The Brain and Social Connectedness:

GCBH Recommendations on Social Engagement and Brain Health

Global Council on Brain Health℠

A COLLABORATIVE FROM AARP®

Introduction

The Global Council on Brain Health (GCBH) is an independent collaborative of scientists, health professionals, scholars, and policy experts from around the world working in areas of brain health related to human cognition. The GCBH focuses on brain health relating to people's ability to think and reason as they age, including aspects of memory, perception, and judgment. This is sometimes also called cognitive health, cognitive function or mental fitness. The GCBH is convened by AARP with support from Age UK to offer the best possible advice about what adults age 50 and older can do to maintain and improve their brain health. GCBH members come together to discuss specific lifestyle issue areas that may impact people's brain health as they age with the goal of providing evidence-based recommendations for people to consider incorporating into their lives.

We know that many people across the globe are interested in learning what they can do to maintain their brain health as they age. An abundance of sources are now available for people to find information, but it can be difficult to know what the weight of current science says when new and sometimes conflicting studies are reported. The GCBH makes its recommendations to help people know what practical steps they can take to foster better brain health and feel confident that it is based on reliable and scientifically credible information.

We aim to be a trustworthy source of information basing recommendations on current evidence supplemented by a consensus of experts from a broad array of disciplines and perspectives. We intend to create a set of resources offering practical advice to the public, health care providers, and policy makers seeking to make and promote informed choices relating to brain health.

Social Engagement and Brain Health

Given the importance of the topic of social engagement for people of all cultures, the GCBH convened a meeting to discuss current scientific evidence underlying the question: how does social engagement affect our brain health as we age? On October 20-22, 2016, members of the GCBH met at Age UK in London. A list of participants and GCBH members are included in Appendix 1.

While individuals vary in the degree to which they seek out social connections, humans share a fundamental need to interact with other people. Experiencing relationships and enjoyable contacts with others and sharing joint activities usually contributes to people's feelings of well-being. From a brain health perspective, research suggests that older people who are more socially engaged and have larger social networks tend to have a higher level of cognitive function. The purpose of this paper is to provide a summary of this research. We know that loneliness and social isolation increase health risks in older people. Various factors like disability and major life events such as retirement or reduction in social networks can make it more likely that people become less socially engaged as they age.

Based upon their knowledge of current scientific evidence, the experts reached four points of consensus on the relationship of social engagement to brain health as people age. Based on this consensus, the GCBH issued twelve recommendations for adults aged 50+ to maintain and build social connections in order to help support their cognitive health over their lifespan. We also provide practical tips for those looking to expand their social engagement.

Following the recommendations, we outline the process the experts used to examine the evidence. The discussion section presents highlights of some of the most interesting parts of the deliberations during the meeting and subsequent refinement of the draft. The GCBH presents examples of social activities for adults that have been evaluated by social scientists to show positive benefits for adults' brain health as well as a variety of other common social engagement opportunities in Appendix 5. This paper is not intended to be an exhaustive review of all pertinent scientific literature on the topic of social engagement and brain health. Rather the selected references listed at the end provide helpful background material and present a sizeable sample of the current evidence base underpinning the GCBH consensus in this area.

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Principles Underlying the Social Engagement Discussion

People relate to others and experience social engagement in various ways. For example, personality, gender, culture, context, past relational experiences, and individual preferences can affect how people relate to and interact with other people one-to-one or in groups. The GCBH discussion began with a conversation about the several ways in which one can engage socially. People generally strive to engage in activities and connect with others in positive ways. At times, people may struggle to find and make social connections that are meaningful for them and, therefore, we should not impose values or judgments on the way people relate and interact. We also recognize that not all social interactions will be experienced as positive or meaningful, or foster a sense of well-being. Nevertheless, for the purpose of this document, the notion of social engagement refers to social interactions that are pleasing and meaningful to those who engage in them and have positive outcomes such as providing emotional and/or practical support.

There is mounting evidence that social engagement may help people maintain mental fitness. However, it has been difficult for researchers to produce definitive evidence for two primary reasons. First, designing experiments to study the effect of social engagement on the brain health of humans has important limitations. For example, while some social engagement experiments have involved studying animals housed alone versus those residing with one or more cage-mates, it would not be considered ethical to design an experiment with humans wherein one group of individuals would be deprived of the company of others. Therefore, study designs intended to show cause and effect, referred to as randomized controlled trials, have not been used as often in social science research as they have been in other areas of brain health inquiry. Instead, scientists studying social engagement have largely relied on epidemiological research studies which are typically observational in nature. These assess different types and levels of human social engagement and compare people to each other rather than manipulating their level of social engagement to assess how those changes impact on people's brain health. A comparison of the strengths and weaknesses of randomized controlled trial and epidemiological study types in humans is provided in Appendix 3.

Second, social engagement is very often intertwined (or associated) with other activities that may also influence brain health, such as cognitive stimulation and physical activities that often occur in the company of other people. It is therefore difficult to tease apart which specific activity is responsible for the observed outcome. Is it the social component of an activity, or the physical or mental challenge, or even the combination of factors? To that end, most of the accumulated evidence to date is based on research that involves asking a large group of people various questions about their lifestyle. Investigators then examine how their answers may relate to their overall health, including their brain health. The weight of the current evidence suggests that social engagement tends to be linked to better cognitive health. Even so, epidemiological studies cannot conclusively establish that social engagement directly causes improvements or maintains brain health; people with better cognitive health may seek out more frequent and higher quality social engagements. Nonetheless, current expert opinion favors recommending social engagement for people as they age based on observational evidence, the other likely potential benefits of interacting with others, and the unlikely harm of becoming more socially active.

It is clear that the nature and amount of evidence available on the impact of social engagement on older adults' abilities to think and reason as they age, including using aspects of their memory, perception and judgment – the primary areas of the GCBH's work— is not as well-developed as the evidence relating to the impact of physical activity and sleep on brain health, the first two areas the GCBH addressed. Therefore, the recommendations on social engagement from the GCBH rely heavily on expert opinion and speak confidently to overall mental well-being. The GCBH agrees that the evidence suggests a positive impact of social engagement on brain health including benefits to adults' thinking and reasoning abilities. However, while there is some very good research evaluating the various effects of different aspects of social engagement on memory and reasoning skills, this is an area that requires significantly more analysis before stronger scientific consensus can be reached.

Consensus Statements

Taking the previous factors into account, the GCBH reached the following consensus statements and recommendations.

1. Social engagement is interacting with others, feeling connected to other people, doing purposeful activities with others and/or maintaining meaningful social relationships.
2. Social connections vary by their structure, function and quality (see Table 1), and these differences affect the outcomes of social engagement on brain health.
3. The weight of evidence suggests that social engagement helps maintain thinking skills and slows cognitive decline in later life.
    a. Evidence from observational studies shows that people who are socially engaged have a lower risk of cognitive decline and dementia.[1]
    b. There is promising evidence from a randomized controlled trial showing that individuals who are more socially engaged have a lower risk of cognitive decline.
4. In spite of the observed link between social engagement and cognitive health, there is not yet sufficient scientific evidence to conclude that social engagement can reduce the risk of brain diseases that cause dementia.
    a. There is some evidence from observational studies that increased social engagement can lower the risk of certain diseases characterized by cognitive decline; however, such evidence is limited.
    b. The GCBH is unaware of any randomized controlled study designed to investigate whether increased social engagement can lower the risk of dementia.

