Relationship between self-perceptions of aging and 'living well' among people with mild-to-moderate dementia: Findings from the IDEAL Programme

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#### Authors' contribution

SS served as principal investigator of the research, designed the study, conducted data analyses, and took the lead in writing the manuscript.

LC conceived and designed the IDEAL programme and contributed to the design and conduct of the current analysis and writing the manuscript.

AM, CQ, JMT, CB and LC (co-investigators in the IDEAL programme) contributed to the design and conduct of the current study and writing the manuscript.

RC, RAL, and CP contributed to the design and conduct of the current study and provided feedback on the draft of the manuscript.

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# Data access statement

IDEAL data were deposited with the UK data archive in April 2020 and will be available for access from April 2023. Details of how the data can be accessed after that date can be found here:

http://reshare.ukdataservice.ac.uk/854293/.

# **Declaration of interest**

The authors declare that they have no competing interests.

#### Abstract

Objective: A primary goal for dementia research is to understand how to best support people to live well with dementia. Among cognitively healthy older individuals, more positive attitudes toward their own aging (ATOA) and/or feeling younger than their chronological age (i.e. having a younger subjective age: SA) are associated with better quality of life (QoL), satisfaction with life (SwL), and well-being (which are indicators of capability to live well), and fewer depressive symptoms. We tested whether people with dementia (PwD) with more positive ATOA and/or with a younger SA report better QoL, SwL, and well-being, and are less likely to experience depression.

Methods: We used cross-sectional data from the IDEAL cohort baseline assessment (conducted between 2014 and 2016), comprising 1541 PwD residing in Great Britain [mean (range) age= 76.3 (43 to 98); 43.6% women]. Results: More positive ATOA was associated with better QoL, SwL, and less likelihood of depression. Younger SA was associated with better QoL, SwL, well-being, and less likelihood of depression. Conclusions: More positive ATOA and younger SA may be beneficial psychological resources that enhance capability to live well with dementia. Promoting more positive perceptions of aging at the societal level may help to equip people with the resilience needed to cope well after a diagnosis of dementia, and enhance the support available to people with dementia. Focusing on retained abilities and achievable goals may help to counteract the impact of negative age-related stereotypes on people with dementia, and enhance person-centred care.

Key words: Attitudes toward own aging, subjective age, quality of life, well-being, life satisfaction, depression

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#### 1.1 Background

An estimated 50 million people worldwide are living with dementia (World Health Organization, 2020). Dementia, or major neurocognitive disorder, involves a significant and progressive cognitive decline in one or more cognitive domains, such as memory and language, that interferes with the ability to conduct everyday activities (American Psychiatric Association, 2013; Martyr & Clare, 2012; Royall et al., 2007; World Health Organization, 1992). At present, people with dementia (PwD) can expect to live on average 3 to 8 years following diagnosis (Tom et al., 2015; Wolters et al., 2019). An important aim therefore is to optimize the capability for individuals to 'live well' during this time (Poulos et al., 2017). 'Living well' with dementia can be defined as the best achievable health state that encompasses all dimensions of physical, mental, and social wellbeing (Institute of Medicine, 2012). Living well with dementia has been conceptualized as including aspects of quality of life (QoL), satisfaction with life (SwL), and psychological well-being (Clare et al., 2019).

Prior research has shown that some aspects of the psychological characteristics (e.g. optimism and selfefficacy) and psychological health (e.g. level of depressive symptoms) of PwD are closely associated with their perceptions of 'living well' (Lamont et al., 2019; Wu, Clare, & Matthews, 2019). Two people of the same chronological age can have very different subjective experiences of aging based on individual and societal factors (e.g., Kotter-Grühn & Hess, 2012; Levy, 2008; 2009; Sargent-Cox, Anstey, & Luszcz, 2012). This has been named *self-perceptions of aging*. Among middle-aged and older adults, self-perceptions of aging are associated with better mental, physical, and cognitive health and with the ability to better adapt to age-related changes and illnesses (Wurm, Warner, Ziegelmann, Wolff, & Schuz, 2013). Given that these are all factors related to increased capability to live well in PwD (Clare et al., 2019; Martyr et al., 2018), self-perceptions of aging may also act as a positive psychological resource, helping people to live well with dementia. Selfperceptions of aging are often measured in terms of an individual's attitudes toward own aging (ATOA), or his/her subjective age (SA).

Levy's (2009) Stereotype Embodiment Theory provides an explanation for the poorer health that characterizes individuals with more negative self-perceptions of aging, such as negative ATOA and/or a SA that is closer to or older than one's chronological age. The theory posits that with increasing age, the age-related stereotypes that individuals have internalized throughout their life become self-relevant and impact upon health and well-being through three pathways (psychological, biological, and behavioral). This is known as *stereotype embodiment* (Levy, 2009). In support of the psychological pathway, empirical evidence shows that individuals with more negative self-perceptions of aging have poorer health through reduced perceptions of control (Levy,

