BIOPSYCHOLOGICAL EFFECTS OF SOCIAL PARTICIPATION ON AGING:
THE ROLE OF IDENTITY-AFFIRMING MUSIC AND THE ARTS

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A dissertation submitted to the Faculty of Graduate and Postdoctoral Affairs
in partial fulfillment of the requirements for the degree of:

Doctor of Philosophy
in Neuroscience

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Ottawa, ON

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Abstract

It is well-known that social participation contributes to health. Emerging evidence also suggests that musical and artistic groups uniquely promote emotional well-being, socialization, and engage multiple cognitive functions. In this regard, the intervening and preventative capacities of artistic social groups ought to be considered to a greater extent, especially in light of increased population aging. The present research examined three artistic interventions among complex-care patients, individuals with dementia, and their caregivers. Three larger studies were also conducted to determine associations among different social groups, social identities (e.g. artistic, sport, religious), and various well-being outcomes, and to explore the potential moderating role of genetic polymorphisms in the relationships between groups and health. In Study 1, complex-care patients who listened to personalized music playlists reported fewer negative emotions, increased life satisfaction, and greater self-esteem over time compared to controls. Among people living with dementia and their caregivers in Studies 2 and 3, an artistic reminiscence program and music-making intervention strengthened relationships between carers and their care recipients, encouraged socialization between group members, and supported well-being. Studies 4 and 5 further investigated differences across social group *types* and revealed that artistic and educational social groups explained the greatest amount of variation in depression, memory, and executive functioning compared to other social groups. Yet, in Study 6, for retirement home residents and students, social identification was more strongly correlated with well-being than social participation alone. Moreover, overall group identity was positively correlated with telomere length among older adults. Interestingly, there was a positive association between group memberships and perceived social status for homozygous carriers of an IGF-1 SNP (rs7136446). Among older and younger adults, there was also a positive

correlation between group identification and health among carriers of the BDNF Met allele (rs6265), and an inverse relationship between group identification and depressive symptoms among carriers of an FGF-2 SNP (rs1048201). Taken together, participating in social groups, notably those involving music or the arts, appeared to confer health benefits among older adults. Knowledge of these associations can be used to help personalize future social interventions for older adults with the aim of maximizing their benefits.

Acknowledgments

Behind every study presented here is a story of new friendships, challenges, triumphs, and inspiration, backed by a large team of individuals without whom this research would not have been possible. At the forefront are my supervisors, Dr. Renate Ysseldyk and Dr. Hymie Anisman. They meticulously combed through every research proposal and study design that amounted to this body of work, of which I am very proud. Renate's compassion, commitment to health interventions, and thoroughness combined with Hymie's kindness, wisdom, and storytelling made for a team I wouldn't trade for the world. I am deeply grateful for their support, guidance, imparted knowledge, and for all the opportunities they provided throughout my doctoral journey. To Renate and Hymie, my sincerest thank you!

I would also like to extend my gratitude to my committee members, Dr. Kim Matheson and Dr. Alfonso Abizaïd. Thank you both for your encouragement, advice, and new perspectives that challenged and enriched my academic journey.

The musical and artistic focus of this dissertation was first inspired by the Music and Memory[®] study at Bruyère's Saint-Vincent's hospital. There, Dr. Tracy Luciani, Kim Durst-Mackenzie, Pierre Beauchesne, Nathalie Lalonde, and Heidi Duhaime helped with many facets of the project—from the ethics application to sharing the results with board members at Bruyère. Soon after, Tracy's genius would lead to the creation of Music Matters, when Dr. Jesse Stewart and Julia Churchill joined as program leaders. Their talent and humanity was immensely inspiring, as was that of Christine Novy's, the arts therapist who lead the Reminiscence program. Aside from the data collected during these projects, it was very evident that these creative interventions positively impacted participants, and the program leaders were key to making this

happen. To everyone involved and to all the participants in these and other studies who graciously shared their stories—thank you.

I would also like to thank the staff at Saint-Vincent’s Hospital, Carefor, and Riverstone Retirement Communities who welcomed and assisted our research team, and to all the volunteers who helped interview participants and manage data: Sarah Zutrauen, Sieara Plebon-Huff, Nathan Lewis, Eloïse Kerr, Alyssa Johnston, Anita Sengupta, Noah Latchem, Mitra Rahimpour, Caitlin Shanahan, and Sara Khalaf. In particular, I would like to thank Olivia Pochopsky, a friend and former colleague who helped lead the Riverstone project and who took on the challenging task of modifying the telomere protocol—thank you for your support, determination, and kindness.

A special thank you to Dr. Dwight Deugo and Dr. Wade Hong as well, who helped me retrieve genetic data from the English Longitudinal Study of Ageing for Study 5. It was a complex and time-consuming task that would not have been completed without their expertise and generosity.

Finally, to my friends and especially my family, thank you for believing in me and for your unfailing support through trials and triumphs. Thank you for listening to my presentations (their many versions) and research stories, for sharing your perspectives, and for your unending love. This work is dedicated to you.

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Abbreviations

AF	<i>Animal Fluency</i>	Met	<i>Methionine</i>
ANCOVA	<i>Analysis of covariance</i>	MIDAS	<i>Music in Dementia Assessment Scales</i>
ANOVA	<i>Analysis of variance</i>	NE	<i>Negative emotions</i>
BAI	<i>Beck Anxiety Inventory</i>	OMCT	<i>Orientation Memory Concentration Test</i>
BDNF	<i>Brain derived neurotrophic factor</i>	PAC	<i>Positive Aspects of Caregiving</i>
CESD-R	<i>Centre for Epidemiological Depression Scale -Revised</i>	PANAS-SF	<i>The Positive and Negative Affect Schedule - Short Form</i>
CI	<i>Caregiver Ideology</i>	PCI	<i>Perceived change index</i>
CID	<i>Caregiver Identity</i>	POA	<i>Power of attorney</i>
CLSA	<i>Canadian Longitudinal Study on Aging</i>	PE	<i>Positive emotions</i>
CS	<i>Caregiver Ideology</i>	RAVLT	<i>Rey Auditory Verbal Learning Test</i>
CST	<i>Caregiver Stress</i>	RC	<i>Relationship</i>
ELSA	<i>English Longitudinal Study of Ageing</i>	RG	<i>Relationship with group</i>
ESC	<i>Emotional Symptom Checklist</i>	RSS	<i>Relative Stress Scale</i>
FGF	<i>Fibroblast Growth Factor</i>	SCOPE-SF	<i>Survey of coping profiles endorsed-short form</i>
GAI-SF	<i>Geriatric Anxiety Inventory - Short Form</i>	SNP	<i>Single nucleotide polymorphism</i>
IGF	<i>Insulin-like growth factor</i>	SWLS	<i>Satisfaction with life scale</i>
IOS	<i>Inclusion of the Other in the Self</i>	Val	<i>Valine</i>
LS	<i>Life Satisfaction</i>		
OMCT	<i>Orientation Memory Concentration Test</i>		

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General Introduction

“Humans are social animals” (Aristotle, 350 B.C.). Interacting with other people engages many psychological and biological processes that could contribute to well-being. For example, identifying with others, enjoying their company, giving and receiving social support, and forming meaningful relationships are often linked to improved quality of life and good health (Gaggioli et al., 2014; Jha et al., 2016; Lee, Chan, & Mok, 2010; Xie et al., 2016). Indeed, social group participation and membership have been linked to increased quality of life (Gaggioli et al., 2014; Hays & Minichiello, 2005) improved cognition (Haslam et al., 2014a), lower incidences of depression (Cruwys et al., 2013), and fewer symptoms of anxiety (Haslam et al., 2014b). This may be especially true for artistic social groups that engage multiple cognitive faculties (Castro et al., 2015; Schnakers, Magee, & Harris, 2016) and uniquely facilitate bonding with others through music-making, drama, and other forms of art (Camic, Williams, & Meeten, 2013; Dingle, Brander, Ballantyne, & Baker, 2013; Hallam & Creech, 2016). Participation in musical groups can also increase positive feelings (Hallam & Creech, 2016), as well as reduce medical visits and medication use (Cohen et al., 2007). In this regard, artistic social groups can function as preventative and intervening health measures among populations with increased health risks. One population that faces growing health challenges and risks is older adults.

For the first time in Canadian census history, the population of Canadian citizens over the age of 65 (16.9%) surpassed that of children under the age of 14 (16.6%) (Statistics Canada, 2017). It is estimated that by the year 2031, about 23% of Canadians will be over the age of sixty-five (Statistics Canada, 2017). Life expectancy is also predicted to increase (Statistics Canada, 2012). The impending surge in population size and longevity of older Canadians, as well as those of other nationalities (United Nations, 2015), poses significant opportunities and

challenges for healthcare providers and policy makers. This expanding demographic with extensive knowledge and life experience is a tremendous asset to society; however, aging is also normally associated with a decline in health that requires medical attention and resources (Fulop et al., 2010; Kelley, McGarry, Gorges, & Skinner, 2015). Furthermore, health issues may constrain social engagement (Litwin et al., 2003) and increase feelings of loneliness amongst seniors. Even in the absence of disease, these changes are associated with aging and are known to negatively affect mental and physical well-being. Regardless of which comes first—illness or social disconnectedness—both factors perpetuate a decline in health (Cornwell & Waite, 2009).

Accumulating evidence suggests that social involvement, including participation in musical groups, improves older adults' health and well-being (Adams et al., 2011; Cruwys et al., 2013; Dingle et al., 2013; Haslam et al., 2014a; Jetten et al., 2015; Steffens et al., 2016). Furthermore, compared to pharmaceutical treatments, social interventions are relatively cost-effective, easy to implement, and low risk, making them an attractive option for preventing and/or managing health issues arising within an aging population (Cohen, 2009; Cruwys et al., 2014). How strongly people identify with their groups—known as social identity (Tajfel & Turner, 1979)—along with the perceived social support therein, reportedly drives the relation between group membership and health (Haslam et al., 2014b; Jetten, C. Haslam, & S. A. Haslam, 2012). Uncovering other mediators of this relationship (e.g. coping) and determining what aspects of well-being (e.g. mood, cognition) benefit from group participation can inform better practice, in terms of finding appropriate ways of promoting social engagement in older populations, and is one of several goals in the present research. Likewise, determining the roles of genetic and extra-genomic factors in the relation between social groups and health can contribute to a better understanding of how groups function to improve well-being. With these

aims in mind, a series of studies was conducted with participation from both healthy older adults as well as those living with dementia, in an effort to illuminate the psychosocial and biological mechanisms by which groups, and especially musical ones, impact the health of seniors.

Social Networks, Identity, and Group Memberships

Over a lifetime, social networks change in response to life events and transitions, all the while influencing personality attributes and behaviours (Kraus et al., 2010), and serving as a source of social support in times of need (Cohen & Syme, 1985). In this regard, family, friends, work colleagues, and other members of personal and professional networks can greatly affect well-being. Furthermore, the quality, rather than the quantity of these relationships generally has a greater impact on health (Fiorillo & Sabatini, 2011). This is particularly relevant in old age when network sizes tend to decrease (Lang & Carstensen, 1994; Cornwell, Laumann, & Schumm, 2008), and remaining connections become increasingly important to well-being. Indeed, social connectedness is positively associated with general health (Ashida & Heaney, 2008) and can predict lower blood pressure and recovery rate from negative emotional states (Ong & Allaire, 2005) in an older population. As such, maintaining meaningful relationships with others and with groups appears to be an important component of healthy aging (Gleibs, S. A. Haslam, C. Haslam, & Jones, 2011; Ysseldyk, S. A. Haslam, & C. Haslam, 2013).

Among older adults, group memberships are important contributors to well-being. They safeguard cognition (Haslam et al., 2014a) and are associated with improved self-esteem (Jetten et al., 2015), life satisfaction (Steffens, Cruwys, C. Haslam, Jetten, S. A. Haslam, 2016), health status (Cherry et al., 2013), fewer depressive symptoms (Ysseldyk, S. A. Haslam, C. Haslam, 2013), and reduced mortality (Steffens et al., 2016). It has been argued that the foundation underlying the link between social connectedness and health is identification with others (C.

Haslam, Cruwys, S. A. Haslam, Jetten, 2015; Turner, Oakes, Haslam, & McGarty, 1994), a process that occurs when an individual's personal attributes (e.g. beliefs, values, norms, attitudes) harmonize with that of other members within a group (Tajfel & Turner, 1979). This identification process helps form an individual's social identity—a shared sense of self derived from group memberships that define them in terms of their similarities with other group members. Social identity differs from one's personal identity, which reflects characteristics that uniquely define and differentiate an individual from others within their group (Oakes et al., 1994). However, salient social identities can also influence thoughts and behaviour (St Clair & Clucas, 2011; Tajfel & Turner, 1979; Turner et al., 1994). For example, older adults believed they suffered from hearing loss and required a hearing aid when they identified as “older people” compared to participants who identified as unique individuals; this result was independent of actual hearing abilities (St Claire & He, 2009). In a separate study, identification as “older”, along with expectations of cognitive decline, resulted in poorer cognitive performance compared to adults who identified as “younger” (Haslam et al., 2012). In this regard, there is evidence that social identities can significantly impact well-being among older adults.

Several studies have recognized the role of social identity in determining health outcomes following various social interventions amongst older adults. For example, residents of a care home were assigned to participate in: 1) a group that decided how to decorate a seniors' residence lounge, 2) a comparison group where staff decided upon the lounge redecoration, or 3) a control group where no intervention was conducted (Haslam et al., 2014a). Individuals who participated in the intervention group (i.e., made decisions on the redecoration together) showed a 19% improvement in cognitive scores, greater than the comparison and control group combined. They also exhibited increased social identification with residents and staff, which was

an important difference between the intervention and comparison groups that may have contributed to the cognitive benefits observed (Haslam et al., 2014a). Building on this research, another study was conducted in which initial identification with one's group clearly determined the extent to which seniors benefited from a musical reminiscence intervention. Through songs or storytelling, past memories were recalled and shared over six weeks. Preliminary analyses revealed no program benefits. However, when results were analyzed as a function of initial group identification, fit with a story reminiscence group was linked to improvements in cognition and increased life satisfaction, while fit with a religious song reminiscence group was associated with decreased anxiety and greater life satisfaction (Haslam et al., 2014b).

The Role of Music in Health and Social Groups

Artistic social activities uniquely engage multiple cognitive functions (Hallam & Creech, 2016; Schnakers et al., 2016) and can contribute to improved physical and mental health (Cohen, 2009). This appears to be true for musical activities (Bottiroli, Rosi, Russo, Vecchi, Cavallini, 2014; Castro et al., 2015; Herholz & Zattore, 2012; Magee & O'Kelly, 2015), which can also impact emotional regulation (Särkämö et al., 2014; Clarke, DeNora, & Vuoskoski, 2015). For example, older adults who joined a professionally guided community-based choir group reported fewer physical health problems, doctors' visits, and depressive symptoms two years into the program compared to those who simply continued to participate in their usual community activities (Cohen et al., 2007). While medication usage increased over time for both groups, it was significantly less pronounced for the choir group (Cohen et al., 2007). Similarly, participation in other community-based musical programs was associated with increased vitality and mobility, as well as fewer depressive symptoms among older adults (Hallam & Creech, 2016).

Musical activities can also encourage social engagement (Baker & Ballantyne, 2012; Cheong et al., 2016; Thompson & Schlaug, 2015). For example, adults with physical disabilities, intellectual disabilities, and/or mental health issues reported feeling more connected with other group members and with their community six and twelve months after joining a choir (Dingle et al., 2013). Similar experiences were reported by retirees who participated in a group songwriting and performing intervention (Baker & Ballantyne, 2012). In acute care, dementia patients were more engaged during creative music therapy compared to baseline measures obtained when no intervention took place (Cheong et al., 2016). It has been suggested that these social proclivities in response to music have long existed and arose from the need to communicate and connect with others (Schulkin & Raglan, 2014). In fact, human language and music listening have been shown to share the same neurological process (Koelsch et al., 2013). Interacting through music is also an emotional process (Sacks, 2007; Thompson & Schlaug, 2015) that can lead to feelings of happiness, confidence, and optimism (Camic et al., 2013; Dingle et al., 2013). Taken together, it would appear that music can enhance social experiences and overall well-being. Thus, interventions that involve listening to and/or making music—especially when that group affirms or builds a social identity—could help to overcome or, at the very least, manage some of the physical and psychological challenges that accompany aging.

Mental Health Outcomes Associated with Aging

Alongside the building or maintenance of social groups and identities, how individuals cope with stressors can significantly impact mental and physical well-being (Berry & Worthington, 2001; Connor & Davidson, 2003; Lazarus & Folkman, 1984; Matheson & Anisman, 2003, 2009; Porter, Keefe, Lipkus, & Hurnitz, 2005). Indeed, coping is important for psychosocial functioning at any age (Carver & Connor-Smith, 2010). However, in the context of

aging, which is normally associated with cognitive decline (Bennett & Madden, 2014) and an increased vulnerability to depression and anxiety (Solhaug et al., 2012), how older adults cope with health challenges becomes particularly important.

Coping. Aging often involves encounters with a number of physical, psychological, and environmental stressors that can challenge the body's homeostatic equilibrium. Over time, they shape an individual's ability to anticipate, respond, and cope with future adversities. Especially unique to old age is that stressors seemingly multiply while the resources needed to deal with them diminish (Ouwehand et al., 2006). Indeed, as physiological systems weaken, negative health outcomes become increasingly inevitable (Fulop et al., 2010). Physical weaknesses and disabilities may also contribute to identity loss if they hinder participation in groups with which an individual identifies (Davison, Pennebaker, & Dickerson, 2000; Jetten & Pachana, 2011; Wang & Shi, 2014). Dealing with identity loss and other age-related issues likely involves adaptive coping skills that, when successful, allow an individual to persevere amidst adversity (Connor & Davidson, 2003). Thus, participation in social groups—including musical groups—may help older adults cope with age-related physical and psychological changes as they provide a source of social support, cognitive stimulation, and empowerment (Cohen, 2009; Creech, Hallam, McQueen, & Varvarigou, 2013).

In dealing with events that are appraised as stressful and demanding, individuals can draw upon various resources (e.g., self-esteem, optimism, social support) to manage the mental and physical repercussions of stressors (Lazarus & Folkman, 1984). They can also utilize one or more coping styles that may include problem-focused (e.g. seeking social support, finding a solution to manage and overcome a stressful situation) and emotion-focused strategies (e.g. rumination, blaming others, emotional containment or expression) (Carver, Scheier, &

Weintraub, 1989; Lazarus & Folkman, 1980). However, choice of coping style is often context-dependent. Feeling anger in response to discrimination can trigger problem-focused coping among young women (Matheson & Anisman, 2003), while situations related to health often elicit emotion-focused coping in middle-aged adults (Lazarus & Folkman, 1980), as do threats to salient religious identities among university students (Ysseldyk, Matheson, & Anisman, 2011). However, there appears to be little consensus regarding whether age influences coping styles. A number of researchers suggest that coping styles remain stable with age (Aldwin, Sutton, Chiara, & Spiro, 1996; Lazarus & Folkman, 1980; McCrae, 1982; Ouwehand, De Ridder, & Bensing, 2006; Regier & Parmelee, 2015; Seiffge-Krenke, Aunola, & Nurmi, 2009) while others demonstrate that they become increasingly mature and adaptive with age. For example, compared to their younger counterparts, older individuals may be more likely to modify their coping preferences in response to a stressor (Brandtstätter & Renner, 1990), control aggressive impulses and positively appraise situations (Diehl, Coyle, Labouvie-Vief, 1996), as well as direct negative emotions into more positive behaviours (Diehl, Chui, Hay, Lumley, & Grünh, 2014). Social groups may help to explain these differences, as they have been reported to influence coping by either supporting adaptive coping styles (C. Jetten, S. A. Haslam, Haslam, Dingle, & Jones, 2014; Stinson et al., 2008) or undermining them (Kellezi & Reicher, 2011; Smith & Christakis, 2008).

The use of emotion-focused coping strategies such as forgiveness, rumination, and wishful thinking have been negatively correlated with cortisol levels (Berry & Worthington, 2001), quality of life (Porter et al., 2005), and physical functioning (Karademas, Tsalikou, & Tallarou, 2010), respectively; conversely, problem-focused coping has been positively related to quality of life and negatively associated with pain and disease symptoms (Alok et al., 2014).

Coping resources such as social support and optimism have also been linked to reduced incidences of coronary heart disease (Barth et al., 2010) and improved pulmonary function (Kubzansky et al., 2002), respectively. Considering the increased likelihood of health issues in old age, and in particular mood disorders (Solhaug, Romuld, Romild, & Stordal, 2012), which are often exacerbated by perceived social isolation (J. T. Cacioppo, & S. Cacioppo, 2014; H. O. Taylor, R. J. Taylor, Nguyen, & Chatters, 2016), adaptive coping strategies may be especially important for seniors. In this regard, participation in musical groups can increase feelings of belonging, social support and optimism (Baker & Ballantyne, 2013; Cohen, 2009; Dingle et al., 2013), thereby potentially helping individuals to cope with age-related physical and psychological issues (Creech et al., 2013).

Depression and anxiety. In addition to challenges related to coping with stressors, older age is often accompanied by increased vulnerability to psychiatric disorders (Solhaug et al., 2012). A number of factors, including downsizing of social networks and sources of social support (Ajrouch, Antonucci, & Janevic, 2001; Cornwell et al., 2008), as well as changes in cognition and physical health, can increase susceptibility to psychopathologies. Depression appears to be the most common mental health condition among older adults and is characterized by persistent feelings of worthlessness, loss of pleasure in activities, fatigue, and an inability to concentrate (Evans & Mottram, 2000). Anxiety, a disorder that involves symptoms of excessive worrying, agitation, and restlessness, is often comorbid with depressive disorders, although this association decreases with age (Diefenbach & Goethe, 2006). Nonetheless, symptoms of depression and anxiety are often attributed to other existing medical conditions amongst seniors, and as such these disorders are often under-diagnosed (VanItallie, 2005; Morichi et al., 2015).

Depressive and anxious symptoms tend to coexist alongside chronic illness and cognitive impairment in older age. For example, a meta-analysis revealed that somatic symptoms of diabetes, arthritis, pulmonary, and cardiovascular disease were strongly associated with depression and anxiety (Katon, Lin, & Kroenke, 2007). Likewise, self-reported depressive symptoms were significantly greater amongst those who also reported heart, digestive, and respiratory issues (Mills, 2001). Depression can also trigger or exacerbate physical conditions, particularly cardiovascular disease (Lett et al., 2004). In this regard, mental health challenges may contribute to the development of chronic illnesses as well as arise from them. A similar relationship is found between neurological deficits and depression. For example, in a study of seniors who were 85 years or older, baseline cognitive impairment scores were linked with accelerated depressive symptoms at follow-up (Vinkers et al., 2004) and silent brain infarcts have been associated with recurrent depression even years after they occurred (Perez et al., 2013). Meanwhile, older individuals who were depressed at baseline and at follow-up were more likely to progress from having normal cognitive scores to those indicating mild cognitive impairment, compared to individuals whose depressive symptoms improved with time (Steenland et al., 2012). This recurring, bidirectional relationship between mental illness and other physical factors presents a challenge for healthcare providers. With many different pathways through which mood disorders can manifest in old age, determining which preventative and intervening measures are most suitable in handling geriatric depression and anxiety is a delicate matter. Pharmacotherapy is relatively expensive and may be particularly dangerous in an older population whose decreased ability to metabolize drugs may contribute to more side effects, and among whom drug interactions are more common and can have life-threatening consequences (Cusack, 2004; Mallet, Spinewine, & Huang, 2007; Taylor, 2014).

Furthermore, physician communication training and moderately intense exercise may fail to improve symptoms of depression (Aakhus et al., 2016; Underwood et al., 2013). However, another way to manage mental illness is to engage individuals in social groups, which are known to act in a protective and curative capacity by reducing incidences of future depression and relapse (Cruwys et al., 2013). Musical social groups are also linked to these benefits as they have been shown to reduce symptoms of depression and anxiety and improve mood (Camic et al., 2013; Cohen et al., 2007; Dingle et al., 2013; Hallam & Creech, 2016). Furthermore, participation in musical groups has been linked to better cognitive functioning (Särkämö et al., 2014)—an outcome that is important in older populations who normally experience cognitive decline (Bennett & Madden, 2014; Salat, 2011).

Cognitive decline. Over time, the brain undergoes a variety of morphological changes at a microscopic level that may alter cognitive functions such as learning and memory (Bennett & Madden, 2014; Dickstein et al., 2007). The integrity of brain white matter has become a significant marker of cognitive decline. Even in the absence of disease, age-related changes in white matter composition result in cell disconnections that contribute to a reduction of cognitive abilities, such as memory and attention (Bennett & Madden, 2014; Salat, 2011). More specifically, a deficit in attention, viewed as the inability to suppress irrelevant information, may contribute to memory decline (Gazzaley, Cooney, Rissman, & D’Esposito, 2005). In some cases, cognitive impairments significantly affect daily functioning, and are instead markers of a more serious affliction. Overexpression, aggregation, and dysfunction of certain proteins in the brain, including beta-amyloid (Mawuenyega et al., 2010) and tau (Brier et al., 2016), disrupt the integrity and function of neural tissue (Sheline et al., 2010). In doing so they contribute to cognitive decline (Roberson et al., 2011), motor impairments (Jawhar, Yrawicka, Jenneckens,

Bayer, & Wirths, 2012), and other debilitating symptoms characteristic of dementia (Boeve et al., 2011; Spector et al., 2012). The World Health Organization reports that approximately 47.5 million people around the world are currently living with some form of dementia, a number predicted to double by the year 2030 and triple by the year 2050 (World Health Organization, 2016).

At the present time, there is no cure for dementia. Only a select number of pharmaceutical interventions have been shown to ameliorate symptoms (Herrmann et al., 2016; Atri et al., 2015; Gauthier et al., 2016) and are often accompanied by side effects (Lanctôt et al., 2003). However, the brain's ability to manage the damaging effects of various environmental and physical stressors may prevent or delay its onset. Known as "cognitive reserve" or "brain reserve" when specifically referring to neuropathologies (Stern, 2003), this trait is built-up over time by lifestyle factors, including leisure activities, education, occupation, and sociality (Scarmeas & Stern, 2003). Interestingly, social networks modified the negative association between cognitive abilities and pathologies related to dementia. Despite having more severe global impairments, cognitive function remained higher amongst those with larger social network sizes (Bennett, Schneider, Tang, Arnold, & Wilson, 2006). The opposite is true as well—social isolation is a prominent risk factor for dementia (Livingston et al., 2017). In contrast, the quality rather than the quantity of social networks reduced the likelihood of developing dementia. Participants who were satisfied with their relationships had a 23% lowered risk for dementia (Amieva et al., 2010). In this regard, social groups, and particularly musical ones (Cheong et al., 2016), may be helpful in managing this condition (Särkämö et al., 2014).

Among people living with dementia, musical interventions have improved mood, memory, attention, and executive functioning (Särkämö et al., 2014). Some aspects of musical

processing, however, decline with age in normal subjects (Bones & Plack, 2015). Fortunately, musical memory appears to persist and may even be conserved in later stages of dementia (Vanstone & Cuddy, 2010; Jacobsen et al., 2015). Brain imaging revealed that areas involved in musical memory showed little atrophy and disruption of glucose metabolism in Alzheimer's patients, despite there being no significant difference in plaque deposition between these regions and the rest of the brain (Jacobsen et al., 2015). Furthermore, listening to familiar tunes can affirm and contribute to important social identities (Giles, Denes, Hamilton, & Hajda, 2009; Ysseldyk, Karamally, Kelly, Morton, & Haslam, 2018), even over and above other leisure activities (Lonsdale & North, 2011). In those living with dementia, these processes can be critical to reawakening one's sense of self that otherwise seems consumed by the disease (Sacks, 2007). Indeed, when asked about the meaning of music in their lives, care home residents living with dementia often reported that musical activities (e.g. playing instruments, music listening) helped affirm personal identities and strengthen their relationships (McDermott, Orrell, & Ridder, 2014).

Relations Between Social Groups and Biological Factors

Another important aspect implicated in the relation between social groups and health among older adults may be the role of genetic factors in determining how people respond to social activities and to music. Numerous genes have been implicated in social behaviours (Creswell et al., 2014; Ebner, Maura, MacDonald, Westberg, & Fischer, 2013; Robinson, Fernald, & Clayton, 2008; Tabak et al., 2016) and a few have also been linked to music listening habits (Ukkola-Vuoti et al., 2011), musical memory (Granot et al., 2007), singing abilities (Park et al., 2012), and choir participation (Morley et al., 2012). Interestingly, there is an overlap between genes related to sociality and musicality, suggesting that these traits may share

neurobiological pathways (Tan, McPherson, Peretz, Berkovic, & Wilson, 2014). For this reason, variations of these and other genes (i.e. genetic polymorphisms), might contribute to differences in social group experiences, particularly musical ones, and subsequent effects on well-being. For example, polymorphisms on the genes for growth factors might act in this capacity. Brain-derived neurotrophic factor (BDNF), insulin-like growth factor-1 (IGF-1), and fibroblast growth factors (FGF) may affect social and musical cognitive functions by virtue of their important role in brain plasticity (Laron, 2001; Lee, Duan, & Mattson, 2002; Turner, Akil, Watson, & Evans, 2006).

BDNF. With a wide distribution throughout the brain (Altar et al., 1997) and a critical role in the growth, functioning, and survival of neurons (Barde, Edgar, & Thoenen, 1982; Drake, Milner, & Patterson, 1999; Huang, Gao, Liu, Zhou, & Peng, 2001; Lee et al., 2002), BDNF has been implicated in a range of conditions including affective, cardiovascular, and neurodegenerative disorders (Ferrer et al., 1999; Murer, Yan, & Raisman-Vozan, 2001; Zhang et al., 2006; Chaldakov et al., 2004). A genetic polymorphism on the BDNF gene, involving a valine (Val) to methionine (Met) substitution (Val66Met), has been linked to central and peripheral BDNF levels. Indeed, the Met allele was associated with less activity-dependent secretion in neurons (Egan et al., 2003) and serum BDNF (Ozan et al., 2010).

Variations of the BDNF gene are also linked to cognitive functioning. Poorer memory (Egan et al., 2003) and a faster rate of cognitive decline in healthy individuals (Miyajima et al., 2008) and in those with Alzheimer's was observed amongst Met-carriers (Lim et al., 2015). Carriers of the BDNF Met allele also fared poorer than Val homozygotes on cognitive tasks (Baj, Carlino, Gardossi, Tongiorgi, 2013; Miyajima et al., 2008; Montag et al., 2014; Schofield et al., 2009), and had different response to social cues. Met carriers were more reactive to

emotional stimuli (Montag et al., 2008) and less empathetic (Taschereau-Dumouchel et al., 2016) than those homozygous for the Val allele. Intriguingly, the BDNF Val66Met polymorphism was linked to differences on a measure of empathy, including “perspective-taking” and “fantasy”. The former domain captures the ability to consider other’s perspectives’ (i.e. requires personal involvement) while the latter measures tendencies towards identifying with fictional characters (i.e. does not require personal involvement; Davis, 1983). Met carriers reported less perspective-taking and more fantasy compared to Val homozygotes; this discrepancy may be linked to different social processing tendencies amongst Val homozygotes and Met carriers, such that Met carriers are partial to impersonal interactions that may require less plasticity and fewer cognitive processes (Taschereau-Dumouchel et al., 2016).

IGF-1. Similar to BDNF, IGF-1 is a critical growth factor for physiological development (Laron, 2001). Impaired IGF-1 activity caused by a genetic mutation has been linked to significantly reduced organ growth, including the brain (Laron, 2001), and in older adults low IGF-1 levels are linked to poorer cognition and neurological disorders (Puche & Castilla-Cortázar, 2012). Intriguingly, high levels of IGF-1 were also associated with lower cognition scores in men aged 40-80 years, and so, there may be an optimal level of IGF-1 that confers good cognitive functioning (Tumati, Burger, Martens, van der Schouw, & Aleman, 2016). Single nucleotide polymorphisms (SNPs) on the gene for IGF-1 have also been associated with Alzheimer’s disease (Vargas et al., 2011) and cancer (Suzuki et al., 2008). However, there appears to be no established link between IGF-1 and sociality. Nonetheless, given its important role in cognition and brain plasticity, IGF-1 may have some bearing on how older adults respond to social groups.

FGF. Like the previously mentioned growth factors, FGF contributes to neural plasticity in various brain regions (Turner et al., 2006; Weissleder et al., 2016) including the hippocampus – an area critical for memory formation (Ohkubo, Uchida, Shin, Partanen, & Vaccarino, 2004). It also plays a role in depressive pathology. Impaired FGF system transcripts were found in brains of humans with major depressive disorder (Evans et al., 2004). Researchers suggested that altered FGF activity leads to neural changes that might underlie cognitive and emotional traits observed in depression (Turner et al., 2006). In this regard, changes in FGF activity conferred by polymorphisms on its genes might be associated with social cognitive functioning.

The Present Research

The following studies aimed to uncover some of the psychosocial and biological factors that underpin the benefits of social participation on health and well-being in older adults. The first three studies involved assessments of artistic (e.g., musical) interventions among hospital- and community-dwelling older populations. In partnership with recreational coordinators, arts therapists, and professional musicians in Ottawa, three unique interventions were assessed both quantitatively and qualitatively for their therapeutic potential amongst complex-care patients, as well as individuals living with dementia and their caregivers. The final three studies investigated well-being among those who participate in different types of social groups, with the aim of highlighting the potentially unique contributions to health imparted by artistic group participation and identification. Furthermore, the mediating role of coping in the relations between group memberships, cognition, depression, and anxiety were explored. The biological determinants (genetic polymorphisms) of these relations were also studied in an effort to elucidate some of the psychosocial and physical mechanisms by which group memberships may affect well-being in older adults. In particular, polymorphisms on genes for growth factors

(BDNF, IGF-1, FGF) were expected to affect social and cognitive functions by virtue of their important role in brain plasticity.

Study 1

Participation in musical activities can positively impact mental and physical well-being (Herholz & Zatorre, 2012; Särkämö & Soto, 2012). Amongst healthy university students, music listening was associated with reduced subjective and objective measures of stress, as evidenced by lower perceived stress scores and salivary cortisol concentrations (Linnemann et al., 2015a). In stroke patients, daily music listening improved attention and verbal memory, and lowered depressive and confusion symptoms compared to those in a control group (Särkämö et al., 2008). Analysis of qualitative data collected from the same population revealed that feelings of relaxation and improved mood were reported more often in the music-listening group than in those who listened to an auditory book (Forsblom et al., 2010). In a separate study, music listening increased perceived control over pain amongst female patients with fibromyalgia syndrome (Linnemann et al., 2015b). Together, these studies share another characteristic—the use of *personalized* music—that may confer additional benefits from music listening. Vivid recall of meaningful memories, increased connectedness to one's sense of self, development of personal and social identities, and improved physical well-being were some of the positive experiences individuals recounted after listening to music of their choosing (Hays & Minichiello, 2005). Compared to classical music, personalized music listening was also significantly more effective in reducing agitated behaviour amongst individuals living with moderate to severe dementia (Gerdner, 2000). Similarly, listening to identity-affirming music was linked to more positive outcomes compared to controls; specifically, after listening to a Christian hymn, Christians reported greater self-esteem, less hostility, and evidenced better memory performance on a word recall task compared to when they listened to other types of music or no music at all (Ysseldyk et al., 2018a).

With these findings in mind, an individualized music listening program—that is, listening to music that reflects one’s valued personal and social identities—was implemented on a hospital complex-care unit to determine its effects on patient well-being. Complex care often includes older individuals with chronic illnesses who experience impaired physical functioning and, as a result, are limited in their ability to actively participate in recreational activities and socialize with others (Kuluski et al., 2014). They are also at risk of developing depression (Martin et al., 2008). Given that music listening does not rely on functional mobility and is a means of improving psychological health, it may be a suitable activity to engage and benefit older and/or chronically ill patients.

The first study aimed to assess the benefits of a pre-existing “*Music and Memory*®” iPod initiative (musicandmemory.org). This unique program enables care staff to provide a music listening intervention to patients and residents at health institutions around the world. Through a certification process, care staff are informed of best practices for obtaining listening devices, maintaining equipment hygiene, legally sharing music, and creating personalized playlists (Music and Memory®, 2016). Bruyère’s Saint-Vincent Hospital in Ottawa, Ontario, is a Music and Memory® certified organization that partnered with our research team to assess the emotional, psychosocial, and general health benefits of this music listening program on a complex-care unit, where patients typically experience longer hospital stays (for months or years) compared to patients on other units (see Ysseldyk, Paric, & Luciani, 2016 for an overview). A control study was also conducted and consisted of patients on different units who are not a part of the Music and Memory® program and who are involved in other activities at Saint-Vincent’s Hospital (e.g. horticulture, cooking, bingo). It was hypothesized that following the Music and Memory® program:

- 1) patients would experience increased emotional well-being, self-esteem, life satisfaction, identification with their hospital community, social network size, and better self-reported health and cognition compared to patients in the control group, and
- 2) changes in emotional and physical well-being would be positively correlated with how strongly participants identify with their hospital community and with their social network size.

Participants and Procedure

Following approval from both the Carleton University Research Ethics Board-B and the Bruyère Research Ethics Board, as well as volunteer training for all researchers involved, the recreational therapist on the complex-care unit at Saint Vincent's Hospital informed and recruited patients. Those interested were identified to researchers who then approached patients to obtain consent. Some individuals were physically unable to provide verbal or written consent and, in these cases, the power of attorney (POA) or substitute decision maker completed a consent form. Overall, eight patients (6 women; 2 men) ranging in age from 56 to 79 years ($M = 67.50$, $SE = 3.24$) agreed to participate in the Music and Memory[®] program and ten patients (2 women; 8 men) aged 43-101 years ($M = 62.0$, $SE = 5.01$) participated in the control study. Two patients moved out of the hospital before completing their final surveys, one from each of the studies. Furthermore, during the control study, one patient passed away while another was unable to complete the last survey due to health issues. These events left seven participants in each study group. Importantly, five of the seven patients in Music and Memory[®] participated in other hospital activities (although fewer than control participants). Pre-program questionnaires (Time 1), which included questions relating to music preferences for participants in the music intervention, were read out loud and completed by researchers (Appendix A). If applicable,

enlarged visual scales were presented to patients to ease questionnaire completion. Information collected regarding patients' musical preferences was used to create personalized music playlists on designated hospital computers. Personalized playlists were then uploaded onto iPods for every patient. Over a period of eight weeks, researchers and volunteers delivered iPods to patients, retrieved them at the end of their hospital shift, and recorded music listening days for each participant in a log, while patients in the control study continued to take part in their preferred hospital activities. During this time, direct quotes from patients regarding their music listening experiences were also recorded by researchers. Mid- (Time 2) and post-program (Time 3) surveys were conducted four and eight weeks into study, respectively, as well as brief weekly program satisfaction questionnaires for participants in the Music and Memory[®] program (Appendix A).

Measures

Emotional well-being. An adaption of Zauszniewski and colleagues' (2004) Emotional Symptom Checklist (ESC) was used to assess emotional well-being. Comprised of fifteen items, it inquired about negative (e.g. restlessness, anxiousness) and positive emotions (e.g. happiness, gratitude) experienced over the past month. One of the original negative emotions was changed to a positive one (unhappy to happy) and five more positive items were included at the end of the questionnaire to help negate any stress caused by reflecting solely on negative feelings. Answers were recorded on a dichotomous scale consisting of "yes" or "no". Every negative emotion experienced by participants received a score of one. These responses were summed to create a single emotional index, such that higher scores represented more negative emotions experienced by participants (Intervention: Time 1, $\alpha = .76$; Time 2, $\alpha = .82$; Time 3, $\alpha = .52$; Control: Time 1, $\alpha = .68$; Time 2, $\alpha = .75$; Time 3, $\alpha = .35$).

Cognition. The Short Orientation Memory Concentration Test (OMCT) was used to briefly assess cognition through seven skill-testing questions. Questions 1-2 and 4-7 are worth 4, 3, 3, 4, 4, and 10, respectively, for a total of 28. The number of errors made for each question were recorded by the researcher. For single answer questions (e.g. What year is it?; questions 1-2 and 4), a single error resulted in a score of zero. For multiple answer questions (e.g., Please say the months of the year in reverse; questions 5-7), two or more errors resulted in a score of zero. Results were summed to create a single cognition score, such that higher scores represented better cognitive abilities. To eliminate potential practice effects, a second version of the questionnaire was acquired for use during the post-program survey (Katzman et al., 1983) (Intervention: Time 1, $\alpha = .47$; Time 3, $\alpha = .81$; Control: Time 1, $\alpha = .27$; Time 3, $\alpha = .29$).

Identification with care community. The extent to which participants identified with other patients, staff, and volunteers was measured using a five-item scale adapted from Doosje, Ellemers, and Spears (1995). The degree to which participants agreed or disagreed with five statements (e.g. “I see myself as being part of Saint-Vincent Hospital”) was recorded on a scale from 1 (strongly disagree) to 5 (strongly agree). Items were reverse-coded as needed, and summed to create a single index where higher scores represented greater identification with the care community (Intervention: Time 1, $\alpha = .79$; Time 3, $\alpha = .69$; Control: Time 1, $\alpha = .60$; Time 3, $\alpha = .74$).

Social network. Connectedness with family and friends was measured via six questions (e.g. “How many relatives do you feel close to such that you could call on them for help?”) comprising the Lubben Social Network Scale – 6 (Lubben et al., 2006). Participants indicated the number of family and friends to which they felt connected using a scale from 0 (none) to 5 (nine

or more). A summed score was created such that higher scores represented larger social networks (Intervention: Time 1, $\alpha = .59$; Time 3, $\alpha = .74$; Control: Time 1, $\alpha = .85$; Time 3, $\alpha = .58$).

Self-esteem. A single-item (“I have high self-esteem”) measured state self-esteem (Robins et al., 2001). Respondents indicated how they felt about the statement using a visual scale from 1 (not very true of me) to 5 (very true of me).

Life satisfaction. Participants’ satisfaction with life was assessed using the Self-Anchoring Striving Scale (Cantril, 1969). A pictorial ladder with steps numbered from zero (bottom = worst possible life) to ten (top = best possible life) was presented to participants who selected on which rung they felt they stood at the time of questioning.

Health. A single item (“How would you rate your overall health at the present time?”) measured global health from 1 (poor) to 5 (excellent) on a visual scale (Sargent-Cox et al., 2008).

