. To complete analyses for Aims 1 and 2, we will collect additional data on patient, medication, and index hospitalization factors, detailed in **Table 3**. A deeper assessment of factors not measurable in administrative data will be examined in chart review in Aim 2 and qualitative interviews in Aim 3.

Table 3. Specifications for Baseline Patient and Hospital Level Covariates

Data Type	Variables
Aim 1: Key sociodemographic and VAMC characteristics	
Sociodemographics	**Sex**: female or male **Race and ethnicity**: American Indian or Alaska Native, Asian, Black, Hispanic, Native Hawaiian or other Pacific Islander, White, multiracial, or unknown. **Rurality**: rural or urban **Area deprivation index (ADI)**: 0-100 (categorized into quartiles)
Hospital characteristics	**VAMC ID, VISN**
Aim 1: Additional covariates	
Additional sociodemographics	Age, census region of residence, VA priority group status, enrollment in Medicare, enrollment in Medicare Part D, homelessness

Commented [ASL(SP36]: Fill or release? There is date the prescription was filled and the date it was released to the patient. We typically use release date.

Commented [LH37]: Be aware that ADI has come under fire in recent years. It is still commonly used and I think it's the right choice. Still, you may want to add a statement about why you chose that over SVI (which I don't like because it's at the county level and was designed for disaster preparedness), or at least acknowledge the limitations of ADI

1.
Rehkopf DH, Phillips RL. The Neighborhood Atlas Area Deprivation Index And Recommendations For Area-Based Deprivation Measures. *Health Affairs*. 2023;42(5):710-711. doi:10.1377/hlthaff.2023.00282

2.
Hannan EL, Wu Y, Cozzens K, Anderson B. The Neighborhood Atlas Area Deprivation Index For Measuring Socioeconomic Status: An Overemphasis On Home Value. *Health Affairs*. 2023;42(5):702-709. doi:10.1377/hlthaff.2022.01406

Comorbidities	Presence of index hospitalization diagnosis prior to hospitalization, Elixhauser comorbidities based upon index hospitalization diagnoses; pre-hospitalization chronic medical and psychiatric conditions defined by CMS chronic conditions warehouse algorithms. VA frailty index (VA-FI)
Hospitalization characteristics	Length of stay, intensive care unit stay, discharge disposition (home, home with home health, against medical advice), discharging service line, hospital bed size, hospital teaching status, VA complexity level[63,64]
Aim 2: Clinical factors which may influence evidence-based medication use	
Allergies	Known allergies and intolerances to study medication classes
Concurrent medication use	Pre-hospitalization and discharge medications with drug-drug interactions; identified from VA and Medicare outpatient fills and inpatient bar-code medication administration (BCMA) data
Laboratory results	Discharge lab parameters which could limit medication use: acute kidney injury, chronic kidney disease (GFR), acute liver injury, electrolyte abnormalities
Vital signs	Discharge vital signs which could limit medication use: blood pressure, heart rate, respiratory rate

E.1.5 Statistical Analysis. Aim 1 analyses will consist of four steps. First, for each condition we will identify national rates of discharge prescribing quality. Second, we will identify national rates of discharge prescribing equity comparing within each sociodemographic factor. Third, we will assess whether observed inequities are driven by within-VAMC versus between-VAMC effects. Fourth, we will compare individual VAMC performance on discharge prescribing quality and equity – providing a set of summary metrics for each VAMC and VISN than can be used by local and national operational leaders to target quality improvement initiatives.

E.1.5.A National Rates of Prescribing Quality. For each condition, we will determine the proportion of hospitalizations in which Veterans were admitted already taking evidence-based therapy, the proportion newly initiated on evidence-based therapy at discharge, and the proportion untreated.[65] Our primary outcome is the receipt of evidence-based therapies prior to hospitalization or newly initiated at hospital discharge. For conditions with multiple evidence-based therapies (e.g. anti-thrombotic therapy and LDL-lowering therapy for ischemic stroke) we will calculate outcomes separately for each therapy and then calculate the proportion receiving all therapies. In secondary analyses we will examine prescribing quality in the subgroup of patients with a new condition diagnosis, defined by no prior inpatient or outpatient diagnoses in the preceding 2 years.

