The reciprocal temporal associations between subjective age and social relations in adult day care centers over a one-year period

Liat Ayalon[1] and Ella Cohn-Schwartz[1,2]

Abstract

Objectives: The present study evaluated the reciprocal temporal associations between one's subjective age (or felt age) and one's social relations in the adult day care center (ADCC) over two waves of data collection, spread about 1 year apart.
Method: Participants from four ADCCs in Israel were approached in 2017 and repeatedly, in 2018 ($N = 224$ in Wave 1 and $N = 259$ in Wave 2). The ADCC social network included both outgoing ties of familiar relationships with other ADCC members as reported by the respondent (out-degree centrality) and ingoing ties, based on reports of other ADCC members who were familiar with the respondent (in-degree centrality).
Results: Out-degree and in-degree centrality at baseline were not associated with change in subjective age. Subjective age at the first time point was not associated with change in out-degree centrality, but it was negatively associated with change in in-degree centrality. Even after controlling for sociodemographic and health variables, adults who felt younger were subsequently cited by more ADCC members.
Conclusions: The findings stress the importance of subjective age to one's relationship in the ADCC. It is suggested that a younger subjective age is a desired quality in the ADCC.

Keywords

Egocentric, sociocentric, subjective age, felt age, long-term care, adult day center

Introduction

Chronological age is defined as the passage of time from birth. Although chronological age is often used to define old age, for example, a person who is 64 years and older (Ayalon et al., 2014), it is not the only way to define one's age identity (Barak & Schiffman, 1981). An alternative form is characterized by the construct of subjective age. This denotes one's felt age, which is not necessarily synonymous with the passage of time. The construct of subjective age is thought to be important in explaining some of the variability associated with the aging process, which is not entirely correlated with one's chronological age (Kornadt et al., 2016; Mirucka et al., 2016).

The Importance of Subjective Age in One's Aging Process

Subjective age is not synonymous with chronological age. Research has shown that young children and adolescents are likely to see themselves as older than they actually are (Galambos et al., 2005; Kleinspehn-Ammerlahn et al., 2008). However, starting in their late 20s, people are more likely to view themselves as younger than they actually are (Montepare & Lachman, 1989; Rubin & Berntsen, 2006). This difference between chronological and subjective age is considered adaptive.

Subjective age is an important construct that has been associated with numerous health and mental health indicators as well as behavioral outcomes (Nagy et al., 2019; Westerhof et al., 2014). Research, based on a daily-diary over a period of 15 days, has shown that when confronting with life challenges, a gap between one's chronological and subjective age is adaptive (Armenta et al.,

2018). Moreover, in a cross-sectional design of Swedish participants between the ages of 84 and 90 years of age, a younger subjective age has been associated with improved health and well-being (Infurna et al., 2010). Similarly, a large representative cross-sectional study in the U.S., conducted among 4,180 older adults, has found that a younger subjective age was associated with a lower C-reactive protein level, which is a systemic inflammation marker (Stephan et al., 2015b). A different study has found both cross-sectional and longitudinal associations between a younger subjective age and walking speed, while relying on two different representative surveys of older Americans (Stephan et al., 2015a). A younger subjective age also has been associated with better cognitive functioning in a 10-year prospective study of midlife in the U.S. (Stephan et al., 2014). Taking into account these various studies, a recent meta-analysis has concluded that subjective age has a small but significant effect on health, health behaviors, and survival (Westerhof et al., 2014).

Predictors of Change in Subjective Age

Subjective age is not necessarily a constant construct. Instead, subjective age may vary based on one's chronological age as well as

[1] Bar-Ilan University, Israel
[2] Department of Public Health, Faculty of Health Sciences, Ben-Gurion University of the Negev, Israel

Corresponding author:
Liat Ayalon, Louis and Gabi Weisfeld School of Social Work, Bar-Ilan University, Ramat Gan 52900, Israel.
Email: liat.ayalon@biu.ac.il

based on other demographic variables and health and well-being indicators. A 6-year longitudinal study, based on the Berlin Aging Study, has found no time-related changes in the subjective age discrepancy, on average. The authors have argued that over time, people continue to feel about 13 years younger than their chronological age. Hence, as chronological age continues to increase, so does one's subjective age. However, a higher number of illnesses at baseline attenuated changes in subjective age (Kleinspehn-Ammerlahn et al., 2008). A different study conducted in Finland also has found no significant mean level changes in the age discrepancy score over an 8-year period. Nonetheless, about one quarter of the sample reported a younger subjective age and one quarter report an older subjective age over time (Uotinen et al., 2006).