Recreational participation. This custom survey assessed active participation in recreational activities at the hospital. Participants listed the activities in which they were involved and indicated frequency of participation (from every day to less than once a month).

Program satisfaction. This custom survey was administered weekly throughout Study 1a to assess satisfaction with the iPod music-listening program. It served as an opportunity for patients to inform volunteers of any changes they wished to make to their playlist.

Results

Music Listening Frequency

A one-way analysis of variance (ANOVA) revealed that the number of music listening days was significantly greater during the second month of the Music and Memory[®] program compared to the first month, ($F(1, 7) = 11.19, p < .05$; see Figure 1.1).

Figure 1.1. Mean number of music listening days during the first and second month of the music program. Error bars represent standard error of the mean. $p < .05$

Emotional, Physical, and Social Well-being

Repeated measures ANOVAs were conducted to assess changes in psychological and physical health as a function of time (before, during, and after the Music and Memory[®] program, or at the beginning, four, and eight weeks into the control study) and study group (Music and Memory[®] vs. control). Overall, there were no significant main effects or interactions between time and group type for cognition, self-esteem, health, patient social network size, identification with hospital community, or recreational participation measures. However, a main effect for time approached significance ($p = .059$) with emotional well-being as the outcome, suggesting that fewer negative emotions were reported over time by participants in both the intervention and control groups. As seen in Figure 1.2, Music and Memory[®] participants initially experienced more negative emotions than patients in the control group, but after eight weeks, scores reported by both groups were nearly identical. It is also worth noting that a paired samples t-test revealed a significant decline in negative emotions between T1 and T3 for Music and Memory[®] participants (M difference = .15, $t(6) = 2.75$, $p < .05$) while that was not the case for control

participants (M difference = .10, $t(6) = .94$, $p = .39$). Although not reaching significance, there was also a trend towards higher life satisfaction over time for participants in the Music and Memory[®] group (main effect for time, $p = .16$; see Figure 1.3), while scores remained stable for those in the control group.

Figure 1.2. Mean ESC scores recorded before, during, and after the music program and control study (Time 1, Time 2, and Time 3, respectively). Error bars represent standard error of the mean.

Figure 1.3. Mean life satisfaction scores recorded before and after the music program and control study (Time 1 and Time 3, respectively), as well as during the program (Time 2). Error bars represent standard error of the mean.

Qualitative Results

Despite the modest evidence of benefits emerging from the quantitative results, patients' qualitative responses from Study 1a supported the notion that the Music and Memory[®] program benefitted patient well-being. For example, several patients reported feelings of relaxation as evidenced by the quotes below:

Patient A: *Puts you in a totally relaxed state.*

You almost feel like you're flying . . . like you're weightless.

Took my mind off of a lot of things.

Patient B: *It gets me away from everything.*

Patient C: *Takes me back to my home in Québec.*

Makes me feel like a person, not only a patient.

Discussion

Despite our heterogeneous and modest sample sizes, the findings of Studies 1a and 1b suggest that on a complex-care unit, personalized music listening can reduce the number of negative emotions reported by patients to a level similar to that of individuals on other units who do not have complex care issues. Music listening also appears to increase life satisfaction scores slightly beyond those reported by the control group, and it marginally improves self-esteem, which coincided with the frequency that participants listened to their personalized music playlists. Patients' qualitative responses regarding the Music and Memory[®] program further supported these trends. These findings are in line with previous research suggesting improvements in psychological well-being following personalized music listening (Bradshaw et al., 2014; Chan et al., 2011; Dingle et al., 2013; Sung, Chang, & Lee, 2010). They also contribute to the diversity of elderly populations in which this type of activity is beneficial, namely complex-care patients. Music and Memory[®] is largely conducted for people living with dementia with the aim of improving mood and triggering important memories (Gerdner, 2000; Music and Memory[®], 2016; Sung et al., 2010). While these outcomes are especially important for people with dementia who progressively lose their identity (Sacks, 2007) and experience negative emotions (Clare et al., 2008; Powers et al., 2014), this study demonstrates that the program can also benefit older individuals afflicted by other conditions. Importantly, however, a high degree of personalization in music programs is likely favourable, perhaps as a means of reinforcing one's identity (e.g., Haslam et al., 2014; Ysseldyk et al., 2018a).

Before a musical intervention can be successfully implemented, there are a number of logistical and ethical considerations that need to be overcome. In this regard, our study not only demonstrated the benefits of music listening for patients on a complex-care unit, but also served

as a learning process through which good practices for implementing and conducting music interventions were identified (see Ysseldyk, Paric, & Luciani, 2016). These include suggestions regarding the simultaneous management of two ethics applications, creation of surveys that can be easily administered and understood by patients, administration of consent forms that are detailed enough to inform patients of study procedures without being tedious, and effective communication strategies with various stakeholders (e.g. hospital staff, volunteers) and audiences for knowledge mobilization. Moreover, this study revealed that conducting community-based research with vulnerable populations and mobilizing the knowledge acquired from this process is an achievement that is best accomplished one step—and often one participant—at a time.

Study 2

Like the chronic conditions experienced on the complex-care unit in Study 1, dementia is a limiting disease that progressively impairs an individual's ability to participate in various daily living and recreational activities (Kolanowski et al., 2009; Tolea et al., 2016). As a result, people living with dementia often lose their sense of dignity (Roach & Drummond, 2014), identity (Sacks, 2007), and experience feelings of unhappiness and loneliness (Clare et al., 2008). Other symptoms of dementia, namely memory loss, also negatively impact emotional and social well-being (Powers et al., 2014). Psychosocial programs that address these issues may help to alleviate symptoms of the disease and improve quality of life (Cooper et al., 2012; Lawrence et al., 2012; Theurer et al., 2015). They may also offer some relief to informal caregivers whose well-being is often deeply affected by that of their care recipient (Robinson et al., 2016; Jansen et al., 2015; Zhu et al., 2015).

Providing unpaid assistance to someone with a chronic illness or disability is commonly referred to as unpaid or informal caregiving (Roth, Fredman, & Haley, 2015). Numerous adverse health outcomes have been associated with informal caregiving, particularly if the caregiver feels that they did not have a choice in taking on the caregiving responsibilities (Schulz et al., 2012), or are not adequately supported (Carroll, Chippior, Karmali, Sriram, & Ysseldyk, in press; Vitaliano, Young, & Zhang, 2004). Some of these health outcomes include depressive symptoms (Pinquart & Sörensen, 2003), decreased feelings of competence, physical complaints, lower quality of life (Millenaar et al., 2016), and increases in inflammatory markers (von Känel et al., 2006). These negative outcomes can be perpetuated by the degree of care that a person needs (Mello et al., 2016). In turn, poor caregiver life satisfaction and depressive symptoms can negatively affect care recipient well-being (Grant et al., 2013). In this regard, providers and

receivers of care can stress each other throughout the caregiving process, compounding the total negative effects experienced.

There are exceptions to these trends, however, where particular subsets of caregivers report positive experiences. For example, caring for a parent was linked to a higher sense of mastery (Hansen, Slagsvold, & Ingebretsen, 2013). Similarly, an early dementia diagnosis increased competence amongst caregivers, who likely felt more prepared to handle impending issues (Vugt & Verhey, 2013). The fine line between caregiving burden and benefit possibly lies in moderation: medium levels of engagement with a care recipient were associated with improved caregiver well-being, while low and high levels of engagement were linked with reduced well-being compared to controls (Matz-Costa, Besen, James, & Pitt-Catsoupes, 2012).

Educational, group, and technology-based interventions have been successful in aiding caregivers with their responsibilities and reducing depressive symptoms (Belle et al., 2006; Eisdorfer et al., 2003), feelings of burden (Chien & Lee, 2011), distress (Dowling et al., 2014), as well as improving a sense of mastery (Zautra et al., 2012), self-efficacy (Gitlin, Corcoran, Winter, Boyce, & Hauck, 2001), coping (de Rotrou et al., 2011; Ducharme et al., 2011), and quality of life (Pendergrass, Becker, Hautzinger, Pfeiffer, 2015). When providers and receivers of care participate together in a psychosocial intervention, they report an increased sense of connectedness with each other (Charlesworth et al., 2016). This is a particularly important outcome as positive relationships are crucial to well-being, especially among those living with dementia (Ablitt et al., 2009). In this regard, Study 2 aimed to identify the psychosocial benefits of a unique artistic intervention based on reminiscence therapy amongst persons with dementia as well as their caregivers.

Similar to the Music and Memory[®] initiative, reminiscence therapy can trigger identity-affirming memories that are usually related to significant life events, such as marriage, child-rearing, travel, etc. Conducted with another person or in a group, reminiscence therapy involves the recounting of these memories with the help of familiar objects from the past (e.g. photographs, household objects) (Woods, Spector, Jones, Orrell, & Davies, 2005). It can also be adapted to include artistic aids (e.g. familiar music) to further encourage socialization and group identification among participants (Haslam, 2010, 2014b; Woods et al., 2005). This form of therapy appears to be particularly useful in those with neurodegenerative diseases that impact memory, such as dementia, although results have been mixed. Reduced depression (Wang, 2007; Chiang et al., 2010) and loneliness (Chiang et al., 2010), as well as improved cognition are some of the benefits observed among those with dementia following a reminiscence intervention (Huang et al., 2015). Importantly, group interventions may also stave off cognitive decline in seniors (Haslam, 2014a). Other studies of reminiscence programs, however, found no significant effects on quality of life in either the care recipient or caregiver (Woods et al., 2012; Charlesworth et al., 2016; Woods et al., 2016). Instead, researchers identified an increase in anxiety amongst carers of those undergoing therapy following a ten-month reminiscence program (Woods et al., 2012). These unfavourable results may be at least partially explained by applying a social identity framework. In this regard, Haslam and colleagues (2014b) found no benefits to story- and song-based reminiscence groups as a function of the type of intervention. Initial identification with group members, however, significantly moderated the effects of the reminiscence intervention on well-being. Identification with the story reminiscence group was linked to improved cognition and greater life satisfaction, while identification

with a religious song reminiscence group was associated with fewer symptoms of anxiety and increased life satisfaction (Haslam, 2014b). Thus, in Study 2, identification with other group members and with one's companion (caregiver or care recipient) was measured to determine the role of social identification on the effects of an arts-based group reminiscence program on well-being. Positive aspects relating to caregiving, happiness in care recipients, and caregiving ideology were also examined. It was hypothesized that following the reminiscence program (compared to baseline measures) *caregivers* would:

- 1) report increased life satisfaction, emotional and physical well-being, improved coping ability, stronger identification and satisfaction with their caregiving responsibilities, as well as increased closeness to their care recipient and reminiscence group. Closeness with others, coping ability, as well as identification and satisfaction with caregiving would also be positively correlated with self-reported psychological and physical well-being.

It was also hypothesized that, following the intervention, *care recipients* would:

- 2) feel happier and closer to their caregivers and reminiscence group, and that closeness with others would be positively correlated with their happiness.
- 3) maintain cognition scores, indicating that a reminiscence program may help delay cognitive decline that would normally be expected over time.

Participants and Procedure

The group reminiscence intervention assessed in this study was based on “*Remembering Yesterday, Caring Today*”, a reminiscence program that, in addition to music and props, utilizes visual arts, drama, and dance to enhance the storytelling process (Woods et al., 2005). The arts therapist leading the program at Carefor Health and

Community Services, a not-for-profit organization that provides community programming and home health care services, initiated recruitment for this study by contacting each caregiver to introduce the proposed research. At the first introductory meeting, where all participants of the reminiscence program gathered to get acquainted, the study was introduced. Ten caregivers (2 men; 8 women) aged 49 to 86 years ($M = 62.70$, $SE = 3.48$) expressed interest in participating and were asked to provide written consent for both themselves and their care recipients (4 men; 5 women, aged 68-94 years, $M = 83.0$, $SE = 2.78$). Care recipients only received consent forms and were interviewed if they were willing to take part in the study and if caregivers approved their involvement. Weekly, two-hour group reminiscence sessions were conducted for eleven weeks. Questionnaires were administered before (Time 1), during (weekly, Time 2-11), and after the program (Time 12) to all participants (Appendix B). For care recipients, all surveys were read aloud and completed by researchers. Qualitative data collected by the arts therapist was also obtained for those who specifically provided consent for this portion of the study. This research was approved by the Carleton University Research Ethics Board-B and by Carefor Health and Community Services.

Caregiver Measures

Life satisfaction. Using the Satisfaction with Life Scale (SWLS; Diener et al., 1985), participants indicated to what extent they agreed or disagreed with five statements (e.g. "In most ways my life is close to ideal") using a scale from 1 (strongly disagree) to 5 (strongly agree). Responses were summed to create a single score, such that higher scores represented greater life satisfaction (Time 1: $\alpha = .80$; Time 12: $\alpha = .62$).

Closeness with others. The Inclusion of Other in the Self scale (IOS; Aron et al., 1992), a two-item questionnaire, was used to ask caregivers how close they felt to their care recipient with dementia and to other members of their reminiscence group. Participants depicted their relationships using one of seven increasingly overlapping circles.

Identity as an informal caregiver. A four-item scale was adapted from Doosje and colleagues (1995) (e.g. “I feel strong ties with other informal caregivers”; see also Carroll et al., in press¹). A summed score was tabulated, where higher scores represented greater identification as an informal caregiver (Time 1: $\alpha = .70$; Time 12: $\alpha = .55$).

Emotional well-being. The Positive and Negative Affect Schedule - Short Form (PANAS-SF) was used to ask caregivers how often they experienced five positive emotions (e.g. inspired, determined) and five negative emotions (e.g. hostile, afraid) using a scale from 1 (never) to 5 (always). Results were summed separately for negative and positive feelings (Thompson, 2007; see Table 2.1 for reliabilities).

Table 2.1

Cronbach α 's for the PANAS-SF

Time Point	Positive Emotions	Negative Emotions	Time Point	Positive Emotions	Negative Emotions
1	.40	.47	7	.82	.42
2	.68	.48	8	.76	.65
3	.21	.57	9	.89	.29
4	.72	.41	10	.85	.86
5	.80	.85	11	.80	.78
6	.75	.42	12	.89	.21

¹ The fifth and only negative item, “I feel that I am very different from other caregivers” was removed to limit reflections on possible sources of caregiving stress.

Coping as an informal caregiver. Coping strategies (e.g. “Is there someone you can turn to with your questions and problems?”) and support outlets (e.g. “Do you feel you are offered enough formal support to cope with the emotional difficulties associated with informal caregiving?”) were examined using a seven-item questionnaire (Carroll et al., in press; Peeters et al., 2010). Participants responded on a scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Caregiver stress. The Relative Stress Scale (RSS) was used to measure stress levels in caregivers through fifteen questions (e.g. “Do you ever feel you need a break?”). Answers were rated on a scale from 0 (not at all) to 4 (to a high degree). Scores were summed to create an index of caregiver stress, where higher scores represented greater stress levels (Greene et al., 1982) (Time 1: $\alpha = .89$; Time 12: $\alpha = .82$).

Caregiving satisfaction and ideology. Caregiving satisfaction (e.g., “You really enjoy being with the care recipient”) and ideology (e.g., “A strong reason for being a caregiver is to be true to family traditions”) were examined with six and four statements, respectively. Participants responded using a scale ranging from 1 (strongly disagree) to 5 (strongly agree). Responses to questions were summed to create a single index for both caregiving satisfaction and ideology, such that higher scores represented greater satisfaction and ideology (i.e. caregiving to fulfill family and religious traditions, or to repay care recipient) (Lawton et al., 1989) (satisfaction: Time 1: $\alpha = .68$; Time 12: $\alpha = .44$; ideology: Time 1: $\alpha = .78$; Time 12: $\alpha = .87$).

Effects of caregiving. Participants indicated whether they had any positive experiences as caregivers using the Positive Aspects of Caregiving questionnaire (Tarlow et al., 2004). Responses to nine statements (e.g. “Made me feel more useful”) were reported

on a scale ranging from 1 (disagree a lot) to 5 (agree a lot) and summed so that higher scores indicated more positive caregiving experiences (Time 1: $\alpha = .93$; Time 12: $\alpha = .88$).

Perceived change. Changes in caregiver well-being in the preceding month were assessed with the Perceived Change Index (Gitlin et al., 2006). Responses to thirteen statements (e.g. “Ability to sleep through the night”) were reported on a scale ranging from 1 (much worse) to 5 (improved a lot). Responses were summed, such that higher scores represented greater improvements in caregivers’ physical and psychological health (Time 1: $\alpha = .82$; Time 12: $\alpha = .75$).

Qualitative responses. Pre-program and post-program questionnaires were prepared and administered by the arts therapist leading the reminiscence program. They included statements and open-ended questions regarding enjoyable moments, surprises, and lessons experienced during the program (e.g. “A surprise I had during the project was...”, “Were your hopes realized?”). Participants provided written responses.

Care Recipient Measures

Identification with others. As with the caregivers, the IOS scale was adapted for use with care recipients, who assessed their relationship with their caregivers as well as with other members of the reminiscence group (Aron et al., 1992).

General life happiness. A single-item measure (“How happy would you say you are these days?”) was used to assess happiness in those living with dementia (Dush et al., 2008). A custom visual scale ranging from 1 (not very happy) to 3 (very happy) was created to aid participants in responding to this question.

Cognition. Two versions of the OMCT were used to assess cognition in care recipients before and after the program (Katzman et al., 1983) (Time 1: $\alpha = .56$; Time 12: $\alpha = .65$).

Results

Caregiver Quantitative Data

Changes over time. Over the course of the reminiscence intervention, caregivers became increasingly close with their care recipients, such that closeness scores at Time 12 were significantly, although modestly, different than Time 1 measures (Figure 2.1A; M difference = .78, $t(8) = 3.50$, $p < .01$). Likewise, caregivers also appeared to become marginally closer with other group members over time (Figure 2.1B; M difference = 1.86, $t(6) = 2.24$, $p = .07$). On measures of well-being caregivers reported significantly more positive changes (Time 1, $M = 36.6$; Time 12, $M = 42.56$; $t(8) = 2.80$, $p < .05^2$). There were no changes over time in measures of caregiver satisfaction, ideologies, and coping.

² Paired t-tests were conducted to assess differences only between Time 1 and 12 given that change from pre-program to post-program measures was of primary interest and that repeated measures utilizes listwise deletion, thereby severely limiting the sample size for analyses if all time points were considered ($N = 4$; some participants missed a program session).

Figure 2.1. Mean closeness to care recipient (A) and closeness to group (B) before (Time 1), during (Time 2-11), and after the reminiscence program (Time 12). Error bars represent standard error of the mean. * $p < .05$.

Correlations among variables of interest. Caregiver closeness with their care recipient at Time 1 was positively correlated with perceived change in well-being at Time 1 (Table 2.2) and with their positive emotions at Time 12 (Table 2.4). Interestingly, positive aspects of caregiving were positively correlated with caregiving identity and ideology (Table 2.2). Furthermore, caregiver relationships with both their care recipient and their group were also positively correlated with their emotions at Time 12 (Table 2.3).

Table 2.2

Zero-order correlations among caregiver measures at Time 1

Measures	LS	RC	CID	PE	NE	CST	CS	CI	PAC
LS									
RC	.02								
CID	-.44	.05							
PE	.07	.29	-.15						
NE	.11	-.14	-.42	.30					
CST	-.04	-.53	-.15	.14	.27				
CS	.33	.56	-.05	.52	-.18	.21			
CI	.62	.14	-.63	.43	.22	.25	.56		
PAC	.57	.38	-.75*	.19	.28	-.14	.22	.66*	
PCI	-.08	.72*	-.19	.51	.16	.13	.64	.29	.44

Note. Life satisfaction (LS), Relationship with Care Recipient (RC), Caregiver Identity (CID), Positive Emotions (PE), Negative Emotions (NE), Caregiver Stress (CST), Caregiver Satisfaction (CS), Caregiver Ideology (CI), Positive Aspects of Caregiving (PAC), Perceived Change Index (PCI). * $p < .05$.

Table 2.3

Zero-order correlations among caregiver measures at Time 12

Measures	LS	RC	RG	CID	PE	NE	CST	CS	CI	PAC
LS										
RC	.34									
RG	.36	.88*								
CID	-.12	.13	.07							
PE	-.01	.84*	.76*	.08						
NE	.07	.30	-.08	-.28	.24					
CST	-.25	-.49	-.62	.38	-.22	-.17				
CS	.18	.56	.48	.83*	.33	-.13	-.11			
CI	.43	.43	.55	.46	.47	-.27	.23	.46		
PAC	.62	.46	.68*	.07	.18	-.17	-.43	.30	.63	
PCI	.00	-.34	-.17	.13	-.23	-.06	.20	-.17	.40	.32

Note. Life satisfaction (LS), Relationship with Care Recipient (RC), Relationship with Group (RG), Caregiver Identity (CID), Positive Emotions (PE), Negative Emotions (NE), Caregiver Stress (CST), Caregiver Satisfaction (CS), Caregiver Ideology (CI), Positive Aspects of Caregiving (PAC), Perceived Change Index (PCI). * $p < .05$.

Table 2.4

Zero-order correlations among caregiver measures at Time 1 and 12

		Time 12											
		Measures	LS	RC	RG	CID	PE	NE	CST	CS	CI	PAC	PCI
Time 1	LS	.68*	.12	.21	-.06	-.10	.18	-.42	.12	.32	.50	.51	
	RC	.04	.84*	.82*	.06	.76*	.07	-.65	.51	.14	.19	-.49	
	CID	-.19	-.12	-.29	-.17	.01	-.03	.23	-.20	-.36	-.72	-.54	
	PE	-.20	.05	.38	.13	.39	-.59	.04	.04	.51	.16	.32	
	NE	-.29	-.11	.18	.30	-.02	-.36	-.24	.11	.36	.41	.76*	
	CST	-.32	-.29	-.39	.17	.06	.27	.78*	-.26	.29	-.20	.64	
	CS	.15	.63	.53	.35	.78*	.20	-.04	.48	.63	.10	.10	
	CI	.56	.42	.55	.21	.41	-.01	-.04	.31	.85*	.71	.46	
	PAC	.35	.48	.61	-.18	.36	.23	-.63	.15	.27	.66	.22	
	PCI	-.32	.66	.67	.01	.88*	.23	-.43	.19	.28	.15	-.00	

Note. Life satisfaction (LS), Relationship with Care Recipient (RC), Relationship with Group (asked at Time 12 only; RG), Caregiver Identity (CID), Positive Emotions (PE), Negative Emotions (NE), Caregiver Stress (CST), Caregiver Satisfaction (CS), Caregiver Ideology (CI), Positive Aspects of Caregiving (PAC), Perceived Change Index (PCI). * $p < .05$.

Caregiver Qualitative Data

Caregivers' responses to open-ended questions were read and coded in a three-stage process to reveal the most dominant themes. During the first stage, open coding, descriptive labels were created for each participant's response. The second and final stages (axial and selective coding, respectively) involved identification of themes among previous codes, such that each round of coding resulted in a smaller number of themes, ultimately revealing core concepts among participant responses (Corbin & Strauss, 2008). Figure 2.2 illustrates common themes identified in caregiver feedback as a thematic map, following Dingle et al. 2013.

Figure 2.2. Thematic representation of caregiver written responses before and after the reminiscence program.

Theme 1: Hopes and Fears. Before the program started, caregivers expressed excitement over sharing their stories and were eager for their care recipient to enjoy themselves.

When asked about their hopes responses included:

Participant 3: *That the reminiscing will spark memories and stories for mum. That these “memories” will make her happy and make her smile. That mum will have a positive experience, making her want to return each week.*

Participant 4: *To enjoy the experience with my husband. To hear about other people's experiences – from lifetime experience to dealing with present.*

Caregivers also reported feeling worried about experiencing negative emotions while reminiscing and about how their care recipient would respond to the reminiscence group. Some examples of their fears include:

Participant 2: *That some of the memories will be negative and trigger sadness or depression.*

Participant 3: *That mum may not participate when she's here. That mum may not want to return.*

Participant 5: *Sorrow, loss, grieving feelings.*

Theme 2: Sociality. During the reminiscence program, the support and consideration caregivers received from other group and staff members helped them to overcome their fears:

Participant 4: *Instead of feeling overwhelmed, I felt supported by everyone. Although I did feel emotional, I also knew that with this group, if these feelings surfaced, it would be ok – no one would be uncomfortable and support would be there.*

Participant 5: *[I made] many acquaintances whose contributions have added to my feelings of acceptance. If they can do it, so can I.*

Through storytelling they continued to bond with their care recipients and formed new relationships that augmented their experience in the program:

Participant 2: *Staff and participants. All unique, all special, all enhanced the experience and the generation of lost or vague memories.*

Participant 6: *Many [friendships] . . . [participant] and her girls (turns out they know my husband). [Participant], who my mom loves all of whom I may see in Barbados. Plus, plus, plus.*

Theme 3: Joy. Caregivers enjoyed their time in the intervention and consistently reported that they would recommend the reminiscence program to others. Their experiences with the program are illustrated in the following examples:

Participant 1: *The stories were wonderful. It was wonderful to hear everyone in the group talk about their memories.*

Participant 4: *A joy to participate and watch our loved one blossom and to share with the other group members.*

Participant 5: *Even though hubby's illness is devastating, progressive, and without hope for recovery, joy is still possible with a 'live in the moment' approach. We had many laughs and experiences that were interesting, despite his inability to recall events.*

Theme 4: Learning. As a result of spending more time with their care recipient and after meeting other caregivers who share similar responsibilities in caring for their loved one, caregivers stressed the importance of reminiscence and learning new things:

Participant 4: *To let some things slip by – that it doesn't really matter if some things are not accurate. Communication and sociability are [of] prime importance.*

Participant 5: *I was reminded of communication methods, particularly how to pull hubby out of his morose moments. [The program] was a great reminder of the importance of experiencing "moments" via dwelling on the past events.*

Participant 6: *Go visit my mom as opposed to just pick her up to come visit with me/my family. It struck me today, as I came to have dinner with my mom, that she really enjoys it. Need to do this more often.*

Care Recipient Quantitative Data

In contrast to the positive qualitative reports from caregivers, care recipients' cognition scores were not significantly different at Time 1 and Time 12 and, not unexpectedly among older adults living with dementia, marginally decreased over time (Time 1, $M = 12.11$; Time 2, $M = 8.75$; $t(7) = 1.96, p = .09$). However, we found no changes over time in care recipient happiness or closeness with others.

Care Recipient Qualitative Data

Care recipient written responses were also assessed and coded to generate key themes regarding their experiences with the reminiscence program (Figure 2.3).

Figure 2.3. Thematic representation of care recipient written responses before and after the reminiscence program.

Theme 1: Hopes and Fears. Unlike caregivers, care recipients had few fears about the program. Those who did reported worries related to personal limitations. When asked if they had fears before the program responses included:

Participant 7: *A little hard of hearing and a bit shy.*

Participant 8: *None. We are at the age we don't really worry about things.*

Participant 10: *Other members of the group need to ask me questions so that I can answer them.*

Care recipients also reported hopes:

Participant 7: *To enjoy the experience. To learn new things and share.*

Participant 8: *Meet people and experience their memories. To share my/our life experience.*

Theme 2: Sociality. Through storytelling, care recipients bonded with others and were reminded of memories they had not thought of in a while:

Participant 8: *A lot of memories. We'd get home and think of lots of things we should have said.*

Participant 10: *We thought about things we wouldn't have thought about on our own. When doing this, we developed a bond together. No one ever felt left out and we all felt like we belonged.*

Theme 3: Joy. The positive experiences care recipients had with their caregivers and other members of the group led to feelings of enjoyment and an eagerness to continue participating in the program as evidenced below:

Participant 7: *I enjoyed every "friggin" one of them!! Favourite – School days. . . I would recommend this to anybody and hope that it will continue.*

Participant 9: *I would [recommend the program]. Because I enjoyed it. It's good to be with people.*

Participant 11: *Everything that was going on was making me happy as heck! . . I loved doing it and I would like to continue.*

Participant 12: *I enjoyed all the sessions.*

Theme 4: Well-being. Care recipients reported feeling rejuvenated and optimistic. They were also aware of improvements in their physical functioning:

Participant 7: *It really gave me a big lift. You think that you forgot this or that, but it helps your memory. To be honest, I've had a good life, but since my memory is bad – this is the best thing that has happened to me. It even helped with the aches and pains and memory! I'm getting less of those "down moments".*

Participant 8: *Felt like we were young again, about 10 years younger! Gives you a feeling you're still kicking.*

Participant 11: *What you're doing here makes people think and helps people see things in the best light. I've wanted to do that all my life.*

Discussion

The experiences of caregivers and people living with dementia in our study build on those reported in previous assessments of reminiscence interventions. For example, in a randomized control trial comparing usual medical treatment with a combination of either peer support or reminiscence groups, caregivers also felt closer to their care recipients following both psychosocial interventions (Charlesworth et al., 2016). In a separate study, care recipients reported increased closeness with their carers (Woods et al., 2016), as well as improved hope and life satisfaction (Wu & Koo, 2015) following reminiscence programs. Our findings build on these results as they suggest that caregivers' closeness with their care recipient and with their group at least modestly strengthened over time. Caregiver closeness with others was also positively correlated with emotional well-being after the reminiscence intervention. Moreover, this was reflected in qualitative responses that suggested a link between bonding with others and positive emotions in caregivers. However, in our study, as in others, there were some difficulties in quantitatively assessing the effects of reminiscence interventions in people living with dementia. There were no significant changes over time related to happiness, closeness with

others, and cognition in care recipients. Likewise, other researchers have reported no changes in quality of life and mental health in care recipients following reminiscence (Charlesworth et al., 2016; Woods et al., 2016). In contrast, our qualitative data suggests that care recipients enjoyed bonding with others and experienced happiness and improved physical functioning. Capturing these results quantitatively may be difficult because measures that are typically administered for this purpose have not been validated for use in people with dementia participating in a musical intervention (McDermott et al., 2014; Vink et al., 2013).

In light of the findings from Study 1, which highlight the ability of music listening to decrease negative emotions and improve relaxation, the findings of the present study build on this by suggesting that music combined with other artistic activities (e.g. drama, dance) that *encourage group participation* could enhance the emotional and physical well-being of participants. Perhaps a shift from music listening to music-making, a more cognitively demanding and participatory activity, in dementia care could help to maintain cognition scores in care recipients and potentially enhance emotional well-being among caregivers and care recipients alike.

Study 3

Consistent with the results from Studies 1 and 2, where listening to music or reminiscing about the past through arts-based methods resulted in changes in emotional well-being and closeness with others, music-making can also increase positive feelings (Hallam & Creech, 2016), social engagement (Camic et al., 2013; Dingle et al., 2013), as well as improve quality of life (McDermott et al., 2014) and memory in older adults (Gooding et al., 2014). For example, following a ten-week group singing intervention, engagement in program activities significantly improved among people living with dementia (Camic et al., 2013). Qualitative data further revealed that care recipients felt an increased sense of fulfillment as they completed tasks they originally thought were beyond their capabilities, while caregivers enjoyed the structure and ambience of the singing environment and were glad to meet other individuals who shared their caregiving experiences (Camic et al., 2013).

In another study, singing also improved cognition and reduced depressive symptoms in those with dementia (Särkämö et al., 2016). Similar music therapies or interventions often involve improvisation (McDermott, Crellin, Ridder, & Orrell, 2013; McDermott et al., 2014; Rio, 2002), which, like singing, can promote participation (Hsu, Huang, Nordgren, Rucker, & Galinsky, 2015; Camic et al., 2013). Program leaders are also able to personalize musical activities through improvisation, by changing their instruction in response to participant reactions and preferences (Ansdell, 1995). As noted in Study 1, the benefits of a particular program may be augmented if it is personalized to reflect important social identities, such that participants identify more strongly with the activities and the people involved (Haslam et al., 2014b; Hays & Minichiello, 2005; Gerdner, 2000).

In light of these findings, group music-making (involving, singing, instrument playing, body movement, and composition) and improvisation were combined to create a novel program, entitled “*Music Matters*”. This unique intervention, which shares the musical focus of Study 1 and the multimodal approach of Study 2, was co-created by the Arts and Wellness Specialist at Bruyère Continuing Care and the research team, with the intent to improve well-being among community-dwelling people living with dementia and their caregivers in an informal environment. It was hypothesized that following participation in the program, *caregivers* would:

- 1) report increased life satisfaction, emotional well-being, stronger caregiver identity, as well as increased closeness to their care recipient and reminiscence group. Closeness with others and caregiving identity were also expected to be positively correlated with life satisfaction and emotional well-being.

It was also hypothesized that following the intervention *care recipients* would:

- 1) feel happier and closer to their caregivers and reminiscence group, and that closeness with others would be positively correlated with their happiness.
- 2) maintain cognition scores, indicating that a reminiscence program may help delay cognitive decline.
- 3) display more positive behaviours in response to the music and people around them (i.e., interest, response, initiation, involvement, enjoyment)

Participants and Procedure

Music Matters was an eight-week program that consisted of two professionally guided music sessions per week. A local jazz musician along with a music professor (who is also a

professional musician) guided song writing, singing, instrument playing, and improvisation. The sessions also culminated in a final performance at the National Arts Centre, in Ottawa, Ontario³.

The study was presented to participants prior to the start of the first music session. Eight caregivers (7 women; 1 man), ranging in age from 50 to 80 years ($M = 69.0$, $SE = 4.66$) expressed interest and were asked to provide written consent. Caregivers also provided consent for their care recipients (3 women; 4 men⁴, aged 77-92 years, $M = 84.60$, $SE = 2.77$). Questionnaires (Appendix C) were administered before (Time 1), mid-way through (four weeks, Time 2), and after the music program (eight weeks, Time 3). Additionally, researchers completed an observational measure regarding care recipient behaviour during the first and last ten minutes of each music session. For care recipients, all surveys were read aloud and completed by researchers. This study was approved by the Carleton University Research Ethics Board-B.

Caregiver Measures

As in Study 2, the SWLS (Diener et al., 1985; $\alpha = .51$), IOS scale (used to assess relationship with care recipient and music group; Aron et al., 1992), identity as an informal caregiver (adapted from Doosje et al., 1995; $\alpha = .60$), PANAS-SF (Thompson, 2007; negative, $\alpha = .20$; positive, $\alpha = .83$), and Perceived Changed Index (Gitlin et al., 2006; $\alpha = .91$) were completed by caregivers. Participants also answered open-ended questions adapted from Dingle and colleagues (2013) before and after the study (e.g. “What were your first impressions of the music group (both positive and negative)?”; “How did being a part of the music program influence your mood?”).

³ <https://nac-cna.ca/en/event/14204>

⁴ One care recipient had two caregivers who attended the Music Matters program.

Care Recipient Measures

The care recipient questionnaires from Study 2, including the General Life Happiness Measure (Dush et al., 2008), IOS scale (used to assess relationship with caregiver and music group; Aron et al., 1992), and the OMCT (Katzman et al., 1983; $\alpha = .55$) were also used in this study. Like their caregivers, care recipients also answered open-ended questions (Dingle et al., 2013) before and after the music program (e.g. “Do you feel connected to the other music group members, like you belong and identify with this group?”; “What was your favourite moment of the music program and why?”). Researchers recorded care recipient verbal responses to these questions and transcribed them.

Behavioural observations. Five behavioural domains (Interest, Response, Initiation, Involvement, and Enjoyment) were assessed for each participant using the Music in Dementia Assessment Scales (MiDAS), an observational measure designed to record changes in participant behaviour (e.g. interest and involvement in musical activities) during the first and last ten minutes of every music session (McDermott, Orrell, & Ridder, 2015). Researchers rated each behaviour on a hundred-millimeter-long line marked 0 to 100 (left to right). The distance between the start of the line (at 0) and the researcher’s mark was later measured in millimeters to provide a score out of 100, such that higher scores indicated improvements in behaviour. Researchers also made note of any other major reactions from care recipients (e.g., agitation, cheerfulness).

Results

Caregiver Quantitative Data

Changes over time. Differences in well-being between Times 1, 2, and 3 were assessed⁵. Compared to Time 1, caregivers reported fewer negative (Figure 3.1A; M difference = -2.33, $t(2) = 7.00$, $p = .02$) and more positive emotions (Figure 3.1B; M difference = 1.33, $t(2) = 2.00$, $p = .184$) at Time 3; however, the latter trend was not significant. In contrast to our hypotheses, perceived change in well-being decreased between Time 1 and Time 2, indicating that caregivers experienced fewer positive changes in overall well-being (Figure 3.2A; M difference = 10.33, $t(2) = -11.72$, $p = .01$). While these scores increased at Time 3, they were not significantly different from Time 1 or Time 2 scores ($p = .72$ and $.18$, respectively). Compared to Time 1, caregivers reported a non-significant increase in closeness with their care recipients at Time 2 and Time 3 (Figure 3.2B, $p = .42$ for both comparisons). There were no changes over time in life satisfaction and caregiving identity.

⁵ Paired t-tests were conducted to assess differences between time points given that repeated measures utilizes listwise deletion, thereby severely limiting the sample size for analyses if all time points were considered ($N = 3$; only three pairs of caregivers and care recipients were present for the first Music Matters session).

Figure 3.1. Mean negative (A) and positive (B) emotions experienced before (Time 1), during (Time 2), and after (Time 3) the music program. Error bars represent standard error of the mean.

* $p < .05$.

Figure 3.2. Mean perceived change in well-being (A) and closeness with care recipient (B) before (Time 1), during (Time 2), and after (Time 3) the music program. Error bars represent standard error of the mean. * $p < .05$.

Correlations among variables of interest. When correlations among the variables of interest were assessed, perceived change in well-being at Time 2 was positively correlated with life satisfaction at Time 2 and caregiver identity at both Time 2 and 3 (Table 3.1 and 3.2). Caregiver closeness with the music group at Time 2 and 3 was also positively correlated with positive emotions at Time 2 (Table 3.1 and 3.2)⁶.

⁶ Only tables presenting significant correlations are included in this chapter. Correlations between variables at other time points for Music Matters can be found in Appendix D.

Table 3.1

Zero-order correlations among caregiver measures at Time 2

Measures	LS	RC	RG	CID	PE	NE
LS						
RC	.13					
RG	.28	.21				
CID	.96**	-.10	.12			
PE	.58	.40	.91*	.40		
NE	-.66	-.28	.34	-.71	-.06	
PCI	.98**	.15	.29	.96**	.58	-.69

Note. Life satisfaction (LS), Relationship with Care Recipient (RC), Relationship with Group (RG), Caregiver Identity (CID), Positive Emotions (PE), Negative Emotions (NE), Perceived Change Index (PCI). * $p < .05$, ** $p < .01$.

Table 3.2

Zero-order correlations among caregiver measures at Time 2 and 3

		Time 3						
Time 2	Measures	LS	RC	RG	CID	PE	NE	PCI
	LS	.13	.18	.49	.92**	.59	-.04	-.18
	RC	.54	.84*	.24	-.21	.72	-.48	.70
	RG	.19	.51	.85*	.34	.14	.04	.42
	CID	-.04	-.10	.38	.92**	.46	-.07	-.34
	PE	.40	.63	.93**	.55	.39	-.07	.33
	NE	-.24	.00	-.10	-.46	-.56	.46	.20
	PCI	.04	.13	.52	.88*	.64	-.20	-.08

Note. Life satisfaction (LS), Relationship with Care Recipient (RC), Relationship with Group (RG), Caregiver Identity (CID), Positive Emotions (PE), Negative Emotions (NE), Perceived Change Index (PCI). * $p < .05$, ** $p < .01$.

Caregiver Qualitative Data

Analysis of qualitative caregiver responses was conducted in the same manner as in Study 2 (Corbin & Strauss, 2008; Dingle et al., 2013). The central themes resulting from this process are portrayed in Figure 3.3 below.

Figure 3.3. Thematic representation of caregiver written responses before and after Music Matters.

Theme 1: Anticipation. At the outset of the program, there were mixed feelings amongst caregivers when asked about their first impressions of Music Matters. The improvisational aspect of the music program sparked concerns in some and intrigue in others. Examples of these sentiments include:

Participant 2: *I was excited to be part of a new music programme. My first impressions were negative: 5 people gave different info about why we were attending—too long for people with dementia.*

Participant 4: *I'm concerned about the small size of participants and hope it increases with time. Also curious as to how we as a group can contribute to a project of quality for the NAC.*

Theme 2: Community. As Music Matters progressed, these concerns dissipated.

Caregivers were reconnected with friends from other musical groups and were eager to meet new people. They bonded through music-making and sharing stories, ultimately building trust and finding support from others. Some of these experiences are expressed below:

Participant 2: *Four of the other members are in the Minds and Song group. It was a happy surprise to see them at the event. I do identify with this group.*

Participant 4: *Knowing I'm not alone and that there are opportunities, if needed, to share stories and to ask for help.*

Participant 6: *There is a sense of community and a chance to learn about different forms of musical expression and how the leaders – Jesse and Julia – are able to shape unexpected materials – memories/song – into a coherent form.*

Theme 3: Joy. The creation of a new Music Matters community and participation in a variety of musical activities were joyful events for caregivers. Caregivers felt fully engaged with others and with the music. This enabled them to relax and worry less about their loved one:

Participant 3: *I looked forward to each session and helping my mother stay engaged in the activities. It certainly was a sunny spot in my week.*

Participant 7: *When [participant] is feeling the side effects of the medication or is very tired he finds it more difficult to focus. One such day Jesse brought his machine in for the first time. When [participant] heard his voice on the machine, he was instantly alert and curious. I could just step back and enjoy – it was wonderful.*

Theme 4: Well-being. While concerning to some caregivers at first, the improvisational nature of Music Matters, along with its novel musical instruments and activities, was physically

and mentally engaging for caregivers. It also inspired feelings of confidence as participants were asked to try new activities. Examples of these experiences include:

Participant 2: *I was physically active, moving, singing to the music. I was asked to offer an opinion, to think on my own.*

Participant 3: *I feel more confident about participating in musical sessions, even though I don't have a strong music background.*

Participant 7: *Most of the music is affirming or calming. It also brought to mind other music that has been important to me over the years so it helped keep me positive.*

Care Recipient Quantitative Data

While there were no differences over time in care recipients' happiness and relationships with others, cognition scores slightly increased after Music Matters compared to before the program started, although this increase was not significant (Time 1, $M = 3.0$; Time 2, $M = 9.8$; $t(1) = 1.00$, $p = .50$). After the program, care recipient happiness was also correlated to caregiver life satisfaction ($r = .88$, $p = .05$).