Table 1.

Structural Components (the features of social connectedness)	**Functional Components** (the nature of interactions)	**Quality Components** (individuals' experience)
• Composition of group: age, gender, cultural diversity • Duration of contact • Frequency of contact • Individual vs. group activity • Presence or absence: family or friends, partner, spouses, neighbors • Size of group (s) • Type	• Complexity (emotional and behavioral dimensions) • Instrumental support • Emotional support • Intensity • Intergenerational dynamic (transfer of knowledge) • Reciprocity • Variety	• Fun/ Novelty • Joyfulness • Meaningfulness/ Purposefulness • Satisfaction with ties • Sense of belonging • Sense of social well-being • Supportiveness

1 What the GCBH means by "risk" is defined in the Glossary in Appendix 2.

Recommendations

Below are recommendations to optimize and promote social engagement. The recommendations are ordered so that the first ones might be appropriate for people who have very few social connections. This is followed by suggestions for those who are relatively socially active. The final recommendations are for those people who are already socially active. The GCBH recommends that these people consider increasing the diversity or variety of their engagement. It is recommended that people should generally maintain a variety of the suggested types of engagements.

To promote meaningful social engagement:

1. Focus on the relationships or social activities you enjoy the most.
2. If you have no one around who can help you engage socially, turn to professionals who can assist.
    a. Examples: telephone hotlines, drop-in centers, a chat with a local religious leader, etc.
3. If you feel lonely, you can try to change this by making a new connection or by seeking different opportunities to engage with others.
4. If there are barriers to interacting with people (e.g., difficulty getting around, unsafe neighborhood), see if you can identify someone you could ask for help, and let someone assist you in making connections.
5. Try to keep a circle of friends, family or neighbors with whom you can exchange ideas, thoughts, concerns and practical matters, and who can also help or encourage you. It does not need to be a large group of people as long as those in it are important to you and you are important to them. Try to have at least one trustworthy and reliable confidante to communicate with routinely (e.g., weekly), someone you feel you can trust and you can count on.
6. If you are married, this can benefit your cognitive health, but you should consider fostering other important relationships. Individuals who have never married or are divorced or widowed often have many other connections that provide support.
7. Try to speak every now and then (e.g. monthly) with relatives, friends and/or neighbors; communicate in person, or by phone, email or other means.
8. Help others, whether informally or through organizations or volunteer opportunities. For example, visit a lonely neighbor or friend, shop for/with them, or try cooking together.
9. Maintain social connections with people of different ages, including younger people. Keep in touch with grandchildren or volunteer to help people at a local school or community center. Think about the skills you have and that you use routinely that might be valuable to pass on to others. Offer to help teach a younger person skills you may already have, such as cooking, organizing an event, assembling furniture, saving for the future, investing in the stock market, etc.
10. Add a new relationship or social activity you didn't try before. Place yourself in everyday contexts where you can meet and interact with others (e.g., stores or parks).
11. Be active and challenge yourself to try out organized clubs, courses, interest groups, political organizations, religious gatherings, or cooking classes.
12. If you are already socially active, diversify your activities. Consider joining or starting a group that doesn't exist in your community and is centered around a common interest (e.g., a work out group).

Practical tips for those who have trouble engaging socially:

1. People can take small steps to connect with others. Share a smile a day with someone, show interest in someone by asking how they are, hold a door for someone, and practice a random act of kindness.
2. Reach out to neighbors or acquaintances whom you may not have spoken to in a long time: for example, call, send a card, email, or check social media.
3. Look at the list of additional resources that we provide in Appendix 1 and consider using them.

Process Used to Produce the Consensus and Recommendations

Issue specialists were selected to participate with the GCBH because they are considered leaders in their fields. Each specialist has conducted research that has significantly contributed to the body of evidence connecting social engagement with brain health amongst older adults. The diverse areas of their expertise represent different perspectives and disciplines including gerontology, psychology, epidemiology, and public health.

Seven issue specialists from four continents were asked to critically examine the state of the science as of October 2016. The issue specialists considered the following major questions as a framework to guide their deliberations. (The complete set of discussion questions considered is available in Appendix 4.)

1. What does it mean to be socially engaged?
2. Does the type of social engagement make a difference in outcomes among older individuals?
3. Does the purpose of social engagement make a difference in outcomes among older individuals?
4. Does social engagement influence cognition or brain function as you age?
    a. Do adults 50+ who stay socially engaged as they age maintain (and/or?) improve cognitive abilities?
    b. Do adults 50+ who stay socially engaged as they age maintain cognitive abilities more than those who don't?
    c. Are there structural and functional changes in the brain in individuals who are socially engaged?
    d. Does social engagement directly affect cognition or does it work by impacting other mechanisms known to affect cognitive functions, i.e. by reducing stress, increasing exercise and movement, etc.?
    e. Does loneliness directly reduce cognitive function or is it that reduced cognitive function makes you lonely (i.e., reverse causality or relationship between the two)?
    f. How can communities help older people become or stay socially engaged?
        i. Neighborhood social cohesion
        ii. The built environment: age-friendly communities

The issue experts engaged in an in-depth moderated discussion, follow-up conference calls, and an exchange and refinement of drafts with the Governance Committee and other participants. This document summarizes the consensus reached and recommendations agreed to for adults interested in adopting behaviors that could help them lead more socially enriched lives and may promote their brain health.

Seven Governance Committee members participated during the in-person meeting. The entire Governance Committee provided input to the document during subsequent conference calls and emails in December 2016. The Governance Committee issuing the recommendations are independent health professionals from across the globe representing diverse expertise in epidemiology, public health, neurology, psychiatry, geriatrics, clinical psychology, social gerontology, cognitive neuroscience, neuropsychology, pharmacology, medical ethics and health policy, and neurodegeneration.

Liaisons from civic and non-profit organizations as well as other academic institutions with relevant expertise in brain health and social engagement issues were invited to provide input and feedback during the Issue Experts and Governance Committee's refinement of this document.

The Governance Committee applied their expertise to determine whether they concurred with the statements, evaluated the objectivity and practicality of the proposed recommendations, and considered the usefulness of the information presented in the document. The GCBH Governance Committee reviewed this summary document to decide whether it accurately reflected the current state of science in the field. The Governance Committee approved the document on January 23, 2017.

Discussion

Changes in Social Networks as We Age

Social networks encompass a broad range of factors such as the nature of the network, satisfaction, marital status of members, number of ties, perception of being understood/misunderstood, and reciprocity in relationships (see Table 1). The quality of an individual's social network can play a role in cognitive function, and the experts think that maintaining a variety of social connections and meaningful interactions with people may be a protective factor against cognitive decline as we age.