Functional status and health status have been identified as potential predictors of changes in subjective age. A study of patients before and after a cataract surgery has found that functional status was a significant predictor of subjective age (Knoll et al., 2004). A 5-year follow-up Norwegian study has found that in a sample of 2,471 individuals between the ages of 40 and 79, in addition to older chronological age, good physical and mental health is associated with a younger subjective age (Bergland et al., 2014). A different cross-sectional survey has found that certain combinations of health dimensions and satisfaction with health correlated with younger subjective age (Hubley & Russell, 2009). One of very few cross-lagged models, which simultaneously examined the temporal reciprocal associations of subjective age and a variety of health indicators, has found that subjective age predicted physical, mental, and self-rated health, but the reverse effect was found only for self-rated health. That study concluded that subjective age is an important resource for preserving health (Cornwell et al., 2009).

Several theoretical explanations have been proposed to explain the adaptive function of changes in subjective age (Kotter-Grühn et al., 2016). One explanation suggests that a younger subjective age serves as a protective mechanism that allows older adults to disengage from the negative perceptions of older age. Relying on an experimental design, the authors have shown that older adults disassociate from their age group when they face negative age stereotypes concerning older adults (Weiss & Lang, 2012). A different explanation, on the other hand, suggests that changes in subjective age allow for identity formation and stabilization in the light of age-related changes. Hence, subjective age may serve either as a self-enhancer or as a means to maintain self-consistency (Westerhof & Wurm, 2015).

The Importance of Social Relations

While there is a growing understanding concerning the relationship between health and well-being characteristics and subjective age, the association between social relations and subjective age is less clear. Social relations represent one's position within the social clock, following the concept of linked-lives (Elder Jr, 1994). Our lives are interconnected and therefore, relationships matter. Specifically, there is some research to show that the status and role of significant others are associated with our own perceptions of our social standing in society as well as our perceived subjective age. For instance, a study of 666 older Americans has found that older adults who enjoyed grandparenthood had a younger subjective age. Moreover, those who entered grandparenthood at a younger age felt older than those who entered grandparenthood "on time." Hence,

having an acquired role of a grandparent further shapes the way we view ourselves (Kaufman & Elder, 2003). A different study based on a representative sample of middle-aged U.S. citizens has found that the death of a mother in childhood is associated with an older subjective age, whereas the death of a father in childhood is not. This again was explained as an "off time" social event, which results in an older age identity (Schafer, 2009). Based on the same database, a different study has found that family turbulence is associated with an older subjective age, yet, changes in family roles are not (Schafer & Shippee, 2010). Consistently, others have shown that adolescents who dated an older partner felt older than their peers (Arbeau et al., 2007). These retrospective cross-sectional studies suggest that affiliation with significant others and the condition of these significant others are correlated with the focal person's subjective age.

Although informative, the majority of these studies have focused on earlier periods in life, such as adolescence or middle age and have neglected to examine the relationship between social relations and subjective age in later life. Relying on two waves of the Health and Retirement Study, a research has shown that reduced loneliness, but not changes in social relations, resulted in an accelerated decrease in subjective age (Ayalon et al., 2016). However, social relations may serve as outcomes of subjective age, rather than merely as predictors. For instance, a cross-sectional study based on 3,094 older Japanese has shown that a younger subjective age was associated with higher levels of social activity, even after controlling for a variety of clinical and demographic variables (Takatori et al., 2018). Others have examined the interaction between subjective age and social relations. A cross-sectional Israeli study has found that subjective age moderated the relationship between close social relations and loneliness, as the association was weaker for individuals who reported a lower subjective age (Spitzer et al., 2019). A different study has looked at social relations as a moderator of the 10-year longitudinal relationship between subjective age and memory performance and heart variability. The study has found that those individuals who had a higher quality relationships are the ones who benefited the most from a younger subjective age (Zee & Weiss, 2019).

