

Title: Improving Care for Chronic Diseases in Rural Dominican Republic and Guatemala: Development of a Mobile Technology Support System for Community Health Workers

Type: Spectrum Pilot Grants for Community Engagement

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ABSTRACT

Aims: Chronic diseases such as diabetes, hypertension, and their sequelae—primarily cardiovascular disease—are now the leading cause of death in low- and middle-income countries (LMICs).¹ Addressing chronic diseases requires a comprehensive healthcare delivery system able to operate within significant personnel and financial constraints. Many experts suggest that community health workers (CHWs) are a building-block for such a system.² In this pilot project we will equip CHWs with a mobile technology support system to improve health care in rural settings.

Methods: This project will be a collaborative effort between Stanford, the Dominican community-based non-governmental organization Rural Alternative Center of El Limon (CAREL), the Provincial Ministry of Public Health, and the Global Telehealth Network. Working in three isolated villages in the Dominican Republic, we will support CHWs with a mobile technology platform, training, and clinical expertise. To perform screening for diabetes and hypertension, and to evaluate this project, we will perform pre- and post-intervention surveys with health-related quality of life as the outcome of interest.

Innovation: Though widely touted as a solution, few models exist for CHW-based management for chronic disease in LMICs. This project will address two important limitations identified from current data: lack of integration with health system and inability to participate in clinical decision making. The new, *connected*, CHW will conduct screening, help maintain medical records, and assist in the management of diabetes and hypertension, with the use of simple protocol-based decision-making tools and online access to national and international specialists.

PROBLEM STATEMENT

The World Health Organization projects that over the next two decades, chronic diseases will lead to five times as many deaths as infectious diseases.³ Currently half of these deaths in LMICs are labeled “premature.” Nearly a third occur during the productive years of an individual’s lifespan.³ Coping with these diseases requires a health care system that incorporates screening, reliable follow-up, and medication availability.

However, in most LMICs the skilled personnel and financial resources required to support such a comprehensive delivery system are unavailable.⁴ Terrain adds a third challenge in the Dominican Republic, where our proposed project will be piloted, and in Guatemala, where the project will be scaled up. Ill patients must travel for hours over hilly terrain or rivers to reach the nearest city hospital. Visits for preventive care to over-subscribed and under-stocked clinics are understandably rare.

Worldwide, ‘task-shifting’ or ‘task-sharing’ has emerged as an attractive approach for extending the reach of health care systems. Community health workers given a range of training can be deployed for functions that tax most systems: from counseling on safe sex to vaccination campaigns. Often residents of the community they are servicing, CHWs have been shown to be effective in maternal health,⁵ and both effective and cost-effective in HIV/AIDS treatment.⁶

Results from studies of CHWs caring for patients with chronic diseases have been mixed.² For example, in a cluster randomized trial in rural India, trained CHWs were able to correctly identify individuals at risk for cardiovascular events and make recommendations regarding therapy.⁷ Physicians agreed with the recommendations in 87% of re-reviewed cases. However, since the CHWs were not able to prescribe medications or even facilitate appointments with physicians, there were no differences in medication use between the intervention and control groups at two-year follow up. Similar results have been reported from a trial in Cape Town, South Africa (data not yet published).

RESEARCH PLAN

We will work with a recently re-invigorated CHW program in the Dominican Republic to address the challenges of integration and clinical decision making. We will develop an electronic, mobile support system that facilitates task-shifting in community-based chronic disease programs. By combining the strengths of a non-governmental organization with deep roots in three Dominican villages, the regional

public health system, and Stanford faculty experts in implementation of global health initiatives, our proposed intervention will have three components of support for the CHW:

1. Mobile technology platform
2. Training
3. Clinical expertise

Mobile technology platform: During the one-year period of this grant, the major objective will be to design and implement a tablet-based electronic decision support system whose inputs come from the CHW and which outputs a follow up and management plan, incorporating consultation from a clinician.

The prototype for this application is a childhood nutrition surveillance Android application developed under Dr. Paul Wise's guidance and scheduled to be launched in 23 villages in Guatemala (Figure 1). After 12 years of working in Guatemala to address childhood malnutrition, Dr. Wise and his programming



Figure 1. User screens for nutrition surveillance application

team (currently led by Alejandro Chavez) have created an electronic platform to simplify data capture, management recommendations, and research. This platform collects data on height/weight, plots the growth curve, and generates a recommendation based on the child's clinical status. Data are stored on an encrypted server and interface with a website.

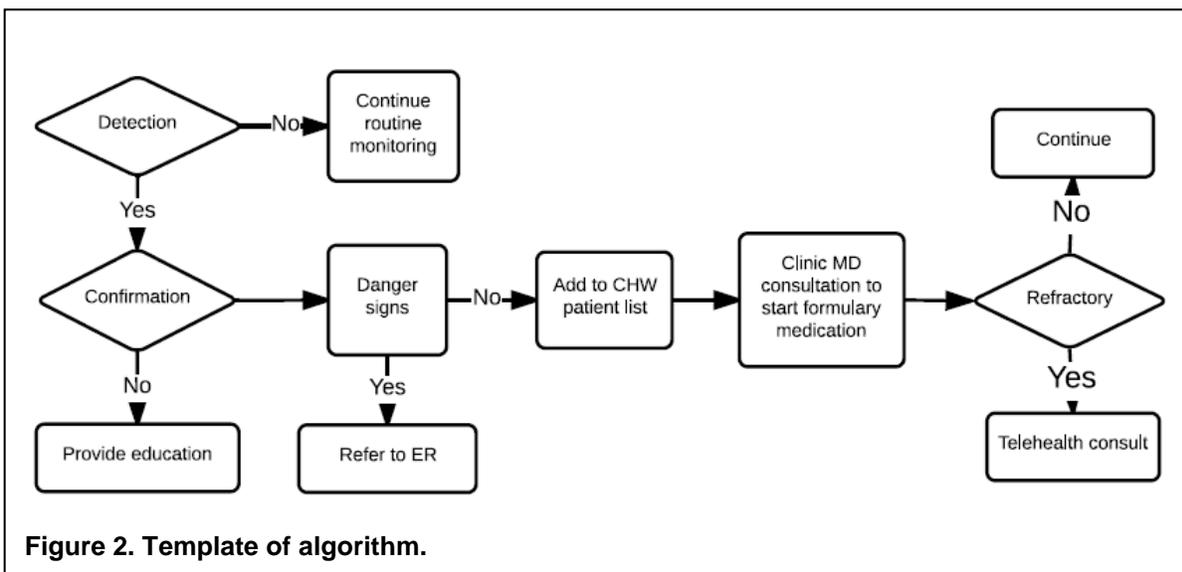
We will work with experienced programmers in Dr. Wise's team to adapt this application for the detection and management of diabetes and hypertension. We envision it to have: data collection, prompting functions for follow up, and an ability to interface with an electronic medical record.

