Clinician scientists transform clinical observations to clinical research and eventually medical advances. However, the lack of time, training, and effective technology support are known barriers for more than 87% of primary care physicians to conduct research. Our goal is to diminish health disparities in primary care and clinical research by empowering clinicians in low socioeconomic communities to participate in frontline clinical research. We propose to develop flexible plug-ins for electronic health records (EHR) to help re-engineer clinical care and research workflows toward improved workflow efficiency and patient safety as well as reduced redundancy.

Inadequate interoperability of processes and systems between clinical research and patient care can lead to costly redundant test orders and visits, and dangerous drug-drug interactions. In 2009, Conway and Clancy suggested that "use of requisite research will be most efficient and relevant if generated as a by-product of care delivery." (JAMA 09, Vol. 301, No.7). A meaningful fusion of clinical care and research workflows promises to avoid conflicts and to improve safety and efficiency for clinical research. EHR plug-ins that support flexible data federation and workflow coordination between clinical research and patient care would (a) improve contextual awareness for both care providers and research personnel, (b) promote a safer environment for research participants by protecting them from adverse drug interactions between clinical prescriptions and research interventions, (c) improve workflow efficiency by eliminating redundant or conflicting tests or visits, and (d) enable synergetic coordination across care and research teams. Frontline clinician scientists could also serve as learning networks for accelerating dissemination of clinical research evidence into practice.

Over the past decade, our team has established mature technology for improving the efficiency of clinical or research workflows, including EHR-based clinical research participants screening, computerized representation of research protocols and clinical guidelines, and an integrated research visit scheduling and financial management tool STEPS10, to name a few. Through our InterTrial research, one of the NIH Roadmap initiatives for re-engineering clinical research enterprise14, we have accumulated invaluable knowledge of clinical research workflows and identified practical needs for informatics support for community-based clinical research. Given the nation's large-scale deployment of EHR starting year 2009, we are motivated to translate the above knowledge into agile research decision support methods that can flexibly work with most functional EHRs to directly address the research needs at community level.

Therefore, our specific aims are to:
1. Create concerted patient care and clinical research workflow models, designed to promote awareness, information sharing and reuse, and activity coordination between patient care and clinical research;

2. Establish a standards-based knowledge base of business rules to support the re-engineered care/research workflow model by harmonizing the user needs of multiple stakeholders;

3. Design a flexible and scalable service-oriented architecture that can interoperate with the knowledge base of business rules and the EHR to provide research decision support for visit scheduling, adverse events detection, automated research form filling, and research participants

screening;

4. Design and apply metrics to evaluate the utility, usability, usefulness, impact, and user perception of the integrated workflow and research decision support method among multiple stakeholders.

We will build on a multidisciplinary collaboration between clinical investigators, clinical research coordinators, and biomedical informatics researchers to achieve the above aims. Our socio-technical approach marries the best of domain knowledge, user needs, and advanced informatics technology to support clinical research based on our understanding that information technology in itself is insufficient to improve workflows but must be driven by the needs of all stakeholders and various socio-technical factors. We believe our proposed research will substantially increase the capacity of comparative effectiveness research in community-based practice settings and improve the efficiency, safety, and ethnic diversity of clinical research, and ultimately help accomplish the translational research mission and bridge health disparity gaps.