GECC | GATEWAY EXPOSOME COORDINATING CENTER

Fall 2024 Town Halls

October 9
November 4
December 10

The GECC is an interdisciplinary project that advances AD/ADRD research by serving as a centralized hub for accessing, harmonizing, linking, and sharing exposome data for AD/ADRD risk, resilience, and disparities.

The GECC is funded by the National Institute on Aging (NIA) U24AG088894.

This document was lightly edited for formatting. We intended to retain our attendees' original content. This document may contain some errors.

These are opinions shared by the town hall attendees and do not necessarily reflect those of the GECC.

Contents

Executive Summary

Thank you taking part in one or more of the town halls held in 2024!

The goal of the Gateway Exposome Coordinating Center (GECC) is to bring together research experts and other stakeholders to advance and accelerate the science on the exposome as a source of risk, resilience, and disparities in Alzheimer's Disease and Related Dementias. We define the exposome as a variety of exposures from people's homes, work, neighborhoods, and communities that independently and combined impact a person's risk for developing dementia.

In the fall of 2024, the GECC hosted a series of town hall meetings with 382 participants representing 128 organizations across 21 countries to discuss the question "What are the major influences (both positive and negative) on brain health as people age? Examples include experiences, exposures, social structures, community resources, or policies." These meetings yielded critical insights that will steer the GECC's future efforts, helping to prioritize research areas, create new resources, and develop tools that will support the broader research community to gain a better understanding of the exposome and its impact on brain health.

Participants were invited to join a breakout room based on the topics brought up during the main session. All participants of the breakout room were welcome to gain inspiration from the questions below. Each breakout room also had a designated notetaker.

ISSUE 1:

PARTICIPANTS:

SUMMARY OF DISCUSSION:

In the interest of time, rather than formal introductions, please share your name and which component of this topic excites you the most.

Some questions to get the conversation flowing:
When thinking about this topic:

- *What information do you use to guide your work?*
- *What information do you wish was available?*
- *What are the key unanswered questions?*
- *Who might use curated information and guidance on this topic?*

In closing:
What key messages would you like to share with the GECC to help us set priorities for developing guidance and assembling information to understand the environment's role in aging?

Thank you again for your insights and perspectives.

October 9, 2024 – Session 1

ISSUE 1: Cognitive Status Across Lifespan (Tools for Assessing Cognitive Status Cross-Culturally / AI and Health Equity)

Broad Interests among participants:

- Tools to assess if people's cognition are changing
- Cognitive abilities beyond 60
- Protective factors related to cognitive abilities
- Detecting dementia at the earliest moment

What information do you wish was available?

- Repository of resources related to tools assessing cognitive status
    - Would be helpful for other researchers
- Cognitive stress test (to measure direct cognitive change)
    - Look at the upper limit of the function
    - Flipping the effect of stress on cognition, having measures that can tap into the maximum load of exposures on cognitive abilities
        - Main concern: may not have measures that are properly testing an individual's cognitive ability
- Family members may not endorse the cognitive functions
    - In low-income countries, families may not notice the decline in cognitive abilities
- Knowing how to understand cognitive ability related to issues of literacy
    - Very little understanding of people who may not be literate
- Don't have enough information about transient status
    - We know that there are fluctuations, but there is a push towards ecological momentary assessment (EMA) (moment-by-moment data) but an additional concern is how do we think about that? What is stable cognitive status?
    - Huge momentum behind collecting massive amounts of data, but have we validated these fluctuations and transient changes in cognition?
- Years ago, a test was performed among healthy older adults but found that there were large fluctuations among healthy 50/60-year-olds (despite the experiment being controlled)
    - Given those fluctuations, how do we measure cognitive status?
- important to evaluate cognitive status over the lifespan
- Comparisons of dementia across different countries
    - Gradients in measurement, how do we standardize these measurements
        - Possible measurement: Harmonized Cognitive Assessment Protocol (HCAP)? (How do we anchor that in ways relative to people's underlying abilities)

What information do you use to guide your work?

- Currently looking at cognitive status, as opposed to cognitive capacity:
    - Ex. evaluating change between cognitive status at two different points in time
    - Looking at the trajectory of change and seeing if that aligns with a normal trajectory

- Potential tools in other countries (Bangladesh, England, etc.)
    - Other groups at other universities (USC, etc.) are working on this

What are the key unanswered questions?

- We need to have measurements of cognition that are accurate and correct over time
- Accurate measurement is the foundation and future of dementia and the other aging work of the Gateway Project

ISSUE 2: Misinformation/Disinformation as Indirect Exposures

Understanding the community ethos

- Explore the underlying beliefs, values, and media influence that shape the community's actions.
- What information is taken up and acted on in a community, especially regarding health and safety?
- These are intangible, difficult-to-measure factors that exist "in the air"—hard to see or feel but impactful.

Example issues

- Consider food safety and pesticide exposure:
    - A local grocery store might sell bread with harmful ingredients.
    - Healthier food options may only be available at high-end stores or in distant locations, creating accessibility challenges.
    - People are unknowingly exposed to harmful elements, which raises questions like, "If it's so dangerous, why is it available?"

Key concepts

- Trust and Health Decisions
    - The choices people make for their health are not always wrong, but there's often a disconnect between what's available and what's actually good for them. Decision-making is a critical factor that can directly or indirectly affect brain health.
- Lack of Information
    - There is often a gap in understanding how to make decisions that benefit long-term health.
    - For example, there's cognitive dissonance between knowing what's harmful (like talc exposure) and not having enough information to avoid it.

Health literacy and misinformation

- Vulnerable populations are more susceptible to misinformation due to limited health literacy.
- Often, health literacy is reactive (people become informed after they fall sick or are exposed) rather than preventative.
- Communities need accurate information upfront to prevent misinformation from taking hold.

Example of exposure issues

- If people aren't aware that certain minerals are toxic, they won't avoid them. This creates a vacuum where misinformation can thrive.

Behavior and exposure

- Understanding what drives certain behaviors can help identify and reduce harmful exposures.
- Currently, there isn't enough effort to spread awareness about potential dangers before people are exposed. Convincing people to consider these risks early on is challenging.

Cultural sensitivity and ethical considerations

- It's essential to approach these issues with respect for the community's culture and traditions.
    - We can't simply impose new ideas without understanding how they may impact long-held traditions.
- For example, some cultural practices, such as eating specific fish from a local lake, may carry health risks. Instead of saying, "This is bad for you," it's more effective to ask, "What do you think might be harmful?" and assess community perceptions.

Exploring the community

- Take a participatory approach when addressing community health risks.
    - Understand why certain behaviors or traditions are in place before suggesting changes.

Key Takeaways:

Promote Preventative Health Literacy

- Shift from reactive to proactive health education, providing communities with early, accessible information on environmental factors affecting aging.

Fill Information Gaps

- Prioritize research on unanswered questions about the environment's impact on aging and communicate these findings in a culturally relevant way.

Build Community Trust

- Engage communities in dialogue, respecting their perceptions and traditions. Tailor health messages to align with their values, fostering trust and collaboration.

Link Behavior to Exposure

- Highlight how daily behaviors influenced by the environment (e.g., food choices, product use) affect long-term health, offering practical ways to reduce risks.

Respect Cultural Sensitivity

- Consider cultural practices when providing health guidance, ensuring that recommendations are respectful, collaborative, and ethical.

ISSUE 3: Education/ SES

Policy changes

- Looking at policy changes (e.g. through natural experimental designs) and how it affects adult SES status
    - Could then lead to more tangible AD/ADRD impacts later in life
- Policies on adulthood education, and understanding life course relationships between formal childhood education and adulthood socioeconomic conditions/occupational social class

Neuropsychological/cognitive assessments

- Currently have high ceilings and low floors, making it difficult to assess cognition
    - People who start off at a high baseline have a lot farther to fall, and current tests don't capture how drastic of a change this is or necessarily why this happens
        - For example, people with the highest education in longitudinal studies are often showing up as the people who are declining the fastest
- We should base cognition testing on life skills instead of education
- Should be assessing illiteracy separately – illiteracy does not necessarily accurately reflect cognition (i.e. an individual who is illiterate may have high numeracy) – need to measure different levels of illiteracy and numeracy
- As researchers, we need to have a broader notion of what "education" means
    - Many individuals are not formally educated but instead have diverse, enriching life experiences (exploring different fields, learning new trades, etc.)
    - How do we measure this? How do these different forms of education then impact AD/ADRD risk and resiliency?

Physical and mental health change across the life cycle

- Varies depending on context (LMICs vs developed countries)
    - In Malawi, for example, people biologically age earlier – in other countries, aging occurs much later
    - Why do some people age successfully in a relatively poor society/why are some people more resilient? Influences from other factors: disease, global disasters, etc.

Data/measures to be collected

- Measures of material hardship – emergency funds, difficulty paying for utilities/housing, etc.
    - Partially included in the Census currently, need to be more robust
- Should have separate markers of SES status (separating out individual and environmental markers)
    - For example, urban/rural environmental markers do not uniformly reflect SES
- Intermediate markers of brain health

    - Right now, often look at the time between initial exposure and outcomes – need to look at what comes in between to design more effective interventions
    - 1946 Birth Cohort Study looks at some of these measures – imaging a common tool
    - Intermediate markers can help us determine root social determinant causes on the equity components of AD/ADRD risk factors
    - Relatedly, need to separate early, mid-life, and late-life SES status and factors
- Generally need to parse out different AD/ADRD rates by different demographic groups
    - Ex: Need to acknowledge why/how AD/ADRD rates are declining by the richest individuals, while this trend does not necessarily hold true for other groups
- Need for improved neuropsychological assessments (see above)

Key Takeaways:

- SES is a very broad topic, and adequately understanding it and its relationship to AD/ADRD requires the development of more robust measures (material hardship, intermediate markers of brain health, separate markers of SES status)
- Much of the education/AD/ADRD relationship has focused on formal education, but education goes beyond the classroom space. We need to determine how to capture more subjective notions of education as well.
- We know that people's aging follows different trajectories based on their SES, education levels, etc. It would be beneficial to clearly identify these different trajectories and then focus more closely on them to get a better understanding of what factors are the same and what factors are different across individuals.

ISSUE 4: Sensory Health (SH)

What is sensory health?

- Function and perceived function of 5 senses
- Vestibular health is sometimes added to the definition
- Age-related examples: hearing loss may affect the quality of life, and over time interactions with the environment may be reduced

Is there a causal relationship? Can this be mitigated by…?

- Evidence stronger in sensory→brain health direction, but could be bi-directional
- Are there ways to mitigate this?
- Evidence has MR, but fewer RCT. Bulk of evidence is epidemiological-based
- ACHIEVE trial is only real RCT (general pop. vs. ARIC?, high-risk CV population, oversampled study population for African Americans)
    - This was for hearing loss

Research on sensory health

- Vision and hearing - much of this is modifiable
    - Glasses
    - Hearing aids
- There are many unmet needs for these things (e.g. cataract procedures, glasses, hearing, etc.
    - I.e. High prevalence of these things in lower-income settings
- Similar evidence for hearing and sight
- Touch and taste are quite understudied
- Vision/hearing linked to social isolation/physical inactivity/depression, all of which are linked to dementia
- Proprioception is also understudied and likely follows pathways different to social isolation
- Untreated hearing loss relating to faster cognitive decline
    - Access to intervention (e.g. surgeries) varies by ethnicity, background, SES, etc.
- Policy
    - Workplaces structured to e.g. limit noise are “low-hanging fruit”
- UN resolution recognized modifiable vision to reach SDG’s
    - Idea to implement country-level intervention to aid vision to assist reaching these SDG’s
    - This could be a good spot to research policy related to sensory health

What are the key unanswered questions?

- a) Can we actually slow cognitive decline and dementia through improving/slowing sensory health?
- b) Pathways: can we create the data along the hypothesized pathways
    - Most population studies do not collect sensory measures

    - Smartphones and tablets can lend themselves to collecting this data
    - Long-term collection of sensory data collection is required
- Self-reporting of hearing/vision loss is a key limitation
- This may not be related to mediating factors (e.g., physical inactivity, social isolation) in the same way as objective impairments
- Self-reports are not the same “construct” as objective measurements
- NHATS <- representative sample that has sensory
- LASI + LASI-DAD <- studies in India that also collect sensory data
- Concordance and discordance between self-reports of SH and objective of SH
- Age, gender, SES, may shape concordance and discordance
- There are more than just physiological factors that influence self-reports (i.e. environment, stress, time of day, recency bias)
- Newly NIA-funded SENSE Network (sensenetwork.org) works on building research infrastructure in this space

Key Takeaways:

- Late-life sensory impairments are associated with cognitive health, are highly prevalent and modifiable
- More data is needed on sensory health in diverse populations
- Self-reported sensory health and objective sensory health are two different constructs and require overlapping, yet varying, modes of study

ISSUE 5: Loneliness

Why is loneliness important:

- Risk factor for dementia and relevant for brain health more generally
- Demographic changes and growing individual focus are leading to more loneliness
- WHO is concerned about loneliness
- Loneliness can mean few interactions with others, and fewer sensory (vision, hearing). Can be related to SES
- Many causes of loneliness: wars, pandemics, age itself, being from different SES

Causes of loneliness

- Mental health
- Increased migration may mean more people are living in places where they don't speak the common language and therefore may feel lonely
- Can exist in both urban and rural areas
- Mechanism can be 2 ways: mental health leads to loneliness AND loneliness leads to mental health challenges

Difference between loneliness and social isolation

- Distinction of desired social network
- These 2 may be related to dementia via different mechanisms
- These 2 factors may be complementary since both can impact brain health (e.g., depression, anxiety). They can also be overlapping.

Loneliness may be modifiable

- Technology may be a contributing factor to loneliness (even in the same household everyone may just be on their own device and not interacting) but can also increase communication with others…
- Marriage rate in some countries (e.g., Japan) is declining.
- Community interventions
- Hearing interventions
- "Buddy system"
- Challenges in scaling up many of these interventions
    - What helps one person feel less lonely may not help another person feel less lonely, which makes it even harder to think about scaling up interventions

Defining loneliness

- Assessment scales: do you have a number of interactions you'd like to have?
    - But the number will differ for everyone and the number can equal loneliness for some people but not others
- UCLA scale

- It's very culturally driven. People in rural India wouldn't understand the concept. Is the same assessment scale appropriate for people across countries (or even within countries)?
- How do you even ask someone if they're lonely?

- Challenges in assessment
  - Can be an overlap of loneliness with things like depression
  - Can be hard to use a self-report scale, especially in places with low levels of literacy

How critical is loneliness for brain health?

- WHO has defined it as very important
- Evidence across the age span – loneliness is not just relevant to older ages

ISSUE 6: Inflammatory Mechanisms of Brain Health

Chronic infections and long-term effects on inflammation

- Lyme disease — very strong connection between infections and brain inflammation; even if the infection does not cross the blood-brain barrier (BBB), cytokines can be triggered by other environmental factors
- Effects of cumulative infection, timing of infections
- Precision medicine; if certain members of a family have AD and others don't, what differences are there epigenetically?

What measures of inflammation and/or infections would be the most useful in this research?

