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“The we's have it”: Evidence for the distinctive benefits of group engagement in enhancing cognitive health in aging

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A R T I C L E I N F O

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A B S T R A C T

Aligned with research in the social capital and general health literature, a large body of evidence shows that older people who are more socially active have better cognitive integrity and are less vulnerable to cognitive decline. The present research addresses the question of whether the type of social engagement (group-based vs. individual) has differential effects on these cognitive health outcomes. Drawing on population data ($N = 3413$) from three waves (i.e., Waves 3, 4 and 5) of the English Longitudinal Study of Ageing, we investigated the independent contribution of group and individual engagement in predicting cognitive functioning four years later. Hierarchical linear regression was used entering age, gender, socioeconomic status, ethnicity, and physical health as covariates. The final model, controlling for initial cognitive function and social engagement (both group and individual) showed that only group engagement made a significant, sustained, and unique contribution to subsequent cognitive function. Furthermore, the effects of group engagement were stronger with increasing age. These findings extend previous work on the social determinants of health by pinpointing the types of relationships that are particularly beneficial in protecting cognitive health. The fact that group engagement optimized health outcomes, and that this was especially the case with increasing age, has important implications for directing community resources to keep older adults mentally active and independent for longer.

There is no doubt that social factors affect health and well-being outcomes. Social isolation and exclusion are associated with increased rates of premature death (e.g., Berkman and Syme, 1979; Cacioppo and Hawkley, 2003; Holt-Lunstad et al., 2010; Holt-Lunstad and Smith, 2012; House et al., 1981), and greater vulnerability to, and adverse outcomes in recovery from, chronic disease (e.g., Boden-Albala et al., 2005; Ertel et al., 2009; Uchino, 2006; Umberson and Montez, 2010). They are also key contributors to declining mental health (e.g., Cruwys et al., in press, 2013; Nguyen and Berry, 2013) and well-being (e.g., Berry and Shipley, 2009; Olesen and Berry, 2011; Tomaszewski, 2013). Moreover, these effects are more pronounced among those whose health is already compromised (House, 2001).

Particularly important for older populations, these social factors are implicated in cognitive health outcomes. Results of numerous longitudinal investigations show that older people who are more socially connected have better cognitive integrity and are less vulnerable to progressive decline (Barnes et al., 2004; Bassuk et al., 1999; Crooks et al., 2008; Ertel et al., 2008; Fabrigoule et al., 1995; Giles et al., 2012; Holtzman et al., 2004; Seeman et al., 2001; Seeman et al., 2011; Zunzunegui et al., 2003). What is notable from these studies is that the effects are substantial. Thus among seniors with the highest number of social networks, there is evidence that general cognitive decline is reduced by 39% (Barnes et al., 2004) and that memory decline is halved (Ertel et al., 2008) over a period of five to six years, relative to people with the lowest levels of social integration. The challenge researchers and practitioners currently face is how best to use these findings to optimize cognitive health as people age.

There is general agreement that improving our understanding of causal mechanisms will address this challenge. This requires the integration of two components: (a) understanding what determines the formation and quality of beneficial social engagement, and (b) understanding the processes through which such engagement exerts its effects. Much of the focus to date has been on understanding the latter, with many researchers arguing that supportive social relationships are vital in controlling the body's response to heightened arousal and stress (Cohen, 2004; Seeman et al., 2002; Uchino, 2004) and that this in turn offers protection against adverse neurodegenerative outcomes (Fillet et al., 2002). Yet while they are an important part of the story, these

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physiological effects are primarily a response to a given social stimulus (e.g., receiving social support from a spouse). Accordingly, it is important to interrogate the psychological processes that underpin these effects so that we are in a position to understand why and how social experiences (e.g., of support) influence biological processes. By way of example, evidence that the nature of social relationships (e.g., those based on shared vs. non-shared group membership) has a profound impact on the trajectory of social support and stress (Haslam et al., 2012; Umberson and Montez, 2010), points to the need to understand how the quality and nature of social relationships feed into positive health outcomes.

Yet to understand these processes we first need to clarify what is the "active ingredient" of social networks in those studies that have investigated its effects on cognitive integrity. To date, the majority of studies in the aging literature have conceptualized social relationships predominantly in interpersonal terms. As a result, indices of network structure typically conflate different types of social relationships – so that they fail to differentiate between the effects of individual, or one-on-one, engagement (i.e., with other well-known individuals; e.g., a spouse, child, friend or relative) and the effects of engagement with broader social groups (e.g., one's wider family, recreational clubs, voluntary and church groups). Moreover, the majority of studies tend to place greater emphasis on the former (e.g., see Bennett et al., 2006; Crooks et al., 2008; Ertel et al., 2008; Fratiglioni et al., 2000; Giles et al., 2012; Green et al., 2008; Holtzman et al., 2004). Indeed, where group engagement is measured, the data tends to be coded for its presence or absence and treated as an equivalent construct to engagement with individuals, often resulting in the two constructs being collapsed into a single social network index (Barnes et al., 2004; Bassuk et al., 1999; Seeman et al., 2001; Zunzenugui et al., 2003).