Slade, & Kasl, 2002), reduced will-to-live (Levy, Slade, Kunkel, & Kasl, 2002), and less effective use of adaptive strategies (Baltes & Baltes, 1990; Pachana, Jetten, Gustafsson, & Liddle, 2017; Wurm et al., 2013).
Regarding the biological pathway, individuals exposed to negative age stereotypes show heightened cardiovascular stress response, and in line with this, younger adults who themselves possess more negative age stereotypes are more likely to experience cardiovascular events later in life (Chida & Steptoe, 2010; Levy, Hausdorff, Hencke, & Wei, 2000; Panaite, Salomon, Jin, & Rottenberg, 2015; Stephan, Sutin, & Terracciano, 2015). Finally, the behavioral pathway implies that individuals with more negative self-perceptions of aging have poorer health due to less engagement in preventative health behaviors such as following a healthy diet, partaking in regular physical exercise, and attending medical check-ups (Kim, Moored, Giasson, & Smith, 2014; Levy & Myers, 2004; Montepare, 2019; Sun & Smith, 2017). However, longitudinal evidence also indicates that poor health can predict an increase in negative self-perceptions of aging, indicating that this relationship may be reciprocal (Kornadt et al., 2019).

#### 1.2 Attitudes toward own aging

Measures of ATOA capture individuals' evaluations of any changes taking place in their lives as they age (Bennett & Eckman, 1973; Kotter-Grühn & Hess, 2012; Lawton, 1975). ATOA start to develop in childhood, reflecting a person's past experience within their social, cultural, and historical context, and they impact on people's behavior at an unconscious level (Diehl et al., 2014). More positive ATOA are associated with indicators of capability to live well (Low, Molzahn, & Schopflocher, 2013), including better physical and functional health (Kavirajan et al., 2011; Kotter-Grühn, Kleinspehn-Ammerlahn, Gerstorf, & Smith, 2009; Levy, Slade, Kunkel, et al., 2002; Maier & Smith, 1999; Moser, Spagnoli, & Santos-Eggimann, 2011; Sabatini et al., 2020; Sargent-Cox, Anstey, & Luszcz, 2014), lower risk of cognitive decline and dementia (Levy, Slade, Pietrzak, & Ferrucci, 2018; Robertson & Kenny, 2016; Robertson, King-Kallimanis, & Kenny, 2016; Seidler & Wolff, 2017; Siebert, Wahl, & Schröder, 2016), and higher satisfaction with life (Wurm, Tomasik, & Tesch-Römer, 2008).

Positive ATOA are related to better capability to live well even among those older individuals who have experienced a recent accident or an acute illness (Wurm, Tomasik, & Tesch-Römer, 2010; Yamada, Merz, & Kisvetrova, 2015). However, whether more positive ATOA are related to better capability to live well among people with a neurodegenerative condition such as dementia is unknown. To date, only one small-scale study comprising 56 PwD and 86 people without dementia has investigated the association between ATOA and a single measure of living well among people with and without dementia (Trigg, Watts, Jones, Tod, & Elliman, 2012). Trigg et al (2012) found that those with dementia reported more negative ATOA on the whole than those without dementia, and that more negative ATOA was associated with poorer QoL among PwD. More positive ATOA among PwD may be associated with better health through the psychological pathway; indeed PwD with more positive ATOA have lower levels of depression and a greater sense of dignity (Kisvetrová et al., 2019). The relationship between more positive ATOA and better health through the behavioral pathway (e.g. more engagement in health-related behaviors such as physical activity) may be weaker compared to that found in healthy older people. Indeed the progressive functional limitations that PwD experience (Martyr & Clare, 2012) may limit their engagement in health-related behaviors despite the presence of positive ATOA.

#### 1.3 Subjective age

An alternative way in which people express their self-perceptions of aging is through evaluations of how old they feel. SA can differ from chronological age (Barrett, 2003; Kotter-Grühn & Hess, 2012); for example, the majority of middle-aged and older individuals report feeling younger than their chronological age (Bordone, Arpino, & Rosina, 2019; Choi & DiNitto, 2014; Opdebeeck, Yates, Kudlicka, & Martyr, 2019; Rubin & Berntsen, 2006; Westerhof et al., 2014). However this is not always the case (Rubin & Berntsen, 2006; Westerhof, Barrett, & Steverink, 2003), as a small proportion of individuals subjectively feel either the same as or older than their chronological age (Choi & DiNitto, 2014; Kotter-Grühn, Kornadt, & Stephan, 2016). Individuals are more likely to feel older than their chronological age when they experience poor mental, physical, and/or cognitive health (Kwak, Kim, Chey, & Youm, 2018; Montepare & Lachman, 1989; Stephan, Caudroit, Jaconelli, & Terracciano, 2014; Stephan et al., 2015; Stephan, Sutin, & Terracciano, 2016; Uotinen, Rantanen, & Suutama, 2005). Despite this, a recent study found that there is no difference in reports of SA between people with and without dementia (Jaconelli et al., 2017). The majority of PwD felt younger than their chronological age; French participants felt 13.4% younger and American 17.3% younger than their chronological age (Jaconelli et al., 2017). Overall, cognitively healthy individuals who have positive ATOA and/or who feel younger than their chronological age report better health and well-being than others (Kwak et al., 2018; Montepare & Lachman, 1989; Stephan et al., 2014; Stephan et al., 2015, 2016; Uotinen et al., 2005). To date, additional evidence is needed to understand whether evaluations of SA are related to living well outcomes in PwD.