- Sibling/twin studies? Number of cytokines, other epigenetic differences
- Starting with large-scale, potentially longitudinal studies, sorting out confounding variables
- How has Covid affected inflammation on a large scale?
- 16-point MSIDS
- Spirochete – Syphilis and Lyme
    - Syphilis, the great imitator; know how to test for and treat it
    - Lyme, arthritis in children, causes plaque, many potential symptoms
- Long-Covid giving more attention to Lyme, chronic fatigue, other under-studied diseases
- ALZPI.org - Alzheimer's pathobiome initiative - Nikki Shulteck
    - Conference is online
- Area of the brain spatially, temporally

ISSUE 7: Responses to Climate Change

What information do you wish was available?

- Health data limitation. To have comprehensive administrative resources and public spaces equipped with the necessary resources. Subsidies are not available for cooling systems. Implementing a robust risk management alarm system would also be highly advantageous.

What are the key unanswered questions?

- Interventions to reduce the impacts: by reducing the exposure, how do we build mental health resilience to climate change?

Who might use curated information and guidance on this topic?

- Curated information and guidance on climate risk can serve a wide array of professionals and organizations. Physicians, nurses, and clinic staff can use climate risk information to educate patients on how changing climate conditions may influence their health, particularly in vulnerable populations.

Key Takeaways:

Climate change can impact mental health in multiple ways

- Extreme events such as wildfires, floods, hurricanes, and heat waves can have short-term effects on mental health due to trauma, and can also directly affect physiological pathways. For example, extreme heat can interfere with the efficacy of psychiatric medications. Repeated exposures to extreme events can also have longer-term impacts due to increases in anxiety and uncertainties over future well-being.

Societal responses to climate change can also impact mental health

- Disruptions to living conditions from climate-induced migration can increase anxiety and depression. Changes in ways of living and working, for example, spending more time indoors due to heat or wildfire smoke, can also affect mental health.
- Long-term trauma resulting from any traumatic experience may also lead to cognitive stress, impacting an individual's ability to think, concentrate, and make decisions effectively.

Climate impacts on mental health will vary by life stage, as well as being modified by co-exposures to other environmental stressors and non-chemical stressors

- Cumulative impacts assessments should include climate change as both a multiplier of effects as well as a direct contributing factor.
- Climate impacts on mental health will potentially also be more prevalent in some communities or populations, for example, adding to the stresses already faced by communities with environmental justice concerns. Addressing climate change considering the disproportionate impacts on marginalized communities.

ISSUE 8: Health Interventions/Policies

World Bank

- Healthy Longevity Initiative (https://www.worldbank.org/en/topic/health/publication/unlocking-power-healthy-longevity#1): life course approach on how to compress morbidity at the end of the life span
- Most cost-effective interventions across the life course
- What data sources would be helpful?
    - Connecting different data (e.g., health data with social data, pensions, etc.) administrative data linkages

Important to look at the legal framework of the environment (tracking the evolution of laws)

- The law can support healthy aging or be a detriment
- Access to healthcare, etc. changes to the law over time impact mental wellbeing
- Need a systematic evaluation of the impact of laws
    - E.g., think about loneliness and the cloud of laws that affect it over time
- Laws from the public health perspective
- Implementation of laws
    - Make sure countries, laws, etc. are comparable (if two countries do not enforce the law at the same level) - can only compare countries that have almost the same level of application of the rule of law

Ex. Medicaid policy

- Different policies in different states, eligibility requirements, etc. affect people's decision-making
    - E.g., having a chronic illness but returning to work would lose your Medicaid eligibility

ISSUE 9: Caregiving

Summary

- Caregivers are a population that is sometimes left behind when we talk about aging populations, so the goal today is to bring this group to the forefront of the conversation. How do we manage the burden/stress of caregiving, provide training, and develop supportive community services to improve the quality of life of both the caregiver and the person receiving care?

Community services

- Programs that provide support to fill in the gaps of the caregiver's role.
- How do we figure out which services are the most important and then roll them out effectively?
- Need to work in multiple policy levels (local government, state level, federal, etc)
- Should be a priority to ensure that caregivers do not take on the extra responsibility of seeking out supportive services.
    - Programs should be advertised effectively and easily accessible/visible to the community
- How do we make sure that the programs and community services designed will be utilized by the target population? How can we get people to desire utilizing supportive services if they do not first recognize the burdens of caregiving?

Cultural differences (ex: India):

- Cultural duty to take care of your parents/family members as they age, so many informal caregivers may not recognize the "burden" and may not seek out supportive services even if they need it.
- Historically, many of the more rural households were multigenerational, but now it is more common for children to move away (new city or country) for work or school and more older adults are serving as a caregiver for their spouses
    - Improving the infrastructure of community resources would be especially helpful for these populations
- Additionally, usually within these communities, there is not much awareness of the burden of caregiving, so once the awareness spreads, people may be more prone to seek out or be open to external supports

Training

- Informal caregivers: It is important to provide education to informal caregivers of people with ADRD to improve their ability to navigate the unexpected situations that may arise when providing care. Training can help individuals manage stress/reduce caregiving burden and thus provide better care for their family members/ those receiving care
- Formal caregivers: Proper training of this workforce can ensure that higher quality, more standardized care is being provided and potentially reduce burnout/job-related stress

- Medical Professionals: Training on navigating the social support aspect of managing ADRD/cognitive impairment. For example, encourage doctors, etc. to empower and support their patients' caregivers in addition to treating the patient since they are the main point of contact for patients and their families.

Other topics of discussion

- We want to ensure that both (1) the care being provided is good and (2) that the caregivers themselves are getting the support they need/know where to access support for themselves and those they are caring for.
- The aging process is faster in middle- to low-income countries, sometimes the focus on infectious diseases etc, makes it harder to develop infrastructure to support aging pops

Key Takeaways:

Training

- Who: Informal/ formal caregivers, and medical professionals
- Goals: Culturally relevant/appropriate training materials that prepare caregivers for unexpected situations that may arise as a caregiver of someone with ADRD. Train medical professionals to understand that caring for a patient with ADRD includes supporting their caregiver(s).

Awareness and Education

- Helping informal and formal caregivers recognize the burdens of caregiving and empower them to utilize available resources like respite services
- Encourage medical professionals to support their patients' caregivers by providing supportive resources and empowering caregivers to take care of their well-being too.
- Create an infrastructure that helps caregivers navigate the ecosystem of available resources and promote the desire to utilize them

Program Development

- How can we design and implement services and interventions to assist caregivers most effectively?
- Important to look at things on the individual level and not just the top-down model when designing these programs and understand the existing policy environment.
- How can respite services in the community be integrated into the healthcare system as a whole?
- How can we make them more visible to those who are looking for them, and promote them so that caregivers do not have to look very far to find them?

ISSUE 10: Environmental Health/Physical and Chemical Hazards

What information do you use to guide your work?

- How to measure exposures using different metrics: binary, continuous, cumulative, etc.

What information do you wish was available?

- Use GIS tools, long-term exposure modeling
- Duration and intensity of exposure, how to apply them for individuals and evaluate how these factors would have an impact on influence, study on approaches in this area
- Integrate the information of what the exposome does, take several pollutants together, and there is a question on how to develop a model on it
- Exposure across different buffer areas and account for repeated exposure across time for participants, like in HRS when we have such information, then come to the question on how to model them correctly

What are the key unanswered questions?

- Housing characteristics
- Heavy metals, especially lead exposure in Mexico, contaminated food and mining industry
- Air pollution and its metal composition
- Heavy metals in water and air like lead, arsenic, zinc, cadmium
- Health across the life course
- Exposures over time and how they relate to overall health and especially cognitive health
- Cooking fuel exposure
- Location for child health well-being

ISSUE 11: Ethics of our Data

Expanding on the data-related ethical concerns in exposome research involves addressing several critical issues:

Complexity of exposome data

- Since exposome research often involves various layers of data (biological, environmental, social), it's crucial to ensure that participants grasp the potential uses of this interconnected information.
- Ethical issues arise when participants may not be fully aware of the scope and depth of the data being gathered.

Data ownership and access/community ownership In line with Community-Based Participatory Research (CBPR) principles

- There should be a shared sense of ownership over the data collected. This means establishing clear agreements on who owns the data, researchers, institutions, or the community and how it will be used to benefit participants directly.

Open access vs. controlled access

- While open data initiatives are becoming increasingly popular to enhance scientific collaboration, they raise concerns about misuse, particularly when it comes to vulnerable populations.
- Strict access controls should be in place to prevent the exploitation of data, ensuring it isn't used for purposes outside the scope of participant consent.

Ethical implications - privacy and confidentiality

- As exposome research combines multiple data points (e.g., genetic information, geographical locations, health data), there's a risk that individuals or communities could be re-identified, even in anonymized datasets.
    - This is especially problematic for small or marginalized communities which can lead to stigmatizations of entire neighborhoods or communities.

Secondary use of data by outside sources

- Participants may agree to participate in exposome research for specific studies but might not be aware that their data could later be used in future research for unrelated purposes. Ethically, there must be clear mechanisms for either gaining renewed consent for secondary data use or limiting use to pre-approved areas of research.

Equitable benefits from data

- Individuals, particularly those from under-resourced communities, should benefit from the knowledge generated through exposome research to improve local health outcomes

Bias in data collection and use

- There is a risk that the data collected might reinforce existing biases, particularly if certain groups are underrepresented in research.
- Ethical frameworks should promote inclusive data collection, ensuring that findings do not disproportionately benefit more privileged populations at the expense of marginalized ones.

Long-term data management

- Longitudinal exposome studies may require data to be stored for decades. Ethical concerns arise when participants wish to withdraw their data after it has already been integrated into larger datasets, raising questions about the feasibility and ethics of data removal. Addressing these ethical concerns ensures that project management in exposome research aligns with the principles of justice, transparency, and respect for individual and community autonomy.

ISSUE 12: Modifiable Behaviors

Modifiable risk factors

- Useful for dementia prevention (and other comorbidities)
- Examples include:
    - Firearms
    - Drinking
    - Drug use
    - Obesity
    - Car accidents
    - Physical activity
    - Poisoning

Wealth as a hindrance

- Access to physical therapy
- The need for proper rehabilitation
- Paying for a gym

Challenges

- Relationships between modifiable factors and outcomes are not always intuitive
    - Groups with high physical activity
    - Blue-collar workers
- Helpful to consider many modifiable risk factors instead of strictly focusing on one or a few
    - Latent profile analysis is a way to deal with this issue which looks at patterns of modifiable risk factors

Data available/used

- Deaths and vital statistics
- Risk scores
    - LIfestyle for BRAin health (LIBRA) score

Key Takeaways:

- Key messages concerning the topic of modifiable risk factors are to consider diverse socioeconomic and demographic factors when looking at their effects on aging.
- Relationships between risk factors and aging can appear counterintuitive unless considered in light of (sometimes many) others.

October 9, 2024 – Session 2

ISSUE 1: Economic Insecurity

Group interests

- Disease/health impact on wealth/retirement savings, financial security. Started focusing on specific diseases, including dementia and how dementia impacts wealth.
- Effect of long-term care (LTC) policies, formal/informal care, on number of outcomes.
- Building out life histories data (dementia, mental health).
    - Difficulty in modeling this (so many different interventions)

Data

- Data sources fairly clear (Gateway to Global Aging Data)
- Data that can track across the life course
- Cognitive data later in life
- Employment histories
- Cumulative exposure
- Stress (at work)
    - Characteristics of workplace (skills required, etc.)
- Data we have outside the Gateway is less clear. E.g., PSID would be relevant, but not in Gateway.
- Useful to have better linkages to other data sources (e.g. labor market experiences), interesting linkages to data dealing with earlier in lifecourse
- Data we would like to be available:
    - Information on work but also other dimensions. Need information at household level, information on partners along the same dimensions. The impression is many data sources offer the opportunity to measure at household level, but are not used. Maybe something to highlight as data are distributed.
    - Also ***how*** are data distributed/used. The aim of Gateway is to make data accessible. Not just what data, but how data are provided. Would like more easily accessible data.

Work

- Long-term effects of economic insecurity on cognition; special subset is caregiver workers leaving the labor force early and the combined impacts of stress/economic precarity on cognition over time.
- Exposures in blue-collar jobs are easier to track (more physical stress) v. white-collar jobs, haven't found many variables capturing those nuances. Cumulative exposures too e.g. bad management styles. Implications in terms of early labor force exit impacts on health
- Characteristics of job, combined with economic security. Not just blue/white collar but how jobs allow individuals to be secure and the impacts of that security on cognition. Interested in caregiver effects (retire early, economic precarity). Caregiver cognition over long periods of time (labor market exit).
- Constant latent stressors related to economic security, precarity

- Do we even know the role of economic security on cognition, basic questions/causal mechanisms theorized? Teasing out to understand stress/mental health risks and economics together.
- Economic security > labor market > retirement, we know something about this transition in the economic literature., but the exact mechanism is unclear.
- Should also focus beyond retirement, look back. This topic seems closely related to education.
- Can look at how different labor market trajectories differ across countries and time. The very same job can have different experiences in different contexts (places, moments in time). Makes comparison difficult, but this can also be something we can potentially leverage. Gateway puts lots of effort to present data from diverse countries. What can be done with data harmonized across the US, SHARE, India, China, South Africa, etc. To understand how labor market experience impacts health, we need to better understand what are the (different) labor market experiences.
    - Interesting to focus on labor market experiences and health across continents/countries.
- Linking data to get at this. Spoke about type of data, but mechanism through which this impacts mental health later in life is far from obvious. Would be interesting to work across different fields to understand this. How to put everything together, figure out linkages (how we do this is not obvious). We establish a relationship between cognitive decline and retirement, but why?

Global context

- In Sub-Saharan Africa, we see different employment dynamics. Household wealth is measured differently, employment is seasonal, these dynamics are described differently. The specific impact on stressors when employment is intermittent? High income dynamics versus others?
- Positionality is important in a global context (e.g. protective effect of high-income countries)
- In developed countries, it is difficult to isolate dementia-related implications of economic/financial security from other dynamics.
- no safety net in low-income contexts, not much stable employment, reliance on social ties/family. Little data on Alzheimer's and correlates in these contexts. Very different. However, we are preparing for rapid population growth and demographic shifts in Sub-Saharan Africa.
- Trying to understand the distribution of cognitive health across India, seeing similar issues due to different structures of different jobs, precarity, labor market impacts being very different across different contexts. Same job (e.g., coder/software engineer) experiences are very different in the US vs India.

Changes across time

- We can look at not just geographic differences, but also differences in time. The same job has different dynamics and experiences across time (e.g., 70s vs now) that need to

be taken into account when tracking labor dynamics and health outcomes across lifecourse. We can look at international differences, as well as differences within countries (same occupation across time). How does this interact with the cognitive decline trajectory?

Lifecourse

- Some cognitive/mental health measures across the lifecourse would be useful.
- NLSY is the only dataset for lifecourse for women workers. But Cognition measures are very light. Would like to see detailed household data from birth to death: economics, health, caregiving, occupation, linked to retirement earnings, medical claims (everything!). For the role of caregiving work on cognition, we do have datasets targeted around a few years before/after onset of caregiving role (HRS family of surveys).

ISSUE 2: Housing/Neighborhood Characteristics

- We need an indicator of social cohesion in neighborhoods. We can use crime rates as a proxy, but this is not an optimal indicator. We also need to be able to address whether aging individuals rely on friends and family for care versus having access to formal support as people age. We need an understanding of different housing programs through HUD.