We will use low-cost Android tablets, connected by wi-fi where available and otherwise by cellular data links.

Training: We will develop modules for CHW training that focus on end-organ effects of diabetes and hypertension. These modules will also provide a formulary of generic medications that are often employed as first-line agents and are available in Dominican Republic. We will deliver these modules in-person and will also provide continuing education via telehealth connections.

Clinical expertise and decision making tools: Partners In Health, a leading global health organization founded among others by Dr. Paul Farmer and Dr. Jim Yong Kim and working towards health equity worldwide, is creating cost-conscious guidelines for chronic disease management.⁸ Using their algorithms for Rwanda as a guide, we will develop algorithms for detection and management of hypertension and diabetes (Figure 2). We will incorporate these algorithms as prompting functions in our electronic platform. At the end of each week, the CHW will have a consultation with a local primary care physician who will then use a project formulary list to prescribe or titrate medications.

After the CHW facilitates initiation of medication, he/she will be prompted to return to see the patient in follow-up, with further prompts directed by achievement of targets. If a specialty consultation is needed, a physician volunteer with the Global Telehealth Network will be available online to advise the CHW (and/or local physician) regarding further therapy.



Preliminary work: We will pilot our system in the villages of Los Naranjales, Los Martinez, and El Limon, with a total population of 600 and adult population of 350. CAREL, our community partner, has worked in these villages for over 15 years. One of its major accomplishments—a stepping stone for our program—is internet capability in remote regions. Reliable internet capability will enable use of electronic decision support and has supported successful telehealth consultations: in summer 2014, we consulted for a young man on dialysis, and a young woman with complications from type 1 diabetes.

Our group has discussed the proposed project with Dr. Edito Sosa, Provincial Director of the Ministry of Public Health and Social Assistance. Dr. Sosa has pledged to facilitate CHW and physician involvement. In addition, The Ministry of Health has recently committed to upgrade its CHW program, hiring and training one CHW for each 100 residents. Thus, within the period of this pilot, we will be working with 5-6 newly hired CHWs as well as one experienced CHW. Finally the Dominican Republic is implementing an electronic health record system with which we expect to interface our decision support system.

Based on an interview with the current CHW, we estimate that about 15% of the 350 adults (> 18 years of age) have known diabetes and/or hypertension. Taking into account newly detected cases, we would expect to be treating 50-75 people.

TIMELINE

Months	CHW training and implementation work	Electronic Platform work
Oct-Dec 2014 <i>Pre-grant</i>	1. Discuss DM & HTN protocols with Partners In Health Rwanda 2. Apply for IRB approval at Stanford & in DR*	1. Recruit Stanford students to work on adapting nutrition application
Jan-Mar 2015	3. Feedback on protocols and on generic medications from DR Ministry and local physicians 4. Start CHW training	2. Create baseline survey/data collection platform 3. Incorporate treatment prompts and protocols
Apr-June 2015	5. Perform “case-simulations” with CHWs and clinic physicians	4. Alpha test software with physicians and CHWs in DR 5. Beta test software in field
July-Dec 2015	Project Implementation: 1. Baseline survey 2. Management via mobile technology platform 3. Telehealth consultations	

*Ethics approval in the Dominican Republic requires a detailed protocol that will be reviewed by central Ministry of Public Health officials based in Santo Domingo; to be presented on our behalf by Dr. Sosa.

Project evaluation: In the seventh month of the grant period, we will implement a community-wide baseline survey which will serve multiple functions including systematic screening for diabetes and hypertension cases, and baseline “pre-intervention” data on blood pressure, medication use, health-related quality of life, and health care expenditures. The survey will be an outreach tool, and encourage broader community involvement in healthcare issues.

After completion of year 1 of the intervention (July 2016), we will administer a “post-intervention” survey, with a primary outcome of interest being health-related quality of life scores among adults. Among the patients with hypertension or diabetes, we will examine the proportion on treatment, the proportion meeting targets, and changes in household expenditures on health. We will also incorporate a mixed-methods approach with qualitative focus group discussions and individual interviews to understand successes and failures.

DESCRIPTION OF INTERDISCIPLINARY COLLABORATIONS

The project creates an academic-community partnership within the framework of health services research. Team members will work together to harness Stanford’s expertise in clinical work, technology, and global health research to create an integrated system of care in a community with well-positioned advocates.

Stanford University

Dr. Shuchi Anand will provide expertise in the diagnosis and management of adult hypertension and diabetes, and is a recent recipient of a NIDDK K-23 focused on global health and chronic diseases. With Dr. Shih she will lead the development of protocols, CHW training modules, and the baseline survey. Both physicians will travel to the Dominican Republic to integrate feedback from Dominican Republic physicians, oversee case simulations using the tablet, and implement the baseline survey followed by the intervention.

Dr. Weiwen (Vivian) Shih will additionally serve as the pediatric expert in early detection and mitigation of pediatric kidney disease, as well as potential cross-over for the nutritional surveillance project in Guatemala.

Dr. Paul Wise has led a large-scale, extremely successful intervention to reduce childhood malnutrition in Guatemala. He will provide oversight and guidance at all key steps of this project as well as a pathway to expansion in Guatemala. His programming team will be the key technical resource for the creation of the electronic decision support platform.

Dr. Grant Miller will guide Drs. Anand and Shih as they create a plan for intervention evaluation for the pilot and its expansion. In particular he will help us explore aspects of household economics amenable to study and guide our qualitative research.

CAREL, El Limon de Ocoa, Dominican Republic

This Dominican, community-based non-governmental organization will provide on-site project management, facilitating community engagement, CHW training, and telecommunications access.

Ministry of Public Health and Social Assistance, Province of Ocoa

Dr. Edito Sosa will provide CHW funding, and facilitate primary care provider participation.

Global Telehealth Network

Dr. Jack Higgins will facilitate online physician consultations.

DESCRIPTION OF PLAN FOR COMMUNITY ENGAGEMENT

Our community partner, CAREL, has been an integral part of the El Limon, Los Martinez, and Los Naranjales communities for over 15 years, working with residents to construct the village's hydroelectric system, internet capability, and a technical training center, and to implement a broad range of educational and cultural activities. CAREL is closely involved with the community's medical problems, having provided extensive financial and logistical support to individuals with medical needs. In concert with Provincial public health experts and village leaders, CAREL has identified morbidity and mortality from chronic diseases as an increasing concern for most villagers.