#### 1.4 The current study

Using data from a large cohort of PwD, the aim of this study is to build upon Jaconelli et al. (2017) and Trigg et al. (2012) and explore the extent to which self-perceptions of aging are linked to capability to live well among PwD. Two indicators of self-perceptions of aging are employed (ATOA and SA) along with QoL, SwL, and psychological well-being as indicators of living well, and self-reported depression as an indicator of poorer psychological health.

We hypothesized that PwD with more positive ATOA would have better capability to live well and less likelihood of experiencing depression. We also hypothesized that those participants who feel younger than their chronological age would report better capability to live well with dementia and less likelihood of experiencing depression compared to participants with an older SA.

## 2. Method

## 2.1 Participants and Design

The present study uses cross-sectional data collected in the first wave of assessment of the Improving the experience of Dementia and Enhancing Active Life programme (IDEAL; Clare et al., 2014; Silarova et al., 2018). We conducted study analyses on version 4.0 of the dataset. In the IDEAL programme PwD were recruited through a network of 29 National Health Service sites (NHS) in England, Scotland, and Wales between 2014 and 2016. Potential participants could take part in IDEAL if they lived in the community and had a diagnosis of any type of dementia and/or a Mini-Mental State Examination (MMSE; Folstein, Folstein, & McHugh, 1975) score of 15 or above (corresponding to mild-to-moderate dementia). There were no restrictions on age. Participants were recruited regardless of whether they had a carer or not. Exclusion criteria for PwD were the presence of a co-morbid terminal illness at baseline, inability to provide informed consent at baseline, and any known potential for home visits to pose a significant risk to research network staff. Information about recruitment and assessments in IDEAL is reported in the published protocol of the IDEAL programme (Clare et al., 2014). The IDEAL study was approved by the Wales 5 Research Ethics Committee (reference:13/WA/0405) and the Ethics Committee of the School of Psychology, Bangor University (reference 2014 - 11684). The IDEAL study is registered with the UK Clinical Research Network, registration number 16593.

### 2.2 Measures

The following measures were selected from the wider dataset for analyses in the present study. All measures were administered to the PwD by a researcher and reflect information self-reported by the PwD.

### 2.2.1 Self-perceptions of aging

To assess ATOA we used the Attitude Toward Own Aging (ATOA) items, taken from the Philadelphia Geriatric Center Morale Scale (Lawton, 1975). Scores on this measure can range from zero to five, with lower scores indicating more negative ATOA and higher scores indicating more positive ATOA. To maximize the use of data despite the amount of missing data, we computed a pro-rata score when a response to one of the five questions was missing (Kaspar, Gabrian, Brothers, Wahl, & Diehl, 2019). We did this for 305 participants. To assess subjective age (SA) we used the single-item question *"How old do you feel at the moment?"* (Opdebeeck et al., 2019). Participants were asked to choose an answer on a 7-item Likert scale (ranging from 1 = "A lot older than my age" to 7 = "A lot younger than my age").

## 2.2.2 Measures of capability to live well and depression

Living well with dementia has been conceptualized as including aspects of QoL, SwL, and psychological well-being (Clare et al., 2019); therefore we included three measures to assess living well. To assess QoL we used the Quality of Life-Alzheimer's Disease scale (QoL-AD; Logsdon, Gibbons, McCurry, & Teri, 1999, 2000). Possible scores range from 13 to 52, with higher scores indicating greater QoL. To measure global judgments of SwL we used the Satisfaction with Life Scale (SwLS; Diener, Emmons, Larsen, & Griffin, 1985). The total score ranges from 5 to 35, with a higher score indicating greater SwL. To assess subjective well-being we used the World Health Organization-Five Well-being Index (WHO-5 Well-Being Index; Bech, 2004); this scale is valid and reliable among older populations including people with Parkinson's disease (Heun, Bonsignore, Barkow, & Jessen, 2001; Martyr et al., 2019; Oyebode, Telling, Hardy, & Austin, 2007; Rodriguez-Blazquez et al., 2011; Schneider et al., 2010; Topp, Østergaard, Søndergaard, & Bech, 2015). The total score ranges from 0 to 100, with a higher score indicating greater positive well-being. To identify those participants that are likely to have depression we used the ten-item Geriatric Depression Scale short form (Almeida & Almeida, 1999), which is a screening tool for depression. We dichotomized the score to make a binary variable following the procedure used in previous studies: 0-3 not depressed; 4+ depressed (Clare et al., 2019; Wu et al., 2019). The above measures have been described in detail elsewhere (Clare et al., 2014; Clare et al., 2019).

## 2.2.3 Covariates

Personal characteristics used in the analyses as covariates are age, sex, socio-economic status, education, and dementia subtype. Participants' socio-economic status was based on the standard occupational classification of the Office for National Statistics (Office for National Statistics, 2010) and included the following categories: professional, managerial and technical, skilled non-manual, skilled manual, partly skilled, unskilled, and armed forces. Education was used as a categorical variable including the categories no qualification; school leaving certificate at age 16, school leaving certificate at age 18, and university.

To enumerate co-morbid conditions we used the Charlson Comorbidity Index (CCI; Charlson et al., 2008; Charlson, Pompei, Ales, & MacKenzie, 1987). This measure was administered involving the family carer where available. Participants were provided with a list of 23 conditions and for each condition were asked to indicate whether they had the condition or not. The total score ranges from zero to 23, with a higher score indicating a more severe level of co-morbidity, see Nelis et al. (2019) for more detail.