Barriers/what we need:

- Currently need access to restricted data
- Another barrier is having access to the specific time period we are interested in
- Access to maps that reflect the area for the time period of interest
- Data on access to services in urban vs rural contexts
- Data linkages to understand how characteristics of residence affect life course exposures
- Lack of self-perception measures, in-depth questioning about how people view their area in surveys
- More information on how housing interventions affect cognition, education, and employment (such as the provision of public housing)

Other measures

- How do climate and environmental exposures contribute to the aging process? What data are useful and at what temporal scale? What are the specific relevant outcomes?
- We need more information on how cognitive health interacts with limitations in ADLs and IADLs and how the immediate environment matters for day-to-day life. For example, could someone with high levels of cognitive impairment still fare well completing daily tasks if their neighborhood environment is optimal? Things like neighborhood walkability and proximate amenities matter for people's quality of life.
    - Area deprivation index
    - Data on counts of amenities NANDA data at U Michigan. National Establishment Time Series Data
- Commuting and exposures
    - Block to block commute flows LEHD and LODES (Longitudinal Employer-Household Dynamics) (Local Origin Destination Employment)
    - How do we disentangle commuting from pollution exposure?
    - Access to pharmacies near home or workplace?

Key Takeaways:

Data Access

- Need more access to specific types of data (listed in notes) to help us better understand how the neighborhood environment may impact cognition over the life course at an individual level

Focuses

- Trying to figure out which questions are the most helpful to ask when analyzing how housing/neighborhood environments impact cognitive health
- Need to have a solid indicator or social cohesion in neighborhoods/ understand networks of social support

Potential Measures

- Walkability and access to everyday amenities
- Commuting to work and differential access to amenities in the neighborhood of residence vs the neighborhood of employment
- Block-to-block commute flows, area deprivation index
- The relationship between cognitive health and the ability to successfully navigate everyday life. Is this mediated by neighborhood circumstances?

ISSUE 3: Exposure to War, Conflict, and Violence

Thoughts on research relating to exposure to war, conflict, and violence

- Adversity impacting late-life health outcomes, and how diverse adversity can look like
- Measurement in sufficient detail
- Harmonizing measures across studies in the Gateway to Global Aging Data - challenges when they are so distinct
- Capturing exposure throughout difficult circumstances (still in initial stages - challenges: how to operationalize the exposure) is contextual and situational, but would like to maintain generalizability
- Conceptual framework still in development (what this may look like over the life course and under varying circumstances), what we can capture during war-related exposures
- There are adaptive responses individuals may develop **which are crucial to capture and measure**
- Resilience and adaptive pathways, conflicted literature on childhood adversity and this may be harmful to late-life health (are they developing resiliency skills that will aid them in late life?), given an individual is exposed to a specific event how can we develop a resource to help
- Northern Ireland - effects of conflict on brain health (areas most impacted by conflict were also experiencing more social bonding- this may have provided some degree of protection for brain health)

Where do we begin

- There are different elements that are involved in exposure to conflict, but we also would like to have generalizability between the situations and how they may affect brain health
- What kind of aspect of the exposure will impact brain health (duration, intensity of conflict, who is affected, the instability that is caused (such as rebuilding life, needing to flee)
- Are there tools that already exist (e.g. WHO ACES tool)? There may be underlying concepts of conflict and that may repeat (taking into consideration, is there a tool to begin with?) Bringing in a common tool and adapting to the current conflict (not only adversity tool but for other relationships, response to future stressors (gaining positive + protective factors)
- Starting off using a tool that has been previously used if exposure to conflict is traumatic for someone (such as PTSD) suggested, thinking about PTSD - there may be people who have not developed PTSD
- Assessing exposure could also be extended not only to the individual but to your family and town to gain deeper insight into impact
- Starting with a tool that is broad and adapting to specific conflict (also a measurement tool that can be used across cohorts)
- War = everyday experience
- Current versus post-conflict setting
- How to ‘do justice’ with your data collection instrument

- Difficult to formulate standardized questions and share them with participants (need to consider psychological aspects of asking questions related to conflict)

Potential approach

- Life history calendar - this approach is sensitive for participants but may provide better data
- Hybrid approach also used in research relating to Vietnam war (Kim Korinek) - hybird approach worked best
- Wars can be post-conflict and still-conflict
- Many conflicts require their own set of tools, how can you train interviewers that solicit information accurately
- No epidemiologic scale will ever be able to do justice (to understand emotional experience and recovery, a different type of study would be required)

Recent commentary on trauma/violence and aging cohorts:
https://pubmed.ncbi.nlm.nih.gov/39191531/

ISSUE 4: Educational Attainment

- People with less education are more likely to develop AD/ADRD

Currently: lack of well-curated, carefully collected data to validate hypotheses

  - This information is crucial to guide work in this area
  - Government plays a very important role here – in theory, they should keep track of this information and it should be easily accessible
    - Need for life history data, education data
    - How do we create and maintain this logbook?
  - Also need data on what kind of educational systems an individual was exposed to
  - Bias is also prominent
    - Particularly gender, class, and religious bias – all connected to education
      - Challenges: it's important to know this information, but broaching this topic with individuals can be uncomfortable (for example, if a certain religious group does not endorse more education)
  - Once the data is collected and we reach a conclusion, we can then give this data and these conclusions back to the government so that they can develop policies that will address the issues
  - With this data and our findings, should also bring this awareness to the general population – for example, letting people know that if you are from these backgrounds, if you do this, etc., then you're more at risk for developing AD/ADRD
- Languages that people are exposed to also a risk factor
  - Number and variety of languages
- Need an objective way of quantifying educational attainment – education in what language, at what level, and how is that correlated to AD/ADRD?
  - Will enable us to do very targeted research, and will facilitate cross-country analysis
- Education is drastically different across contexts – so how do various components in the education system contribute to an individual's development, which will then shape AD/ADRD risk?
- Connections between education and SES background

Key Takeaways:

Key steps to consider when conducting education/AD/ADRD studies

- Conducting studies in different demographics and different conditions (SES, religion, etc.) is crucial so that our observations/findings can apply across the world
  - Need to set boundaries for conducting individual studies
- When we conduct studies, how do we decide the population of focus? Local, social, economic, and educational divides need to be taken into consideration
- Defining the hypothesis
  - Consider different factors:

        - Class where education was obtained
        - Medium of education (in terms of language)
        - Richness in curriculum
        - Teachers (availability, expertise, quality, style)
        - Peers
        - Exams (stress, for example)
        - Stream (science, arts, etc.)
        - Government policies that already exist
        - People with disabilities
- Need to carefully define questions – what would the individual understand and are they able to give the right answer?
    - Related to this, who is asking the questions?
        - In what language/dialect/variant are the questions being asked?
    - Are people comfortable answering the questions?
- Keep in mind personally identifiable information (PII)

ISSUE 5: Social and Intergenerational Relationships

Summer interdisciplinary data immersion.
Data used: HRS
Q: How to use/find/develop data or track relationships over lifetime?
A: Life history questions. Social variables relating to relationships. View longitudinally and comparatively for differences.

What are some of the other ways that we can get to the heart of relationships throughout the lifetime?

- Social Media information, Zoom logs, etc. (Facebook has a public data set)

What intergenerational information can provide insight into this topic?

- Facebook data set: Geography data set.
    - Reports the amount of Facebook friendships between two geographies. For example, it shows how many people are connected via Facebook between Los Angeles and Las Vegas.
- Study similar to HRS used in Japan. Father-to-son social status. How do grandparents caring for grandchildren impact cognition?
- What other types of data sets would be helpful that give some notion of connectedness?
    - Open data set from UK

What information do you wish was available?

- Ecological momentary assessment (EMA) style dataset. Very granular. For example, how does your mood change after a certain social interaction? (UAS at USC has some of the data)
- Do time-use surveys get at the EMA data? Not sure
- Momentary assessments are much harder to do over a long period of time
- Questions on surveys about how long their relationships have lasted? Duration of closest relationships.
- How do people choose where to live? Retirement: either stay where I am or if moving, moving to some place that has an established social network for me.
- Need more inclusion of minorities in surveys as well as including immigrants. Need to include sexual identity, etc.

Loneliness

- When social connection is studied from the social sciences it is almost impossible to assess if someone is lonely. The process is very contextual and personal; it is almost impossible to do this.
- How do we develop the policies for intervention as we think of the risk factors of loneliness?

What do you think about the interactions between social status and how this influences social relationships? How does social background influence intergenerational relationships?

- Economic status: family caregivers and how they manage coping and stress. Individuals who were historically low-income have higher coping strategies.
- Immigrants: Relationship between caregiver stress and immigration.
- Keep in mind the chronic health and how that impacts relationships. Increased stress from caregivers of aging parents, siblings, and children.

Employment histories

- If we look at this and social relationships, we should be assessing them jointly and not independently. Employment along with existing partnerships.
    - How to accomplish: Need data on employment histories, partnership and family histories, connections with friends, and a social network.

Incarceration and cognition

- There is sometimes a lack of detailed information about the length of time in prison as well as why.
- Is incarceration tracked in HRS? - Might be as basic as “Have you ever been incarcerated?” Very limited. Also need information about whether or not an immediate family member is incarcerated.
    - In the HRS Life History Survey:
      Before age 50:
      Have you ever been in a jail, prison or a detention center for more than 3 days?
      .....
      1. YES
      2. NO
      Blank. ANSWER NOT GIVEN/MISSING

Is there any data on people owning pets?

- HRS does not have a question about pets.

Alternative forms of passive collection of data?

ISSUE 6: Impact of Chemical Stressors and Air Pollution on Brain Health

What information do you use to guide your work?

- The U.S. Environmental Protection Agency (EPA) conducts extensive ambient air monitoring to assess air quality. The data gathered through these extensive networks and technologies help regulate and improve air quality and serve as a valuable resource for scientific research and community awareness

What information do you wish was available?

- Satellite-derived environmental exposure measurements
- AOD data, how to think about the standard errors
- Validation and measurement errors
- Difficulty in generating point prediction, R^2
- How robust are these data when used for health data?
- Global data on PM2.5 from the University of Washington (Randall Martin group)

What are the key unanswered questions?

- Biological mechanism - how pollutants impact the brain
    - Reactive oxygen species, inflammation
- Evidence on pollutants impacting blood-brain barriers

Key Takeaways:

- The discussion was majorly focused on air pollution exposure.
    - Understanding how different populations, particularly older adults, are more or less susceptible to environmental exposures.
    - Implementing a robust risk management alarm system.
    - Time-series measurements: Longitudinal data that provide insights into exposure over time and its health implications.
    - Historical residential data: Access to detailed, historical data on residential addresses to aid in accurate exposure assessment. Example Gateway HRS.
    - Integrated environmental measures: Utilization of composite data sources like the Gateway HRS data, which already includes pollution, blue and green spaces, light at night, and other environmental measures, available through secure enclaves.
    - Surveys on Environmental Exposure Awareness: Development and implementation of surveys to capture public awareness and responses to environmental exposures. Evidence on RCTs performed in Pakistan has air pollution-related questionnaires.

November 4, 2024 – Session 1

ISSUE 1: Climate Change and Healthy Aging

- What does climate change encompass?
- What do we mean by climate change and its effects on aging?
    - Downstream effects, severity of storms, vector-borne diseases, etc.

Acute events

- I.e. stress to them directly and ability to adapt and develop resilience
- Pre (anticipation)
    - Stress and anxiety
- Real-time (experience)
- Post
    - Increased incidence vs. exacerbation vs. susceptibility distinction is key for studying correctly
    - Displacement
- Frequency of acute events
    - How to adapt policies to locations regularly experiencing

Cumulative (life course) exposures

- Repeated exposure (e.g. to storms or other hazards like heat or downstream air pollution from wildfires)
- Anticipatory effects from potential exposures (living at risk of hurricane or wildfire exposures)

Access to data and measurement methodologies

- Mobilizing human resources to ensure harmonization across researchers/data, and ensuring a cross-disciplinary approach
    - This is one such effort: https://climatehealthcafe.org/
        - CAFE dataverse: https://dataverse.harvard.edu/dataverse.xhtml?alias=CAFE
- Disruption to built or social infrastructure increases vulnerability (i.e. interaction against pre-existing risk factors)
- Solutions will be many; there isn't a one-size-fits-all approach
- What are the blockers in the way of studying climate change and its effect on aging?
- Leveraging existing study infrastructure and cohorts for studying effects longitudinally (e.g. Health and Retirement study)
    - Should always think about global study populations

Mandate to bring together policies (aging, climate, social support, etc.)

- These exist in silos
- Why is there no single "city department" for climate change? Who's centrally in charge of climate adaptation, resilience etc.
- Climate change is a "global threat" but is a very intimate local risk
    - (re: not a one-size-fits-all solution)

- Moreover, vulnerability varies by cities

Specific health outcomes

- What are the incident diseases that can manifest in air pollution?
- Older adults can be addressed through PH to build resilience to climate risks
- Mechanisms of effects on aging, especially in the context of distinguishing between exacerbation vs. incidence of disease, is a critical area of need for study
- The exposure is also critical to get defined: frequency, intensity, flavor (e.g. heat vs. air pollution vs. wildfire), cumulative exposures, interactions between the two (coupled flood and heat), exacerbated environmental factors (e.g. mold)

Key Takeaways:

- Correctly framing the temporal aspects of exposure:
  - Timing
    - Is there an effect **before** an acute event? I.e stress before hurricane
    - Is there an effect **during** the event? I.e. damage to home, injury, mortality, etc.
    - Is there an effect **after** the event? I.e. displacement, increase in infectious disease
  - Event definitions
    - What are the **frequency** of climate change-attributable events?
    - What is the **intensity** of events?
    - **How do events compare to one another**?
- It is imperative that research is clear in distinguishing between incidence and exacerbation of the studied health outcomes
- How do we separate what's attributable to the changing climate from what is an already moving train (i.e. developing nations, revising the natural landscape, modification of the atmosphere/biosphere, etc.)
- Especially in a policy context, unison and harmonization in resources is key to avoid siloing efforts
- Mechanisms in all areas of climate change are critical to study and understand
  - What is the pathway of effects from a specific exposure on other exposures (i.e. heat on pollution, flooding on residential/neighborhood quality, etc.)
  - What is the pathway of effect on the brain itself from each specific exposure?

ISSUE 2: Air Pollution

What information do you use to guide your work?

- Local cohorts
  - Emory University data and local air pollution models from Georgia Tech focused on Metro Atlanta.
- National models
  - Nationwide air pollution models from SEDAC provide broader exposure data.
- Pollution and socioeconomic indices
  - Area Deprivation Index for SES data at the census tract level and the Toxic Release Inventory for polluting infrastructures.
- Health and Retirement Study (HRS)
  - Combined with global studies for broader data on indoor pollution exposure.

What information do you wish was available?

- Socioeconomic-specific pollution data
  - Interest in data stratified by SES to capture disparities in exposure and outcomes.
- Improved measurement consistency
  - Urban areas have more varied air quality and therefore more measurement stations; rural areas, by contrast, are under-monitored.
  - Suggested statistical methods to improve data coverage in low-measurement areas.
- Regular and recent data updates
  - Need for frequent updates, as SEDAC data is currently only available up to 2020, limiting longitudinal analyses.
- Longitudinal and life course exposure data
  - Historical data pre-2000 is unreliable, making it difficult to assess early-life exposures, especially as individuals move across locations.
- Residential history information
  - The difficulty in collecting complete residential histories, with known biases in gender, SES, and ethnicity. For instance, women may lack documented address history due to different credit practices.