As people age, it is common that their social networks change and sometimes grow smaller. Life transitions can change both size and composition of social networks. For example, people may retire from employment, or because of illness or death of friends, family and associates, the number of people individuals are exposed to may decrease. The death of a friend or family member, and particularly the loss of a spouse, has been shown to detrimentally impact overall health as well as cognitive health. The absence of significant social relationships has been suggested to be as detrimental to a person's health as smoking, high blood pressure, and obesity. But the profound sense of loss that comes with these transitions may be partly offset by developing or maintaining connection through other kinds of social relationships that can help with coping with the loss.

People may also choose to be more selective in the connections they choose to maintain later in life. The "socioemotional selectivity theory" explains that as people grow older and experience changes in cognitive capacities, they may become increasingly selective with their relationships and invest more resources in emotionally meaningful goals and activities. The constriction of social networks, however, is not necessarily inevitable, as new living arrangements or different companion or volunteer opportunities occur and new family members such as grandchildren are born. How people relate and interact with others is modifiable because people can change their interactions and lifestyles to improve effective or meaningful social engagement as they age.

Nature of Evidence Reviewed

Social activities vary widely across cultures around the world. This diversity can explain the differences that exist in both the type and intensity of social activities that are studied. The GCBH undertook a rigorous examination of scientific evidence from across the world that focused on the relationship of social engagement to cognitive and brain health. The evaluation was based on a review of randomized controlled trials and epidemiological studies published in peer reviewed journals, as well as the issue specialists' opinions. The impact of social engagement on the health of individuals across the lifespan has been well documented in countries such as the United States. However, far fewer studies have captured the impact in other regions of the world, nor have very many studies been specific to brain health.

There have been some randomized controlled trials that have tested the impact of real-world engagement on cognitive ability of adults age 50 and older. These studies, such as Experience Corps and the Synapse project (See Appendix 5, Section A1 and A2), support a causal relationship between social engagement and cognition, though more studies are needed because these activities often include multiple factors that could positively impact cognitive functioning in addition to the social component.

Challenges of Reverse Causality

When we explore potential links between social engagement and brain health, we always need to consider whether it is social engagement that benefits brain health, or vice versa. That is, if we experience changes in our thinking skills we may choose to, or feel the need to, change the frequency and type of social engagement in which we participate. In that scenario, reduced social engagement would be an outcome of declining brain health. In many studies, it's not possible to determine which factor comes first. When researchers have collated results across studies, the outcome has suggested that, on balance, better social engagement is good for brain health, but more research in this area is needed.

Loneliness

While strong social bonds can boost health and improve quality of life, loneliness caused by poorly functioning relationships increases the risk for mental and physical disorders. In fact, negative relationships with a lot of strain may increase feelings of loneliness. Loneliness and isolation are different concepts. People can feel lonely even if they are often surrounded by others. Loneliness occurs when people feel there is a gap between the social engagement they want and what they have. Self-reported loneliness increases the risk for cognitive decline in older people. Chronic loneliness has more detrimental effects on brain health over time than temporary

periods of loneliness. In the case of individuals diagnosed with a chronic disease or disability, feelings of loneliness can be even more profound. Losses in physical function and self-care capacities, for example, can lead to reduced social engagement, which in turn accelerates cognitive decline. Changes in everyday competence in this way can lead to feelings of loneliness.

AARP Foundation is spearheading Connect2Affect. This is a research-based platform designed to create a deeper understanding of loneliness and isolation, draw attention to the issues caused by the lack of social engagement, and catalyze action to end social isolation among older adults. Learn more at connect2affect.org. Other helpful resources are listed in Appendix 1.

Neuroimaging and Neuropathology Studies

There is compelling evidence that social engagement has positive impacts on the brain, though more research is needed. Such evidence includes neuroimaging data reflecting positive changes in the brain associated with social engagement. Here we describe three seminal studies in the field that include neuroimaging data. Experience Corps (see Appendix 5, section A1), an intergenerational social health promotion program, reported on the effects of examining brain function and brain volume for participating men and women. Remarkably, findings in an fMRI study showed that purposeful activity embedded within a social health promotion program improved cognition and related brain function. A subsequent randomized controlled trial further showed that Experience Corps halted and, in men, even reversed declines in brain volume in regions vulnerable to dementia (e.g., the hippocampus) over a span of two years. These were the first studies to incorporate neuroimaging into intervention studies that directly examined the impact of a multimodal social engagement program on markers of brain health in older adults.

The Synapse Project (see Appendix 5, section A2), also utilized fMRI in a randomized trial to assess the impact of group engagement in high-challenge activities (quilting or digital photography or a combination of both) as compared to socializing only. fMRI analysis revealed that individuals randomized to cognitively demanding, purposeful activities showed improved cognition and brain function that were not seen in the socializing only group. Finally, the Rush Memory and Aging Project is another study that examined factors associated with healthy cognitive aging. Results showed that those with larger social networks were better protected against the cognitive declines related to Alzheimer's disease pathology. In other words, Alzheimer's disease pathology was less likely to be associated with cognitive impairment among persons with large social networks as compared to individuals with smaller social networks. More research is needed, however, to determine whether social engagement helped to buffer the brain causing people to exhibit fewer symptoms of the disease.

Purpose and Generativity in Life

The GCBH also examined evidence related to purpose in life. Purpose in life refers to the extent that people see their lives as having meaning, a sense of direction, and goals to live for. A sense of purpose is shaped by social structural and functional factors, including gender roles, and is influenced by changing life circumstances, such as retirement. Several intervention studies have shown that purpose in life may be a promising target for prevention and intervention strategies aimed at enhancing health, including cognitive and brain health. A mounting body of research also suggests that having a sense of purpose in life is associated with a wide range of positive health outcomes (e.g., reduced risk of Alzheimer's disease, cognitive impairment, heart attacks, strokes, death), health behaviors (e.g., more likely to use preventive health screenings, engage in more physical activity, and sleep quality), and biological functioning (e.g., reduced levels of inflammation and cortisol). The exact mechanisms linking purpose with better health are unclear, but growing research suggests that people with higher purpose are more proactive in taking care of their health. This may be prompted by an overarching outlook in which life itself is greatly valued.

In addition, the opportunity to make a lasting contribution, known as generativity, has been seen as a key to successful aging. Core to the feeling of generativity is a commitment to promoting younger generations. Throughout life, generativity can occur via numerous social roles, including parenting, mentoring, caretaking, and civic engagement. Participation in "Experience Corps," an intergenerational civic engagement program in which older adults volunteered in their community schools, increased generative desire and generative achievement in such older adults. That kind of participation may result in a number of health benefits, and particularly in brain health, as described above and further in Appendix 5.