Nevertheless, there is evidence that some relationships (i.e., family and spousal) may be especially important for some aspects of health (Kiecolt-Glaser and Newton, 2001; Christakis and Allison, 2006), with additional relationships and activities identified as protective of mental health and psychological distress (i.e., with friends, and neighbors, community activity, interest in current affairs and religious observance; Berry et al., 2007; Berry and Welsh, 2010). There is also evidence that particular forms of community participation – notably, political participation and political protest – has been found to be bad for one's mental health (Berry et al., 2007; Berry and Welsh, 2010). Although cognitive health was not the focus of these studies with younger participants, this evidence strengthens the case for investigating the effects of different types of social relationships. Indeed, the need to identify the most effective forms of engagement has been highlighted as an important research agenda in the aging field (Carstensen and Hartel, 2006).

Perhaps most informative in the light of this characterization of the "social", are findings from a longitudinal study of 2387 elderly Taiwanese conducted by Glei et al. (2005). As in many other studies, social relationships were measured as a function of individual engagement including marital status and the number of close relatives, other relatives, friends and neighbors with whom a person had weekly contact. In line with the above reasoning, though, these researchers included an additional measure comprising largely group-based relationships and activities (e.g., involvement in elderly organizations, political groups, volunteering). Interestingly, the study found that people who participated in one or two group activities displayed 13% fewer cognitive deficiencies up to three years later and that those who participated in three or more group activities had 33% fewer. At the same time, individual relationships alone had no impact at all on these same cognitive outcomes. The implications of these findings are important for the present analysis, as they point, for the first time in the aging literature, to the possibility that the *type of relationship* that is implicated in the social connectivity that people enjoy (specifically, group vs. individual) has a significant bearing on their cognitive health outcomes.

Also interesting in the context of Glei's findings is the fact that the size of these different social networks was not a key predictor of health outcomes. Rather, preservation of function was best predicted by the quality of these relationships as indexed by measures of the extent of active participation and engagement. Indeed, this is a finding that has emerged from many other studies investigating relationships between social capital and cognition (e.g., James et al., 2011; Fabrigoule et al., 1995; Krueger, 2009) and the role of social and emotional support in this link (Bassuk et al., 1999; Seeman et al., 2001). The study conducted by Barnes et al. (2004) provides further interesting data on this point. As noted earlier, here cognitive decline was reduced by 39% in those with the greatest social network size, but it was reduced much further, by 91%, among those with the highest levels of social engagement. These data make an important point about the added value of engagement and support and highlight that cognitive preservation is not a natural or inevitable consequence of all social relationships. If this were the case, we should see no difference in the contribution of network size and relationship quality, but, as this and other research shows, the latter appears to have considerable impact on cognitive outcome.

The critical question, relevant to social mechanism, raised by findings such as these is what makes engagement and social support possible? This is where social psychological theory offers some potential answers – not least because this points to important differences between group and individual engagement that explain why they might affect health in different ways. In particular, the social identity framework (Tajfel and Turner, 1979; Turner et al., 1987; Turner et al., 1994), and the recently developed social identity approach to health (Haslam et al., 2009; Jetten et al., 2012, 2014) explain how social group memberships can influence health outcomes through their impact on a person's sense of *social identity*. Fundamental to these theories and approach is the idea that social groups (whatever their basis; e.g., family, friendship, religious, community, recreational) provide an important and distinctive basis for self-understanding because they furnish people with a sense of themselves as part of a larger collective ("us", e.g., "us Australians", "us grandmothers", "us Democrats") rather than as merely unique individuals (in terms of personal identity, "I"; Turner, 1982).

To the extent that they are incorporated as an important part of our identity, groups frame and inform our values (e.g., our belief in free speech when our Democratic identity is salient), and structure our thoughts, emotions, and behavior (e.g., to question, feel disillusionment, and protest when our democratic rights are infringed). More importantly still, a sense of shared identity provides a meaningful basis to give, receive, and benefit from various forms of health-enhancing social support (i.e., emotional, cognitive, material; Haslam et al., 2009, 2012). Critically, then, social identification explains why we willingly engage – and benefit from relationships – with some people (e.g., members of our local church, when religious identity is salient), but not others (e.g., members of a conservative political party with whom one has neither a sense of connectedness or belonging).

Applying this logic to the present context, social identity theorizing would argue that *social identification* provides an important basis for social participation, and thus the mechanism through which health benefit – whether mental, physical or cognitive – is gained. This is because social participation does not occur in a psychological vacuum. On the contrary, there must be a basis, reason, and motivation to actively participate in social activities with others, and this is more likely to be the case when people perceive themselves as sharing social identity (e.g., as members of the same family, community, or other group). In this context, social identification with a group becomes an important social and psychological *resource* – a resource that makes social participation, of the form that researchers encourage to protect cognitive health, possible (Jetten et al., 2014).

We can also use this theorising to explain why a focus on network size *alone* has limited utility. For, as studies of the effects of being in a crowd have shown, one may have many social ties and an abundance of social contact, but still feel isolated if those relationships are perceived to hold no particular meaning or value for self (Alnabulsi and Drury, in press; Novelli et al., 2013). It also follows from this analysis that because improved health outcomes are derived from the opportunity to interact with others in meaningful ways, then group engagement may offer more than purely individual engagement in protecting against cognitive decline. This is because psychological group membership offers greater opportunities for accessing social support, given that the resource comprises multiple people (many of whom are not known personally), and not just a limited number of personally known others. Indeed, because a sense of shared social identity creates a sense of psychological connection to unknown others (e.g., people in the same community) it makes intellectual and social engagement with those others appear safer and more likely to be beneficial. Moreover, this effect is likely to be magnified to the extent that one is a member of multiple groups.