What are the key unanswered questions?

- Understanding early-life exposures
  - Limited data on how early-life exposure impacts long-term health, particularly among diverse SES groups.
- Detailed component analysis of PM2.5
  - Early-stage research on which specific components of PM2.5 are most harmful and policy-relevant.
  - Potential to inform policy by identifying primary sources of harmful pollutants.
- Addressing spatial confounding

- Large spatial variations lead to confounding in exposure-outcome studies, with few methods currently adjusting for this.
    - *A comparison of PM2.5 exposure estimates from different estimation methods and their associations with cognitive testing and brain MRI outcomes - PubMed*
    - *Association of Gaseous Ambient Air Pollution and Dementia-Related Neuroimaging Markers in the ARIC Cohort, Comparing Exposure Estimation Methods and Confounding by Study Site - PubMed*
    - *The complex relationship of air pollution and neighborhood socioeconomic status and their association with cognitive decline - PubMed*
- Thinking about brain health as a singular concept is a poor idea. We need to think about the underlying biology.
- We are modeling bias over and over again. Bias is more predictable than truth.

Emerging research areas

- Pollution, SES, and cognitive health
    - The complex relationship between neighborhood SES, pollution, and cognitive decline requires more investigation.
- Microplastics and ultrafine particles
    - Need for standardized measurement methods, as these are increasingly relevant for neurological health.
- Agricultural pollutants
    - Unusual linkages between agricultural pollution (pesticides, herbicides) and health outcomes highlight the need for updated safety evaluations.
- Radiation exposure
    - Radiation that attaches to particulate matter, such as radon, remains an understudied exposure pathway.

Who might use curated information and guidance on this topic?

- Policymakers and public health organizations
    - Interested in the impact of pollution on aging and the need for targeted interventions.
- Researchers
    - Focused on exposure-outcome studies, especially regarding cognitive and neurological impacts.
- Community health advocates
    - Can use curated information to address environmental health inequities and advocate for vulnerable populations.

Key Takeaways:

- Prioritize data collection and coverage improvements

    - Regular, updated, and spatially comprehensive pollution data are essential.
- Support for socioeconomic disparities in exposure
    - Research and policies should target inequalities in pollution exposure and measurement accuracy.
- Standardize new pollutant measurements
    - Microplastics and ultrafine particles need standardized methodologies for consistent research outcomes.
- Expand focus on support systems and policy
    - Policies should consider access to essential services (e.g., food, transportation) and their impact on vulnerability to pollution.

ISSUE 3: Working History and Working Environment, Occupational Exposures

What do people think is important?

- Understanding job-level exposures (more specific to the person, more task-oriented and considering factors like self-efficacy) vs. occupational-level exposures that are broad
- Expanding evidence that work environments shape brain health over the life course because we spend many hours and lots of cognitive engagement at work over time; work can be engaging but also stressful!
- Understanding how the retirement transition plays into brain health
- Acknowledging disparities in employment opportunities over time
    - Disparities in occupation and employment history
    - People may have missed out on employment because of caregiving duties (differential by gender) so this also may lead to disparities in cognition

What kind of information do they want?

- Time use data across the life course (both occupational and hobby-related, residential history) but recognizing this is a huge amount of data and may be hard to collect
- More specific chemical and metal exposures, more specific PPE use (existing data in sources like ONET are coarse)
    - Occupational hygienists do this kind of work
    - Also maybe an opportunity to integrate NIOSH data
- Understanding what tasks are associated with the different occupational classifications
    - We typically know occupation but we don't know detailed daily tasks or learning environment, both things that may affect cognitive health
    - Identifying common sources internationally as well and harmonizing across the globe (sister studies with HRS may be an opportunity!)
    - Additionally understanding the potential interaction between occupational type and more specific job tasks
- Things that happen to you vs. things that happen with you
    - Day-to-day activities vs. spaces you're in; there may be more protection (ex. Against radiation in the workplace)
- More information on the mechanisms that lead to cognitive engagement in the workplace; furthermore, in the retirement transition, how can those same mechanisms be replicated so retirees stay cognitively engaged?
    - Ex. Can we get better data on: Time use, motivation measurements, self-efficacy, and autonomy in the workplace

What data are available?

- General occupational exposures
- ONET (https://www.onetonline.org/) can map more specific tasks onto occupational exposures

    - Includes social, physical, cognitive demands of job but not external exposure data (ex. ONET just has exposure to chemicals rather than specific chemicals; has variable related to whether they use PPE but it's a coarse measure)
- Dawn's group website has a database that does this as well
    - Working with Health and Retirement Study (HRS) to link this with life history data

What challenges do they have researching/understanding this topic?

- Wanting guidance related to workplace exposures and environment
- Knowing that some on-the-job training is more educational than other jobs, especially labor-intensive jobs; how do you tease out/is it even possible to disentangle brain health effects of education vs. work
    - Hard but important to do; might have different implications in terms of cognitive engagement
- Knowing that workplaces today are very different than they were decades ago, and that the same job across time (ex. Computer programmer) looks very different now than in the 1970s
    - The 1980s were an inflection point for changes in occupational exposures
    - Occupational data capturing a person's work in, for example, the 1980s might be coded with 2010 census occupational codes, but those are going to be two different things
    - Physical demands of work have changed over time
- Capturing engagement over time, even year by year, in jobs

ISSUE 4: Social Connection and Belonging

Group interests

- Hard outcomes/short-term outcomes dominate over long-term outcomes
- Bolstering the base of data is critical
- Social opportunities need to be available for individuals with mental health challenges
- How do we increase opportunities for social connection
- Polarization disconnects us from belonging, soon today's youth will also struggle with a sense of belonging
- More social policies/formal programs that provide care, allow people to remain engaged to maintain cognitive health
- Social prescribing is shown to be beneficial
- Funding for engagement services that could improve cognitive health is a barrier
- Thinking about social factors is critical (in addition to environmental factors) when thinking about cognitive health

What information do you use to guide your work?

- Social engagement
    - HRS sister studies
    - English longitudinal study

ISSUE 5: OMICS Application in Exposome and Aging

Challenges

- Standardization of measurement and pipelines for some single omics is strong (Genomics, DNA methylomics, transcriptomics), other omics is still with a lot of heterogeneity (e.g. metabolomics in ECHO without 10 metabolites in common across cohorts)
- Multiomics space does not have standardization yet, lots of different methods
- Consistency of measures for the same samples across laboratories (and across species)
- Power issues: lots of comparisons, batch effects, measurement error, etc.
- Hard to find meaningful or reproducible findings, maybe try targeted approach
    - Targeted approach is informed from previous exploratory studies, instead of all exploratory studies
- Pooling data (ECHO, TopMed) versus meta-analysis (PACE), decisions based on data access permissions and based on degree of batch effects
- Defining brain health: biologically based issues of disease (AD best defined, other outcomes are more fuzzy, which makes detection of omics signals more challenging)
- Some examples of environmental omics collaboration through the new U01 precision environmental health in ADRD tri-consortium (mouse, human, iPSCs)
    - https://reporter.nih.gov/search/Ipsa2j-zW0KA6jeWPXFX8Q/projects
    - https://reporter.nih.gov/search/Q314nxld3kihyIAs4ffj6Q/projects
- Some interest in a working group about omics to guide cohorts adding new measures and harmonizing across cohorts
    - Some interest in introductory seminars for those just beginning with omics

Key Takeaways:

- Create a working group where researchers can share their research and examples of how to analyze omics with ADRD and recommendations for other studies (what data to collect, how to analyze)

ISSUE 6: Socioeconomic Inequalities and Social Determinants of Health

What information do you use to guide your work?

- Multi-ethnic backgrounds and the validity of cognitive tasks and objective tests of cognitive function
- Trying to include more diverse risk factors, selection and recruitment bias in data collection; trying to engage people from marginalized groups, especially incarcerated, houseless, and indigenous populations
- Involving co-researchers or PPI group in recruitment, interviewing, and data analysis

What information do you wish was available?

- Looking at early diagnosis and prevention, we would like to have data at earlier stages in life, not just cohorts ~50 y and above; life course
- Important changes, especially with memory, in the early/middle life stages; capture data from people who do not make it to later life stages
- Trade off between administrative or registry data and lifestyle/behavior data
- Best way to define dementia without using administrative or registry data

What are the key unanswered questions?

- Dementia - unclear on etiology, hinders therapeutic targets
- Interaction between SES inequalities and exposures/lifestyle risks
- Mechanisms by which determinants of health are so predictive of life course and health outcomes
- States getting approval to use medicaid resources to study care access and outcomes
- Translating solutions (exercise, green spaces, etc) to change that is seen and functional in society

Who might use curated information and guidance on this topic?

- Creating policy briefs to influence political stakeholders to get people to take the research seriously/make changes
- Organizations and associations bridging research/researchers to policy and policy makers
- Engaging political stakeholders at the early stages of a study to engage them/convince them of its importance
- Having numerous stakeholders involved to avoid engagement fatigue or to not rely too heavily on one or a few people and bringing them in more deeply

Key Takeaways:

- Social connection and belonging – some topics are more ‘squishy’ and others are more rigid/straightforward, and the former are sometimes overlooked for more simply-measured ideas

- Adding social determinants on any research being conducted adds depth and understanding and is an under-utilized resource

ISSUE 7: Greenspace

What information do you use to guide your work?

- Biggest issue is on exposure assessment, specificity of exposure assessment
- GPS, decide what area around the home or people to determine the exposure
    - First thing is to understand the area
- Consistency, when talking about greespace, what is really the exposure we are talking about: forest, agriculture, parks. They may act different depending on the exposure
- What we could do is comb over all the metrics and compile them to develop approaches to harmonize the metrics within the GECC

What information do you wish was available?

- Harmonize the green space metrics for exposure measurement, develop a common and more accessible dataset (like the barrier to access the data would not be too high), and novel approach to harmonize those things

What are the key unanswered questions?

- Self-serving responses as a health outcome
- Day-to-day cognitive function
- GPS to get greenspace exposure measurement
- Life-course exposure
- Dementia incidence and maybe biology markers, basically every aging outcome could be linked to greenspace
- How greenspace interacts with air pollution and temperature.

ISSUE 8: Physical Activity (PA)

Importance of thinking of physical activity (PA) differently from greenspace, stress

Mechanisms for how PA impacts brain health

- Cleanses the brain
- Reduced stress
- Keeps connections between brain and muscles active
- Reduces the impact of cardiometabolic risk factors

Important to note distinction between PA vs exercise

- Exercise is more planned, goal of getting heart rate up, balance
- Casual walking
- Perhaps PA and exercise are on a spectrum

Individual framework

- Within a person's body

Contextual factor

- Things potentially promoting of PA (e.g., greenspace, malls, fitness centers)
- These are often the things we can map and link to people

How can we improve ways to assign PA to people

- Beyond general walkability scores
- Maybe Fitbit data?
- But there may be tradeoffs between 'new' exposure assignments that may be better but then losing the ability to harmonize exposures over time

Constraints to PA

- Costs?
- Environment?
- Education

Policies to collect data on

- Diabetes educators that also encourage exercise (look at access to these types of persons in a health plan)
- Access to exercise programs in benefits plans
- Does the workplace have a gym?
    - Policies that require workplaces to have fitness centers and/or programs
- Access to things that encourage exercise
- Credits for health insurance or life insurance
- Proximity to a gym or gym membership data/membership rates
- Active transportation

    - Safe bike lanes
    - Investments in public transportation (or lack thereof) since places like metro Detroit have limited public transportation options so people are forced to drive
- Did infrastructure investments (specifically during Covid) result in any physical improvements?
- Adult exercise “playgrounds” along streets - do these have any link to improved health?
- Road closures during Covid: people flocked to these areas for community gathering
- Work from home - did it free up time for exercise?
- Data on where exercise machine sales take place
- Rural/urban
    - Access to physical therapy, cardiovascular treatment facilities
- TV and radio ads on the importance of physical activity

How do interactions with healthcare facilities interact with physical activity?

- “Now I have arthritis, what do I do about it”
    - Does having access to rehab/PT help you stay physically active rather than just doing less and less physical activity

How do you help people change (how do you target people who are NOT physically active to become physically active)?

- Is it insurance or SES

Greenspace

- One of the ways greenspace is thought to impact health is through the ability to do physical activity
- But how does safety/quality of the greenspace matter and how do we incorporate that into research
- Is it shaded or pleasant?
- Once you make a park, who goes there?

Data

- Use Google to survey people: google pushes a question to a user on their phone when it sees their location entering a park (“is this your first time in this park?” “Is it a nice park?”
- Ecological momentary assessment

ISSUE 9: Data Harmonization and Common Data Elements

Defining data harmonization, linkages, elements, etc. in this context

- Cross-linking data repositories
- In health, there is often a lack of education measures - and when there is information on where someone may have gone to school, there isn't a full picture
  - Usability of data is in itself a barrier
    - Ex: someone may live in X area, but may not attend X's school district
- Difficulties documenting/quantifying exposures to stress
  - Ex: Circadian/circular exposures to stress in examples of global communities impacted by recurring natural disasters, environmental degradation,and other impacts of climate change
  - https://www.alzheimersdata.org/
  - Difficulty linking data due to identifiability or even regulations like FERPA or HIPAA which protect the privacy of people
- How best to coordinate between different data sets to minimize confusion
  - It can be as simple as making each other aware of the resources and data available
  - https://niehs.github.io/chords_landing/index.html

Collecting nationally available data from federal government resources/repositories

- https://educationdata.urban.org/documentation/
- Harmonization across time and dataset
  - Schools and colleges are geocoded to allow analysis of surrounding addresses, zip codes, or areas
  - Often not as feasible with more surface-level national available data sets in comparison to a cohort study, for example

Data/quantification issues

- Cases where data categories may have been combined, but data for non-combined categories are not available
  - Ex: data sets that may combine different racial or socioeconomic groups into one, but data for each group prior to combination is unavailable
- Differences across regions, nations, etc.
  - Legislation distinctions resulting in distinctions in policy data/measures
  - https://lawatlas.org/
  - Ex: South Korea and India not allowing some forms of health data to be used/exported outside of the country due to privacy protections/restrictions

Long-term data goals related to cognition, Alzheimer's Disease research

- Continue developing tutorials to reduce unfamiliarity gaps with some kinds of data (e.g., epidemiological data in the context of environmental research and vice versa)

- Researchers are comfortable with their specific types of methods and data, although other methods and data types may be better for a purpose needed by the researcher
    - Addressing the dilemma that other data types may be more helpful than others, but the research has already been done
- Identifying the cause and effect of policies possibly using econometric techniques

November 4, 2024 – Session 2

ISSUE 1: Community Resources to Promote Social Network, Engagement, and Support

Highlights:

- Data Collection
    - Need to gather more data on availability, quality, and utilization of available community services for older adults/ those living with ADRD
- Potential data sources for community services
    - Older Americans Act
    - Area Agencies on Aging
- Challenges/ things that are difficult to measure
    - Social participation, social cohesion, and community engagement
    - Measuring and defining “access”
    - Measuring the extent one’s benefits from a community service
- Need to change the narrative and reduce stigmas associated with some programs to increase service utilization
    - Suggestions: partner with/ model service centers after existing pillars of the community (religious institutions and churches, etc)