Digital Social Engagement

Advancements in digital technology, along with increasing internet access and the development and use of social media across the world, present new opportunities for older adults to engage socially. In using computer-based communication

platforms, such as email, Instant Messaging Software (IMS, e.g., WhatsApp, WeChat, Skype, or), Social Networking Sites (SNS, e.g., Facebook), online communities, blogs, etc., seniors may both *maintain* their relationships with family and friends and *expand* their existing social world. Typically, the digital engagement complements rather than replaces in-person communication. For example, grandparents living far from their grandchildren can use digital platforms to keep in touch with them, and old friends can use such technologies for daily updates as well as for planning offline get-togethers. Similarly, new relationships formed online often spillover into the physical world, although some online relationships remain digital only.

Whereas digital relationships may not offer the same qualities of in-person contact, they offer many social rewards for the individuals involved. For example, studies of online communities for older persons showed that community members report numerous benefits including intellectual stimulation, playful experiences and emotional support. Such social engagement may be particularly valuable for older individuals living in remote places and/or facing mobility limitations. To an extent, it may compensate for lost relationships and offer relief and distraction from stressful circumstances. In addition, thanks to the anonymity, invisibility and the opportunity for reading and responding to communication intermittently as schedules permit rather than at the same time, digital engagement enables people to easily communicate with others and express their feelings, opinions, and skills. This has been theorized to allow greater control and more self-disclosure and lead to personal development and improved self-image for adults in later life.

Studies have found that learning computer and internet skills enhances a sense of independence and creates a process of empowerment due to the power of change and the power of knowledge. Internet use is also associated with higher levels of social connectivity, higher levels of perceived social support, decreased feelings of loneliness, lower levels of depression, and generally more positive attitudes toward aging.

Moreover, there is some evidence demonstrating that digital engagement effects on cognitive abilities in later life are similar to that of in-person communication. An Australian study involving more than 5,000 older men found that those who use computers have a lower risk of receiving a diagnosis of dementia by up to 8.5 years, and an experimental study conducted in the United States revealed that older adults, after learning to use Facebook, performed about 25 percent better on memory tasks. Nevertheless. as noted in the knowledge gap section below, the relationship of digital social engagement to brain function is an area in which significantly more research is needed before consensus on its effects can be reached.

Close Relationships

A meaningful relationship with another person can bring companionship, love, happiness, and comfort to an individual's life. The impact of close relationships, particularly marriage, on an individual's health has been investigated from both a physical health and psychological well-being perspective. The health of a husband or wife is strongly associated with his or her spouse's health. Participating in a fulfilling romantic relationship can be very beneficial. However, the benefit of such a relationship depends on its quality. In addition to psychological well-being, relationships have been found to be associated with a broad range of other health outcomes including cardiovascular, endocrine and immune function. Yet relying exclusively on one primary relationship for all social interaction can lead to isolation if the other person should become sick or die, so it remains important to develop a range of other social relationships as the above recommendations suggest.

Handholding has been found to decrease levels of the stress hormone, cortisol. A friendly touch can also serve to calm one down and reduce the stress response. Couples have been shown to be able to regulate each other's physiological response to threat through handholding. It should be noted, however, that the role of touch in interpersonal relationships varies widely in different cultural contexts.

In many parts of the world, the number of years that couples may enjoy one another's company after children move out has increased. The opportunity to engage in more regular sexual activity may be a result of a renewed sense of privacy. Increased time alone with a partner and sexual activity can have a positive impact on physical and psychological well-being as one ages. Research has shown that engaging in intercourse is related to a higher quality of intimate relationships. This in turn can also result in lower rates of depressive symptoms and better cardiovascular health in both men and women. However, there is very limited research on the effects of sexual activity on cognitive function in older adults.

Pets / Companion Animals

Pets can provide a nonhuman form of social support and companion animals can play multiple roles in our lives. The benefit of human-animal interactions to human health is an area of growing research. A number of therapeutic, physical, psychological and social benefits of pet companionship

have been reported. Taking care of pets can give a sense of purpose and structure to a pet owner's day. Pets such as dogs, cats, and birds can also serve an important role as a catalyst for social interaction. Dogs have been described as social "ice-breakers" by serving as a conversation trigger between strangers or casual acquaintances. As a result, dog walkers are more likely to experience social contact and conversation with other people than walkers without pets.

Specific benefits to adults interacting with animals range from findings of reduction in depression, anxiety, and social isolation to decreased blood pressure, reduced risk of heart attacks and increased physical activity. It should be noted, however, that along with the increase in physical activity, comes the risk of pet-related falls, particularly in the older population. There also needs to be recognition that some people are fearful of animals, that various cultures view animal companionship very differently, and that frail elders may reach a point where they can't properly care for the animal. More research is needed on which types of pets are best suited to be companion animals.

Studies have been conducted to examine the effect of pets on the cognitive aging process in healthy individuals as well as those with dementia. Several small investigations of pet therapy have reported improvements in behavior in people living with dementia. For example, research has found that people with Alzheimer's disease have shown reduced verbal aggression and anxiety in the presence of animals. Animal-assisted therapy is commonly used in nursing homes.

Neighborhood Social Cohesion

A growing body of research suggests that social characteristics of neighborhoods, such as neighborhood social cohesion, are associated with a wide range of health behaviors and outcomes. Neighborhood social cohesion is the perceived degree of connection among neighbors, and people's willingness to intervene for the common good. Neighborhood social cohesion is characterized by the degree to which residents feel they belong to the area, and the degree of trust that is shared among neighbors. Higher neighborhood social cohesion has been associated with a range of positive health behaviors and outcomes including increased physical activity, increased number of attempts to quit smoking, decreased risk of heart attacks, and increased use of preventive healthcare services. Further research on the specific impact on the relationship of neighborhood social cohesion to adults' cognitive function is needed however before the GCBH can draw conclusions in this area.

Traditional community and family social engagement

Participation in family and community activities through traditional and cultural practices is another form of social engagement. The relationship between social engagement and level of cognitive function in many regions of the world often focuses on self-reported health. Unique traditional and cultural social activities are yet to be fully examined in studies assessing links between aging and cultural social activities. Refer to Appendix 5, section C.

Sharing of Food can be a Communal, Socially Engaging Activity

The centrality of food in our lives has led to a tradition of eating with others and therefore has long been associated with social engagement. Food is also an occasion for sharing and giving. In this way, food is a focus of many social activities. An example of how food has been used to spark social engagement can be found in the Appendix 5, Section B.

Knowledge Gaps

Developing consistent measures and definitions of social engagement

As the field of research surrounding social engagement continues to develop, particularly as new technologies become available, there is opportunity to further develop consistent measures and definitions of social engagement. This will aid in the creation of a cohesive body of knowledge and in evaluating strength of the evidence. The definitions and tools need to take into account different personal, cultural, and environmental factors because these differences can impact the outcomes of social engagement.

Moreover, as researchers develop interventions, they should emphasize inexpensive, widely available, and non-invasive measures that can be applied across different populations and cultures. When it comes time to apply and scale-up successful evidence-based therapies, it is those factors that will determine feasibility of use and therefore the practical benefit for the most number of people.