Drawing from its extensive experience, linkages, and credibility with the three site communities, and working in close coordination with the PIs, CAREL will implement a community-wide participatory health initiative focused on the CHWs, with the objective of developing a social environment of community and individual responsibility for healthcare needs. This will be achieved through a series of meetings, workshops, and other activities that:

1. Introduce the project to key community actors then continue the outreach to the general population
2. Foster a mutually supportive relationship between CHWs, patients, and Public Health personnel
3. Raise awareness diabetes and hypertension as major causes of death and disability
4. Provide community feedback and accountability for CHW services.

A more detailed community engagement plan description is appended to CAREL's Letter of Participation.

DESCRIPTION OF POTENTIAL IMPACT AND TRANSITION TO FUNDING

This project will serve as a model for training and integrating CHWs for chronic disease management in medically underserved areas throughout the world. We plan to expand this pilot study to the current sites of nutritional surveillance program in Guatemala (23 villages) and to CAREL's network of 25 villages in Dominican Republic. Both countries are facing an increasing burden of diabetes and hypertension in their populations, and both are relying on CHW to supplement their primary care services.

The partners in this collaboration intend to seek additional funding for the program through the following sources: the Ministry of Public Health and Social Assistance of the Dominican Republic, Centers for Disease Control's Division for Diabetes Translation, and the World Bank.

REFERENCES

1. Wang H, Dwyer-Lindgren L, Lofgren KT, et al. Age-specific and sex-specific mortality in 187 countries, 1970-2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet* 2012;380:2071-94.
2. Joshi R, Alim M, Kengne AP, et al. Task shifting for non-communicable disease management in low and middle income countries - a systematic review. *PloS one* 2014;9:e103754.
3. World Health Organization. Global status report on noncommunicable diseases 2010. In: Organization WH, ed. 2011.
4. The World Bank. World DataBank: Health Nutrition and Population Statistics
5. Lewin S, Munabi-Babigumira S, Glenton C, et al. Lay health workers in primary and community health care for maternal and child health and the management of infectious diseases. *The Cochrane database of systematic reviews* 2010:CD004015.
6. Mdege ND, Chindove S, Ali S. The effectiveness and cost implications of task-shifting in the delivery of antiretroviral therapy to HIV-infected patients: a systematic review. *Health policy and planning* 2013;28:223-36.
7. Joshi R, Chow CK, Raju PK, et al. The Rural Andhra Pradesh Cardiovascular Prevention Study (RAPCAPS): a cluster randomized trial. *Journal of the American College of Cardiology* 2012;59:1188-96.
8. Kidder A, Gene Kwan, Corrado Cancedda, and Gene Bukhman. *The PIH Guide to Chronic Care Integration for Endemic Non-Communicable Diseases* In: Bukhman AKaG, ed. Boston: Brigham and Women's Hospital 2013.

Budget

Personnel	
Program Coordinator (3/5 time)	16500
Stanford Computer Science Student Stipend	10000
Administrative costs (5%)	2367
Equipment	
Tablets 6 x \$ 200	1200
Diagnostic Equipment and Supplies	500
Upgrade of communities' wireless access equipment	1600
Transportation	
Limon-Los Martinez-Los Naranjales 3/wk x \$20 x 50wk	3750
Ocoa-Santo Domingo \$ 50 x 40 trips	2000
2 Pls x 2 trips x \$ 1200	4800
Communication	
Internet service	2400
Cellphones (including data) (8 accounts x 12 months x \$50)	4800
Total requested	49917
Additional funding (From Global Telehealth Network)	
Training sessions and meetings	1200

Budget justification:

A large portion of the budget is devoted to personnel costs, including a program coordinator to be hired and supported by CAREL, who will serve as a conduit for all involved CHWs and physicians. He/she will have enough programming experience to trouble shoot the electronic platform, and will also be able to monitor data quality for the baseline survey. We will recruit a Stanford Computer Science student to work under Alejandro Chavez (current programming team leader) for adaption of nutritional surveillance platform to diabetes and hypertension detection and management. Stipend costs are estimated from Dr. Wise's prior experience.

Project equipment requirements include tablets to be used by CHWs and diagnostic equipment for screening and follow up of diabetes and hypertension (electronic blood pressure cuffs, glucometers, and glucose strips). Transportation support for project coordinator, CAREL members, and principal investigators is also requested.

Finally, to support communication among CHWs and physicians, we will update, maintain, and extend the current internet connection with new batteries and radio transmission systems. We will assure cell phone connections in areas without internet connection. The Global Telehealth Network will cover costs of hosting and publicizing pre- and post-implementation meetings.

Biosketches of Stanford Personnel

BIOGRAPHICAL SKETCH

NAME OF GRANT APPLICANT Anand, Shuchi	POSITION TITLE Instructor, Division of Nephrology Stanford University School of Medicine
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A. Education and Training

INSTITUTION AND LOCATION	DEGREE <i>(if applicable)</i>	YEAR(s)	FIELD OF STUDY
Carleton College	BA	1998-2002	Economics
Washington University School of Medicine	MD	2002-2006	
Brigham and Women's Hospital	Residency	2006-2009	Internal Medicine
Stanford University School of Medicine	Fellowship	2009-present	Nephrology
Stanford University School of Medicine	MS	2011-2013	Epidemiology

B. Personal Statement

I am extremely excited to propose a project on community health worker support in collaboration with partners in the Dominican Republic and mentors at Stanford. Not only does this project attempt to address gaps in current community health worker models, it also has a tremendous scope for scalability, with both groups from Dominican Republic and Guatemala expressing interest in doing so.

This proposal builds on my interest in working at intersection of the global health and chronic diseases. Directly relevant to this proposal, I have also completed a Fogarty Global Health Equity Scholarship, having spent the past year at the Center for Chronic Disease Control in New Delhi and am currently evaluating data from a surveillance study, looking at prevalence and risk factors of chronic kidney disease. In addition, I have recently completed a Masters in Health Research and Policy (Epidemiology). This project will be a milestone in my development as an investigator, allowing me to extend my reach beyond epidemiology into programmatic, health services research—a major goal of my K23 award. A superb group of mentors will guide this process. In addition to getting ongoing content guidance from Drs. Chertow and Barry (senior mentors on my K-23 project), I will get guidance relevant to implementation (Dr. Wise) and impact evaluation (Dr. Miller).