Social participation

- Social participation is really important to promote long-term cognitive health
- Spatial context is important here
- Care homes/ nursing homes lack interaction with their surrounding community, but efforts have been made to improve the link between the two:
    - Examples (U.K.): nursery on-site, school visits, outings, holiday celebrations, etc
    - Expectation: Quality of life would improve with a stronger link between care home residents and the broader community

Access and availability

- Refers to immediate local resources that promote social support and social networking
- Loneliness perspective - related to the availability of community resources
- How do we define a service that is meant to address social isolation?
    - The name is only one part of it, have to consider the services offered
    - Daycare/day centers (provide a range of services promoting social participation)
        -
            - There has been a reduction of adult daycares in the UK
- Cost of community services can be very high

Changing the narrative

- Anecdote: Family member initially did not want to attend adult daycare program, but it became an integral part of their day as time went on. They lived to be 99 years old.
- Participating in an adult day program may be a source of enjoyment for older adults, but stigmas associated with programs for those who may be living with ADRD or otherwise impaired may cause hesitation to use these services

    - Change the narrative to reduce stigma related to certain resources for older adults/ those living with ADRD
    - Make resources more neighborhood-based vs destination-based
- Churches are a big source of community engagement, community organizations partner with churches to promote utilization of services
    - Usually thought of as just religious, but also provide a lot of community services
    - Might be more meaningful to community members to have a community center that resembles the same values as a church or other religious space (in terms of creating a hub that is respected/trusted among the community)

Research & data collection

- How can we measure these factors that don't show up on a map?
    - Rate of church membership, voting rates/registration, quality of services, # of community organizations with a headquarters in the neighborhood
- Measuring access
    - Must consider physical and financial access, quality of services
    - Do people want these services? Are they seeking them out?
    - Are people satisfied with the offered services, or are they dropping out of programs?
- Qualitative vs quantitative
    - A lot of the existing data regarding community-level resources, social participation, and social support is qualitative because there are so many variables that are different in different communities or in different cultural contexts
- Rush University - research on ppl who live in historically redlined neighborhoods (1930s), long-term effects on health/quality of life
    - Looking at social cohesion in neighborhoods that have been redlined since the 1930s vs. those that were not initially redlined but began to mirror redlined communities following blockbusting and white flight in the 50s and 60s.
- Difficulties:
    - May be different levels of family and social cohesion in each cultural group due to differing histories of oppression
    - Not always easy to compare two different locations (i.e. oppression may be experienced by the same cultural group differently in a different city or country)
        - May be able to draw some parallels
- Goal of research/generating data = inform policy that impacts older adult population

Data sources

- U.S. - Older Americans Act, Area Agencies on Aging (state and local level)
    - This is the primary funder of services - ADHC, senior centers, nutrition programs, etc - that help combat social isolation in the U.S.
    - Would be worth looking at their data to understand what is available, who is enrolled, etc

- UK - Nothing for community services that resembles easily accessible NHS hospital data because in the UK a lot of funding for community services happens at the local level

ISSUE 2: Developmental Origins of Health and Disease (DOHaD)

Does aging begin in utero (or even pre-conceptually)?

Early-stage epigenetic reprogramming

- DOHaD has focused largely on negative, but there are also positive life course trajectories
- Push beyond toxicants & nutrition (both well-studied) to the full exposome
- Measurement: epigenome (blood, saliva), not much information on how that correlates to the brain.
    - Animal models, advanced in vitro organ-on-chip models, or even specific cell types
- Lead exposure
    - Toxicology studies, understanding exposure thresholds (better/more biologically appropriate for humans) for studies, relevance to human experience.

How can we better connect what we see in animal studies with human experience?

- Seeing a shift in the ability to ask questions in humans because of epigenetic clocks (recent boom in literature)
    - Need to ensure we are refining and using this tool well (how to best apply to HRS, different birth cohorts)
    - NIEHS consortia: TaRGET II
        - Mouse Models - Collect target tissue of interest (first: liver, second: brain) and surrogate (blood, skin). Upcoming comparisons. Gene expression, DNA methylation, Chromatin Structure specific to the type of tissue
            - Brain tissue banks to drill down into brain-specific (also brain region-specific) understanding
        - How to better understand blood v brain biomarkers, the connection between the two, what else we can measure

Toxic exposure and prenatal care

- Nutrition, exposures.
- Twin studies, looks like parental education may be an important part of the early post-natal environment, as well as (broader, environmental/socioeconomic) exposures
    - Combination of influences sets the course for brain development (in combination with genetics)
    - Seems like we aren't measuring this well enough.
        - Socioeconomics, neighborhood, gets there a bit
        - Seems families (family-specific conditions, behaviors) and policies are important
    - Multi-generational feedback on reprogramming

Developmental origins expansion

- Prenatal care
- Parental education
- Experiences in the first few years of life

State Initiatives

- Michigan and California both save neonatal blood spots, can access this data to measure toxicant exposure, epigenetics, biomarkers for health-related issues later in life
    - Can link blood spots potentially back to prenatal care, environmental exposures
    - Potential low-hanging fruit
- State public health lab part of U.Wisconsin, WADIC data (connects broad swaths of data: electronic health records, maternal data, medicaid/medicare data)
    - Thinking about piloting linkages to broader exposome data
- MI-Cares at Michigan
    - Collecting young cohort, designed to study cancer but can be opened up to other issues
    - Building on blood spot cards that have been collected, applying to other studies
    - Capitalize on existing studies collecting blood spot data to apply to/build out other studies
        - E.g. blood cards and air pollution, other existing gateway studies
            - Caution re. Blood cards can be contaminated (depending on storage), oversaturated when collected

Proxies

- Parental education is proxy for many early childhood exposures driven by parental behavior (nutrition, early educational activities, activities needed to “launch” productive brain development)
- Epigenetics as a proxy, easier to measure DNA methylation than toxicants (e.g. in blood spots)

Brain biobanks, how to bring in exposures to toxicants

- Non-human primate research, models

Birth cohorts

- Starting to age, ability to track intergenerational dynamics
- Maternal samples collected at birth can extend back
- Mothers lost in some of this research (data collected for impact on child), long-term trajectory of mother’s health and their exposures
- Other birth cohorts out there? Taiwan, Japan, MoBa, DNBC

ISSUE 3: Health Care Access and Treatments

Other town hall sticky notes related to healthcare

- Coordinated care - person-centered
- Early life screenings for related conditions and cognition-related health
- Other chronic condition
- Connection between health and social care
- Financial resources
- Health (and healthcare) literacy

Pharmacology

- Medications are taken to treat cognitive decline, diabetes, hypertension. Variation in the way people are treated for these diseases.
    - Those taking hypertension medications for long periods of time, and what impact
    - Could be easy levers (potentially) to reduce their cognitive decline.
    - The potential way clinical decisions can be impactful via the treatment of other conditions
- Different classes of medications.
    - Some medications are better than other classes.
    - Major difficulty: Lack of information. Information at the detailed level is not there.
- One Solution: More information and data at a very detailed level would be helpful.
    - Link claims data to HRS data: Helpful for a lot of different areas including what the GECC is focusing on.
    - Access to biomarker data and comparing mechanisms. How are the underlying mechanisms being affected by different treatments? Mechanisms and relationship to biomarkers.
    - Access issues on information that want to understand better the risk factors for medication solutions. Clinics need more information. The current incentives are aligned to provide the best care for patients
    - Reimbursement decision/benefit design provides incentives for types of care that may support or be barriers to brain health

Biomarkers

- Some biomarkers are difficult to do in many settings
- Blood biomarkers being used
- Non-specific biomarkers (like GFAB) seem to be more predictive than specific biomarkers regarding cognition and Alzheimer's
    - They capture both Alzheimer's and other aspects of health
    - We need more access to MRI machines… very expensive.
    - How do we better interpret the biomarkers we are looking at
- The better prepared we are at validating and interpreting biomarkers, the better treatments we can provide. A lot of countries have no access to this.
- Inflammatory biomarkers in blood: impact on cognitive decline over time

- They are very far upstream from the disease progression. Hard to pinpoint the timing of the intervention and how this would differ from the other burdens (like amyloid)
- Response: Neural inflammation is an important pathway for cognitive impairment/decline. A lot of information on inflammatory biomarkers. Not something coming up that has a strong predictive value.
- GFAB works much better compared to other more specific inflammatory markers

- A lot of healthcare coverage is VERY local.
  - Not only on a national level, but even locality-locality variations.
  - Some societies already collect biomarkers (Japan, Korea). India national healthcare record.

Healthcare data

- Important to correlate healthcare data on cognitive outcomes
- Healthcare indicators:
  - Availability
    - Physical
    - Financial
  - Accessibility
  - Acceptability
  - Quality
- Data on all of those things would be great to look at on cognitive outcomes
- Question of what kind of healthcare you are talking about
  - Alzheimer's and dimensional care is most obvious, but not the only relevant area
  - Assuming there are other determinants of cognitive health: cardiovascular, life course… access and availability of any kind of healthcare is relevant
- Social determinants of health are also important
- Difficult, but would be good:
  - Question of whether the healthcare individuals receive is integrated or fragmented
    - Integrated, person-centered, that begins with the humanities of the patient and assesses them with functional criteria that cut across different diseases. Healthcare plans that are based on this integration could be beneficial.

ISSUE 4: Physical Environment

What information do you use to guide your work?

- Conversations with people in the community/lived experiences
  - Experiences of people there (access to water and sanitation in India)
- Data
  - Geocoded Census- and survey-based measures (potential issue of getting past exposures)
  - Geospatial data characterizing neighborhoods where individuals live, link data to health
  - Crime data (how is it measured differently i.e. within a city / in the suburbs)
  - Cross-country data/cross-national data
- More marginalized groups may not have access to community resources
- Area Deprivation Index: linked this data to cohorts, look at life-course and county-level deprivation exposures to better understand mid-life cardiovascular risk factors and late-life brain health outcomes
- Data gathered from existing resources that cover the intersecting aspects of the exposome and how they are linked to human health

What information do you wish was available?

- Comparable cross-country data (geographical differences)
- Community perceptions: how may perceptions differ geographically or depending on different neighborhoods
  - How they perceive their neighborhood could outweigh “actuality” of experience

What are the key unanswered questions?

- Don’t have a good metric of perceived environment
  - Definition of a “neighborhood”
  - Question of scale
  - Broader conceptualization of a “community”
- Other physical & economic factors that relate to the environment (overlapping factors)

Who might use curated information and guidance on this topic?

- Interacting community of researchers and building bridges in the scientific community
- Data could be useful outside of academia and need for such research i.e. for urban planners
- Question around how to ensure research translates into policy/those involved in urban planning
  - Understand what neighborhoods have/don’t have access to public transit and how to use that
  - Can use spatial analysis to explain what areas have certain amenities & the types of health outcomes in those areas, using tools like maps to demonstrate that

        - Rather than using something that may be more difficult to interpret (i.e. an NDVI index), point out the practical application of the analysis
    - How to make guidance and how to interpret indexes/analyses produced during research
- Community-based organization:
    - Neighborhoods with fewer parks/fewer public spaces/fewer sidewalks/lower walkability index
    - Framing of neighborhood's "economic well-being" → funding to reimagine parks in the neighborhood
    - How does one get investment into neighborhoods, given data on the exposures and health outcomes in an area?

Key Takeaways:

- Questions around translating research into policy, how to ensure data is interpretable for policymakers

ISSUE 5: Chemical Toxicant & Toxin Environmental Exposures

Lead exposures

- Discussion in the context of lead exposures and how to measure this
    - Lead has been studied for a while -- has informed much policy and mandates (e.g., blood spots)
    - Discussed on lead-based white paint
    - How can we get at measures of lead exposure?
- Some toxicants can pass the blood-brain barrier (like lead) so transfer from blood to brain - but dose-response is still unknown

Forms of measurement

- Cognitive development and lifespan in the context of Health and Retirement Study (HRS)
- Retrospective life histories, when folks were children and where they moved over time
- Early-life exposome
- Dose-response: how much are children/people exposed to? Can we quantify this?
- Epigenetics - could we look at -omics work to bridge environmental exposures to brain health outcomes?
    - Could this be used to look at cumulative exposures?

Timing – life course

- Concerns about brush fires, workplace, and other exposures that have changed over time
- To what extent does drinking during pregnancy or using substances affect brain health later on?
- Lead exposure over the life course - does this make children more susceptible to later life MCI/cognition or is it an incremental “having to catch up”?
- How can we study environmental exposures when we don’t have historical data (e.g., blood lead levels)
    - Can’t go back in time
    - Biomarkers of exposure
    - Have lots of data on outcomes now, but what about historical data/data from early life that is more difficult to obtain/missing?
- Data repositories
- What are some things that may mitigate harms from early life exposure to toxicants?
    - Social aspects, behavioral aspects
    - Already know that lead is bad, but what is a good intervention to mitigate the harms?
- Sensitive time windows of exposure
    - Pregnancy and menopause

Types of studies

- Animal studies that could confirm some of the epidemiological work
    - For lead, there are mice/rat models
    - For cadmium, there are also dog models (dogs as a sentinel population for humans)
        - Dog models have been used in cancer studies

Chemical toxicants: lead, cadmium, asbestos, Agent Orange, particulate matter

- Asbestos
    - Occupational and military exposures
- Agent Orange
    - Epigenetic changes have been shown
- Particles from bush fires
    - Information on firefighters being collected
    - Issue is again the historical exposure
    - What is the half-life of these exposures in the body?
    - What are the pathways of exposure? At Rush, there are studies looking at the composition of air pollutant exposures through the olfactory bulb vs
- Geographical locations and timing of disaster-related events
    - Fires - is this captured in a way to study?
- Human Health Exposure Analysis Resource - biorepository
    - Purpose is to add environmental exposures to studies that have been funded
    - Can do targeted or untargeted analyses, metabolomics, biomarkers
    - Made available for investigators to use and address hypotheses - theirs for 1 year and then made publicly available
    - Available to those who register - as long as investigator at an institution that has an IRB or ethics board
    - Data is all de-identified
    - Funded to the end of 2025 - process of finishing all 54 projects
    - Majority are birth cohorts/children's studies but many are also adults - less on aging
    - All studies are linked for finding commonalities (in a way pooled and harmonized)

Toxicants are related to climate-related events (e.g., floods, hurricanes, wildfires)

- Converging issues of climate change and aging in place
- People stay where they live due to social networks
- Related to stress

Key Takeaways:

- Lots of questions to think about as we set priorities. For example:
    - How can we study environmental exposures when we don't have historical data?
    - What are some things that may mitigate harms from early life exposure to toxicants?