As hypothesized, significant behavioural changes were also observed among care recipients by the researchers (see Figure 3.4). Willingness to *initiate* music-making and conversation (Figure 3.4C; M difference = 21.17, $t(6) = 2.66$, $p = .04$), as well as *enjoyment* in musical activities (Figure 3.4E; M difference = 6.18, $t(2) = 2.57$, $p = .04$) significantly increased during the second month of the program compared to the first.

Figure 3.4. Mean interest (A), response (B), initiation (C), involvement (D), and enjoyment (E) scores during the first and second month of the music program. Error bars represent standard error of the mean. * $p < .05$.

Care Recipient Qualitative Data

Care recipients' verbal interview responses largely emerged after the program⁷, and the overarching themes of happiness and mental health were identified, as depicted in Figure 3.5.

Figure 3.5. Thematic representation of care recipient verbal responses after Music Matters.

Theme 1: Happiness. A dominant theme in care recipient responses was the happiness they experienced throughout the program as a result of being with other people and participating in musical activities. For 6 of the 8 caregivers and 5 of the 7 care recipients, music was a part of their lives prior to the program and so participating in Music Matters was an opportunity to continuing doing what they enjoy. Examples of the emotional impact the program had on care recipients include:

Participant 8: *Numero uno. Number 1. That's all I can say. [The group] means a lot to me. It means much. . . Music always up for me, always. I love music and of course I love dancing too.*

⁷ Only three care recipients participated in the first Music Matters session and survey, one of which did not provide detailed responses to interview questions. As such, most qualitative results were derived from post-program interviews.

Participant 10: *It makes me happy. It makes me very happy.*

Participant 11: *It means a fair bit, because it's uh, we enjoy music and we enjoy the people here.*

We're all probably more or less in the same boat.

Participant 12: *Being five floors up with all those people, you included there. All that. That, that sticks.*

Theme 2: Mental Health. Care recipients also noticed changes in their mental health after Music Matters which, in addition to increased happiness, included relaxation and cognitive engagement:

Participant 10: *It keeps my brain moving. It makes me think.*

Participant 11: *Singing is a very healing thing at any time. And it's also fun at any time whether . . . Music is very important for me. Has been and always will be.*

Participant 12: *I relax into it . . . [So this is just a way for you to relax and be you?] Yeah, I can be a nut.*

Discussion

An increased focus on music along with a novel, multimodal intervention approach promoted positive changes among caregivers and care recipients that were generally in-line with our hypotheses and results from other studies demonstrating the emotional and behavioural impact of music-making (Camic et al., 2013; Cheong et al., 2016; Hallam & Creech, 2016; Thaut et al., 2014). Indeed, fewer negative emotions were reported by caregivers following Music Matters as with other older adults after community-based music-making groups (Hallam & Creech, 2016). However, perceived change in well-being among caregivers unexpectedly decreased and this unfavourable change may be related to increased awareness of their responsibilities and struggles as caregivers. Some of these responsibilities were reflected in

caregivers' qualitative responses that included knowing they could ask for help if needed and feeling more relaxed when care recipients were engaged and happy.

Cognition appeared to slightly improve in care recipients, which supplements previous evidence that music-making interventions can enhance memory (Gooding et al., 2014; Thaut et al., 2014). This finding also complemented what care recipients reported about their mental well-being—they were more relaxed, content, and cognitively engaged—and how positively they responded to music-making activities as evidenced by improved initiation and enjoyment. Together these findings, and those reported by care recipients, suggest that an improvisational music-making program that enables participants to freely express themselves, and that encourages physical and mental engagement, can have a significant impact on the overall well-being of caregivers and their care recipients living with dementia.

Taken together, Studies 1-3 examined whether psychological and subjective well-being among those with chronic conditions, including dementia, changed following participation in various artistic and/or musical interventions. The next series of studies broaden this analysis, as they examine how social participation, particularly in artistic groups but also compared with other types of groups, might promote health and delay the onset of disease in healthy adults. The subsequent studies also begin to explore what biological and psychological factors might facilitate the relationship between social participation and well-being in older adults.

Study 4

The first three community-based studies recounted here assessed artistic interventions—involving drama, visual art, and especially music. The programs aimed to improve emotional well-being, enhance sociality, and affirm social group identification through music listening and volunteer contact (Study 1), as well as through artistic activities that encouraged socialization with other group members (Studies 2 and 3). Indeed, previous research suggests that the benefits conferred from participating in social activities appear to be determined, in part, by the nature of each activity—for example, whether it is social or physical, stimulating (e.g. educational classes, music playing) or passive (e.g. reading a newspaper, music listening) (Al-Najjar et al., 2015; Pochopsky et al., 2016; Ysseldyk et al., 2013). Indeed, among 800 women followed for 38 years, mid-life engagement in artistic activities was associated with a reduced risk of Alzheimer’s disease, while physical activities were linked with a reduced risk of vascular dementia later in life (Al-Najjar et al., 2015). Similarly, in another large cohort study, only stimulating activities (e.g., artistic endeavors, organizational meetings) were associated with a lowered risk of dementia in those over the age of 65 (Akbaraly et al., 2009).

Improved mental, social, and physical well-being are also reported by those who participate in musical activities such as singing in a choir. For example, while seniors in an intervention (choir) or control group both participated in other physical and/or cultural community activities, those in a choir had lower depression scores and better self-reported health at a two-year follow-up compared to controls (Cohen et al., 2007). In a separate study, adults with either one or more physical and mental health challenges (physical or intellectual disabilities, depression) reported increased connectedness with other group

members, improved social functioning, and better physical health after a year of participating in a choir compared to before they started singing with the group (Dingle et al., 2013).

Increased life satisfaction is also a commonly reported outcome in studies of group interventions (Bohlmeijer, Roemer, Cuijpers, & Smit, 2007; Friedman et al., 2017; Haslam et al., 2008; Ramírez, Ortega, Chamorro, & Colmenero, 2014), including musical ones (Chen, Lin, & Jane, 2009; Haslam et al., 2014). Older adults who participated in an eight-week community intervention, designed to help participants recognize and enjoy positive experience, reported increased life satisfaction, as well as fewer depressive and physical symptoms (Friedman et al., 2017). Similarly, participation in a psychological intervention that encouraged reminiscence, forgiveness, and gratitude resulted in greater life satisfaction and fewer depressive symptoms among adults over the age of 60 (Ramírez et al., 2014). In light of these findings, life satisfaction was included as an outcome measure in the following study to further ascertain the benefits of group participation.

As the nature of an activity often helps to determine the effects it has on physical and mental health, a more detailed analysis of activities was conducted in Study 4 using data from the *Canadian Longitudinal Study on Aging* (CLSA). The CLSA also offered an opportunity to determine the benefits of group participation on a much larger scale, compared to the small sample sizes of Studies 1-3, thereby allowing more confidence in the generalization of research results. Indeed, the nationwide study includes responses from over 51,000 adults between the ages of 45 and 85, and has collected data on a variety of social factors, as well as psychological and physical health. Of particular interest to the present research, participants were asked whether they were involved in musical activities

(e.g. play a musical instrument or sing in a choir). These data, along with measures of physical and mental health, were used to investigate the effects of participating in music groups and how they compare to other social and recreational activities. As seen in Figure 4.1 (and bearing in mind the extensive benefits of music listening and making previously discussed), it was hypothesized that:

- 1) participating in musical activities would be associated with lower incidences of depression and anxiety, better cognitive functioning, and increased life satisfaction compared to participation in other activities, and
- 2) the effects of musical activities on well-being would be increasingly apparent with age, as physical and psychological decline become more likely.

Figure 4.1 Conceptual Model of Relations among Musical and Other Activities (Predictors) and Outcome Variables

Method

Participants and Procedure

Data were obtained from the CLSA following approval from the Carleton University Research Ethics Board-B. The first wave of measurements was collected between 2011 and 2016, and included subjective (e.g. life satisfaction, perceived social status) and objective measures of health (e.g. cognition), as well as social and psychological variables. Social networks (e.g. number of relatives and friends), support (e.g. someone to count on or who can provide advice), and participation in eleven different activities (e.g. musical activities, sports,

charity work, etc.), as well as satisfaction with life (Diener et al., 1985; $\alpha = .84$; used in Study 1b for caregivers) were assessed. Participation in activities was reverse coded such that high scores represented more frequent involvement in each activity. Participants also completed the Center for Epidemiologic Studies Short Depression Scale—Revised (CESD-R) which assessed depressive symptoms ($\alpha = .78$; Radloff et al., 1977; Andresen et al., 1994) and reported whether they received a formal diagnosis of anxiety (dichotomously coded, 0 = no and 1 = yes). Furthermore, memory and executive functioning were measured using the Rey Auditory Verbal Learning Test (RAVLT; Rey, 1964) and Animal Fluency measure (AF; Read, 1987), respectively. For the RAVLT, participants were tested on immediate (RAVLT1) and 5-minute delayed recall (RAVLT2) of 15 words, where each correct recall received one point. The AF asked participants to name as many animals as possible in one minute. See Appendix E for a list of CLSA measures analyzed in this study.

Results

The comprehensive and tracking CLSA datasets were merged to provide a sample of 51,338 participants (50.9% female; 49.1% male). Statistical analysis was performed using SPSS version 23.0 for Mac OS (SPSS Inc., Chicago, IL, USA). Frequency of participation in activities is shown in Table 4.1 below. To provide an overview of the impact of various activities on well-being, correlations between group type and outcomes of interest (life satisfaction, depression, anxiety, and cognition) are also presented in Table 4.2. In a series of bootstrapped, hierarchical weighted least squares regressions, life satisfaction, depression, and measures of cognition were separately regressed onto frequency of group participation (one group at a time) and age while controlling for sex, marital status, and total income—factors known to be possible predictors of well-being (Patten, Wang, & Williams, 2006). While there were significant sex differences in

life satisfaction, depression, anxiety, and cognition (determined using ANOVA and logistic regression, see Table 4.3), moderation analyses revealed that sex did not significantly moderate relationships between different groups and outcomes of well-being. Analytic weights, which account for sampling probabilities and provincial population size, were also included. Incidences of anxiety in relation to the same predictor variables and covariates above were measured using bootstrapped hierarchical logistic regressions. Only select regression tables are presented in the results section below—those regarding activities that account for the most variation in an outcome variable as well as participation in music-making activities. All other tables can be found in Appendix F. Assumptions of independence, linearity, and homoscedasticity of residuals, as well as absence of multicollinearity, were met in all cases with the exception of anxiety probabilities, which is addressed in the appropriate section below. In all procedures, statistical significance was determined at $p < 0.05$ (two-tailed). Due to large sample sizes, correlations were also often significant, and so only those greater than .1 were considered meaningful.

Table 4.1

Frequency of participation in activities among participants of the CLSA.

Activities	Frequency of Participation					Total
	*Once a year or less/ Never/Neve er	*Several times a year/At least once a year/A few times a year	*Several times a month/At least once a month/A few times a month	*Several times a week/ Once a week/A few times a week	*Everyday/ Once a day/Daily	
1. Playing a musical instrument or singing in a choir (music)	39015	1764	2832	3874	1710	49195
2. Playing board games, cards, crossword puzzles, jigsaw puzzles, or Sudoku (games)	11311	5778	6873	9893	16986	50841
3. Family or friendship based activities outside the household (family/friends)	623	4161	19510	24883	2080	51257
4. Church or religious activities such as services, committees or choirs (religious)	23915	9621	5093	12130	487	51246
5. Sports or physical activities that you do with other people (sports)	12319	3766	8369	22444	4351	51249
6. Educational and cultural activities involving other people such as attending courses, concerts, plays, or visiting museums (arts and education)	8092	16675	20818	5276	398	51259
7. Service club or fraternal organization activities—examples include: Lion’s Club, Rotary, Kiwanis Club, Royal Canadian Legion, or Foresters? (clubs)	37984	4331	5732	3032	150	51229
8. Neighbourhood, community or professional association activities (associations)	23840	12435	10462	4107	366	51210
9. Volunteer or charity work (volunteer)	19430	11110	10764	8885	1060	51249
10. How often do you use social networking sites to stay in touch or make plans with friends? (online networking with friends)	137	632	2489	5453	8724	17435
11. How often do you use social networking sites to stay in touch or make plans with family? (online networking with family)	191	749	2630	5508	8266	17344

Note. Responses denoted by an asterisk apply to groups 1-2, while those immediately after the slash and the final responses apply to groups 3-9 and 10-11, respectively. Bolded words will be used to reference activities in text and subsequent tables.

Table 4.2

Bootstrapped correlations between activities, life satisfaction, depression, anxiety, and cognition (RAVLT1, RAVLT2, AF).

	Life Satisfaction	Depression	Anxiety	RAVLT1	RAVLT2	AF
1. Music	.09****	-.03****	0	.07****	.06****	.09****
2. Games	-.01	-.04****	-.01	.07****	.07****	.06****
3. Family/ friends	.18****	-.14****	-.04****	.10****	.08****	.10****
4. Religious	.10****	-.04****	-.04****	-.02****	-.03****	-.10****
5. Sports	.16****	-.17****	-.06****	.11****	.09****	.11****
6. Arts and Education	.24****	-.13****	-.04****	.15****	.12****	.15****
7. Clubs	.11****	-.05****	-.03****	-.04****	-.04****	-.06****
8. Associations	.22****	-.08****	-.04****	.08****	.05****	.08****
9. Volunteer	.23****	-.09****	-.04****	.08****	.06****	.07****
10. Online networking with friends	.02**	.01	0	0	.01	-.03***
11. Online networking with family	.03**	-.01	0	0	0	-.03**

p < .0001

Note. Zero-order correlations are presented for all relations except those between groups and anxiety, which are point-biserial correlations. RAVLT1 and RAVLT2 = Rey Auditory Verbal Learning Test, immediate and delayed recall, respectively; AF = Animal Fluency Test.

Table 4.3

Mean life satisfaction, depression, anxiety, RAVLT1, RAVLT2, and AF scores as a function of sex.

	Life Satisfaction	Depression	Anxiety	RAVLT1	RAVLT2	AF
Male	6.17	1.49	6.0%	5.63	3.86	20.38
Female	5.98	1.57	10.1%	6.48	4.88	19.94
ANOVA/	$F(1, 46128) = 106.05$ *** $R^2 = .002$	$F(1, 51242) = 434.98$ *** $R^2 = .008$	Nagelkerke $R^2 = .013$	$F(1, 48659) = 2137.76$ *** $R^2 = .042$	$F(1, 48518) = 2425.02$ *** $R^2 = .048$	$F(1, 49806) = 69.92$ *** $R^2 = .001$
*** $p < .0001$						

Note. Results were determined using ANOVA for all outcomes except anxiety, for which logistic regressing was employed.

Life satisfaction. As seen in Table 4.2, participation in most groups was associated with greater life satisfaction to some extent; however, participation in sports, outings with family and friends, as well as arts and education, group involvement appeared to be most strongly correlated with life satisfaction scores compared to other activities. In particular, as seen in Table 4.4, involvement in *sports* significantly predicted life satisfaction scores, $F(4, 47920) = 506.81, p < .0001$. In contrast to our hypotheses however, as shown in Table 4.5, partaking in *musical* activities was not meaningfully associated with life satisfaction, $F(4, 46070) = 17.22, p < .0001$.

Table 4.4

Hierarchical weighted least squares regression analyses predicting life satisfaction from sports group participation.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Sports = at least once a year	.18****	.02	.22****	.02	.10****	.02	.04****
	Sports = at least once a month	.44****	.02	.48****	.02	.31****	.02	
	Sports = once a week	.62****	.02	.65****	.02	.44****	.02	
	Sports = once a day	.70****	.02	.73****	.02	.52****	.02	
2	Age			.01****	0	.02****	0	.05****
3	Sex					.08****	.01	.13****
	Married					.47****	.02	
	Widowed					.23****	.03	
	Divorced					-.02	.03	
	Separated					-.27****	.04	
	Total Income = 20,000-<50,000					.51****	.03	
	Total Income = 50,000-<100,000					.75****	.03	
	Total Income = 100,000-<150,000					.94****	.03	1.16****
	Total Income = ≥150,000						.03	

p < .0001

Note. Table displays unstandardized regression coefficients.

Table 4.5

Bootstrapped hierarchical weighted least squares regression analyses predicting life satisfaction from musical activity participation.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Music = several times a year	.08**	.03	.10**	.03	.04	.03	.06****
	Music = several times a month	.11****	.03	.12****	.03	.09****	.02	
	Music = several times a week	.16****	.02	.16****	.02	.13****	.02	
	Music = everyday	.05	.03	.06	.03	.05	.02	
2	Age			.01****	.00	.02****	.00	.06****
3	Sex					.11****	.01	.09****
	Married					.47****	.02	
	Widowed					.21****	.03	
	Divorced					-.02	.03	
	Separated					-.29****	.04	
	Total Income = 20,000-<50,000					.57****	.03	
	Total Income = 50,000-<100,000					.86****	.03	
	Total Income = 100,000-<150,000					1.08****	.03	
	Total Income = ≥150,000					1.32****	.03	

** $p < .01$ **** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Depression. As seen in Table 4.2, there were small but significant negative correlations between participation in different types of activities and depression—the exception was involvement in community groups, which (unexpectedly) was associated with more depressive symptoms. Nonetheless, as shown in Table 4.6, it is worth noting the modest contribution of *sports groups*, which accounted for 3% of the variation in depression scores, $F(4, 47868) = 384.00, p < .0001, R^2 = .03$. even when controlling for age, sex, marital status, and income. In contrast, as Table 4.7 shows, *musical* activities did not meaningfully affect depressive symptoms as hypothesized, $F(4, 46005) = 10.37, p < .0001, R^2 = .001$. However, there were small but highly significant coefficients for participation in musical activities several times a month and

several times a week—when controlling for sociodemographic factors, playing a musical instrument or partaking in a choir was linked to fewer depressive symptoms.

Table 4.6

Bootstrapped hierarchical weighted least squares regression analyses predicting depressive symptoms from sports group participation.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Sports = at least once a year	-.10****	.01	-.11****	.01	-.07****	.01	.03****
	Sports = at least once a month	-.15****	.01	-.16****	.01	-.11****	.01	
	Sports = once a week	-.20****	.01	-.21****	.01	-.16****	.01	
	Sports = once a day	-.23****	.01	-.24****	.01	-.19****	.01	
2	Age			-.002****	.00	-.005****	.00	.03****
3	Sex					.06****	.00	.08****
	Married					-.08****	.01	
	Widowed					-.01	.01	
	Divorced					-.03**	.01	
	Separated					.04*	.02	
	Total Income = 20,000- <50,000					-.18****	.01	
	Total Income = 50,000- <100,000					-.26****	.01	
	Total Income = 100,000- <150,000					-.31****	.01	
	Total Income = ≥150,000					-.35****	.01	

** p < .01 **** p < .0001

Note. Table displays unstandardized regression coefficients.

Table 4.7

Bootstrapped hierarchical weighted least squares regression analyses predicting depressive symptoms from musical group participation.

Step	Predictor	B Step 1	S.E.	B Step 2	S.E.	B Step 3	S.E.	R ²
1	Music = several times a year	-.02	.01	-.02	.01	-.01	.01	.001****
	Music = several times a month	-.03**	.01	-.03***	.01	-.03**	.01	
	Music = several times a week	-.05****	.01	-.05****	.01	-.04****	.01	
	Music = everyday	-.003	.01	-.004	.01	.004	.01	
2	Age			-.001****	.00	-.01****	.00	.001****
3	Sex					.05****	.00	.06****
	Married					-.08****	.01	
	Widowed					-.01	.01	
	Divorced					-.03**	.01	
	Separated					.04**	.02	
	Total Income = 20,000-<50,000					-.20****	.01	
	Total Income = 50,000-<100,000					-.30****	.01	
	Total Income = 100,000-<150,000					-.35****	.01	
	Total Income = ≥150,000					-.41****	.01	
* $p < .05$ ** $p < .01$ *** $p < .001$ **** $p < .0001$								

Note. Table displays unstandardized regression coefficients.

Anxiety. The effect of group participation on anxiety was assessed using bootstrapped hierarchical logistic regression, where sex, marital status, and total income were included as covariates. Age was not linearly related to the logit of anxiety as determined via the Box-Tidwell (1962) procedure. Transformations applied to age did not remedy this issue and so age was categorized for subsequent analyses (1= 45-54; 2= 55-64; 3= 65-74; 4= 75-85).

Music participation alone was not associated with the likelihood of having anxiety, $\chi^2(4) = 2.539$, $p = .64$, and odds did not significantly change as age and covariates were added to the model (Table 4.8). In fact, participation in any social group did not meaningfully predict anxiety

as evidenced by small correlations between variables and Nagelkerke R^2 values less than .01 (see Tables 4.2, 4.8, and Tables 4.33-4.42 in Appendix F).

Table 4.8

Bootstrapped hierarchical logistic regression analyses predicting anxiety from musical group participation.

Step	Predictor	B Step 1	S.E.	Odds Ratio	B Step 2	S.E.	Odds Ratio	B Step 3	S.E.	Odds Ratio	Nagelkerke R^2
1	Music = several times a year	.09	.09	1.10	.04	.09	1.04	.09	.09	1.10	0
	Music = several times a month	-.08	.08	.92	-.09	.08	.91	-.07	.08	.93	
	Music = several times a week	-.02	.06	.98	-.02	.06	.98	.02	.07	1.02	
	Music = everyday	-.04	.10	.96	-.06	.10	.94	.00	.10	1.00	
2	Age (categorical)				-.21****	.02	.81	-.29****	.02	.75	.01****
3	Sex							.47****	.04	1.6	.05****
	Married							-.19***	.06	.83	
	Widowed							-.27***	.08	.77	
	Divorced							-.09	.07	.92	
	Separated							-.14	.11	.87	
	Total Income = 20,000-<50,000							-.73****	.06	.48	
	Total Income = 50,000-<100,000							-.94****	.06	.39	
	Total Income = 100,000-<150,000							-1.15****	.07	.32	
	Total Income = ≥150,000							-2.46****	.08	.23	

*** $p < .001$ **** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Cognition. As will be recalled, the RAVLT1 and RAVLT2 tests measured immediate and delayed recollection of 15 words, respectively, while AF involved participants naming as many animals as possible in one minute.

Most activities had a small but significant impact on RAVLT and AF scores (Table 4.2). Once again, however, the greatest effects appeared to be exhibited by *arts and education* groups (RAVLT1, $F(4, 45577) = 327.39, p < .0001, R^2 = .03$; RAVLT2, $F(4, 45442) = 209.35, p < .0001, R^2 = .02$; AF, $F(4, 46587) = 384.14, p < .0001, R^2 = .03$). As expected, memory and executive functioning scores also significantly changed with age; the effects of age on cognition were more pronounced than those of group participation and can be seen in Tables 4.9, 4.11, and 4.13, when age is added to the model following *arts and education* group participation.

Table 4.9

Bootstrapped hierarchical weighted least squares regression analyses predicting RAVLT1 scores from arts and education group participation and age.

Step	Predictor	B Step 1	S.E.	B Step 2	S.E.	B Step 3	S.E.	R ²
1	Arts and education = at least once a year	.83****	.03	.62****	.03	.47****	.03	.03****
	Arts and education = at least once a month	1.05****	.03	.86****	.03	.62****	.03	
	Arts and education = once a week	1.06****	.04	.94****	.04	.69****	.04	
	Arts and education = once a day	1.23****	.10	.90****	.10	.73****	.10	
2	Age			-.05****	0	-.04****	0	.09****
3	Sex					.93****	.02	.14****
	Married					.01	.04	
	Widowed					-.02	.05	
	Divorced					.10*	.05	
	Separated					.02	.07	
	Total Income = 20,000-<50,000					.46****	.05	
	Total Income = 50,000-<100,000					.74****	.05	
	Total Income = 100,000-<150,000					.88****	.05	
	Total Income = ≥150,000					1.04****	.05	

* $p < .05$ **** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.10

Hierarchical weighted least squares regression analyses predicting RAVLT1 scores from music group participation.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Music = several times a year	.57****	.05	.44****	.05	.37****	.08	.01****
	Music = several times a month	.47****	.04	.44****	.04	.41****	.05	
	Music = several times a week	.44****	.04	.45****	.04	.45****	.04	
	Music = everyday	.34****	.05	.30****	.05	.40****	.04	
2	Age			-.05****	0	-.04****	0	.07****
3	Sex					.97****	.02	.14****
	Married					-.04	.04	
	Widowed					-.05	.05	
	Divorced					.10*	.05	
	Separated					-.01	-.01	
	Total Income = 20,000-<50,000					.54****	.05	
	Total Income = 50,000-<100,000					.90****	.05	
	Total Income = 100,000-<150,000					1.09****	.05	
	Total Income = ≥150,000					1.27****	.05	

* $p < .05$ **** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.11

Bootstrapped hierarchical weighted least squares regression analyses predicting RAVLT2 scores

from arts and education group participation and age.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Arts and education = at least once a year	.75****	.04	.50****	.03	.38****	.03	.02****
	Arts and education = at least once a month	.94****	.03	.73****	.03	.52****	.03	
	Arts and education = once a week	1.01****	.05	.87****	.04	.65****	.04	
	Arts and education = once a day	1.08****	.12	.72****	.12	.58****	.11	
2	Age			-.06****	.00	-.05****	.00	.08****
3	Sex					1.09****	.02	.13****
	Married					-.06	.04	
	Widowed					-.04	.06	
	Divorced					.05	.05	
	Separated					.04	.08	
	Total Income = 20,000-<50,000					.45****	.05	
	Total Income = 50,000-<100,000					.70****	.05	
	Total Income = 100,000-<150,000					.84****	.06	
	Total Income = ≥150,000					.89****	.06	

* $p < .05$ ** $p < .01$ *** $p < .001$ **** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.12

Hierarchical weighted least squares regression analyses predicting RAVLT2 scores from music group participation.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Music = several times a year	.52****	.06	.37****	.06	.30****	.05	.01****
	Music = several times a month	.41****	.05	.37****	.05	.34****	.04	
	Music = several times a week	.41****	.04	.42****	.04	.43****	.04	
	Music = everyday	.41****	.06	.36****	.06	.48****	.06	
2	Age			-.06****	0	-.05****	0	.07****
3	Sex					1.13***	.02	.13****
	Married					-.09*	.04	
	Widowed					-.05	.06	
	Divorced					.07	.05	
	Separated					.02	.08	
	Total Income = 20,000-<50,000					.52****	.05	
	Total Income = 50,000-<100,000					.84****	.05	
	Total Income = 100,000-<150,000					1.03****	.06	
	Total Income = ≥150,000					1.09****	.06	

* $p < .05$ **** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.13

Bootstrapped hierarchical weighted least squares regression analyses predicting AF scores from arts and education group participation and age.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Arts and education = at least once a year	2.43****	.09	1.67****	.08	1.22****	.08	.03****
	Arts and education = at least once a month	3.19****	.08	2.50****	.08	1.84****	.08	
	Arts and education = once a week	2.95****	.11	2.53****	.11	1.95****	.11	
	Arts and education = once a day	3.48****	.29	2.34****	.27	1.78****	.27	
2	Age			-.18****	.00	-.15****	.00	.12****
3	Sex					-.17***	.05	.14****
	Married					-.30**	.10	
	Widowed					-.36*	.14	
	Divorced					.29*	.13	
	Separated					.11	.19	
	Total Income = 20,000-<50,000					.96****	.13	
	Total Income = 50,000-<100,000					2.00****	.13	
	Total Income = 100,000-<150,000					2.70****	.14	
	Total Income = ≥150,000					3.27****	.14	

* $p < .05$ ** $p < .01$ *** $p < .001$ **** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.14

Hierarchical weighted least squares regression analyses predicting AF scores from music group participation.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Music = several times a year	1.53****	.14	1.04****	.13	.90****	.13	.01****
	Music = several times a month	1.19****	.12	1.06****	.11	1.02****	.11	
	Music = several times a week	1.38****	.10	1.37****	.10	1.35****	.10	
	Music = everyday	1.64****	.15	1.46****	.14	1.44****	.14	
2	Age			-.19****	0	-.15****	0	.11****
3	Sex					-.06	.05	.14****
	Married					-.43****	.10	
	Widowed					-.42**	.15	
	Divorced					.33*	.13	
	Separated					.06	.19	
	Total Income = 20,000-<50,000					1.23****	.13	
	Total Income = 50,000-<100,000					2.53****	.13	
	Total Income = 100,000-<150,000					3.40****	.14	
	Total Income = ≥150,000					4.03****	.14	
* <i>p</i> < .05 ** <i>p</i> < .01 *** <i>p</i> < .0001								

Note. Table displays unstandardized regression coefficients.

Discussion

The CLSA data allowed for a high-powered analysis of the effects of group participation on well-being amongst older adults. Participation in different types of social groups, as well as musical and other artistic activities, was generally associated with improved well-being outcomes, including greater life satisfaction, fewer depressive symptoms, less anxiety, and better cognition.

At first glance, however, it appeared that results from this study did not support our original hypothesis, given that our main variable of interest (i.e. “playing a musical instrument or singing in a choir”) was not strongly related to any measure of well-being. Yet, a recent study that asked the same question revealed a link between music playing and improved working

memory and processing speed (Mansens, Deeg, & Comijs, 2017). These seemingly contradictory findings may be explained by differences in how the question was coded—Mansens and colleagues (2017) were able to look at the benefits of music playing and choir singing separately, while the CLSA data combined individuals who took part in either (or both) of these activities to generate a single variable indicating participation in music-making. Playing an instrument and choir singing have both been positively correlated to improvements in physical, psychological, and social well-being (Moss, Lynch, & O'Donoghue, 2018; Schellenberg, 2004; Schladt et al., 2017), but they may target different cognitive and psychosocial domains (Miendlarzewska & Trost, 2014).

The effects of music-making may also depend on the social aspect of each activity, or lack thereof. Playing an instrument is often a *solitary* act and has been linked to a reduced risk of dementia and cognitive impairment (Balbag, Pedersen, & Gatz, 2014), as well as improved working memory (Mansens, Deeg, & Comijs, 2017). Fewer depressive and anxious symptoms, as well as improved life satisfaction, are often linked to *social* musical activities, such as singing in a choir (Coulton, Clift, Skingley, & Rodriguez, 2015; Moss et al., 2018; Schladt et al., 2017), and these reported health outcomes are correlated with improved social functioning (Pearce, Launay, Machin, & Dunbar, 2016; Stewart & Lonsdale, 2016). Therefore, grouping individuals that play musical instruments with those who sing in a choir—a combination of social and (potentially) non-social activities—may have obscured our results.

In a similar fashion, combining educational and cultural activities (e.g. attending courses, concerts, plays) in the same category precluded us from identifying the specific contribution of artistic group participation to well-being. However, our results clearly identified this group type as having some of the most beneficial effects on well-being (compared to other groups),

including memory, executive functioning, and life satisfaction. Other Canadian data suggests that these effects are likely due to involvement in cultural, rather than educational, activities. For example, the final report of the Canadian Adult Literacy and Life Skills Survey revealed that participation in adult education sharply declined with age, from 34% (aged 56-60), to 20% (aged 61-65), to 13% (aged 66-70), to 7% (aged 71-75) (Statistics Canada, 2008). Meanwhile (as seen in Table 4.1), almost all participants in the CLSA took part in educational and cultural activities. Therefore, it is conceivable that most of these individuals were involved in some type of cultural rather than—or at least in addition to—educational activities.

Given frequent reports of the emotional benefits of artistic group participation (Hallam & Creech, 2016; Schnakers et al., 2016), it is surprising that only sport groups had an impact on depressive symptoms and anxiety diagnoses—and even for sports group the effects were small. Indeed, it is possible that factors beyond simple group membership, namely psychosocial group factors such as social group identification, as well as genetic factors (e.g. SNPs) might better explain relations between group memberships, depression and anxiety. As previously discussed, numerous studies have revealed the role of social identity in the (positive) relations between groups and well-being (Cruwys et al., 2014; Ysseldyk et al., 2014) and SNPs have been reported to moderate social functioning (Montag et al., 2008; Taschereau-Dumouchel et al., 2016). Therefore, these factors should be taken into account in future analyses.

Study 5

In addition to the types of groups with which people participate and identify, the ability to connect with others and form relationships appears to be partly influenced by genetic factors (Chang et al., 2014; Karlsson et al., 2016; Skuse et al., 2014). As previously described, polymorphisms on genes that code for various hormones and neurotransmitter have been linked to different aspects of social functioning (Algoe & Way, 2014; Chang et al., 2014; Hildebrandt et al., 2016; McQuaid et al., 2015). For example, a SNP on CD38 (rs6449182), a protein which affects oxytocin secretion, was linked to gratitude towards a partner and relationship satisfaction (Algoe & Way, 2014). In a separate study, a SNP on the oxytocin receptor (rs237887) was associated with facial recognition memory (Skuse et al., 2014). Genetic polymorphisms have also been linked to subjective measures of well-being, including life satisfaction (Bartels, 2015; De Neve, Christakis, Fowler, Frey, 2012; Minkov & Bond, 2017; Rietveld et al., 2013). Indeed, a genome-wide association study revealed that anywhere from 5-18% of the variance in such measures can be explained by genetic polymorphisms (Rietveld et al., 2013). A few specific genetic variants have been identified in this context; for example, the longer, more transcriptionally active variant of the serotonin transporter gene was associated with increased life satisfaction (De Neve et al., 2012). A genome-wide association study also revealed a link between life satisfaction, positive affect, or a combination of both measures, and three SNPs (rs3756290, rs2075677, rs4958581) on genes coding for proteins involved in various cell signaling pathways (Okbay et al., 2016).

As noted earlier, the role of growth factors in cognitive functioning may also have some bearing on how social interactions are perceived, internalized, and remembered, and whether they lead to improved feelings of subjective well-being. While the role of BDNF, IGF-1 and

FGF on these and other social processes is unclear, given their influence on brain plasticity (Maass et al., 2016; Voss et al., 2013; Weissleder et al., 2016), SNPs on genes for growth factors may influence social cognitive processes, thereby affecting individual social experiences and perceptions of life satisfaction.

While Studies 1-4 investigated associations among artistic and/or musical group memberships, social factors (e.g. relationships with others, social network) and well-being, the present study aimed to extend this narrative by determining whether genetic polymorphisms on genes for BDNF, IGF-1, and FGF moderated the relationship between artistic group memberships and life satisfaction, depression, anxiety, and cognition. To investigate this possibility, a portion of the data from the *English Longitudinal Study of Ageing* (ELSA) were obtained. This comprehensive dataset includes biological (e.g. genetic polymorphisms, blood and salivary cortisol), physical (e.g. weight, grip strength), and psychosocial variables (e.g., life satisfaction, group memberships) collected from individuals over the age of 50 and followed for 13 years. Musical groups memberships are included in a broader category of creative and engaging groups that also involve educational and visual arts classes. Thus, the effects of musical activities on well-being could not be isolated as they were in previous studies. However, the size and comprehensiveness of this dataset provided an opportunity to determine the role of genetic factors in moderating the effects of group memberships on overall well-being. Thus, as displayed in Figure 5.1, it was hypothesized that:

- 1) Compared to other activities, artistic group memberships would be the most beneficial to well-being over time.
- 2) Polymorphisms on genes for BDNF, FGF, and IGF-1 would moderate the relationship between group memberships and life satisfaction, depression, anxiety, and cognition.

Figure 5.1 Conceptual Moderator Model of Relations among Artistic and Other Group Memberships (Predictor) and Outcome Variables as a Function of SNPs (Moderator)

Method

Participants and Procedure

Data were obtained from the English Longitudinal Study of Ageing (ELSA) following approval from the Carleton University Research Ethics Board-B. Beginning in 2002, individuals living in England were surveyed every other year, for thirteen years (seven waves; 53.8% female; 46.2% male). Additional participants were recruited at waves 3, 4, and 6 for a total of 7407 study participants. Measurements collected between 2002 and 2015 (waves 1-7) included objective and subjective health measures (e.g. anxiety diagnosis, depressive symptoms), psychosocial measures (e.g. life satisfaction, social groups), and genetic variables (SNPs on BDNF, IGF-1, FGF, and other genes). Appendix G contains all ELSA measures analyzed in this study.

For each social group, participation in all seven waves of data collection was coded as 1 and participation in no waves was coded as 0. Likewise, anxiety was coded dichotomously such that 0 signified no diagnosis and 1 confirmed a diagnosis. A modified version of the CESD scale that includes dichotomous responses for ease of interviewing (Steffick, 2000), was used to measure depressive symptoms (see Appendix G). Responses were averaged (“yes” was coded as

1, positive items were reverse scored) to produce a final CESD score such that higher values indicated more symptoms of depression (wave 1, $\alpha = .96$; wave 2, $\alpha = .96$; wave 3, $\alpha = .95$; wave 4, $\alpha = .98$; wave 5, $\alpha = .98$; wave 6, $\alpha = .97$; wave 7, $\alpha = .98$). Lastly, responses to the life satisfaction questionnaire (Diener et al., 1985; available in waves 2-7) were reverse scored and averaged such that higher scores signified greater life satisfaction (wave 2, $\alpha = .90$; wave 3, $\alpha = .90$; wave 4, $\alpha = .89$; wave 5, $\alpha = .90$; wave 6, $\alpha = .90$; wave 7, $\alpha = .90$).

Results

As in Study 4, statistical analyses were performed using SPSS. Correlations between participation in each of the eight groups and life satisfaction, depression, anxiety diagnoses, and cognition are found in Tables 5.1-5.6. Repeated measures analyses of covariance (ANCOVA) were conducted to assess changes in life satisfaction and cognition as a function of participation in eight different groups; political, neighbourhood, religious, charity, arts and education, social, sports, and other groups (assessed separately). Repeated measures ANCOVAs were also used to determine the moderating role of SNPs on genes for growth factors of interest (BDNF, IGF, and FGF). However, since frequencies of SNPs are known to vary by ethnicity (Risch, 2000), genetic analyses were only conducted in Caucasians. Non-Caucasians were grouped in a single “non-white” category by the ELSA committee, thus preventing analyses of the moderating role of SNPs across different ethnic groups. Polymorphisms on IGF-1 (rs7136446, $\chi^2 = 2.85$), BDNF (rs6265, $\chi^2 = 3.57$; rs1157659, $\chi^2 = 2.83$), and FGF-2 (rs1048201, $\chi^2 = .25$) met Hardy-Weinberg equilibrium expectations ($\chi^2 < 3.84$), while a SNP on FGF receptor 2 did not (rs1219648, $\chi^2 = 3.86$) and was therefore removed from analysis (calculations can be found in Appendix I). Due to the small number of individuals participating in any activity for all seven waves ($Ns = 66-387$), an interaction between group type and SNPs could not be established longitudinally; therefore,

these factors were assessed separately over time and interactions between them were only analyzed in Wave 7, which included pre-existing study members and newly recruited participants. Time until diagnosis (number of waves) was calculated for depression and anxiety, and analyzed as a function of group participation (number of waves). Birth year and sex were included as covariates in all analyses as they were significantly related to life satisfaction and cognition⁸. Analyses also included weights to adjust for demographic differences between survey responders and non-responders. Statistical significance was determined at $p < 0.05$ (two-tailed) for all analyses and assumptions of sphericity, independence of covariate and treatment effects, and homogeneity of regression slopes were met. As in Study 4, correlations were often significant due to large sample sizes, and so only those greater than .1 were considered meaningful.

⁸ Unlike Study 4, income and marital status were not included as covariates because they drastically reduced the sample size for repeated measures ANCOVAs.

Table 5.1

Zero-order correlations between group participation and life satisfaction across seven waves.

Group Type	Life Satisfaction					
	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6	Wave 7
Political party, trade union, or environmental group (political) (total $N = 1758$)	.03	.03	.03	.04	.01	.03
Tenants groups, resident groups, neighbourhood watch (neighbourhood) (total $N = 1554$)	.02	.04	.04	.03	.04	.02
Church or other religious group (religious) (total $N = 2075$)	.09****	.11****	.10****	.09****	.09****	.07**
Charitable associations (charity) (total $N = 1412$)	.04	.04	.03	.03	.06*	.05*
Education, arts or music groups or evening classes (arts and education) (total $N = 1696$)	.04	.04	.03	.04	.04*	.04
Social clubs (social) (total $N = 1460$)	.01	.01	0	.01	.05*	.03
Sports clubs, gyms, exercise classes (sports) (total $N = 2477$)	.07****	.05**	.06**	.08****	.08****	.08****
Any other organizations, clubs or societies (other) (total $N = 1084$)	.03	.03	.02	.03	.04	.06*
* $p < .05$ ** $p < .01$ *** $p < .0001$						

Note. Bolded words will be used to reference activities in text and subsequent tables.

Zero-order correlations between group participation and depression across seven waves.

Group Type	Depression						
	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6	Wave 7
Political (total $N = 2316$)	-.06**	-.06**	-.04	-.03	-.05*	-.03	-.06**
Neighbourhood (total $N = 2025$)	-.07**	-.04	-.05*	-.05*	-.04*	-.03	-.03
Religious (total $N = 2582$)	-.07**	-.06**	-.06**	-.04*	-.07**	-.04*	-.07****
Charity (total $N = 1896$)	-.05	-.03	-.06*	-.01	-.03	-.02	-.05*
Arts and education (total $N = 2230$)	-.07**	-.05*	-.05*	-.02	-.06**	-.03	-.07**
Social (total $N = 1884$)	-.05*	-.04	-.03	-.02	-.06*	-.04	-.02
Sports (total $N = 3223$)	-.07****	-.07****	-.06**	-.06****	-.08****	-.07****	-.08****
Other (total $N = 1430$)	-.07**	-.08**	-.10****	-.08**	-.09**	-.10****	-.09**

* $p < .05$ ** $p < .01$ *** $p < .001$ **** $p < .0001$

Table 5.3

Point-biserial correlations between group participation and anxiety across seven waves.

Group Type	Anxiety						
	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6	Wave 7
Political (total $N = 2219$)	.01	0	.01	.04*	.02	.04*	.03
Neighbourhood (total $N = 1940$)	.01	-.01	0	-.03	-.03	-.02	.01
Religious (total $N = 2482$)	.01	0	-.01	-.01	-.02	0	0
Charity (total $N = 1826$)	0	-.01	-.02	-.01	-.02	-.03	-.03
Arts and education (total $N = 2153$)	0	0	0	.01	-.01	.03	.02
Social (total $N = 1800$)	-.04	.02	-.01	0	-.02	-.01	-.03
Sports (total $N = 3094$)	-.01	.04*	0	-.01	-.02	0	0
Other (total $N = 1387$)	.02	-.02	-.02	-.01	-.03	-.03	-.04

* $p < .05$

Table 5.4

Zero-order correlations between group participation and RAVLT1 across seven waves.