The Present Study

Clearly subjective age has been associated with a variety of later life outcomes (Rubin & Berntsen, 2006). However, its relationship with various indicators of social relations has not been well-explored. We propose that this relationship can go both ways, as subjective age has been shown to be both a predictor and an outcome of changes in social relations. It is possible that those individuals who see themselves as younger than they actually are, also are more energetic and sociable. This in return may result in greater popularity (in-degree centrality) as well as greater social activity (out-degree centrality) in the adult day care center (ADCC), as a younger subjective age is a desired social property in the ADCC. It also is possible, however, that greater social activity and popularity represent positive experiences, which in return result in a younger subjective age. As the relationships between subjective age and social relations can go both ways, we formed no concrete hypotheses about the temporal associations between the two constructs.

Moreover, the majority of past research has focused on close family members and partners and neglected to examine the potential role of nonfamilial social relationships. We know from past

research that many social changes take place in later life (Shaw et al., 2007). As people get older, environments such as ADCCs can constitute a large portion of older adults' free time, while their time spent with close family members might decline, as children move out and partners pass away (Wrzus et al., 2013). Thus, nonfamilial ties with other ADCC consumers might play a valuable role in shaping the lives of older adults.

The present study examined the reciprocal temporal associations between subjective age and social relations in older adults who participate in four ADCCs. A prominent feature of ADCCs is their age-segregated nature (Ayalon et al., 2018). These settings usually employ a lower age limit, which only allows in people over a certain age. The settings also employ a functional criterion, so that only people who are impaired in activities of daily living are eligible to participate. Although this type of setting aims to alleviate loneliness and enhance social interactions, past research has shown that ADCCs are not always effective in fulfilling this task (Ayalon, 2018; Iecovich & Biderman, 2012). Specifically, ADCCs are characterized by sparse networks, in which most participants do not know each other. Reciprocity too is quite uncommon in the network, so that knowing others does not necessarily mean being known by these same people (Ayalon et al., 2018). Nonetheless, ADCCs are thought to have a buffering effect on the stress associated with growing older (Valadez et al., 2006). ADCCs provide a unique opportunity to examine older individuals' social relations, as they offer a close social environment populated by others of similar ages.

To examine the social network, we relied on a sociocentric approach, which takes into account the entire social network. Such an approach does not only look at the individual and his or her perceptions regarding relationships with other members in the social environment but also incorporates the ties between members who make up the network and their perceptions of the focal person (Marsden, 2002). The sociocentric approach was confined to the ADCC, as this setting has clear social boundaries, defined by participation in the ADCC (Ayalon et al., 2018). The advantage of a sociocentric approach is that it distinguishes between the ego's (i.e., the focal person) perceptions of the social network and the perspective of the alters (i.e., those connected to the ego). For instance, one might perceive his or her ties as inadequate and lacking, yet, others might perceive their ties with this same person as strong and satisfying, or vice versa.

Theoretically, this study connects between subjective age and social relations, in the context of the ADCC. In the light of the growing attention given to ADCCs as a potential source of formal support to both older adults and their family members (Wacker & Roberto, 2013), this study provides insights concerning the role of ADCCs in an area, which has not been addressed, thus far, yet is of utmost importance to older people's health and well-being, namely one's subjective age (Avidor et al., 2014) and its reciprocal associations with social relations in the long-term service context. As past research has suggested possible bidirectional associations between subjective age and social relations, we examined both temporal associations in the present study.