E.1.5.B National Rates of Prescribing Equity. For each condition, we will determine the proportion of hospitalizations in which Veterans within each of our key sociodemographic groups (e.g., race and ethnicity, sex, rurality, and neighborhood deprivation) receive evidence-based therapy (**Table 2**). For stability of estimates, we will limit examinations to sociodemographic groups with at least 20 condition-specific hospitalizations annually. We will examine bivariate associations between each sociodemographic category and prescribing outcomes. We will then construct three-level mixed-effects logistic regression to model the adjusted rate difference of receiving evidence-based therapy, incorporating random effects to account for clustering of patients within VAMCs and within VISNs. We will use a stepwise process to construct adjusted models of these outcomes, sequentially adding the demographic, comorbidity, and hospitalization covariates listed in **Table 3**. We will also calculate variation partition coefficients to identify the variation attributable to patient factors, to VAMCs, and to VISNs.[66]

E.1.5.C Assessing Equity Within-VAMCs versus Between-VAMCs. To assess the extent to which inequities are driven by within-VAMC versus between-VAMC effects, for each condition cohort we will sequentially divide each disadvantaged sociodemographic group (e.g. Black race) into within-VAMC and between-VAMC components. MPI Dr. Anderson and Co-Is Drs. Fine, Hausmann, and Mor have previously applied these methods to assess equity between acute care hospitals in quality performance measures and in delivery of post-hospital care.[43,67]

First, we will calculate the proportion of each disadvantaged group within each hospital and assign this value to all the patients for the same hospital and condition. This hospital-specific value represents the **between-VAMC component**, for example, the values 0, 0.4, and 0.8 could correspond to VAMCs with 0%, 40%, and 80% of Black Veterans for a specified condition. The **within-VAMC component**, is then calculated by subtracting the between-VAMC component from the indicator variable for each disadvantaged group (e.g., Black=1; White=0). For example, in a VAMC in which 40% of the patients were Black, the between-VAMC component would be 0.4 for all patients in that VAMC, whereas the within-hospital component would be 0.6 for Black patients (i.e., 1−0.4) and −0.4 for White patients. We will then construct generalized mixed-effects linear-regression models to estimate differences between groups in each equity domain including the separated within-VAMC and between-VAMC components.[42,66] For these models, we will include VAMC as random effects and covariates as described above in **Section E.1.5.B**. We will perform analogous calculations for each equity domain (female vs. male; Hispanic vs. non-Hispanic White; rural vs. urban; most advantaged vs. least advantaged neighborhood quartile).

- The **within-VAMC component** reflects the difference in performance rates between sociodemographic groups (e.g. Black versus White Veterans) who were treated within the same VAMC.
- The **between-VAMC component** reflects the difference in performance rates between VAMCs in which all Veterans were Black or all Veterans were White. Because these extreme compositions do not reflect actual VAMCs, we will rescale the between-VAMC component to reflect typical VAMC demographic composition using the median for hospitals that serve that sociodemographic group).

E.1.5.D Assessment of Individual VAMC Performance in Prescribing Quality and Equity. We will then assess individual VAMC prescribing quality and equity. To assess VAMC performance in **prescribing quality**, we will identify VAMC-rates of evidence-based prescribing for each condition among VAMCs with ≥20 condition-specific hospitalizations per year.[36,68] To assess VAMC performance in **prescribing equity,** we will construct VAMC-rates of evidence-based prescribing for each key sociodemographic category in each condition. VAMCs will be eligible for this analysis if they cared for ≥10 hospitalizations within each condition for each demographic groups per year (e.g., ≥10 female and ≥10 male heart failure hospitalizations). **Figure 4** depicts an example VAMC-level analysis of prescribing equity, from a published outpatient pharmacoequity study of anticoagulant initiation in patients with newly diagnosed atrial fibrillation led by MPI Dr. Essien.[11]

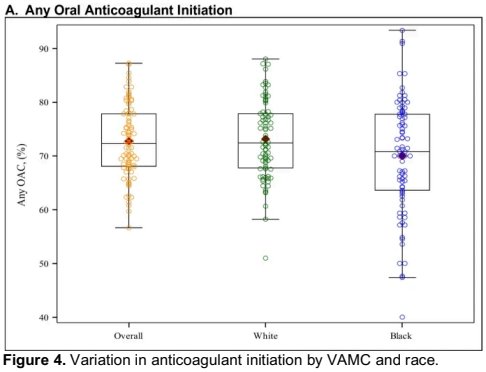

Figure 4. Variation in anticoagulant initiation by VAMC and race.

The above approach will allow us to identify high- and low-achieving VAMCs with regards to overall quality and to assess differences in prescribing between sociodemographic groups. However, a summary performance measure is still needed to identify high priority conditions and patient groups for quality improvement and implementation efforts. **To develop a summative equitable prescribing measure** for each condition, we will adapt the CMS Disparity Methods for the Hospital-Wide Readmission measure used by CMS and VA.[69] For each condition and sociodemographic criteria, we will define equitable prescribing by two criterion: 1) discharge prescribing rate for an at-risk group was better than the national VAMC median for that group, and 2) outcomes for the at-risk group that were within 1 percentage point of outcomes for the non–at-risk group within the VAMC. **Table 4** shows a hypothetical condition-specific output measure for a VAMC.