    - Dose-response: how much are people exposed to? How much will it “matter”?
    - Sensitive time windows of exposure (e.g., pregnancy and menopause) - are these both exposure and outcome-dependent?
- Different types of chemical toxicants are important, including the ones discussed: lead, cadmium, asbestos, Agent Orange, particulate matter
- We have to remember that these toxicants are also related to climate

ISSUE 6: Caregiving

- Long-term care (LTC) access will impact AD/ADRD risks and outcomes
    - Affordability: rarely available through private health insurance, etc.
    - Quality of LTC – different quality measures
    - Things related to caregivers themselves: if paid, what is the level of compensation, access to time off and respite, turnover/stability, access to caregiver support (linked to community services domain), attitudes of people towards providing care, involvement of family members in care (multiple members providing care or not, paid caregivers working with family members, etc.), if caregivers are also employed elsewhere, if caregivers are also looking after young children as well ("sandwich carers"), shortage of caregivers (exacerbated by COVID-19)
    - Setting: home-based vs. institutional care
        - Within institutional care: type of instutition, size, ownership (non-profit or private)
- Caregiver stress and other roles that are predominately female and associated with health and cognitive decline and higher risk of women relative to men (if that is actually true).

ISSUE 7: Physical Activity, Exercise, Access to Healthy Living and Neuro-cognition

Exercise/being active has been consistently linked to better health outcomes (physical outcomes, cognitive health (dementia and Alzheimer's)

Thinking of being active vs sedentary

- Individuals spent over 9 hours seated
- Thinking of the environment that may influence activity (walkability of the environment) and cognition over time
- Activity in a social context (exercising with other people, which is beneficial socially and physically)
- Being motivated and living in an environment that is suitable for exercise may be beneficial in developing healthier behaviors

What information do you use to guide your work?

- MIDUS

What is needed in understanding physical activity and cognition?

- Not only motivation, but design of neighborhoods and technologies
- Socio-economic status
- Interconnectedness between physical activity and social interactions (in addition to the environment in which these events take place)
- Understanding the elements in which individuals live (roads, parks, lighting, other aspects of access, safety)
- Having a true understanding of how much physical activity an individual is doing
- The role that an individual has (e.g. caregiver)

How do we measure individuals' lived experiences as it relates to physical activity?

- Expanding on the definition of lived experiences (what is happening in an individual's day-to-day)
- MIDUS- neighborhood data (neighborhood quality)
    - Examples of what is asked in MIDUS: how long has someone lived in their neighborhood, do you own your home, do you feel safe during the day and night, can you call a neighbor if you need help?
    - Linking participants from HRS at the census level

Asking about levels of crime, high traffic accidents, and the safety of the environment

- Family interaction
- Not only objective measures are important, but experiences on the individual level are equally important
- Defining the interdependency of different exposures

Questions about physical activity

- Measuring physical activity (e.g. active watch), data is not easy to process, Fitbit has been used in MIDUS, but the level of intensity is not clear, to know how much physical activity someone gets must be sensitive, strength training is very important to functional health (e.g., grip strength and walking speed are used to measure activities related to functional health)
- Latent variables, two variables (heart rate and steps) may be tied to other variables
- Fitbit does not measure swimming/cycling well, self-reported data may help
- Having an exercise partner or exercise group/neighbor that someone has established a routine with is crucial to being able to exercise, Mid-life experiences predictive of the health later in life, important for exposome: **Variables must be situated developmentally

Adolescent and child physical activity data can be important in understanding physical activity over the life course

- Parents (indivduals establishing behaviors relating to physical activity are crucial to begin with)
- Greenspace and bluespace
- Location influences the type of physical activity
- Family relocation impacting physical activity
- Seeing proximity to publicly available sports facilities, parks, how accessible are participants to activities that encourage physical activity
- Cross-country analyses, migration may be an important factor as well

ISSUE 8: Policy Environment

What information do you use to guide your work?

- Medicare claims
- NHATS
- HRS
- Kaiser cohorts
- NIA data linkages

What information do you wish was available?

- Preventative care policies
- Mental health care policies
- Paid family leave
- Education policies
- Data repository where people can access linked datasets
- Having access to clear information about policies, how they are defined, how they are regulated
    - In the US and other countries
    - At the national and state/local level

What are the key unanswered questions?

- How does the environment influence behavior and impact health and mid-life/late-life outcomes?

December 10, 2024 – Session 1

ISSUE 1: Social Isolation, Connectedness, and Social Cohesion

Connectedness and brain health

- Social cohesion and connectedness play critical roles in brain health.
- Loneliness and social connection are distinct concepts with different health impacts. Isolation (lack of connection) seems more crucial to brain aging and clinical outcomes than loneliness (subjective feeling).

Role of local governments and policies

- Local governments can foster spaces for connection by integrating arts, health, and public policy.
- Challenges include ensuring access to these spaces for aging individuals with functional challenges, climate considerations, and cultural/linguistic accessibility.

Third spaces and aging

- Third spaces (beyond home and work) are essential for fostering connection.
- Barriers include safety concerns, climate, and physical accessibility, particularly for older adults or marginalized communities.
- Examples like community centers in Japan and other countries provide a model of proactive community care.

Impact of life transitions

- Retirement or job loss can lead to isolation due to the loss of social networks, income, and identity.
- Remote work offers flexibility but can exacerbate feelings of loneliness, particularly for older adults or caregivers.

Technological support and social media

- Technology can help maintain connections (e.g., Zoom, social media), but it's not a substitute for in-person interactions.
- Programs like the VA's tech literacy initiatives for veterans highlight the need for community-based tech support to bridge digital divides.

Multigenerational living and caregiving

- Supporting multigenerational living through home modifications and caregiving models that don't rely solely on unpaid family labor is vital.
- Companies and universities are beginning to address caregiving needs through ERGs (Employee Resource Groups) and DEI initiatives, offering a promising model for broader adoption.

Cultural and structural considerations

- The U.S.'s nuclear family model limits support structures compared to the extended family systems seen in immigrant or other cultural contexts.

- Community-building efforts should consider diverse family structures and be inclusive of linguistic and cultural differences.

Research and actionable priorities

- Priorities should span city-level infrastructure, personal-level interventions, and network-building initiatives.
- Data is needed to understand if connectedness is more a result of environmental factors (e.g., living communities fostering connection) or individual disposition.

Challenges and opportunities

- Barriers to Access: Safety, climate, physical challenges, and lack of resources in smaller cities.
- Sustainable Solutions: Community and workplace programs must balance in-person and technological solutions.
- Proactive Care Models: Inspired by global examples, ensuring proactive checks on isolated individuals can mitigate risks like those observed in the Chicago heat wave case.

Innovative ideas

- "Meals on Wheels" as "Social Media on Wheels" to connect older adults.
- Community volunteer programs for tech literacy and connection.
- Caregiving ERGs as platforms for diverse caregiving needs within organizations.
- Exploring the concept of “exposome” to integrate social and environmental health factors.
- This discussion really highlighted the need for integrated, multi-level approaches to foster social cohesion and combat isolation, recognizing its profound impact on brain health and overall well-being.

ISSUE 2: Outdoor Environment and Brain Health

General

- There is a need to adopt standard analytical epidemiological analyses designed for short-term events rather than relying solely on traditional epidemiological methods.
- Efforts should focus on capturing plausible links using innovative methods and emphasizing causal climate models.
- It's important to evaluate the changes in risk exposure during flooding events and understand their impact on individuals experiencing cognitive decline.
- The rapid pace of climate change presents an opportunity for research aimed at predicting and mitigating adverse outcomes, thus informing and alarming the population to reduce long-term effects.
- High-quality estimates should be generated to identify those at higher risk during extreme weather events like flooding and hurricanes, with special attention to mental and physical impacts on affected populations.
- Heat waves have a biological impact on brain health, which could be influenced by inflammatory stress, cardiovascular stress, and having brain health deficits make the person more at rest because of medications.
- Medications for psychiatric conditions may complicate the body's ability to regulate temperature, a hypothesis worth investigating.

Actionable research recommendations

- Emphasize experimental designs for stress testing to explore causal relationships between heat exposure and brain health. Relevant supporting articles, such as "Heat shock treatment reduces beta-amyloid toxicity in vivo by diminishing oligomers" (https://pmc.ncbi.nlm.nih.gov/articles/PMC2921903/), can offer insights into potential biological mechanisms.
- Global municipal leaders support and encourage the research which is translated to actions/programs/policies to improve brain health.
- We lift up the Environmental Justice Index for communities to see where they should target interventions: https://www.atsdr.cdc.gov/place-health/php/eji/index.html. The US Department of Housing and Urban Development also has an Older Adult Home Modification program: https://www.hud.gov/program_offices/cfo/gmomgmt/grantsinfo/fundingopps/fy2023_oahmp.

ISSUE 3: Brain Aging and Biological and Epigenetic Clocks

How do we think about change and process?

- Lack of longitudinal follow-up
- Typically measured cross-sectional samples, or a couple of waves through a few studies (i.e., Framingham Heart Study, Normative Aging Study)
- Time-based vs process-based models for understanding aging - most of what we have done is time-base but are interested in process-based (process of developing disease)
    - Process tied to estimating time course in which phenom actually changing
    - Does it make sense to get measurements of epigenetic clocks every day? Probably not
    - Paper shows that we are “younger” in the morning
    - Sliwinski, M., & Mogle, J. (2008). Time-based and process-based approaches to analysis of longitudinal data. *Handbook of cognitive aging: Interdisciplinary perspectives*, 477-491.

How frequently do we have to measure?

- We don’t know the time course
- Epigenetic clocks respond to experiences in the environment
    - Some changing a lot, some holding steady
- Sensitive periods of exposure/risks of aging? Are there periods where you are a little bit more protected?
- Estimates of biological aging are higher during pregnancy
- HRS - adapt pace of aging methodology being done
    - Page of aging clock - Biomarker based - what is the average change in pace in one sample vs another sample - look at follow-up in each person
    - AD incidence is higher among those with a higher pace of aging
    - How environmental factors affect the pace of aging
    - Need follow-up data
    - Way to assess objectively
    - Gender differences (males have a faster pace of aging)
        - Higher ages -- faster pace of aging
        - https://pmc.ncbi.nlm.nih.gov/articles/PMC11071564/
- Asking people to self-report how quickly they thought they were aging
    - How do we know perception of physiology related to epigenetic changes?
    - Usually, perceptions can diverge from physiological (i.e., stress/cortisol)
    - May still correlate (subjective and objective measures)
    - See variability - within a person over the 14 days
- Aging may not be exactly linear
    - Different ways of assessing aging may not perfectly align
    - Blood biomarkers
    - More accessible to ask self-report

- DNA methylation - predict differences in cog measures (daily measures on smartphones - for two weeks)
    - 25-65 year olds
    - See clocks predict peaks (and greater inconsistency/variability)
    - https://doi.org/10.1093/gerona/glad242
- What time of the day do we collect the data?
    - Diurnal rhythm - best in the morning and evening, worst in the afternoon
    - Should probably have a common time point
    - Time of measurement effects
    - From existing datasets: many coming in the AM fromfasting blood samples (based on looking at diabetes) - likely to be all around the same time - therefore may be getting “peak youngness” - otherwise adding to the noise as people will vary through the day
    - People are now assessing time effect more closely - planning to take blood at the same time of the day
    - If looking at year-to-year change and different times of day - may not see what you want to see
- Demographers have focused on cross-sectional data
- Immunological aging
- Not a lot of recent work on environmental epigenetics in older adults, brain and health
    - Who is working in this area?
    - Interested in air pollution and noise pollution and biological aging
- Allostatic load ideas - wear and tear - using up resources - evidence has been small
- A lot of stress measurements are coarse (for example, ACEs - horrible, but not all exposed to these)
    - Just adding the number of events may not be enough
    - Important to remember the childhood part of ACEs

Biological aging with various exposures

- Connections of air pollution, heat stress, and biological clocks
    - USC group studying in HRS?
    - Could use auxiliary data - use public weather data with sample
- Review paper on environment and biological responses
    - https://www.tandfonline.com/doi/full/10.1080/23748834.2024.2335707
    - Way to try to process the conversation
    - Focused on urban areas
    - Pathways of exposure and role of context depending on if urban or rural - for rural:
        - Social isolation
        - Transportation
        - Access to healthcare and amenities
    - More on air pollution but less on other exposures

    - Much of the literature is biased toward urban environments rather than rural - there are going to be more older people aging in rural areas
        - Also for developing countries
- Personal monitoring
- Thinking about the overlap of race/ethnicity with environmental exposures - what does “race” mean? Residential segregation
- Rural aging
    - May think that their environment is protective (no air pollution from cars, light, noise)
    - Yet there are different types of pollution - agricultural

ISSUE 4: Diet and Food Security

General

- Having people to follow in larger cohorts to study how diet influences brain health
    - Nurses's cohort
- Access to diet and food is important, especially in the care of patients with dementia or cognitive decline
- Diet of the caregiver can play a role in the wellness of the person (the caregiver's diet could be congruent) - one potential area to intervene on
    - Food impurities can disturb the microbiome – related to gut and brain access (metabolic individuality)
    - How do these food additives and impurities affect brain health?
- Areas for more exploration to better determine if there are certain groups of the population who are at greater risk or more susceptible (genetic, diet, etc.)
- Another contribution to nutrition is sensory functions (dental hygiene, ability to taste, smell, etc.)
- Exposures throughout the life course impact other exposures and subsequently our brain health and aging
    - Nutrition across the lifespan
- Diet quality differs among different groups (individuals with cognitive decline, socioeconomic status, etc.)
- Food insecurity is a dynamic process that depends on an individual's circumstances across their lifetime
    - Measurement of Food insecurity
    - 10-point scale to collect data/compare and contrast diet and food security
    - Food Insecurity Experience Scale and American Household Food Insecurity Access Scale
- Discussion of vouchers/SNAP program provided for individuals of lower socioeconomic status and "nudges" for "healthier" options
- Community programs to better understand perspectives from these communities (surveys and their effectiveness in communities that may have low literacy rates, response rates, etc.)

What information do you wish was available?

- How to better access a better diet/make decisions about that
    - How to build this around their cultural and food preferences
- Measurement of food insecurity (implications of where to provide services to underserved communities)
- Precision of nutrition
    - Need a good understanding of how these factors come together and affect a need for precision
        - Community-level approach, this can also depend on the country
        - Increased data availability from GPS (can pinpoint geographic locations)

        - Ex. noise exposure, quality of air, and other factors that can be measured by devices like wearables
    - Use of big data (diet alone is not going to prevent dementia, use big datasets to understand differences across different populations)
    - Necessity of data-sharing within and across countries

What are the key unanswered questions?

- How do these food additives and impurities affect brain health?
- Areas for more exploration to better determine if there are certain groups of the population who are at greater risk or more susceptible (genetic, diet, etc.)
- Persistence of exposure and whether exposure is metabolized
- What is one way to measure food insecurity?
- Can we look at physical activity separately or should we look at physical activity and diet collectively to understand brain health
- Provide evidence that early-life exposure to diet matters and the implications of that on brain health
    - Need to convince policymakers to change policy

ISSUE 5: Physical Activity, Exercise, and Brain/Cognitive Health

What information do you wish was available?

- Possibly a combined focus between cohort studies and RCTs because of the drawbacks to conducting RCTs and the availability/cost of running cohort studies
- There appears to be a bias towards RCTs and a minor stigma associated with cohort studies or large-scale samples, despite that data being more accessible and of value in its own way

What are the key unanswered questions?