Yet while they have a strong grounding in evidence and theory, these hypotheses have not yet been tested directly. The purpose of the present paper is to provide this analysis, focusing specifically on the contribution that group- and individual-based engagement make to cognitive health.[1] More specifically, drawing on data from the English Longitudinal Study of Aging, we examine the independent contributions of these different forms of social engagement in protecting against cognitive decline and extend this analysis to consider the impact of vulnerability to determine whether these effects are more impactful with increasing age.

Table 1
Descriptive statistics for demographic, social relationship and cognitive health variables in analysis.

Measure	Range	T1 M(SD)	T2 M (SD)	T3 M (SD)	Cohen's *d* (*p* value)
Covariates					
Age	50–99 (top coded)	62.58 (8.94)			
Sex	57.3% female				
Socioeconomic status (income decile)	1–10	6.06 (2.73)			
Physical health	1–4	2.98 (1.02)	2.90 (1.05)	2.78 (1.08)	
Social engagement measures					
Participation in cultural activities	1–6	3.01 (.97)	2.99 (.97)	2.99 (.99)	−.75 ($p < .001$)
Community activities	0–8	4.79 (1.63)	4.80 (1.61)	4.84 (1.62)	−.06 ($p = .001$)
Number of group memberships	0–8	1.61 (1.43)	1.54 (1.41)	1.46 (1.37)	−.04 ($p = .027$)
Relationship quality	0–4	2.89 (.68)	2.86 (.68)	2.84 (.68)	−.13 ($p < .001$)
Frequency of contact	0–6	3.64 (1.07)	4.02 (1.03)	3.45 (.93)	−.66 ($p < .001$)
Number of close relationships	0–30 (top-coded)	8.86 (5.26)	8.36 (4.53)	8.24 (4.32)	−.09 ($p < .001$)
Cognitive function measures					
Orientation	0–4	3.83 (.41)	3.82 (.43)	3.82 (.45)	−.02 ($p = .227$)
Word fluency	1–56	21.76 (6.44)	21.99 (6.55)	21.81 (6.52)	.01 ($p = .705$)
Prospective memory	0–5	4.00 (1.57)	4.11 (1.53)	4.07 (1.55)	.03 ($p = .03$)
Immediate memory	0–10	6.26 (1.61)	6.24 (1.60)	6.19 (1.64)	−.04 ($p = .022$)
Delayed memory	0–10	5.12 (1.91)	5.06 (1.94)	5.00 (2.02)	−.06 ($p < .001$)

Notes.
$N = 3413$.

1. Method

1.1. Sample

Participants were 3413 respondents to the English Longitudinal Study of Ageing (ELSA); a large-scale panel study of people representative of the English population aged 50 years and older (Marmot et al., 2013; Steptoe et al., 2012). All participants in the study were born before March 1952 and had been identified through their involvement in the Health Survey for England. ELSA commenced its first wave of data collection in 2002/3 and respondents were invited to participate every two years. For the present study, the sample comprised respondents who had taken part in Waves 3, 4, and 5 and had no missing data on key variables. Relevant demographic data for age, gender and socioeconomic status are reported in Table 1.

1.2. Measures

The ELSA database contains objective and subjective data on changes in health, economic, and social circumstances. Our focus was on ELSA measures of cognitive function and measures of group and individual engagement in social relationships. Many of these measures have been derived from, or used in, previous research that has investigated the relationship between these constructs in older adults. These data were collected either during a face-to-face interview or through a questionnaire that respondents completed independently.

The social relationship data comprised all relevant measures from ELSA that tapped social capital, participation, engagement and relationship quality and were measured in Waves 3 to 5. These have not been defined in the dataset as having a focus on group or individual engagement.[2] Higher scores indicate stronger relationship quality and greater social capital, participation and engagement in the areas assessed. However, in the case of loneliness, higher scores were indicative of greater perceived loneliness and isolation.

i) Number of close relationships

This measure asked respondents to indicate how many children, immediate family and friends with whom they had a close

[1] With the focus in this study being on the particular contribution that group and individual-based engagement make to cognitive integrity over time, we did not examine the contribution of individual items and components (e.g., spousal, relative, neighbor, family, friend, volunteering, church, sports, and social groups) separately. Importantly though, other studies have examined their individual contributions, and found sense of belonging to be particularly important in protecting mental health (see Berry et al., 2007; Berry and Welsh, 2010).