Commented [LH38]: I don't understand this criterion. What do you mean by outcomes (like mortality or readmission?).

Table 4. Hypothetical COPD output measure for a VAMC

Metric	VAMC	Overall Quality; % Receiving Treatment	Female Veterans	Black Veterans	Hispanic Veterans	Rural Veterans	Veterans Residing in Disadvantaged Neighborhoods
Evidence-based Inhalers After COPD Hospitalization	**#998**	**70% Top Quartile among all VAMCs**	**72% Equitable**	**65% Inequitable**	**75% Equitable**	**60% Inequitable**	**70% Equitable**

E.1.6 Limitations & Analytic Challenges: Veterans in certain sociodemographic categories are likely to be hospitalized too infrequently to be reliably measured or to have sufficient power to detect differences at the VAMC level (e.g. race and ethnicity categories other than Black, Hispanic, and White). Thus, we will additionally assess quality and equity performance at the VISN level (median 22,000 total acute hospitalizations/VISN). For these analyses, we will apply the same minimum number of hospitalizations criteria to each VISN (20 per condition and sociodemographic category) and define equitable prescribing as above. An additional limitation is misclassification of medication exposure, for example if a medication is filled outside of VA – we limit this by including Medicare Part D and PIT files. We will examine rates of primary non-adherence (in which a prescribed medication is never filled) as part of Aim 2 chart reviews.

E.1.7 Expert Stakeholder Engagement. Upon completion of Aim 1, we will conduct a virtual focus group with our hospitalist-based expert stakeholder group (**see Gunderson / Happe letter of support**) to present our national-level data and gather insights on the patient sociodemographic, clinical, and hospital-level determinants of evidence-based discharge identified in this research aim. Feedback from these focus group sessions will help inform the approach for our chart review in Aim 2 as well as interview questions asked in qualitative Aim 3.

Commented [LH39]: I generally avoid this term. You could refer to it as partner engagement

E.2. Aim 2: To determine common reasons Veterans do not receive evidence-based medications at hospital discharge.

E.2.1 Overview. There are a multitude of factors which may lead Veterans to not receive evidence-based medications at hospital discharge (**Figure 5**). In Aim 2, we will conduct a retrospective cohort study on a sample of Veteran hospitalizations identified in Aim 1, combining granular clinical data from CDW with targeted chart reviews of hospital discharge summaries and clinician notes, to identify the most common reasons Veterans did not receive evidence-based medications and to adjudicate the appropriateness of clinical decision-making leading Veterans to not be discharged with guideline-directed medications.

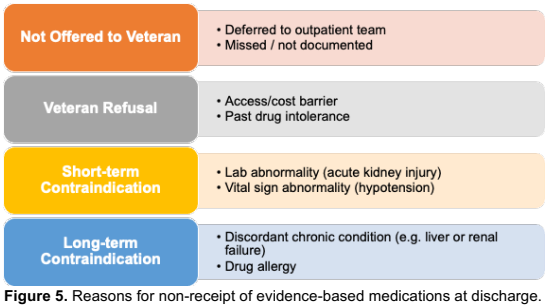

Figure 5. Reasons for non-receipt of evidence-based medications at discharge.

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These data will be complementary to Aim 1 and fill a second foundational knowledge gap needed to inform the design of interventions to equitably improve prescribing quality for all hospitalized Veterans. Aim 1 will characterize overall gaps in hospital prescribing quality and equity and identify both higher-performing VAMCs to learn from and lower-performing VAMCs to target interventions towards. Aim 2 will then illuminate common reasons for gaps in evidence-based discharge prescribing, including instances in which delaying delivery of evidence-based medications may be appropriate (e.g. clinical contraindications) versus potentially amenable to intervention (e.g. clinical inertia, clinician oversight, patient refusal). In Aim 3, we will then present these findings to stakeholders to identify priority target areas for future interventions.

Chart reviews have been a preferred modality for evidence generation used by our operational partners at VA MedSAFE and by researchers to study medication use patterns, identify adverse drug events, and describe the clinical context leading to events.[70-72] Chart reviews provide an opportunity to examine real-world clinical-decision making, as clinicians typically document contraindications or reasons patients are not given evidence-based medications, however this data is often not captured in structured CDW data fields. We will enrich chart reviews with structured CDW data fields when available, for example vital signs and drug allergies, thus providing a robust two-step investigation into prescribing decisions. MPI Dr. Anderson has experience conducting multiple chart review studies in VA to identify discharge medication use and to categorize appropriateness of reasons for diagnostic testing.[40,73]

E.2.2. Cohort Construction. We will create a cohort of 1,000 hospitalizations included in Aim 1, using random sampling to identify 200 hospitalizations from each of the 5 condition-specific cohorts described in **Section E.1.1**. We will sample only hospitalizations in which Veterans were not prescribed evidence-based therapies on admission or at discharge. To aid in assessing pharmacoequity, we will oversample Veterans across our key equity domains (e.g., Veterans from minoritized racial and ethnic backgrounds, female Veterans, and those residing in rural neighborhoods) to ensure that 50% of each cohort reflects these minoritized groups.

