

HEALTHY LONGEVITY GLOBAL COMPETITION

2020 Catalyst Awardees

Sponsor: National Institute on Aging, National Institutes of Health

Development of a Wheelchair Maintenance Alert Application for Elderly Wheelchair Users

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PROJECT DESCRIPTION

Elderly wheelchair users experience wheelchair breakdowns every 2-3 months in low- and middle-income countries (LMICs) and rural areas of high-income countries. One in three breakdowns leads to adverse physical, social, psychosocial and economic consequences to wheelchair users which increases the public health and personal burden. Preventative wheelchair maintenance has been found to reduce the frequency of wheelchair breakdowns by ten-fold, but compliance with maintenance recommendations is extremely low because they are generic and not reflective of how and where the wheelchair is being used. To address this issue, we are developing a low-cost, scalable maintenance application that leverages artificial intelligence tools to provide maintenance recommendations tailored to how a wheelchair is used. The availability of low-cost technology and widespread use of smartphones by the elderly and people with disabilities in LMICs has led us to develop a smartphone application called WheelTrak that measures wheelchair wear as a function of usage in community. Based on the wear factors, the application produces a Wheelchair Wear Index (WWI) that is representative of wear of critical wheelchair parts that are prone to breakdown. Once a WWI threshold is reached, maintenance is required, and the application notifies the user and/or caregiver who can conduct maintenance to avoid breakdowns and related health consequences. We will conduct a data collection study in collaboration with our wheelchair industry partner – UCP Wheels in El Salvador – and characterize the WWI for the elderly by tracking wear factors which include user's travel distance, ground shocks and surface vibrations using WheelTrak and a wheel sensor. Based on the trained WWI algorithm, a preventative maintenance schedule will be developed for older adults that can be employed through WheelTrak for maintenance reminders. Semi-structured interviews will be conducted to evaluate the usability of the application and gather barriers to maintenance. User feedback will assist us in improving WheelTrak for greater user satisfaction and compliance with maintenance and addressing any personal or logistical challenges that elderly users and their caregivers or family members may face with conducting maintenance activities in LMICs. Findings from the proposed studies in this application will assist us in planning future studies to investigate the WWI-enabled WheelTrak tool as an intervention to prevent or reduce breakdowns and health consequences with the elderly in LMICs.

Leveraging Social Networks and Linkage to Care to Foster Healthy Aging in a Low-Income Context

Principal Investigator	Iliana V. Kohler
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Co-Investigator(s)	Fabrice Kaempfen; Hans-Peter Kohler, Alberto Ciancio, Eugene Katenga-Kaunda

PROJECT DESCRIPTION

Sub-Saharan African low-income countries (SSA LICs) have yet to develop effective and viable policies and health systems responses to foster healthy aging among a growing elderly population that is poorly served by overstretched health systems. While behavioral and health system change is challenging in any context, this challenge is exacerbated in SSA LICs as non-communicable diseases (NCDs) and aging-related diseases are an emerging—rather than established—disease burden. As a result, there prevails a poor understanding of risk factors, symptoms, treatment and prevention options. In addition, health systems are often limited with inadequately trained health providers and frequent resource scarcity available to meet the aging-related health needs of older people. This project leverages the Mature Adults Cohort of the Malawi Longitudinal Study of Families and Health (MLSFH-MAC), one of the very few ongoing longitudinal population-based aging studies in a SSA LIC, for explorative research with the ultimate goal to inform the development of cost-effective and sustainable interventions that target social networks and social diffusion as an effective strategy to foster healthy aging among older persons. We focus specifically on the 3Cs: cardiovascular diseases (CVDs), poor cognitive and mental health, and chronic musculoskeletal pain. These 3Cs are among the most demanding and socially costly, but generally malleable health burdens for aging populations in SSA LICs and globally. The Overall Aim is to understand social interactions about healthy aging, identify the social processes affecting health-knowledge and health-seeking behavior related to the 3Cs, and generate much needed evidence that will inform innovative intervention designs that leverage social dynamics to foster healthy-aging through sustained behavioral changes and linkages-to-care for older people most at risk and/or most affected by the 3Cs. Specific Aim 1 will identify individual, community and health-system factors promoting healthy aging in a SSA LIC context characterized by low life expectancy and high burden of diseases, including high prevalence of HIV/AIDS. Specific Aim 2 will investigate the pathways through which 3Cs-related health information is diffused through social networks in rural LIC communities characterized by low knowledge about risk factors, disease symptoms, treatment options, and limited exposure to 3Cs-related preventive care. Based on the generated evidence from MLSFH-MAC and guided by theories of behavioral change, Specific Aim 3 will initiate the development of an innovative social-network-based intervention design to foster healthy aging among the elderly in rural SSA LICs contexts, with the focus on pathways for: (a) improving 3Cs-related health-knowledge through social diffusion of information and behavioral norms, and (b) using social networks to enhance the linkage-to-care of the elderly affected by the 3Cs who are most likely to benefit given available 3Cs-related resources at local clinics.