Group Type	RAVLT1						
	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6	Wave 7
Political (total $N = 2325$)	.08****	.07**	.08****	-.08****	-.06**	-.08****	.13****
Neighbourhood (total $N = 2032$)	.08**	.04	.10****	.08****	-.03	.07**	.07**
Religious (total $N = 2597$)	.06**	.03	.08****	.06**	.06**	-.07****	.06**
Charity (total $N = 1907$)	.09****	.11****	.09****	.06**	.08**	.13****	.11****
Arts and education (total $N = 2240$)	.08****	.11****	.10****	.12****	.11****	.08****	.10****
Social (total $N = 1895$)	0	0	0	.01	.02	.02	-.01
Sports (total $N = 3245$)	.09****	.07****	.09****	.09****	.07****	.11****	.10****
Other (total $N = 1439$)	.09**	.03	.09**	.08**	.07*	.07*	.10****
* $p < .05$ ** $p < .01$ **** $p < .0001$							

Note. RAVLT1 = Rey Auditory Verbal Learning Test 1, Immediate Recall

Table 5.5

Zero-order correlations between group participation and RAVLT2 across seven waves.

Group Type	RAVLT2						
	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6	Wave 7
Political (total $N = 2331$)	.08***	.08***	.09***	.10***	.09***	.07***	.11***
Neighbourhood (total $N = 2037$)	.07**	.06*	.10****	.08****	.06**	.07**	.10****
Religious (total $N = 2603$)	.05*	.07****	.08****	.07****	.07**	.07**	.06**
Charity (total $N = 1911$)	.08**	.10****	.12****	.08****	.08**	.08****	.11****
Arts and education (total $N = 2243$)	.09****	.12****	.11****	.11****	.10****	.08****	.11****
Social (total $N = 1898$)	.01	0	.02	.01	.01	.02	0
Sports (total $N = 3249$)	.07****	.08****	.11****	.10****	.10****	.11****	.11****
Other (total $N = 1444$)	.07**	.08**	.09**	.08**	.07**	.09**	.09**
* $p < .05$ ** $p < .01$ **** $p < .0001$							

Note. RAVLT2 = Rey Auditory Verbal Learning Test 2, Delayed Recall

Table 5.6

Zero-order correlations between group participation and Animal Fluency scores for waves 1-5 and 7.

Group Type	AF					
	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5	Wave 7
Political (total $N = 3025$)	.13***	.10***	.12***	.12***	.11***	.13***
Neighbourhood (total $N = 2610$)	.07****	.07****	.09****	.07****	.07****	.09****
Religious (total $N = 3287$)	.06**	.05**	.04*	.05**	.04*	.05**
Charity (total $N = 2475$)	.11****	.07**	.09****	.10****	.11****	.10****
Arts and education (total $N = 2872$)	.11****	.10****	.10****	.10****	.10****	.12****
Social (total $N = 2463$)	-.01	.02	-.01	.03	0	.01
Sports (total $N = 2469$)	.14****	.16****	.15****	.15****	.18****	.18****
Other (total $N = 1883$)	.14****	.11****	.10****	.11****	.12****	.14****
* $p < .05$ ** $p < .01$ *** $p < .0001$						

Life satisfaction. Repeated measures ANCOVA revealed a main effect for participation in *religious, arts and education*, and *sports* (Table 5.7), such that members reported significantly greater life satisfaction scores compared to non-members (see Figure 5.2). There was also a significant main effect for time in all analyses ($p < .0001$), although life satisfaction scores increased or decreased only slightly with each wave, remaining relatively stable across time (see Figure 5.2). In contrast, analyses revealed no significant interactions between time and group participation.

Table 5.7

Repeated measures ANCOVA main effects of group participation on life satisfaction.

Group Type	<i>F(df)</i>	Partial eta squared	<i>M</i> (members)	<i>SD</i>	<i>M</i> (non-members)	<i>SD</i>
Political	.94(1, 1754)	.001	5.33	.98	5.14	1.05
Neighbourhood	2.24(1, 1550)	.001	5.31	.91	5.12	1.07
Religious	23.89(1, 2071) ****	.011	5.46	.87	5.13	1.06
Charity	3.55(1, 1408)	.003	5.35	1.06	5.11	1.06
Arts and education	5.35(1, 1692) *	.003	5.44	.96	5.14	1.04
Social	.33(1, 1456)	0	5.21	1.09	5.10	1.07
Sports	17.84(1, 2473) ****	.007	5.53	.86	5.15	1.04
Other	1.48(1, 1080)	.001	5.31	1.02	5.10	1.08

* $p < .05$ **** $p < .0001$

Figure 5.2. Mean life satisfaction among individuals participating in different groups across seven waves. Black lines illustrate members of a group and grey lines illustrate non-members. Error bars represent 95% confidence intervals and * denotes a significant main effect for group participation.

Depression. Depressive symptoms measured using the CESD were assessed via ANCOVA to reveal whether they differed as a function of group participation. As seen in Table 5.8 and Figure 5.3, there were significant main effects for all but *social* groups on depression, although they were small. For each analysis, there was also a main effect for time ($p < .01$), although, as for life satisfaction, no clear trends emerged across all seven waves—depression scores only marginally increased and decreased over time. However, there were no interactions between time and group participation.

Table 5.8

Repeated measures ANCOVA main effects of group participation on depression.

Group Type	$F(df)$	Partial eta squared	M (members)	SD	M (non-members)	SD
Political	5.43(1, 2312)*	.002	.12	.13	.18	.18
Neighbourhood	11.55(1, 2021)**	.006	.13	.13	.18	.18
Religious	29.49(1, 2578)****	.011	.13	.14	.17	.18
Charity	7.07(1, 1892)**	.008	.14	.17	.18	.18
Arts and education	24.54(1, 2226)****	.011	.11	.11	.18	.18
Social	2.39(1, 1880)	.001	.10	.12	.17	.18
Sports	25.78(1, 3219)****	.008	.10	.12	.17	.18
Other	15.40(1, 1426)****	.011	.10	.12	.19	.19

* $p < .05$ ** $p < .01$ **** $p < .0001$

Figure 5.3. Mean depression scores among individuals participating in different groups across seven waves. Black lines illustrate members of a group and grey lines illustrate non-members. Error bars represent 95% confidence intervals and * denotes a significant main effect for group participation.

Anxiety. Time to anxiety diagnosis as a function of group type was determined using ANCOVAs. Participation in any group was not significantly linked to anxiety, although members of *political* ($p = .054$) and *arts and education* ($p = .053$) groups tended to report an anxiety diagnosis later than participants who were not a part of these groups (Table 5.9, Figure 5.4). Although not significant, *neighbourhood*, *religious*, *charity*, and *other* group participation was linked to sooner reports of anxiety—samples sizes for group participants were very small, however, and so results from these underpowered analyses should be carefully appraised.

Table 5.9

Repeated measures ANCOVA main effects of group participation on time until anxiety diagnosis.

Group Type	$F(df)$	Partial eta squared	M (members)	SD	M (non-members)	SD
Political	3.77(1, 188)	.020	2.02	1.94	1.08	1.64
Neighbourhood	.16(1, 173)	.001	.68	1.46	.98	1.55
Religious	1.73(1, 209)	.008	.80	1.29	1.26	1.70
Charity	.74(1, 139)	.005	.49	.97	1.03	1.53
Arts and education	3.79(1, 155)	.024	2.32	2.07	1.12	1.60
Social	.06(1, 172)	0	1.32	1.43	1.15	1.68
Sports	.32(1, 276)	.001	1.35	1.62	1.12	1.61
Other	1.18(1, 120)	.010	.33	.94	1.09	1.69

Figure 5.4. Mean time to anxiety diagnosis (number of waves) as a function of group participation during all (member) or no waves (non-member). Error bars represent 95% confidence intervals.

Cognition. As with the CLSA, memory and executive functioning were measured using the RAVLT (Rey, 1964) and AFT (Read, 1987), respectively. Memory scores were obtained at all waves, while executive functioning was measured during waves 1-5 and 7. Repeated measures ANCOVAs revealed differences in memory as a function of all groups with the exception of *social* groups (Figure 5.5, 5.6). As seen in Tables 5.10 and 5.11, participation in *arts and education* groups explained the greatest amount of variation in RAVLT1 and RAVLT2 scores, respectively. There was also a significant main effect for time in all analyses regarding RAVLT1 and RAVLT2 scores ($p < .0001$), albeit, once again, no trends were evident over time. As seen in Figure 5.5 and 5.6, memory scores slightly increased or decreased with each wave. Finally, there was a significant interaction between time and participation in *sports* groups on RAVLT2 scores. Members of *sports* groups had slightly higher memory scores at wave 7 compared to wave 1, while non-members of these groups had lower memory scores at wave 7 compared to wave 1 (Figure 5.6).

Table 5.10

Repeated measures ANCOVA main effects of group participation on RAVLT1 scores.

Group Type	<i>F(df)</i>	Partial eta squared	<i>M</i> (members)	<i>SD</i>	<i>M</i> (non-members)	<i>SD</i>
Political	31.07(1, 2321)****	.013	6.49	1.14	5.74	1.21
Neighbourhood	31.93(1, 2028)****	.015	6.29	1.05	5.76	1.25
Religious	44.95(1, 2593)****	.017	6.15	1.11	5.85	1.20
Charity	47.11(1, 1903)****	.024	6.46	1.02	5.71	1.22
Arts and education	66.84(1, 2236)****	.029	6.67	1.06	5.64	1.20
Social	.02(1, 1891)	0	5.96	1.03	5.89	1.25
Sports	45.54(1, 3241)****	.014	6.51	1.11	5.79	1.22
Other	26.94(1, 1435)****	.018	6.23	1.05	5.64	1.23

 $p < .0001$

Note. RAVLT1 = Rey Auditory Verbal Learning Test 1, Immediate Recall

Figure 5.5. Mean RAVLT1 scores among individuals participating in different groups across five waves. Black and grey lines illustrate members and non-members of a group, respectively. Error bars represent 95% confidence intervals and * denotes a significant main effect for group participation.

Table 5.11

Repeated measures ANCOVA main effects of group participation on RAVLT2 scores.

Group Type	<i>F(df)</i>	Partial eta squared	<i>M</i> (members)	<i>SD</i>	<i>M</i> (non-members)	<i>SD</i>
Political	32.11(1, 2327)****	.014	5.40	1.33	4.45	1.52
Neighbourhood	39.20(1, 2033)****	.019	5.21	1.27	4.48	1.56
Religious	46.89(1, 2599)****	.018	4.98	1.45	4.59	1.50
Charity	36.79(1, 1907)****	.019	5.30	1.32	4.43	1.53
Arts and education	59.76(1, 2239)****	.026	5.56	1.49	4.33	1.49
Social	.07(1, 1894)	0	4.73	1.37	4.62	1.56
Sports	45.88(1, 3245)****	.014	5.42	1.31	4.52	1.54
Other	25.34(1, 1440)****	.017	5.08	1.24	4.32	1.54

p < .0001

Note. RAVLT2 = Rey Auditory Verbal Learning Test 2, Delayed Recall

Figure 5.6. Mean RAVLT2 scores among individuals participating in different groups across five waves. Black and grey lines illustrate members and non-members of a group, respectively. Error bars represent 95% confidence intervals and * denotes a significant main effect for group participation.

As was the case for RAVLT1 and RAVLT2, there was a main effect for participation in all groups, with the exception of *social* groups, such that members had higher AF scores compared to non-members. There was also a significant main effect for time on AF scores for all analyses (Table 5.12, Figure 5.7; $p < .0001$), albeit, and as was the case for all previous health outcomes, no clear trends in cognition scores were apparent between wave 1 and 7. Participation in *neighbourhood* and *sports* groups, however, did interact with time (*neighbourhood*, $F(1, 2606) = 4.59, p < .05$; *sports*, $F(1, 2465) = 6.40, p < .05$). Members of these groups had similar cognition scores at wave 7 and wave 1, while non-members had significantly lower cognition scores at wave 7 compared to wave 1 (*neighbourhood*, M difference between wave 1 and 7 scores = .86, $p < .0001$; *sports*, M difference between wave 1 and 7 scores = 1.15, $p < .0001$).

Table 5.12

Repeated measures ANCOVA main effects of group participation on Animal Fluency scores.

Group Type	$F(df)$	Partial eta squared	M (members)	SD	M (non-members)	SD
Political	52.79(1, 3021)****	.017	24.24	4.88	20.02	5.17
Neighbourhood	42.74(1, 2606)****	.016	22.75	5.08	20.30	5.45
Religious	30.70(1, 3283)****	.009	21.69	4.84	20.77	5.28
Charity	51.45(1, 2471)****	.020	22.93	4.99	19.92	5.23
Arts and education	90.85(1, 2868)****	.031	24.17	5.37	19.83	5.22
Social	.003(1, 2459)	0	20.88	4.53	20.66	5.50
Sports	84.80(1, 2465)****	.033	23.80	5.31	19.74	5.30
Other	42.88(1, 1879)****	.022	23.11	4.60	19.46	5.20

**** $p < .0001$

Note. AF = Animal Fluency

Figure 5.7. Mean executive functioning scores among individuals participating in different groups during waves 3 and 5. Black and grey lines illustrate members and non-members of a group, respectively. Error bars represent 95% confidence intervals and * denotes a significant main effect for group participation.

The Moderating Role of SNPs. Analyses of the links to the polymorphisms revealed no main effects or interactions between SNPs of interest and group participation on life satisfaction, depression, anxiety, and cognition. For this reason, and pursuant to the exploratory nature of this portion of the study, other psychosocial outcome variables were analyzed as a function of SNPs and group participation—they included perceived social status (Diener et al., 1985), ability to concentrate, and feelings of confidence and happiness (Goldberg & Hillier, 1979; see Appendix G). Analyses revealed a main effect for an IGF-1 SNP on perceived social status over time. In particular, homozygous carriers of the IGF-1 SNP (CC; $N = 381$; rs7136446) had significantly lower self-perceived social status, $F(1, 2177) = 3.45, p < .05$ (Figure 5.8A), compared to carriers of the dominant T allele.

In wave 7, there was a main effect for group participation (*political*, $F(1, 3648) = 5.71, p < .05$; *arts and education*, $F(1, 3648) = 56.65, p < .0001$) and a main effect for the IGF-SNP on perceived social status (*political*, $F(2, 3648) = 5.48, p < .01$; *arts and education*, $F(2, 3648) = 6.37, p < .01$). Participants in either group reported higher perceived social status compared to non-members (*political*, M difference = 2.20; *arts and education*, M difference = 6.84). Among members and non-members of *political* groups, homozygous carriers of the IGF-1 dominant allele also had greater perceived social status scores compared to heterozygotes, M difference = 1.34, $p < .05$, and homozygous carriers of the SNP, M difference = 4.09, $p < .05$. This was true for members and non-members in *arts and education* groups as well, such that individuals homozygous for the IGF-1 dominant allele reported greater perceived social status compared to heterozygotes, M difference = 1.24, $p < .05$, or individuals carrying two copies of the SNP, M difference = 4.02, $p < .05$. Intriguingly, there was an interaction between *political* groups and the IGF-1 SNP, $F(2, 3648) = 4.01, p < .05$, such that perceived social status varied as a function of

group participation for carriers of the dominant T allele, whereas individuals homozygous for the SNP had more similar perceived social status scores regardless of whether they were involved in political groups (Figure 5.9A). This was also the case for participation in *arts and education* groups, $F(2, 3648) = 3.86, p < .05$ (Figure 5.10A)⁹.

In contrast to the findings regarding IGF-1, there were no main effects or interactions between group participation and SNPs on BDNF (rs6265, rs1157659) and FGF-2 (rs1048201) genes.

⁹ It is important to note that 17.7% (1309) of ELSA participants were homozygous for the IGF-1 SNP (rs7136446) and when group participation was included as a factor in analyses, the N of those homozygous for this SNP was lower. There were 78 and 86 homozygotes for the SNP that participated in political and arts and education groups, respectively.

Figure 5.8. Mean life satisfaction as a function of SNPs on IGF-1 (A), BDNF (B, C), and FGF-2 (D) genes over time. Error bars represent 95% confidence intervals and * denotes a significant main effect for a genetic polymorphism.

Figure 5.9. Mean perceived social status as a function of *political* group participation and SNPs on IGF-1 (A), BDNF (B, C), and FGF-2 (D) genes in wave 7. Error bars represent 95% confidence intervals and * denotes a significant interaction between a genetic polymorphism and *political* group participation.

Figure 5.10. Mean life satisfaction as a function of arts and education group participation and SNPs on IGF-1 (A), BDNF (B, C), and FGF-2 (D) genes in wave 7. Error bars represent 95% confidence intervals and * denotes a significant interaction between a genetic polymorphism and arts and education group participation.

Discussion

Mirroring the findings from Study 4, participation in arts and education groups was associated with increased life satisfaction, fewer depressive symptoms, and improved cognition, as were outings with friends and family, sport, political, and religious group memberships. The

results from Study 5 are also in line with another recent study from the United Kingdom that determined the contribution of 40 factors (e.g. health conditions, civic participation, material resources) to overall well-being. Among more than 15,000 people aged 60 and over, creative and cultural group participation explained the greatest amount of variation in overall well-being (5.75%), followed by physical activities (5.12%), mental health (4.5%), and level of education (4.39%) (Green, Iparraguirre, Davidson, Rossall, & Zaidi, 2017).

Although interactions between SNPs and group participation could not be determined over time, a SNP on the IGF-1 gene (rs1048201) appeared to confer lower perceived social status, particularly among members of *political* and *arts and education* groups. Specifically, among participants in either of these groups, individuals homozygous for the SNP reported lower perceived social status compared to those with one or two copies of the dominant allele. These findings are in line with our overall hypotheses, in that SNPs on growth factor genes are related to how individuals respond to their environment. To the best of our knowledge, it appears that polymorphisms on IGF-1 have not been previously linked to perceived social status and group participation. In fact, few genetic variants have been associated with subjective well-being (Hyde et al., 2016; Mullins & Lewis, 2017; Okbay et al., 2016). It is useful to understand that in addition to psychosocial and physical factors, genetic polymorphisms can also moderate health outcomes. This information could potentially prove useful to track the etiology of poor health, identify new clinical targets, and contribute to creating novel psychosocial interventions that address genetic predispositions.

Despite these contributions to the literature on social well-being and genetic polymorphisms, some caveats should be mentioned. Analyses of time until anxiety diagnoses were slightly underpowered for arts and education (power = .76) and political groups (power =

.70). This occurred because very few individuals who participated in these groups for all seven waves had an anxiety diagnosis (arts and education, $N = 9$; political, $N = 14$). It would have been preferable to have data based on an anxiety scale, rather than just a diagnosis, so that participants could be placed on a spectrum of anxiety symptoms. While these issues limit the generalizability of our findings in relation to people with anxiety, it might also be a testament to the beneficial effects of both group types, in that participation in these groups was least associated with depressive symptoms or anxiety diagnoses compared to other group types.

In a similar light, small sample sizes and questionnaire design affected our genetic and group membership analyses as well. We were unable to determine interactions between group participation and SNPs on measures of well-being due to the small number of individuals participating in any group for all seven waves. Our analyses of the effects of group memberships on well-being were also limited, in that participation in groups was only measured dichotomously. Group identification is more closely related to well-being than group participation alone and for this reason, will be assessed in the following study.

Study 6

The first three studies included in the present research focused on community-based interventions that uniquely employed the arts, especially music, to increase identification with others and improve well-being in older populations (as well as their caregivers) with various health conditions. However, the studies' small samples sizes restricted the interpretation and generalizability of results. Studies 4 and 5 compensated for these limitations by utilizing very large populations and a broad array of health measures to isolate and compare the benefits of musical groups on well-being, as well as to identify possible genetic markers associated with relations between group memberships and subjective well-being. However, the latter two studies did not include measures of social identity as in Studies 1-3. The final studies (6a and 6b) were an opportunity to bridge this gap, particularly in assessing relations between musical group memberships, genetic polymorphisms, identity, coping, life satisfaction, depression, and anxiety—and to include an examination of a unique biological marker of aging, namely telomeres.

Due to inherent limitations in the cellular replication process, DNA ends cannot be copied. To prevent degradation of coding genes, repetitive nucleotide sequences up to several thousand bases in length and located at the distal ends of chromosomes, known as the telomere, are instead shortened with each cell cycle (Blackburn, 2000). The continued breakdown of these sequences is linked to processes considered fundamental to aging – oxidative stress and cellular senescence (Zglinicki & Martin-Ruiz, 2005). Oxidative stress involves an accumulation of energy production byproducts that can become toxic to the cell. This type of stress contributes to telomere shortening and can be triggered by various psychological stressors (e.g. caregiving, financial strain, relationship difficulties; Epel et al., 2004; Puterman, Lin, Krauss, Blackburn, &

Epel, 2015). Shorter telomeres increase the likelihood of senescence, a process that renders cells incapable of dividing (Bodnar et al., 1998). Given their role in these processes, telomeres have been extensively studied as potential biomarkers of aging. In fact, mortality rate was nearly twice as high amongst those with shorter compared to longer telomeres. This trend was attributable to increased heart and infectious disease (Cawthon, Smith, O'Brien, Sivatchenko, & Kerber, 2003). Likewise, shorter telomeres are also linked to diabetes (Zhao et al., 2014), asthma (Kyoh et al., 2013), macular degeneration (Weng et al., 2015), cognitive decline (Movérare-Skrtic et al., 2012), and affective disorders (Shalev et al., 2014).

Although telomere attrition is inevitable, positive lifestyle factors and participation in social activities may decelerate this process (Ornish et al., 2013). Physical activity (Cherkas et al., 2008; Mundstock et al., 2015), abstinence from smoking, as well as frequent consumption of fruits, vegetables (Mirabello et al., 2009), and vitamin C (Sen et al., 2014) are all associated with longer telomeres. Intriguingly, meditation and mindfulness-based interventions have also conferred positive effects on cellular aging. Experienced meditators had longer telomeres than those who had never meditated before (Hoge et al., 2013). Similarly, in female breast cancer survivors, group interventions (mindfulness-based cancer recovery and supportive-expressive therapy) prevented the telomere shortening that was seen in those who did not participate in such therapies (Carlson et al., 2014). However, it should be underscored that significantly longer telomeres, like shorter ones, are not always favourable, as longer telomeres have also been linked to cancer (Sanchez-Espiridion et al., 2014; Bojesen et al., 2013; Svenson et al., 2008). Taken together, these findings implicate telomeres as dynamic markers of biological aging and disease that can respond to social engagement, ultimately signaling a change in biology as a result of social group participation. For this reason, changes in telomere length were measured in Studies

6a and 6b to investigate potential benefits to biological health associated with social (including musical) group engagement.

As in Study 5, SNPs on growth factor genes were also explored as possible moderators of the relationship between social group participation and health. Their role in promoting brain plasticity may contribute to how social interactions are processed and remembered (Montag et al., 2008; Taschereau-Dumouchel et al., 2016). In this regard, SNPs on genes for BDNF, IGF-1, and FGF could influence how people identify with others and how they benefit from group participation.

Similar to SNPs, identification with others may determine the effects of group interventions on well-being among older adults. In this regard, initial identification with group members moderated the effects of story and song reminiscence groups on life satisfaction and mental health in older adults (Haslam et al., 2014b). Group memberships have also been reported to be tied to coping strategies, which were linked to well-being (Jetten et al., 2014; Matheson & Cole, 2004). With this in mind, Study 6a was designed to determine whether group identity and coping strategies mediated the effects of social group participation on well-being in older adults. It was also presumed that group effects on health would be especially prominent among those participating in musical groups, which encouraged socialization and identification with others, as well as improved cognition in Studies 1-3 (Camic et al., 2013; Hays & Minichiello, 2005; Hsu et al., 2015).

Finally, a second study (6b) involving younger, university students was conducted to enable comparisons. As seen depicted in Figures 6.1 and 6.2, it was hypothesized that:

- 1) participating in and identifying with musical groups would be associated with lower incidences of depression and anxiety, better health and ability to handle stress, as well as longer telomeres (Figure 6.1)
- 2) age would moderate the effects of musical groups on well-being, such that they would be more apparent in the older population compared to the young (given that physical and psychological decline become more likely with age) (Figure 6.1)
- 3) coping would mediate the relations between group memberships, group identification, and depressive and anxious symptoms, life satisfaction, health, ability to handle stress, and telomere length (Figure 6.1)
- 4) SNPs on genes for BDNF, IGF-1, and FGF would moderate the relationship between group memberships, group identity, and health outcomes (Figure 6.2)

Figure 6.1 Conceptual Mediator and Moderator Model of Relations among Group Memberships and Identity (Predictors), Coping (Mediators), and Outcome Variables as a Function of Age (Moderator)

Figure 6.2 Conceptual Moderator Model of Relations among Group Memberships and Identity (Predictors), and Outcome Variables as a Function of SNPs (Moderators)

Method

Participants and Procedure

Following approval from the Carleton University Research Ethics Board-B and Riverstone Retirement Communities, participants were recruited for Study 6a through posters, presentations, and recruitment sessions at four Riverstone residential care homes in Ottawa (Bridlewood Trails, Maplewood, Oakpark, and Carlingwood) (65 women, 22 men; aged 59-102 years, $M = 86.73$, $SE = .83$). Students were recruited for Study 6b through SONA at Carleton University (245 women, 121 men; aged 17-52 years, $M = 20.02$, $SE = .23$). Due to recommendations from retirement home staff, residents living on memory care (i.e., dementia) units were excluded. Once written informed consent was obtained, participants were asked to complete a survey (Appendix H) and provide a saliva sample for genetic and telomere analyses. Following study completion, participants were provided with written and verbal debriefing.

Measures

Activity participation and group identity. Participants were asked to list activities they were involved in at their retirement home or university community, and how long and how often they participated in each one. Musical and other artistic activities were identified with this

portion of the questionnaire. Participants were also asked how strongly they identify with group members in each activity (Postmes et al., 2012) using a scale from 1 (fully disagree) to 7 (fully agree). If a participant reported more than one group of the same type (i.e. sports, musical), an average of those identity ratings was computed to provide a single group identification score for each group type. For each participant, the mean of all group identities was also calculated to provide a measure of overall group identity.

Coping. Thirty coping items were assessed using the Survey of Coping Profiles Endorsement – Short Form (SCOPE-SF; Matheson & Anisman, 2003), which included cognitive-behavioural (e.g. rumination, cognitive restructuring) and socio-emotional (e.g. social support seeking, emotional containment, wishful thinking) coping styles. Participants rated their use of each coping style in recent months on a scale of 0 (never) to 4 (almost always).

A principal component analysis revealed different coping factors for older and younger adults. And so, to facilitate comparisons between the diverse samples used in Study 6a and 6b (i.e., older adults and students), a superordinate coping structure used in previous studies (Matheson & Anisman, 2009; Ysseldyk et al., 2011) was instead applied to reduce the number of coping variables for both samples. Five coping dimensions were thus used in subsequent analyses and included: problem-focused (social support seeking, active coping, cognitive restructuring, problem solving, and humour; Study 6a, $\alpha = .74$; Study 6b, $\alpha = .73$), emotional engagement (rumination, self-blame, wishful thinking, and emotional expression; Study 6a, $\alpha = .75$; Study 6b, $\alpha = .76$), emotional avoidance (blaming others, emotional containment, denial, and passivity; Study 6a, $\alpha = .62$; Study 6b, $\alpha = .63$), and religious coping (single item), as well as consumption behaviours (food, drug, and alcohol intake; Study 6a, $\alpha = .50$; Study 6b, $\alpha = .48$).

Depressive symptoms. Participants responded to ten questions comprising the Center for Epidemiologic Studies Short Depression Scale—Revised (CESD-R; Radloff et al., 1977; Andresen et al., 1994) regarding how often they experienced depressive symptoms in the previous week (e.g. “I felt depressed”). The scale ranged from 0 (rarely or none of the time, less than 1 day) to 3 (all of the time, 5-7 days). Items were reversed-scored as needed and summed to provide an index of depressive symptoms. Higher scores were representative of more depressive symptoms (Study 6a, $\alpha = .68$; Study 6b, $\alpha = .82$).

Anxiety. Symptoms of anxiety in retirement home residents were assessed using the Geriatric Anxiety Inventory – Short Form (GAI-SF; Byrne et al., 2011). This 5-item questionnaire inquired about anxious symptoms experienced during the past week. Participants could either agree (coded as 1) or disagree (coded as 0) with each item (e.g. “I often feel nervous”). All responses were summed and higher scores represented greater symptoms of anxiety ($\alpha = .75$).

In the student population, anxiety symptoms were measured using the Beck Anxiety Inventory (BAI; Beck, Epstein, Brown, & Steer, 1988). Participants rate how bothered they were by 21 different symptoms (e.g. “unable to relax”) in the prior week using a scale from 0 (Not at all) to 3 (Severely). Responses were summed such that higher scores indicated greater anxiety ($\alpha = .88$).

Handling stress. A single-item stress measure was used to determine participants’ ability to handle stress experienced in the past year (Littman et al., 2006). Responses were rated on a scale from 1 (“I can shake off stress”) to 6 (“Stress eats away at me”).

Life satisfaction. As in Study 1, participants’ satisfaction with life was assessed using the single-item Self-Anchoring Striving Scale (i.e., Cantril’s Ladder; Cantril, 1969). They were

asked the following: “Please refer to this ladder with steps numbered from zero at the bottom to ten at the top [A picture of a ladder was shown]. The top of the ladder represents the best possible life for you and the bottom of the ladder represents the worst possible life for you. On which step of the ladder would you say you personally feel you stand at this time?”

Health. Also used in Study 1, this global, self-rated, one-item subscale measured subjective health in residents (Sargent-Cox et al., 2008). Participants were asked, “How would you rate your overall health at the present time? Please select a number from 1 to 5, with 1 being poor, 2 being fair, 3 being good, 4 being very good, and 5 being excellent.”

Successful aging. An open-ended question, “What do you think is the key to successful aging?”, also qualitatively capture participants’ thoughts on successful aging in Study 6a.

Saliva Collection and DNA Processing

Saliva was collected, preserved, and processed using kits from Norgen Biotek, Canada (Collection, Preservation, and Isolation Kit: Cat# RU35700). Genomic DNA was isolated and purified as per the manufacturer’s protocol and subsequently stored at -80°C.

Genotyping. Only Caucasian samples were prepared for genotyping as marked differences of genotype distribution have been reported to occur between Caucasian and Asian cultures (Saphire-Bernstein, Way, Kim, Sherman, & Taylor, 2011). All DNA samples were diluted in nuclease-free water to a concentration of 22 ng/μl and measured to 33 μl prior to shipment. DNA samples were sent to the McGill University and Génome Québec Innovation Centre in Montreal, Quebec for SNP genotyping using Sequenom® iPLEX® Gold Genotyping Technology.

Telomere assay. Since telomeres are known to vary by ethnicity (Brown, Needham, Ailshire, 2016), telomere length was only measured among Caucasians, particularly as an

insufficient number of individuals from other ethnicities were recruited. Telomere length was determined using Cawthon's method of relative telomere length measurement (2009), which has been validated for use with saliva samples in recent studies (Brown et al., 2016; Jodczyk, Fergusson, Horwood, Zero-order, & Kennedy, 2014). This method employs quantitative polymerase chain reaction (qPCR) to determine the ratio of telomere copy number to single-gene copy number (beta-globin) (T/S Ratio). The telomere primer sequences were as follows: telg AACTAAGGTTTGGGTTTGGGTTTGGGTTTGGGTTAGTGT and telc TGTTAGGTATCCCTATCCCTATCCCTATCCCTATCCCTAACA. The control gene was beta-globin and its primer sequences were as follows: hbgu CGGCGGCGGGCGGCGGGCTGGGCGGCTTCATCCACGTTACCTTG and hbgd GCCCGGCCCGCCGCGCCCGTCCCGCCGGAGGAGAAGTCTGCCGTT. The concentration of each telomere and beta-globin primer per reaction was 500 nM and 400 nM, respectively. Five concentrations of a reference DNA sample, beginning at 150 ng of DNA, were prepared via three-fold serial dilutions to create standard curves for telomeres and beta-globin. Other reactions contained 20 ng of experimental or positive control DNA. The assay was conducted using a CFX ConnectTM Real-Time PCR Detection System and the cycling profile was as follows: Stage 1: 15 min at 95°C; Stage 2: 2 cycles of 15 seconds (s) at 95°C, 30 s at 49°C; and Stage 3: 50 cycles of 15 s at 95°C, 30 s at 59°C, 15 s at 72°C with signal acquisition, 30 s at 81°C, 15 s at 82°C with signal acquisition. Samples with 260/280 ratios below 1.4 were removed from statistical analysis leaving 68 older adults ($M = .62$, $SE = .03$) and 173 younger adults ($M = .80$, $SE = .02$). More stringent 260/280 ratio criteria would result in a significant reduction in sample size (e.g. samples with 260/280 ratios below 1.5 removed; $N = 51$, older

adults; $N = 107$, younger adults). The inter-assay coefficients of variation for telomere and beta-globin measurements are 12.07% and 12.23%, respectively.

Results

In Study 6a and 6b, the effects of group participation on depression, anxiety, life satisfaction, self-rated health, and ability to handle stress were assessed as a function of group type (e.g. musical, sport, religious) and group identity (i.e., the extent to which individuals valued and saw themselves as connected to other group members). The potential moderating and mediating roles of SNPs and different coping styles, respectively, in the relationships between group type, group identification, and well-being was assessed using the PROCESS macro that applied bootstrapping procedures and confidence intervals based on 5000 resamples (Hayes & Rockwood, 2016)¹⁰. Genotype distributions for SNPs on BDNF (rs6265, $\chi^2 = .70$; rs1157659, $\chi^2 = .06$), IGF-1 (rs7136446, $\chi^2 = .1$), FGF-2 (rs1048201, $\chi^2 = .71$) and FGF-5 (rs1219648, $\chi^2 = 2.12$) were in Hardy-Weinberg equilibrium ($\chi^2 < 3.84$; calculations can be found in Appendix I). Statistical analysis was performed using SPSS and significance determined at $p < 0.05$ (two-tailed). Responses to open-ended questions were coded using NVivo, a qualitative data analysis software (QSR International Pty Ltd. NVivo for Mac).

Group memberships were coded into six categories based on the frequency of participants' open-ended self-reports: *musical* (listening to and/or making music), *artistic* (excluding music but including dance, photography, crafts, etc.), *game* (puzzles, crosswords, bingo), *physical* (sports, walking), *community* (contribution to Riverstone or Carleton community, including cultural and interest groups as well as outings with friends), and *religious*

¹⁰ Unlike the previous two studies, age, sex, marital status, and income were not included as covariates in analyses as most of these variables did not significantly contribute to variability in any outcome for both older and younger adults, while others violated covariate assumptions for ANCOVAs.

(typically affiliated with Christian denominations). Participation in one or more of each group type was coded as 1, while lack of participation was coded as 0. The number of participants in each group and the percentage of the total population they comprised are presented in Table 6.1.

Older adults participated in various groups nearly three times as much as younger adults.

Table 6.1

Number of participants in each group type at Riverstone Retirement Communities (Study 6a; older adults) and Carleton University (Study 6b; younger adults).

Group type	Study 6a	Percentage of total retirement sample	Study 6b	Percentage of total student sample
Musical	23	26.14	3	.81
Artistic	27	30.68	9	2.44
Game	44	50.00	0	0
Physical	49	55.68	63	17.07
Community	56	63.64	56	15.18
Religious	5	5.68	7	1.90
People in one or more groups	81	92.05	117	31.71

Study 6a: Quantitative Results

Well-being. ANOVA was used to assess differences in measures of well-being as a function of group participation among older adults. In contrast to hypotheses, depression, anxiety, life satisfaction, self-rated health, and telomere length did not differ as a function of participation in different group *types*. As displayed in Table 6.2, only participation in *game* groups was associated with a better ability to handle stress.

However, well-being was correlated with group *identification*¹¹. Specifically, identification with *game* and *physical* groups was negatively correlated with depressive

¹¹ Participants in religious groups strongly and equally identified with their group, therefore correlations between religious group identity and health outcomes were not possible.

symptoms and positively correlated with life satisfaction (see Table 6.2). Overall group identity was also positively correlated with life satisfaction and telomere length.

Table 6.2

Correlations between group type, group identification, and depression, anxiety, life satisfaction, self-rated health, ability to handle stress, and telomere length among older adults.

	Depression	Anxiety	Life satisfaction	Self-rated health	Ability to handle stress	Telomere length
Group type						
Musical	.13	-.13	-.14	.05	.11	-.09
Artistic	.06	.08	-.12	-.05	-.09	-.05
Game	-.06	.11	.10	0	-.24*	-.09
Physical	-.14	.05	.07	.04	.14	0
Community	-.09	-.07	.12	0	.08	.15
Religious	-.04	-.04	.07	.19	.03	.04
Group identification						
Musical	.02	-.12	-.24	-.24	-.23	-.01
Artistic	-.11	-.01	.09	-.14	.01	.13
Game	-.45**	-.28	.18	.15	.05	.25
Physical	.09	.12	.43**	.01	-.07	.26
Community	-.21	.05	.02	-.02	-.16	0
Overall group identity	-.19	-.08	.24*	-.02	-.06	.29*

* $p < .05$ ** $p < .01$

Note. Point-biserial and zero-order correlations are shown for group type and group identification, respectively.

The Mediating Role of Coping. The potential mediating role of coping styles in the relations between groups and well-being was then assessed with multiple mediation analyses, using bootstrapping procedures and confidence intervals based on 5000 resamples (Hayes & Rockwood, 2016). Contrary to our hypotheses, coping did not mediate the relationship between any group type and well-being. However, point-biserial correlations revealed that *artistic* and *physical* group memberships and to a greater extent, group identification, were associated with increased use of problem-focused coping, but problem-focused coping was not correlated with

any health outcomes (Table 6.3). In contrast, increased use of emotional engagement coping and consumption behaviours (e.g. drugs, alcohol) were linked with more depressive and anxious symptoms, as well as a poorer ability to handle stress. Unexpectedly, religious coping was also positively correlated with depressive symptoms.

Table 6.3

Correlations between group type, group identification, health outcomes and coping styles among older adults.

	Problem -focused	Emotional- engagement	Emotional avoidance	Religious coping	Consumption behaviours
Group type					
Musical	.01	-.13	-.02	-.05	.10
Artistic	.25*	.13	.15	-.06	-.02
Game	.01	.05	.09	.14	.14
Physical	.25*	.14	.08	.11	.05
Community	.19	.03	.13	.03	-.02
Religious	-.06	.09	-.05	-.02	-.10
Group identification					
Musical	-.04	.03	.10	.35	.01
Artistic	.42*	-.12	.02	.22	-.10
Game	.13	-.18	.03	-.10	-.30
Physical	.45**	.09	-.02	.14	.07
Community	.03	-.13	-.01	-.08	-.01
Overall group identity	.33	0	.08	.11	-.11
Health outcomes					
Depression	-.13	.34**	.20	.27*	.39***
Anxiety	-.04	.47****	.19	.13	.52****
Life satisfaction	.10	-.20	-.14	-.15	-.11
Self-rated health	.01	-.02	.06	-.17	-.04
Ability to handle stress	-.07	-.35**	-.14	-.10	-.27*
Telomere Length	-.12	-.06	0	-.20	0

* $p < .05$ ** $p < .01$ *** $p < .001$ **** $p < .0001$

Note. Point-biserial correlations are shown for group type, while zero-order correlations are shown for group identification and health outcomes.

In summary, among the older adults in Study 6a, participating in any social group was generally not correlated with well-being, with the exception of game groups being linked with a

poorer ability to handle stress. Instead, *identifying* with *game* and *physical* groups was associated with fewer depressive symptoms and greater life satisfaction, respectively. Overall group identity was also positively associated with life satisfaction and telomere length. Contrary to our hypotheses, however, coping was not found to mediate the relationship between group memberships (or identity) and health.

Study 6a: Qualitative Results

In addition to the quantitative survey items, older adults were also asked to answer the open-ended question, “What do you think is the key to successful aging?”. As in studies 2 and 3, qualitative responses were assessed using the grounded theory method (Corbin and Strauss, 2008). Coding and visualization of results was generated using NVivo software. Following analysis, nine themes emerged from participants’ responses as depicted in Figure 6.3.

1 Sociality 20.32%	4 Optimism 13.95%	5 Acceptance and Easygoing -ness 11.72%
2 Remaining active 15.52%	6 Problem Solving and Hard Work 9.05%	8 Autonomy 7.74%
3 Good health 14.26%	7 Religion and Faith 8.17%	9 <u>Humour</u> 4.08%

Figure 6.3. Hierarchy of themes among qualitative responses from older adults. Box sizes are proportional to theme frequency.

Note. “Optimism” and “Good health” were equally represented by participant responses.

Theme 1: Sociality. Older adults frequently reported family, friends, volunteering, and making new acquaintances as important aspects of healthy aging and well-being. Sentiments of trust, acceptance, support and charity emerged, amongst others:

“Good friends, good marriage, good family, good outlook on life in general.”

“Just have to keep going and be socially active.”

“Cheerful outlook if at all possible in a marriage. 90% giving, 10% expected.”

Theme 2: Remaining active. Staying mentally and physically active by reliving memories and having various hobbies were some of the activities older adults mentioned in reference to maintaining overall well-being:

“Being involved in activities, keeping active and interested in life.”

“Keep involved in church, society, friends; stable family life, keep memories alive and use them, positive, and use humour.”

“Lots of activity – mental and physical, and socializing.”

“Living life to its fullest, friends, activities, arts, music, love.”

Theme 3: Good health. In addition to genetic factors and staying physically active, participants also noted the importance of promoting good health via medical exams and proper diet, and other healthy habits:

“Proper diet, checkup with physician.”

“It depends on your genes.”

“Eat well, sleep well.”

“Keeping active and eating and drinking moderately. Mom attributed it to healthy appetite.”

Theme 4: Optimism. Positive approaches to living were also often mentioned by residents as a means of aging well:

“Live one day at a time. Be happy.”

“Positive attitude, accepting the aging process.”

