

At Dr. Reddy's lab, researchers are engaged in a variety of research initiatives, with a particular emphasis on projects aimed at promoting healthy cognitive aging, delaying dementia progression, and providing support for caregivers. In the following document, we have outlined four collaborative projects for which we are seeking partners. If any of these ideas interest you, please let us know, and we would be happy to share detailed research proposals.

### **Research and Educational Programs for Hispanic Young Adults**

The Reddy Internal Medicine Lab Student Program at Texas Tech University Health Sciences Center (TTUHSC) provides high school and university students with valuable STEM-based research experiences focused on healthy aging, Alzheimer's prevention, and related dementias. Prioritizing diversity and inclusion, the program specifically targets Hispanic communities in West Texas, aiming to offer hands-on research opportunities to young Hispanic scholars while serving as a model for other research labs. Recognizing the vital need for research in healthy aging and dementia prevention, especially in underrepresented communities, the program emphasizes engaging Hispanic and female students in STEM. Partnerships with local high schools, such as Estacado High School and the Talkington School for Young Women Leaders, will facilitate student involvement in animal research using mouse models, co-authoring journal articles, and presenting findings at the Hispanic Health Expo. To implement the program, we will establish partnerships with local high schools, community colleges, and organizations like Latino Lubbock to recruit Hispanic students. A detailed curriculum focused on healthy aging and Alzheimer's prevention will be developed, incorporating hands-on research and opportunities for co-authoring journal articles. We will engage experienced mentors from TTU, TTUHSC, and partner organizations to guide students throughout the program. Community engagement will be prioritized through events like the Hispanic Health Expo, showcasing student research and promoting awareness in the community. Resources, such as funding for branded apparel and scholarships for students, will be secured to foster team identity and support educational pursuits. The program's impact on student recruitment, retention, and graduation rates in STEM fields will be continuously evaluated, with a long-term goal of expanding the program to influence other universities and medical centers within the TTU System, thereby advancing research in healthy aging and dementia prevention. Recent publications by High School, Undergraduate, and medical students:

- Jacob, M., Reddy, R. P., Garcia, R. I., Reddy, A. P., Khemka, S., Roghani, A. K., ... & Reddy, P. H. (2024). Harnessing Artificial Intelligence for the detection and management of Colorectal Cancer Treatment. *Cancer Prevention Research*.
- Reddy, A., Reddy, R. P., Roghani, A. K., Garcia, R. I., Khemka, S., Pattoor, V., ... & Sehar, U. (2024). Artificial Intelligence in Parkinson's Disease: Early Detection and Diagnostic Advancements. *Ageing Research Reviews*, 102410.
- Mian, M., Tahiri, J., Eldin, R., Altabaa, M., Sehar, U., & Reddy, P. H. (2024). Overlooked cases of mild cognitive impairment: Implications to early Alzheimer's disease. *Ageing Research Reviews*, 98, 102335.
- Roghani, A. K., Garcia, R. I., Roghani, A., Reddy, A., Khemka, S., Reddy, R. P., ... & Sehar, U. (2024). Treating Alzheimer's disease using nanoparticle-mediated drug delivery strategies/systems. *Ageing Research Reviews*, 102291.

- Khemka, S., Sehar, U., Manna, P. R., Kshirsagar, S., & Reddy, P. H. (2024). Cell-Free DNA As Peripheral Biomarker of Alzheimer's Disease. *Aging and Disease*.
- Garcia, R. I., Khemka, S., Roghani, A. K., Reddy, R. P., Pattoor, V., Jacob, M., ... & Reddy, P. H. (2024). Caring for Individuals with Alzheimer's Disease: A Spotlight on Hispanic Caregivers. *Journal of Alzheimer's Disease Reports*, 8(1), 877-902.