Method

The Sample and Procedure

The study was supported by a grant from the Israel Science Foundation 537/16. For the purpose of this study, data from four ADCCs were included in the analysis. Three of the ADCCs were located in the center of the country and one was located in the South of the country. ADCCs varied in size, ranging between 135 participants in the largest ADCC (BH) and 75 participants in the smallest one (BG). ADCCs were selected to represent a range of sizes and geographic locations. Older adults were eligible to participate, provided they spoke Hebrew or English and did not suffer from dementia as indicated by the social worker in each of the settings. We received lists of names of all service users from the respective ADCCs. Potential respondents received written announcements as well as oral presentations about the study. Respondents were able to opt out of the study at any time and there were no sanctions associated with lack of participation. Interviews were conducted in a face to face format by trained research assistants. Most interviews occurred in a special room designated for this purpose. Interviews covered two waves of data collection spread over a 1-year period (2016–2018). In each of the settings, interviews occurred for about 3 to 4 months. The study was approved by the ethics committee of the PI's university. All participants signed an informed consent. Overall, nonresponse rate ranged between 38% and 65% at the baseline measurement and between 42% and 51% in the follow-up measurement. This was attributed primarily to leaving the setting and health/death as detailed below.

During the first wave of data collection, 224 interviews were conducted, whereas in the second wave, 259 interviews were conducted. Loss to follow-up was primarily due to leaving the ADCC (17%), refusal (8%), and deteriorated health/death (7%). Hence, a total of 140 participated in both waves of data collection constitute the study sample. They constituted 62% of the participants in the first wave; as these settings are notoriously known for being extremely dynamic (Abbott & Pachucki, 2017). Their ages ranged between 66 and 99 years ($M = 82.93$, $SD = 6.62$).

Measures

Subjective age. Participants' felt age was measured using the question: "Many people feel older or younger than they really are. What age do you feel most of the time? (please note a specific age that best reflects your feeling)." Chronological age was subtracted from the response to this question and this outcome was divided by one's chronological age, to take into consideration respondents' response in relation to his or her chronological age. A higher score on this construct, in absolute value, reflects a greater distance from one's own age. A positive score indicates an older subjective age and a negative score indicates a younger subjective age. Subjective age was assessed at baseline and at the follow-up measurement.

The sociocentric social network. Each respondent received a list of names of all individuals receiving services in the respective ADCC. All names appeared on the list, unrelated to whether or not these individuals participated in the present study. The following question was used to construct the social network: "Please indicate whether you know the following person [NAME OF ALL ADCC USERS]."

The embeddedness of individuals in the ADCC was measured by two social network indicators: *out-degree centrality* and *in-degree centrality*. The term *degree* represents the number of connections an individual has with other individuals in the network. The number of outgoing ties was represented by one's *out-degree centrality* (e.g., the number of ADCC participants the respondent
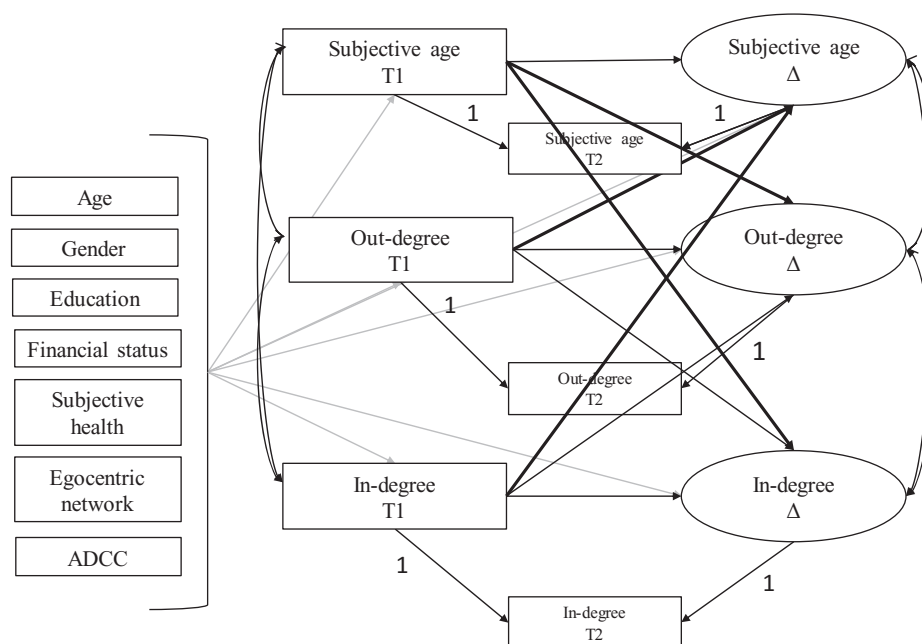
Figure 1. Illustration of the latent change score model used in the study.
Note. The main paths of analysis are boldened; observed variables are drawn as rectangles; and latent variables are drawn as circles. ADCC = adult day care center.