“Feel your life has value and purpose, have a source of love in your life, do things you like to do that bring you joy and satisfaction, keep harmony with fam and friends, love self, don’t hold grudges, get enough sleep, pass your passions to others.”

Theme 5: Acceptance and easygoingness. Acknowledging the aging process one day at a time was recounted as a way to persevere and maintain a sense of calm:

“Accepting life each day as it is.”

“Being positive, agreeing that life goes on, facing life head on and doing your best.”

“Taking it easy, deep breathing, counting unflappability.”

“Sit slack, stand easy, let troubles go away.”

Theme 6: Problem solving and hard work. In light of the inevitable mental and physical changes that accompany aging, older adults suggested that a proactive approach to such issues favours well-being:

“Positive thinking even without your independence. If problems arise, try to do something about them, then live with them.”

“Keep busy, participate in life, help others, don't sit back and complain, do something about it.”

“Being satisfied with what you have - or work to make it better yourself.”

Theme 7: Religion and faith. For some residents, church activities and maintaining a relationship with God were an important part of their path to successful aging:

“The grace of God. Reasonably good health (mental and physical). Family and friends. Good genes.”

“Keep involved in church, society, friends; stable family life, keep memories alive and use them, positive, and use humour.”

“Take one day at a time and keep in touch with your family and friends and pray to God.”

“Be happy, positive thinking, keep active, never forget the Good Lord. Love your fellow man or woman.”

Theme 8: Autonomy. Maintaining independence despite challenges that arise was reported as a key aspect of successful aging:

“Lack of independence / threat of independence hurts aging successfully. Threat of financial insecurity hinders successful aging. Independence, successful aging.”

“Working hard all my life and making my own decisions after 94.”

“Live in secure place with good health- feel secure. Know that you will be able to pay bills.”

Theme 9: Humour. As with the optimistic and easygoing approaches described above, residents included humour as a means to age positively:

“Laughing at myself.”

“Keeping active and being optimistic as well as having a sense of humour-besides having a purpose in life.”

“Humour. That’s my opinion and that’s the only one that matters.”

Figure 6.4. Common words among qualitative responses from older adults. Word size is proportional to word frequency.

Study 6b: Quantitative Results

Well-being. Differences in well-being as a function of group type were also assessed with ANOVAs in the student population. Simply participating in *physical* activity groups was only weakly associated with a better ability to handle stress and partaking in any other group was not correlated with well-being (Table 6.4). Rather, as with older adults, group *identification* was correlated with health outcomes. In particular, *physical*, *community*, and overall group identities were negatively correlated with both depressive and anxious symptoms. *Physical* and overall group identities were also positively correlated with life satisfaction.

Table 6.4

Correlations between group type, group identification, and depression, anxiety, life satisfaction, self-rated health, ability to handle stress, and telomere length among younger adults.

	Depression	Anxiety	Life satisfaction	Self-rated health	Ability to handle stress	Telomere length
Group type						
Musical	.08	.08	.01	-.01	.02	-.05
Artistic	.01	.02	-.03	.01	.01	-.09
Physical	-.08	-.04	.07	.10	-.15**	-.05
Community	.01	.06	.03	0	.04	-.10
Religious	-.04	-.07	-.03	.01	.01	-.02
Group identification						
Musical	.24	.65	1.00	-.19	.93	NA ¹²
Artistic	.05	.04	-.04	.02	.02	NA
Physical	-.27*	-.29*	.28*	.11	-.15	.18
Community	-.34*	-.35**	.27	.22	-.07	-.14
Religious	-.26	-.03	.33	.46	.10	-.88
Overall group identity	-.32**	-.38****	.29**	.19	-.14	.01

* $p < .05$ ** $p < .01$ *** $p < .001$ **** $p < .0001$

Note. Point-biserial and zero-order correlations are shown for group type and group identification, respectively.

The Mediating Role of Coping. As in older adults, analyses were conducted to assess the potential mediating role of the five different coping styles in the relations between group memberships and well-being. These coping styles included problem-focused (social support seeking, active coping, cognitive restructuring, problem solving, and humour; $\alpha = .73$), emotional engagement (rumination, self-blame, wishful thinking, and emotional expression; $\alpha = .76$), emotional avoidance (blaming others, emotional containment, denial, and passivity; $\alpha = .63$), and religious coping (single item), as well as consumption behaviours (food, drug, and

¹² With a sample size of 1, correlations were not possible for cells labeled NA. Sample size was reduced for these group types because some individuals were not Caucasian, and therefore there was no telomere value, or because the quality of their saliva sample was poor (260/280 ratio less than 1.4).

alcohol intake; $\alpha = .48$). As was the case with older adults, physical activity group participation was positively correlated with the use of problem-focused coping (Table 6.5); however, in contrast to older adults, problem-focused coping also mediated the links between *physical* activity group participation and depression, self-reported health, and ability to handle stress (Figure 6.5). Problem-focused coping was also associated with less anxiety and greater life satisfaction (Table 6.5), although, for most health outcomes, these effects were quite small. Emotional engagement, avoidance, and coping through consumption behaviours were also consistently related to health outcomes; however, as seen in Table 6.5, these coping styles were not linked to participation in any social group. Likewise, coping styles were not linked to identification with any group and coping did not mediate the relationships between group identification and well-being.

Figure 6.5. The mediating role of problem-focused coping in the relationship between physical activity group participation and (A) depressive symptoms, (B) self-reported health, and (C) ability to handle stress. The unstandardized coefficients for the direct and indirect effects are presented above and below the dotted line, respectively, and 95% confidence intervals are in brackets. * $p < .05$, *** $p < .001$

Table 6.5

Correlations between group type, group identification, health outcomes and coping styles among younger adults.

	Problem-focused	Emotional-engagement	Emotional avoidance	Religious coping	Consumption behaviours
Group type					
Musical	.01	.08	-.05	-.02	.03
Artistic	-.04	-.05	.07	-.03	.05
Physical	.12*	-.07	-.05	-.02	-.07
Community	.09	.03	-.08	-.05	-.07
Religious	.09	-.02	-.02	.18**	-.07
Group identification					
Musical	-.58	.32	-.98	.50	-.33
Artistic	-.64	-.61	-.32	-.55	-.44
Physical	.09	-.14	-.07	-.12	.04
Community	.12	-.03	.10	-.13	.11
Overall group identity	.02	-.17	-.09	-.12	.08
Health outcomes					
Depression	-.27****	.52****	.26****	-.11*	.28****
Anxiety	-.13*	.41****	.23****	-.02	.32****
Life satisfaction	.25****	-.32****	-.16**	.05	-.12*
Self-rated health	.25****	-.26****	-.07	.10	-.14**
Ability to handle stress	.22****	-.49****	-.17**	.06	-.22****
Telomere Length	.05	-.01	-.01	.06	.02

* $p < .05$ ** $p < .01$ **** $p < .0001$

Note. Point-biserial correlations are shown for group type, while zero-order correlations are shown for group identification and health outcomes.

Overall, among younger adults, group identification was more closely related to well-being than group participation alone, just as in older adults. In particular, *physical*, *community*, and *overall* group identities were associated with fewer symptoms of depression and anxiety. However, coping did not mediate the relationship between group identification and well-being. Unlike among older adults, problem-focused coping also mediated the relationship between *physical* activity groups and depression, health, and ability to handle stress.

The Moderating Role of SNPs. To maximize sample size for genetic analysis, data from the older (Study 6a) and younger (Study 6b) populations were pooled. Group identity was also averaged across all groups given that an insufficient number of individuals participated in specific groups in order to conduct genetic analyses at the group level (as described in Table 6.1). In this pooled dataset, depression, $F(1, 455) = 34.92, p < .0001$, life satisfaction, $F(1, 421) = 40.68, p < .0001$, ability to handle stress, $F(1, 454) = 17.79, p < .0001$, and telomere length, $F(1, 239) = 29.82, p < .0001$, differed as a function of age group, such that younger adults were more depressed, while older adults were better able to handle stress and were more satisfied with life, although they had shorter telomeres than younger adults. For this reason, age was included as a covariate in moderation analyses involving these health outcomes.

Contrary to our hypotheses, SNPs on growth factor genes was not related to the effects of group participation on well-being. Instead, the relationship between overall group identity and self-reported health was moderated by the Val66Met polymorphism and accounted for an additional 4.18% of the variation in health ($\Delta R^2 = .0418, b = .33, t = 2.30, p < .05$). As seen in Figure 6.6, overall group identity was positively correlated with self-reported health among individuals carrying the BDNF Met allele (GA, AA; rs6265; $b = .27, t = 2.60, p < .05$). Separate analyses of Studies 6a and 6b revealed that this was still the case for older, but not younger adults (see Figure 6.7A and 6.8A). Overall group identity was also negatively correlated with depressive symptoms among the pooled sample, but only for carriers of a SNP on the FGF-2 gene (CT, TT; rs1048201; $b = -.31, t = -5.00, p < .0001$), where the interaction explained an additional 8.73% of variance in depression ($\Delta R^2 = .0873, b = -.29, t = -3.47, p < .001$; Figure 6.9). This relationship was identified in separate analyses of younger, but not older adults (see Figure 6.10C and 6.11C). Relationships between overall group identity and health outcomes

were not moderated by other SNPs on BDNF (rs1157659), FGF-5 (rs3733336), and IGF-1 (rs7136446) genes.

Figure 6.6. The relation between overall group identity and self-reported health as a function of SNPs on BDNF (A, B), FGF (C, D), and IGF-1 (E) genes. Low and high group identities represent values one SD above and below the mean, respectively. $*p < .05$

Figure 6.7. The relation between overall group identity and health among older adults as a function of SNPs on BDNF (A, B), FGF (C, D), and IGF-1 (E) genes. Low and high group identities represent values one SD above and below the mean, respectively. * $p < .05$

Figure 6.8. The relation between overall group identity and health among younger adults as a function of SNPs on BDNF (A, B), FGF (C, D), and IGF-1 (E) genes. Low and high group identities represent values one SD above and below the mean, respectively.

Figure 6.9. The relation between overall group identity and depressive symptoms as a function of SNPs on BDNF (A, B), FGF (C, D), and IGF-1 (E) genes. Low and high group identities represent values one SD above and below the mean, respectively. *** $p < .001$

Figure 6.10. The relation between overall group identity and depressive symptoms among older adults as a function of SNPs on BDNF (A, B), FGF (C, D), and IGF-1 (E) genes. Low and high group identities represent values one SD above and below the mean, respectively.

Figure 6.11. The relation between overall group identity and depressive symptoms among younger adults as a function of SNPs on BDNF (A, B), FGF (C, D), and IGF-1 (E) genes. Low and high group identities represent values one SD above and below the mean, respectively. * $p < .05$

Overall, genetic polymorphisms on genes for BDNF and FGF-2 were linked to whether older and younger adults experienced better health and fewer depressive symptoms in relation to strongly identifying with their social groups. Carriers of one or two copies of the BDNF Met allele and FGF-2 SNP reported better health and fewer depressive symptoms, respectively, with increasing group identification.

Discussion

Study 6 suggested the potential for new benefits of group participation and identification and how they are related to health. Among younger and older adults, group identification was more often linked to health outcomes than group participation alone, and was also associated with longer telomeres in older adults. However, among younger adults, coping mediated the effects of group participation on well-being and was strongly correlated with health outcomes. A pooled analysis including both younger and older adults also showed that SNPs moderated associations between group identification and well-being.

Group Memberships, Identity, Coping, and Health among Older Adults

Contrary to our hypotheses, well-being did not differ as a function of group *participation* among older adults. Only *game* group participation was modestly associated with a better ability to handle stress. Instead, group *identification* was most strongly correlated with well-being. In particular, identifying with *game* and *physical* groups was associated with fewer depressive symptoms and increased life satisfaction, respectively. Indeed, other studies have reported that seniors partake in *game* groups (e.g. puzzles, card games) to encourage mental stimulation, social interaction, and for enjoyment (Mortenson, Sixsmith, & Kaufamn, 2017). These activities may result in improved well-being by delaying cognitive decline (Pillai et al., 2011) and reducing the risk of dementia (Verghese et al., 2003). Furthermore, the association between

physical activity groups and well-being among older adults is a well-known and expected finding in this study (Hillman, Erickson, & Kramer, 2008; Olanrewaju, Kelly, Cowan, Brayne, & Lafortune, 2016). However, contrary to our hypotheses and our results from previous studies, we observed no unique effects of *musical* or *artistic* group participation and identification on health outcomes. This might be explained, in part, by low participation rates in these groups.

However, greater overall group identity was linked to longer telomeres among older adults. Longer telomeres have been associated with positive social and health outcomes (e.g. perceived social support, Stein et al., 2018; exercise, Puterman et al., 2018; meditation, Conklin et al., 2018). The findings in Study 6a build upon previous work, and are among the few reports that link social identity to biological factors at the cellular level. Most recently, Ysseldyk et al (2018b) identified a negative association between inflammatory markers and ingroup ties, a component of social identity that relates to a sense of belonging and shared bond among group members (Cameron, 2004).

Also contrary to what we expected, coping did not mediate the effects of group participation or group identification on well-being among older adults. Although both *artistic* and *physical* group involvement and identification were positively correlated with problem-focused coping, this coping style did not mediate any relations between health and well-being. Emotional engagement and consumption behaviours were also associated with more depressive and anxious symptoms, as well as a poorer ability to handle stress, while religious coping was (unexpectedly) linked to more depressive symptoms. Most of these findings are in line with previous research that has identified links between group memberships, coping, and health in older populations. For example, active coping strategies have been associated with fewer depressive symptoms in older clinical and community populations (Bjørkløf, Engedal, Selbæk,

Kouwenhoven, & Helvik, 2013), while emotion-focused coping predicted greater disability at a two-year follow-up among adults with osteoarthritis over the age of 45 (Regier & Parmelee, 2015). Participation in a reminiscence intervention also led to increased use of problem-solving, social support seeking, and avoidant coping compared to participants in a control group (Satorres, Viguer, Fortuna, & Meléndez, 2017).

The positive correlation between religious coping and depression identified in Study 6a is incongruent with other research. Previous studies have consistently shown that (positive) religious coping is associated with *fewer* depressive symptoms among older individuals (Bjørkløf et al., 2013; Brewer, Robinson, Sumra, Tatsi, & Gire, 2015). It may be that our small sample was a biased representation of individuals who may have been angry with God or who blamed their circumstances on Him—termed negative religious coping—which has been associated with more depressive symptoms (Bosworth, Park, McQuoid, Hays, Steffens, 2003; Brewer et al., 2015; Exline, Yali, & Sanderson, 2000). The coping item used in our study is ambiguous (“turned to God or my faith”) and does not differentiate between these two coping styles. In this regard, the nature of religious coping, that is, whether it is positive or negative, should be accounted for in future studies.

It may also have been difficult to identify any relationships between social groups, coping, and health because items were not strongly related within each coping dimension, as evidenced by relatively low Cronbach’s alphas. The superordinate coping structure adopted in this study may have partly contributed to this issue. While it facilitated comparisons between older and younger adults that would otherwise not be possible, it might have decreased relatedness between items within each coping dimension.

Qualitative responses from older adults regarding what they believe to be the key to successful aging support the above findings and especially illustrated the value of social groups and remaining active throughout life and into older age. Other interviews with older adults have identified social engagement and interactions (Carr & Weir, 2017; Reichstadt, Sengupta, Depp, Palinkas, & Jeste, 2010) as predominant themes among responses to questions concerning successful aging. These themes also remained consistent across age and gender in a separate qualitative study (Jopp et al., 2015). Individual perspectives collected in these studies and in ours provide more depth regarding the aging process and can, in tandem with quantitative data, help inform future health interventions and policies for an aging society.

Group Memberships, Identity, Coping, and Health among Younger Adults

Among students surveyed in Study 6b, as with older adults, identification with social groups was more closely related to well-being than group participation alone. In particular, *physical* and *community* group identification was associated with fewer depressive and anxious symptoms. Identifying with *physical* groups was also linked to greater life satisfaction. These findings are consistent with previously reported effects of physical and community group participation (Hillman et al., 2008; Talò et al., 2014).

In contrast to older adults, coping mediated some relationships between group type (not group identification) and well-being among students. *Physical* activity groups were associated with increased problem-focused coping, which in turn was linked to better health, ability to handle stress, and fewer depressive symptoms. Active coping also predicted better health outcomes. This is in line with previous research that has demonstrated negative associations between active coping and depressive and anxiety symptoms in college students (Chou, Ko, Hsiao, Cheng, & Yen, 2017) and use of task-oriented coping, which is synonymous with

problem-solving, was found to reduce the risk of depression among young adults (Winfo, Baldessarini, & Windlle, 2015). While it is well-known that social groups can influence coping (Jetten et al., 2014; Matheson & Cole, 2004; Stinson et al., 2008), Study 6b appears to be among the first to identify links between specific group types, coping styles, and health outcomes among younger adults.

Interestingly, however, there was a negative association between religious coping and depression among younger adults in Study 6b, which is in line with previous research on this topic, but in contrast to the above-mentioned finding linking religious coping with *more* symptoms of depression among older adults. Based on previous research, this would suggest that younger adults may have utilized more positive religious coping strategies (e.g. searching for comfort through God, partnering with God to solve a problem; Pargament, Tarakeshwar, Ellison, & Wulff, 2001), which have been associated with fewer depressive symptoms (Bjorck & Thurman, 2007; Carpenter, Laney, & Mezulis, 2012; Rosmarin, Bigda-Peyton, Öngur, Pargament, & Biörgvinsson, 2013).

Relations Between Group Types, Group Identification, SNPs, and Health Outcomes Among Older and Younger Adults

Perhaps the most intriguing finding in the present study was the moderating role of SNPs in the relationship between overall group identity and well-being. After determining that SNPs did not moderate relations between groups and health (our previous hypothesis), SNPs on genes for BDNF and FGF-2 moderated whether older and younger adults experienced fewer depressive symptoms and better health as a function of strongly identifying with their social groups. The BDNF Val66Met polymorphism has been associated with altered serum BDNF levels, which purportedly contributes to the pathophysiology of depression (Ozan et al., 2010; Youssef et al.,

2018). In Studies 6a and 6b, carriers of one or two copies of the Met allele experienced better health with increasing overall group identification. At first blush, this finding seems advantageous; however, being susceptible to the effects of social identity on well-being also suggests that these Met carriers might experience poorer health in concert with weak group identification. As such, our findings are in line with previous studies (Lim et al., 2015; Montag et al., 2014; Taschereau-Dumouchel et al., 2016) where the Met allele conferred vulnerability to adverse health outcomes (e.g. accelerated cognitive decline, less empathy).

In contrast BDNF, little information exists for a SNP on the FGF-2 gene. In previous research, carriers of the rs1048201 SNP were more likely to drop out of SSRI treatments due to side effects (Kato et al., 2009), have lower bone mineral density (Lei, Papasian, & Deng, 2011) and myopia (i.e. nearsightedness) (Mutti et al., 2007), suggesting that the SNP confers vulnerability to poorer health. Indeed, there was a negative relationship between overall group identification and depressive symptoms for carriers of this SNP in our study. To the best of my knowledge, this is the first time FGF-2 has been linked to psychosocial factors, and together with BDNF, it helped explain the link between social identity and well-being—a novel finding that can be used to understand social behaviour and personalize health interventions that encourage social identification.

General Discussion

It has long been known that social participation markedly impacts well-being. Group memberships—and the social identities that emerge from them—have been associated with positive moods (Knowles & Gardner, 2008; Park & Hinsz, 2015), reduced feelings of stress (Haslam & Reicher, 2006), better health behaviours (e.g. treatment adherence; Magrin et al., 2015), and improved immune functioning (Fancourt et al., 2016), amongst other mental and

physical benefits (Cruwys, South, Greenaway, & Haslam, 2014; Ysseldyk, Matheson, & Anisman, 2010). Emerging research highlights the benefits of musical and arts-based groups that appear to uniquely promote socialization, engage multiple cognitive functions (Schnakers et al., 2016; Thompson & Schlaug, 2015), as well as promote physical health, self-expression, and communication of emotions that ultimately contribute to reduced symptoms of depression (Dunphy et al., 2018). Conversely, socially isolated individuals have greater odds of mood disorders (Taylor et al., 2016), stroke (Hakulinen et al., 2018), and mortality (Oxman, Freeman, & Manheimer, 1995; Steptoe, Shankar, Demakakos, & Wardle, 2013). In this respect, capitalizing on the benefits of social groups is particularly relevant to older adults who face increased risk of disease, as is normal and expected with age (Fulop et al., 2010), and whose social networks tend to decrease over time (Cornwell et al., 2008). Participation in social groups can help slow the progression of declining health and ameliorate quality of life, especially for individuals living with prevalent neurological conditions, including Alzheimer's disease (Statistics Canada, 2016; Zutrauen, Villeneuve, & Ysseldyk, 2018), for which there is no known cure. If and when cures are found for these diseases, social groups will remain an important aspect of care, as being diagnosed and treated for a disease is a stressful process impacting the afflicted and those who care for them (Lang & Fowers, 2018). However, the link between social participation and well-being among older adults is not entirely understood—the effects of artistic and other types of group memberships (e.g. religious or sports groups) on psychosocial and biological health, as well as the psychosocial mechanisms that may drive this relationship (e.g. social identity, coping) have yet to be fully explored. The present research aimed to address these queries by examining social and artistic group involvement in older clinical and community populations.

Music and the Arts: Does Group Type Matter?

One of the primary goals of this research was to compare group types with respect to their effects on well-being. With each study, it became clearer that certain social groups had greater and/or differential effects on health compared to others. Indeed, artistic and sport group participation was often more strongly linked to health outcomes compared to participation in other social groups. Genetic polymorphisms and coping styles were also found to influence relations between group types and well-being.

Impacts of music and the arts. Firstly, complex-care patients who received personalized music playlists in Study 1 had slightly higher life satisfaction and self-esteem scores compared to control group patients on hospital units who only participated in other activities (e.g. bingo, bocce ball). The number of negative emotions experienced also declined more so among intervention participations compared to controls. While these effects were not significant, they do corroborate findings from other music-listening studies (Costa, Ockelford, & Hargreaves, 2018; Schroeder et al., 2018). Indeed, older care home residents who listened to personalized music for thirty minutes each day over three weeks reported less depressive and anxious symptoms (Costa et al., 2018). Likewise, among older adults visiting an emergency room, as well as persons with dementia or stroke, music listening was more beneficial compared to standard care (Belland, Rivera-Reyes, & Hwang, 2017; Kwak, Anderson, & Valuch, 2018; Särkämö, 2013) and audiobooks (Särkämö, 2008).

Given the findings from Study 1, more interactive interventions and data rich studies were subsequently conducted among individuals living with dementia and their caregivers. In Study 3, participation in a group music-making intervention (*Music Matters*) proved more beneficial for care recipients than the group reminiscence program assessed in Study 2, as

cognition scores trended upwards during music-making compared to participants in the reminiscence program (who exhibited poorer cognition over time). Observational measures also revealed that care recipients in the music-making program (Study 3) enjoyed the activities and were more likely to initiate music-making at the end of the program compared to the beginning. Unfortunately, however, no behavioural observations were made during the reminiscence intervention in Study 2, and so comparisons could not be made between the two interventions in this regard. Nonetheless, interviews with care recipients in both studies revealed that they enjoyed the group activities, felt more mentally engaged, relaxed, and rejuvenated. Together, these findings overlap with a recent surge in music-making research that also identified psychosocial, as well as biological, benefits for care recipients (Elliot & Gardner, 2018; Fu, Belza, Nguyen, Logsdon, & Demorest, 2018; Gomez, 2017; Maseda et al., 2018; Schneider, Hunter, & Bardach, 2018; Tang et al., 2018). For example, a thirty-minute individualized music session for people with dementia carried out twice a week for twelve weeks resulted in greater happiness, enjoyment, relaxation, sociability, attention to immediate environment, as well as decreased heart rate and increased oxygen saturation compared to before the intervention (Maseda et al., 2018). Following a separate program involving music listening and playing that also lasted twelve weeks, participants reported lower apathy and their cognition scores remained stable compared to controls, whose cognition worsened with time (Tang et al., 2018). Group singing also improved verbal fluency, word recall and lung functioning among community-dwelling older adults (Fu et al., 2018).

For older adults with dementia and other age-related conditions, interactive and creative group activities like music-making appear to offer a cognitively demanding opportunity that may help counteract declines in memory. Importantly, the social bonding facilitated through music-

and arts-related interventions may also impact relationships between caregivers and care recipients. Caregivers in the reminiscence and music-making program felt closer to their care recipients and other group members over time. Carers in the reminiscence intervention also reported more positive well-being (e.g. better sleep, sense of control over the care recipient's problems) at the end of the program compared to the beginning. Participation in other artistic interventions has also been associated with increased bonding (Baker, Stretton-Smith, Clark, Tamplin, & Lee, 2018), happiness (Clark, Tamplin, & Baker, 2018), as well as less anxiety and fewer burdens among caregivers (Raglio et al., 2016). Unexpectedly, however, and in contrast to the reminiscence group, caregivers in the music-making intervention reported fewer changes in well-being, despite experiencing less negative and more positive emotions. As previously discussed, caregivers may have become increasingly aware of their care recipient's struggles during the music-making intervention, thereby triggering concern regarding their ability to manage these issues. These concerns were in turn reflected in surveys of well-being, as well as interview responses. Indeed, caregivers reported feeling worried about the appropriateness of some activities for people with dementia, but were relieved and happy when their care recipient became fully engaged in musical tasks and when they were able to discuss their concerns with other caregivers. And so, while cognitively stimulating activities like music-making can challenge people with dementia, expose abilities affected by the disease, and potentially trigger concern among caregivers, in a group setting like that experienced during the *Music Matters* program, these issues might be overcome and new skills can be acquired with continued social support from other group members. Indeed, the results from Studies 2 and 3 suggest that a group reminiscence and/or a music-making intervention can be helpful additions to standard dementia care that foster social connections, support, and well-being. The more demanding nature of

music-making, however, presents a unique opportunity for caregivers and care recipients alike to confront, better manage, and even prevail over issues related to dementia.

Does group type matter? Outside the realm of musical group interventions, artistic social groups generally appeared to be more beneficial to well-being than other group memberships, although this depended on the health outcome in question. Among the Canadian and British participants assessed in Studies 4 and 5 (respectively), educational, artistic, and cultural group participation (referred to as artistic social groups in subsequent text) were more closely linked to anxiety, memory, and executive functioning compared to other social activities. Meanwhile, participating in sports groups was most strongly linked to increased life satisfaction and reduced depression, with arts groups following closely behind. To the best of our knowledge, there appear to be few studies like these that compare different types of social groups on well-being. Most notably, a large study conducted in the United Kingdom revealed that creative and cultural group participation made the greatest overall contribution to well-being (Green et al., 2017). However, as in Studies 4 and 5, the specific contributions of musical activities were not identified. Instead, musical groups were included in a broader category of creative and cultural activities. For this reason, in Study 6a and 6b, musical group memberships were isolated within reports of broader social group participation among retirement home residents and university students. Unfortunately, only a small number of older and younger adults who participated in musical groups were recruited, and so it was difficult to determine what effects, if any, these groups had on health. However, analyses revealed a positive correlation between artistic social groups (not including music) and problem-focused coping among older adults. Other studies have repeatedly shown that problem-focused coping, which includes asking for support and finding ways to manage problems, is linked to improved well-

being (Alok et al., 2014; Hildon, Montgomery, Blane, Wiggins, & Netuveli, 2010; Ouwehand, De Ridder, & Bensing, 2006). Participation in physical activity groups was also associated with increased use of problem-focused coping among older adults, and for students, this coping style mediated the relationship between physical groups and health outcomes, including depressive symptoms, health, and ability to handle stress. With this in mind, Studies 6a and 6b clearly identified a significant role for other, non-musical social groups in promoting well-being. And so, while participation in artistic social groups made the greatest contributions to overall health in Studies 4 and 5, Study 6 was a reminder that other group memberships can be valuable and that group *type* is but one of many factors that explain how social groups may affect well-being.

The Role of Social Identity

In light of the knowledge that particular groups types, including musical and artistic groups, may benefit well-being, subsequent inquiries explored factors that might drive the relationship between social group participation and health. Of interest in the present research was social identity—that is, the sense of self derived from social group participation that reflects similarities with other group members (Tajfel & Turner, 1979). Studies 1-3 collected information regarding patient and caregiver identity, as well as how close participants felt to their caregiver or care recipient, and other group members. In Study 1, music playlists were personalized with the goal of tapping into patients' various social identities, as other research has suggested that this process promotes well-being (Costa, Ockelford, & Hargreaves, 2018; Deason, Strong, Tat, Simmons-Stern, & Budson, 2018). Participants in Study 1 reported fewer negative emotions (approaching statistical significance), although we found no change in how patients identified with their hospital community as a whole. It may be that other aspects of the patients' social identities were affected, such as relationships with members of their circle of care, including

select nurses, social workers, recreational therapists, and volunteers. It is suggested that these relationships are addressed in future studies of hospital interventions.

However, and as expected, caregivers in the reminiscence (Study 2) and music-making program (Study 3) felt closer to other participants over time, especially their own care recipient. These effects were, in turn, positively correlated with caregiver well-being. Interview responses from participants in Studies 2 and 3 emphasized these findings, with frequent mentions of connecting with others, sharing personal struggles and triumphs, and feeling joy as a result of this bonding process. These social experiences are often reported in other studies of artistic interventions (Baker et al., 2018; Clark et al., 2018; Dingle et al., 2013) and it is postulated that they help promote the positive health outcomes that are also observed among study participants (Ronzi, Orton, Pope, Valtorta, & Bruce, 2018). This was especially evident in Study 6, when social identification was measured for each group membership reported by participants. Indeed, for younger and older adults, group identification was more strongly correlated with well-being than group participation alone. In particular, stronger group identities were linked to fewer depressive and anxious symptoms, as well as increased life satisfaction. Interestingly, among older adults, greater overall group identity was also associated with longer telomeres—a significant and novel finding that highlights the relationship between psychosocial and cellular factors. Other studies have also identified links between telomeres and social factors, including social support from family (Lincoln, Lloyd, & Nguyen, 2017), marital status (Whisman, Robustelli, & Sbarra, 2016), and socioeconomic status (Geronimus et al., 2015). The biological mechanisms underpinning these relationships remain to be determined. Nonetheless, these findings are especially important to consider in the context of aging, when social relationships and identities are often threatened by disease, death, and other stressful life transitions (Davison

et al., 2000; Jetten & Pachana, 2011), and when cellular attrition is inevitable (Fulop et al., 2010). In this regard, social group interventions that encourage identification with others may indirectly promote physical well-being via cellular mechanisms and, at the very least, slow the progression of age-related conditions.

Relations among Genetic Variants, Social Groups, and Well-Being

Like social identity, genetic variants contributed to the relationship between social group participation and well-being. It was initially proposed that SNPs on genes for particular neurotrophins, namely BDNF, IGF, and FGF, would moderate relationships between group memberships and well-being (by virtue of their heavy involvement in brain plasticity, which might be influenced by experience and environment; Dyer, Vahdatpour, Sanfeliu, & Tropea, 2016; Turner et al., 2006; Zhang et al., 2006). This appeared to be the case in Study 5, where it was revealed that a SNP on the IGF-1 gene moderated the relationship between political, arts, and education group participation and perceived social status. Carriers of the dominant allele reported greater social status if they participated in these social groups compared to those who did not, while individuals homozygous for the SNP reported similar social status scores regardless of whether they were participants in these groups. To the best of our knowledge, these findings are the first to demonstrate that SNPs can moderate the benefits of social group participation. The IGF-1 SNP analyzed in Studies 5 and 6, rs7136446, is located on an intron on the IGF gene and only appears to have been associated with negative post-stroke outcomes (Åberg et al., 2013), higher body fat (Huuskonen et al., 2011), as well as cancer susceptibility and elevated levels of plasma IGF-1 (Johansson et al., 2007; Verheus et al., 2008). In other studies, circulating IGF-1 predicted emotional and cognitive disturbances (Levada & Troyan, 2017) and demonstrated antidepressant-like effects (Mueller, Pritchett, Wiechman, Zharikov, &

Hajnal, 2018). Evidently, IGF-1 levels have some bearing on cellular, psychological, and cognitive processes, which presumably may impact responses to social environments and experiences, as observed in Study 5. What remains uncertain is why the effects of the IGF-1 SNP were only observed for participants in political, arts, and education groups. That said, given our previous findings and discussion regarding group *type*, perhaps the cognitively demanding nature of these particular social groups is more dependent on IGF-1 activity than other groups. It is well-known that music and the arts engage multiple cognitive functions (Hallam & Creech, 2016; Schnakers et al., 2016) and perhaps political, trade union, or environmental groups involve challenging activities that do the same. Further research is required to clarify these findings.

In Study 6, SNPs on BDNF and FGF genes were also related to group participation and well-being. In particular, among carriers of the BDNF Met allele (rs6265), there was a positive correlation between group identification and self-reported physical health, while for carriers of an FGF-2 SNP, group identification was negatively associated with depressive symptoms. These results are in contrast with those in Study 5, where there was a positive correlation between group participation and perceived social status only among carriers of a dominant allele, and not a SNP on the IGF-1 gene (rs1048201). It may be that these growth factors operate differently in response to social environments—effects of the Val66Met polymorphism are context-specific, having been associated with positive (Jiang et al., 2017; Xu et al., 2018) and negative health outcomes (Baj et al., 2013; Montag et al., 2014). This may apply to the IGF-1 (rs7136446) and FGF-2 SNPs (rs1048201) as well, although their effects across different populations have yet to be clarified. Alternatively, it may be an issue of sample size. In contrast to Study 5, in which thousands of British participants were assessed, Study 6 required that older and younger adults be combined to provide a modest sample size for SNP analyses. With this in mind, genetic

findings from Study 6 should be interpreted with caution. Indeed, among smaller intervention studies, results are often inconsistent (Sihvonen et al., 2017). This may be explained by the varied methodologies adopted and/or by the fact that participants are responding differentially in part due to their genetic makeup. Nonetheless, knowledge of how genetic factors moderate relations between social groups and health outcomes can inform future social intervention designs and assessments.

Considerations for Future Interventions

Regardless of where they take place and whom they involve, musical and artistic social interventions have the capacity to improve psychosocial and biological outcomes (Dunphy et al., 2019; Sihvonen et al., 2017; van der Steen et al., 2018), as evidenced to some degree by all studies presented here. The challenges lie in recruiting for, implementing and assessing social programs so that older adults can have continued, uninterrupted access to these groups and so that subsequent interventions can be better informed. Feasibility studies can ease the implementation process and prevent unforeseen factors from obscuring research results, but more importantly, from obscuring participant experiences and satisfaction (Lipsey & Cordray, 2000; Orsmond & Cohn, 2015). Feasibility studies can also provide an opportunity for researchers and care staff to determine how to best reach and involve more socially isolated community-dwelling and institutionalized older adults. During this time, it is also important to involve caregivers if applicable, as they too can benefit from interactive, artistic programming. Indeed, social interventions can also provide caregivers with the opportunity to bond with their care recipient and to share their struggles with other carers (Baker et al., 2018; Clark et al., 2018; Dassa et al., 2018). As was observed during the reminiscence and music-making studies, caregivers enjoyed bonding with their care recipient through program activities. They were also glad to find support

from other carers who shared their experiences and recommendations, and from program facilitators who kept care recipients engaged, thereby providing some relief to caregivers with regard to their concern for their loved one's well-being.

Once a social intervention is established, however, it is important for program leaders and/or organizers to identify and track the factors driving the success of the program, or lack thereof. Our studies, amongst others (Haslam et al., 2014a, 2014b) strongly suggest that social identity is one such factor, and research has demonstrated that social interventions can be designed to enhance social identification with others with the intent to further improve well-being (Cruwys et al., 2014; Haslam, Cruwys, Haslam, Dingle, & Chang, 2016). Indeed, in Study 6, group *identification* was more strongly linked to health outcomes than group *type* in both older and younger adults. These results are in line with previous research suggesting that social identity is more closely related to well-being than group participation alone (Haslam et al., 2014b; Sani, Herrera, Wakefield, Boroch, & Gulyas, 2012). However, this is not to suggest that group type is irrelevant—Studies 4 and 5 demonstrated that particular group types, including arts, education, and sports groups, are associated with increased life satisfaction, fewer depressive symptoms, and better cognition. Rather, group type and identification ought to be considered together, with the latter serving as a means to enhance the benefits experienced from group participation. Social group participation likely operates through multiple pathways to affect well-being. Indeed, other mediators of this relationship have been identified, including self-esteem and positive attitude towards aging (Ronzi et al., 2018). Along with social identity, these factors are important to consider when designing and assessing social interventions for older adults.

Finally, after a social intervention has concluded, the challenge of program continuance remains, including incorporating modifications based on participant feedback and research findings. In Study 6, we asked older adults what they believed the key to successful aging to be, and the most reported factor was *sociality*, followed by remaining active and keeping good health. Continued social participation helps to address all of these factors. Health care leaders, researchers, and policy makers (among other stakeholders) have the great task of determining ways to encourage social engagement and support existing social interventions among older adults in the community and in healthcare institutions. Indeed, although some efforts in this regard are currently underway (e.g., the age-friendly community movement; WHO, 2007), continued attention must be focused on how to maintain such programs, including those offered by volunteers or with short-term/precarious funding. As a result of the present research, the *Music and Memory*[®] program (Study 1) is now a permanent offering at several Bruyère locations in Ottawa, while the reminiscence program (Study 2) and *Music Matters* (Study 3) are no longer available (although efforts are being made to re-ignite such programs). Additional research to determine what factors hinder program continuance—and how to overcome them—is needed.

Limitations

As with all research, the studies conducted here have limitations. Recruitment challenges emerged, especially in the community-based studies involving complex-care patients (Study 1) and individuals living with dementia (Studies 2-3). Thus, through a combination of ethical challenges (e.g., the need for informed consent from power of attorneys), recreational therapist recommendations on who would be appropriate to include, and participant attrition, our anticipated goal of several dozen participants in Study 1 amounted to only seven participants in the end. Indeed, the recruitment of participants living with dementia (Studies 2-3) or in long-term

and complex-care (Study 1) can often include unforeseen challenges (Murfield, Cooke, Moyle, Shum, & Harrison, 2011); these challenges are also described in greater detail for Study 1 in particular by Ysseldyk and colleagues (2016). Unfortunately, recruitment efforts of this type can also be biased. Studies of social interventions often naturally attract socially active individuals, instead of those who are more isolated and perhaps in greater need of social programming or support (Ronzi et al., 2018). Recruiting and studying these harder-to-reach individuals is imperative to our understanding of how social groups can function as health interventions (Jetten, Haslam, Haslam, 2011). Therefore, it is worth noting that the research presented here might provide only one side of the story, in that the participants included were receptive to researchers knocking on their door (Study 1), waiting for them in the main lobby of a retirement home (Study 6), or had caregivers who were able to accompany them on a weekly basis (Studies 2 and 3). Fortunately, Studies 4 and 5 helped to offset this limitation with more representative community (national) samples.

Difficulties with recruitment also resulted in small sample sizes in some of the studies presented here (as in Study 1 noted above). On one hand, smaller social groups set the stage for intimate gatherings that allowed program leaders to devote more time and attention to each participant and that promoted social engagement between individuals. Indeed, this was the case in Studies 2 and 3, for which we also took advantage of the qualitative benefits of observational and interview data. On the other hand, small sample sizes can limit the ability to conduct meaningful statistical analyses as well as the generalizability of findings. As social interventions cannot feasibly accommodate a large number of participants by virtue of their design and purpose, one course of action includes continued studies of small social interventions that corroborate and build upon previous findings—this was the goal of Studies 1-3. In contrast to

Studies 1-3, however, analyses in Study 4 were highly powered given the large sample size and so statistical tests were often significant. However, this did not always imply that results were meaningful. Some significant R^2 values were very small and therefore negligible in the context of this research. Likewise, in Study 5, there were also thousands of participants; however, analyses were limited to individuals participating in particular group types for all seven waves and consequently sample sizes were significantly reduced, especially when SNPs were included in statistical tests. Additionally, given that SNPs and telomeres vary with ethnicity (Brown et al., 2016; Risch, 2000), and that an insufficient number of participants of different ethnicities were recruited, only Caucasians were assessed for biological analyses in Study 5 and 6. In Study 6, the sample size for telomere analysis was further reduced because of the low quality and contamination of some saliva samples that could not be appropriately analyzed for telomere length. These limitations impede the generalizability of our biological findings.

A final concern included the low reliability values (i.e. Cronbach's alphas) achieved for some scales used in the smaller studies presented here. These could have occurred because of the small sample sizes themselves or because the scale may not have been sensitive to changes over time. Indeed, the scales used in Study 1 had not previously been adopted to measure the effects of a music program on a complex-care unit—finding measures that addressed music effectiveness in similar populations was difficult. A more likely explanation for this issue, however, is that the scales used were designed to be sensitive to individual differences in a construct at one point in time, rather than across time (Eddy, Dishion, Stoolmiller, 1998; Lipsy & Cordray, 2000). For example, in Study 1, Cronbach's alphas were acceptable for the emotional well-being scale at Time 1 and 2 ($\alpha = .76$ and $.82$, respectively), but at Time 3, the reliability value dropped to $.52$. During this third interview period, two patients were facing critical health

and personal issues that undoubtedly caused a sudden mix of emotions—these were reflected in the emotional well-being scale and could have contributed to the reduced inter-relatedness of scale items. In this regard, there is a strong need for appropriate measures of program assessment in similar populations and others with age-related conditions. Taken together, while no study is without its flaws, together these issues of recruitment bias, sample size, and scale appropriateness suggest that readers should assume a cautionary and critical approach to the results and implications presented here.

Conclusion

What began as a small study of individualized music-listening in Study 1, culminated into a much larger exploration of musical, artistic, and other social groups at the community and nationwide levels. As evidenced by our research, socialization and self-expression of identity are often inherently promoted by music-making and other artistic activities. These factors can interact with biological and psychological mechanisms to affect overall well-being and be used to personalize social interventions with the aim of enhancing health benefits. Research in this domain is sometimes framed as offering a solution to impending economic and healthcare burdens related to an aging population. Of course, social interventions can be cost-effective and helpful in remedying these issues; however, they are far more than an economic solution and ought to be acknowledged as such. For some individuals, including participants in our studies, group memberships are their *raison d'être*, providing them with a sense of life purpose. For others, they serve as a source of social support, nourish identity and connectedness, and promote meaningful engagement that benefits overall health. In this regard, social groups can function as important treatments and preventative measures among community-dwelling and institutionalized older adults. And in the case of artistic and musical groups, socialization can

potentially improve health and well-being among those living in residential care and/or with chronic conditions, including dementia—and their caregivers alike—one song at time.