E.2.3. Chart Review Process. Chart reviews will follow a highly structured process. Trained research assistants will perform reviews of clinical documentation (hospital discharge summaries and clinical notes) to identify reasons evidence-based medications were not initiated. Our operational partners at VA MedSAFE have committed to providing training to research staff on conducting medication-focused chart reviews based on their extensive experience (see Letter of Support from Dr. Fran Cunningham). We will train each reviewer on a minimum of 10 training charts which will be reviewed by the study MPIs and MedSAFE pharmacist chart reviewers prior to training research assistants.

Commented [SA41]: Who are the reviewers stated here?

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Reviewers will be randomly assigned hospitalizations across VAMCs and conditions. Reviewers will follow a detailed manual created by the study investigators. First, hospital discharge summaries will be extracted using CDW Text Integration Utilities (TIU) files, as a standard hospital discharge summary note type is used throughout the national VA, this allows for efficient extraction and automated detection of text fields related to the condition and medications of interest. Research assistants will use extracted discharge summaries to identify the preliminary rationale for not initiating evidence-based therapies, if evident, and then use CAPRI (the national VA medical record review program) to review all notes from the primary inpatient team and relevant consultant teams (e.g. pulmonary consult for a patient with COPD) providing care to the Veteran during the index hospitalization as well as patient discharge instructions. This review will also provide a robustness check on our pharmacy fill methods for identifying discharge medication use as detailed in **Section E.1.2**.

Separately from chart review, we will use CDW allergy, vital sign, and laboratory data to identify possible clinical contraindications to evidence-based medication therapies (e.g. known drug allergy, acute kidney injury, hypotension). Data from both chart review and CDW will be extracted and merged into a single adjudication form which includes the primary and any secondary reasons a Veteran was not discharged on the evidence-based medication of interest as identified by the research assistant, a brief narrative description of the documented reason including relevant quotes from clinical notes, the day of discharge vital signs and relevant laboratories, discharge medication list, and drug allergy list.

E.2.3. Adjudication Process. Reasons for non-initiation of evidence-based therapies and the appropriateness of clinical decision-making will then be adjudicated by a group of expert clinicians. This group will include study investigators and front-line inpatient physicians and pharmacists identified through our operational partner groups. All adjudicators will complete a 1-hour training including 10 training charts prior to independent grading. Each adjudication form will be independently reviewed by 2 expert clinicians to classify reasons for non-initiation into clinically meaningful groups (see **Figure 5** for preliminary categories) and to classify the appropriateness of clinical decision-making leading to an evidence-based medication not being initiated. Appropriateness will be grouped as appropriate (e.g. known drug allergy to medication class), inappropriate (e.g. oversight of prescribing without any clinical contraindication), or uncertain, similar to prior studies.[74-76] Reviewers will grade their confidence in their appropriateness assessment using a six-point ordinal scale. For each chart, if insufficient data are available for the clincians to make a decision, chart reviews will be repeated by an alternate study team member. If the two expert clinicians disagree, the chart will be presented at a monthly adjudication meeting with disagreement resolved by consensus.

E.2.4. Anticipated Limitations and Analytic Challenges. In some cases, clinicians may not clearly document reasons for not initiating evidence-based therapies during hospitalization. As described above, we will enhance chart reviews through the use of structured CDW data fields to identify possible medication contraindications. The rate of unclear documentation is also an important outcome, as discharge summaries and clinical notes are the preferred communication strategy between inpatient and outpatient clinical teams. Poor documentation may facilitate medication errors or missed opportunities, and thus quantifying it is valuable. Despite this limitation, enhanced chart review provides an advantage over alternative strategies, including: a) clinician interviews - rely on hypothetical scenarios and are prone to social desirability bias; b) patient interviews - which are of limited utility when a medication was not presented as an option to the patient; c) prospective clinician observation - which is prone to Hawthorne effect/observer bias and difficult to conduct across multiple VAMCs. As this chart review is designed to provide description data on reasons evidence-based medications are not initiated during hospitalization, we chose a sample size based upon feasibility rather than a formal power calculation. However, by oversampling under-represented groups, our approach will provide 80% power to detect a 7.2% difference in appropriateness of clinical-decision making overall, assuming a base rate of 70% in-appropriate non-initiation of medications, and a 15% difference in condition-specific cohorts.

