Reducing Low-Value Care: Applying the Intention-Action Framework to Specialty Referrals

Motivation and Project Aims

Low-value care—the use of a health service for which the harms or costs outweigh the benefits (Chassin & Galvin, 1998)—is a widespread and persistent problem (Powers et al., 2020; Oakes & Radomski, 2021). In the U.S. alone, low-value services account for up to 30% of care provided and contribute to an estimated $210 billion in wasteful spending (Institute of Medicine, 2013). Low-value healthcare services place a significant burden on patients, leading to prolonged wait times, emotional distress, and financial strain, while often resulting in avoidable appointments and procedures that disrupt their daily lives (Brownlee et al., 2017; Verkerk et al., 2023). Such treatments can also undermine patients' trust in the healthcare system and diminish their overall satisfaction with care (Brownlee et al., 2017; Verkerk et al., 2023). Low-value medical care arises not only from structural factors, such as defensive medicine or misaligned incentives that encourage low-value practices (Kessler & McClellan, 1996), but also from cognitive and psychological mechanisms that influence physicians' decision-making processes during patient encounters (Kool et al., 2020; Lyu et al., 2017; Mira et al., 2018; Scott et al., 2017). Addressing these cognitive and psychological drivers through low-cost interventions grounded in behavioral science insights, deployed at the point of care, could offer a promising approach to fostering higher-value clinical practices.

While low-value care takes many forms (e.g., overprescription of antibiotics or opioids; Meeker et al., 2016; Doctor et al., 2018), we focus on one specific form: low-value specialty referrals. Low-value specialty referrals often trigger a cascade of downstream medical services (e.g., additional tests, procedures, and follow-up visits), which makes this context a high-impact setting for testing interventions aimed at reducing unnecessary care. We will design and implement interventions integrated with the electronic health record (EHR) to nudge physicians toward making high-value specialty referrals and avoiding low-value ones. Using a randomized controlled trial (RCT) at one of the nation's largest academic healthcare systems (UCLA Health), we aim to demonstrate that these interventions can reduce low-value referrals, improve access to specialty care, and enhance patient satisfaction.

Theoretical Framework & Intervention Design

To conceptualize the mechanisms for reducing low-value specialty referrals, we draw on the intention-action framework, which posits that changing behavior requires to first establish some intentions to act and, second, turn such intentions into action (Heckhausen & Gollwitzer, 1987; Sheeran, 2002). Building on this framework, we categorize the cognitive and psychological drivers of low-value referrals into two groups.

One set of drivers relates to the intention to avoid low-value referrals at the time of the patient encounter. While physicians may broadly endorse the goal of limiting low-value referrals, informational barriers and insufficient recall of diagnostic criteria or symptom thresholds might prevent physicians from recognizing when a referral is low value (Lyu et al., 2017; Raudasoja et al., 2024). Additionally, immediate concerns, such as the pressure to accommodate patient requests for referrals, may subside the goal of avoiding a low-value referral (Lyu et al., 2017; Raudasoja et al., 2024; Summerton, 1995).

The second set of drivers pertains to the intention-action gap (Sheeran, 2002). Even when physicians intend to avoid low-value referrals, such a goal may not be top of mind at the time of the patient encounter. In addition, the choice architecture of the EHR system may make initiating low-value referrals overly convenient (Schwartz et al., 2019), lacking deliberate prompts or frictions that could encourage physicians to carefully consider the necessity of a referral (Colla et al., 2017).

The first class of barriers may benefit from intention-oriented interventions that focus on providing information to help physicians overcome knowledge or recall barriers and update their beliefs about the

costs and benefits of the focal activity, recalibrating decision-making and aligning intentions with best practices. The second class of barriers, on the other hand, may benefit from action-oriented interventions that focus on making the goal of avoiding low-value referrals top of mind and introducing frictions to make them harder to recommend, leveraging choice architecture to encourage reflection and align actions with physicians' broader goals of providing high-value care.