Age-Friendly Communities

Age-Friendly communities are being implemented across the world. One of the perceived benefits of living in an age-friendly community is that housing, transportation and community planning can facilitate increased and better quality social engagement. The built environment and neighborhood characteristics play a role in enabling or promoting people's engagement in physical and social activities, particularly for older individuals as well as those with disabilities. If you have to stop driving and lack access to other forms of transportation, this can reduce your participation in a range of social activities particularly if you live in rural or suburban communities. Further research is needed on how age-friendly communities serve as optimal models to enhance social engagement to potentially improve health/well-being, including brain health. Development of Age-Friendly and Dementia-Friendly communities are supported by GCBH conveners Age UK and AARP as well as by the Alzheimer's Society in the UK and Dementia Friendly America. These communities are the focus of increasing discussion among policy makers around the world as cities seek to meet the needs of older residents. The World Health Organization's (WHO) Global Network for Age-friendly Cities was established in 2010 to connect communities and organizations around the world that have a commitment to becoming more age-friendly.

Digital Connectedness vs. In-person Connections

Older adults are the fastest growing segment among internet users around the world. Parallel to the increase in the number of users is a considerable growth in the body of knowledge on older persons' use of the internet. Previous studies focused on several key issues, including internet utility for older adults (e.g., communication, information and recreation), impact of use on their health and emotional well-being, barriers and limitations concerning internet use, and interventions such as special training, specific technological applications and senior-friendly design. Studies conducted to date, however, have not delved into individual differences among users, nor have they explored potential negative effects of Internet use on well-being in later life. Thus, we must further develop our understanding of the particular ways in which participation in virtual communication may affect seniors' well-being.

As communication technology expands, digital engagement is being discussed as a way to counteract social isolation or feelings of loneliness. However, there is not yet a body of evidence to establish to what extent digital engagement can effectively promote cognitive health in later life. The vast majority of developed evidence around social engagement and its association with cognitive function has been based upon physical, in-person connections, not virtual ones such as those available through the internet. Additional research is required to explore to what degree and how digital engagement contributes to brain health in old age.

How Social Engagement Impacts the Brain is Still Largely Unknown

The mechanisms by which social engagement interacts with brain functioning is unclear. There are several theories.

Why might social engagement affect the brain and its function?

Possible Mechanisms/Theories

- A stress reduction pathway (physiological)
- "Use it or Lose It" principle (engagement utilizes active cognitive skills) or increasing cognitive reserve (the mind's resistance to brain damage/pathology)
- Promotes access to emotional support
- Providing access to tangible or informational resources or help in making better decisions

Developing Area of Inquiry: Social connections can be positive or negative, ineffective or effective.

Social relationships vary considerably, and in fact, not all interactions can be viewed as positive. In that regard, the quality of social integration and level of social support and even strain a person may experience from social connections should be considered.

A. Effective relational interactions occur when people are able to engage in a conversation in a reciprocal manner whereby everyone in a conversation feels validated in a warm, genuine and accepting manner.

B. Ineffective relational interactions are described as instances whereby individuals act in a judgmental manner or only engage in the interaction from their own perspective (lacking empathy for others). Other ineffective interactions may occur where individuals jump from topic to topic without explaining the relevance to the people they are trying to relate to. Ineffective relational interactions includes situations in which a person's social goals and psychological needs are unaddressed due to the observable manner in which they relate to other people. One area of research has also looked at perceived threats leading to ineffective social engagement. This may occur if an individual experiences abuse, for example during childhood, or when people have experienced emotional abuse at some point in their life.

C. Social engagements perceived as unsafe trigger natural defense strategies (fight, flight, freeze) to protect people against the perceived threat. While this paper has discussed the impact of positive social interactions, research around the cognitive effects of negative interactions should also be considered.

Conclusion

The impact of social engagement on peoples' abilities to think and function independently as they age, including the impact on their memory, speed of processing information, executive function, or planning ability, may depend upon the meaningfulness of social interactions and on how positively people feel about these interactions. Therefore, the benefits may depend on what people do and with whom they interact. Demographic factors such as ethnicity, gender, age, socioeconomic status, family structure, and living arrangements all play a role in how people experience and respond to social engagement. Though evidence supports that interacting with others may slow cognitive decline, the impact of social engagement on brain functioning has yet to be fully determined. Continued research on this topic is necessary as there is substantial interest in identifying interventions involving social engagement activities to reduce the risk of cognitive decline in older adults.

The consensus statements and recommendations above are based on the current state of science as of October 2016. As further developments occur in the study of the impact of social engagement on brain health, the GCBH will periodically revisit these recommendations and provide updates when appropriate.

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Members of the Global Council on Brain Health are independent health care professionals and experts coming from a variety of disciplines. The social engagement issue specialists and Governance Committee members formulated these recommendations, the Governance Committee approved them.

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Participants and Liaisons' List of Additional Resources

AARP's Age-Friendly Network. See: http://www.aarp.org/livable-communities/network-age-friendly-communities/

AARP Foundation's Connect2affect. Learn more at: http://connect2affect.org

Age UK runs befriending services. Find out more at: www.ageuk.uk/health-wellbeing/loneliness/feeling-lonely. They also have a Campaign to End Loneliness. See: http://www.campaigntoendloneliness.org

The Alzheimer's Society leads the Dementia Friends initiative in the UK enabling the creation of dementia friendly communities. See: https://www.dementiafriends.org.uk

Area Agencies on Aging.
See: www.eldercare.gov

Dementia Friendly America is a movement to foster dementia friendliness in the United States. See: http://www.dfamerica.org

The Gerontological Society of America has established an expert panel on Human-Animal Interaction as it relates to aging and has announced a grant for research in 2017. See: https://www.geron.org/programs-services/alliances-and-multi-stakeholder-collaborations/human-animal-interaction-and-healthy-aging

Love Letters Challenge, by DoSomething.org organized a Valentine's Day Campaign challenging young adults to send a card to an older adult. See: https://www.dosomething.org/us/campaigns/love-letters-challenge

Meals on Wheels (America). See: http://www.mealsonwheelsamerica.org

Senior Corps Programs. See: www.nationalservice.gov/programs/senior-corps

Silver Line helpline for older people. See: https://www.thesilverline.org.uk/

Society for Companion Animal Studies. See: http://www.scas.org.uk

**Participation in this activity by these individuals does not necessarily represent the official viewpoint of the U.S. Department of Health and Human Services, the National Institutes of Health, or the National Institute on Aging.*

2. Glossary

The glossary highlights how the GCBH used these terms within the context of their discussions and in this document.

Brain Health. The mental process of cognition including the abilities to think, reason, learn, remember, concentrate, use judgment and plan.

Cognitive Decline. The Institutes of Medicine (IOM) in 2015 defined a similar term, cognitive aging, as the lifelong process of gradual and ongoing, yet highly variable, change in cognitive functions that occur as people get older. Cognitive decline is a term used by the experts to describe losing cognitive abilities over time as people age absent a specific disease or condition.