E.3. Aim 3: To identify barriers to and facilitators equitable, high-quality discharge prescribing.

E.3.1 Overview. In this qualitative aim, we will identify barriers to and facilitators of current processes to improve the quality and equity of prescribing at hospital discharge. We will interview key VA clinician stakeholders caring for Veterans in the hospital and VA facility administrators responsible for creating clinical programs and policies and quality improvement initiatives. Informed by learning health system principles, these interviews will elicit stakeholder responses to their own VAMC's performance on quality and equity of hospital prescribing as well as preferred strategies for improving performance and perceived barriers and facilitators to implementation. Our recruitment strategies and interview guides will be informed by our Aim 1 and 2 findings. **The qualitative findings from this aim will reveal critical determinants of high quality and equitable prescribing that are not readily captured in administrative or chart review data**. The barriers and facilitators identified in Aim 3 will be presented to our expert stakeholder panel who will help guide the development of future implementation strategies to improve quality and equity of hospital-based prescribing for Veterans with chronic diseases.

E.3.2 Conceptual frameworks guiding the qualitative approach. We will use a Pharmacoequity Framework (**Figure 1**) to guide our semi-structured interview guides, and coding approach. We will also use an evidence-based implementation science framework, the **Capability, Opportunity, and Motivation-Behavior (COM-B) Model (Figure 6)** to inform our qualitative interviews and analyses.[77] The COM-B Model posits that for a behavior (e.g., prescribing at hospital discharge) to occur, individuals must have the capability, opportunity, and motivation to perform it. COM-B is part of the Behavior Change Wheel, a synthesis of 19 behavior change frameworks from the fields of psychology and public health. COM-B has been frequently used to develop practice-changing interventions.[78-81] This Model will guide our exploration of the knowledge, motivational, and opportunity barriers to and facilitators of successfully prescribing evidence-based therapies at hospital discharge.

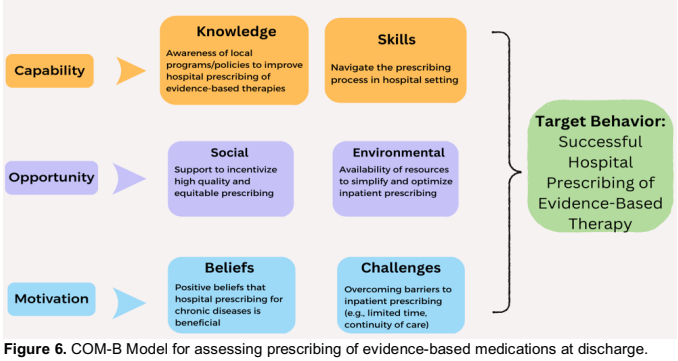

Figure 6. COM-B Model for assessing prescribing of evidence-based medications at discharge.

E.3.3 Clinician and administrator participant recruitment and data collection.

Identification of "target" VA facilities for stakeholder interviews. Using the approach outlined in **Section XX**, we will identify VA facilities with ≥20 at risk (e.g., minoritized racial and ethnic group, rural) hospitalized patients in FY23. We will rank these facilities by quartiles based on: (1) frequency of initiation of evidence-based therapy at hospital discharge, and (2) disparities in initiation of evidence-based therapy on discharge within this time frame (e.g., the difference in frequency of initiation of evidence-based therapy between White and non-White Veterans).[11] Among facilities in the highest and/or lowest quartiles based on these characteristics, we will identify **4 "target" facility subtypes** from which we will select stakeholders: (1) no disparity / high prescribing; (2) high disparity / high prescribing; (3) high disparity / low prescribing; and (4) no disparity / low prescribing. **Figure 7** demonstrates an example of what this would look like from Dr. Essien's CDA research in AF.

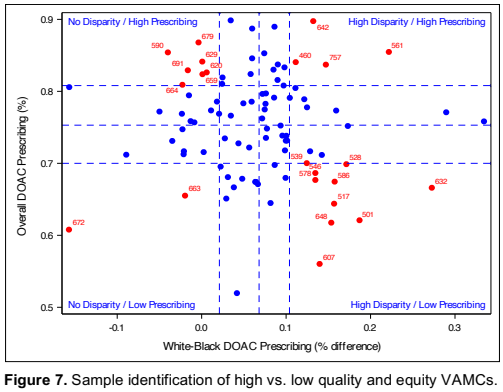

Figure 7. Sample identification of high vs. low quality and equity VAMCs.