[2] It is important to note that scales were not categorized as measures of either group or individual engagement prior to analysis. Instead we used a data-driven strategy – based on factor analysis – to derive these constructs.

relationship. Responses were summed across the three relationship types (with a maximum value of 30, to reduce negative skew).

ii) Relationship quality

This measure of social support from ELSA captures the perceived average quality of social contacts that respondents had with their children, immediate family, partner, and friends. Respondents were asked to answer seven questions (e.g., "How much can you rely on [child] if you had a serious problem?) using a 4-point scale (range "a lot" to "not at all"). Respondents who did not have children or a partner were scored "not at all" for items relating to that type of relationship. The overall score was the average of responses to the seven questions across the four relationship types.

iii) Frequency of contact

Two questions assessed contact frequency with the above people (e.g., How often do you see [your child] on average?) using a 6-point scale (range "three or more times a week" to "less than once a year or never"). The score was the average of responses to the two items across the three relationship types (friends, immediate family and children).

iv) Loneliness

In ELSA, loneliness is measured using four-items (Hughes et al., 2004), based on the Revised UCLA Loneliness Scale (Russell et al., 1980; e.g., "How often do you feel you lack companionship), and participants asked to respond to each using a 3-point scale (range "hardly ever or never" to "often").

v) Number of group memberships

This scale captures respondents' membership of organizations, clubs and societies. Respondents are given eight options (e.g., sports club, church group, social clubs, neighborhood watch, education, arts or music groups) and asked to tick all those that apply to them. The score for this measure was the total number of options selected. A final option of membership of no organizations was provided, and when ticked, this was assigned a score of zero. Responses were summed to create a continuous score ranging from 0 to 8.

vi) Community activities

This item from the ELSA comprised a list of eight activities that people could engage in (e.g., going on a day trip, going on holiday, engaging in a hobby or pastime, using the internet and email, reading a daily newspaper), and they were simply asked to indicate which applied to them. The measure was the sum of the items respondents endorsed.

vii) Participation in cultural activities

Respondents were asked to indicate the degree to which they engaged in four community and cultural activities (e.g., going to the cinema, eating out, going to the theatre, concert or opera). A 6-point scale (range "twice or more a month" to "never") was used to respond to each and the final score was the average of ratings for all activities.

Our measures of cognitive function comprised five tests of mental ability administered during a nurse visit. These are described in more detail by Huppert et al. (2006). Higher scores on all are indicative of better cognitive integrity.

i) Orientation

Orientation to the day of the week and date (day, month, year) was assessed using questions from the Mini-Mental State Examination (MMSE; Folstein et al., 1975).

ii) Immediate memory

This measure was the immediate verbal memory learning task employed in the Health and Retirement Study (Ofstedal et al., 2005). Ten words are presented aurally by computer at a rate of one word every 2 s, and participants are asked to recall as many words as possible immediately. Four different randomly assigned word lists are used, and members of the same household are given different versions.

iii) Delayed memory

Memory for the above word list is tested after a short delay filled with other cognitive tests.

iv) Prospective memory

This was assessed by asking participants to remember to carry out a previously presented instruction (writing their initials in the top left-hand corner of a page attached to a clipboard when it is handed to them) at a point later in the session. This prospective memory test is closely based on a task incorporated in the Medical Research Council Cognitive Function and Aging Study (MRC CFS; Huppert et al., 2000).

v) Verbal fluency

Participants are asked to recall as many items they can within a minute from a particular category – in this case animals. It is a commonly used measure in neuropsychological assessment and has been used in other aging and cognition studies (e.g., Huppert et al., 2000).

In addition, we included a number of measures commonly used as covariates in longitudinal investigations of cognitive health. Variables included for this purpose were age, gender, ethnicity (white versus non-white), financial status (as an index of socio-economic status,[3] based on a person's total annual financial, physical and housing wealth, excluding pension wealth, and recorded in deciles), and perceived physical health (gauged by participant response to the question "how often does your health stop you from doing what you want to do?" which they were required to rate on a 5-point scale, ranging from "never" to "often").[4] As well as being common covariates in longitudinal investigations of cognitive health, the latter variable was included to exclude the possibility that any effects of social engagement were driven by other factors (i.e., physical health) that might influence participation.

[3] Wealth, of course, is only one index of socio-economic status. However, it is the one used by Banks et al. (2008) in previously reported findings from the ELSA study.

[4] In light of this being a measure of perceived health, we also ran our analyses controlling for a more objective index of health, in this case whether respondents suffered from a long-standing illness or disability. This analysis essentially revealed the same pattern of findings as the analysis in which perceived health was used as a control variable (i.e., that T2 group engagement made a significant contribution to the prediction of T3 cognition, $t(3400) = 6.27$, $p < .001$, but this was not the case with T2 individual engagement, $t(3400) = -1.755$, $p = .08$.

1.3. Statistical analysis

Maximum likelihood factor analysis with oblimin rotation was first undertaken with T1 social relationship measures to identify factors representing individual and group engagement. Standardized scores were used rather than raw scores due to differences in the scale and distribution between the different variables. As the results below show, a two-factor solution was obtained with the contributing scales largely supporting a distinction between group and individual engagement. These data were entered into subsequent analysis to determine their contribution to predicting later cognitive function.

In this second stage of analysis, three waves of ELSA data were used – Wave 3 representing Time 1 (T1, collected in 2006), Wave 4 as Time 2 (T2, collected in 2008), and Wave 5 as Time 3 (T3, collected in 2010). The decision to focus on these later waves of the ELSA was based on the greater consistency in the social relationship measures used in these waves of the survey. These data were subjected to hierarchical regression controlling for age, gender, ethnicity, financial status, and perceived physical health.

2. Results

Table 1 provides the mean data for all measures at each time point. Notable here is the significant decline between Waves 3 and 5 on all social measures, most strongly for participation and contact, and significant decline in two cognitive measures of immediate and delayed memory.