Confounder. A situation in which the effect or association between an exposure and outcome is distorted by the presence of another variable.

Connected. To experience a sense of belonging and welcomed in a group.

Dementia. Dementia isn't a specific disease. Instead, dementia describes a group of symptoms affecting memory, thinking and social abilities severely enough to interfere with daily functioning. Though dementia generally involves memory loss, memory loss has different causes. So memory loss alone doesn't mean you have dementia. Alzheimer's disease is the most common cause of a progressive dementia in older adults, but there are a number of causes of dementia. Depending on the cause, some dementia symptoms can be reversed.

Effective relational interactions. Refers to people who are able to act according to the interpersonal context and who display relational qualities such as empathy, unconditional acceptance of other people, who are genuine in the interaction, flexible and able to adopt the perspective of other people.

Empathy. Empathy involves an understanding of another person's world by listening, to allow a better understanding of the other person's situation, and by responding with verbal and non-verbal messages that communicate affective understanding of that person's situation. Cognitive empathy refers to the ability to recognise and interpret the other person's situation while affective empathy refers to an accurate emotional expression of that person's situation.

Epidemiological studies *(which can be cross-sectional or longitudinal)*. In these studies, which are observational in nature, scientists try to establish a link between lifestyle activities over time (e.g., social engagement) and long-term outcomes (brain health with aging).

Ineffective Relational Interaction. An interpersonal style observed when people elicit rejection or distance from other people with frustrated achievement of social goals and psychological needs.

Instrumental Support. Various types of physical, tangible help that others provide such as housekeeping, transportation, material goods.

Loneliness. A feeling a person experiences as a result of the gap in the connection with others between what they want and what they have.

Longitudinal studies. In longitudinal research, scientists observe changes over an extended period of time to establish the time-sequence in which things occur or the effect of a factor over time.

Meaning. There are three components in personal meaning: (1) cognitive component, which is about making sense of one's experiences in life, (2) motivational component that is about pursuit and attainment of worthwhile goals, and (3) affective component that is about feelings of satisfaction, fulfilment, and happiness accompanying goal attainment.

Neuroimaging or brain imaging. The use of various techniques to visualize the structure, function of the nervous system. Examples of brain imaging technologies include computerized axial tomography (CAT), Positron Emission Tomography (PET), and fMRI (functional Magnetic Resonance Imaging).

Neuropathology. The study of diseases of the nervous system (i.e. Alzheimer's disease).

Randomized Controlled Trial (RCT). In a typical randomized controlled trial, people are randomly selected to receive either the intervention or a control condition. In a double-blind trial, both the participants and the researchers are unaware of (or "blinded" to) which person received the intervention until after the results are analyzed.

Risk. Risk is the chance or probability of a particular event happening in a group of people with similar characteristics or traits, compared with not having that characteristic or trait. An individual's overall risk of having a condition is the cumulative effects of factors that increase the chance of developing the condition (risk factors) as well as factors that decrease the chance of developing the same condition (protective factors).

Risk reduction. Reducing risks for cognitive decline or impairment in the abilities to think, reason, and remember means lowering your chances of experiencing loss in those abilities. A person's overall risk may also be reduced by increasing factors that protect against cognitive decline or dementia. Dementia (due to Alzheimer's disease or another

related disorder) is one condition, and cognitive decline (the slowing of thinking and memory in the absence of a major brain disease) is another condition. When scientists study risk-reduction strategies for cognitive decline, they are looking for factors that can reduce the risk of impairment to cognitive functions in the population in general. Therefore, some activity or intervention that reduces risk for a particular condition or disease means that a smaller proportion of people who engage in that activity are likely to have the condition or disease. However, risk reduction strategies are not the same as preventing any one individual from getting the condition or suffering from disease. For example, wearing a seatbelt reduced—but did not eliminate—the chance of injuries among people who were involved in automobile accidents, and we nevertheless now recommend people wear seatbelts while they are driving.

Social Cohesion. The perceived degree of connection among neighbors, and people's willingness to intervene for the common good.

Social Networks.

Structural. The features and description of the social network.

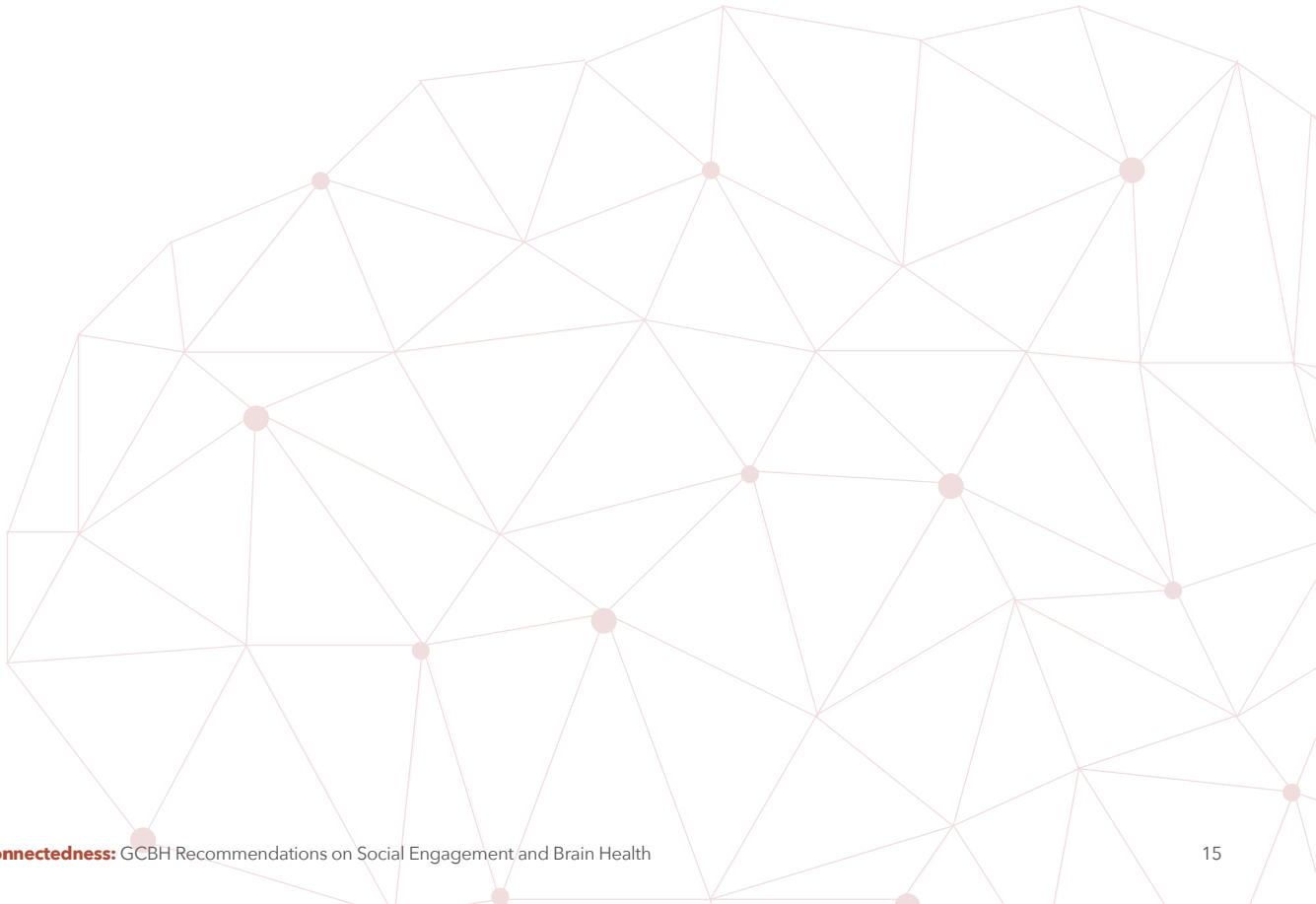
Functional. The nature of the interactions within a social network.