Preventing Disability from MSK Pain in Northern Tanzania

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PROJECT DESCRIPTION

Musculoskeletal pain can be debilitating. Left untreated, musculoskeletal pain leads to functional decline, independent of other health conditions, that for older adults is known to increase the risk for cognitive decline and even mortality. Over-the-counter pain medication or seeing a physician who requests expensive imaging or prescription medicine are common for addressing chronic pain and restricted mobility. Less often prescribed are non-pharmacological interventions using exercise as therapy despite demonstrated effectiveness. Physical therapist-led exercise therapy is guideline recommended for individuals with MSK pain or limitations in daily activities. However, availability and access to physical therapists in low- and middle-income countries (LMICs) is limited. Given the rise in mobile phone ownership in LMICs, there is tremendous opportunity to leverage mobile health (mHealth) technology for MSK care delivery. The need for accessible MSK care in Tanzania is critical: low back pain is the second leading cause of disability, yet there are 0.4 physical therapists per 100,000 Tanzanians. Building from an established research and training collaboration, our five-year goal is to have implemented a model of care that expands access to physical therapists using mHealth support of exercise at home in even rural and remote villages. Our proposed two-year implementation research study will adapt and plan for scaling

up an intervention we found effective with older adult Veterans in the United States. Guided by the Institute for Healthcare Improvement Framework for Going to Full Scale, we will accomplish two specific aims. (1) Explore the feasibility, reach, appropriateness, acceptability, and costs of an innovative MSK care model for Northern Tanzania compared with current practice. (2) Adapt and refine the physical therapy, text message and telephone counseling components of the model to be locally relevant and expand availability and access to care. This project is innovative as it shifts the current approach to addressing chronic MSK pain to a non-pharmacological approach leveraging mhealth to expand access to evidence-based care. The proposed research is significant because of its potential to build health system capacity and reduce the costly burden of MSK pain in Tanzania and other LMICs. The scalable intervention and new knowledge generated from the proposed R03 implementation research will guide our team to continue to work in partnership with the Ministry of Health to go full scale in Northern Tanzania and spread to other regions for improved population health.

Sense4Safety-Supporting Socially Vulnerable Older Adults

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PROJECT DESCRIPTION

Falls and fall-related injuries are significant public health issues for adults 65 years of age and older. Over a third of older adults (OA) fall each year and 10-20% of falls result in serious injuries such as fractures and head trauma. The annual direct medical costs in the US as a result of falls are estimated to exceed \$50 billion, and this estimate does not include the indirect costs of disability, dependence, and decreased quality of life. Mild cognitive impairment (MCI) is a leading risk factor for falls in OA. Approximately 15%-20% of OA have MCI, and over 60% of OA with MCI fall annually – two to three times the rate of those without cognitive impairment. Socially vulnerable OA living in low-resource neighborhoods with poor housing conditions have twice the risk of falling. We have developed an innovative technology-supported nursing-driven intervention called Sense4Safety to identify escalating risk for falls real-time through in-home passive sensor monitoring, employ machine learning to inform individualized alerts for fall risk and link ‘at risk’ socially vulnerable older adults with a nurse tele-coach who will guide them in implementing evidence-based individualized plans to reduce fall-risk. The purpose of this study is to refine the Sense4Safety intervention based on extensive feedback by low income OA with MCI, their family members or trusted others and clinicians in order to ensure that the passive monitoring system to predict fall risk for OA with MCI can generate actionable and tailored information.

Technology-Based Fall Risk Assessments for Older Adults in Low-Income Settings

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PROJECT DESCRIPTION

In the US, older adults (OAs) who live in low-income communities are less likely to engage in physical activity (PA). Lack of PA is related to chronic conditions and poor quality of life. Limited data suggest that OAs who report fear of falling (FOF) and overestimate their fall risk are less likely to participate in PA; and the association between FOF and PA intensity differs by fear severity. One-third of OAs have maladaptive fall risk appraisal (FRA), a condition in which there is a discrepancy between levels of FOF) and balance performance. Maladaptive FRA may impede low-income OAs participation in PA and can result in social isolation. Measuring FRA in OAs can be challenging due to self-report bias and cognitive deficit. Thus, we developed a fall risk appraisal matrix, a graphical grid categorizing levels of FOF and balance performance into four groups (rational/