2.1. Factor analysis

Factor analysis for the social relationship variables at T1 revealed two factors (confirmed using the Kaiser criterion, scree examination and a Monte-Carlo modification of parallel analysis; see Glorfeld, 1995) for which loadings are provided in Table 2. Together, these accounted for 57.0% of the variance. Factor 1 comprised measures that indexed relationships with individuals through the number and quality of relationships with another person (i.e., number, quality, and frequency of contact with a spouse, relative and friend). Factor 2 comprised, to a large extent,

Table 2
Results of maximum-likelihood oblimin rotation factor analysis for social relationship variables at T1.

Measure of social relationships	Factor	
	1	2
Participation in cultural activities	.19	**.76**
Community activities	.33	**.72**
Number of group memberships	.14	**.52**
Relationship quality	**.94**	.11
Frequency of contact	**.60**	.04
Number of close relationships	**.34**	.12
Loneliness	−.44	−.27

Notes.
$N = 3413$.

measures relevant to group relationships; notably societal and civic engagement and participation in cultural activities. Loneliness did not load distinctly on one factor, and was negatively associated with both. This may reflect the fact that it tapped a different aspect of socialization – specifically, the *outcome* of poor relationships as opposed to the number or quality of relationships as measured by the remaining variables. Given this, loneliness was excluded for the purposes of the present analyses.[5] A follow-up factor analysis including only these six variables retained a two-factor solution but explained an improved 62.8% of the variance. This analysis was repeated for T2 data and yielded a largely identical factor structure explaining 64.2% of the variance. In line with the theoretical analysis that informed the study, these findings confirm the existence of two independent constructs, that we have characterized as *group engagement* and *individual engagement*.

Table 3
Results of maximum-likelihood oblimin rotation factor analysis for cognitive measures at T1.

Cognitive measure	Factor loading
Delayed memory (T1)	.88
Immediate memory (T1)	.83
Verbal fluency (T1)	.48
Prospective memory (T1)	.27
Orientation (T1)	.24

Notes.
$N = 3413$.

The cognitive measures were also subjected to factor analysis at each time point. In all cases, a single-factor solution emerged (confirmed using the Kaiser criterion, scree examination and a Monte-Carlo modification of parallel analysis; Glorfeld, 1995). The analysis used maximum likelihood extraction, with the single factor solution explaining 41.4%, and 45.1% of the variance at T1 and T3, respectively (see Table 3). This factor, essentially an index of general cognitive ability, was used in the regression analyses.[6]

Having identified and specified these factors, we initially subjected them to correlational analysis to look at the stability of relationships between these variables over time. These data are presented in Table 4 and show that both individual and group engagement are significantly related to cognitive function at the different time points, but importantly, that the strength of the association is always greater in the case of group engagement.

2.2. Main analysis

Hierarchical regression was then used to test the prediction that group engagement would be more important in supporting cognitive health over time (see Table 5). Multicollinearity was assessed due to the repeated-measures nature of the design. Collinearity diagnostics indicated that no condition index exceeded 6 and no dimension had more than one variance proportion greater than .50 (Tabachnick and Fidell, 2013). At Step 1, the five covariates were entered with results showing that all significantly predicted T3 cognition. People with greater cognitive integrity were more likely to be female, white, younger, and have higher socioeconomic status and perceived physical health. Introducing T1 cognition explained an additional 21% of the variance and this change in R^2

[5] Despite loneliness being excluded from our factor solution, additional analysis was conducted to determine whether it contributed to prediction of T3 cognition. This analysis included initial loneliness (T1) and change in loneliness (to T2) as predictors in the model. Loneliness was not a significant predictor of T3 cognition in a model that also included group engagement (T1 Loneliness: $t(3348) = -.72$, $p = .47$; T2 Loneliness: $t(3345) = -.48$, $p = .63$).

[6] While a single factor solution might appear unorthodox in the context of the cognitive measures that are intended to tap different aspects of ability, this is probably less surprising in a community (as opposed to a disease-specific) sample for whom ability in all these domains is likely to be related (e.g., strong memory capacity is likely to be associated with strong executive ability). For similar reasons, orientation is likely to have loaded weakest on this factor, given that participants' performance was near ceiling on this measure.

Table 4
Correlations between different forms of social engagement and cognition as a function of time.

	1. T1 individual	2. T1 group	3. T2 individual	4. T2 group	5. T3 individual	6. T3 group	7. T1 cognition	8. T2 cognition	9. T3 cognition
1.	1	.311**	.846**	.285**	.539**	.284**	.115**	.110**	.132**
2.	.311	1	.298**	.870**	.403**	.828**	.370**	.319**	.340**
3.	.846**	.298**	1	.316**	.597**	.330**	.113**	.105**	.119**
4.	.285**	.870**	.316**	1	.409**	.869**	.385**	.352**	.381**
5.	.539**	.403**	.597**	.409**	1	.510**	.142**	.113**	.111**
6.	.284**	.828**	.330**	.869**	.510**	1	.347**	.296**	.324**
7.	.115**	.370**	.113**	.385**	.142**	.347**	1	.608**	.623**
8.	.110**	.319**	.105**	.352**	.113**	.296**	.608**	1	.629**
9.	.132**	.340**	.119**	.381**	.111**	.324**	.623**	.629**	1

Notes: Individual and group refer to different types of social engagement; $N - 3413$.
**$p < .01$.

was significant, $F(1,3406) = 1430.77$, $p < .001$. In Step 3, T1 individual ($t(3404) = 1.51$, $p = .132$) and group ($t(3404) = 6.61$, $p < .001$) engagement were entered, which significantly improved the model, $F(2,3404) = 27.80$, $p < .001$.