C. Research/and or Professional Experience

Employment/Positions

2001	Fogarty Intern, Bamako, Mali
2005	OC Hubert Fellow (Center for Disease Control), Nakhon Phanom, Thailand
2006	Research intern, Hopkins-Sassoon Hospital Maternal Infant HIV Transmission Trial
2006-2009	Resident, Internal Medicine, Brigham and Women's Hospital, Boston, MA
2009-2013	Fellow, Nephrology, Stanford University School of Medicine, Palo Alto, CA

2012-2013 Fogarty Global Health Equity Scholar, Stanford University School of Medicine and Center for Chronic Disease Control, India
2013-present Instructor, Division of Nephrology, Stanford University School of Medicine, Palo Alto, CA

Professional Memberships & Board Certifications

2009-present Member, American Society of Nephrology
2011-present Member, Stanford University Physician Scholars
2014-present Member, International Society of Nephrology
2014-present Coordinator, Global Health Nephrology Interest Group
2010 American Board of Internal Medicine Certification
2012 American Board of Internal Medicine Certification in Nephrology

Honors

1998 Knight Ridder National Scholar
2000 Phi Beta Kappa—Inductee during Junior year of College
2002 Minnesota Economic Association second place for Undergraduate thesis
2005 Washington University Alumni Award for outstanding scholarship
2006 Alpha omega alpha inductee during medical school

Publications

Most relevant to current award (in chronological order)

1. Jordan HT, Prapasiri P, Areerat P, **Anand S**, Clague B, Sutthirattana S, Chamany S, Flannery B, Olsen SJ. A comparison of population-based pneumonia surveillance and health-seeking behavior in 2 provinces in rural Thailand. *Int J Infect Dis.* 2008 Oct. PMID: 18977679
2. Gupta A, **Anand S**, Sastry J, Krisagar A, Basavaraj A, Bhat SM, Gupte N, Bollinger RC, Kakrani AL. High risk for occupational exposure to HIV and utilization of post-exposure prophylaxis in a teaching hospital in Pune, India. *BMC Infect Dis.* 2008 Oct; 8(1):142. PMID: 18939992. PMCID: PMC2588594.
3. Gaziano TA, Bitton A, **Anand S**, Abrahams-Gessel S, Murphy A. Growing epidemic of coronary heart disease in low- and middle income countries. *Curr Probl Cardiol.* 2010 Feb;35(2):72-115. PMID: 20109979. PMCID: PMC2864143
4. Gaziano TA, Bitton A, **Anand S** and Weinstein MC. The global cost of nonoptimal blood pressure. *J Hypertens.* 2009 Jul;27(7):1472-7. PMID: 19474763.
5. **Anand S**, Khanam MA, and Finkelstein F. Global perspective on chronic kidney disease. Book chapter for *Nutrition in Kidney Disease*, 2nd edition. In Press.
6. **Anand S**, Bitton A and Gaziano TA. The Gap between Estimated Incidence of End-Stage Renal Disease and Use of Therapy. *PLoS One.* 2013 Aug;8(8):e72860. PMID: 24023651 PMCID: PMC3758352
7. Saquib, N, Khanam MA, Saquib J, **Anand S**, Chertow GM, Barry M, Ahmed T, and Cullen M. Type 2 Diabetes Epidemic among the Urban Middle Class in Bangladesh. Manuscript accepted at *BMC Public Health*.
8. Bieber B, Qian J, **Anand S**, Yan Y, Chen N, Wang M, Wang M, Zuo L, Hou F, Pisoni R, Robinson B, and Ramirez S. Two-Times Weekly Hemodialysis in China: Frequency, Associated Patient and Treatment Characteristics, and Quality of Life in the China Dialysis Outcomes and Practice Patterns Study (DOPPS). *Nephrol Dial Transplant*, epub 2013 Dec. PMID:24322579

9. **Anand S**, Khanam MA, Saquib J, Saquib N, Ahmed T, Alam DS, Cullen MR, Barry M and Chertow GM. High prevalence of chronic kidney disease in a community survey of urban Bangladeshis. *Globalization and Health*. 2014 Feb; 10 (9). PMID: 24555767. PMCID: PMC3944963

Other publications (in chronological order)

1. **Anand S**, Chertow G, Johansen KL, Grimes B, Kurella Tamura M, Dalrymple L, Kaysen G. Association of Self-reported Physical Activity With Laboratory Markers of Nutrition and Inflammation: The Comprehensive Dialysis Study. *Journal of Renal Nutrition*. 2011 Jan. PMID: 21239185. PMCID: PMC3124610
2. Kurella Tamura M, **Anand S**, Li S, Chen S, Whaley Connell AT, Stevens LA, Norris KC. Comparison of CKD Awareness in a Screening Population Using the Modification of Diet in Renal Disease (MDRD) Study and CKD Epidemiology Collaboration (CKD-EPI) Equations. *AJKD*, 2011 March; 57 (3): S17-S23. PMID: 21338846. PMCID: PMC3075598
3. **Anand S**, Kaysen GA, Chertow GM, Johansen KL, Grimes B, Dalrymple LS, Kurella Tamura M. Vitamin D deficiency, self-reported physical activity and health-related quality of life: the Comprehensive Dialysis Study. *Nephrol Dial Transplant*. Epub 2011 Mar. PMID: 21430182. PMCID: PMC3247798
4. **Anand S** and Kurella Tamura M. Combining angiotensin-receptor blockers with angiotensin-converting-enzyme inhibitors in elderly patients. In the Literature Editorial Contribution. *AJKD*. 2012 Jan;59(1):11-4. PMID: 21995968
5. Dalrymple L, Johansen K, Chertow G, Grimes B, **Anand S**, McCulloch C and Kaysen G. Serum Albumin and Prealbumin during the First Year of Dialysis: the Comprehensive Dialysis Study. *J Ren Nutr*. 2011 Nov;21(6):429-37. PMID: 22633987. PMCID: PMC3124610
6. **Anand S** and Winkelmayer WC. Causal or casual? The association between artificially sweetened carbonated beverages and vascular disease. *J Gen Intern Med*. 2012 Sep;27(9):1100-1. PMID: 22692638
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9. Johansen KL, Kaysen GA, Dalrymple LS, Grimes BA, Glidden DV, **Anand S**, Chertow GM. Association of physical activity with survival among ambulatory patients on dialysis: the Comprehensive Dialysis Study. *Clin J Am Soc Nephrol*. 2013 Feb;8(2):248-53. PMID: 23124787. PMCID: PMC3562868
10. **Anand S**, Johansen KL, and Manjula Kurella Tamura. Aging and chronic kidney disease: the impact on physical function and cognition. *J Gerontol A Biol Sci Med Sci*. 2013 Aug 2 (epub). PMID: 23913934
11. **Anand S**, Chertow G, Johansen KL, Grimes B, Dalrymple L, Kaysen G, and Manjula Kurella Tamura. Vitamin D deficiency and mortality in patients receiving dialysis: the Comprehensive Dialysis Study. *Journal of Renal Nutrition*. 2013 Nov;23(6):422-7. PMID:23876600.