Recruitment and assessment of clinicians and administrators. MPI Dr. Essien, Dr. Hamilton (qualitative Co-I), and project staff (Erica Fletcher and Cari Merritt) will identify and recruit hospital-based clinicians (e.g., physicians, physician assistants, and pharmacists) with direct involvement in the care of hospitalized Veterans nationally (**Table 5**). We will recruit these clinicians within **each** of the 4 specified target facility subtypes.[82] We aim to identify at least 3 administrators (e.g., Chiefs of Staff, Hospital Medicine Directors) from each of these facility subtypes. We will use the "snowball" sampling method to recruit providers and administrators,[83] whereby an initial key contact at each site will assist the research team in identifying potential participants. With the support of our national Operations partners (VA Center for Medication Safety (MedSAFE), Office of Health Equity, and Hospital Medicine) Dr. Essien will begin this process by sending an email to site administrators (e.g., Chief of Staff; and Hospital Medicine and Pharmacy Directors) describing the study and asking for the name(s) of hospitalists and pharmacists, or other medical leaders currently engaged in hospital discharge decision-making. Dr. Essien successfully used this interview approach in his VA HSR Career Development Award to recruit clinicians and several members of our study team, including Dr. Hamilton and Dr. Hausmann, have successfully used similar recruitment strategies for stakeholder interviews in prior HSR studies.[84-86]

Table 5. Inclusion and Exclusion Criteria for Interview Study Participants

Participant	Clinicians	Administrators
Inclusion criteria	Hospitalists (e.g., physicians, physician assistants) Pharmacists providing care in the inpatient setting	Chiefs of Staff, Hospital Medicine Directors, Pharmacy Directors

Commented [LH43]: You may want to check with Matt Chinman or Shari Rogal to see if they would call COM-B an implementation science framework. It was developed by a health psychologist to explain individual-level behavior change. It's used in imp sci research but I would not say it's an imp sci framework (just my opinion)

Sample Size	12-15 clinicians per target VA facility type (e.g., no disparity / high prescribing; (2) high disparity / high prescribing; and (3) high disparity / low prescribing.	3-4 administrators per target VA facility type
Sampling Strategy	Based on approach outlined in Aim 3 (not purposive sampling)	Based on approach outlined in Aim 3 (not purposive sampling)

Semi-structured interview guides and data collection. Using the COM-B Model, clinician-directed questions will address **Capability** (e.g., knowledge of evidence-based therapies, comfort discussing treatment options, knowledge of resources to help patients navigate transitions to specialty care); **Opportunity** (e.g., strategies to mitigate denials of coverage; SDOH-related barriers experienced by patients in seeing specialists; care coordination challenges between primary care and specialists post-discharge); and **Motivation** (e.g., clinical thresholds or signs that drive decisions to prescribing therapies, such as severity of symptoms). This model will also be used to assess administrator's perspectives of quality and equitable prescribing in the inpatient setting.

We will conduct one-time, 30-minute, semi-structured, secure video interviews with 52-60 clinicians and 9-12 administrators. Interviews will be semi-structured to allow built-in flexibility to explore topics in greater depth according to individual respondents' experiences and perspectives. The goal of these interviews is to obtain provider and administrator perspectives on factors that may influence prescribing of evidence-based therapies on hospital discharge and to assess COM-B-informed barriers to and facilitators of prescribing not captured in our quantitative analyses or chart reviews. The development of our clinician and administrator interview guides will be informed by COM-B domains most relevant to high quality and equitable prescribing for hospitalized Veterans (**Table 6**). In addition to information on barriers and facilitators, we will share data from Aim 1 with interviewees and ask them about specific programs at their VAMC that improve prescribing, which levers would be most feasible and scalable, and which areas they would advise to be prioritized in a future intervention.

Table 6. COM-B-Informed Draft Questions for Clinicians/Administrators on Prescribing for Hospitalized Veterans

COM-B Domains	Sample Questions
Knowledge	• How confident are you in your knowledge of the treatment guidelines for hospitalized patients?
Capability	• What are your biggest concerns about initiating medications in the inpatient setting? Does this differ for individuals from disadvantaged backgrounds? • Do you feel comfortable discussing new chronic disease management decisions with hospitalized Veterans? Including those from disadvantaged backgrounds?
Opportunity	• How supportive is your hospital environment in promoting equitable discharge prescribing? • Do you have enough time to discuss medication initiation in the hospital setting? • How accessible are the necessary resources (e.g., patient handouts) to help all Veterans understand the indication for starting a new therapy?
Motivation	• What motivates you to start Veterans on a new therapy in the hospital? • How do you feel about the impact you can have on a Veteran's long-term health outcomes as a hospital-based clinicians / administrator? • What would discourage you / your team from starting a new medication in the hospital? Does this differ for patients from disadvantaged backgrounds?
Solutions	• What specific programs at your VAMC may contribute to the prescribing rates observed? • What factors identified are the most modifiable, feasible, or scalable? • What factors identified would you like to see prioritized?