- How much of the current field is redundant/copied work?
- Is there novelty in the field or are we in a confirmatory loop?
- How can we improve adherence to physically active lifestyles?
- What are the true discouraging factors preventing people to be active?
    - Weather?
    - Emotional state?
    - Feelings of safety?
- How can we incorporate infrastructure or policy changes to make physical activity part of daily living?
    - Do cycle lanes actually work?
    - Is more greenspace enough to improve physical activity levels?
    - Can better driving education make walkers/joggers/cyclists feel safer?

Who might use curated information and guidance on this topic?

- Doctors
- Personal trainers

What would you like to see in the research in the future?

- More specificity in prescription/recommendation of physical activity to specific individuals
- The effects of environment on levels of physical activity
- How behavioral science can be used to improve rates of physical activity
- Higher quality of reporting in behavior and physical activity research/experiments
- Better understanding of the participant experience in physical activity studies:
    - Explaining the value of their participation
    - Giving them the expectation of an exit process if they want to drop out so we can better capture why people stop engaging in physical activity studies
- Greater inclusivity in the physical activity research at all levels

ISSUE 6: Work

Lots of studies on PM2.5 and dementia, but PM2.5 can be magnitudes higher in the workplace

Cognitive engagement at work

- Different types of cognitive work/skills at work
    - Management, working across groups, social skills, analytical work, stress
    - Does exposure to these (or lack thereof) influence cognitive decline differently?

How could we measure these things?

- ONET?
    - Surveys are costly ways to get what you're interested in
- HR records:
    - USC has self-evaluations (Work-day), quasi time diaries
    - But would need to link these to cognitive data
    - May also provide info on retirement
- ISR is asking people to do EMAs (ecological momentary assessments), 6 times a day for 7 days
- Heart-rate monitors (e.g., apple watches)
    - Heart rate likely correlates with stress
- Trying to involve Apple, fit-bit, etc. to get data
- Cell phones
    - Can track movement and/or geolocation
    - Time spent on the phone (possibly a crude measure of social interaction)

Existing work between leaving the workforce and cognitive decline

- ADP - used to have significant market share but it's decreased a lot in recent years.
- PLAID (competitor for mint)
    - Can link bank accounts, credit cards, so have transactional-level data
- Take-up is only about ~10% (and tend to be younger and higher income)
- Transactions linked to categories
- They only have information for people that consent (you give them the ability to link data)
    - So they don't have a warehouse of all data, just for those that consent
- Goal is to bring leaders from many tech and financial tech companies to figure out ways to get passive data
- An issue will be making sure data from different companies is harmonized so that it can be combined
- Nuts and bolts matter: when people change passwords then links across accounts die and then you don't have the time series
- Data donations

ISSUE 7: Lifecourse, Timeline, and Early Life Experiences

- Things associated with progression of disease vs. incidence of disease (particularly diseases causing cognitive decline)

Measurement questions

- What exactly defines dementia? Physiological/biological basis to defining it? Biomarkers used, understanding the continuum.
- Distinction between Alzheimer's and dementia (the former having physiological causes)
- Understanding multi-causal dementia, measuring Alzheimer's, Parkinson's, etc. through biomarkers in comparison to causes of cognitive impairment
- Barriers to measuring cognitive decline, the difficulty of measuring cognition in prior years (potentially attaining an adequate baseline?)
    - Survey questions
    - Linking databases/longitudinal studies to censuses, hospital records (e.g., HRS to census data)
        - Avoiding the issue of reverse causation by relying too much on HRS
        - Linking HRS sample to investigate causality
    - Record linkage generally

Understanding how people's life experiences and history impact cognition, particularly cumulative disadvantage across the life course

- Wide range of disadvantages - exposure to violence, abuse, job instability, etc.
- Impact of social policies on relieving social disadvantages and in turn cognitive decline caused by disadvantage through the life course
- Handwritten census records from 1890-1920 (approximately), looking at household member occupations - found an association between increased risk of dementia amongst low SES/lesser skilled laborers

Which exposures do we care about? Why do they matter? When do they measure them? What are the risk periods?

- Timing of exposures - at what point do exposures impact cognitive decline? Key but understudied area
- Relevant exposures and modifiers
    - Better treatment of vascular disease has decreased the prevalence of dementia in the US and Europe - asymptomatic, but disease-positive people, how can we measure exposure and cognitive decline amongst these people
        - Careful attention to study design to avoid making incorrect associations or conclusions about causality
    - Risk periods for older people who we might not have access to some data for (Google Maps might not have existed during X, Y, Z time, for example)

- Handwritten census records from 1890-1920 (approximately), looking at household member occupations - found an association between increased risk of dementia amongst low SES/lesser skilled laborers
    - Difficulty assessing causality or association because, for example, manual labor might be a result rather than a cause
- Area Deprivation Index as a tool for identifying the significance of exposures - Index defines socioeconomic disadvantage across neighborhoods, providing an understanding of life course/physical environment differences

- Effects from specific physical effects. Which effects? When do they magnify impacts on cognitive decline?
    - For example, mercury is more detrimental during specific windows of exposure
    - Difficulty of assessing windows of exposure is that people would have to be interviewed, have biomarkers taken more often - expensive and difficult with large sample sizes
    - Framework for understanding … for example, aging itself does not cause cognitive decline but may make people more susceptible to some risk factors that exacerbate cognitive decline
        - Relevance of Cliff Jack's research on Alzheimer's disease
- Do some exposures (e.g., social environment specifics) mitigate the symptoms or impacts of Alzheimer's Disease?
    - People diagnosed with Alzheimer's Disease (development of amyloid plaques and neurofibrillary tangles), but the progression of symptoms differs across people with different exposures
- Which exposures matter most? Exposures at what point in the life course? Pilot studies to lead us in the right direction of what to investigate going forward

Scale

- Leveraging unique populations - assessing cognition in specific populations or people who have been followed through the life course – e.g., birth cohorts
- Statistically linking measures — see McArdle 2008
- Simulate a birth cohort study by replicating associations of interest and then extrapolating it
- Extracting information from Google Maps (with knowledge of a subject's location/neighborhood) - provides non-self-reported data that is useful for understanding amenities, disamenities, exposures, and other variables

ISSUE 8: Access to Community Resources/services (Healthcare, LTC, Home and Community Services)

Broad topic

- Key here is “accessibility” since this is a community-level topic
- May range from emergency response to LTC
- Can be methodologically challenging to research and measure accessibility
- Defining “services” in a spatial context can be challenging. Contrasted with “environment” this is clear: a bus stop is static and easier to measure with geospatial methods; a telephone call to a home aid or on-call bus is more difficult to ascertain
- Generalizability of datasets here is an asset. GECC is focused on dementia and Alzheimer’s Disease Related Dementias, but datasets can be leveraged in other directions

Features of community resources

- Housing options/types; subsidized, public housing, varies by income
- Service coordination services (either in congregate housing vs. traditional homes)
- Housing insurance and interactions with health
- Country-level policies (e.g. universal health care vs. privatized)
- Transportation. Walkability and accessibility metrics. Goal is to measure if individuals can walk themselves, can they get a bus somewhere, are services like Uber available?
    - Distinction between on-call transportation and publicly funded transit (e.g. buses vs. DartBus)
    - Finances matter here too and will vary by city: large cities will have public transit, smaller centers likely rely on on-call buses etc.

What are data needs / what’s the ideal dataset? What challenges exist with obtaining this data?

- More detailed information is needed on housing-related services
    - E.g. support for individuals finding housing, are home aids available in the area? Is there a service coordinator for individuals for individuals with disabilities?
    - Services may include biological needs (bathing, cleaning, food), psychosocial (therapy),
- A challenge is the disparate/diffuse nature of data.
    - E.g. data can be available at federal, state/provincial, community levels, within hospitals, health units, etc.
- This aspect of the GECC could be one of the more difficult areas of data collection and availability
- Centralized & harmonized resources are an incredibly important aspect
    - Researchers don’t have time to be experts in all domains
    - Developing datasets that are useful “across the board” is beneficial to the wider research community

    - Key example: linking data to climate change data and how community services can aid in adaptation (e.g. AQI/AQHI alerts)
- Rural and small communities represent novel challenges, e.g. helicopters used for emergency response in rural areas but there are very few available.

Key Takeaways:

- **Data challenges** (e.g. linkage, measurement, definition) are at the heart of community services research
- Emphasis needs to be placed on **establishing centralized & harmonized measures of community services**; we can't all be experts in all things!
- The topic is inherently spatial, making some aspects easier in terms of data (e.g. in large cities measuring accessibility to services like transit or retail) whereas other aspects can be spatial but more difficult to measure (e.g. availability of on-call buses for elderly and disabled in rural areas)
- Key focus areas are **housing** (e.g. subsidized housing), **homecare support** (e.g. home aids, community service coordinator), **transportation**, and **emergency response**
- Policy factors like universal healthcare are important to consider.

December 10, 2024 – Session 2

ISSUE 1: Healthy Food/Nutrition, Diet

General

- Much of the research on diet/nutrition related to ADRD focuses on preventative strategies (i.e. what to eat to maintain cognitive health) but is almost non-existent post-diagnosis
- ADRD patients lose control of their diet as the disease progresses and are reliant on caregivers to provide them with food/manage their diet
    - Often this can lead to malnutrition and eating problems
- Diet and nutrition are also connected to other chemical exposures + gut microbiome that can have an impact on brain metabolism
    - By measuring big data we can map to see the impact of what we are eating on brain metabolism

Resources

- Brain Health Food Guide - Canadian food pyramid generated by Baycrest Hospital in the Toronto area
    - More comprehensive/prescriptive than a normal food pyramid because it explains what foods you should limit, not just which foods you should eat
    - Hasn't yet undergone the same tests as the Mind Diet
- Community Programs
    - Intergenerational cooking program aimed at getting ADRD patients back in the kitchen and engaged in their nutrition
        - Helps to educate the younger generation and promotes more sense of control over diet/nutrition for the ADRD patients
        - Last cohort - program took place in an adult day program, socialization aspect
    - Delight - 8-week exercise and nutrition program for ADRD patients and their caregivers

Challenges

- The big challenge with diet is measuring it, especially post-diagnosis of ADRD and as the disease continues to progress
- Lots of cultural and regional differences in diet that may be tied to cognition
- Diet/nutrition guidelines and America's attitude towards certain diets is rooted in systemic racism, thus labeling some cultural diets as unhealthy unnecessarily
- Intersection of diet and physical activity is important to consider

Key Takeaways:

- Need to focus more on post-diagnosis analysis of diet/nutrition and provide more interventions that are not solely prevention-focused
- Measuring diet is very difficult especially as a disease progresses

- Community interventions can have an impact on nutrition outcomes/health behaviors of ADRD patients and their caregivers

ISSUE 2: Air pollution

General

- The field has focused so far on PM2.5, traffic pollution, ozone, others (black carbon, components of PM2.5/metals), not much on overall mixtures or a wider range of air pollutants.
    - Many open questions on pollution and brain health, pathways still being understood
    - As GECC team co-lead, important: ultra-fine particles. Had to separate out effects (pollutants/exposures grouped together) but pretty good data around NO2, PM2.5, ozone more challenging, ultra-fine more localized.

Relationships to air pollution and health

- Looking at aggregate measures of air pollution (e.g., vascular impacts and beyond). Why the focus on PM2.5 (not the most relevant in terms of size permeating the blood-brain barrier). Should we be stretching our thinking?
- Air pollutants are used as indicators of other things. What broader or proxy measure is PM2.5 indicating (acknowledging its widespread use)
- Emphasis on other body systems beyond the blood-brain barrier (vascular disease)
- Air pollution is related to vascular disease, which is related to cognitive decline. Important to parse out specific relations and mechanisms
- Are we aware of studies looking at other organ systems (beyond brain health/cognition focus)? Other organ systems as mechanistic pathways?
- Vascular dimensions/pathways (heart, peripheral vasculature, plaques as evidence for ultrafine particles and initial inflammation)
- Lung function, liver, systems we don't typically think of when we think of dementia (beyond brain, vascular)?
- Links between pulmonary effects and brain effects. Sure pathways are mixed together to some extent.
- How are these particles and their proxies being metabolized? What is the reaction of the body (brain, organs) to these particles. E.g., in the nose, there are enzymes metabolizing things (such as ultrafines, organic matter on PMs). Metabolic component is an unexplored area.
- Overview of all organs where there has been links between organs and air pollution. Working group by American Thoracic Society.

Gaps/challenges

- Interested in ultra-fines, some data and models. The main limitation is time: interested in long-term exposures in dementia/cognition but data are limited particularly with ultra-fines.
    - Time window when effects occur
    - Getting better exposure measures

    - What is the important exposure period of interest, better data to model that limits answering this question
- Two major gaps in the field
    - How pollutants are getting to the brain (pathway)
    - Measuring cumulative exposure over time (modeled, or directly in tissue). Amount of exposure, time frame of exposure, or both?
- Also, mechanisms. Direct and indirect causal mechanisms, pathways disrupting cognition.

Timing issues

- Getting good measures of all of these, as well as timing questions, complicates things. With time course, a challenge is the inability to get data from earlier in life. Richness of the data is separated into pre- and post-2000.
- Talking about time periods, not sure when relevant exposures occurred (60s? 70s? 80s? Cumulative? All of the above, but recent exposures precipitating?)
- Pre- and post-2000 because more data for people to develop models including spatial resolution, spatial patterns. Lots of work recently building on satellite imagery/data. Challenges with precision in exposures going back prior to 2000.
- Geospatial coding difficult pre-2000s
- Spending time estimating exposures farther back in time (with tenuous accuracy/outcomes) can feel futile

Modeling ultrafine particles

- Pretty good models on ultrafine particles in Seattle and Toronto, but would challenge researchers to find a model that can cover US or Canada (anything available in geospatial air pollution modeling in Chicago region?)
- Rely on Joel Kaufman for this, pretty good ultrafine models in Chicago
- There has been interest in conducting ultrafine modeling in Chicago, other regions, with data limitations to broader national modeling.
- New cheap technologies to measure and deliver this data?
- Low-cost sensors for ultrafine particles are still $10,000+. Interest in developing lower cost models…prior reliance on lower-cost technologies had questionable outcomes
- Portable version close to $20,000 each (although work quite well)
- Using satellite information to model ultrafines? They are more effective in modeling PM2.5
- Studies in Toronto with mobile monitoring for NO2, ultrafines, etc… after acquiring satellite dataset measuring NO2, NO2 from space was more correlated with surface ultrafines than with surface NO2. Concerns around data as imperfect indicators. National ultrafine model without something comparable for NO2, unsure if modeling surrogate for trapped pollutants rather than ultrafines.