Table 5
Hierarchical regression model predicting T3 cognitive function.

	b	SE	β	p value	Semi-partial r	R^2 change
Step 1						.21*
Age	−.04	<.01	−.38	<.001	.35*	
Sex	.17	.03	.08	<.001	.08*	
Subjective physical health	.10	.02	.10	<.001	.10*	
Ethnicity	−.50	.14	−.05	<.001	.05*	
Financial status	.05	.01	.14	<.001	.13*	
Step 2						.23*
Age	−.03	<.01	−.23	<.001	−.21*	
Sex	.06	.03	.03	.016	.03*	
Subjective physical health	.03	.01	.03	.012	.03*	
Ethnicity	−.28	.12	−.03	.016	−.03*	
Financial status	.02	.01	.05	<.001	.05*	
Cognitive health (T1)	.53	.01	.53	<.001	.48*	
Step 3						.01*
Age	−.03	<.01	−.23	<.001	−.22*	
Sex	.07	.03	.03	.020	.03*	
Subjective physical health	.01	.01	.01	.315	.01	
Ethnicity	−.27	.12	−.03	.021	−.03*	
Financial status	.01	.01	.02	.213	.02	
Cognitive function (T1)	.50	.01	.50	<.001	.44*	
Individual engagement (T1)	.02	.02	.02	.131	.02	
Group engagement (T1)	.12	.02	.10	<.001	.08*	
Step 4						.01*
Age	−.03	<.01	−.23	<.001	−.21*	
Sex	.07	.03	.03	.007	.03*	
Subjective physical health	.01	.01	.01	.555	.01	
Ethnicity	−.27	.12	−.03	.021	−.03*	
Financial status	.00	.01	.01	.446	.01	
Cognitive function (T1)	.49	.01	.49	<.001	.43*	
Individual engagement (T1)	.06	.03	.05	.028	.03*	
Group engagement (T1)	−.04	.03	−.03	.235	−.02	
Individual engagement (T2)	−.05	.03	−.04	.082	−.02	
Group engagement (T2)	.19	.03	.17	<.001	.08*	
Step 5						.01*
Age	−.02	<.01	−.22	<.001	−.19*	
Sex	.08	.03	.04	.004	.04*	
Subjective physical health	.01	.01	.01	.535	.01	
Ethnicity	−.27	.12	−.03	.019	−.03*	
Financial status	.01	.01	.01	.353	.01	
Cognitive function (T1)	.49	.01	.49	<.001	.43*	
Individual engagement (T1)	.06	.03	.05	.024	.03*	
Group engagement (T1)	−.04	.03	−.03	.233	−.02	
Individual engagement (T2)	−.05	.03	−.05	.055	−.02	
Group engagement (T2)	.19	.03	.16	<.001	.08*	
Age × Individual engagement (T2)	.00	<.01	.02	.133	.02	
Age × Group engagement (T2)	.02	<.01	.03	.044	.03*	

Notes.
$N = 3413$.
*$p < .05$.

Although only group engagement made a significant contribution to prediction at Step 3, it is worth noting that the contribution of T1 individual engagement was significant at Steps 4 and 5. At Step 4, T2 measures of group and individual engagement were added to the model to assess whether a change in these variables from T1 predicted subsequent cognitive performance, $F(2,3402) = 19.55$, $p < .001$. Here group engagement ($t(3402) = 6.22$, $p < .001$), but not individual engagement ($t(3402) = -1.74$, $p = .082$), contributed to the prediction of cognitive outcomes. In other words, when controlling for (a) covariates, (b) initial cognitive health and (c) initial social engagement, it was group engagement that predicted cognitive integrity best four years later.

In a final step we entered the interactions between the two types of social engagement and age to determine whether the effects of these social relationships on cognitive health differed as a function of increasing vulnerability due to age. As the data in Table 3 show, there was a significant interaction between age and group engagement ($t(3400) = 2.01$, $p = .044$), but not between age and individual engagement ($t(3402) = 1.50$, $p = .133$) when predicting T3 cognition. Simple slopes analysis was conducted to interpret this interaction. This provided the predicted rate of cognitive decline for people with group engagement that were lower than average (i.e., 1 SD below the mean), average, and higher than average (i.e., 1 SD above the mean) and, from this, age-equivalent scores could be calculated (see Dawson, 2014). As shown in Fig. 1, group engagement was of moderate importance for those at the younger end of the age spectrum, such that those aged 50 years functioned cognitively at the level of a person aged 45 years if they had above-average group engagement. However, the functional savings were much more substantial at the older end of the age spectrum, with respondents aged 80 years performing cognitively at the level of a person aged 70.5 years if they had above-average group engagement.[7]

2.3. Sensitivity analyses

Given the correlational nature of these analyses there is obviously the possibility of reverse causation such that cognitive decline explains changes in social relationships. To address this possibility and assess the robustness of our findings, we conducted three sensitivity analyses. The first of these removed participants

[7] We applied the ELSA longitudinal population weights to deal with the problem of selective attrition. The findings were replicated, but power was markedly reduced due to the exclusion from these weights of any participants whose data was not complete across all waves. For this reason we report results relating to the full dataset.