E.3.4 Sample size. The projected sample sizes of clinicians and administrators are designed to meet standard practices for in-depth qualitative research, which has shown that a sample size of 10 to 12 per group (e.g., target VA facility) is usually sufficient to yield thematic saturation, the point at which additional data collection produces no new information.[87] Because the point at which saturation has been reached can only be assessed by ongoing preliminary analysis conducted in tandem with the data collection process. We have appropriately provided estimated ranges for our projected sample sizes, rather than fixed target numbers, and will conduct data collection and coding in parallel.

E.3.5 Coding and analysis of qualitative data. The clinician and administrator interviews will be audio-recorded and transcribed using de-naturalized transcription. We will de-identify and upload transcribed data into NVivo 12 PRO software for *Windows* for analysis. We will use directed qualitative content analysis methods[88] to code and analyze this narrative data. The 2-coder approach will include deductive coding using COM-B domains and constructs and inductive, open coding using the constant comparative method.[89] The coders (Fletcher and Merritt) will read and interview transcripts multiple times to develop and refine coding categories. The lists of categories will then be sorted and grouped according to similar content under higher order headings, with reductions of the data by content areas. Interpretation of the data, in particular the linkages to COM-B domains and constructs, will be an iterative process. As patterns of codes are combined into categories and

subcategories, overarching themes covering all data will be identified. Once coding is complete, we will generate analytical summaries across the data, as well as by interview type (i.e., clinicians and administrators, and all 3 facility subtypes). To ensure quality control, bias mitigation, and inter-rater reliability, Dr. Hamilton will oversee codebook development train the co-coders. To the extent possible, we will qualitatively identify patterns of similarities across clinicians, and within groups related to characteristics of clinicians (e.g., sociodemographics, experience practicing medicine), and hospitals (e.g., location, patient diversity) that may warrant future study.

E.3.6 Ensuring rigor in the qualitative analysis. We will take several steps to ensure rigor,[90] including:

- **Member Checking:** Sharing findings with a Stakeholder Advisory Group to verify resonance with community partner experiences.[91]
- **Rich Description:** Providing detailed accounts of the research context and participants to enable others to determine the transferability of the findings to other settings.[92]
- **Purposive Sampling:** Selecting participants who can provide rich, relevant, and diverse insights.[93]
- **Audit Trail:** Keeping detailed records of all research decisions, processes, and steps taken during the study.[94]
- **Code-Recoding:** Having the same data coded by different researchers to ensure consistency.[95]
- **Reflexivity:** Reflecting on and documenting the researchers' biases and assumptions on the research.[96]

E.3.7 Potential limitations and alternative strategies. We have identified **three** potential limitations associated with this aim and devised mitigating strategies and/or arguments against the likelihood of the limitation. (1) Recruiting key stakeholders could be challenging. The research team has a strong connection to a national pharmacist network with operations partner VA MedSAFE (**see Dr. Fran Cunnigham letter of support**) and a national network of VA hospitalists (**see Dr. Melver Anderson letter of support**), including MPI Dr. Essien who is a practicing VA hospitalist. MPI Dr. Anderson has also conducted qualitative interviews with the Hospital Medicine Academic Collaborative in the past. Our recruitment strategy at each site is not dependent on any particular individual responding, and thus we will seek "replacement" responders when we encounter non-responders. (2) Limitations associated with qualitative interviews (e.g., recall and selection bias) may limit our findings. We propose to recruit stakeholders actively providing care for hospitalized Veterans, thus reducing the likelihood of these biases. In addition, this was a critical reason we decided to focus our interviews on clinicians rather than Veterans, though they will serve an important role as advisors through the Greater Los Angeles Veteran Engagement Team (3) Findings may not be generalizable to all VA medical centers. We will engage our national, hospitalist Stakeholder Advisory Group across all research aims, including Aim 2 to ensure that qualitative findings reflect the practice settings and context of a broad group of clinicians nationally. This will help us ensure that our findings can be implementable in future work.