knows). The number of ingoing ties was captured by *in-degree centrality*, indicating how many other ADCC users know the ego (i.e., the focal person). The out-degree centrality represents one's level of social activity in the network, whereas the in-degree centrality represents one's popularity in the network (Snijders, 2001). These two indicators also can be seen as representing one's subjective perception versus the social environment's perception of the individual's (ego's) social standing. Each participant therefore had one value for his or her out-degree centrality and one for the in-degree centrality. These values were measured at both time points.

Covariates. Several covariates were used in the analyses due to their possible associations with subjective age (Barak & Stern, 1986). Age was a continuous variable. Gender was divided into men (1) and women (2). Education was utilized as years of education. Financial status was gleaned by asking respondents to define their financial situation, with response options ranging from 1 ("can't make ends meet") to 4 ("excellent"). Respondents were also asked to evaluate their current health, with response options ranging between 1 ("very bad") and 5 ("excellent").

The study also assessed the personal social networks of respondents, encompassing their meaningful social ties even beyond the ADCC. This was assessed using the probe:

> People sometimes talk to others about important matters. With whom can you share good news, bad news, concerns you may have or talk about matters that are very important to you? Please state their first name and relationship to you.

They were also given a list of possible relationships (such as family members, friends, colleagues, and health professionals) to recall these meaningful others. These ties were summed up to provide a comprehensive account of the close personal network the respondents have, not limited to their ties in the ADCC. Each

participant had one value for the number of egocentric social network ties.

Data Analysis

Analysis was conducted using R (R Core Team, 2016). The social networks in the ADCCs were derived using the igraph package (Csardi & Nepusz, 2006). We examined the entire set of reported ties, which takes into account the direction of the tie (e.g., when A is satisfied with the relationship with B, the direction of the tie is different from a situation in which B is satisfied with the relationship with A). Hence, forming a directed network. Such an analysis allows to differentiate between ties from the ego's perspective (e.g., respondent; out-going ties) and ties from alters' perspective (e.g., people in the respondent's network; in-going ties). Those who did not provide information on the network were excluded from further analysis.

The analysis began with a description of the study variables, followed by measuring the Pearson correlations between the different variables. The main analysis utilized a latent change score (LCS) approach. LCS models are a powerful and flexible class of structural equation modeling that explicitly model change as a latent variable (McArdle, 2009). LCSs are created by setting the regression path between baseline and follow-up equal to 1, implying that some portion of the follow-up score is equal to the baseline score, and the residual variable is interpreted as a change score (McArdle & Nesselroade, 2014). Figure 1 shows an illustration of the LCS model examined in the current study. This model examined the associations of out-degree centrality, in-degree centrality, and subjective age at baseline with their change scores. Two models were run—the first focused only on the variables of interest, and the second added the covariates—age, gender, education, financial status, self-rated health, the egocentric network, and the ADCC in which the respondent participated.

Table 1. Sample characteristics and correlations between the study variables.