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A Musical Affair: Songs, Memories, and Social Connections in Complex Care Patients at Bruyère's Saint-Vincent Hospital

	<p>Music Listening Log</p> <p>*Please remember to record both the start and end time of music listening</p> <p>Patient name: _____</p> <p>Room Number: _____</p>
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[illegible]

Survey

Emotional Symptom Checklist

(Administered before, midway through, and at the end of the program)

Please indicate whether or not you have felt the following emotions in the past week.

1. anxiousness	☐ Yes	☐ No
2. nervousness	☐ Yes	☐ No
3. tension	☐ Yes	☐ No
4. worry	☐ Yes	☐ No
5. anger	☐ Yes	☐ No
6. restlessness	☐ Yes	☐ No
7. irritability	☐ Yes	☐ No
8. sadness	☐ Yes	☐ No
9. loneliness	☐ Yes	☐ No
10. happiness	☐ Yes	☐ No
11. excitement	☐ Yes	☐ No
12. joyful	☐ Yes	☐ No
13. pleasant	☐ Yes	☐ No
14. hopefulness	☐ Yes	☐ No
15. gratitude	☐ Yes	☐ No

Visual to be presented to patients for this scale:

YES NO

Short Orientation-Memory-Concentration Test (OMCT)

(Administered before the program)

1. What year is it? _____
2. What month is it? _____
3. Please repeat the following address: John Brown, 42 West St., Hamilton.
4. About what time is it? _____ (*Actual time:* _____)
5. Please count backwards from 20-1. (*Number of errors:* _____)
6. Please say the months of the year in reverse. (*Number of errors:* _____)
7. Please repeat the address mentioned earlier. (*Number of errors:* _____)

Identification with Care Community
(Administered before and after the program)

Using a scale from 1 to 5, with 1 being “strongly disagree” and 5 being “strongly agree”, please state how you feel about the following statements:

1. I see myself as being part of Saint-Vincent Hospital.

1	2	3	4	5
Strongly Disagree				Strongly Agree

2. I am pleased to be part of Saint-Vincent Hospital.

1	2	3	4	5
Strongly Disagree				Strongly Agree

3. I feel strong ties with people in Saint-Vincent Hospital.

1	2	3	4	5
Strongly Disagree				Strongly Agree

4. I can identify with people in Saint-Vincent Hospital.

1	2	3	4	5
Strongly Disagree				Strongly Agree

5. I feel that I am very different from other people in Saint-Vincent Hospital.

1	2	3	4	5
Strongly Disagree				Strongly Agree

Visual presented to patients for this scale:

Strongly Disagree	Disagree		Agree	Strongly Agree

Lubben Social Network Scale – 6 (LSNS-6)

(Administered before and after the program)

Please reflect on your family when answering the following questions. Consider people to whom you are related by birth, marriage, adoption, etc.

1. How many relatives do you see or hear from at least once a month?

0	1	2	3	4	5
none	one	two	three or four	five through eight	nine or more

2. How many relatives do you feel at ease with that you can talk about private matters?

0	1	2	3	4	5
none	one	two	three or four	five through eight	nine or more

3. How many relatives do you feel close to such that you could call on them for help?

0	1	2	3	4	5
none	one	two	three or four	five through eight	nine or more

Please reflect on your friendships. Consider all of your friends including those who reside or volunteer at Saint-Vincent.

4. How many of your friends do you see or hear from at least once a month?

0	1	2	3	4	5
none	one	two	three or four	five through eight	nine or more

5. How many friends do you feel at ease with that you can talk about private matters?

0	1	2	3	4	5
none	one	two	three or four	five through eight	nine or more

6. How many friends do you feel close to such that you could call on them for help?

0	1	2	3	4	5
none	one	two	three or four	five through eight	nine or more

Visual presented to patients for the Lubben Social Network Scale:

0	1	2	3-4	5-8	9+
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Single-Item Self-Esteem Scale

(Administered before, midway through, and after the program)

Please reflect on how you feel about yourself, particularly your level of self-esteem. Using a scale from 1 to 5, with 1 being “not very true of me” and 5 being “very true of me”, please state how you feel about the following statement:

1. I have high self-esteem.

1	2	3	4	5
Not very true of me				Very true of me

Visual presented to patients for this scale:

Self-Anchoring Striving Scale

(Administered before, midway through, and after the program)

Please imagine a ladder with steps numbered from zero at the bottom to ten at the top. The top of the ladder represents the best possible life for you and the bottom of the ladder represents the worst possible life for you. On which step of the ladder would you say you personally feel you stand at this time? (Researcher will circle the respondents answer below).

Global Self-Rated Health Measure

(Administered before, midway through, and after the program)

How would you rate your overall health at the present time? Please select a number from 1 to 5, with 1 being poor, 2 being fair, 3 being good, 4 being very good, and 5 being excellent.

1	2	3	4	5
poor	fair	good	very good	excellent

Visual presented to patients for this scale:

Floor Activity Participation

(Administered before and after the program)

- Are you involved with other recreational activities at Saint-Vincent?
☐ Yes
☐ No

The questions below will only be asked if the participant replies with "yes" to the question above.

- Can you please list the activities?

Activity 1: _____	Activity 4: _____
Activity 2: _____	Activity 5: _____
Activity 3: _____	Activity 6: _____

- How often do you participate in each activity?

Activity 1:	Activity 4:
☐ Everyday	☐ Everyday
☐ Every week	☐ Every week
☐ Every other week	☐ Every other week
☐ At least once a month	☐ At least once a month
☐ Less than once a month	☐ Less than once a month

Activity 2:

- ☐ Everyday
- ☐ Every week
- ☐ Every other week
- ☐ At least once a month
- ☐ Less than once a month

Activity 5:

- ☐ Everyday
- ☐ Every week
- ☐ Every other week
- ☐ At least once a month
- ☐ Less than once a month

Activity 3:

- ☐ Everyday
- ☐ Every week
- ☐ Every other week
- ☐ At least once a month
- ☐ Less than once a month

Activity 6:

- ☐ Everyday
- ☐ Every week
- ☐ Every other week
- ☐ At least once a month
- ☐ Less than once a month

Visual presented to patients for the Floor Activity Participation Scale:

Everyday	Every week	Every other week	At least once a month	Less than once a month
----------	------------	---------------------	--------------------------	---------------------------

Demographics

(Administered before the program)

1. In what year were you born? _____
2. What is your sex?
 - ☐ Male
 - ☐ Female
3. What is your ethnic/racial identity?
 - ☐ Asian (i.e. Chinese, Japanese, Korean)
 - ☐ South Asian (i.e. East Indian, Pakistani, Punjabi, Sri Lankan)
 - ☐ South East Asian (i.e. Cambodian, Indonesian, Laotian)
 - ☐ Arabic
 - ☐ Black
 - ☐ South/Latin American
 - ☐ Mexican
 - ☐ Aboriginal
 - ☐ Euro-Caucasian
 - ☐ Other *please specify*: _____

4. What is your religious affiliation?
☐ Protestant
☐ Catholic
☐ Jewish
☐ Muslim
☐ Buddhist
☐ Hindu
☐ Sikh
☐ Baha'i
☐ Atheist
☐ Agnostic
☐ Other *please specify:* _____
5. What is your current relationship status? *Please check the one that best applies to you.*
☐ Single
☐ In a serious dating relationship
☐ Co-Habiting
☐ Engaged
☐ Married
☐ Separated/Divorced
☐ Widowed
6. What condition are you currently being treated for?

7. What is the highest level of education that you have completed?
☐ Grade school
☐ Some high school
☐ High school diploma
☐ Trade certificate/diploma
☐ Some college
☐ College diploma/degree
☐ Some university
☐ University degree
8. How long have you been at Bruyère, SVH?
_____ days, _____ months, OR _____ years

Additional Follow-up Survey Questionnaires**Short Orientation-Memory-Concentration Test (OMCT)****Version 2**

(Administered after the program)

1. What year is it? _____
2. What month is it? _____
3. Please repeat the following address: Robert Smith, 51 North St., Burlington.
4. About what time is it? _____ (*Actual time:* _____)
5. Please count backwards from 20-1. (*Number of errors:* _____)
6. Please say the months of the year in reverse. (*Number of errors:* _____)
7. Please repeat the address mentioned earlier. (*Number of errors:* _____)

Program Satisfaction
(Administered weekly)

Using a scale from 0 to 3, with 0 being “not at all”, 1 being “somewhat”, 2 being “most of the time”, and 3 being “extremely”, please answer the following questions.

1. Are you enjoying the music listening program?

0	1	2	3
Not at all	Somewhat	Most of the time	Extremely

2. Do you feel that you have enough listening time?

0	1	2	3
Not at all	Somewhat	Most of the time	Extremely

3. Are you still satisfied with your playlist?

0	1	2	3
Not at all	Somewhat	Most of the time	Extremely

4. Please mention any additional comments or concerns.

Visual presented to patients for this scale:

Not at all

Somewhat

Most of the
time

Extremely

Appendix B: Study 2 Measures

Effects of Group Reminiscence Therapy on People with Dementia

Pre- and Post-Program Survey for Caregivers

The Satisfaction with Life Scale

Below are five statements that you may agree or disagree with. Using the 1-7 scale below, indicate your agreement with each item by placing the appropriate number on the line preceding that item. Please be open and honest in your responding.

- 7 – Strongly agree
- 6 – Agree
- 5 – Slightly agree
- 4 – Neither agree nor disagree
- 3 – Slightly disagree
- 2 – Disagree
- 1 – Strongly disagree

- _____ In most ways my life is close to my ideal.
- _____ The conditions of my life are excellent.
- _____ I am satisfied with my life.
- _____ So far I have gotten the important things I want in life.
- _____ If I could live my life over, I would change almost nothing.

Inclusion of the Other in the Self

Instructions: Please circle the picture that best describes your current relationship with your relative with dementia.

Your Identity as an Informal Caregiver

Please circle the number that best describes your feelings with the corresponding statement.

1. I see myself as an informal caregiver

do not agree at all 1 2 3 4 5 6 7 agree completely

2. I am pleased to be an informal caregiver

do not agree at all 1 2 3 4 5 6 7 agree completely

3. I feel strong ties with other informal caregivers

do not agree at all 1 2 3 4 5 6 7 agree completely

4. I identify with other informal caregivers

do not agree at all 1 2 3 4 5 6 7 agree completely

The International Positive and Negative Affect Short Form

Thinking about yourself and how you normally feel, **to what extent do you generally feel/how have you felt in the past week:**

1. Upset

1	2	3	4	5
Never				Always

2. Hostile

1 2 3 4 5
Never Always

3. Alert

1 2 3 4 5
Never Always

4. Ashamed

[illegible]

5. Inspired

1	2	3	4	5
Never				Always

6. Nervous

1	2	3	4	5
Never				Always

7. Determined

1	2	3	4	5
Never				Always

8. Attentive

[illegible]

9. Afraid

[illegible]

10. Active

[illegible]

Coping as an Informal Caregiver

Below are some questions about your experiences as an informal caregiver. Please tick the boxes that are relevant to YOU.

The following questions concern the **past two months/eleven weeks, since the beginning of the reminiscence program.**

[illegible][illegible]

**How are you feeling?
(Relative Stress Scale)**

	Not at all				To a high degree
1. Do you ever feel you can no longer cope with the situation?	0	1	2	3	4
2. Do you ever feel you need a break?	0	1	2	3	4
3. Do you ever get depressed by the situation?	0	1	2	3	4
4. Has your own health suffered at all?	0	1	2	3	4
5. Do you worry about accidents happening to the care recipient?	0	1	2	3	4
6. Do you ever feel that there will be no end to the problem?	0	1	2	3	4
7. Do you find it difficult to get away on holiday?	0	1	2	3	4
8. How much has your social life been affected?	0	1	2	3	4
9. How much has the household routine been upset?	0	1	2	3	4
10. Is your sleep interrupted by the care recipient?	0	1	2	3	4
11. Has your standard of living been reduced?	0	1	2	3	4
12. Do you ever feel embarrassed by the care recipient?	0	1	2	3	4
13. Are you at all prevented from having visitors?	0	1	2	3	4
14. Do you ever get cross or angry with the care recipient?	0	1	2	3	4
15. Do you ever feel frustrated at times with the care recipient?	0	1	2	3	4

Caregiving Domains

Please rate the extent to which you agree with each of the following statements in your role as a caregiver.

Caregiving Satisfaction

You really enjoy being with the care recipient?	Strongly Disagree	1	2	3	4	Strongly Agree 5
Your care recipient shows real appreciation of what you do for him/her?	Strongly Disagree	1	2	3	4	Strongly Agree 5
Your care recipient's pleasure over some little thing gives you pleasure?	Strongly Disagree	1	2	3	4	Strongly Agree 5
Helping your care recipient has made you feel closer to him/her?	Strongly Disagree	1	2	3	4	Strongly Agree 5
It makes you happy to know that your care recipient is being cared for by his/her family?	Strongly Disagree	1	2	3	4	Strongly Agree 5
You take care of your care recipient more because you want to than out of a sense of duty?	Strongly Disagree	1	2	3	4	Strongly Agree 5

Traditional Caregiving Ideology

A strong reason for being a caregiver is to be true to family traditions?	Strongly Disagree	1	2	3	4	Strongly Agree 5
Being a caregiver is a way for you to live up to religious principles?	Strongly Disagree	1	2	3	4	Strongly Agree 5
A strong reason for being a caregiver is to provide a good model for your own children to follow?	Strongly Disagree	1	2	3	4	Strongly Agree 5
You think of the help you give to the care recipient as an opportunity to repay him/her?	Strongly Disagree	1	2	3	4	Strongly Agree 5

Positive Aspects of Caregiving

Some caregivers say that, despite all the difficulties involved in giving care to a family member with memory or health problems, good things have come out of their caregiving experience too. Below is a list of some of the good things reported by caregivers. Please indicate how much you agree or disagree with these statements.

[illegible]

Perceived Change Index

In the **past month/since starting the reminiscence program**, for each item, please indicate if you have felt things have become much worse, somewhat worse, stayed the same, improved somewhat, or improved a lot.

	Much Worse	Somewhat Worse	Stayed the Same	Improved Somewhat	Improved a Lot
Feeling rested	☐	☐	☐	☐	☐
Ability to sleep through the night	☐	☐	☐	☐	☐
Ability to have time for yourself	☐	☐	☐	☐	☐
Your energy level	☐	☐	☐	☐	☐
Feeling overwhelmed	☐	☐	☐	☐	☐
Feeling upset	☐	☐	☐	☐	☐
Feeling calm or relaxed	☐	☐	☐	☐	☐
Things have been going your way	☐	☐	☐	☐	☐
Feelings of being angry	☐	☐	☐	☐	☐
Ability to understand the care recipient's behaviour	☐	☐	☐	☐	☐
Sense of control over the care recipient's problems	☐	☐	☐	☐	☐
Ability to manage day-to-day caregiving	☐	☐	☐	☐	☐
Ability to handle new caregiving problems	☐	☐	☐	☐	☐

General Questions About Yourself

1. What is your age? _____ years
2. What is your sex?
 - ☐ Male
 - ☐ Female
3. What is your ethnic/racial identity?
 - ☐ Asian (i.e. Chinese, Japanese, Korean)
 - ☐ South Asian (i.e. East Indian, Pakistani, Punjabi, Sri Lankan)
 - ☐ South East Asian (i.e. Cambodian, Indonesian, Laotian)
 - ☐ Arabic
 - ☐ Black
 - ☐ South/Latin American
 - ☐ Mexican
 - ☐ Aboriginal
 - ☐ Euro-Caucasian
 - ☐ Other *please specify:* _____
4. What is your religious affiliation?
 - ☐ Protestant
 - ☐ Catholic
 - ☐ Jewish
 - ☐ Muslim
 - ☐ Buddhist
 - ☐ Hindu
 - ☐ Sikh
 - ☐ Baha'i
 - ☐ Atheist
 - ☐ Agnostic
 - ☐ Other *please specify:* _____
5. What is your current relationship status? *Please check the one that best applies to you.*
 - ☐ Single
 - ☐ In a serious dating relationship
 - ☐ Co-Habiting
 - ☐ Engaged
 - ☐ Married
 - ☐ Separated/Divorced
 - ☐ Widowed

6. What is the highest level of education that you have completed?
- ☐ Grade school
 - ☐ Some high school
 - ☐ High school diploma
 - ☐ Trade certificate/diploma
 - ☐ Some college
 - ☐ College diploma/degree
 - ☐ Some university
 - ☐ University degree
7. What is your living situation?
- ☐ Living alone
 - ☐ Living with partner
 - ☐ Living with a partner and children
8. What is your residential situation?
- ☐ Living at home
 - ☐ Living in a son's or daughter's home
 - ☐ Other: _____
9. What is your relationship to the care recipient?
- ☐ Spouse/Partner
 - ☐ Son/daughter (in-law)
 - ☐ Other Relative
 - ☐ Neighbour
 - ☐ Other: _____
10. For how long have you been looking after the care recipient (approximately)?
- ☐ Less than half a year
 - ☐ Half a year to 1 year
 - ☐ 1 to 2 years
 - ☐ 2 to 3 years
 - ☐ 3 to 4 years
 - ☐ 4 to 5 years
 - ☐ More than 5 years
11. How many times per week do you provide care for the care recipient?
- ☐ Daily
 - ☐ 3 to 6 times per week
 - ☐ 1 to 2 times per week
 - ☐ less than once per week
 - ☐ less than once per month

12. Are there other relatives/friends who have significant share in the care?

- ☐ No, I am the main caregiver
- ☐ Yes, one other person
- ☐ Yes, two others
- ☐ Yes, three or more others

13. What activities do you help with? (*more than one answer possible*)

- ☐ Washing and/or dressing/undressing
- ☐ Showering
- ☐ Taking medication
- ☐ Eating meals
- ☐ Walking, standing
- ☐ Household tasks
- ☐ Cooking, food preparation
- ☐ Transport, driving
- ☐ Shopping
- ☐ Administration
- ☐ External activities (such as in a club or association)
- ☐ Odd jobs (including cleaning, gardening, repairs, maintenance)
- ☐ Coping with fears, anger, or confusion
- ☐ Other: _____

14. Do you live close to your Carefor Community Centre?

- ☐ Very close
- ☐ Close
- ☐ Somewhat far
- ☐ Very far

General Questions About the Person You Are Caring For

1. Is the care recipient male or female?
 - ☐ Male
 - ☐ Female
2. What is his or her age? _____ years
3. What is his/her civil status?
 - ☐ Unmarried
 - ☐ Married
 - ☐ Widowed
 - ☐ Divorced/separated
4. What his/her residential situation?
 - ☐ Living at home
 - ☐ Living in a son's or daughter's home
 - ☐ Other: _____
5. What professional help is currently being received by the person you are caring for?
 - ☐ No professional help
 - ☐ Physical care/nursing
 - ☐ Support with household tasks
 - ☐ Talks with a counselor or advisor for the care recipient
 - ☐ Day care treatment/Day care center/Social encounter center
 - ☐ Medical treatment
 - ☐ Other: _____

Pre- and Post-Program Survey for Care Recipients

Inclusion of the Other in the Self

Instructions: Please circle the picture that best describes your current relationship with your caregiver.

General Life Happiness Measure

Overall, how happy would you say you are these days? Would you say you are . . .

Not very happy

Pretty happy

Very happy

Short Orientation-Memory-Concentration Test (OMCT)

1. What year is it? _____
2. What month is it? _____
3. Please repeat the following address: John Brown, 42 West St., Hamilton.
4. About what time is it? _____ (*Actual time:* _____)
5. Please count backwards from 20-1. (*Number of errors:* _____)
6. Please say the months of the year in reverse. (*Number of errors:* _____)
7. Please repeat the address mentioned earlier. (*Number of errors:* _____)

Short Orientation-Memory-Concentration Test (OMCT)

Version 2

(Administered after the program)

1. What year is it? _____
2. What month is it? _____
3. Please repeat the following address: Robert Smith, 51 North St., Burlington.
4. About what time is it? _____ (*Actual time:* _____)
5. Please count backwards from 20-1. (*Number of errors:* _____)
6. Please say the months of the year in reverse. (*Number of errors:* _____)
7. Please repeat the address mentioned earlier. (*Number of errors:* _____)

Weekly Survey for Caregivers

Inclusion of the Other in the Self

Instructions: Please circle the picture that best describes your current relationship with your relative with dementia.

Inclusion of the Other in the Self (Included in the post-program survey)

Instructions: Please circle the picture that best describes your current relationship with your reminiscence group.

The International Positive and Negative Affect Short Form

Thinking about yourself and how you normally feel, how have you felt in the past week:

1. Upset
1 2 3 4 5
Never Always

2. Hostile
1 2 3 4 5
Never Always

3. Alert
1 2 3 4 5
Never Always

4. Ashamed
1 2 3 4 5
Never Always

5. Inspired
1 2 3 4 5
Never Always

6. Nervous
1 2 3 4 5
Never Always

7. Determined
1 2 3 4 5
Never Always

8. Attentive
1 2 3 4 5
Never Always

9. Afraid
1 2 3 4 5
Never Always

10. Active
1 2 3 4 5
Never Always

Weekly Survey for Care Recipients

Inclusion of the Other in the Self

Instructions: Please circle the picture that best describes your current relationship with your caregiver.

**Inclusion of the Other in the Self
(Included in the post-program survey)**

Instructions: Please circle the picture that best describes your current relationship with your reminiscence group.

General Life Happiness Measure

Overall, how happy would you say you are these days? Would you say you are . . .

Not very happy

Pretty happy

Very happy

Appendix C: Study 3 Measures**Music Matters: Identity and Well-being among Adults with Early- to Mid-Stage Dementia and their Caregivers****Pre-Program Survey for Caregivers****The Satisfaction with Life Scale**

Below are five statements that you may agree or disagree with. Using the 1-7 scale below, indicate your agreement with each item by placing the appropriate number on the line preceding that item. There are no right or wrong answers, so please be open and honest in your responding.

- 7 – Strongly agree
- 6 – Agree
- 5 – Slightly agree
- 4 – Neither agree nor disagree
- 3 – Slightly disagree
- 2 – Disagree
- 1 – Strongly disagree

_____ In most ways my life is close to my ideal.

_____ The conditions of my life are excellent.

_____ I am satisfied with my life.

_____ So far I have gotten the important things I want in life.

_____ If I could live my life over, I would change almost nothing.

Inclusion of the Other in the Self

Instructions: Please circle the picture that best describes your current **relationship with your care recipient**.

Your Identity as a Caregiver

Please circle the number that best describes your feelings with the corresponding statement.

1. I see myself as a caregiver

do not agree at all 1 2 3 4 5 6 7 agree completely

2. I am pleased to be a caregiver

do not agree at all 1 2 3 4 5 6 7 agree completely

3. I feel strong ties with other caregivers

do not agree at all 1 2 3 4 5 6 7 agree completely

4. I identify with other caregivers

do not agree at all 1 2 3 4 5 6 7 agree completely

The International Positive and Negative Affect Short Form

Thinking about yourself and how you normally feel, **to what extent do you generally feel/how have you felt in the past week:**

1. Upset

1	2	3	4	5
Never				Always

2. Hostile

1 2 3 4 5
Never Always

3. Alert

1 2 3 4 5
Never Always

4. Ashamed

1	2	3	4	5
Never				Always

5. Inspired

1	2	3	4	5
Never				Always

6. Nervous

1 2 3 4 5
Never Always

7. Determined

1 2 3 4 5
Never Always

8. Attentive

1 2 3 4 5
Never Always

9. Afraid

[illegible]

10. Active

[illegible]

Perceived Change Index

In the **past month/since starting the music program**, for each item, please indicate if you have felt things have become much worse, somewhat worse, stayed the same, improved somewhat, or improved a lot.

	Much Worse	Somewhat Worse	Stayed the Same	Improved Somewhat	Improved a Lot
Feeling rested	☐	☐	☐	☐	☐
Ability to sleep through the night	☐	☐	☐	☐	☐
Ability to have time for yourself	☐	☐	☐	☐	☐
Your energy level	☐	☐	☐	☐	☐
Feeling overwhelmed	☐	☐	☐	☐	☐
Feeling upset	☐	☐	☐	☐	☐
Feeling calm or relaxed	☐	☐	☐	☐	☐
Things have been going your way	☐	☐	☐	☐	☐
Feelings of being angry	☐	☐	☐	☐	☐
Ability to understand the care recipient's behaviour	☐	☐	☐	☐	☐
Sense of control over the care recipient's problems	☐	☐	☐	☐	☐
Ability to manage day-to-day caregiving	☐	☐	☐	☐	☐
Ability to handle new caregiving problems	☐	☐	☐	☐	☐

The following questions are only in the pre-program survey:

What were your first impressions of the music group (both positive and negative)?

Do you feel connected to the other music group members, like you belong and identify with this group?

General Questions About Yourself

1. What is your age? _____ years
2. What is your sex?
 - ☐ Male
 - ☐ Female
3. What is your ethnic/racial identity?
 - ☐ Asian (i.e. Chinese, Japanese, Korean)
 - ☐ South Asian (i.e. East Indian, Pakistani, Punjabi, Sri Lankan)
 - ☐ South East Asian (i.e. Cambodian, Indonesian, Laotian)
 - ☐ Arabic
 - ☐ Black
 - ☐ South/Latin American
 - ☐ Mexican
 - ☐ Aboriginal
 - ☐ Euro-Caucasian
 - ☐ Other *please specify:* _____
4. What is your religious affiliation?
 - ☐ Protestant
 - ☐ Catholic
 - ☐ Jewish
 - ☐ Muslim
 - ☐ Buddhist
 - ☐ Hindu
 - ☐ Sikh
 - ☐ Baha'i
 - ☐ Atheist
 - ☐ Agnostic
 - ☐ Other *please specify:* _____
5. What is your current relationship status? *Please check the one that best applies to you.*
 - ☐ Single
 - ☐ In a serious dating relationship
 - ☐ Co-Habiting
 - ☐ Common-law marriage
 - ☐ Engaged
 - ☐ Married
 - ☐ Separated/Divorced
 - ☐ Widowed

6. What is the highest level of education that you have completed?
 - ☐ Grade school
 - ☐ Some high school
 - ☐ High school diploma
 - ☐ Trade certificate/diploma
 - ☐ Some college
 - ☐ College diploma/degree
 - ☐ Some university
 - ☐ University degree
7. What is your living situation?
 - ☐ Living alone
 - ☐ Living with partner
 - ☐ Living with a partner and children
8. What is your residential situation?
 - ☐ Living at home
 - ☐ Living in a son's or daughter's home
 - ☐ Other: _____
9. What is your relationship to the care recipient?
 - ☐ Spouse/Partner
 - ☐ Son/daughter (in-law)
 - ☐ Other Relative
 - ☐ Neighbour
 - ☐ Other: _____
10. For how long have you been looking after the care recipient (approximately)?
 - ☐ Less than half a year
 - ☐ Half a year to 1 year
 - ☐ 1 to 2 years
 - ☐ 2 to 3 years
 - ☐ 3 to 4 years
 - ☐ 4 to 5 years
 - ☐ More than 5 years
11. How many times per week do you provide care for the care recipient?
 - ☐ Daily
 - ☐ 3 to 6 times per week
 - ☐ 1 to 2 times per week
 - ☐ less than once per week
 - ☐ less than once per month

12. Are there other relatives/friends who have significant share in the care?

- ☐ No, I am the main caregiver
- ☐ Yes, one other person
- ☐ Yes, two others
- ☐ Yes, three or more others

13. What activities do you help with? (*more than one answer possible*)

- ☐ Washing and/or dressing/undressing
- ☐ Showering/bathing?
- ☐ Taking medication
- ☐ Eating meals
- ☐ Walking, standing
- ☐ Household tasks
- ☐ Cooking, food preparation
- ☐ Transport, driving
- ☐ Shopping
- ☐ Administration
- ☐ External activities (such as in a club or association)
- ☐ Odd jobs (including cleaning, gardening, repairs, maintenance, snow removal)
- ☐ Coping with fears, anger, or confusion
- ☐ Other: _____

14. Do you play any music instruments? If so, how long have you known how to play them?

15. Do you sing (e.g. choirs, bands)? If so, how long have you been singing?

16. Do you live close to Elizabeth Bruyère Hospital?

- ☐ Very close
- ☐ Close
- ☐ Somewhat far
- ☐ Very far

General Questions About the Person You Are Caring For

1. Is the care recipient male or female?

- ☐ Male
- ☐ Female

2. What is his or her age? _____ years

3. What type of dementia does he or she have?

4. What is his/her civil status?

- ☐ Unmarried
- ☐ Married
- ☐ Widowed
- ☐ Divorced/separated

5. What his/her residential situation?

- ☐ Living at home
- ☐ Living in a son's or daughter's home
- ☐ Other: _____

6. What professional help is currently being received by the person you are caring for?

- ☐ No professional help
- ☐ Physical care/nursing
- ☐ Support with household tasks
- ☐ Talks with a counselor or advisor for the care recipient
- ☐ Daily treatment/Day program center/Social encounter center
- ☐ Medical treatment
- ☐ Other: _____

7. Do they play any music instruments? If so, how long have they known how to play them?

8. Do they sing (e.g. choirs, bands)? If so, how long have they been singing?

Pre-Program Survey for Care Recipients

Inclusion of the Other in the Self

Instructions: Please circle the picture that best describes your current relationship with [researcher say's name of caregiver].

The closer the figures appear in the pictures below, the closer you are in your relationship.

General Life Happiness Measure

Overall, how happy would you say you are these days? Would you say you are . . .

Not very happy

Somewhat
unhappy

Neutral

Pretty happy

Very happy

Short Orientation-Memory-Concentration Test (OMCT)

1. What year is it? _____
2. What month is it? _____
3. Please repeat the following address: John Brown, 42 West St., Hamilton.
4. About what time is it? _____ (*Actual time:* _____)
5. Please count backwards from 20-1. (*Number of errors:* _____)
6. Please say the months of the year in reverse. (*Number of errors:* _____)
7. Please repeat the address mentioned earlier. (*Number of errors:* _____)

The following questions are only in the pre-program survey:

What were your first impressions of the music group (both positive and negative)?

Do you feel connected to the other music group members, like you belong and identify with this group?

Mid- and Post-Program Survey for Caregivers

The Satisfaction with Life Scale

Below are five statements that you may agree or disagree with. Using the 1-7 scale below, indicate your agreement with each item by placing the appropriate number on the line preceding that item. There are no right or wrong answers, so please be open and honest in your responding.

- 7 – Strongly agree
- 6 – Agree
- 5 – Slightly agree
- 4 – Neither agree nor disagree
- 3 – Slightly disagree
- 2 – Disagree
- 1 – Strongly disagree

- _____ In most ways my life is close to my ideal.
- _____ The conditions of my life are excellent.
- _____ I am satisfied with my life.
- _____ So far I have gotten the important things I want in life.
- _____ If I could live my life over, I would change almost nothing.

Inclusion of the Other in the Self

Instructions: Please circle the picture that best describes your current **relationship with your care recipient**.

Inclusion of the Other in the Self

Instructions: Please circle the picture that best describes your current **relationship with your music group**.

Your Identity as a Caregiver

Please circle the number that best describes your feelings with the corresponding statement.

1. I see myself as a caregiver

do not agree at all 1 2 3 4 5 6 7 agree completely

2. I am pleased to be a caregiver

do not agree at all 1 2 3 4 5 6 7 agree completely

3. I feel strong ties with other caregivers

do not agree at all 1 2 3 4 5 6 7 agree completely

4. I identify with other caregivers

do not agree at all 1 2 3 4 5 6 7 agree completely

Thinking about yourself and how you normally feel, how have you felt in the past week:

10. Active
1 2 3 4 5
Never Always

Perceived Change Index

In the past month, for each item, please indicate if you have felt things have become much worse, somewhat worse, stayed the same, improved somewhat, or improved a lot.

	Much Worse	Somewhat Worse	Stayed the Same	Improved Somewhat	Improved a Lot
Feeling rested	☐	☐	☐	☐	☐
Ability to sleep through the night	☐	☐	☐	☐	☐
Ability to have time for yourself	☐	☐	☐	☐	☐
Your energy level	☐	☐	☐	☐	☐
Feeling overwhelmed	☐	☐	☐	☐	☐
Feeling upset	☐	☐	☐	☐	☐
Feeling calm or relaxed	☐	☐	☐	☐	☐
Things have been going your way	☐	☐	☐	☐	☐
Feelings of being angry	☐	☐	☐	☐	☐
Ability to understand the care recipient's behaviour	☐	☐	☐	☐	☐
Sense of control over the care recipient's problems	☐	☐	☐	☐	☐
Ability to manage day-to-day caregiving	☐	☐	☐	☐	☐
Ability to handle new caregiving problems	☐	☐	☐	☐	☐

The following questions are only in the post-program survey:

1. What does it mean to you to be a member of this music group?

2. Has your sense of connectedness with other members of the music group changed since you first started the program? (if yes, please describe)

3. How did being a part of the music program influence your mood?

4. Have you noticed any (other) effects of being in the music group in terms of your mental or physical health and wellbeing?

5. What was your favourite moment of the music program and why?

Mid- and Post-Program Survey for Care Recipients

Inclusion of the Other in the Self

Instructions: Please circle the picture that best describes your current relationship **with** [researcher say's name of caregiver].

The closer the figures appear in the pictures below, the closer you are in your relationship.

Inclusion of the Other in the Self

Instructions: Please circle the picture that best describes your current relationship with **your music group**.

The closer the figures appear in the pictures below, the closer you are in your relationship.

General Life Happiness Measure

Overall, how happy would you say you are these days? Would you say you are . . .

Short Orientation-Memory-Concentration Test (OMCT) Version 2 (Only in post-program survey)

1. What year is it? _____
2. What month is it? _____
3. Please repeat the following address: Robert Smith, 51 North St., Burlington.
4. About what time is it? _____ (*Actual time:* _____)
5. Please count backwards from 20-1. (*Number of errors:* _____)
6. Please say the months of the year in reverse. (*Number of errors:* _____)
7. Please repeat the address mentioned earlier. (*Number of errors:* _____)

The following questions are only in the post-program survey:

1. What does it mean to you to be a member of this music group?

2. How does being a part of the music program influence your mood?

3. What was your favourite moment of the music program and why?

MiDAS Scale
(For Researcher Use only)

Participant Code:	Time:
Researcher:	Date:

Which rating is this?

- ☐ Beginning of session
☐ End of session

1. Levels of Interest in objects/activities/people around him/her (attention). For example:

- Did he/she show his/her interest in an activity or other people around him/her?
- Did his/her posture or facial expression change if activities or music catch his/her attention?
- Did he/she become animated if activities or music catch his/her attention?

Score

None at all _____ Highest

2. Levels of Response in communication/activity (awareness, interaction). For example:

- Did his/her facial expression or body-movements indicate his/her awareness of staff or therapist?
- Did he/she make eye-contact with staff, therapist or other group members?
- Did he/she join in conversation, music-making, or vocal sound?

Score

None at all _____ Highest

3. Levels of Initiation in communication/activity (intention). For example:

- Did he/she try to communicate with staff, therapist or other group members?
- Did he/she start conversation, start music-making, or initiate vocalization?
- Did he/she talk about his/her life experiences (reminiscence) or mention music meaningful to them?

Score

None at all _____ Highest

4. Levels of Involvement in communication/activity (participation). For example:

- Did he/she become engaged in conversation, music-making, or any forms of communication?
- Did he/she show his/her enthusiasm in activities that interest him/her?

Score

None at all _____ Highest

5. **Levels of Enjoyment** during communication/activity. For example:

- Smiling, laughing, brighter mood
- Playfulness, sense of humour
- Relaxed mood

None at all _____ Highest Score

6. During this period of time did you notice any major reactions from the person?

Agitation	<input style="width: 30px; height: 25px; border: 1px solid black;" type="checkbox"/>	Relaxed mood	<input style="width: 30px; height: 25px; border: 1px solid black;" type="checkbox"/>
Withdrawn/low in mood	<input style="width: 30px; height: 25px; border: 1px solid black;" type="checkbox"/>	Attentive/interested	<input style="width: 30px; height: 25px; border: 1px solid black;" type="checkbox"/>
Restless/anxious	<input style="width: 30px; height: 25px; border: 1px solid black;" type="checkbox"/>	Cheerful/smiling	<input style="width: 30px; height: 25px; border: 1px solid black;" type="checkbox"/>

7. Any comments?

Appendix D: Study 3 Correlation Tables

Table 3.3

Zero-order correlations among caregiver measures at Time 1

Measures	LS	RC	CID	PE	NE
LS					
RC	.59				
CID	.73	.98			
PE	.44	.98	.93		
NE	.68	-.19	.00	-.36	
PCI	.97	.76	.87	.63	.50

Note. Life satisfaction (LS), Relationship with Care Recipient (RC), Caregiver Identity (CID), Positive Emotions (PE), Negative Emotions (NE), Perceived Change Index (PCI).

Table 3.4

Zero-order correlations among caregiver measures at Time 3

Measures	LS	RC	RG	CID	PE	NE
LS						
RC	.73					
RG	.38	.42				
CID	.09	0	.53			
PE	.03	.47	.18	.23		
NE	.13	0	-.19	.23	-.54	
PCI	-.08	.48	.23	-.44	.55	-.62

Note. Life satisfaction (LS), Relationship with Care Recipient (RC), Relationship with Group (RG), Caregiver Identity (CID), Positive Emotions (PE), Negative Emotions (NE), Perceived Change Index (PCI).

Table 3.5

Zero-order correlations among caregiver measures at Time 1 and 2

		Time 2						
Measures		LS	RC	RG	CID	PE	NE	PCI
Time 1	LS	.91	-.23	-.04	.99	.29	-.97	.94
	RC	.87	.66	.79	.69	.95	-.76	.84
	CID	.95	.50	.66	.81	.87	-.87	.92
	PE	.76	.78	.88	.55	.99	-.63	.73
	NE	.33	-.87	-.76	.59	-.50	-.50	.38
	PCI	.98	0	.19	1.00	.50	-1.00***	.99

Note. Life satisfaction (LS), Relationship with Care Recipient (RC), Relationship with Group (RG), Caregiver Identity (CID), Positive Emotions (PE), Negative Emotions (NE), Perceived Change Index (PCI). *** $p < .001$.

Table 3.6

Zero-order correlations among caregiver measures at Time 1 and 3

		Time 3						
Measures		LS	RC	RG	CID	PE	NE	PCI
Time 1	LS	-.36	-.23	.29	.97	.63	0	-.62
	RC	.54	.66	.95	.76	.99 [*]	0	.27
	CID	.37	.50	.87	.87	.99	0	.08
	PE	.68	.78	.99	.63	.98	0	.44
	NE	-.93	-.87	-.50	.50	-.14	0	-.99
	PCI	-.14	0	.50	1.00 ^{***}	.79	0	-.43

Note. Life satisfaction (LS), Relationship with Care Recipient (RC), Relationship with Group (RG), Caregiver Identity (CID), Positive Emotions (PE), Negative Emotions (NE), Perceived Change Index (PCI). ** $p < .001$.

Appendix E: Study 4 Measures**Social Participation**

About how much time do you spend doing each of the following activities, taking into account both work and leisure time?

1) Playing a musical instrument or singing in a choir.

- ☐ once a year or less
- ☐ several times a year
- ☐ several times a month
- ☐ several times a week
- ☐ everyday

2) Playing board games, cards, crossword puzzles, jigsaw puzzles, or sudoku.

- ☐ once a year or less
- ☐ several times a year
- ☐ several times a month
- ☐ several times a week
- ☐ everyday

In the past twelve months, how often did you participate in:

1) Family or friendship based activities outside the household?

- ☐ never
- ☐ at least once a year
- ☐ at least once a month
- ☐ at least once a week
- ☐ at least once a day

2) Church or religious activities such as services, committees or choirs?

- ☐ never
- ☐ at least once a year
- ☐ at least once a month
- ☐ at least once a week
- ☐ at least once a day

3) Sports or physical activities that you do with other people?

- ☐ never
- ☐ at least once a year
- ☐ at least once a month
- ☐ at least once a week
- ☐ at least once a day

4) Educational and cultural activities involving other people such as attending courses, concerts, plays, or visiting museums?

- ☐ never
- ☐ at least once a year
- ☐ at least once a month
- ☐ at least once a week
- ☐ at least once a day

5) Service club or fraternal organization activities—examples include: Lion's Club, Rotary, Kiwanis Club, Royal Canadian Legion, or Foresters?

- ☐ never
- ☐ at least once a year
- ☐ at least once a month
- ☐ at least once a week
- ☐ at least once a day

6) Neighbourhood, community or professional association activities?

- ☐ never
- ☐ at least once a year
- ☐ at least once a month
- ☐ at least once a week
- ☐ at least once a day

7) Volunteer or charity work?

- ☐ never
- ☐ at least once a year
- ☐ at least once a month
- ☐ at least once a week
- ☐ at least once a day

How often do you use social networking sites to stay in touch or make plans with friends?

- ☐ daily
- ☐ a few times a week
- ☐ a few times a month
- ☐ a few times a year
- ☐ never

How often do you use social networking sites to stay in touch or make plans with family?