incongruent/ irrational/ congruent). Additionally, body composition (e.g., obesity, low skeletal muscle mass) has been associated with FOF and functional impairment. However, research has not examined the association among body composition, FRA, and PA using Assistive Health Technology (AHT), which is the application of organization knowledge, skills, procedures, and systems in order to improve functioning. We propose to explore the associations among body composition, FRA, and PA using AHT including bioelectric impedance analysis (BIA), BTrack Balance System (BBS), and accelerometer-based physical activity devices. These devices are portable, non-invasive, safe, valid, reliable and allow for home testing. We employ a cross-sectional study. Aim 1 is to examine the feasibility of recruitment (e.g., how many OAs need to be screened to recruit the sample?) and acceptability of technologies and procedures for use among OAs in low-income settings. Aim 2 is to examine the associations among fall risk appraisal, body composition, and physical activity. Participants (N=120) will be enrolled if they are: 1) ≥ 60 years of age, 2) low-income (using poverty thresholds from the US Census Bureau), 3) no marked cognitive impairment, and 4) live in their own homes or apartments. Exclusion criteria: 1) a medical condition precluding balance test (e.g., unable to stand on the balance plate) and/or PA (e.g., shortness of breath when performing PA); or 2) currently receiving treatment from a rehabilitation facility, or 3) medical implants (e.g., pacemakers). Data will be collected at OAs' place of residence. OAs will be assessed FOF, balance performance, and body composition using a questionnaire, BBS, and BIA, respectively. OAs will wear an accelerometer-based physical activity device (ActiGraph GT9X Link) for 7 days. Accurate FRA is essential in implementing physical activity programs. This study will provide data for the development of a technology-based intervention that facilitates a shift from maladaptive to adaptive FRA, and improving participation in PA, thus enhancing healthy longevity among OAs in low-income settings.

Yoga for Healthy Aging (YHA) Study: A Mind-Body Intervention to Reduce Multimorbidity In the Elderly

Principal Investigator	Purnima Madhivanan
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Co-Investigator(s)	Vijaya Srinivas; Hemanth Bhargav; Rahul Shidhaye

PROJECT DESCRIPTION

The world's population is rapidly aging, putting intense pressure on healthcare systems. Almost a fourth of the global burden of disease arises in older people; and chronic conditions are increasingly concentrated in the elderly in low- and middle-income countries. Current intervention approaches are poorly suited to older patients with multiple, co-occurring, and inter-related conditions. Comprehensive and holistic approaches that improve both physical health and subjective well-being, are required. Seniors Yoga, a form of yoga tailored to be safe, gentle, and helpful for elderly, represents a promising strategy for addressing multimorbidity in this population. The research has the potential to make a major contribution in improving access to 'self-care' yoga-based intervention. The goal of this initiative is to adapt an evidence-based yoga lifestyle intervention for use in primary care settings to address the physical and mental needs of seniors aged 60-80 years living in urban slums of Mysore, India.

Voice2Connect: Informing the Design of Smart Speakers for Social Connectedness in Low-income Older Adults

Principal Investigator	Jane Chung
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PROJECT DESCRIPTION

There is a growing public health concern regarding the high risk of social isolation and loneliness among low-income older adults and its resulting impact on their longevity and overall well-being. The issue of social isolation is particularly relevant to low-income senior housing (LISH) residents who often have multiple chronic conditions and disabilities, lack of financial and social resources, and limited social networks. Thus, there is an urgent need to develop innovative approaches to mitigate these issues in older adults living in LISH. Voice-operated smart speakers have the potential to reduce social isolation and loneliness in this population, for example, by connecting with other people, sending a reminder about social activities, or providing a conversational agent. We propose to examine how smart speakers can support the needs of social connectedness among older adults living alone in LISH. We will use an iterative user-centered design and employ a mixed-methods approach, incorporating participatory methods, focus group interviews, and functional and psychosocial health questionnaires. The specific aims of this study are: (1) to determine experiences of social isolation, user needs, user context, and preferences related to the use of smart speakers for social connectedness in the LISH setting, (2) to evaluate older adults (smart speaker users and non-users)' and stakeholders' attitudes towards the use of smart speakers for promoting social engagement, with a focus on perceived usability and usefulness of the technology, and (3) to identify potential implementation barriers and privacy concerns among older adults and stakeholders. Stakeholders will include housing staff (N=10), family members of older adults (N=6), and health care professionals (N=6) providing wellness services to LISH residents. Older adults (N=36) will form six focus groups and take part in a series of three focus group sessions in which they participate in user-centered design activities to identify potential smart speaker features that can support the needs of social connectedness. Their thoughts and ideas will be used to develop low-fidelity prototypes and scenarios of use for each prototype. After prototype and scenario development, we will seek input from the older adults, housing staff, and health care providers through focus groups, which will be used to refine the prototype. The refined prototypes will be validated with the older adult participants. We will use a thematic analysis and inductive coding method to analyze focus group interview transcripts. Descriptive statistics will be used to analyze the questionnaire data collected from older adults and stakeholders. Findings from this study will inform our future research where we build smart speaker algorithms and functionalities that can facilitate the planning of innovative smart speaker-based social connectedness interventions for older adults in LISH.