	Variable	Mean (%)	SD	Range	1	2	3	4	5	6	7	8	9	10	11
1	Subjective age (baseline)	−0.22	0.25	−0.94 to 0.08	—										
2	Subjective age (follow-up)	−0.12	0.23	−0.98 to 0.9	0.45***	—									
3	Out-degree (baseline)	6.87	10.36	0 to 62	−0.07	−0.14	—								
4	In-degree (baseline)	6.31	5.47	0 to 26	−0.04	−0.06	0.40***	—							
5	Out-degree (follow-up)	8.65	9.54	0 to 47	−0.16	−0.03	0.16	0.29***	—						
6	In-degree (follow-up)	8.58	5.54	0 to 27	−0.22*	−0.13	0.30***	0.57***	0.39***	—					
7	Egocentric network	3.36	2.40	0 to 12	−0.07	−0.17*	0.17*	0.04	0.03	0.08	—				
8	Age	82.93	6.62	66 to 99	0.02	−0.03	−0.13	−0.34***	−0.24**	−0.17*	0.07	—			
9	Women	69.8%			−0.06	−0.03	0.02	0.12	0.16	0.15	0.07	0.01	—		
10	Education (years)	8.42	4.75	0 to 23	−0.04	−0.05	0.16	−0.03	−0.1	−0.18*	−0.06	−0.03	−0.28**	—	
11	Financial status	2.22	0.83	1 to 4	−0.05	−0.07	−0.15	−0.17*	−0.16	−0.26**	0.21*	0.15	−0.07	0.29***	—
12	Self-rated health	2.36	0.86	1 to 5	−0.12	−0.07	−0.17*	−0.20*	−0.11	−0.10	0.00	0.07	−0.03	0.08	0.23**

Note. $N = 140$.
*$p < .05$; **$p < .01$; ***$p < .001$.

The analysis consisted of the 140 participants who were interviewed at both waves. Full information maximum likelihood was used to account for missing data on the study variables. This procedure uses all the available information in a model to provide a maximum likelihood estimation and is implemented in structural equation modeling (Acock, 2005). The models were run with a maximum likelihood estimator with robust standard errors (MLR) to allow variables to deviate from multivariate normality. The use of MLR entailed adjustment of model comparisons to better approximate χ^2 under nonnormality (Satorra & Bentler, 2010). Model fit was evaluated primarily based on the criteria of comparative fit index (CFI) > .95, standardized root mean square residual (SRMR) < .08, and root mean square error of approximation (RMSEA) < .08 (Hooper et al., 2008). The Lavaan package in R was used for the model estimation using the structural equation modeling approach (Rosseel, 2012).

Results

Descriptive results of the sample are shown in Table 1. The majority of the sample consisted of women (69.8%) and the mean age of the sample was 83. They had an average of 8.4 years of education, rated their financial status as "enough to get by" (2, range: 1–4), and their health as "mediocre" (2, range: 1–5).

The four ADCCs were rather evenly represented in the sample, with 23%–27% of the sample coming from each of the ADCCs. The respondents rated their subjective age as younger than their real age in both waves (reflected by a negative subjective age score). Their subjective age became slightly higher over time, and a paired sample t-test showed this difference to be significant ($t(127) = −3.85$, $p < 0.001$). The average out-degree centrality was almost 6.9 ties, and the in-degree centrality was 6.3 ties. This was increased at follow-up to 8.6 out-degree ties and 8.6 in-degree ties. The egocentric network was smaller than the network within the ADCCs, with

an average of 3.4 ties cited. Of these ties, 2.8 were family members (83%), 0.4 were friends (12%), and the remaining 0.1 ties (5%) were neighbors and health service providers.

Table 1 also presents the correlations between the study variables. It shows that lower subjective age (reflecting a younger perceived age) at baseline was related to a higher in-degree centrality. Persons with a higher out-degree centrality were more likely to have a higher in-degree centrality and a larger egocentric network.