- ☐ daily
- ☐ a few times a week
- ☐ a few times a month
- ☐ a few times a year
- ☐ never

Life Satisfaction

1. In most ways my life is close to ideal.
 ___disagree → proceed to a
 ___neither agree nor disagree (coded as 4)
 ___agree → proceed to b

a. Would you say you . . .
 ___slightly disagree (recoded as 3)
 ___disagree (recoded as 2)
 ___strongly disagree (recoded as 1)

b. Would you say you . . .
 ___slightly agree (recoded as 5)
 ___agree (recoded as 6)
 ___strongly agree (recoded as 7)

2. The conditions of my life are excellent.
 ___disagree → proceed to a
 ___neither agree nor disagree (coded as 4)
 ___agree → proceed to b

a. Would you say you . . .
 ___slightly disagree (recoded as 3)
 ___disagree (recoded as 2)
 ___strongly disagree (recoded as 1)

b. Would you say you . . .
 ___slightly agree (recoded as 5)
 ___agree (recoded as 6)
 ___strongly agree (recoded as 7)

3. I am satisfied with my life.
 ___disagree → proceed to a
 ___neither agree nor disagree (coded as 4)
 ___agree → proceed to b

a. Would you say you . . .
 ___slightly disagree (recoded as 3)
 ___disagree (recoded as 2)
 ___strongly disagree (recoded as 1)

b. Would you say you . . .
 ___slightly agree (recoded as 5)
 ___agree (recoded as 6)
 ___strongly agree (recoded as 7)

4. So far, I have gotten the important things I want in life.

___disagree → proceed to a
 ___neither agree nor disagree (coded as 4)
 ___agree → proceed to b

a. Would you say you . . .
 ___slightly disagree (recoded as 3)
 ___disagree (recoded as 2)
 ___strongly disagree (recoded as 1)

b. Would you say you . . .
 ___slightly agree (recoded as 5)
 ___agree (recoded as 6)
 ___strongly agree (recoded as 7)

5. If I could live my life over, I would change almost nothing.

___disagree → proceed to a
 ___neither agree nor disagree (coded as 4)
 ___agree → proceed to b

a. Would you say you . . .
 ___slightly disagree (recoded as 3)
 ___disagree (recoded as 2)
 ___strongly disagree (recoded as 1)

b. Would you say you . . .
 ___slightly agree (recoded as 5)
 ___agree (recoded as 6)
 ___strongly agree (recoded as 7)

CESDR

	Rarely or none of the time (less than 1 day)	Some or a little of the time (1-2 days)	Occasionally or a moderate amount of time (3-4 days)	All of the time (5-7 days)
1. I was bothered by things that usually don't bother me.	☐	☐	☐	☐
2. I had trouble keeping my mind on what I was doing.	☐	☐	☐	☐
3. I felt depressed.	☐	☐	☐	☐
4. I felt that everything I did was an effort.	☐	☐	☐	☐
5. I felt hopeful about the future.	☐	☐	☐	☐
6. I felt fearful.	☐	☐	☐	☐
7. My sleep was restless.	☐	☐	☐	☐
8. I was happy.	☐	☐	☐	☐
9. I felt lonely.	☐	☐	☐	☐
10. I could not "get going".	☐	☐	☐	☐

Anxiety

Has a doctor ever told you that you have an anxiety disorder such as a phobia, obsessive-compulsive disorder or a panic disorder?

- ☐ No
☐ Yes

Cognition

Memory: Rey Auditory Verbal Learning Task 1 (RAVLT1; Rey, 1964)

The first task will start with a recorded voice that will read you a list of words. We have purposely made the list long so it will be difficult for anyone to recall all of the words. Most people recall just a few words. Please listen carefully, as the list of words cannot be repeated. When the list of words is finished, I will ask you to recall aloud as many of the words as you can, in any order. May I start the recording? *Immediate recall recorded (number of words).*

Executive Functioning: Animal Fluency (AF; Read, 1987)

Now, I would like you to name as many different animals as you can think of. You have one minute to do this. When you are ready to begin, I will start recording. Are you ready to begin? *Number of animals recorded.*

Memory: RAVLT2

A little while ago, a recorded voice read you a list of words and you repeated the ones you could remember. Please tell me any of the words that you can remember now. *Delayed recall recorded (number of words).*

Demographics

What is your age? __

Record sex. Ask if necessary: are you male or female?

- ☐ Male
☐ Female

What is your current marital/partner status?

- ☐ Single, never married or never lived with a partner
☐ Married/Living with a partner in a common-law relationship
☐ Widowed
☐ Divorced
☐ Separated

What is your best estimate of the total household income received by all household members, from all sources, before taxes and deductions, in the past 12 months? Was it:

- ☐ Less than \$20,000
☐ \$20,000 or more, but less than \$50,000
☐ \$50,000 or more, but less than \$100,000
☐ \$100,000 or more, but less than \$150,000
☐ \$150,000 or more

Appendix F: Study 4 Regression Tables

Table 4.15

Hierarchical weighted least squares regression analyses predicting life satisfaction from game group participation.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Game = several times a year	.19****	.02	.20****	.02	.12****	.02	0
	Game = several times a month	.20****	.02	.21****	.02	.13****	.02	
	Game = several times a week	.19****	.02	.19****	.02	.13****	.02	
	Game = everyday	.21****	.02	.19****	.02	.14	.02	
2	Age			.01****	0	.02****	0	.01****
3	Sex					.09****	.01	.11****
	Married					.48****	.02	
	Widowed					.23****	.03	
	Divorced					-.01	.03	
	Separated					-.27****	.04	
	Total Income = 20,000-<50,000					.56****	.03	
	Total Income = 50,000-<100,000					.85****	.03	
	Total Income = 100,000-<150,000					1.06****	.03	
	Total Income = ≥150,000					1.31****	.03	

**** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.16

Hierarchical weighted least squares regression analyses predicting life satisfaction from family/friends group participation.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Family/friends = at least once a year	.74****	.06	.75****	.06	.44****	.06	.03****
	Family/friends = at least once a month	1.19****	.06	1.21****	.06	.75****	.06	
	Family/friends = once a week	1.41****	.06	1.43****	.06	.95****	.06	
	Family/friends = once a day	1.60****	.06	1.62****	.06	1.12****	.06	
2	Age			.01****	0	.02****	0	.04****
3	Sex					.07****	.01	.13****
	Married					.48****	.02	
	Widowed					.22****	.03	
	Divorced					-.01	.03	
	Separated					-.27****	.04	
	Total Income = 20,000-<50,000					.50****	.03	
	Total Income = 50,000-<100,000					.76****	.03	
	Total Income = 100,000-<150,000					.96****	.03	
	Total Income = ≥150,000					1.18****	.03	

p < .0001

Note. Table displays unstandardized regression coefficients.

Table 4.17

Hierarchical weighted least squares regression analyses predicting life satisfaction from religious group participation.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Religious = at least once a year	.19****	.02	.19****	.02	.13****	.02	.01****
	Religious = at least once a month	.14****	.02	.14****	.02	.09****	.02	
	Religious = once a week	.25****	.02	.23****	.02	.21****	.02	
	Religious = once a day	.26****	.06	.25****	.06	.32****	.06	
2	Age			.01	0	.02****	0	.01****
3	Sex					.09****	.01	.12****
	Married					.48****	.02	
	Widowed					.22****	.03	
	Divorced					.01	.03	
	Separated					-.25****	.04	
	Total Income = 20,000-<50,000					.56****	.03	
	Total Income = 50,000-<100,000					.85****	.03	
	Total Income = 100,000-<150,000					1.07****	.03	
	Total Income = ≥150,000					1.32****	.03	

p < .0001

Note. Table displays unstandardized regression coefficients.

Table 4.18

Bootstrapped hierarchical weighted least squares regression analyses predicting life satisfaction from arts and education group participation.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Arts and education = at least once a year	.44****	.02	.47****	.02	.27****	.02	.03****
	Arts and education = at least once a month	.65****	.02	.68****	.02	.41****	.02	
	Arts and education = once a week	.64****	.02	.66****	.02	.43****	.02	
	Arts and education = once a day	.64****	.06	.69****	.06	.47****	.06	
2	Age			.01****	0	.02****	0	.03****
3	Sex					.08****	.01	.12****
	Married					.51****	.02	
	Widowed					.26****	.03	
	Divorced					-.01****	.03	
	Separated					-.25****	.04	
	Total Income = 20,000-<50,000					.50****	.03	
	Total Income = 50,000-<100,000					.74****	.03	
	Total Income = 100,000-<150,000					.93****	.03	
	Total Income = ≥150,000					1.15****	.03	

p < .0001

Note. Table displays unstandardized regression coefficients.

Table 4.19

Hierarchical weighted least squares regression analyses predicting life satisfaction from club participation.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Clubs = at least once a year	.19****	.02	.20****	.02	.15****	.02	.02****
	Clubs = at least once a month	.20****	.02	.19****	.02	.15****	.02	
	Clubs = once a week	.22****	.03	.20****	.03	.22****	.03	
	Clubs = once a day	.50****	.12	.48****	.12	.43****	.11	
2	Age			.01****	0	.02****	0	.02****
3	Sex					.11****	.01	.12****
	Married					.49****	.02	
	Widowed					.24****	.03	
	Divorced					0	.03	
	Separated					-.25****	.04	
	Total Income = 20,000-<50,000					.56****	.03	
	Total Income = 50,000-<100,000					.85****	.03	
	Total Income = 100,000-<150,000					1.07****	.03	
	Total Income = ≥150,000					1.31****	.03	

p < .0001

Note. Table displays unstandardized regression coefficients.

Table 4.20

Hierarchical weighted least squares regression analyses predicting life satisfaction from association group participation.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Associations = at least once a year	.23****	.01	.25****	.01	.11****	.02	.01****
	Associations = at least once a month	.32****	.02	.32****	.02	.19****	.02	
	Associations = once a week	.32****	.02	.31****	.02	.25****	.04	
	Associations = once a day	.29****	.07	.29****	.07	.24****	.11	
2	Age			.01****	0	.02****	0	.01****
3	Sex					.09****	.02	.12****
	Married					.50****	.04	
	Widowed					.24****	.05	
	Divorced					0	.05	
	Separated					-.26****	.07	
	Total Income = 20,000-<50,000					.56****	.05	
	Total Income = 50,000-<100,000					.83****	.05	
	Total Income = 100,000-<150,000					1.04****	.05	
	Total Income = ≥150,000					1.27****	.05	

p < .0001

Note. Table displays unstandardized regression coefficients.

Table 4.21

Hierarchical weighted least squares regression analyses predicting life satisfaction from volunteer group participation.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Volunteer = at least once a year	.25****	.02	.27****	.02	.14****	.02	.01****
	Volunteer = at least once a month	.36****	.02	.37****	.02	.24****	.02	
	Volunteer = once a week	.37****	.02	.36****	.02	.29****	.02	
	Volunteer = once a day	.29****	.04	.28****	.04	.24****	.04	
2	Age			.01****	0	.02****	0	.06****
3	Sex					.09****	.01	.10****
	Married					.48****	.02	
	Widowed					.23****	.03	
	Divorced					0	.03	
	Separated					-.26****	.04	
	Total Income = 20,000-<50,000					.56****	.03	
	Total Income = 50,000-<100,000					.83****	.03	
	Total Income = 100,000-<150,000					1.04****	.03	
	Total Income = ≥150,000					1.27****	.03	

p < .0001

Note. Table displays unstandardized regression coefficients.

Table 4.22

Hierarchical weighted least squares regression analyses predicting life satisfaction from online networking with friends.

Step	Predictor	B Step 1	S.E.	B Step 2	S.E.	B Step 3	S.E.	R ²
1	Networking with friends = a few times a year	.05	.13	.07	.13	.02		0
	Networking with friends = a few times a month	.11	.12	.13	.12	.06		
	Networking with friends = aa few times week	.17	.12	.19	.12	.12		
	Networking with friends = daily	.17	.12	.19	.12	.13		
2	Age			.01****	0	.02****		0
3	Sex					.15****		.12****
	Married					.58****		
	Widowed					.36****		
	Divorced					.10*		
	Separated					-.19**		
	Total Income = 20,000-<50,000					.63****		
	Total Income = 50,000-<100,000					.97****		
	Total Income = 100,000-<150,000					1.19****		
	Total Income = ≥150,000					1.45****		

* $p < .05$ ** $p < .01$ *** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.23

Hierarchical weighted least squares regression analyses predicting life satisfaction from online networking with family.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Networking with family = a few times a year	-.22*	.11	-.20	.11	-.24*	.10	0
	Networking with family = a few times a month	-.18	.10	-.16	.10	-.21*	.10	
	Networking with family = aa few times week	-.06	.10	-.06	.10	-.12	.09	
	Networking with family = daily	-.08	.10	-.07	.10	-.13	.09	
2	Age			.01****	0	.02****	0	0
3	Sex					.12****	.02	.12****
	Married					.58****	.04	
	Widowed					.32****	.06	
	Divorced					.08	.05	
	Separated					-.20**	.07	
	Total Income = 20,000-<50,000					.70****	.06	
	Total Income = 50,000-<100,000					1.01****	.06	
	Total Income = 100,000-<150,000					1.22****	.06	
	Total Income = ≥150,000					1.46****	.06	

* $p < .05$ ** $p < .01$ *** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.24

Hierarchical weighted least squares regression analyses predicting depression from game group participation.

Step	Predictor	B Step 1	S.E.	B Step 2	S.E.	B Step 3	S.E.	R ²
1	Game = several times a year	-.07****	.01	-.08****	.01	-.06****	.01	0
	Game = several times a month	-.05****	.01	-.05****	.01	-.04****	.01	
	Game = several times a week	-.05****	.01	-.05****	.01	-.05****	.01	
	Game = everyday	-.05****	.01	-.04****	.01	-.05****	.01	
2	Age			0	0	0	0	0
3	Sex					.06****	0	.06****
	Married					-.08****	.01	
	Widowed					-.01	.01	
	Divorced					-.03**	.01	
	Separated					.04*	.02	
	Total Income = 20,000-<50,000					-.19****	.01	
	Total Income = 50,000-<100,000					-.29****	.01	
	Total Income = 100,000-<150,000					-.35****	.01	
	Total Income = ≥150,000					-.40****	.01	
* p < .05 ** p < .01 *** p < .0001								

Note. Table displays unstandardized regression coefficients.

Table 4.25

Hierarchical weighted least squares regression analyses predicting depression from family/friends group participation.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Family/friends = at least once a year	-.23****	.02	-.24****	.02	-.16	.02	.02****
	Family/friends = at least once a month	-.37****	.02	-.38****	.02	-.26	.02	
	Family/friends = once a week	-.44****	.02	-.44****	.02	-.33	.02	
	Family/friends = once a day	-.49****	.02	-.50****	.02	-.34	.02	
2	Age			0	0	0	0	.02****
3	Sex					.06****	0	.08****
	Married					-.08****	.01	
	Widowed					0	.01	
	Divorced					-.03**	.01	
	Separated					.04**	.02	
	Total Income = 20,000-<50,000					-.18****	.01	
	Total Income = 50,000-<100,000					-.26****	.01	
	Total Income = 100,000-<150,000					-.31****	.01	
	Total Income = ≥150,000					-.36****	.01	

** *p* < .01 **** *p* < .0001

Note. Table displays unstandardized regression coefficients.

Table 4.26

Hierarchical weighted least squares regression analyses predicting depression from religious group participation.

Step	Predictor	B Step 1	S.E.	B Step 2	S.E.	B Step 3	S.E.	R ²
1	Religious = at least once a year	-.05****	.01	-.05****	.01	-.03****	.01	0
	Religious = at least once a month	-.03****	.01	-.03****	.01	-.02**	.01	
	Religious = once a week	-.05****	.01	-.05****	.01	-.06****	.01	
	Religious = once a day	-.03	.02	-.02	.02	-.04	.02	
2	Age			0	0	0	0	0
3	Sex					.06****	0	.06****
	Married					-.08****	.01	
	Widowed					0	.01	
	Divorced					-.04**	.01	
	Separated					.03*	.02	
	Total Income = 20,000-<50,000					-.19****	.01	
	Total Income = 50,000-<100,000					-.30****	.01	
	Total Income = 100,000-<150,000					-.35****	.01	
	Total Income = ≥150,000					-.41****	.01	

* $p < .05$ ** $p < .01$ *** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.27

Hierarchical weighted least squares regression analyses predicting depression from arts and education group participation.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Arts and education = at least once a year	-.16****	.01	-.16****	.01	-.11	.01	.02****
	Arts and education = at least once a month	-.22****	.01	-.22****	.01	-.15	.01	
	Arts and education = once a week	-.21****	.01	-.21****	.01	-.16	.01	
	Arts and education = once a day	-.22****	.02	-.23****	.02	-.18	.02	
2	Age			0	0	-.01	0	.03****
3	Sex					.06****	0	.07****
	Married					-.09****	.01	
	Widowed					-.01	.01	
	Divorced					-.03**	.01	
	Separated					.04*	.02	
	Total Income = 20,000-<50,000					-.17****	.01	
	Total Income = 50,000-<100,000					-.25****	.01	
	Total Income = 100,000-<150,000					-.30****	.01	
	Total Income = ≥150,000					-.35****	.01	

* $p < .05$ ** $p < .01$ *** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.28

Hierarchical weighted least squares regression analyses predicting depression from club participation.

Step	Predictor	B Step 1	S.E.	B Step 2	S.E.	B Step 3	S.E.	R ²
1	Clubs = at least once a year	-.04****	.01	-.04****	.01	-.03**	.01	0
	Clubs = at least once a month	-.05****	.01	-.05****	.01	-.04****	.01	
	Clubs = once a week	-.06****	.01	-.06****	.01	-.06****	.01	
	Clubs = once a day	-.10*	.04	-.09****	.04	-.07	.04	
2	Age			0	0	0	0	0
3	Sex					.05****	0	.06****
	Married					-.08****	.01	
	Widowed					-.01	.01	
	Divorced					-.03**	.01	
	Separated					.04*	.02	
	Total Income = 20,000-<50,000					-.19****	.01	
	Total Income = 50,000-<100,000					-.30****	.01	
	Total Income = 100,000-<150,000					-.35****	.01	
	Total Income = ≥150,000					-.41****	.01	
* p < .05 ** p < .01 *** p < .0001								

Note. Table displays unstandardized regression coefficients.

Table 4.29

Hierarchical weighted least squares regression analyses predicting depression from association group participation.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Associations = at least once a year	-.09****	.01	-.09****	.01	-.05****	.01	.01****
	Associations = at least once a month	-.10****	.01	-.10****	.01	-.07****	.01	
	Associations = once a week	-.09****	.01	-.09****	.01	-.08****	.01	
	Associations = once a day	-.08**	.03	-.08**	.03	-.06*	.03	
2	Age			0	0	0	0	.01****
3	Sex					.06****	0	.07****
	Married					-.08****	.01	
	Widowed					-.01	.01	
	Divorced					-.03**	.01	
	Separated					.04*	.02	
	Total Income = 20,000-<50,000					-.19****	.01	
	Total Income = 50,000-<100,000					-.29****	.01	
	Total Income = 100,000-<150,000					-.34****	.01	
	Total Income = ≥150,000					-.39****	.01	
* <i>p</i> < .05 ** <i>p</i> < .01 *** <i>p</i> < .0001								

Note. Table displays unstandardized regression coefficients.

Table 4.30

Hierarchical weighted least squares regression analyses predicting depression from volunteer group participation.

Step	Predictor	B Step 1	S.E.	B Step 2	S.E.	B Step 3	S.E.	R ²
1	Volunteer = at least once a year	-.08****	.01	-.09****	.01	-.05****	.01	.01****
	Volunteer = at least once a month	-.11****	.01	-.11****	.01	-.08****	.01	
	Volunteer = once a week	-.10****	.01	-.10****	.01	-.09****	.01	
	Volunteer = once a day	-.10****	.02	-.10****	.02	-.09****	.02	
2	Age			0	0	0		.01****
3	Sex					.06****	0	.07****
	Married					-.08****	.01	
	Widowed					-.01	.01	
	Divorced					-.03**	.01	
	Separated					.04*	.02	
	Total Income = 20,000-<50,000					-.19****	.01	
	Total Income = 50,000-<100,000					-.29****	.01	
	Total Income = 100,000-<150,000					-.34****	.01	
	Total Income = ≥150,000					-.39****	.01	
* p < .05 ** p < .01 *** p < .0001								

Note. Table displays unstandardized regression coefficients.

Table 4.31

Hierarchical weighted least squares regression analyses predicting depression from online networking with friends.

Step	Predictor	B Step 1	S.E.	B Step 2	S.E.	B Step 3	S.E.	R ²
1	Networking with friends = a few times a year	-.03	.05	-.04	.05	-.03	.05	0
	Networking with friends = a few times a month	0	.04	-.01	.04	0	.04	
	Networking with friends = aa few times week	-.02	.04	-.02	.04	-.02	.04	
	Networking with friends = daily	0	.04	0	0	-.01	.04	
2	Age			0	0	-.01****	0	0
3	Sex					.05****	.01	.06****
	Married					-.10****	.02	
	Widowed					-.03	.02	
	Divorced					-.05**	.02	
	Separated					0	.03	
	Total Income = 20,000-<50,000					-.22****	.02	
	Total Income = 50,000-<100,000					-.33****	.02	
	Total Income = 100,000-<150,000					-.40****	.02	
	Total Income = ≥150,000					-.44****	.02	

** $p < .01$ **** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.32

Hierarchical weighted least squares regression analyses predicting depression from online networking with family.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Networking with family = a few times a year	.03	.04	.02	.04	.04	.04	0
	Networking with family = a few times a month	.04	.04	.04	.04	.05	.04	
	Networking with family = aa few times week	.01	.04	.01	.04	.03	.04	
	Networking with family = daily	.03	.04	.02	.04	.03	.04	
2	Age			0	0	-.01****	0	0
3	Sex					.06****	.01	.06****
	Married					-.09****	.02	
	Widowed					-.01	.02	
	Divorced					-.04*	.02	
	Separated					.03	.03	
	Total Income = 20,000-<50,000					-.24****	.02	
	Total Income = 50,000-<100,000					-.33****	.02	
	Total Income = 100,000-<150,000					-.40****	.02	
	Total Income = ≥150,000					-.44****	.02	

* $p < .05$ **** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.33

Hierarchical logistic regression analyses predicting anxiety from game group participation.

Step	Predictor	B Step 1	S.E.	Odds Ratio	B Step 2	S.E.	Odds Ratio	B Step 3	S.E.	Odds Ratio	Nagelkerke R ²
1	Games = several times a year	-.24****	.06	.78	-.32****	.06	.73	-.26****	.06		0
	Games = several times a month	-.19**	.06	.83	-.25****	.06	.78	-.23****	.06		
	Games = several times a week	-.17**	.06	.85	-.18**	.05	.84	-.21****	.05		
	Games = everyday	-.09*	.05	.91	-.03	.05	.97	-.10*	.05		
2	Age (categorical)				-.02	0	.98	-.03	0		.01****
3	Sex							-.48****	.04		.04****
	Married							-.17**	.06		
	Widowed							-.23**	.08		
	Divorced							-.08	.07		
	Separated							-.09	.10		
	Total Income = 20,000-<50,000							-.73****	.06		
	Total Income = 50,000-<100,000							-.96****	.06		
	Total Income = 100,000-<150,000							-.1.18****	.07		
	Total Income = ≥150,000							-.145****	.08		

* $p < .05$ ** $p < .01$ **** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.34

Hierarchical logistic regression analyses predicting anxiety from family/friend group participation.

Step	Predictor	B Step 1	S.E.	Odds Ratio	B Step 2	S.E.	Odds Ratio	B Step 3	S.E.	Odds Ratio	Nagelkerke R ²
1	Family/friends = at least once a year	-.38**	.12	.68	-.43**	.13	.65	-.22	.13	.81	0
	Family/friends = at least once a month	-.68****	.12	.51	-.76****	.12	.47	-.43**	.13	.65	
	Games = once a week	-.80****	.12	.45	-.88****	.12	.41	-.55****	.13	.58	
	Games = once a day	-.88****	.15	.42	-.94****	.15	.39	-.61****	.15	.54	
2	Age (categorical)				-.02****	0	.98	-.03****	0	.97	.01****
3	Sex							.50****	.06	1.65	.05****
	Married							-.18**	.08	.83	
	Widowed							-.23**	.07	.79	
	Divorced							-.08	.10	.92	
	Separated							-.11	.06	.89	
	Total Income = 20,000-<50,000							-.70****	.06	.50	
	Total Income = 50,000-<100,000							-.89****	.06	.41	
	Total Income = 100,000- <150,000							-1.09****	.07	.34	
	Total Income = ≥150,000							-1.38****	.08	.25	

* $p < .05$ ** $p < .001$ **** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.35

Hierarchical logistic regression analyses predicting anxiety from religious group participation.

Step	Predictor	B Step 1	S.E.	Odds Ratio	B Step 2	S.E.	Odds Ratio	B Step 3	S.E. .	Odds Ratio	Nagelkerke R ²
1	Religious = at least once a year	-.10*	.05	.91	-.13**	.05	.88	-.08	.05	.93	0
	Religious = at least once a month	-.16**	.06	.85	-.15*	.06	.86	-.14*	.06	.87	
	Religious = once a week	-.33****	.05	.72	-.24****	.05	.79	-.28****	.05	.76	
	Religious = once a day	-.16	.18	.85	-.07	.18	.93	-.14	.18	.87	
2	Age (categorical)				-.20****	.02	.82	-.28****	.02	.76	.01****
3	Sex							.50****	.04	1.64	.05****
	Married							-.18**	.06	.84	
	Widowed							-.26**	.08	.77	
	Divorced							-.11	.07	.90	
	Separated							-.14	.10	.87	
	Total Income = 20,000-<50,000							-.74****	.06	.48	
	Total Income = 50,000-<100,000							-.96****	.06	.39	
	Total Income = 100,000-<150,000							-1.17****	.07	.31	
	Total Income = ≥150,000							-1.48****	.08	.23	

* $p < .05$ ** $p < .001$ *** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.36

Hierarchical logistic regression analyses predicting anxiety from sports group participation.

Step	Predictor	B Step 1	S.E.	Odds Ratio	B Step 2	S.E.	Odds Ratio	B Step 3	S.E.	Odds Ratio	Nagelkerke R ²
1	Sports = at least once a year	-.06	.06	.94	-.17*	.07	.85	-.01	.07	.99	.01****
	Sports = at least once a month	-.29****	.05	.75	-.40****	.05	.67	-.23****	.05	.80	
	Sports = once a week	-.45****	.04	.64	-.52****	.04	.59	-.35****	.04	.71	
	Sports = once a day	-.57****	.07	.57	-.63****	.07	.53	-.48****	.07	.62	
2	Age (categorical)				-.24****	.02	.79	-.29****	.02	.75	.02****
3	Sex							.50****	.04	1.66	.05****
	Married							-.18**	.06	.83	
	Widowed							-.28****	.08	.75	
	Divorced							-.09	.07	.91	
	Separated							-.12	.10	.89	
	Total Income = 20,000-<50,000							-.69****	.06	.50	
	Total Income = 50,000-<100,000							-.86****	.06	.42	
	Total Income = 100,000-<150,000							-1.05****	.07	.35	
	Total Income = ≥150,000							-1.33****	.08	.27	

* $p < .05$ ** $p < .01$ *** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.37

Hierarchical logistic regression analyses predicting anxiety from arts and education group participation.

Step	Predictor	B Step 1	S.E.	Odds Ratio	B Step 2	S.E.	Odds Ratio	B Step 3	S.E.	Odds Ratio	Nagelkerke R ²
1	Arts and education = at least once a year	-.25****	.05	.78	-.34****	.05	.71	-.17**	.05	.84	.01****
	Arts and education = at least once a month	-.49****	.05	.61	-.58****	.05	.56	-.36****	.05	.70	
	Arts and education = once a week	-.33****	.07	.72	-.38****	.07	.69	-.22****	.07	.81	
	Arts and education = once a day	-.29****	.19	.75	-.43*	.19	.65	-.25	.19	.78	
2	Age (categorical)				-.23****	.02	.79	-.29****	.02	.75	.02****
3	Sex							.50****	.04	1.65	.05****
	Married							-.22****	.06	.81	
	Widowed							-.30****	.08	.74	
	Divorced							-.10	.07	.91	
	Separated							-.13	.10	.88	
	Total Income = 20,000-<50,000							-.69****	.06	.50	
	Total Income = 50,000-<100,000							-.86****	.06	.43	
	Total Income = 100,000-<150,000							-1.04****	.08	.36	
	Total Income = ≥150,000							-1.32****	.08	.27	

* $p < .05$ ** $p < .01$ **** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.38

Hierarchical logistic regression analyses predicting anxiety from club participation.

Step	Predictor	B Step 1	S.E.	Odds Ratio	B Step 2	S.E.	Odds Ratio	B Step 3	S.E.	Odds Ratio	Nagelkerke R ²
1	Club = at least once a year	-.11	.06	.89	-.14*	.06	.87	-.07	.06	.94	0
	Club = at least once a month	-.31****	.06	.73	-.26****	.06	.78	-.21****	.06	.81	
	Club = once a week	-.23**	.08	.79	-.16*	.08	.86	-.15	.08	.86	
	Club = once a day	-.07	.32	.94	0	.32	1.00	.12	.32	1.13	
2	Age (categorical)				-.21****	.02	.82	-.29****	.02	.75	.01****
3	Sex							.48****	.04	1.61	.05****
	Married							-.20**	.06	.82	
	Widowed							-.28****	.08	.76	
	Divorced							-.10	.07	.91	
	Separated							-.13	.10	.88	
	Total Income = 20,000-<50,000							-.74****	.06	.48	
	Total Income = 50,000-<100,000							-.95****	.06	.39	
	Total Income = 100,000-<150,000							-1.16****	.07	.32	
	Total Income = ≥150,000							-1.46****	.08	.23	

* $p < .05$ ** $p < .01$ **** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.39

Bootstrapped hierarchical logistic regression analyses predicting anxiety from association group participation.

Step	Predictor	B Step 1	S.E.	Odds Ratio	B Step 2	S.E.	Odds Ratio	B Step 3	S.E.	Odds Ratio	Nagelkerke R ²
1	Associations = at least once a year	-.26****	.04	.77	-.32****	.04	.73	-.20****	.04	.82	.01****
	Associations = at least once a month	-.40****	.05	.67	-.42****	.05	.66	-.32****	.05	.73	
	Associations = once a week	-.26****	.07	.77	-.23**	.07	.80	-.22**	.07	.81	
	Associations = once a day	-.38****	.22	.68	-.38	.22	.69	-.34	.23	.71	
2	Age (categorical)				-.22****	.02	.80	-.29****	.02	.75	.01****
3	Sex							.49****	.04	1.64	.05****
	Married							-.21****	.06	.81	
	Widowed							-.30****	.08	.74	
	Divorced							-.10	.07	.90	
	Separated							-.13	.10	.88	
	Total Income = 20,000-<50,000							-.72****	.06	.49	
	Total Income = 50,000-<100,000							-.91****	.06	.40	
	Total Income = 100,000-<150,000							-1.09****	.07	.34	
	Total Income = ≥150,000							-1.37****	.08	.25	

** $p < .01$ *** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.40

Bootstrapped hierarchical logistic regression analyses predicting anxiety from volunteer group participation.

Step	Predictor	B Step 1	S.E.	Odds Ratio	B Step 2	S.E.	Odds Ratio	B Step 3	S.E.	Odds Ratio	Nagelkerke R ²
1	Volunteer = at least once a year	-.22****	.04	.80	-.29****	.05	.75	-.17****	.05	.84	0
	Volunteer = at least once a month	-.38****	.05	.69	-.39****	.05	.68	-.31****	.05	.74	
	Volunteer = once a week	-.32****	.05	.72	-.29****	.05	.75	-.27****	.05	.76	
	Volunteer = once a day	-.20	.12	.82	-.16	.12	.85	-.19	.12	.83	
2	Age (categorical)				-.22****	.02	.80	-.29****	.02	.75	.01****
3	Sex							.50****	.04	1.64	.05****
	Married							-.19**	.06	.83	
	Widowed							-.28****	.08	.76	
	Divorced							-.10	.07	.91	
	Separated							-.12	.10	.88	
	Total Income = 20,000-<50,000							-.72****	.06	.49	
	Total Income = 50,000-<100,000							-.92****	.06	.40	
	Total Income = 100,000-<150,000							-1.11****	.07	.33	
	Total Income = ≥150,000							-1.4****	.08	.25	

** $p < .01$ *** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.41

Hierarchical weighted least squares regression analyses predicting anxiety from online networking with friends.

Step	Predictor	B Step 1	S.E.	Odds Ratio	B Step 2	S.E.	Odds Ratio	B Step 3	S.E.	Odds Ratio	Nagelkerke R ²
1	Networking with friends = a few times a year	0	.32	1.00	-.06	.32	.94	0	.33	1.00	0
	Networking with friends = a few times a month	-.13	.30	.88	-.17	.30	.84	-.13	.31	.88	
	Networking with friends = aa few times week	-.11	.30	.90	-.15	.30	.86	-.11	.30	.90	
	Networking with friends = daily	-.07	.30	.93	-.11	.30	.90	-.11	.30	.90	
2	Age (categorical)				-.13****	.03	.88	-.21****	.03	.81	0
3	Sex							.39****	.06	1.48	.03****
	Married							-.11	.10	.90	
	Widowed							-.38*	.15	.69	
	Divorced							-.06	.11	.94	
	Separated							.01	.16	1.01	
	Total Income = 20,000-<50,000							-.70****	.11	.50	
	Total Income = 50,000-<100,000							-.95****	.12	.39	
	Total Income = 100,000-<150,000							-1.22****	.13	.30	
	Total Income = ≥150,000							-1.48****	.14	.23	

* $p < .05$ **** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.42

Hierarchical weighted least squares regression analyses predicting anxiety from online networking with family.

Step	Predictor	B Step 1	S.E.	Odds Ratio	B Step 2	S.E.	Odds Ratio	B Step 3	S.E.	Odds Ratio	Nagelkerke R ²
1	Networking with family = a few times a year	-.31	.26	.73	-.35	.26	.71	-.27	.26	.76	0
	Networking with family = a few times a month	-.46*	.24	.63	-.48*	.24	.62	-.41	.24	.67	
	Networking with family = aa few times week	-.43	.23	.65	-.43	.23	.65	-.36	.23	.70	
	Networking with family = daily	-.39	.23	.68	-.40	.23	.67	-.38	.23	.68	
2	Age (categorical)				-.14****	.03	.87	-.22****	.03	.80	0
3	Sex							.45****	.06	1.57	.04****
	Married							-.14	.10	.87	
	Widowed							-.17	.14	.85	
	Divorced							-.16	.12	.86	
	Separated							-.01	.17	1.00	
	Total Income = 20,000-<50,000							-.87****	.12	.42	
	Total Income = 50,000-<100,000							-.99****	.11	.37	
	Total Income = 100,000-<150,000							-1.26****	.13	.29	
	Total Income = ≥150,000							-1.55****	.14	.21	

* $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.43

Hierarchical weighted least squares regression analyses predicting RAVLT1 scores from music group participation.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Music = several times a year	.57****	.05	.44****	.05	.37****	.08	.01****
	Music = several times a month	.47****	.04	.44****	.04	.41****	.05	
	Music = several times a week	.44****	.04	.45****	.04	.45****	.04	
	Music = everyday	.34****	.05	.30****	.05	.40****	.04	
2	Age			-.05****	0	-.04****	0	.07****
3	Sex					.97****	.02	.14****
	Married					-.04	.04	
	Widowed					-.05	.05	
	Divorced					.10*	.05	
	Separated					-.01	-.01	
	Total Income = 20,000-<50,000					.54****	.05	
	Total Income = 50,000-<100,000					.90****	.05	
	Total Income = 100,000-<150,000					1.09****	.05	
	Total Income = ≥150,000					1.27****	.05	
* <i>p</i> < .05 **** <i>p</i> < .0001								

Note. Table displays unstandardized regression coefficients.

Table 4.44

Hierarchical weighted least squares regression analyses predicting RAVLT1 scores from game group participation.

Step	Predictor	B Step 1	S.E.	B Step 2	S.E.	B Step 3	S.E.	R ²
1	Game = several times a year	.57****	.05	.44****	.05	.37	.05	.01****
	Game = several times a month	.47****	.04	.44****	.04	.41	.04	
	Game = several times a week	.44****	.04	.45****	.04	.45	.04	
	Game = everyday	.34****	.05	.30****	.05	.40	.05	
2	Age			-.05****	0	-.04	0	.07****
3	Sex					.97****	.02	.14****
	Married					-.04	.04	
	Widowed					-.05	.05	
	Divorced					.10*	.05	
	Separated					-.01	.07	
	Total Income = 20,000-<50,000					.54****	.05	
	Total Income = 50,000-<100,000					.90****	.05	
	Total Income = 100,000-<150,000					1.09****	.05	
	Total Income = ≥150,000					1.27****	.05	

* $p < .05$ **** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.45

Hierarchical weighted least squares regression analyses predicting RAVLT1 scores from family/friends group participation.

Step	Predictor	B Step 1	S.E.	B Step 2	S.E.	B Step 3	S.E.	R ²
1	Family/friends = at least once a year	.63****	.10	.51****	.10	.30**	.10	.01****
	Family/friends = at least once a month	1.07****	.10	.89****	.10	.53****	.09	
	Family/friends = once a week	1.27****	.10	1.08****	.10	.65****	.09	
	Family/friends = once a day	1.25****	.11	1.08****	.11	.62****	.10	
2	Age			-.05****	0	-.04****	0	.07****
3	Sex					.94****	.02	.13****
	Married					-.02	.04	
	Widowed					-.05	.05	
	Divorced					.10*	.05	
	Separated					.01	.07	
	Total Income = 20,000-<50,000					.51****	.05	
	Total Income = 50,000-<100,000					.86****	.05	
	Total Income = 100,000-<150,000					1.03****	.05	
	Total Income = ≥150,000					1.21****	.05	
* p < .05 ** p < .01 *** p < .0001								

Note. Table displays unstandardized regression coefficients.

Table 4.46

Hierarchical weighted least squares regression analyses predicting RAVLT1 scores from religious group participation.

Step	Predictor	B Step 1	S.E.	B Step 2	S.E.	B Step 3	S.E.	R ²
1	Religious = at least once a year	.18****	.03	.09****	.03	.03	.02	0
	Religious = at least once a month	.08*	.03	.12****	.03	.04	.03	
	Religious = once a week	-.08**	.03	.16****	.03	.09****	.02	
	Religious = once a day	-.15	.11	.05	.10	.10	.10	
2	Age			-.05****	0	-.04****	0	.07****
3	Sex					.95****	.02	.13****
	Married					-.02	.04	
	Widowed					-.04	.05	
	Divorced					.11*	.05	
	Separated					.01	.07	
	Total Income = 20,000-<50,000					.55****	.05	
	Total Income = 50,000-<100,000					.92****	.05	
	Total Income = 100,000-<150,000					1.10****	.05	
	Total Income = ≥150,000					1.29****	.05	

* $p < .05$ ** $p < .01$ *** $p < .001$ **** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.47

Hierarchical weighted least squares regression analyses predicting RAVLT1 scores from sports group participation.

Step	Predictor	B Step 1	S.E.	B Step 2	S.E.	B Step 3	S.E.	R ²
1	Sports = at least once a year	.57****	.04	.33****	.04	.31****	.04	.02****
	Sports = at least once a month	.57****	.03	.32****	.03	.25****	.03	
	Sports = once a week	.67****	.03	.50****	.03	.33****	.03	
	Sports = once a day	.61****	.04	.48****	.04	.31****	.04	
2	Age			-.05****	0	-.04****	0	.07****
3	Sex					.95****	.02	.14****
	Married					-.03	.04	
	Widowed					-.04	.05	
	Divorced					.10*	.05	
	Separated					0	.07	
	Total Income = 20,000-<50,000					.51****	.05	
	Total Income = 50,000-<100,000					.84****	.05	
	Total Income = 100,000-<150,000					1.00****	.05	
	Total Income = ≥150,000					1.18****	.05	

* $p < .05$ **** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.48

Hierarchical weighted least squares regression analyses predicting RAVLT1 scores from club participation.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Clubs = at least once a year	-.11**	.03	-.17****	.03	-.15****	.08	0
	Clubs = at least once a month	-.15****	.03	.02	.03	.03	.03	
	Clubs = once a week	-.22****	.04	-.02	.04	.04	.03	
	Clubs = once a day	-.11	.19	.10	.19	.19	.04	
2	Age			-.05****	0	-.04****	0	.07****
3	Sex					.96****	.02	.13****
	Married					-.02	.04	
	Widowed					-.04	.05	
	Divorced					.11*	.05	
	Separated					.01	.06	
	Total Income = 20,000-<50,000					.55****	.05	
	Total Income = 50,000-<100,000					.92****	.05	
	Total Income = 100,000-<150,000					1.11****	.05	
	Total Income = ≥150,000					1.30****	.05	

* $p < .05$ ** $p < .01$ *** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.49

Hierarchical weighted least squares regression analyses predicting RAVLT1 scores from association group participation.

Step	Predictor	B Step 1	S.E.	B Step 2	S.E.	B Step 3	S.E.	R ²
1	Associations = at least once a year	.50****	.02	.36****	.02	.25****	.02	.01****
	Associations = at least once a month	.50****	.03	.41****	.03	.29****	.02	
	Associations = once a week	.33****	.04	.39****	.04	.31****	.04	
	Associations = once a day	.34****	.12	.33****	.12	.30**	.11	
2	Age			-.05****	0	-.04****	0	.07****
3	Sex					.95****	.02	.14****
	Married					-.01	.04	
	Widowed					-.03	.05	
	Divorced					.11*	.05	
	Separated					.01	.07	
	Total Income = 20,000-<50,000					.53****	.05	
	Total Income = 50,000-<100,000					.87****	.05	
	Total Income = 100,000-<150,000					1.03****	.05	
	Total Income = ≥150,000					1.19****	.05	

* $p < .05$ ** $p < .01$ *** $p < .001$ **** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.50

Hierarchical weighted least squares regression analyses predicting RAVLT1 scores from volunteer group participation.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Volunteer = at least once a year	.48****	.03	.31****	.03	.23****	.02	.01****
	Volunteer = at least once a month	.50****	.03	.45****	.03	.33****	.03	
	Volunteer = once a week	.43****	.03	.51****	.03	.39****	.03	
	Volunteer = once a day	.33****	.07	.40****	.07	.31****	.07	
2	Age			-.05****	0	-.04****	0	.08****
3	Sex					.94****	.02	.14****
	Married					-.03	.04	
	Widowed					-.05	.05	
	Divorced					.10*	.05	
	Separated					0	.07	
	Total Income = 20,000-<50,000					.53****	.05	
	Total Income = 50,000-<100,000					.88****	.05	
	Total Income = 100,000-<150,000					1.05****	.05	
	Total Income = ≥150,000					1.22****	.05	
* <i>p</i> < .05 **** <i>p</i> < .0001								

Note. Table displays unstandardized regression coefficients.