To shed light on mechanisms and identify the most prominent drivers of low-value specialty referrals, we will use a 2x2 factorial design to test the **independent and joint impacts** of an intention-oriented intervention and an action-oriented intervention on reducing these referrals. **The intention-oriented intervention** will address the first set of barriers by focusing on physicians' beliefs about specialty referrals. For example, the EHR interface could provide information about when referrals are low value, present clear, evidence-based referral criteria to address knowledge gaps while also serving as a recall aid for physicians during clinical encounters. Additionally, the EHR interface could suggest alternative patient management strategies to address common health concerns without resorting to immediate referrals. To further strengthen physicians' intentions to avoid low-value referrals and combat the pressure to accommodate patients' referral requests, the intervention could present statistics highlighting the hidden costs of unnecessary referrals and their negative implications for patient burden.

The action-oriented intervention, on the other hand, will focus on helping physicians act on the intentions to avoid low-value referrals by modifying the choice architecture of the referral process. The intervention will include a decision support scheme with a checklist requiring physicians to confirm specific evidence-based criteria before finalizing a referral. This clinical decision support will ease cognitive burden (Gawande, 2010) and increase frictions for low-value referrals, with the goal of aligning physicians' actions with their desire to avoid low-value referrals.

The specific content and design of these interventions will be finalized in consultation with physician leadership, informed by interviews with frontline physicians and a literature review of cognitive and psychological factors contributing to low-value specialty referrals. We are also open to the feedback from reviewers of this proposal.

Low-value specialty referrals will be defined by clear criteria developed through consensus among relevant medical specialists, such as cardiology referrals for hypertension before trying at least two antihypertensive medications, or pulmonology referrals for a cough lasting less than six weeks. Our efforts will focus on the three largest referral specialties at UCLA Health: cardiology, pulmonology, and gastroenterology (GI).

Outcome Measures, Safeguards, and Statistical Power

The six-month trial will randomize physicians into one of four arms, varying whether their EHR interface includes the intention-oriented intervention, the action-oriented intervention, both interventions, or neither. The primary analyses will be conducted at two levels:

1. Our physician-level analyses will include all physicians who have seen at least one primary care attributed patient at UCLA Health during the trial period. Importantly, the physician sample is not limited to primary care physicians, as other types of physicians (e.g., cardiologists) may also refer primary care attributed patients for specialty care (e.g., pulmonology referrals). UCLA Health has approximately 2,700 physicians, of whom over 1,600 generated at least one referral for cardiology, pulmonology, or GI conditions in the past six months. For each physician meeting the inclusion criteria, the primary outcome will be the average number of cardiology, pulmonology, and GI referrals per primary care attributed patient. Assuming that at least 2,000 UCLA Health physicians would see at least one primary care attributed patient and be able to make specialty referrals during our trial period, we estimate 80% power to detect an effect size of 0.138 standard deviations (SDs) for the main effects of our two interventions, using a Bonferroni-adjusted significance level (two-sided alpha = 0.025).

2. Our encounter-level analyses will consider all encounters between a primary care attributed patient and a primary care physician during the trial period. In the past six months, UCLA Health recorded roughly one million such encounters across approximately 300 primary care physicians (PCPs). During this period, primary care attributed patients collectively received about 24,000 cardiology, pulmonology, and GI referrals made by their primary care physicians. The primary outcome at the encounter level will be a binary indicator of whether a given encounter results in a cardiology, pulmonology, or GI referral. Accounting for clustering at the physician level, we estimate 80% power to detect an effect size of 0.036 SDs (intra-class correlation coefficient, ICC = 0.01) or 0.08 SDs (ICC = 0.05) for the main effects of our two interventions, with a Bonferroni-adjusted significance level (two-sided alpha = 0.025). Since we plan to control for patients' and physicians' baseline referral tendencies in our regression analyses, within-physician correlation of endline outcomes is expected to remain limited, further supporting the statistical robustness of the trial. This power analysis includes all PCP encounters, but in many cases, specialty referrals are not under consideration, which may dilute the estimated effect size and reduce statistical power. By focusing on a subset of relevant encounters—those in which referrals are actually being considered—we aim to reduce this dilution effect. While a smaller sample size may theoretically reduce power, the amplified effect size within this subset id expected to improve overall statistical power.