Biomarkers

- Cumulative effects, what is bioaccumulating in the body and what is being processed/how.
- If there was a way to easily measure these processes in live people, testing whether and what cumulative exposures are
- Between biomarkers and exposures, wrist bands. Also intriguing with air pollutants, trace radiation (e.g., attached with aerosols). Can measure this in the indoor environment. Also exists in the outdoor environment, suggest related to a range of outcomes including brain effects.
- Also, indoor air pollution at large–occupational. Ultrafines (again) while indoors, e.g. cooking. This may be dominant exposure for many.
- Different infiltration rates, ambient exposure rates

Indoor versus outdoor exposures

- Residential history data has been interesting. NACC has lots of data, but residential data are limited. Special to find a cohort with good outcomes data and residential history data, before exposure models can be applied.
- Air pollution, climate risk. source/composition of pollutants (black carbon, nitrates)? Focus on source as it relates to mitigation and intervention.
- Indicators strongly linked: traffic air pollution, fossil fuel combustion (in traffic). Sources of PM2.5 across N. America and dementia incidence (S. Adar) found PMs related to wildfire and agriculture had strong associations with dementia. Lots of unpacking in what is going on here. Agricultural PM as indicator: ammonium nitrate. Perhaps ammonium nitrate as a proxy for regions with heavy pesticide use, etc… Another important outcome was coping ability (and then traffic pollution)
- Interesting idea about pesticides, organic pollutants in air and then from other sources (water, food, etc). Another thing to parse out. We are absorbing these things all the time, from where and how.
- Another way to think of exposures: commuting experience (is this occupational, environmental, air pollution)
- In some studies, we see very high rates of indoor exposures. A relatively unexplored lifetime exposure where it is a little harder to model and measure correctly.
- Harder to regulate/flag non-occupational indoor experience as a cross-cutting exposure (chemical, social/behavioral, air, pollution)

ISSUE 3: Built and Social Environment

Data wish list

- Neighborhood data from the past (at a national scale). Coffee Shop, library, recreation center, neighborhood park, etc.
    - Specific features (not just composite neighborhood SES) measured historically and nationally
- Historical street map data only goes back to 2011. Now, have to download 4TB of data (entire history of the world)
- Locally-grounded online social infrastructure/"third places"
    - Previous efforts with Yelp, Twitter activity
- Publicly available/affordable (ideally free!) Google Location and Visa card swipe payment data (financial transactions which track where people are from)
- Historical activities space that would tie into other surveys
- Historical built environment data
- No trustworthy data source for CURRENT information a lot of times
- Longitudinal time use data, with connections to fine-scale geographies (never zip code)
- NETS - National establishment time series database has a lot of issues
- Microscale neighborhood characteristics (at the street block level)
    - Could this be integrated with national-level survey data?
    - Machine learning can learn to autocode this
    - LIDAR data with Machine learning is being used to generate 1m x 1m data, but it lacks connection to actual people/individuals
- Broader dimensions of access (measured nationally and longitudinally)
    - Not just geographic proximity
    - Affordability
    - Availability (e.g., hours)
    - Accessibility
    - Accommodation
    - Acceptability
- Overlay natural environmental factors to capture seasonality (which impacts the use of the built environment, travel patterns, socialization, health behaviors, and mental health)
    - Heat
    - Darkness
    - Precipitation (snow, ice)
    - Terrain

Current sources

- TRI
- Tiger files
- ACS data - socioeconomic
- NaNDA (National Neighborhood Data Archive)
- NETS

- Bureau of Labor Statistics

Could activity space be calculated as "potential" activity space instead of "current" activity space?

- There might be a destination that exists, but can people actually get there?
    - Limited mobility for the elderly. Have to rely on others for transportation, etc.
    - How does this interact with the activity space?

Would a bigger activity space or smaller activity space be better?

- Bigger doesn't mean better. Quality over quantity.
    - Part of the reason GPS data trajectory datasets are not useful in many ways
- Connecting those spaces with time can help a little bit
- Useful for understanding places they are being exposed to
- People have different perceptions of what is safer: buses vs train travel.

Link to NEWS survey items:
https://activelivingresearch.org/sites/activelivingresearch.org/files/NEWS_Survey_0.pdf

Seasonal factors (huge, underexplored issue)

- Northern climate with snow in the winter
    - Transportation becomes very different in climates that are not as cold or don't get as much snow.
- Darkness is also a big factor that impacts people's activities
- Heat in the south as well
- Older adults' mobility in the winter
  https://www.tandfonline.com/doi/abs/10.1111/geob.12004
- Canadian data: There is no spike in online socializing in the winter, but there is a decline in in-person socializing in the winter
- Some positive opportunities for bonding in the winter: Helping someone shovel the snow, going to the mall to walk, etc.

Put together a survey about the questions we would like answered

- Current survey from Amber (of 100 people):
    - Very uncomfortable with the frequency of extreme heat events
    - Very wide range of what is an extreme temperature
    - Takes into account what measures

ISSUE 4: Chemical/Environmental Exposures

What information do you use to guide your work?

- Engagements with community and networks of aging populations
- Provide work to support groups who may not be interested yet in chemical exposures

What information do you wish was available?

- The impact of chemical exposures (including mixtures) across the lifetime
    - E.g., examining the risk of quartiles of exposures in the United States
- Understanding the intersection of these chemical exposures on dementia risk (acknowledging that defining what dementia is and its subtypes is its own challenge)
- Effects of cumulative vs acute exposures to multiple exposures

What are the key unanswered questions?

- Exposures across the entire lifecourse (pre-conception all through current exposures)
- The intersection between chemical exposures and
    - Current health condition
    - Past/current trauma and life experiences

Who might use curated information and guidance on this topic?

- A lot of public interest in chemical exposures so they might be interested in this information; especially information about product use, behavioral changes
- Community members who feel that they might be at higher risk of dementia/cognitive impairment and are interested in interventions
- Policymakers and regulatory to set standards

Key Takeaways:

- Environmental chemicals can impact a lot of different pathways
- These exposures can change developmental pathways (neurodevelopmental pathways)
- Understand both the mechanistic pathways and points of intervention to be communicated to the broader public.

ISSUE 5: Access to Community Resources and Care

Discussing ways to measure quality of care/access to care

- Local/state health departments may have their own databases to measure quality/access
- How do we get access to data that is ready to be used in a useful and analytical way?

Key unanswered questions

- Identifying physical coverage gaps
    - We have a lot of data about individuals (social isolation)
    - Step 1: are there services? Step 2: Are services even used by the community members?

How do we begin to track how older adults use healthcare services?

Some questions that are intended to be answered by this work

- Can you age in place?
- Are there any home care services (could be in relation to nursing) in the US? The group is unsure if they do exist
- Importance of integration of work relating to quality/access to care with policy

ISSUE 6: Metabolism and Brain Health

Metabolism is the end goal/result for all the other topics

- It needs to be better characterized
- It is the net influence of diet, gut microbiome, and all other topics covered in this meeting
    - The “metabolome”
- Everyone studying the impact of the exposome on the brain would benefit from this research.

Key answered questions

- Molecular imprint of the exposome on metabolic health

Interests in exploring preventing vascular factors because they are beneficial in preventing the onset of dementia

- Refactors for cognitive
- There is no evidence that population trials are effective in preventing the onset of dementia
- Population trials
    - Longitudinal study that demonstrates that preventive measures in vascular factors are good at preventing dementia
- This is a public health problem - this research would help prevent cognitive health decline
- They have risk factors for cognitive decline, but they don’t have the resources to do a population trial
    - They need a large sample, they need to do a baseline study and a follow-up study. This is beneficial for hospitals.
    - To determine the size of the population trial, they would need help from public health and statisticians.
- Clinical trials would also be beneficial

ISSUE 7: Education and Cognitive Stimulation

Key questions/topics of interest

- Why is there this connection between education and cognition/dementia? There seems to be a genetic component: what are the causal pathways?
- Education in LMICs and comparison of outcomes across countries
- Educational pathways
- Does education increase cognitive reserve, does it hide the signs of cognitive decline, etc.
- Education affects so many things in life - hard to tell if education affects a certain outcome, or if it affects intermediary factors, and these factors in turn affect a certain outcome - what can we actually attribute to education then?
    - Also challenging: so many factors go into education (such as parental wealth) – again, how do we attribute outcomes to education independently?

Data

- Wish there was more data on education quality – right now we mainly know about education quantity (such as compulsory schooling)
- Also think about when we're getting reports on education, the accumulation of education over time/educational trajectory points along the life course
- Having data at different geographic levels would be informative (having variables, such as quality, available at the smallest level) and increase accessibility
    - However, could be difficult and expensive to execute
- Full-count Census data and HRS data could be used together to start to figure out the geographic component
- Noise with geography, though – since not everyone will attend their neighborhood schools
- In general, difficult to get good measures of cognitive decline
    - HRS measures cognitive ability but the data is noisy – overall can do statistical analyses but requires lots of assumptions
    - To try to solve this problem: potentially link with social media accounts, analyze text, the complexity of the text, etc. → richer data
        - Also interesting because you can look at people from similar backgrounds
        - Also with text analysis: looking at mistakes on financial documents over time as people age – not as closely connected to education, but could be another measure of cognitive decline
- Looking forward: collecting education data from individuals still in school, that could then be linked with later-life data down the line
    - This would likely be difficult in the US, but in countries with social registers, this could be easier, data is more linkable
    - Also midlife data, before people begin to cognitively decline/right when they may be starting to cognitively decline

Curated information and guidance

- What can we bring out of available data vs. what do we need to begin novel data collection on?
- What format should data be in to increase accessibility?

ISSUE 8: Social Isolation

What information do you use to guide your work?

- Existing large longitudinal panel datasets. HRS family of studies
    - g2aging.org
- MIDUS, NSDE - national study of daily experiences
- Collect own data using Ecological Momentary Assessments (EMA)
- NSHAP National Social Life Health and Aging Project

What information do you wish was available?

- More readily available infrastructure for identifying more intensive longitudinal datasets with smaller sample sizes. Those that don't already exist on the Gateway for example
    - Metadata platform to help replicating studies
    - Accessible information on how researchers create measures
    - Global standard for Ecological Momentary Assessments (EMA)
    - Strategies we use to connect EMA with longitudinal studies

What are the key unanswered questions?

- Understanding the day-to-day social interactions which may constitute a mechanism explaining changes in brain health e.g., connection between hearing loss and cognition
- How different ways of measuring distinct but related constructs (e.g., contact, quality, loneliness) under the umbrella of social relationships uniquely affect brain health
    - Most research focuses on close ties, but we need to understand the effect of non-family or less close ties and how these interactions can be cognitively stimulating
- How to link self-report with biological measures

Who might use curated information and guidance on this topic?

- Social scientists
- Epidemiologists
- Gerontologists
- Quantitative methodologists

ISSUE 9: Different Types of Stress

What information do you use to guide your work?

- HRS
- Publicly available datasets for SysReview and Meta-Analysis
- Primary data collection at source (examples: prison and jails for research into incarceration-based stress)
- Lived experience reports from caregivers, committees, discussions with policymakers
- Expert consultation

What information do you wish was available?

- Efficacy of interventions on the general public
- The nature of interventions proposed to affect change in stress
    - In policy
    - In education
    - For individual case-by-case instances
- A curated list of possible interventions that have scientific consensus, or at least a reasonable amount of success, as being efficacious towards improving stress-related outcomes

What are the key unanswered questions?

- Are sources of funding being used responsibly to investigate interventions with potential, and not wasted on things that have already been shown to have little/no effect?
- What do we know is working? How do we know that?
- How would funding be used most appropriately in future research into stress/cognitive health?
- Can the nature of research and its outcomes be effectively 'translated' to alternative sources of funding besides the well-known academic/scientific sources (NSF, NIH, etc.)?
- How does stress affect older adults?
- How do we capture stress across the life course?
- What are cumulative exposures and what parts of the lifetime should we focus on?

Who might use curated information and guidance on this topic?

- Stakeholders outside of academic/scientific groups

Comments or thoughts on the nature of stress

- Stress is intertwined with many of the other exposures and can be thought of as a mediator

What would you like to see in this field of research?

- Standardized quality of research methods in this field.
- Diversity of research methodologies in the dementia/stress/cognitive health field.
    - This includes synthesis of those experimental designs

- A reduced amount of scientific/research jargon in the available literature
- Less information kept behind paywalls
- Brain health disparities of people who have been dealing with incarceration.

Key Takeaways:

- This discussion on stress highlights a need for comprehensive information on the efficacy of interventions targeting stress-related outcomes across various contexts, such as policy, education, and individual cases. In particular, there is interest for a curated list of scientifically supported interventions and better transparency on how funding is allocated, ensuring resources prioritize promising avenues rather than ineffective ones.
- Most discussion attendees would like a better understanding of stress's impact on older adults, its cumulative effects across the life course, and ways to translate research outcomes to non-academic funding sources. Additionally, the field would benefit from standardizing research quality, embracing methodological diversity, reducing jargon, and making findings more accessible.
- There is a particular interest in addressing brain health disparities in marginalized populations, such as individuals who have experienced incarceration, emphasizing the role of stress as a mediator in broader health contexts. This information could serve stakeholders beyond academia, fostering actionable insights into mitigating stress across diverse populations.

Participant Organizations

Alzheimer's Association
American Institute for Research
Arizona State University
Babes-Bolyai University
Baruch College
Boston University
Brigham and Women's Hospital
BrightFocus Foundation
Brown University
Ca'Foscari University of Venice
Centers for Disease Control
City of Houston
Clemson University
Columbia University
Columbia University Irving Medical Center
Cornell University
Davos Alzheimer's Collaborative
Drexel University
Duke University
Emory University
Emporia Consultancy
Environmental Protection Agency
Florida State University
Francis, Edward, and Cronin, Inc.
George Washington University
Georgetown University
Global Brain Health Institute
Grantmakers in Aging
Harvard University
Health Aging and Retirement in Thailand
Health Education Council
Health Effects Institute
Heinrich Heine University of Dusseldorf
Indian Institute of Management Tiruchirappalli
Indian Institute of Science
Johns Hopkins University
Keio University
King's College London
Laboratory of Neuro Imaging at University of Southern California
Manchester University
Marymount University
Mayo Clinic
McGill University
Michigan State University
Missoula County
Mount Sinai School of Medicine
National Bureau of Economic Research
National Institute of Environmental Health Sciences
National Institutes of Health
National Institute of Mental Health and Neuro Sciences
National League of Cities
New York City Department of Health and Mental Hygiene
New York University Langone Health
Nihon University
North Carolina State University
Northeast Ohio Medical University
Northwestern University
Organisation for Economic Cooperation and Development
Paril Sciences and Letters
Penn State University
Queen's University Belfast
Rosalind Franklin University
Rush University

Rutgers University
SHARE Berlin Institute
Social Science Genetic Association Consortium
Stanford University
State of Minnesota
Stony Brook University
Sungkuynkwan University
The Canadian Urban Environmental Health Research Consortium
The City of Orange Township
The London School of Economics and Political Science
The Wharton School of the University of Pennsylvania
Trinity College Dublin
United Arab Emirates University
University College London
University of Bordeaux
University of California at Berkeley
University of California at Los Angeles
University of California at Sat Francisco
University of California Davis
University of Cambridge
University of Chicago
University of Colorado
University of Colorado Anschutz Medical Campus
University of Connecticut Health Center
University of Florida
University of Helsinki
University of Houston
University of Illinois Chicago
University of Kentucky
University of Lausanne
University of Malaya
University of Michigan
University of Minnesota
University of Montana
University of Montreal
University of Neuchatel
University of New Hampshire
University of North Carolina
University of Pennsylvania
University of Pittsburgh
University of Sao Paolo
University of Southampton
University of Southern Alabama
University of Southern California
University of Stirling
University of Sydney
University of Texas at Austin
University of Texas at Houston
University of Texas at San Antonio
University of Texas Medical Branch
University of Tokyo
University of Toronto
University of Trieste
University of Utah
University of Washington
University of Waterloo
University of Wisconsin
Urban Institute
Vanderbilt University
Vanderbilt University Medical Center
World Bank
World Health Organization
Yale University