Table 4.51

Hierarchical weighted least squares regression analyses predicting RAVLT1 from online networking with friends.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Networking with friends = a few times a year	-.05	.21	-.20	.20	-.27	.20	0
	Networking with friends = a few times a month	.06	.19	-.07	.19	-.18	.19	
	Networking with friends = aa few times week	-.10	.19	-.19	.19	-.32	.18	
	Networking with friends = daily	-.01	.19	-.13	.19	-.31	.18	
2	Age			-.04****	0	-.03****	0	.03****
3	Sex					.86****	.03	.08****
	Married					-.02	.06	
	Widowed					-.10	.10	
	Divorced					.12	.08	
	Separated					-.04	.11	
	Total Income = 20,000-<50,000					.38****	.10	
	Total Income = 50,000-<100,000					.65****	.10	
	Total Income = 100,000-<150,000					.85****	.10	
	Total Income = ≥150,000					1.04****	.10	

p < .0001

Note. Table displays unstandardized regression coefficients.

Table 4.52

Hierarchical weighted least squares regression analyses predicting RAVLT1 from online networking with family.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Networking with family = a few times a year	.24	.18	.12	.17	.13	.17	0
	Networking with family = a few times a month	.21	.16	.13	.16	.13	.16	
	Networking with family = a few times week	.12	.16	.09	.16	.05	.15	
	Networking with family = daily	.17	.16	.12	.16	.04	.15	
2	Age			-.04****	0	-.03****	0	.03****
3	Sex					.87****	.03	.08****
	Married					.02	.07	
	Widowed					-.01	.10	
	Divorced					.21*	.08	
	Separated					.09	.11	
	Total Income = 20,000-<50,000					.46****	.10	
	Total Income = 50,000-<100,000					.73****	.10	
	Total Income = 100,000-<150,000					.95****	.10	
	Total Income = ≥150,000					1.13****	.10	

* $p < .05$ **** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.53

Hierarchical weighted least squares regression analyses predicting RAVLT2 scores from music group participation.

Step	Predictor	B Step 1	S.E.	B Step 2	S.E.	B Step 3	S.E.	R ²
1	Music = several times a year	.52****	.06	.37****	.06	.30****	.05	.01****
	Music = several times a month	.41****	.05	.37****	.05	.34****	.04	
	Music = several times a week	.41****	.04	.42****	.04	.43****	.04	
	Music = everyday	.41****	.06	.36****	.06	.48****	.06	
2	Age			-.06****	0	-.05****	0	.07****
3	Sex					1.13***	.02	.13****
	Married					-.09*	.04	
	Widowed					-.05	.06	
	Divorced					.07	.05	
	Separated					.02	.08	
	Total Income = 20,000-<50,000					.52****	.05	
	Total Income = 50,000-<100,000					.84****	.05	
	Total Income = 100,000-<150,000					1.03****	.06	
	Total Income = ≥150,000					1.09****	.06	

* $p < .05$ **** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.54

Hierarchical weighted least squares regression analyses predicting RAVLT2 scores from game group participation.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Game = several times a year	.52****	.04	.36****	.04	.28****	.04	.01****
	Game = several times a month	.48****	.04	.35****	.04	.24****	.04	
	Game = several times a week	.63****	.03	.61****	.03	.46****	.03	
	Game = everyday	.48****	.03	.67****	.03	.45****	.03	
2	Age			-.06****	0	-.05****	0	.08****
3	Sex					1.07****	.02	.13****
	Married					-.10*	.04	
	Widowed					-.06	.06	
	Divorced					.07	.05	
	Separated					.03	.08	
	Total Income = 20,000-<50,000					.51****	.05	
	Total Income = 50,000-<100,000					.83****	.05	
	Total Income = 100,000-<150,000					1.01****	.06	
	Total Income = ≥150,000					1.08****	.06	
* <i>p</i> < .05 **** <i>p</i> < .0001								

Note. Table displays unstandardized regression coefficients.

Table 4.55

Hierarchical weighted least squares regression analyses predicting RAVLT2 scores from family/friends group participation.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Family/friends = at least once a year	.57****	.12	.44****	.12	.26*	.11	.01****
	Family/friends = at least once a month	1.00****	.11	.80****	.11	.48****	.11	
	Family/friends = once a week	1.14****	.11	.94****	.11	.55****	.11	
	Family/friends = once a day	1.13****	.13	.94****	.12	.53****	.12	
2	Age			-.06****	0	-.05****	0	.07****
3	Sex					1.11****	.02	.13****
	Married					-.09*	.04	
	Widowed					-.07	.06	
	Divorced					.06	.05	
	Separated					.03	.08	
	Total Income = 20,000-<50,000					.50****	.05	
	Total Income = 50,000-<100,000					.80****	.05	
	Total Income = 100,000-<150,000					.97****	.06	
	Total Income = ≥150,000					1.03****	.06	
* <i>p</i> < .05 **** <i>p</i> < .0001								

Note. Table displays unstandardized regression coefficients.

Table 4.56

Hierarchical weighted least squares regression analyses predicting RAVLT2 scores from religious group participation.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Religious = at least once a year	.15****	.03	.05	.03	.01	.03	0
	Religious = at least once a month	.01	.04	.05	.04	-.03	.04	
	Religious = once a week	-.12****	.03	.14****	.03	.06*	.03	
	Religious = once a day	-.22	.12	-.01	.12	.04	.11	
2	Age			-.06****	0	-.05****	0	.07****
3	Sex					1.12****	.02	.13****
	Married					-.08*	.04	
	Widowed					-.06	.06	
	Divorced					.07	.05	
	Separated					.03	.08	
	Total Income = 20,000-<50,000					.53****	.05	
	Total Income = 50,000-<100,000					.85****	.05	
	Total Income = 100,000-<150,000					1.03****	.06	
	Total Income = ≥150,000					1.10****	.06	

* $p < .05$ **** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.57

Hierarchical weighted least squares regression analyses predicting RAVLT2 scores from sports group participation.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Sports = at least once a year	.49****	.05	.23****	.05	.24****	.04	.01****
	Sports = at least once a month	.51****	.04	.24****	.04	.20****	.03	
	Sports = once a week	.58****	.03	.38****	.03	.25****	.03	
	Sports = once a day	.50****	.04	.35****	.04	.20****	.04	
2	Age			-.06****	0	-.05****	0	.07****
3	Sex					1.11****	.02	.13****
	Married					-.09*	.04	
	Widowed					-.06	.06	
	Divorced					.06	.05	
	Separated					.02	.08	
	Total Income = 20,000-<50,000					.50****	.05	
	Total Income = 50,000-<100,000					.79****	.05	
	Total Income = 100,000-<150,000					.96****	.06	
	Total Income = ≥150,000					1.01****	.06	

* $p < .05$ **** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.58

Hierarchical weighted least squares regression analyses predicting RAVLT2 scores from club participation.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Clubs = at least once a year	-.14****	.04	-.21****	.04	-.17****	.04	0
	Clubs = at least once a month	-.19****	.04	0	.04	.01	.03	
	Clubs = once a week	-.30****	.05	-.07	.05	0	.05	
	Clubs = once a day	-.22****	.22	0	.21	.11	.21	
2	Age			-.06****	0	-.05****	0	.07****
3	Sex					1.12****	.02	.13****
	Married					-.08*	.04	
	Widowed					-.06	.06	
	Divorced					.06	.05	
	Separated					.03	.08	
	Total Income = 20,000-<50,000					.54****	.05	
	Total Income = 50,000-<100,000					.85****	.05	
	Total Income = 100,000-<150,000					1.03****	.06	
	Total Income = ≥150,000					1.10****	.06	

* $p < .05$ **** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.59

Hierarchical weighted least squares regression analyses predicting RAVLT2 scores from association group participation.

Step	Predictor	B Step 1	S.E.	B Step 2	S.E.	B Step 3	S.E.	R ²
1	Associations = at least once a year	.44****	.03	.28****	.03	.19****	.03	.01****
	Associations = at least once a month	.35****	.03	.30****	.03	.20****	.03	
	Associations = once a week	.26****	.04	.34****	.04	.26****	.04	
	Associations = once a day	.31****	.13	.31*	.13	.30*	.13	
2	Age			-.06****	0	-.05****	0	.07****
3	Sex					1.11****	.02	.13****
	Married					-.08	.04	
	Widowed					-.05	.06	
	Divorced					.06	.05	
	Separated					.03	.08	
	Total Income = 20,000-<50,000					.51****	.05	
	Total Income = 50,000-<100,000					.82****	.05	
	Total Income = 100,000-<150,000					.98****	.06	
	Total Income = ≥150,000					1.03****	.06	

* $p < .05$ **** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.60

Hierarchical weighted least squares regression analyses predicting RAVLT2 scores from volunteer group participation.

Step	Predictor	B Step 1	S.E.	B Step 2	S.E.	B Step 3	S.E.	R ²
1	Volunteer = at least once a year	.41****	.03	.21****	.03	.16****	.03	.01****
	Volunteer = at least once a month	.47****	.03	.41****	.03	.31****	.03	
	Volunteer = once a week	.35****	.03	.44****	.03	.33****	.03	
	Volunteer = once a day	.31****	.08	.38****	.08	.29****	.08	
2	Age			-.06****	0	-.05****	0	.07****
3	Sex					1.10****	.02	.13****
	Married					-.09*	.04	
	Widowed					-.06	.06	
	Divorced					.06	.05	
	Separated					.02	.08	
	Total Income = 20,000-<50,000					.52****	.05	
	Total Income = 50,000-<100,000					.82***	.05	
	Total Income = 100,000-<150,000					.99****	.06	
	Total Income = ≥150,000					1.04****	.06	

* $p < .05$ **** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.61

Hierarchical weighted least squares regression analyses predicting RAVLT2 from online networking with friends.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Networking with friends = a few times a year	.26	.24	.07	.23	.02	.23	0
	Networking with friends = a few times a month	.17	.22	.01	.22	-.10	.21	
	Networking with friends = aa few times week	.15	.22	.03	.22	-.11	.21	
	Networking with friends = daily	.22	.22	.08	.22	-.11	.21	
2	Age			-.05****	0	-.04****	0	.03****
3	Sex					1.00****	.04	.08****
	Married					-.05	.07	
	Widowed					-.07	.12	
	Divorced					.17	.09	
	Separated					.15	.13	
	Total Income = 20,000-<50,000					.46****	.11	
	Total Income = 50,000-<100,000					.69****	.11	
	Total Income = 100,000-<150,000					.86****	.11	
	Total Income = ≥150,000					.96****	.12	

p < .0001

Note. Table displays unstandardized regression coefficients.

Table 4.62

Hierarchical weighted least squares regression analyses predicting RAVLT2 from online networking with family.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Networking with family = a few times a year	.40*	.20	.26	.20	.31	.19	0
	Networking with family = a few times a month	.19	.19	.09	.18	.19	.18	
	Networking with family = aa few times week	.11	.18	.08	.18	.06	.18	
	Networking with family = daily	.18	.18	.12	.18	.06	.17	
2	Age			-.05****	0	-.04****	0	.03****
3	Sex					1.03****	.04	.09****
	Married					0	.08	
	Widowed					.03	.12	
	Divorced					.28**	.09	
	Separated					.27*	.13	
	Total Income = 20,000-<50,000					.44****	.11	
	Total Income = 50,000-<100,000					.70****	.11	
	Total Income = 100,000-<150,000					.89****	.11	
	Total Income = ≥150,000					1.00****	.12	

* $p < .05$ ** $p < .01$ *** $p < .001$ **** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.63

Hierarchical weighted least squares regression analyses predicting AF scores from game group participation.

Step	Predictor	B Step 1	S.E.	B Step 2	S.E.	B Step 3	S.E.	R ²
1	Game = several times a year	1.47****	.09	.96****	.09	.84****	.09	.01****
	Game = several times a month	1.37****	.09	.96****	.09	.89****	.08	
	Game = several times a week	1.36****	.08	1.29****	.08	1.27****	.08	
	Game = everyday	1.15****	.08	1.73****	.07	1.77****	.07	
2	Age			-.19****	0	-.16****	0	.12****
3	Sex					-.28****	.05	.14****
	Married					-.47****	.10	
	Widowed					-.48**	.14	
	Divorced					.33*	.13	
	Separated					.10	.19	
	Total Income = 20,000-<50,000					1.18****	.13	
	Total Income = 50,000-<100,000					2.46****	.13	
	Total Income = 100,000-<150,000					3.30****	.14	
	Total Income = ≥150,000					4.00****	.14	
* p < .05 ** p < .01 *** p < .0001								

Note. Table displays unstandardized regression coefficients.

Table 4.64

Hierarchical weighted least squares regression analyses predicting AF scores from family/friends group participation.

Step	Predictor	B Step 1	S.E.	B Step 2	S.E.	B Step 3	S.E.	R ²
1	Family/friends = at least once a year	1.74****	.29	1.33****	.27	.75**	.27	.01****
	Family/friends = at least once a month	3.04****	.27	2.41****	.26	1.51****	.26	
	Family/friends = once a week	3.74****	.27	3.10****	.26	2.1***	.26	
	Family/friends = once a day	3.88****	.30	3.28****	.29	2.27****	.26	
2	Age			-.19****	0	-.15****	0	.11****
3	Sex					-.15**	.05	.14****
	Married					-.39****	.10	
	Widowed					-.47**	.13	
	Divorced					.31*	.14	
	Separated					.07	.19	
	Total Income = 20,000-<50,000					1.09****	.13	
	Total Income = 50,000-<100,000					2.29****	.13	
	Total Income = 100,000-<150,000					3.07****	.14	
	Total Income = ≥150,000					3.68****	.14	

* $p < .05$ ** $p < .01$ *** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.65

Hierarchical weighted least squares regression analyses predicting AF scores from religious group participation.

Step	Predictor	B Step 1	S.E.	B Step 2	S.E.	B Step 3	S.E.	R ²
1	Religious = at least once a year	.16*	.07	-.15*	.07	-.28****	.07	.01****
	Religious = at least once a month	-.57****	.09	-.47****	.09	-.52****	.09	
	Religious = once a week	-1.21****	.07	-.42****	.07	-.31****	.07	
	Religious = once a day	-1.37****	.29	-.73**	.28	-.47	.27	
2	Age			-.19****	0	-.15****	0	.10****
3	Sex					-.06	.05	.13****
	Married					-.35**	.10	
	Widowed					-.37*	.14	
	Divorced					.34*	.13	
	Separated					.09	.19	
	Total Income = 20,000-<50,000					1.25****	.13	
	Total Income = 50,000-<100,000					2.54****	.13	
	Total Income = 100,000-<150,000					3.36****	.14	
	Total Income = ≥150,000					4.02****	.14	
* p < .05 ** p < .01 *** p < .001 **** p < .0001								

Note. Table displays unstandardized regression coefficients.

Table 4.66

Hierarchical weighted least squares regression analyses predicting AF scores from sports group participation.

Step	Predictor	B Step 1	S.E.	B Step 2	S.E.	B Step 3	S.E.	R ²
1	Sports = at least once a year	1.75****	.11	.93****	.11	.61****	.11	.02****
	Sports = at least once a month	2.11****	.09	1.25****	.08	.83****	.08	
	Sports = once a week	1.97****	.07	1.36****	.07	.86****	.07	
	Sports = once a day	1.38****	.11	.93****	.10	.46****	.10	
2	Age			-.18****	0	-.15****	0	.11****
3	Sex					-.10	.05	.14****
	Married					-.40****	.10	
	Widowed					-.43**	.13	
	Divorced					.31*	.13	
	Separated					.08	.19	
	Total Income = 20,000-<50,000					1.12****	.13	
	Total Income = 50,000-<100,000					2.33****	.13	
	Total Income = 100,000-<150,000					3.10****	.14	
	Total Income = ≥150,000					3.73****	.14	

* $p < .05$ ** $p < .01$ *** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.67

Hierarchical weighted least squares regression analyses predicting AF scores from club participation.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Clubs = at least once a year	-.27**	.09	-.49****	.09	-.60****	.09	0
	Clubs = at least once a month	-.81****	.09	-.23**	.09	-.29**	.08	
	Clubs = once a week	-.94****	.12	-.24*	.11	-.21	.11	
	Clubs = once a day	-.66	.54	.04	.51	-.05	.50	
2	Age			-.19****	0	-.15****	0	.10****
3	Sex					-.10	.05	.13****
	Married					-.39****	.10	
	Widowed					-.42**	.14	
	Divorced					.32*	.13	
	Separated					.07	.19	
	Total Income = 20,000-<50,000					1.24****	.13	
	Total Income = 50,000-<100,000					2.55****	.13	
	Total Income = 100,000-<150,000					3.37****	.14	
	Total Income = ≥150,000					4.03****	.14	

* *p* < .05 ** *p* < .01 *** *p* < .001 **** *p* < .0001

Note. Table displays unstandardized regression coefficients.

Table 4.68

Hierarchical weighted least squares regression analyses predicting AF scores from association group participation.

Step	Predictor	B Step 1	S.E.	B Step 2	S.E.	B Step 3	S.E.	R ²
1	Associations = at least once a year	1.50****	.07	.99****	.06	.63****	.06	.01****
	Associations = at least once a month	1.28****	.07	1.12****	.07	.77****	.07	
	Associations = once a week	.82****	.11	1.05****	.10	.90****	.10	
	Associations = once a day	1.14****	.33	1.11****	.31	.91**	.31	
2	Age			-.18****	0	-.15****	0	.11****
3	Sex					-.11*	.05	.14****
	Married					-.37****	.10	
	Widowed					-.41**	.14	
	Divorced					.32*	.13	
	Separated					.07	.19	
	Total Income = 20,000-<50,000					1.18****	.13	
	Total Income = 50,000-<100,000					2.40****	.13	
	Total Income = 100,000-<150,000					3.18****	.14	
	Total Income = ≥150,000					3.76****	.14	

* $p < .05$ ** $p < .01$ *** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.69

Hierarchical weighted least squares regression analyses predicting AF scores from volunteer group participation.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Volunteer = at least once a year	1.60****	.07	1.00****	.07	.69****		.01****
	Volunteer = at least once a month	1.45****	.07	1.27****	.07	.99****		
	Volunteer = once a week	1.00****	.08	1.27****	.08	1.14****		
	Volunteer = once a day	.82****	.20	1.03****	.19	.95****		
2	Age			-.19****	0	-.15****		.11****
3	Sex					-.14**		.14****
	Married					-.41****		
	Widowed					-.43**		
	Divorced					.32*		
	Separated					.07		
	Total Income = 20,000-<50,000					1.17****		
	Total Income = 50,000-<100,000					2.40****		
	Total Income = 100,000-<150,000					3.20****		
	Total Income = ≥150,000					3.80****		
* <i>p</i> < .05 ** <i>p</i> < .01 *** <i>p</i> < .0001								

Note. Table displays unstandardized regression coefficients.

Table 4.70

Hierarchical weighted least squares regression analyses predicting AF from online networking with friends.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Networking with friends = a few times a year	.41	.58	-.211	.57	-.29	.56	0
	Networking with friends = a few times a month	.28	.55	-.23	.53	-.28	.53	
	Networking with friends = aa few times week	-.22	.54	-.61	.53	-.62	.52	
	Networking with friends = daily	-.20	.54	-.66	.53	-.62	.52	
2	Age			-.16****	.01	-.12	.01	.06****
3	Sex					-.14	.09	.08****
	Married					-.42*	.18	
	Widowed					-.44	.29	
	Divorced					.35	.23	
	Separated					.11	.31	
	Total Income = 20,000-<50,000					.68*	.27	
	Total Income = 50,000-<100,000					1.88****	.27	
	Total Income = 100,000-<150,000					2.68****	.28	
	Total Income = ≥150,000					3.40****	.28	

* $p < .05$ **** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Table 4.71

Hierarchical weighted least squares regression analyses predicting AF from online networking with family.

Step	Predictor	<i>B</i> Step 1	S.E.	<i>B</i> Step 2	S.E.	<i>B</i> Step 3	S.E.	<i>R</i> ²
1	Networking with family = a few times a year	.43	.49	-.04	.48	-.18		0
	Networking with family = a few times a month	.05	.46	-.26	.44	-.37		
	Networking with family = aa few times week	-.41	.45	-.53	.44	-.63		
	Networking with family = daily	-.40	.45	-.61	.43	-.66		
2	Age			-.16****	.01	-.13****		.06****
3	Sex					-.12		.08****
	Married					-.38*		
	Widowed					-.25		
	Divorced					.48*		
	Separated					.31		
	Total Income = 20,000-<50,000					.64*		
	Total Income = 50,000-<100,000					1.74****		
	Total Income = 100,000-<150,000					2.64****		
	Total Income = ≥150,000					3.30****		

* $p < .05$ **** $p < .0001$

Note. Table displays unstandardized regression coefficients.

Appendix G: Study 5 Measures

Social Participation

Are you a member of any of these organizations, club or societies? Tick all that apply.

- ☐ Political party, trade union or environmental groups
- ☐ Tenants groups, resident groups, neighbourhood watch
- ☐ Church or other religious groups
- ☐ Charitable associations
- ☐ Education, arts or music groups or evening classes
- ☐ Social clubs
- ☐ Sports clubs, gyms, exercise classes
- ☐ Any other organizations, clubs or societies

Life Satisfaction

1. In most ways my life is close to ideal.

- ☐ Strongly agree
- ☐ Agree
- ☐ Slightly agree
- ☐ Neither agree nor disagree
- ☐ Slightly disagree
- ☐ Disagree
- ☐ Strongly disagree

2. The conditions of my life are excellent.

- ☐ Strongly agree
- ☐ Agree
- ☐ Slightly agree
- ☐ Neither agree nor disagree
- ☐ Slightly disagree
- ☐ Disagree
- ☐ Strongly disagree

3. I am satisfied with my life.

- ☐ Strongly agree
- ☐ Agree
- ☐ Slightly agree
- ☐ Neither agree nor disagree
- ☐ Slightly disagree
- ☐ Disagree
- ☐ Strongly disagree

4. So far I have got the important things I want in life.

- ☐ Strongly agree
- ☐ Agree
- ☐ Slightly agree
- ☐ Neither agree nor disagree
- ☐ Slightly disagree
- ☐ Disagree
- ☐ Strongly disagree

5. If I could live life again, I would change almost nothing.

- ☐ Strongly agree
- ☐ Agree
- ☐ Slightly agree
- ☐ Neither agree nor disagree
- ☐ Slightly disagree
- ☐ Disagree
- ☐ Strongly disagree

Depression

Much of the time during the past week,

- 1) have you felt depressed? Yes No
- 2) have you felt that everything you did was an effort? Yes No
- 3) has your sleep been restless? Yes No
- 4) were you happy? Yes No
- 5) have you felt lonely? Yes No
- 6) have you enjoyed life? Yes No
- 7) have you felt sad? Yes No
- 8) could you not get going? Yes No

Anxiety

What type of emotional, nervous or psychiatric problems do/did you have?

- ☐ Hallucinations
- ☐ Anxiety*
- ☐ Depression
- ☐ Emotional problems
- ☐ Schizophrenia
- ☐ Psychosis
- ☐ Mood swings
- ☐ Manic depression
- ☐ Something else

*Only anxiety was isolated and recoded from this question, such that 1 = anxiety diagnosis and 0 = no anxiety diagnosis.

General Health Questionnaire: A measure of mental health

We should like to know how your health has been in general over the past few weeks.

Have you recently . . .

1. . . . been able to concentrate on whatever you're doing?

- ☐ Better than usual
- ☐ Same as usual
- ☐ Less than usual
- ☐ Much less than usual

2. . . . lost much sleep over worry?

- ☐ Not at all
- ☐ No more than usual
- ☐ Rather more than usual
- ☐ Much more than usual

3. . . . felt you were playing a useful part in things?

- ☐ More so than usual
- ☐ Same as usual
- ☐ Less useful than usual
- ☐ Much less useful

4. . . . felt capable of making decisions?

- ☐ More so than usual
- ☐ Same as usual
- ☐ Less useful than usual
- ☐ Much less useful

5. ... felt constantly under strain?
☐ Not at all
☐ No more than usual
☐ Rather more than usual
☐ Much more than usual
6. ... felt you couldn't overcome your difficulties?
☐ Not at all
☐ No more than usual
☐ Rather more than usual
☐ Much more than usual
7. ... been able to enjoy your normal day-to-day activities?
☐ More so than usual
☐ Same as usual
☐ Less useful than usual
☐ Much less useful
8. ... been able to face up to your problems?
☐ More so than usual
☐ Same as usual
☐ Less useful than usual
☐ Much less useful
9. ...been feeling unhappy and depressed?
☐ Not at all
☐ No more than usual
☐ Rather more than usual
☐ Much more than usual
10. ... been losing confidence in yourself?
☐ Not at all
☐ No more than usual
☐ Rather more than usual
☐ Much more than usual
11. ... been thinking of yourself as a worthless person?
☐ Not at all
☐ No more than usual
☐ Rather more than usual
☐ Much more than usual

12. .. been feeling reasonable happy, all things considered?

- ☐ Same as usual
☐ Less useful than usual
☐ Much less useful

Cognition

Memory: Rey Auditory Verbal Learning Task 1 (RAVLT1; Rey, 1964)

I will now read a set of 10 words. I would like you to recall as many as you can. We have purposely made the list long so it will be difficult for anyone to recall all the words. Most people recall just a few. Please listen carefully to the set of words as they cannot be repeated. When I have finished, I will ask you to recall aloud as many of the words as you can, in any order. Is this clear?

Now please tell me the words you can recall. *Immediate recall recorded (number of words).*

Executive Functioning: Animal Fluency (AF; Read, 1987)

Now I would like you to name as many different animals as you can think of. You have one minute to do this. The computer voice will tell you when to stop. Ready, go!

Memory: RAVLT2

A little while ago, you were read a list of words and you repeated the ones you could remember. Please tell me any of the words that you can remember now. *Delayed recall recorded (number of words).*

Perceived Social Status

Think of this ladder as representing where people stand in our society. At the top of the ladder are the people who are the best off – those who have the most money, most education and best jobs. At the bottom are the people who are the worst off – who have the least money, least education, and the worst jobs or no jobs. The higher up you are on this ladder, the closer you are to the people at the very top and the lower you are, the closer you are to the people at the very bottom. Please mark a cross on the rung on the ladder where you would place yourself.

Example:

Demographics

What is your date of birth? __

Ask or code sex.

☐ Male

☐ Female

Genetic Polymorphisms

Brain derived neurotrophic factor (rs6265, rs1157659)

Insulin-like growth factor-1 (rs7136446)

Fibroblast growth factor (rs1048201)

Fibroblast growth factor receptor 2 (rs1219648)

Appendix H: Study 6 Measures

Origins of Youth: Biopsychological Effects of Social Participation on Aging

CESDR

Rarely or none of the time (less than 1 day)	Some or a little of the time (1-2 days)	Occasionally or a moderate amount of time (3-4 days)	All of the time (5-7 days)
--	---	---	-------------------------------

1. I was bothered by things that usually don't bother me.	☐	☐	☐	☐
2. I had trouble keeping my mind on what I was doing.	☐	☐	☐	☐
3. I felt depressed.	☐	☐	☐	☐
4. I felt that everything I did was an effort.	☐	☐	☐	☐
5. I felt hopeful about the future.	☐	☐	☐	☐
6. I felt fearful.	☐	☐	☐	☐
7. My sleep was restless.	☐	☐	☐	☐
8. I was happy.	☐	☐	☐	☐
9. I felt lonely.	☐	☐	☐	☐
10. I could not "get going".	☐	☐	☐	☐

GAI-SF

Please answer the items according to how you've felt in the last week.

Check the column under **Agree** if you mostly agree that the item describes you;

Check the column under **Disagree** if you mostly disagree that the item describes you.

	Agree	Disagree
1. I worry a lot of the time.	☐	☐
2. I often feel nervous.	☐	☐
3. Little things bother me a lot.	☐	☐
4. I think of myself as a worrier.	☐	☐
5. My own thoughts often make me anxious.	☐	☐

Social Connectedness Scale

1. I feel disconnected from the world around me.

1	2	3	4	5	6
Agree					Disagree

2. Even around people I know, I don't feel that I really belong.

1	2	3	4	5	6
Agree					Disagree

3. I feel so distant from people.

1	2	3	4	5	6
Agree					Disagree

4. I have no sense of togetherness with my peers.

1	2	3	4	5	6
Agree					Disagree

5. I don't feel related to anyone.

1	2	3	4	5	6
Agree					Disagree

6. I catch myself losing all sense of connectedness with society.

1	2	3	4	5	6
Agree					Disagree

7. Even among my friends, there is no sense of brother/sisterhood.

1	2	3	4	5	6
Agree					Disagree

8. I don't feel I participate with anyone or any group.

1	2	3	4	5	6
Agree					Disagree

Identification with Retirement Community

Using a scale from 1 to 5, with 1 being "strongly disagree" and 5 being "strongly agree", please state how you feel about the following statements:

1. I see myself as being part of the _____.

1	2	3	4	5
Strongly Disagree				Strongly Agree

2. I am pleased to be part of the _____.

1	2	3	4	5
Strongly Disagree				Strongly Agree

3. I feel strong ties with people in the _____.

1	2	3	4	5
Strongly				Strongly
Disagree				Agree

4. I can identify with people in the _____.

1	2	3	4	5
Strongly				Strongly
Disagree				Agree

5. I feel that I am very different from other people in the _____.

1	2	3	4	5
Strongly				Strongly
Disagree				Agree

Retirement Community Activities

1. Are you involved with recreational activities at _____?

- ☐ Yes
☐ No

2. If you answered yes to the question above, please list the activities below and indicate how often you participate in each activity and how strongly you identify with other members of your group.

Name of Activity 1:

How long have you been participating in this activity?

How often do you participate in this activity?

- ☐ Everyday
☐ Every week
☐ Every other week
☐ At least once a month
☐ Less than once a month

I identify with this group.

1	2	3	4	5	6	7
fully						fully
disagree						agree

Name of Activity 2:

How long have you been participating in this activity?

How often do you participate in this activity?

- ☐ Everyday
☐ Every week
☐ Every other week
☐ At least once a month
☐ Less than once a month

I identify with this group.

1	2	3	4	5	6	7
fully						fully
disagree						agree

Name of Activity 5:

How long have you been participating in this activity?

How often do you participate in this activity?

- ☐ Everyday
☐ Every week
☐ Every other week
☐ At least once a month
☐ Less than once a month

I identify with this group.

1 2 3 4 5 6 7
fully fully
disagree agree

Name of Activity 6:

How long have you been participating in this activity?

How often do you participate in this activity?

- ☐ Everyday
☐ Every week
☐ Every other week
☐ At least once a month
☐ Less than once a month

I identify with this group.

1 2 3 4 5 6 7
fully fully
disagree agree

Name of Activity 3:

How long have you been participating in this activity?

How often do you participate in this activity?

- ☐ Everyday
☐ Every week
☐ Every other week
☐ At least once a month
☐ Less than once a month

I identify with this group.

1 2 3 4 5 6 7
fully fully
disagree agree

Name of Activity 4:

How long have you been participating in this activity?

How often do you participate in this activity?

- ☐ Everyday
☐ Every week
☐ Every other week
☐ At least once a month
☐ Less than once a month

I identify with this group.

1 2 3 4 5 6 7
fully fully
disagree agree

Name of Activity 7:
Name of Activity 8:

How long have you been participating in this activity?

How long have you been participating in this activity?

How often do you participate in this activity?

- ☐ Everyday
☐ Every week
☐ Every other week
☐ At least once a month
☐ Less than once a month

How often do you participate in this activity?

- ☐ Everyday
☐ Every week
☐ Every other week
☐ At least once a month
☐ Less than once a month

I identify with this group.

1 2 3 4 5 6 7
fully fully
disagree agree

I identify with this group.

1 2 3 4 5 6 7
fully fully
disagree agree

CDRS-R

Considering your experiences over the last month, please rate how true the following statements are on a scale of 0 (rarely true) to 4 (true nearly all of the time). *Over the past month . . .*

1. I was able to adapt to change.

0	1	2	3	4
Not true at all	Rarely True	Sometimes True	Often True	True nearly all of the time

2. I could deal with whatever came my way

0	1	2	3	4
Not true at all	Rarely True	Sometimes True	Often True	True nearly all of the time

3. I tried to see the humorous side of problems

0	1	2	3	4
Not true at all	Rarely True	Sometimes True	Often True	True nearly all of the time

4. I thought that coping with stress could strengthen me

0	1	2	3	4
Not true at all	Rarely True	Sometimes True	Often True	True nearly all of the time

5. I tended to bounce back after illness or hardship

0	1	2	3	4
Not true at all	Rarely True	Sometimes True	Often True	True nearly all of the time

6. I could achieve goals despite obstacles being in my way

0	1	2	3	4
Not true at all	Rarely True	Sometimes True	Often True	True nearly all of the time

7. I could stay focused under pressure

0	1	2	3	4
Not true at all	Rarely True	Sometimes True	Often True	True nearly all of the time

8. I was not easily discouraged by failure

0	1	2	3	4
Not true at all	Rarely True	Sometimes True	Often True	True nearly all of the time

9. I thought of myself as a strong person

0	1	2	3	4
Not true at all	Rarely True	Sometimes True	Often True	True nearly all of the time

10. I could handle unpleasant feelings

0	1	2	3	4
Not true at all	Rarely True	Sometimes True	Often True	True nearly all of the time

SCOPE – Short Form

The purpose of this questionnaire is to find out how people deal with their problems or the stresses in their lives. The following are activities that you may have done. After each activity, please indicate the extent to which you would use this as a way of dealing with problems or stresses in recent months.

In that situation, I	Not at all Somewhat Totally				
1. accepted that there was nothing I could do to change my situation.	0	1	2	3	4
2. blamed myself for my problems.	0	1	2	3	4
3. told others that I was really upset.	0	1	2	3	4
4. asked others for help or advice.	0	1	2	3	4

	Not at all		Somewhat		Totally
5. spent a lot of time thinking about my problems.	0	1	2	3	4
6. took time for recreation or pleasure activities.	0	1	2	3	4
7. made plans to overcome my concerns or problems.	0	1	2	3	4
8. avoided thinking about my problems.	0	1	2	3	4
9. told jokes about my situation.	0	1	2	3	4
10. thought a lot about who was responsible for my problems (besides me).	0	1	2	3	4
11. worried about my problems a lot.	0	1	2	3	4
12. made humorous comments or stories about my situation	0	1	2	3	4
13. wished the situation would just go away or be over with	0	1	2	3	4
14. thought a lot about how I brought my problems on myself	0	1	2	3	4
15. decided to wait and see how things turned out.	0	1	2	3	4
16. tried to keep my mind off things that were upsetting me	0	1	2	3	4
17. sought reassurance and emotional support from others	0	1	2	3	4
18. thought about how my problems were caused by other people.	0	1	2	3	4
19. cried, even if someone else was around.	0	1	2	3	4

	Not at all		Somewhat		Totally
20. looked for how I could grow and learn through my situation	0	1	2	3	4
21. told myself that other people have problems like mine	0	1	2	3	4
22. did things to keep busy or active (eg., exercised, went out)	0	1	2	3	4
23. held in my feelings.	0	1	2	3	4
24. daydreamed about how things may turn out.	0	1	2	3	4
25. tried to act as if I wasn't feeling bad.	0	1	2	3	4
26. took steps to overcome the problem.	0	1	2	3	4
27. turned to God or my faith.	0	1	2	3	4
28. used prescription drugs to try to make me feel better.	0	1	2	3	4
29. used alcohol to try to make me feel better.	0	1	2	3	4
30. used food to try to make me feel better.	0	1	2	3	4

SISC

1. On a scale of 1 to 6, how would you rate your ability to handle stress?

1	2	3	4	5	6
I can shake off stress					Stress eats away at me

2. In the past year, how would you rate the amount of stress in your life?

1	2	3	4	5	6
No stress					Extreme Stress

Self-Anchoring Striving Scale

Please refer to this ladder with steps numbered from zero at the bottom to ten at the top. The top of the ladder represents the best possible life for you and the bottom of the ladder represents the worst possible life for you. On which step of the ladder would you say you personally feel you stand at this time?

Global Self-Rated Health Measure

How would you rate your overall health at the present time? Please select a number from 1 to 5, with 1 being poor, 2 being fair, 3 being good, 4 being very good, and 5 being excellent.

1	2	3	4	5
poor	fair	good	very	excellent

Medical History

1. When was the last time you ate today? _____ minutes/hours ago
 2. When was the last time you drank something today? _____ minutes/hours ago
 3. Are you currently being treated for any condition(s) (e.g. disease, allergy, depression)?
 - ☐ No
 - ☐ Yes *please specify:*
-

4. Are you taking medication for any of the following conditions? Please check all that apply.

- ☐ High Blood Pressure
- ☐ Diabetes
- ☐ Cardiovascular Disease
- ☐ Hypothyroidism
- ☐ Gastrointestinal Disorders
- ☐ Dementia
- ☐ Depression
- ☐ Anxiety
- ☐ Other: _____

5. Do you smoke?

- ☐ No
- ☐ Yes → How often? ____ very often ____ somewhat often ____ once in a while ____ rarely
____ socially

6. Did you smoke in the past?

- ☐ No, I have never smoked.
- ☐ Yes → For how long? ____ years
How often? ____ very often ____ somewhat often ____ once in a while ____ rarely
Did you smoke socially? Yes / No

7. Do you consume alcohol? If so, how often?

- ☐ No
- ☐ Yes → How often? ____ very often ____ somewhat often ____ once in a while ____ rarely
____ socially

8. Have you had any of the following conditions in the recent past? Please check all that apply.

- ☐ Pneumonia
- ☐ Influenza (the flu)
- ☐ Shingles
- ☐ Cancer
- ☐ Depression
- ☐ Anxiety
- ☐ Other: _____

Demographic Information

1. What is your current age? _____

2. What is your gender?

- ☐ Male
- ☐ Female

☐ Other: _____

3. What is your ethnic/racial identity?

- ☐ Asian (i.e. Chinese, Japanese, Korean)
- ☐ South Asian (i.e. East Indian, Pakistani, Punjabi, Sri Lankan)
- ☐ South East Asian (i.e. Cambodian, Indonesian, Laotian)
- ☐ Arabic
- ☐ Black
- ☐ South/Latin American
- ☐ Mexican
- ☐ Aboriginal
- ☐ Euro-Caucasian
- ☐ Other *please specify:* _____

4. What is your religious affiliation?

- ☐ Protestant
- ☐ Catholic
- ☐ Jewish
- ☐ Muslim
- ☐ Buddhist
- ☐ Hindu
- ☐ Sikh
- ☐ Baha'i
- ☐ Atheist
- ☐ Agnostic
- ☐ Other *please specify:* _____

5. What is your current relationship status? *Please check the one that best applies to you.*

- ☐ Single
- ☐ In a serious dating relationship
- ☐ Co-Habiting
- ☐ Engaged
- ☐ Married
- ☐ Separated/Divorced
- ☐ Widowed

6. What is your current living arrangement? *Please check the one that best applies to you.*

- ☐ Living alone
- ☐ Living with spouse/significant other
- ☐ Other *please specify:* _____

7. When did you move into _____?

Date: _____

8. What is the highest level of education that you have completed?

- ☐ Grade school
- ☐ Some high school
- ☐ High school diploma
- ☐ Trade certificate/diploma
- ☐ Some college
- ☐ College diploma/degree
- ☐ Some university
- ☐ University degree

What do you think is the key to successful aging?

Appendix I: Hardy-Weinberg Calculations

Study 5

SNP	Observed Frequencies (O)	Expected Frequencies (E)	(O-E) ² /E	Conclusion
rs6265 BDNF	GG: 4908 GA: 2211 AA: 285 Total: 7404 p = .81 q = .19	p ² = .66 2pq = .31 q ² = .04 GG: 4887 GA: 2295 AA: 296	GG: .09 GA: 3.07 AA: .41 χ ² : 3.57	χ ² < 3.841 No violation
rs1157659 BDNF	TT: 1993 CT: 3648 CC: 1761 Total: 7402 p = .52 q = .48	p ² = .27 2pq = .50 q ² = .23 TT: 1999 CT: 3701 CC: 1702	TT: .02 CT: .76 CC: 2.05 χ ² : 2.83	χ ² < 3.841 No violation
rs7136446 IGF-1	TT: 2597 CT: 3499 CC: 1309 Total: 7405 p = .59 q = .41	p ² = .35 2pq = .48 q ² = .17 TT: 2592 CT: 3554 CC: 1259	TT: .01 CT: .85 CC: 1.99 χ ² : 2.85	χ ² < 3.841 No violation
rs1048201 FGF-2	CC: 5095 CT: 2088 TT: 217 Total: 7400 p = .83 q = .17	p ² = .69 2pq = .28 q ² = .03 CC: 5106 CT: 2072 TT: 222	CC: .02 CT: .12 TT: .11 χ ² : .25	χ ² < 3.841 No violation
rs1219648 FGFR2	AA: 2782 GA: 3471 GG: 1148 Total: 7401 p = .61 q = .39	p ² = .37 2pq = .48 q ² = .15 AA: 2738 GA: 3552 GG: 1110	AA: .71 GA: 1.85 GG: 1.30 χ ² : 3.86	χ ² > 3.841 Violation

Study 6

SNP	Observed Frequencies (O)	Expected Frequencies (E)	(O-E) ² /E	Conclusion
rs6265 BDNF	GG: 161 GA: 75 AA: 5 Total: 241 p = .82 q = .18	p ² = .67 2pq = .30 q ² = .03 GG: 161 GA: 72 AA: 7	GG: 0 GA: .13 AA: .57 χ ² : .70	χ ² < 3.841 No violation
rs1157659 BDNF	TT: 45 CT: 122 CC: 77 Total: 244 p = .43 q = .57	p ² = .18 2pq = .49 q ² = .32 TT: 44 CT: 120 CC: 78	TT: .02 CT: .03 CC: .01 χ ² : .06	χ ² < 3.841 No violation
rs7136446 IGF-1	TT: 82 CT: 115 CC: 44 Total: 241 p = .58 q = .42	p ² = .34 2pq = .49 q ² = .18 TT: 82 CT: 118 CC: 43	TT: 0 CT: .08 CC: .02 χ ² : .1	χ ² < 3.841 No violation
rs1048201 FGF-2	CC: 167 CT: 71 TT: 5 Total: 243 p = .83 q = .17	p ² = .69 2pq = .28 q ² = .03 CC: 168 CT: 68 TT: 7	CC: .01 CT: .13 TT: .57 χ ² : .71	χ ² < 3.841 No violation
rs1219648 FGF-5	AA: 111 GA: 98 GG: 34 Total: 243 p = .66 q = .34	p ² = .44 2pq = .45 q ² = .12 AA: 107 GA: 109 GG: 29	AA: .15 GA: 1.11 GG: .86 χ ² : 2.12	χ ² < 3.841 No violation