To safeguard against potential adverse effects on patient health (e.g., due to high-value referrals being reduced by the interventions), we will monitor unplanned hospital admissions, emergency department visits, and all-cause mortality within 30 days of a physician encounter and compare these outcomes between physicians as-randomized. Additionally, we will assess patient satisfaction using UCLA Health's existing patient feedback surveys. To evaluate longer-term impacts, we will examine specialty referral patterns over six months following the conclusion of the trial.

Heterogeneous Effects and Insights for Aging Populations

In addition to assessing the main effects of the intention- and action-oriented interventions, we will explore heterogeneous treatment effects to better understand the mechanisms driving behavior change. Drawing on our own research about how individuals' past behaviors shape their responses to different types of behavioral interventions (Brody, Dai, Saccardo et al., 2024; Saccardo, Dai, et al., 2024), we predict that the two types of interventions may have differential impacts depending on physicians' baseline referral tendencies. Specifically, we hypothesize that the intention-oriented intervention will be more effective among physicians with a high referral tendency, as these providers may benefit most from updated beliefs about the value of referrals. Conversely, the action-oriented intervention may have a greater impact on physicians with moderate-to-low referral tendencies, where reducing decision-making burdens can facilitate follow-through.

Beyond these theory-driven analyses, we will examine whether the interventions have differential effects on elderly versus younger patients. Low-value care may be particularly burdensome for aging and elderly populations, who often require more frequent medical visits and face greater logistic challenges (e.g., coordinating transportation, relying on caregivers). Estimating heterogeneous effects by patient age will provide practical insights into how these interventions may alleviate the particularly high burdens faced by elderly patients.

Moreover, we will apply machine learning techniques to identify additional heterogeneity in treatment effects. Machine learning will allow us to explore whether specific provider characteristics, patient panel attributes, or situational factors interact with the interventions in unexpected ways. This approach will help us evaluate whether machine learning can uncover patterns beyond those predicted by baseline referral tendencies, providing a richer understanding of behavior change mechanisms.

Feasibility and Timeline

The proposed trial is highly feasible, supported by a strong history of collaboration between the PIs and UCLA Health. Dai and Leuchter co-direct the UCLA Health Nudge Unit, with Saccardo playing a key role on the team. Together, they have developed and evaluated behavioral interventions to improve clinical quality and health outcomes, and published their findings at *Nature*, *PNAS*, and *Nature Human Behavior* (Dai et al., 2021; Reiff et al., 2022; Saccardo et al., 2024). The UCLA Health Executive Leadership Committee has committed to supporting the operational components of the proposed trial (e.g., sponsoring EHR modifications), but research funding is essential to rigorously evaluate the interventions using scientific methods. The PIs are already engaging with UCLA Health physicians to discuss the study design, with plans to finalize the interventions by April 2025, complete EHR integration by November 2025, and conduct the six-month trial from December 2025 to May 2026.

Connection with Ongoing Research and Future Directions

This proposal is part of a broader research agenda by Dai and Saccardo aimed at leveraging the intention-action framework to improve the reach and impact of behavioral science interventions in healthcare, with a particular focus on the heterogeneous effects of intention-oriented and action-oriented interventions and the potential synergies between them. In a recent project jointly funded by NBER and USC Roybal (as part of #5P30AG034532-15 and #5P30AG024968-21), Dai and Saccardo (1) investigate the heterogeneous impact of intention- and action-oriented interventions on patients' preventive care decisions using archival data from completed trials and (2) examine their joint and separate effects on physicians' clinical quality in an ongoing RCT involving cardiologists.

We see the proposed trial as a critical extension of our broader research agenda by applying our conceptual framework to a different clinical setting, a distinct medical decision-making context, and newly designed EHR-based interventions. While our ongoing trial with cardiologists at UCLA Health focuses on promoting desirable behaviors (i.e., closing care gaps), the proposed trial aims to prevent undesirable behaviors (i.e., low-value referrals), providing a complementary test of our framework. Additionally, the larger sample size of over 2,000 physicians (compared to approximately 50 cardiologists in the ongoing trial) enhances statistical power and generalizability. Our analytical approach for studying both the main effects and heterogeneous treatment effects ensures conceptual consistency with our funded work while enabling us to build cumulative knowledge across diverse healthcare contexts.