BIOGRAPHICAL SKETCH

NAME Weiwen Shih	POSITION TITLE Fellow, Pediatric Nephrology
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EDUCATION/TRAINING			
INSTITUTION AND LOCATION	DEGREE <i>(if applicable)</i>	MM/YY	FIELD OF STUDY
University of Texas at Austin	BS	07/00-05/04	Biochemistry
University of Texas Health Science Center at San Antonio	MD	06/04-06/08	Medicine
Stanford University		07/08-06/09	Pediatric Internship
Stanford University		07/09-06/11	Pediatric Residency
Stanford University		07/12-present	Pediatric Nephrology Fellowship

A. Personal Statement

As a young pediatric nephrologist interested in global health, I am focused on improving outcomes, quality of care, and quality of life in patients in medically underserved countries. The proposed project fits well within these goals, as we work to develop a model for further community health worker programs in medically underserved countries worldwide. By working with the Stanford Center for Innovation in Global Health, I hope to further hone my skills in developing sustainable health care programs globally. This project will serve as an excellent springboard for me to expand my skills and further my understanding in implementation of global health research. I am fortunate to have the guidance of two mentors, Dr. Paul Wise and Dr. Grant Miller who provide excellent leadership and experience in the development of technology to facilitate medical global health and international medical research intervention evaluation, respectively. Following completion of residency, I chose to take an additional year working in General Pediatrics to gain more experience and knowledge as a General Pediatrician. During that time, I worked with residents and medical students to hone my teaching skills and further my understanding of working in an academic center. My confidence and capabilities expanded immensely, and the time only reinforced my desire to become an academic pediatric nephrologist. Since the start of my fellowship, I have been increasingly enthusiastic to broaden my experience from direct patient care to improving patient care through clinical research. In summary, my experience and enthusiasm as a new researcher combined with knowledgeable mentorship creates an ideal research environment and gives me the tools to lead the proposed project.

B. Positions and Honors

Positions and Employment

2012-current	Fellow, Division of Pediatric Nephrology, Stanford University, Palo Alto, CA
2011-2012	Clinical Instructor, Division of General Pediatrics, Stanford University, Palo Alto, CA

2011-2012 Pediatrician, Division of General Pediatrics, Santa Clara Valley Medical Center, San Jose, CA
2009-2011 Resident, Division of Pediatrics, Stanford University, Palo Alto, CA
2008-2009 Intern, Division of Pediatrics, Stanford University, Palo Alto, CA

Other Experiences and Professional Memberships

2013-present Member, American Society of Nephrology
2012-present Member, American Society of Pediatric Nephrology
2010-present Member, Pediatric Academic Society
2008-present Member, American Academy of Pediatrics
2007-2008 Clinic Liaison, Texas Medical Association
2004-2008 Member, American Medical Association
2004-2008 Member, Texas Medical Association

Honors

2011-2012 Outstanding teacher in General Pediatrics
2008 John A. Mangos, MD Award for Excellence in Pediatrics
2013 Poster presentation for case presentation at Annual Dialysis Conference
2014 Poster presentation at Annual Dialysis Conference submitted
2014 Abstract for Pediatrics Academic Society submitted
2014 Poster presentation for case presentation at Annual Dialysis Conference submitted

C. Research Support

Ongoing Research

UL1 TR000093 and UL1 TR001085 Child Health Research Institute (CHRI) 7/1/2013-6/30/2015

To demonstrate an association between high chloride exposure and acute kidney injury, allowing for identification of modifiable risk factors to prevent the development of AKI in critically ill patients

Role: Post doctoral fellow

BIOGRAPHICAL SKETCH

NAME Paul H. Wise, MD, MPH	POSITION TITLE Professor of Pediatrics
eRA COMMONS USER NAME wisep	Co-Director, March of Dimes Center for Prematurity Research, Stanford University

EDUCATION/TRAINING			
INSTITUTION AND LOCATION	DEGREE <i>(if applicable)</i>	YEAR(s)	FIELD OF STUDY
Cornell University	AB	1969-74	Latin American Studies
Cornell University College of Medicine	MD	1974-78	Medicine
Harvard School of Public Health	MPH	1977-8	General Studies

A. Personal Statement

My research activities have long been focused on disparities in birth and child health outcomes. Of special concern have been the life-course implications of early life exposures and the development of effective community-based and policy-based responses. I have a broad background in pediatric outcomes, health services, and policy research, and have led research teams focused on a variety of subspecialty disciplines, including neonatology, pulmonology, hematology/oncology, rheumatology, emergency medicine, and others. My current positions include Co-Director of the March of Dimes Center for Prematurity Research at Stanford University which is dedicated to addressing social disparities in prematurity and its sequelae. I have considerable experience in developing and supporting highly collaborative research initiatives that integrate clinical, basic and social science expertise. Prior to my current position, I served in highly interdisciplinary leadership roles, including Director of the Harvard Institute of Reproductive and Child Health and Vice-Chief of the Division of Social Medicine and Health Inequalities at Harvard Medical School. In addition, I have served in a variety of cross-disciplinary consultative roles, as Special Assistant to the US Surgeon General, Chair of the Steering Committee of the NIH Global Network for Women's and Children's Health Research, and currently, as Chair of the Task Force on Strategic Priorities of the Secretary of the Department of Health and Human Service's Advisory Committee on Genetics, Health and Society. I am currently a member of the NICHD, NIH Advisory Council. Specific to this submission I have considerable experience working with community-based research and intervention programs in the developing world with particular interest in technology-based enhancements to community health worker capacity.