## 2.3. Analyses

We calculated correlation coefficients among study covariates and among study outcomes. We considered correlation coefficients under .10 as negligible, between .10 to .29 as small, between .30 to .49 as moderate, and .50 or above as large (Cohen, 1988).

To explore whether scores on ATOA and SA explain variability in living well and self-reported depression, linear regressions were conducted with participants' scores for QoL, SwL, psychological well-being, and logistic regressions for depression. In all analyses QoL, SwL, psychological well-being and depression measures were the outcome variable and either ATOA or SA was the explanatory variable. In each of the eight analyses we fitted two models. In the unadjusted models we included only the explanatory variable (ATOA or SA), whereas in the adjusted models we added covariates to the model to allow for potential confounding. To analyze the associations of ATOA and SA with depression we used logistic regression models. The covariates were age, sex, socio-economic status, education, diagnosis subtype, and co-morbidity. The data met the assumptions of the linear model (linearity and homogeneity of variance). We conducted analyses using STATA version 16 (StataCorp, 2017).

#### 3. Results

## 3.1 Study sample

The study sample included 1541 participating PwD, of whom just over half were diagnosed with Alzheimer's disease (55.5% of participants), just over half were male (56.4% of participants), the mean (SD; range) age was 76.3 (8.6; 43 to 98), and the majority were white (96.9% of participants). Further characteristics of the study sample are reported in Table 1.

\_\_Please insert Table 1 about here\_\_\_

### **3.2 Descriptive statistics**

Supplementary Tables 1 and 2 respectively present correlation coefficients among study covariates and among study outcomes. Overall, most of the study covariates are not significantly correlated with each other. Correlations that are statistically significant are negligible or small; indicating that multicollinearity is not an issue in study analyses. Measures of living well and depression are significantly correlated with each other; however correlation coefficients range between .47 to .68 suggesting that the four study outcomes (QoL, SwL, psychological well-being, and depression) capture different aspects of capability to live well and psychological health of PwD.

## 3.3 Associations of ATOA with indicators of capability to live well with dementia and depression

Table 2 reports unadjusted and adjusted coefficients from the regression analyses exploring the relationship between ATOA and QoL, SwL, psychological well-being, and depression. After adjusting for covariates, ATOA significantly predicted participants' scores on all outcome measures. More specifically, ATOA explained 27% of variability in participants' scores on QoL, 18% of variability in participants' scores on SwL, 21% of variability in participants' scores on psychological well-being, and 25% of variability in participants' likelihood of having depression.

\_\_\_Please insert Table 2 about here\_\_\_

#### 3.4 Associations of SA with indicators of capability to live well with dementia and depression

Table 3 reports unadjusted and adjusted coefficients from the regression analyses exploring the relationship between SA and each of QoL, SwL, psychological well-being, and depression. After adjusting for covariates SA significantly predicted participants' scores on all outcome measures. SA explained 9% of variability in participants' scores on QoL, 5% of variability in participants' scores on SwL, 4% of variability in participants' scores on psychological well-being, and 5% of variability in participants' likelihood of having depression.

\_\_\_Please insert Table 3 about here\_\_\_

#### 4.1 Discussion

This is the first study to explore the extent to which ATOA and SA explain variability in multiple indicators of living well and psychological health conceptualized as QoL, SwL, and psychological well-being, and depression (Clare et al., 2019) using a large sample of community-dwelling individuals living with mild-to-moderate dementia. Study results show that both more positive ATOA and a younger SA are associated with better scores on measures of QoL, SwL, and psychological well-being. Results also show that people with more positive ATOA and a younger SA are less likely to have self-reported depression.

Building on the work of Trigg et al. (2012), the current study indicates that PwD with more positive ATOA not only have better QoL, but also better SwL and better psychological well-being, and are less likely to have self-reported depression. These findings are in line with and add to wider research showing that more positive ATOA predict better capability to live well in samples of people without dementia (Kavirajan et al., 2011; Kotter-Grühn et al., 2009; Levy, Slade, & Kasl, 2002; Levy, Slade, Kunkel, et al., 2002; Levy et al., 2018; Low et al., 2013; Robertson & Kenny, 2016; Robertson et al., 2016; Seidler & Wolff, 2017; Siebert et al., 2016), including samples of people with an acute illness (Wurm et al., 2010; Yamada et al., 2015). The association of ATOA with depression is particularly important given the higher prevalence of depression in PwD than the general population. Indeed about 40% of people living with dementia have depression, whereas among adults aged 55 to 74 the prevalence of depression is 7.5% for women and 5.5% for men (Enache, Winblad, & Aarsland, 2011; World Health Organization, 2012).