This trial has the potential to generate significant practical and policy insights by testing the synergistic effects of scalable, low-cost interventions designed to reduce low-value care. By decreasing low-value specialty referrals, these interventions may reduce the time, financial, and emotional burden on patients, and improve access to timely care—critical priorities for healthcare systems striving to deliver both high-quality and patient-centered care. By integrating behavioral science insights into EHR workflows and leveraging a theoretical framework that targets key mechanisms of behavior change, this research can inform broader efforts to optimize clinical decision-making and minimize unnecessary medical treatments across diverse healthcare settings. Our work aligns naturally with Stages 0, I, and II of the NIH Stage Model for Behavioral Interventions, as it involves designing, implementing, and rigorously testing behaviorally informed interventions in a real-world healthcare environment. If successful, this trial will establish a strong foundation for follow-up research to test generalizability across other clinical contexts and healthcare systems. It will also position us to pursue NIH funding to further advance our research agenda, including identifying the most effective intention- and action-oriented interventions for specific clinical settings and ensuring scalable implementation of interventions with proven efficacy.

Budget

Research Assistant: One research assistant will assist the PIs in coordinating meetings with UCLA Health, crafting meeting minutes, drafting IRB documents, literature review, as well as other project needs. The research assistant will be hired at the hourly rate of $32 per hour with 55% benefits. We estimate a total of 500 hours of effort will be needed during the award period.	$24,800
Data Analyst: One analyst will be responsible for building and executing queries to abstract the necessary data from the EHR. A full-time data analyst plus fringe benefits costs $120,240, and we will employ 35% of a data analyst effort for the year.	$42,084
Statistician: The project will involve participation of a statistician, who is also a machine learning expert and will be hired as a consultant at the hourly rate of $95 per hour. We estimate a total of 150 hours of effort will be needed during the award period.	$14,250
PhD students: PhD students will be hired as graduate student researchers to interview/survey physicians as well as assist with the design, implementation, and analyses of the project. The cost of a GSR position of 10 hours per week for one academic year is ~44,000 (including resident fee remission). Additionally, we will offer a summer stipend of $3,000 per month for two months.	$50,000
Salary for PI Leuchter: Richard Leuchter as one of the PIs will maintain the relationship with the partner organization (UCLA Health) and oversee the design, data collection, analysis, manuscript writing, and submission of the study. The requested fund will cover 10% of NIH cap, along with the fringe benefits at a rate of 41%.	$31,288
Salary for PI Dai: Hengchen Dai as one of the PIs will maintain the relationship with the partner organization (UCLA Health), supervise the PhD students who will be working on the project, and oversee the design, data collection, analysis, manuscript writing, and submission of the study. The requested fund will cover 10% of NIH cap, along with the fringe benefits at a rate of 28% (based on NBER's fringe rate).	$28,403
Salary for PI Saccardo: Silvia Saccardo as one of the PIs will maintain the relationship with the partner organization (UCLA Health), supervise the PhD student who will be working on the project, and oversee to the design, data collection, analysis, manuscript writing, and submission of the study. The requested fund will cover 10% of NIH cap, along with the fringe benefits at a rate of 28% (based on NBER's fringe rate).	$28,403
Salary for Nudge Unit Co-investigator: One behavioral scientist from UCLA Health Nudge Unit will provide consultation on intervention design, preregistration, and data analyses as well as participate in manuscript writing. The requested fund will cover 5% of NIH cap, along with the fringe benefits at a rate of 28% (based on NBER's fringe rate).	$14,202
Salary for Health System Leadership Collaborator: One of UCLA Health's Regional Primary Care leads will collaborate with the PIs to liaison between the study team and UCLA Health leadership, facilitate logistical operations of the trial, and provide operational input to ensure the intervention and trial designs are feasible. The requested funds will cover 5% of the NIH salary cap, including fringe benefits at a rate of 41%.	$15,555
Interviews and Surveys: Physicians from UCLA Health will be recruited for interviews to develop the intervention content ($200 for 20 physicians), and physicians from independent samples will be recruited for surveys to understand the mechanisms and collect expert predictions ($60 for a 20-min survey for 100 physicians).	$10,000

Total = $258,985

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