B. Positions and Honors.

1978-81	Residency in Pediatrics, Children's Hospital Medical Center, Boston
1981-1984	Director, Emergency and Primary Care Services, Children's Hospital, Boston, MA
1984-1987	Director of Perinatal Epidemiology, Joint Program in Neonatology, Brigham and Women's Hospital, Boston, MA
1988	Young Professional Award, American Public Health Association
1990-91	Special Expert, NICHD, NIH and Office of the Surgeon General, USPHS
1992-1996	Director, Harvard Institute for Reproductive and Child Health, Harvard Medical School, Boston, MA
1995	Franklin Delano Roosevelt Award, The March of Dimes, Massachusetts Chapter
1996-2004	Director, Social and Health Policy Research Department of Pediatrics, Boston Medical Center
2000-2006	Chair, NIH Global Network for Women's and Children's Health Research, NICHD, NIH

2001	Richard and Millie Brock Award for Contributions to Pediatrics, New York Academy of Medicine
2002	Anne E. Dyson Memorial Award Visiting Professor, Department of Pediatrics, University Rochester School of Medicine
2003-4	Vice-Chief, Division of Social Medicine and Health Inequalities Department of Medicine Brigham and Women's Hospital
2004-14	Director, Center for Policy, Outcomes and Prevention, Dept. of Pediatrics; and Core Faculty, Centers for Health Policy and Primary Care and Outcomes Research, Stanford University
2005-	Richard E. Behrman Professor of Child Health and Society, Professor of Pediatrics, Stanford University School of Medicine
2007-11	Member, Secretary's Advisory Committee on Genetics, Health and Society, DHHS. Chair, Task Force on Strategic Planning
2010-	Senior Fellow, Freeman-Spogli Institute for International Studies, Stanford University
2011-	Co-Director, March of Dimes Center for Prematurity Research
2012-	National Advisory Child Health and Human Development Council, NICHD, NIH

C. Selected peer-reviewed publications (Selected from 156 publications).

Most relevant to the current application

1. **Wise PH**, Kotelchuck M, Wilson M, Mills M. Racial and socio-economic disparities in childhood mortality in Boston. *New Eng J Med* 1985;313:360-6.
2. Kempe A, **Wise PH**, Barkan SE, et. al. Clinical determinants of the racial disparity in very low birth weight birth. *N Engl J Med* 1992;327:969-73.
3. Wang NE, Saynina O, Kuntz-Duriseti K, Mahlow P, **Wise PH**. Variability in pediatric utilization of trauma facilities in California: 1999-2005. *Ann Emerg Med* 2008; 52: 607-15.
4. Chamberlain LJ, Chan J, Mahlow P, Huffman LC, Chan K, **Wise PH**. Variation in specialty care hospitalization for children with chronic conditions in California: A total-population study. *Pediatrics* 2010; 125(6):1190-9.
5. Wise MD, Little AA, **Wise PH**, Wang CJ. Can state early intervention programs meet the increased demand of children suspected of having autism spectrum disorders? *J Devel Behav Peds* 2010; 31(6):469-76.
6. Wang XB, Zuckerman B, Pearson C, Kaufman G, Chen C, Wang G, Niu T, **Wise PH**, Bauchner H, Xu X. Maternal cigarette smoking, metabolic gene polymorphism, and infant birth weight. *JAMA*. 2002;287(2):195-202.
7. Pineda N, Chamberlain LJ, Chan J, Cidon MJ, **Wise PH**. Access to pediatric subspecialty care: A population study of pediatric rheumatology inpatients in California. *Arthritis Care Res (Hoboken)*. 2011;63(7):998-1005.
8. Chamberlain LJ, Pineda N, Winestone L, Saynina O, Rangaswami A, Link M, **Wise PH**. Access to pediatric subspecialty care: a population study of pediatric oncology inpatients in California. *J Ped Hem Onc. (In Press)*.
9. Lakkam M, Wager S, **Wise PH**, Wein LM. Quantifying and exploiting the age dependence in the effect of supplementary food for child undernutrition. *PLoS One*. 2014;9:e99632.
10. Carmichael SL, Cullen MR, Mayo JA, Gould JB, Loftus P, Stevenson DK, **Wise PH**, Shaw GM. Population-level correlates of preterm delivery among black and white women in the U.S. *PLoS One*. 2014;9(4):e94153.
11. Shaw GM, **Wise PH**, Mayo J, Carmichael SL, Ley C, Lyell DJ, Shachar BZ, Melsop K, Phibbs CS, Stevenson DK, Parsonnet J, Gould JB. Maternal prepregnancy body mass index and risk of spontaneous preterm birth. *Pediatr Perinat Epi*. 2014;28:302-11.

Additional publications of importance to the field

12. **Wise PH.** Confronting social disparities in child health: a critical appraisal of life-course science and research. *Pediatrics*. 2009;124:S203-11.
13. Sachs BP, Fretts RC, Gardner R, Hellerstein S, Wampler NS, **Wise PH.** The impact of extreme prematurity and congenital anomalies on the interpretation of international comparisons of infant mortality. *Obstet Gynecol* 1995;85(6):941-946.
14. Hamvas A, **Wise PH,** Yang RK, Wampler NS, et al. The influence of the wider use of surfactant therapy on neonatal mortality among blacks and whites. *New Engl J Med* 1996;334:1635-40.
15. Kempe A, **Wise PH,** Wampler NS, Cole FS, Wallace H, Dickenson C, Rhinehart H, Lezotte DC, Beatty B. Risk status at discharge; etiology of death for postneonatal infant deaths: a total population study. *Pediatrics*. 1997; 99:338-44.
16. Kahn RS, **Wise PH.** Finkelstein JA. Bernstein HH. Lowe JA. Homer CJ. The scope of unmet maternal health needs in pediatric settings. *Pediatrics*. 1999;103(3):576-81.
17. Erickson LC, **Wise PH,** Cook EF, Beiser A, Newburger JW. The impact of managed care insurance on utilization of lower-mortality hospitals by children undergoing cardiac surgery in California. *Pediatrics*. 2000;105:1271-8.
18. Kahn RS, **Wise PH,** Kennedy BP, Kawachi I. State income inequality, household income, and maternal mental and physical health:cross sectional national survey. *BMJ*. 2000;321:1311-5. [PMCID: PMC27533]
19. Smith LA, **Wise PH,** Wampler NS. Knowledge of welfare reform program provisions among families of children with chronic conditions. *Am J Public Health*. 2002;92:228-30. [PMCID: PMC1447047]
20. Huffman LC, Brat GA, Chamberlain LJ, **Wise PH.** Impact of managed care on publicly insured children with special health care needs. *Acad Pediatr*. 2010;10:48-55.