In the present study, the proportion of PwD feeling younger than their age (36.8% of participants) was smaller than that reported in samples of people without dementia (70% of participants felt younger than their

age; Choi & DiNitto, 2014; Opdebeeck et al., 2019). However, in the present study the proportion of PwD feeling younger than their age was higher (36.8% of participants) compared to that of French (13.4% of participants) and American (17.3% of participants) PwD reported in a previous study (Jaconelli et al., 2017). The different proportions of PwD feeling younger than their actual age between our study and that of Jaconelli et al. (2017) may be due to methodological differences. The present study was conducted on a sample of individuals resident in Great Britain, whereas the Jaconelli et al. (2017) study was conducted on a sample of individuals resident either in Germany or in the US. Cultural differences in the way in which individuals perceive their own aging have been documented (Brothers, Gabrian, Wahl, & Diehl, 2016; Miche et al., 2014; Westerhof & Barrett, 2005). Moreover, the two studies used different measures to assess SA. In Jaconelli et al. (2017) participants were asked to indicate the age they feel they are in years, whereas in the present study participants were asked to choose an answer on a 7-item Likert scale; the second approach used in the current study reduces difficulty in answering (Montepare, 1996) and hence may lead to more accurate results for PwD. Results of the present study show that PwD who feel younger than their chronological age report more positive QoL, SwL and psychological well-being, and are less likely to experience depression. This is in line with research conducted in samples of people without dementia, extending this work to people with other neurodegenerative condition (Kwak et al., 2018; Montepare & Lachman, 1989; Stephan et al., 2014; Stephan et al., 2015, 2016; Uotinen et al., 2005).

ATOA explained a larger amount of variability in QoL, SwL, psychological well-being, and depression compared to SA. The different strength in the associations of ATOA and SA with QoL, SwL, psychological well-being and depression is consistent with existing evidence showing that ATOA and SA are distinct concepts that capture different aspects of self-perceptions of aging (Spuling, Klusmann, Bowen, Kornadt, & Kessler, 2019). The stronger association of ATOA with living well scores suggests that ATOA is more strongly associated with individuals' capability to live well than SA. This may be due to ATOA being developed early in life and influencing individuals' behavior at an unconscious level (Bennett & Eckman, 1973; Kotter-Grühn & Hess, 2012; Lawton, 1975).

In sum, together with existing evidence (Wurm et al., 2010; Yamada et al., 2015), the findings of the current study suggest that positive self-perceptions of aging are a psychological resource that can help middleaged and older individuals to live well with illnesses including dementia. As self-perceptions of aging are greatly influenced by societal views of aging, study results further highlight the importance of promoting positive perceptions of aging at societal level. Levy (2017) discussed in detail how several strategies may be useful to optimize views of aging. Moreover, as negative perceptions of aging start to be developed early in life, it is important to decrease negative stereotypes about older people and ageism across individuals of all ages. Promoting more positive views of aging among younger individuals may enable people to grow older equipped with a psychological resource that increases their likelihood of living well and maintain psychological health despite the occurrence of illnesses such as dementia (Wurm et al., 2010; Yamada et al., 2015). Understanding the possible impact of negative ATOA may contribute to developing a more sensitive, person-centered and personalized approach to supporting people living with dementia. Focusing on retained abilities and achievable goals may be one way of helping to counteract the effects of negative age-related stereotypes and improve QoL (Dawson et al., 1986; Trigg et al., 2012; Wells & Dawson, 2000).

#### 4.2 Study limitations

Much previous research within this area has used domain-specific measures of ATOA (Barker, O'Hanlon, McGee, Hickey, & Conroy, 2007; Laidlaw, Power, & Schmidt, 2007; Sarkisian, Hays, & Mangione, 2002; Sexton, King-Kallimanis, Morgan, & McGee, 2014; Steverink, Westerhof, Bode, & Dittmann-Kohli, 2001; Wurm, Tesch-Römer, & Tomasik, 2007). Due to space restrictions in this large-scale multi-faceted survey, we used the 5-item Attitude Toward Own Aging (ATOA) questionnaire (Lawton, 1975), but it does not assess ATOA in relation to different life domains (e.g. cognition, mental health, physical health, and social relations). Future studies may benefit from more detailed measures of ATOA or perceptions of aging. Understanding more about the areas in which negative attitudes are more problematic for PwD may allow for more targeted support. For instance the concept of awareness of age-related change (AARC; Diehl et al., 2014) would make it possible to assess domain-specific self-perceptions of aging in the cognitive domain, alongside other life domains such as health and physical functioning, interpersonal relationships, socio-cognitive and socio-emotional functioning, and lifestyle/engagement (Brothers, Gabrian, Wahl, & Diehl, 2019; Sabatini et al., 2020). Moreover, for each item of the ATOA scale respondents can answer in a bimodal way, reporting either a positive or a negative ATOA. This is a limitation as participants cannot report a neutral ATOA. In this study we used the MMSE to assess cognitive ability and the ten-item Geriatric Depression Scale short form to assess the presence of depression. These measures are screening tools and hence may not be accurate indicators of dementia severity and of the presence of depression. However, due to the width of the assessment conducted as part of the IDEAL study, only brief measures could be used.

The IDEAL cohort (Clare et al., 2014) is a study based in Great Britain and participants were almost entirely white British. As there are cultural differences in self-perceptions of aging, generalizations of study results to other cultural groups should be made with caution (Westerhof & Barrett, 2005). Furthermore, all participants had mild-to-moderate dementia, and so it is difficult to say how further cognitive decline will impact on the continued importance of psychological resources. Finally, the current study is based on analyses of cross-sectional data, so we did not explore the direction of the associations of ATOA and SA with indicators of capability to live well. For clarification, we will conduct these analyses once longitudinal data are available.