### **Understanding the impact of lifestyle and other factors on cognitively superior elderly population of West Texas**

The long-term goal of this research project is to identify the factors that contribute to healthy aging without cognitive impairments in individuals aged 60 to 90, while understanding why others develop chronic conditions and cognitive decline, including Alzheimer's disease (AD). Although only a small percentage of early-onset AD cases are linked to genetic mutations, the causal factors for most late-onset AD cases remain unclear, with lifestyle elements such as diet, exercise, and environmental exposure believed to play significant roles. To fulfill this objective, we will collect ethnographic profiles, cognitive assessments, blood samples, brain scans, and genomic data related to lifestyle from both cognitively healthy individuals and those with mild cognitive impairment or severe AD. Our study will involve four specific aims: the first aim is to conduct cognitive assessments using the Montreal Cognitive Assessment (MoCA) test on 1,000 cognitively healthy participants and 50 participants with AD/MCI, hypothesizing that higher cognitive scores correlate with better cognitive health. The second aim is to explore the demographic and physical factors associated with cognitive health, focusing on the impact of psychosocial and environmental elements on elderly cognition. The third aim involves comparing brain health through magnetic resonance imaging (MRI) between cognitively healthy individuals and those with cognitive impairments, with the expectation of observing significant differences correlated with cognitive health. Finally, the fourth aim will investigate the presence of blood-based biomarkers to detect AD, hypothesizing that certain biological markers will be associated with superior cognitive health, while assessing various blood parameters and circulating DNA levels. The outcomes of this study are expected to provide valuable insights into the factors that promote healthy brain aging and those that contribute to cognitive decline and chronic conditions. In our six-month longitudinal study, participants will first complete initial telephonic interviews before being invited to attend Study Visit 1. During this visit, they will receive an explanation of the study, provide informed consent, and participate in various assessments, including the MoCA test for healthy individuals. Additionally, anthropometric measurements, blood sampling, sociodemographic surveys, and MRI scans will be conducted. The same process will be repeated during Study Visit 2, which occurs six months later, except for the MoCA assessment. Relevant publications are listed below:

- Basu, T., Sehar, U., Malhotra, K., Culberson, J., Khan, H., Morton, H., ... & Reddy, P. H. (2023). Healthy brain aging and delayed dementia in Texas rural elderly. *Ageing Research Reviews*, 102047.
- Brownell, M., Sehar, U., Kshirsagar, S., & Reddy, P. H. (2024). Is Effective Recruitment Strategy Critical to Assess Brain Cognitive Function of Super Agers in Rural West Texas. *Journal of Alzheimer's Disease Reports*, 8(1), 555-559.

- Sehar, U., Mukherjee, U., Khan, H., Brownell, M., Malhotra, K., Culberson, J., ... & Reddy, P. H. (2024). Effects of Sleep Deprivation on Brain Atrophy in Individuals with Mild Cognitive Impairment and Alzheimer's Disease. *Ageing Research Reviews*, 102397.
- Brownell, M., Sehar, U., Mukherjee, U., & Reddy, P. H. (2024). Creating Cultural and Lifestyle Awareness About Dementia and Co-morbidities. *Journal of Alzheimer's Disease Reports*, 8(1), 747-764.

### **Supporting Caregivers: Investigating Burden and Innovating Tools for Caregiver Well-being**

The long-term goal of our study is to evaluate current measurement tools and develop methods to support Hispanic family caregivers in rural West Texas. We will collect comprehensive measures to assess the psychosocial and environmental burden of Hispanic family caregivers of patients with Alzheimer's disease and related dementias (AD/ADRD) in rural West Texas, focusing on five risk domains: depression, burden, self-care, social support, and patient problem behaviors, as outlined in the REACH II study. This mixed-methods approach will include conducting qualitative interviews with caregivers to explore their emotional and physical support needs, followed by thematic analysis of the transcripts to identify recurring themes and patterns in their experiences. In conjunction with qualitative data, we will design and distribute caregiver surveys to gather quantitative information on caregiver stress and coping mechanisms, administering five standardized, validated measures to evaluate their reliability and utility for our target population while identifying gaps to inform a novel measurement tool. Our hypotheses include expectations that these risk domains will worsen over time and show consistent reliability, with no variations across the proposed scales, alongside subgroup analyses to yield insights for future interventions. Additionally, we aim to develop innovative assessment methods tailored to Hispanic caregivers, including a culturally competent measurement tool, establishing a Hispanic expert panel, conducting seminars by healthcare providers, involving social workers for improved communication regarding AD/ADRD, and increasing awareness in the community. Furthermore, we will collaborate with the research team to develop policy recommendations based on the study findings, contributing to a published policy report. Our hypothesis asserts that we will successfully evaluate the reliability and validity of our culturally competent measurement tool for Hispanic informal caregivers. Relevant publications are listed below

- Sehar, U., Rawat, P., Choudhury, M., Boles, A., Culberson, J., Khan, H., ... & Reddy, P. H. (2023). Comprehensive understanding of Hispanic caregivers: Focus on innovative methods and validations. *Journal of Alzheimer's Disease Reports*, 7(1), 557-574.
- Bisht, J., Rawat, P., Sehar, U., & Reddy, P. H. (2023). Caregivers with cancer patients: focus on hispanics. *Cancers*, 15(3), 626.
- Rawat, P., Sehar, U., Bisht, J., & Reddy, P. H. (2023). Support provided by caregivers for community-dwelling diabetic hispanic adults with intellectual disabilities and comorbid conditions. *International Journal of Molecular Sciences*, 24(4), 3848.