Quality. The individuals' experience and how they rate their social networks.

Social Rewards. A reaction to a positive interaction which spurs a positive sense of well-being and connectedness.

Social Support. A sense that social relationships will provide a sense of well-being or assistance.

Well-being. Self-judgment of life satisfaction often described as the state of being comfortable, healthy or happy.



3. Comparison of Epidemiological versus Randomized Controlled Trials

	Epidemiological Studies	Randomized Controlled Trials
Purpose	To observe a group of people in their natural surroundings (often over extended periods of time), and to identify personal characteristics, behaviors, and conditions which predict someone's chance of developing a condition or a disease.	To determine, in a controlled setting, whether implementing a change (in behavior, diet, medication, etc.) can definitively lead to a specific outcome. This compares those engaging in an activity with those not engaging in the activity.
Example	Researchers who survey and follow 6,800 men and women aged 50 to 89 in a long-term study on aging in England ask for self-reported sexual activity over past 12 months and then test these participants on word recall and number sequencing.	Researchers at a University Medical Center wish to recruit 450 people age 60 or older from 12 senior centers to sing in a choir for a year, be interviewed by the study staff before and during the trial and complete several health assessments. The control group would need to be similarly situated seniors from the senior centers who do not participate in the choir but are interviewed and assessed on the same factors.
Study duration	Years to decades	Weeks to months, sometimes years
Strengths	• Usually larger number of people • Can take into account influences from many more factors and personal characteristics and disease states • Can assess many dose levels and durations of behavior. • Can detect slow or cumulative changes over time • Where observational studies are representative of the population, they have greater external validity which means that the findings can be applied to a wider range of people.	• Helps to prove causal link and to better understand mechanisms • Randomization can eliminate many competing hypotheses as to why the change actually happened (because confounding factors have an equal probability of occurring in all groups). • Can test whether different doses of an intervention (e.g., exercise frequency, drug dose) can lead to different outcomes. • Uses detailed and objective measurements and assessments.
Limitations	• Does not prove any specific causal link. • May not capture all characteristics which influence health. • Any characteristic may reflect another more important factor (e.g., people who take expensive medications may have better access to health care). • Selective drop-out of those less socially advantaged and less healthy. • Difficult to generalize from one region to another due to differences in diet, environment, healthcare, etc. • Often cannot collect detailed information due to the large numbers of participants and measures.	• Usually smaller number of people • While an RCT attempts to control for confounding factors, it may not capture all characteristics which influence health. • The study may be too limited in size or duration to detect subtle effects. • Difficult to test conditions which scientists cannot change (e.g., gender, genetics, past exposure) • Difficult to generalize from one region to another due to differences in diet, environment, healthcare, etc. • In smaller RCTs, outcomes can be biased by accidental inclusion of people who are much more or much less likely to respond to the intervention. • Effects are restricted to defined dose and intervention type.

	Epidemiological Studies	Randomized Controlled Trials
Limitations (cont.)	• Expensive to set up and run, especially over long periods. • Some studies rely on self-reported behavior which may be inaccurate. • People who volunteer to participate in a study to be followed for long periods of time may have particular characteristics leading to bias in the sample.	• RCTs usually have very strict inclusion and exclusion criteria so the samples are often unrepresentative and results cannot be as widely generalized. • Attrition rate during the course of the RCT could bias the results. • Outcome reporting bias can influence results in which primary outcomes are changed, introduced or omitted since the original protocol. • Short time frame limits capacity to examine long term interventions which is particularly relevant for lifestyle changes that may lead to small, cumulative effects over years and decades such as physical activity.

4. Discussion Questions

1. What does it mean to be socially engaged?
    a. Is it being with other people?
    b. Is it engaging in meaningful activity?
    c. Is it both?
    d. How does social engagement relate to loneliness and isolation?
2. Does the type of social engagement make a difference in outcomes among older individuals?
    a. individual or group activity
    b. size of group
    c. family or friends
    d. partners, spouses
    e. sexual relationships, physical contact or presence
    f. reciprocity
    g. frequency, intensity, diversity
    h. complexity (emotional and behavioral dimensions)
3. Does the purpose of social engagement make a difference in outcomes among older individuals?
    a. Volunteering for a social good
    b. Feeling there is purpose to living
    c. Feeling useful or necessary
    d. Preparation and motivation to engage
    e. Comparison of with or without purpose and type—*i.e.*, religious, political, hobby and sport
4. Does social engagement influence cognition or brain function as you age?
    a. Do adults 50+ who stay socially engaged as they age maintain (and/or?) improve cognitive abilities?
    b. Do adults 50+ who stay socially engaged as they age maintain cognitive abilities more than those who don't?
    c. Are there structural and functional changes in the brain in individuals who are socially engaged?
    d. Does social engagement directly affect cognition or does it work by impacting other mechanisms known to affect cognitive functions, i.e. by reducing stress, increasing exercise and movement, etc.?
    e. Does loneliness directly reduce cognitive function or is it reduced cognitive function that makes you lonely (reverse causality or relationship between the two)?
    f. How can communities help older people become or stay socially engaged?
        i. Neighborhood social cohesion
        ii. The built environment—Age friendly communities

5. Different Programs and Types of Activities Encouraging Social Engagement

Several examples of studies below demonstrate how social engagement has been found to impact cognitive health in order to illustrate why scientists believe that adults' social connections can help them maintain thinking and reasoning skills as they age. These stories are drawn from research conducted to study different components and impacts of social engagement. These examples provide illustrations of various structures, functions and qualities of social activities, but all of them have shown positive benefits to brain health associated with social engagement.

A. Examples of Social Engagement Programs Formally Evaluated for Their Impact on Adults' Cognitive Function.

1. Older Adults Volunteering in Their Communities with Children:

Volunteer work is widely believed to be beneficial not only for the community, but also for the individuals who perform it. Increasing life expectancy has contributed to the transformation of the traditional retirement period of older adults into a period of healthy activity for many individuals, notably including volunteering. Research studies evaluating the cognitive effects of older adults volunteering in elementary schools demonstrated improved memory and reasoning skills in the adults.