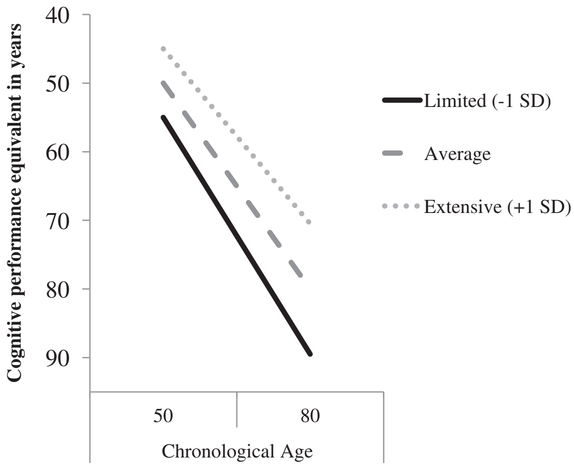

Fig. 1. Cognitive performance equivalent in years as a function of intensity of group engagement for older adults at the lower (i.e., 50 years) and upper (i.e., 80 years) ends of the age spectrum.

who may have already experienced cognitive decline from our sample at T1, in order to increase the chance that any decline in social connectedness was likely to have occurred prior to any decline in cognition. This analysis included only those participants who performed above the mean on cognition at T1 ($N = 1787$) and all effects were replicated. In particular, group engagement at T2 significantly contributed to the model ($t(3776) = 3.70$, $p < .001$), whereas individual engagement did not ($t(3776) = -1.88$, $p = .061$). In a second sensitivity analysis, we replaced the control measure of cognitive health at T1 with the T2 measure. This reduced the likelihood that any cognitive decline between T1 and T2 was responsible for any change in group engagement (and thus final cognitive function). In this reanalysis all the effects were preserved; T2 group engagement made a significant contribution to prediction, $t(3330) = 5.26$, $p < .001$, and individual engagement did not, $t(3330) = -1.80$, $p = .07$).

A third sensitivity analysis utilized a multilevel modeling approach, which allowed us to model individual-level variance (the intraclass correlation; accounting for 62.17% of differences in cognitive health) and test the presence of individual differences in the slopes for group and individual engagement, substantially reducing error in the model. This analysis replicated the main results, showing that the intercept for group engagement was a significant predictor of cognitive health ($B = .41$, $SE = .046$; $p < .001$) but that the intercept for individual engagement was not ($B = -.02$, $SE = .049$; $p = .73$). Furthermore, change in group engagement over time significantly predicted cognitive health ($B = .04$, $SE = .011$; $p < .001$), whereas change in individual engagement over time did not ($B = .00$, $SE = .012$; $p = .84$). Finally, the change in group engagement over time became more important with increasing age ($B = .01$, $SE = .001$; $p = .028$), whereas change in individual engagement did not interact with age ($B = .00$, $SE = .001$; $p = .14$).

3. Discussion

The present study investigated the contribution of social group and individual engagement in protecting the cognitive integrity of older adults over time. This question was addressed using data from the ELSA study, and three key findings emerged. First, we found that these components of social relationships – group and individual – represented distinct and separable constructs. Second, when entered into regression analysis, results showed that of these two types of social relationships, it was group engagement that made a significant, sustained (at T1 and T2) and unique contribution to the prediction of subsequent cognitive function. Finally, we found a significant interaction between group engagement and age, indicating that these group relationships matter most when people are at the older end of the age spectrum. The starkest finding here was that being connected to social groups had the effect of reducing the cognitive age of an 80-year-old by 9.5 years.

We no longer question the claim that social relationships are vital for health. What we lack, as argued in a recent editorial (Barbour et al., 2012), is an understanding of the aspects of social relationships that are key to health. The present research helps us to address this challenge. For in demonstrating the greater predictive power of group engagement in protecting cognitive integrity, we provide evidence of the kinds of social relationships, beyond specific types (i.e., spousal, child, religious observance), that are associated with positive outcomes among older adults. While these effects were moderate for the younger-old (evident in a functional saving of five years if a person moved from having average group engagement to that which is one standard deviation above this mean), they were far more substantial for the older-old. Here a functional saving of almost 10 years was found for this same degree of improvement in group engagement. Given the greater power in our analysis (both in terms of sample size, and the extent of longitudinal span), these findings also represent an advance on those of Glei et al. (2005). In particular, they allow us to confirm the independent contribution of group engagement to cognitive function. At the same time this also allows us to identify a novel pattern – namely that group engagement (not individual engagement) has a greater impact on cognitive function as people grow older.

There are important practical implications and recommendations that flow from these findings. To preserve cognitive integrity, particularly as people become more vulnerable through age, it would appear that there is particular value in directing investment towards helping them develop and maintain social group engagement. Indeed, this would also seem to be a sensible strategy in light of other evidence that as well as helping to preserve cognitive function, a distinct focus on enhancing the quality of group life (rather than just individual relationships) is likely to have broader pay-offs for well-being, mental and physical health (Tewari et al., 2012; Olesen and Berry, 2011).