Despite the above limitations, the current study is one of the few studies exploring ATOA and SA in PwD. Another strength of the study is the use of a large sample size, methods that elicit the views of PwD themselves, the inclusion of people with any type of dementia in roughly the proportions diagnosed in memory clinics in Great Britain, drawn from areas with differing degrees of social and economic deprivation (Wu et al., 2018). Moreover, the present study controlled for potential confounders of the relationships between ATOA/SA and included several indicators of capability to live well (quality of life, life satisfaction, and psychological well-being) and psychological health, enabling a comprehensive assessment of living well.

## 5. Conclusions

This is the first study to explore whether ATOA and SA predict variability in quality of life, life satisfaction, psychological well-being, and depression among people living with mild-to-moderate dementia. The study found that both more positive ATOA and a younger SA were associated with better QoL, SwL, and psychological well-being, and less likelihood of depression. However, longitudinal research is needed to understand the direction of the associations and to identify the possible factors that may impact on the associations of ATOA with living well outcomes and depression. We found that a younger SA was associated with better capability to live well with dementia and less likelihood of depression, yet a greater proportion of PwD felt either the same as their chronological age or older than their chronological age compared to findings from samples of cognitively healthy older people. As positive ATOA and a younger SA are associated with better capability to live well among PwD, future efforts could consider how presence of these characteristics could be optimized.

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Variables	Statistics	Missing data
Age in years, Mean (SD; range)	76.3 (8.6; 43 to 98)	0
Age groups (n (%))		
Aged < 65	136 (8.8)	
Aged between 65 and 69	178 (11.6)	
Aged between 70 and 74	259 (16.8)	
Aged between 75 and 79	367 (23.8)	
Aged 80 and above	601 (39.0)	
Sex (Women; n (%))	672 (43.6)	0
Diagnosis subtype (n (%))		0
Alzheimer's disease	855 (55.5)	
Vascular dementia	170 (11.0)	
Mixed (Alzheimer's and vascular)	325 (21.1)	
Frontotemporal dementia	54 (3.5)	
Parkinson's disease dementia	44 (2.9)	
Dementia with Lewy bodies	53 (3.4)	
Unspecified dementia	40 (2.6)	
Socio-economic status (Yes; n (%))		78
I (Professional)	132 (9.0)	
II (Managerial and technical)	518 (35.4)	
III-NM (Skilled non-manual)	300 (20.5)	
III-M (Skilled manual)	309 (21.1)	
IV (Partly skilled)	145 (9.9)	
V (Unskilled)	38 (2.6)	
Armed forces	21 (1.4)	
Education (n (%))	<b>``</b> ,	29
No qualification	397 (28.2)	
School leaving certificate at age 16	247 (17.5)	
School leaving certificate at age 18	481 (34.2)	
University	283 (20.1)	
Co-morbidity, Mean (SD)	2.9 (1.9)	104
Depression, (n (%))		40
Not depressed	1045 (69.6)	
Depressed	456 (30.4)	
Psychological well-being, Mean (SD:	60.9 (20.6: 0 to 100)	25
range)		
Quality of life, Mean (SD; range)	36.8 (5.9; 17 to 52)	143
Satisfaction with life. Mean (SD:	26.1 (6.1: 6 to 35)	41
range)		
Attitudes toward own aging, Mean	2.4 $(1.6; 0 \text{ to } 5)$	32
(SD: range)		
Subjective age (n (%))		31
A lot older than my age	61 (4.0)	-
A little older	134 (8.9)	
Not much older	61 (4.0)	
About the same	659 (43.6)	
Not much younger	40 (2.7)	
A little vounger	355 (23.5)	
A lot younger than my age	200 (13.3)	

Table 1. Descriptive statistics for demographic and main study variables at baseline (n= 1541)

Attitudes toward own aging = Total score on the attitudes toward own aging scale from the Philadelphia Geriatric Center Morale Scale. Co-morbidity = Score for number of co-morbidities. Depression = Dichotomous variable indicating whether participants are depressed or not depending on their score on the Geriatric Depression Scale short form. Psychological well-being = Score on the WHO-5 well-Being Index. Quality of life = Score on the Quality of Life-Alzheimer's Disease scale. Satisfaction with life = Score on the satisfaction with life scale.