- Mr. Kim contacted his local Experience Corps branch in the United States and signed up to participate in this community-based program asking retired adults to give back a lifetime of wisdom to a younger generation in need in public elementary schools. Volunteers are trained to assist through teaching literacy skills, provide library support (using Dewey decimal system to find books), and promote positive communication towards conflict resolution. The goal is to improve the academic performance and to develop life skills of children by harnessing retired adults' time, skills, and wisdom to volunteer in teams in neighborhood elementary schools as mentors of children during a critical window of children's brain development. Experience Corps is an example of a social health promotion model involving high-intensity volunteer service (15 hours per week over an academic year). Studies conducted on Experience Corps have demonstrated that, through service, the older volunteers showed increases in physical, cognitive, and social activity. In addition, volunteering led to better brain function in the adults and improved cognitive health (i.e. improvement in memory, processing speed, and executive function) while also providing a sense of meaningfulness and purpose. Mr. Kim describes his volunteer experience with younger people through Experience Corps as follows: "Volunteering removed the cobwebs from my brain". See http://www.aarp.org/experience-corps/.

2. Learning New, Cognitively Challenging Activities with Other Adults:

Adults coming together to learn new activities where they regularly engaged in cognitively challenging activities were evaluated to understand whether mental effort expended during the specific social engagement activity had the potential to improve cognitive health.

- Mrs. Jones signed up to participate in the Synapse Project. The Synapse Project was designed to investigate whether sustained engagement in activities requiring novel learning and cognitive challenge could improve cognitive health as a result of mental effort. Mrs. Jones was assigned to the participant group engaged in cognitively-demanding novel activities where she was asked to take up quilting for 15 hours a week over a period of 3 months. Other participants in this project were put into a group to learn about digital photography. Study results reported that participants who engaged in these novel activities showed improved episodic memory along with some evidence of improved speed of processing when compared with the other study group where participants engaged in less demanding activities that required little new learning (i.e. socializing or listing to classical music). That might suggest that benefits are greatest when social engagement involves learning new skills rather than just spending more time with others or passively receiving health information. See: the Synapse Project, http://the-synapse-project.org.

3. Engaging in Artistic Group Activities:

- Artistic activities are thought to engage the mind, body, and emotions in unique ways by sparking curiosity, problem solving, and a sense of accomplishment. Past research, including the Creativity an Aging Study, reported better health, fewer doctor visits, and less medication usage, along with more positive responses on the mental health measures. There are numerous programs available that aim to promote social activity and engagement for adults through lifelong learning

in various art forms. Choral singing is a multi-modal activity, meaning that it requires cognitive, physical, and psychosocial engagement. Participation in community choirs is being studied as part of a randomized control trial to examine whether it improves health outcomes, including its effect on cognitive health. See the Community of Voices choir (http://communityofvoices.org).

B. Sharing of Food can be a Communal, Socially Engaging Activity.

An example of how food has been used to spark social engagement:

- Mr. Jacobs lives in Tasmania, Australia and participates in a 'community kitchen.' A community kitchen is a group of people that meets regularly to cook healthy and affordable meals while socializing. Community kitchens can operate anywhere there is an existing kitchen, for example at churches, schools or neighborhood houses. Mr. Jacobs looks forward to sharing meals with others and finds that it helps him to feel less socially isolated while providing mental stimulation. It has also enabled him to acquire skills in the kitchen by interacting with others and he is always leaves feeling a sense of satisfaction that he contributed to preparing his dinner. The well-prepared leftovers he returns home with is another benefit. The most effectively run senior-focused community kitchens have someone on site to oversee the kitchen and assist with prep work so seniors won't tire from too much chopping. That said, other community kitchen models include people of all ages and this helps to foster intergenerational engagement. See http://communitykitchens.org.au.

Other programs that play a role in reducing nutritional risk among the elderly, such as Meals on Wheels, can also make a difference in terms of opportunities for social contact. A study of loneliness and isolation among Meals on Wheels clients in Australia found that the majority of clients valued personal contact with Meals on Wheels volunteers who deliver the food as highly as the meal. Some branches of Meals on Wheels do offer the option of congregate meals and transport is provided to the meal site. Meals on Wheels originated in the United Kingdom, and programs now also operate in Australia, Canada, Ireland, the United Kingdom and the United States. See www.mealsonwheelsamerica.org.

C. Traditional Community and Family Social Engagement Is A Good Way to Connect With Others.

A hypothetical example of participating in community and family events to create a sense of community cohesion and belonging with opportunities for cognitive stimulation:

- Mrs. Attah lives in Nigeria and finds that contact with friends and participation in family and community activates to be the most important factor contributing to her quality of life and self-rated health. She enjoys participating in celebrations marking marriages, child birth, and naming ceremonies. Other traditional festivals and social activities present older adults in the community with the opportunity to engage socially with other people of all ages, such as the start of the rainy season and harvest of new yams. Mrs. Attah looks forward to attending masquerade dances each year in the traditional Igbo communities of South East Nigeria.

D. Purpose in life is often viewed as a central component of well-being and having the ability to lead a fulfilling life.

A hypothetical example of engaging in social activity with purpose leading to benefits for cognitive health:

- Mr. Yamamoto lives in a community located just outside Tokyo and actively seeks out more ways in which he can be engaged with it. Older people in Japan base their idea of being useful on their life purpose, or 'ikigai.' It guides daily activities, from exercise to social engagement to productive contributions and engagement with their families and wider society. For example, he began helping neighbors who are no longer able to drive, by driving them to their doctor appointments. Further, when neighbors are recovering from a medical procedure he regularly checks in with them, making sure they are okay. He offers to talk with his neighbors when he thinks they may be feeling stressed or worried. In addition, he is part of a local organization that advocates for community resources. He and others successfully advocated for a new accessible van that helps people in the community to get to doctor appointments. Finally, Mr. Yamamoto has become savvier about health information and likes sharing and discussing this information with his friends and neighbors by telling his neighbors about the importance of preventive health services, like the flu shot. These kinds of activities not only enhance the sense of cohesion in Mr. Yamamoto's community, they also provide him a reason to get up every morning. Further, the problem solving that he has to engage in every day, as well as the lively conversations he enjoys throughout the day keeps his brain at work and healthy.

6. Disclosure Statement of Potential Financial Conflicts of Interest

All twenty experts participating in the formulation of this paper were identified as having no financial conflict of interests. Eighteen of the experts who participated in the meeting and contributed to the formulation of the recommendations attested they had no conflicts of interest. Two disclosed potential conflicts of interest involving consultation with pharmaceutical companies or new drug investigations. None of these were relevant to social engagement, the topic of the meeting, or the recommendations made in this paper. The authors are unaware of any affiliations that might be perceived as affecting the objectivity of this paper and recommendations.

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