- Kopel, J., Sehar, U., Choudhury, M., & Reddy, P. H. (2023, March). Alzheimer's disease and Alzheimer's disease-related dementias in African Americans: Focus on caregivers. In *Healthcare* (Vol. 11, No. 6, p. 868). MDPI.
- Basu, T., Sehar, U., Selman, A., Reddy, A. P., & Reddy, P. H. (2023, May). Support provided by caregivers for community-dwelling obesity individuals: focus on elderly and Hispanics. In *Healthcare* (Vol. 11, No. 10, p. 1442). MDPI.
- Culberson, J. W., Kopel, J., Sehar, U., & Reddy, P. H. (2023). Urgent Needs of Caregiving in Ageing Populations with Alzheimer's Disease and Other Chronic Conditions: Support Our Loved Ones. *Ageing Research Reviews*, 102001.
- Rawat, P., Sehar, U., Bisht, J., Reddy, A. P., & Reddy, P. H. (2023). Alzheimer's Disease and Alzheimer's Disease-Related Dementias in Hispanics: Identifying Influential Factors and Supporting Caregivers. *Ageing Research Reviews*, 102178.

### **Sleep, Nutrition, and Cognitive health: A Study on Brain Health Across Diverse Age and Ethnic Groups**

The objective of this study is to explore the relationships between sleep quality and duration, brain health, diet, and physical activity across various age groups, genders, and ethnic backgrounds. Adequate sleep is critical for maintaining overall well-being, influencing cognitive functions, productivity, and daily performance. As sleep patterns change with age, they can significantly impact health outcomes, including obesity, cardiovascular diseases, diabetes, and mental health disorders such as depression and anxiety. Students and office workers face challenges related to insufficient sleep, which can hinder academic performance and workplace efficiency, while older adults often contend with fragmented sleep, increasing the risk of cognitive decline and mood disorders. By examining sleep issues across different demographic groups, we aim to enhance quality of life and reduce healthcare costs, thereby addressing a critical area of concern for public health. To achieve our objective, we propose a longitudinal study involving approximately 500 participants aged 18 to 90, including both males and females from diverse ethnic backgrounds, with a particular focus on Hispanic and other minority groups. Participants will be recruited from local communities, colleges, senior centers, and healthcare facilities, using targeted outreach strategies such as multilingual flyers, social media campaigns, and informational sessions in community spaces. Initial assessments will include brain imaging (MRI), cognitive tests, and health questionnaires, alongside continuous monitoring of sleep patterns using sleep trackers and daily logs. We will also examine dietary intake through food diaries and validated questionnaires, and physical activity levels will be tracked using activity monitors. The study will use multivariate regression models to analyze the interplay between sleep, diet, physical activity, and brain health while accounting for potential confounding factors. By comparing sleep patterns across different ethnic minority groups, the study aims to establish new sleep standards that minimize brain atrophy and cognitive decline in later life. This comprehensive approach will contribute valuable insights to sleep neuroscience and inform interventions aimed at improving cognitive function and overall well-being, particularly within Hispanic communities and other underrepresented populations. Relevant publications are listed below:

- Sehar, U., Mukherjee, U., Khan, H., Brownell, M., Malhotra, K., Culberson, J., ... & Reddy, P. H. (2024). Effects of Sleep Deprivation on Brain Atrophy in Individuals with Mild Cognitive Impairment and Alzheimer's Disease. *Ageing Research Reviews*, 102397.
- Mukherjee, U., Sehar, U., Brownell, M., & Reddy, P. H. (2024). Mechanisms, Consequences and Role of Interventions for Sleep Deprivation: Focus on Mild Cognitive Impairment and Alzheimer's Disease in Elderly. *Ageing Research Reviews*, Accepted.