D. Research Support

Ongoing Research Support

- 5P50 HG00338909 (Cho, PI) 03/01/10 – 02/28/15
NIH
(SPO#30192)
Center for Integrating Ethics and Genetic Research
The major goals of this project are to identify the implications of new genetic discoveries on health policy and ethics.
Role: Investigator
- March of Dimes Birth Defects Foundation (Stevenson, PI) 01/01/12 – 12/31/14
SPO #50185
March of Dimes Prematurity Research Center at Stanford University
The major goals of the project are to disentangle what appear to be the evasive host (genetic) environments that underlie preterm birth.
Role: Co-PI
- 1R25TW00951001 (Wang, PI) 07/01/13 – 01/31/18
NIH
(SPO#107566)
Integrating Technology and Context into Research Ethics Education in ACME
The major goal of this project is to train scholars and emerging healthcare leaders from developing countries in Asia on research ethics via the Asia Collaborative for Medical Education (ACME) Collaborative.
Role: Investigator
- U01 HL103629 (Robinson, PI) 09/01/10-04/30/17
NIH

Clinic, Family & Community Collaboration to Treat Overweight and Obese Children
The purpose of this study is to study the effectiveness of behavioral, social and environmental interventions to prevent and treat overweight and obese children.
Role: Investigator

Freeman-Spogli Institute for International Studies (Wise, PI) 01/01/12-8/31/14
Improving Child Health in Areas of Unstable Governance
This project is directed at identifying child health needs and service provision failures in areas of the world affected by political instability and civil conflict. It is focused on generating new technical and political strategies designed to ensure more effective service provision in complex political settings.

Completed Research Support

California Health Care Foundation 17591 (Wise, PI) 04/01/13 –09/30/14
Improving California Children's Services CCS Through User-Driven Data Analysis
The major goals of this program are to provide the California Department of Health Care Services (DHCS) and stakeholders of the California Children's Services program (CCS) with data-driven guidance necessary to make policy and programmatic changes to improve the care of children with special health care needs. (CSHCN).

California Health Care Foundation (Wise, PI) 08/01/10-06/30/11
Utilization and Expenditure Analysis of the California Children's Services Database
This project examines the epidemiology of health care utilization and expenditures among children in the California Children's Services program, primarily all children enrolled in Medicaid with a serious chronic illness in California.

BIOGRAPHICAL SKETCH

NAME Miller, Norman Grantham	POSITION TITLE Associate Professor of Medicine
eRA COMMONS USER NAME Miller.Norman	

EDUCATION/TRAINING			
INSTITUTION AND LOCATION	DEGREE <i>(if applicable)</i>	YEAR(s)	FIELD OF STUDY
Yale University	B.A.	1995	Psychology
Harvard University	M.P.P.	2000	Public Policy
Harvard University	Ph.D.	2005	Health Policy/Economics

A. Personal Statement

My research focuses on (1) evaluating health policies and programs for improving population health and (2) developing and testing new strategies for addressing the behavioral obstacles that can limit their impact. On the former, I have conducted evaluations of programs and policies including the family planning and reproductive services of Profamilia in Colombia, the New Rural Cooperate Medical Scheme in China (China's major health insurance program for the rural poor), the Chiranjeevi Yojana Program in India (covering the expense of institutional deliveries among poor women in Gujarat, India) and Colombia's Regimen Subsidiado (the predominant publicly-financed health insurance program in Colombia). On the latter, I have conducted large-scale intervention-based experimental studies of demand- and supply-side barriers to the appropriate adoption and use of public health and basic medical technologies. I have led my work on behavioral obstacles to health improvement with teams in India, Bangladesh, and China. Finally, I am currently developing a new initiative to join Stanford with Indian health policymakers and professionals to investigate the social, behavioral, and institutional obstacles to health policy success. The initiative will develop an agenda led by the experience of these Indian health policymakers and professionals, and it will develop and conduct graduate level student team projects spanning three quarters (including one in India in collaboration with India peer students). Given these experiences, I am well-qualified to support Dr. Anand and Shih in their proposed research in the Dominican Republic. I will work with them in particular on the areas of impact evaluation and scalability.

B. Positions and Honors

Positions and Employment

2014 - Director, Stanford Center for International Development, Stanford University
 2012 - Associate Professor of Medicine (with tenure), Stanford University
 2005 - Assistant Professor of Medicine, Department of Medicine, Stanford University
 2006 - Assistant Professor of Economics (by courtesy) and Assistant Professor of Health Research and Policy (by courtesy), Stanford University
 2008 - 2010 Academic Visitor, Department of Economics, Universidad de los Andes
 2012 - Associate Professor of Medicine, Department of Medicine, Stanford University;
 Senior Fellow, Freeman Spogli Institute for International Studies, Stanford University; Associate Professor of Economics (by courtesy) and Associate Professor of Health Research and Policy (by courtesy), Stanford University

Other Experience and Professional Memberships

2002 - present Referee: American Economic Journal: Applied Economics; American Economic Review; American Journal of Tropical Medicine and Hygiene; B.E. Journal of Economic Analysis & Policy; Demography; Economic Development and Cultural Change; Economic Journal; Economics Bulletin; Forum for Health Economics and Policy; Health Economics; Journal of the American College of Cardiology, Journal of Economic History; Journal of the European Economic Association; Journal of Health Economics; Journal of Human Resources; Journal of Labor Economics; Journal of Law, Economics, and Organization; Journal of Policy Analysis and Management; Journal of Public Economics; Lancet; Medical Care; Population Studies; Proceedings of the National Academy of Sciences; Quarterly Journal of Economics; Review of Economic Studies; Review of Economics and Statistics; Review of Economics of the Household; Social Science & Medicine

2002 - present Member: International Health Economics Association

2002 - present Member: AcademyHealth

2003 - present Member: Population Association of America

2004 - present Member: American Economic Association

2009 - present Grant Reviewer: National Institute of Child Health and Human Development (NIH/NICHD) Special Emphasis Panel; National Science Foundation

2009 External Ph.D. Examiner: Department of Economics, University College London

Honors and Awards

2000 - 2002 Graduate Award - the Harvard Health Policy Program for research on health and health care in Iran

2000 - 2002 Agency for Healthcare Research and Quality Trainee

2002 - 2004 Harvard Center for International Development Graduate Student Fellow

2002 - 2005 NBER Pre-Doctoral Fellow in Aging and Health Economics

2005 Graduate Award - the Warburg Fund through the Harvard Economics Department for research on the social consequences of civil conflict in Colombia

2005 - 2012 Faculty Research Fellow, National Bureau of Economic Research (NBER)

2005 - Faculty Fellow, Stanford Center for International Development

2005 - Faculty Affiliate, Stanford Center for Latin American Studies

2006 Best Student Paper Prize, American Society of Economists (Inaugural Award)

2006 Biennial Prize for Distinguished Contribution to Scholarship in Population, American Sociological Association Section on Population (Inaugural Award)

2009 - Faculty Affiliate, Woods Institute for the Environment, Stanford University