Outcome		В	SE	95% CI	<i>p</i> - value	β	95% CI	Partial R <sup>2</sup> (%)	Total R <sup>2</sup> (%)
Quality of life,	N = 1194								
Unadjusted	ATOA	2.17	0.08	2.00 to 3.33	<.001	0.58	0.55 to 0.61		34.0
Adjusted	ATOA	1.98	0.09	1.80 to 2.14	<.001	0.53	0.50 to 0.57	27.0	39.0
	Age	0.06	0.02	0.03 to 0.09	<.001	0.09	0.04 to 0.13	0.1	
	Sex	0.35	0.27	-0.19 to 0.89	.202	0.03	-0.02 to 0.07	0.1	
	Socio-economic	-0.02	0.02	-0.05 to 0.01	.158	-0.04	-0.09 to 0.02	0.0	
	status								
	Education	0.32	0.14	0.05 to 0.60	.021	0.06	0.01 to 0.11	0.0	
	Diagnosis	-0.33	0.09	-0.51 to -0.15	<.001	-0.08	-0.13 to -0.04	0.1	
	subtype								
	Co-morbidity	-0.50	0.07	-0.64 to -0.63	<.001	-0.16	-0.21 to -0.12	3.0	
Satisfaction wit	h life, N = 1279								
Unadjusted	ATOA	1.8	0.09	1.57 to 1.93	<.001	0.46	0.42 to 0.50		21.0
Adjusted	ATOA	1.66	0.10	1.47 to 1.84	<.001	0.44	0.40 to 0.48	18.0	0.3
	Age	0.10	0.02	0.06 to 0.13	<.001	0.14	0.09 to 0.19	0.2	
	Sex	-0.40	0.30	-0.99 to 0.19	.187	-0.03	-0.08 to 0.02	0.0	
	Socio-economic	0.02	0.02	-0.02 to 0.05	.354	0.03	-0.03 to 0.08	0.0	
	status								
	Education	0.12	0.15	-0.18 to 0.42	.446	0.02	-0.03 to 0.08	0.0	
	Diagnosis	-0.41	0.10	-0.60 to -0.22	<.001	-0.10	-0.16 to -0.06	1.0	
	subtype								
	Co-morbidity	-0.14	0.08	-0.30 to 0.02	.081	-0.04	-0.09 to 0.01	0.0	

Table 2. Regression analyses of the associations of quality of life, satisfaction with life, psychological well-being, and depression (outcomes) with attitudes toward

own aging (explanatory variable)

28

Psychological well-being, N = 1292									
Unadjusted	ATOA	6.66	0.30	6.07 to 7.26	<.001	0.51	0.47 to 0.55		26.0
Adjusted	ATOA	6.09	0.31	5.48 to 6.70	<.001	0.47	0.43 to 0.51	21.0	30.0
	Age	0.22	0.06	0.11 to 0.33	<.001	0.09	0.05 to 0.14	0.0	
	Sex	-1.40	0.99	-3.34 to 0.55	.159	-0.03	-0.08 to 0.01	0.0	
	Socio-economic	-0.01	0.06	-0.12 to 0.10	.806	-0.01	-0.06 to 0.05	0.0	
	status								
	Education	0.52	0.50	-0.46 to 1.50	.300	0.03	-0.02 to 0.08	0.0	
	Diagnosis	-1.28	0.32	-1.92 to -0.65	<.001	-0.09	-0.14 to -0.05	0.1	
	subtype								
	Co-morbidity	-1.50	0.26	-2.02 to -0.99	<.001	-0.14	-0.18 to -0.09	0.2	
Depression, N =	= 1282								
		Coeff	SE	95% CI	<i>p</i> -value	Likelihood	<i>p</i> -value		Total Pseudo
						Ratio Chi <sup>2</sup> (1)			R <sup>2</sup> (%)
Unadjusted	ATOA	-1.05	0.06	-1.17 to -0.94	<.001	471.27	<.001		29.0
Adjusted	ATOA	-1.01	0.06	-1.14 to -0.89	<.001	473.63	<.001	25.0	30.0
	Age	-0.02	0.01	-0.04 to -0.01	.029			0.0	
	Sex	0.13	0.16	-0.17 to 0.44	.398			0.0	
	Socio-economic	-0.00	0.01	-0.02 to 0.02	.854			0.0	
	status								
	Education	-0.13	0.08	-0.28 to 0.02	.096				
	Diagnosis	0.19	0.05	0.10 to 0.28	<.001			0.0	
	subtype								
	Co-morbidity	0.11	0.04	0.04 to 0.19	.020			0.0	

ATOA = Total score on the attitudes toward own aging scale from the Philadelphia Geriatric Center Morale Scale. The adjusted model controlled for the effect of age, sex, socio-economic status, diagnosis subtype, and co-morbidity on the outcome variable. B = Regression coefficient. SE = Standard error.  $\beta$  = Standardized regression coefficient.

Table 3. Regression analyses of the associations of quality of life, satisfaction with life, psychological well-being, and depression (outcomes) with subjective age score

(explanatory variable)