E.3.8 Expert Stakeholder Engagement. The barriers and facilitators identified in this aim will then be presented to the expert stakeholder panel which will guide the selection of intervention strategies to improve quality and equity of prescribing in a future IIR proposal. We will conduct two 1-hour-long virtual focus groups to gather insights on the barriers, facilitators, and recommendations for evidence-based prescribing interventions identified in this research aim. With participant consent, all sessions will be audio-recorded and transcribed verbatim. We will also collect demographic and professional background information to contextualize responses. The broad themes from our qualitative work will be presented to the expert panel for relevance, feasibility and acceptability, as well as prioritization. We will employ structured techniques, such as nominal group technique, to reach consensus on the most promising intervention components. In this approach**,** panel members will individually rank the proposed strategies in terms of feasibility, potential impact, and equity. Rankings will be aggregated and discussed to understand areas of consensus and divergence. Based on the panel's feedback, we will map prioritized barriers and facilitators onto intervention components using an implementation science framework[78,97-99] and a Learning Health Systems framework to ensure that the evidence identified in our research can be directly used by front-line clinicians and operational leaders. This foundational work will help inform the selection and development of evidence-based prescribing interventions that we will pilot and evaluate in a future Merit proposal. Examples of such intervention strategies may include a health equity dashboard, academic detailing, or identification of local champions.

F. IMPLEMENTATION AND DISSEMINATION PLAN

The formation of this proposal reflects input from our multidisciplinary research team, Operations, and front-line clinician partners. We have developed these studies in close partnership with three program offices: (1) the VHA National Hospital Medicine Program Office (**see Letter from Dr. Melver Anderson**), (2) Office of Health Equity (**see Letter from Dr. Ernest Moy**), and (3) VA Center for Medication Safety (VAMedSAFE) (**see Letter from Dr. Fran Cunningham**). These longitudinal partnerships will enable us to disseminate results from each aim broadly and to provide individual VAMCs information about their current performance consistent with the *Data to Knowledge* stage of the translation-to-policy learning cycle. Our team has already presented this

work to the Greater Los Angeles Veteran Engagement Team in March 2024 and the VA Hospital Medicine Academic Consortium (HMAC) who provided feedback on proposal development and have committed to continue to work to develop strategies to share this data with Veterans and front-line clinicians.

We will work with operational partners in the National Hospital Medicine Program and VA Office of Health Equity to develop VAMC-level prescribing quality and equity metrics into dashboards. We will use the Primary Care Equity Dashboard (PCED) as a model for disseminating Aim 1 metrics widely. The PCED was developed by co-I Dr. Leslie Hausmann, in partnership with the Office of Health Equity, to advance equity-focused quality improvement initiatives and has active users across 119 different VAMCs spanning all 18 VISNs and VA Central Office.[100] As 2024 has seen the launch of a new national VA Hospital Medicine data dashboard and a national Hospital Medicine Analytics Team – the leaders of which we are closely connected with through VHA National Hospital Medicine Program Office – we are primed for widespread dissemination of our research findings to inpatient clinicians and quality improvement leaders.

To further disseminate our work and enhance its impact, we will pursue multiple avenues to share our findings with VA clinicians, Veterans, and stakeholders. First, we will engage Veterans through biannual Veterans Advisory Board / Veteran Engagement Team meetings at both VA Pittsburgh and the Greater Los Angeles VA to obtain feedback on our results, which will directly inform our subsequent analyses we will pursue and qualitative interviews we conduct with clinicians in Aim 3. **Second,** we will work closely with CHERP's Equity and Engagement Capacity Building Core to disseminate findings on vulnerable groups and identify actionable steps for VA to address disparities in hospital care. **Third,** we will work with HSR to create CyberSeminars for VA research, policy, and clinical communities during the project. CyberSeminars will disseminate findings from Aim 1 analyses on national quality and equity in hospital prescribing, from Aim 2 analyses of reasons Veterans do not receive evidence-based medications, and best practices learned from high-performing VAMCs from Aim 3. MPI Essien has presented annually on his VA HSR CDA research since 2022. **Fourth,** we will work with CHERP's Communications Core to disseminate our findings in a series of CHERP feature stories delivered to >9,800 subscribers, including researchers, VA administrators, and Veterans. **Fifth,** to disseminate methods and facilitate future research we will submit statistical code and documentation for conducting Aim 1 analyses assessing national and VAMC-specific rates of prescribing quality and equity to VA Phenomics Library and through CIPHER and GitHUB, ensuring reproducibility and allowing other research and operational teams to adapt these evaluation methods to assess quality and equity for other hospital-based outcomes. **Sixth**, we anticipate this research will be highly impactful to operational leaders and researchers examining health care quality and equity within the VA through the VA Center for Information Dissemination and Education Resources (CIDER) and outside of the VA by dissemination of research through peer reviewed manuscripts for each aim and presentation of study results at national general internal medicine, hospital medicine, and health policy conferences. Lastly, the research team will work with VAPHS and GLA VA Public Relations staff to create press releases about our published work for print, radio, and television news outlets as applicable.

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