2009 Divisional Teaching Award, Department of Medicine, Stanford University

2010 Inter-American Prize for Research on Social Security, Conferencia Interamericana de Seguridad Social (CISS)

2011 Divisional Teaching Award, Department of Medicine, Stanford University

2012- Member, Urban Services Initiative, Adbud Latif Jameel Poverty Action Lab (J-PAL)

2012- Research Associate, National Bureau of Economic Research (NBER)

2013 Excellence in Refereeing, American Economic Review

2013- Research Associate, ESRC Research Centre for Micro-Social Change (MISOC), Institute for Social and Economic Research, University of Essex

2014- Affiliate, Abdul Latif Jameel Poverty Action Lab (J-PAL)

C. PUBLICATIONS

Articles most relevant to the current application

1. Miller, G, Pinto, D, Vera-Hernández, M, "Risk Protection, Service Use, and Health Outcomes under Colombia's Health Insurance Program for the Poor," *American Economic Journal: Applied Economics* 5(4): 61-69, 2013.
2. Bhattacharya, J, Gathmann, C, Miller, G, "The Gorbachev Anti-Alcohol Campaign and Russia's Mortality Crisis," *American Economic Journal: Applied Economics* 5(4): 232-260, 2013. PMID: PMC3818525

3. Bendavid, E, Holmes, CB, Bhattacharya, J, Miller, G, "HIV Development Assistance and Adult Mortality in Africa," *Journal of the American Medical Association* 307(19): 2060-2067, 2012. PMID: PMC3434229.
4. Miller, G, Luo, R, Zhang, L, Sylvia, S, Shi, Y, Foo, P, Zhao, Q, Martorell, R, Medina, A, Rozelle, S, "Effectiveness of Provider Incentives for Anaemia Reduction in Rural China: A Cluster Randomised Trial," *BMJ* 345: e4809, 2012. PMID:PMC3406729
5. Mobarak AM, Dwivedi P, Bailis R, Hildemann L, Miller G. "Low Demand for Nontraditional Cookstove Technologies," *Proceedings of the National Academy of Sciences USA* 109(27): 10815-10820, 2012. PMID:PMC3390883
6. Singer Babiarz, K, Miller, G, Yi, H, Zhang, L, Rozelle, S, "New Evidence on the Impact of China's New Cooperative Medical Scheme and Its Implications for Rural Primary Care," *BMJ* 341:c5617, 2010.
7. Miller, G, Urdinola, P, "Cyclical, Mortality, and the Value of Time: The Case of Coffee Price Fluctuations and Child Survival in Colombia," *Journal of Political Economy* 118(1): 113-155, 2010. PMID:PMC3214991
8. Miller, G, "Contraception as Development? New Evidence from Family Planning in Colombia," *Economic Journal* 120(545): 709-736, 2010.
9. Miller, G, "Women's Suffrage, Political Responsiveness, and Child Survival in American History," *Quarterly Journal of Economics* 123(3): 1287-1327, 2008. PMID:PMC3046394
10. Cutler, D, Miller G, Norton, D, "Evidence on Early-Life Income and Late-Life Health from America's Dust Bowl Era," *Proceedings of the National Academy of Sciences* 104(33): 13244-13249, 2007. PMID:PMC1948901
11. Cutler, D, Miller, G, "The Role of Public Health Improvements in Health Advances: The 20th Century United States," *Demography* 42(1): 1-22, 2005.

D. RESEARCH SUPPORT

Ongoing Research Support

Freeman Spogli Institute, Stanford University Miller (PI) 08/01/14-07/31/19
The Stanford-India Health Policy Initiative (SIHPI) and Micronutrient Deficiencies in Tamil Nadu, India
 This project aims to design and test interventions to improve the performance of childhood nutrition programs using a rigorous randomized controlled trial (RCT) methodology. SIHPI's network and field-based investigation will provide on-the-ground intelligence to guide their structure.
 Role: Principal Investigator

NIH (SPO# 48696) Miller (PI) 06/15/11-03/31/16
 5R01 HL10602304
Paying for Performance and CE of Strategies to Combat Anemia in China
 This project studies how direct rewards for better health (lower anemia rates) to primary school principals in rural China alter the use of educational and nutritional inputs. It also analyzes how these incentives substitute or complement similar incentives provided to students' parents.

Gates Foundation Mohanan (PI) 06/06/11-03/31/15
BEST- Bihar Evolution of Social Franchising and Telemedicine
 The major goal of this project is to carry out an evaluation of the impact of a large-scale social franchising and telemedicine program financed by the Gates Foundation in rural Bihar as well as related additional studies on how to improve the effectiveness of health care delivery in rural India.
 Role: PI: Sub Award

NIH Barry (PI) 09/01/10-08/31/14
 1RC4 TW00878101
Stanford Global Health Consortium: Innovation, Design, Evaluation and Action

The major goals of this project are to develop infrastructure at Stanford for innovation in the design and modeling of new diagnostics, drugs, and devices for global health which are scalable, have high impact, and are able to be implemented and commercialized.

Role: Investigator

Completed Research Support

NIH - Center for Innovation in Global Health
8-RTW008781Z Barry (PI) 08/1/13-07/31/14
The Stanford-India Emergency Management and Research Institute (EMRI) Study
This study aims to provide the first quantitative evidence of GVK EMRI's early impact on population-level infant and maternal health outcomes.
Role: Sub Award

K01 HD053504 Miller (PI) 06/01/07 –05/31/11
NIH/NICHD
The Causes and Behavioral Foundations of Mortality Decline in Developing Countries
Career Development Award to synthesize applied econometrics and demography into a new program of empirical mortality research.

Gates Foundation Mohanan (PI) 11/15/10-07/31/11
Evaluation of Private Provider Project in Bihar
This project is to plan an evaluation of the impact of a large-scale social franchising and telemedicine program financed by the Gates Foundation in rural Bihar. It will also plan additional studies on how to improve the effectiveness of health care delivery in rural India as well.
Role: PI, subcontract

International Initiative for Impact Evaluation (3IE) (Mohanan, PI) 05/01/10-05/31/12
Improving Maternal and Child Health in India: Evaluating Demand and Supply Side Strategies
This project's objectives are to evaluate voucher programs to increase rates of institutional deliveries among poor women in two India states (Gujarat and Karnataka) and to conduct experimental studies of how performance-based incentive payments to medical care providers improve their effectiveness.
Role: PI, subcontract

Presidential Fund for Innovation Miller (Co-PI) 01/01/12 –08/31/13
International Studies Freeman Spogli Institute for International Studies
Paying for Performance to Improve Health in Rural China: Does Resource Scarcity Breed Innovation in Service Delivery?
The major goals of this project are to analyze how the degree of innovation in service delivery under such incentives responds to the amount of resources available.