Outcome		В	SE	95% CI	<i>p</i> - value	β	95% CI	Partial R <sup>2</sup> (%)	Total $R^2(\%)$
Quality of life;	1200								
Unadjusted	Subjective age	1.17	0.10	0.98 to 1.36	<.001	0.32	0.27 to 0.37		11.0
Adjusted	Subjective age	1.10	0.09	0.92 to 1.29	<.001	0.31	0.26 to 0.35	9.0	21.0
	Age	0.06	0.02	0.03 to 0.10	.001	0.09	0.04 to 0.14	1.0	
	Sex	0.18	0.31	-0.43 to 0.79	.563	0.02	-0.04 to 0.07	0.0	
	Socio-economic	-0.03	0.02	-0.07 to 0.00	.058	-0.06	-0.11 to 0.00	0.0	
	status								
	Education	0.36	0.16	0.05 to 0.67	.022	0.07	0.01 to 0.13	0.0	
	Diagnosis	-0.53	0.10	-0.73 to -0.33	<.001	-0.13	-0.18 to -0.08	2.0	
	subtype								
	Co-morbidity	-0.72	0.08	-0.87 to -0.56	<.001	-0.23	-0.28 to -0.18	1.0	
Satisfaction wi	ith life; N = 1281								
Unadjusted	Subjective age	0.89	0.10	0.70 to 1.08	<.001	0.24	0.19 to 0.29		6.0
Adjusted	Subjective age	0.82	0.10	0.63 to 1.01	<.001	0.22	0.17 to 0.27	5.0	12.0
	Age	0.10	0.02	0.07 to 0.14	<.001	0.14	0.09 to 0.20	2.0	
	Sex	-0.36	0.33	-1.01 to 0.28	.267	-0.03	-0.08 to 0.02	0.0	
	Socio-economic	0.01	0.02	-0.03 to 0.04	.740	0.01	-0.05 to 0.07	0.0	
	status								
	Education	0.16	0.16	-0.16 to 0.49	.327	0.03	-0.03 to 0.09	0.0	
	Diagnosis	-0.59	0.11	-0.80 to -0.38	<.001	-0.15	-0.20 to -0.10	2.0	
	subtype								
	Co-morbidity	-0.34	0.08	-0.51 to -0.18	<.001	-0.11	-0.16 to -0.06	1.0	

Psychological	Psychological well-being; N = 1294								
Unadjusted	Subjective age	2.82	0.33	2.17 to 3.47	<.001	0.22	0.17 to 0.27		6.0
Adjusted	Subjective age	2.59	0.33	1.94 to 3.23	<.001	0.21	0.16 to 0.26	4.0	13.0
	Age	0.23	0.06	0.10 to 0.36	<.001	0.09	0.04 to 0.15	1.0	
	Sex	-2.85	1.10	-4.01 to 0.30	.092	-0.04	-0.10 to 0.01	0.0	
	Socio-economic	-0.05	0.06	-0.17 to 0.07	.406	-0.02	-0.08 to 0.03	0.0	
	status								
	Education	0.70	0.55	-0.38 to 1.79	.203	0.04	-0.02 to 0.10	0.0	
	Diagnosis	-1.94	0.35	-2.63 to -1.25	<.001	-0.14	-0.19 to -0.09	0.2	
	subtype								
	Co-morbidity	-2.32	0.28	-2.88 to -1.77	<.001	-0.21	-0.26 to -0.16	0.5	
Depression; N	N = 1287								
		Coeff	SE	95% CI	<i>p</i> -value	Likelihood	<i>p</i> -value		Pseudo R <sup>2</sup>
						Ratio			(%)
						Chi <sup>2</sup> (1)			
Unadjusted	Subjective age	-0.40	0.04	-0.48 to -0.32	<.001	113.90	<.001		7.0
Adjusted	Subjective age	-0.41	0.04	-0.49 to -0.32	<.001	193.23	<.001	7.0	12.0
	Age	-0.2	0.01	-0.03 to -0.00	.022			0.0	
	Sex	0.13	0.14	-0.14 to 0.40	.343			0.0	
	Socio-economic	0.00	0.01	-0.01 to 0.02	.673			0.0	
	status								
	Education	-0.13	0.07	-0.27 to 0.00	.052			0.0	
	Diagnosis	0.21	0.04	0.15 to 0.32	<.001			2.0	
	subtype								
	Co-morbidity	0.20	0.03	0.14 to 0.27	<.001			3.0	

The adjusted model controlled for the effect of age, sex, socio-economic status, diagnosis subtype, and co-morbidity on the outcome variable. B = Regression coefficient. SE = Standard error.  $\beta$  = Standardized regression coefficient.

# Supplementary Table 1. Correlation coefficients (p-value) among study covariates

Variables	Attitudes toward	Subjective age	Age	Sex	Socio-economic	Education	Diagnosis subtype
	own aging				status		
Subjective age	0.337 (<.001)						
Age	0.016 (.340)	0.066 (.019)					
Sex	-0.016 (.531)	-0.026 (.321)	0.042 (.099)				
Socio-economic status	-0.062 (.016)	-0.065 (.012)	-0.077 (.002)	0.001 (.980)			
Education	0.061 (.023)	0.040 (.131)	-0.096 (<.001)	-0.177 (<.001)	-0.393 (<.001)		
Diagnosis subtype	-0.143 (<.001)	-0.053 (.041)	-0.019 (.452)	-0.102 (<.001)	0.005 (.832)	-0.003 (.897)	
Co-morbidity	-0.165 (<.001)	-0.021 (.435)	0.082 (.002)	-0.065 (.014)	0.046 (.079)	-0.064 (.016)	0.119 (<.001)

# Supplementary Table 2. Correlation coefficients (p-value) among study outcomes

Variables	Quality of life	Satisfaction with life	Psychological well-being
Satisfaction with life	0.606 (<.001)		
Psychological well-being	0.680 (<.001)	0.587 (<.001)	
Depression	-0.574 (<.001)	-0.472 (<.001)	-0.518 (<.001)

Quality of life = Score on the Quality of Life-Alzheimer's Disease scale. Satisfaction with life = Score on the Satisfaction with Life Scale. Psychological well-being = Score on the WHO-5 Well-Being Index. Depression = Dichotomous variable indicating whether participants are depressed or not depending on their score on the 10-item Geriatric Depression Scale.