Finally, we ran two LCS models. Their results appear in Table 2. The first model only examined the variables of interest and the second model added the covariates. The first model, without the covariates, showed excellent fit of the data ($\chi^2 = 94.90$, $df = 15$, CFI = 1.00, RMSEA = 0.00, SRMR = 0.00). All latent changes had significant variances (out-degree Δ: 11.72, $p < 0.001$; in-degree Δ: 2.83, $p < 0.001$; subjective age Δ: 0.04, $p < 0.001$). The model explained 45% of variance in out-degree change, 39% of the variance of in-degree change, and 38% of the variance in subjective age change. This model showed that out-degree centrality at baseline was not significantly associated with change in subjective age. Similarly, in-degree centrality at baseline was not significantly associated with change in subjective age. Subjective age at baseline was not associated with change in out-degree centrality. However, subjective age at baseline was associated with change of in-degree centrality. Participants who had lower subjective age at baseline, that is, felt younger than their chronological age, also had more ADCC members cite them a year later.

The second model added the covariates. It also had an excellent fit of the data ($\chi^2 = 515.99$, $df = 105$, CFI = 1.00, RMSEA = 0.00, SRMR = 0.00). All latent changes had significant variances (out-degree Δ: 69.48, $p < 0.001$; in-degree Δ: 10.92, $p < 0.001$; subjective age Δ: 0.40, $p < 0.001$). The model explained 58% of variance in out-degree change, 58% of the variance of in-degree change, and 36% of the variance in subjective age change. This model showed

Table 2. Results of the latent change score model.

| | Model 1 | | | | | | | | | Model 2 | | | | | | | | |
| | Subjective age Δ | | | Out-degree Δ | | | In-degree Δ | | | Subjective age Δ | | | Out-degree Δ | | | In-degree Δ | | |
Variable	B [95% CI]	β	p	B [95% CI]	β	p	B [95% CI]	β	p	B [95% CI]	β	p	B [95% CI]	β	p	B [95% CI]	β	p
Subjective age (baseline)	−0.59 [−0.78, −0.41]	−0.58	<0.001	−5.68 [−12.72, 1.36]	−0.11	0.114	−4.30 [−7.33, −1.28]	−0.21	0.005	−0.62 [−0.82, −0.42]	−0.61	0.000	−4.42 [−11.84, 3.00]	−0.09	0.243	−2.95 [−5.17, −0.73]	−0.14	0.009
Out-degree centrality (baseline)	0.00 [−0.01, 0.00]	−0.10	0.495	−0.96 [−1.20, −0.71]	−0.77	<0.001	0.04 [−0.04, 0.12]	0.08	0.314	0.00 [−0.01, 0.00]	−0.07	0.591	−0.94 [−1.16, −0.72]	−0.76	<0.001	0.06 [0.01, 0.12]	0.13	0.028
In-degree centrality (baseline)	0.00 [0.00, 0.00]	0.01	0.945	0.45 [0.05, 0.86]	0.19	0.027	−0.47 [−0.65, −0.28]	−0.50	<0.001	0.00 [−0.01, 0.01]	0.01	0.966	0.45 [0.01, 0.88]	0.19	0.044	−0.28 [−0.44, −0.11]	−0.29	0.001
Subjective age Δ				0.02 [−0.06, 0.10]	0.03	0.513	−0.01 [−0.05, 0.03]	−0.03	0.632				0.08 [−0.20, 0.36]	0.05	0.585	−0.02 [−0.09, 0.06]	−0.03	0.631
Out-degree centrality Δ							1.41 [0.48, 2.35]	0.25	0.003							2.76 [−3.38, 8.90]	0.10	0.378
Egocentric network										−0.01 [−0.03, 0.00]	−0.12	0.141	0.07 [−0.50, 0.65]	0.01	0.799	0.11 [−0.11, 0.33]	0.05	0.331
Age										0.00 [−0.01, 0.01]	−0.05	0.602	−0.33 [−0.50, −0.16]	−0.17	<0.001	−0.02 [−0.11, 0.06]	−0.03	0.620
Women										−0.01 [−0.09, 0.08]	−0.01	0.887	1.92 [−0.56, 4.39]	0.07	0.129	−0.48 [−1.68, 0.73]	−0.04	0.437
Education (years)										0.00 [−0.01, 0.01]	−0.03	0.710	−0.09 [−0.45, 0.27]	−0.03	0.617	−0.12 [−0.24, 0.00]	−0.11	0.051
Self-rated health										−0.01 [−0.06, 0.03]	−0.04	0.598	−0.88 [−3.21, 1.45]	−0.06	0.458	−0.79 [−1.58, 0.00]	−0.13	0.051
Financial status										−0.01 [−0.04, 0.02]	−0.04	0.442	−0.81 [−2.55, 0.93]	−0.05	0.360	−0.13 [−0.75, 0.50]	−0.02	0.687
BG (ref: KS)										0.06 [−0.06, 0.17]	0.10	0.341	2.61 [−2.66, 7.87]	0.09	0.322	2.42 [0.68, 4.16]	0.20	0.006
BH (ref: KS)										0.03 [−0.10, 0.16]	0.06	0.623	7.48 [2.01, 12.95]	0.24	0.007	8.40 [6.32, 10.48]	0.69	<0.001
BM (ref: KS)										0.03 [−0.09, 0.16]	0.06	0.605	5.09 [0.03, 10.14]	0.18	0.048	2.75 [1.17, 4.32]	0.24	0.001
R^2	0.34			0.51			0.26			0.36			0.58			0.58		