So why might group engagement be more strongly associated with cognitive decline relative to individual engagement? One hypothesis is that the level of engagement required to maintain group relationships is greater than that involved in maintaining individual relationships, such that this encourages greater cognitive stimulation and improved cognitive outcomes (Spector et al., 2001; Spector et al., 2003). The logistics of co-ordination (e.g., timing, transport), for instance, are greater when attempting to organize an activity for many as opposed to one other, and this might provide opportunities for greater stimulation. Benefits may also arise from the more intensive participation that group activities entail. In this regard, the existing literature on cognitive health and social engagement highlight the importance of active participation, and in the present data this was greater among people with greater group engagement (such that people with average group engagement scored in the range of 3–6 on community participation, whilst those with higher than average group engagement scored in the 5–7 range). Because group engagement typically implicates multiple people (many of whom are not previously known), it is also the case that it may provide individuals with more (new) potential sources from which to obtain social support, and hence that this is a richer psychological resource (Jetten et al., 2014) that promotes positive forms of coping and other positive health outcomes.

At the same time, it is also possible to pull these various elements together, in terms of an overarching theoretical analysis. In particular, as noted earlier, the social identity approach provides a framework for understanding how, by furnishing people with a sense of shared identity, groups provide a distinct basis for intensive engagement and effective social support that is likely to be health-enhancing (Haslam et al., 2009). Specifically, this is because shared identities (a sense of common "we-ness") provide reason and motivation to seek out and engage with other people and to give and receive support, in ways that one-to-one relationships may not.

Having said this, it is clearly not the case that individual engagement is irrelevant to health. Indeed, our model shows that T1 individual engagement made a contribution in predicting subsequent cognitive resilience. Nevertheless, these effects were smaller than those associated with group engagement, and their longitudinal predictive power was weaker, suggesting that change in individual engagement over time is less important than that associated with group engagement.[8] It seems likely that this reflects the fact that many of these ties comprise relationships with people that are well known and that are less likely to change over time (e.g., relationships with relatives). There is also evidence of this in our data, in so far as group engagement was more likely to decline with age ($r = -.12$) than individual engagement ($r = -.05$). Individual engagement may, therefore, be less important in creating (and predicting) cognitive resilience in part because it involves less cognitive "stretching". It is also possible that particular individual relationships may have watered down the effects of others, given that some relationships have been reported to be more protective of cognitive function than others in the wider health literature. For example, Kiecolt-Glaser and Newton (2011) and Christakis and Allison (2006) emphasize the importance of spousal ties, while Ueno (2005) argues for the potency of friendship networks. Clearly though, the particular relationships that provide the greater boost to health will differ across individuals – some, but not all, experience family as particularly supportive and it is also likely that political participation, although generally associated with psychological distress (e.g., Berry et al., 2007), may be health-enhancing for some people. In this context, a more helpful approach may be to consider the strength with which one identifies with particular others in determining especially beneficial relationships, as this is more likely to generalize both across people and across a range of contexts (e.g., see Cruwys et al. 2014). This hypothesis, however, is clearly speculative and requires more rigorous investigation.

A notable strength of the present research is its large, representative and longitudinal design including appropriate covariates to address alternative explanations. For instance, it might be argued that the present findings could be accounted for by mental and physical ability, which group engagement appears to tap more readily than individual engagement. However, the fact that the same patterns persist when we control for initial cognitive function and physical status renders this explanation less plausible. Nevertheless, as with much longitudinal research of this form, we acknowledge that our ability to make causal inferences is compromised by the non-experimental nature of our study. In this regard, there is clearly a need for controlled experimental studies that examine the effects of sustained social interactions on short- and long-term changes in cognitive function.

Another limitation derives from our reliance on those measures (and only those measures) that are available in the ELSA database. Certainly future research would benefit from incorporation of other indices more relevant to the present theoretical analysis (in particular, measures of social identification). Such refinements would clearly allow testing of psychological theory and probe the mechanisms that support cognitive resilience more forensically. More sensitive cognitive measures would also help to establish further the extent of the impact of group-based connectedness on cognition in domains other than memory and fluency.

Additionally, while there were no systematic biases in the dataset that we are aware of, it is important to note that the mean age of our sample – 62 years – was lower than that of several other longitudinal investigations (78–79 years in Giles et al., 2012; James et al., 2011), although the age range was similar. However, we explored the effect of age by including the interactions between group and individual engagement and age in our analyses. This revealed the same pattern of greater cognitive preservation with more group engagement emerged across the age spectrum (albeit more dramatically in the older-old).

4. Conclusion

In the context of a growing aging population, there is a pressing need to manage cognitive decline in ways that keep people mentally active and independent for longer. While we recognize that social connections are vital for health, a key challenge is to identify how best to use these ties to optimize health outcomes. The present research speaks to this challenge by showing that, when it comes to protecting cognitive health, the nature of one's social connectivity is immensely important. More particularly, it appears that group engagement helps to sustain cognition in ways that individual engagement does not. To the extent this is true, this has important implications for resource mobilization and deployment. In particular, this is because group engagement requires particular forms of investment in resources and infrastructure (e.g., meaningful community activities, transport, accessible social spaces) in order to help older people build, and sustain, relationships with social groups. While this comes at a price, this would seem to be a prudent investment – especially when one considers what one would have to pay for the yet-to-be-invented drug with the potential to reduce the cognitive age of an 80-year-old by nearly a decade.

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[8] Initial group engagement (T1), change in group engagement (T2) and the interaction between group engagement and age were all significant predictors. For individual engagement, however, it appeared that only initial engagement (T1) was important, and this weak relationship was not significant in all models.

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