Note. $N = 140$.

similar results to the first model. Out-degree and in-degree centrality at baseline were not associated with change in subjective age. Subjective age at the first time point was not associated with change in out-degree centrality, but it was negatively associated with change of in-degree centrality. Thus, even after controlling for sociodemographic and health variables, adults who felt younger were subsequently cited by more ADCC members.

Discussion

The present study provides a first step in examining the bidirectional temporal associations between subjective age and social relations. This examination is important in the light of the substantial role that subjective age (Mock & Eibach, 2011; Westerhof et al., 2014) and the social network (Tang et al., 2016; Zou et al., 2015) play in our health and well-being. By examining subjective age within a social context, we gain a better understanding of older adults' linked lives. Hence, this study advocates for a perspective that views time as composed of multiple psychosocial influences within the social context (Elder Jr, 1994). The results show that having a younger subjective age results in improved social popularity a year later. A younger subjective age was not associated with changes in social activity though. Moreover, neither social popularity nor social activity predicted changes in subjective age over time.

Our findings show that the one indicator of significant longitudinal associations with subjective age is the in-degree centrality, namely the number of individuals who know the focal person in the ADCC. Having a younger subjective age can be viewed as an attractive quality that makes one more socially popular within the network. Past research has shown that older adults in a continuing care retirement community (CCRC) who had a better health status also benefited from their good health socially (Schafer, 2016), as good health was viewed as a valuable resources in the CCRC (Ayalon, 2015). It is possible that not only health but also a younger subjective age is seen as a positive quality, which attracts other ADCC consumers to the older adult in question. The fact that a younger subjective age was not associated with greater social activity (e.g., out-degree centrality) stresses a clear distinction between one's subjective experience in the social situation and the situation as perceived by other social players in the network.

An unexpected finding concerns the fact that the social network characteristics were not associated with changes in subjective age. Past research has shown that subjective age is not a stable trait but rather varies based on age and health indicators (Kornadt et al., 2016; Montepare, 2009; Westerhof & Wurm, 2015). However, the potential temporal associations between social relations and subjective age are less clear. One study has found that a decrease in loneliness resulted in a decrease in subjective age. But, changes in objective social indicators did not predict changes in subjective age (Ayalon et al., 2016). Because subjective aging reflects people's perceptions, it might be influenced to a larger degree by subjective perceptions of social relations compared to more objective social indicators. Hence, it is possible that had we examined subjective social indicators, such as loneliness, the analysis would have resulted in significant reciprocal associations.

The ADCC is specifically designed to alleviate older adults' loneliness and provide them with a source of social stimulation (Ayalon, 2018; Iecovich & Biderman, 2012). Although past research has questioned the effectiveness of these efforts (Ayalon,

2018; Ayalon et al., 2018), the present study clearly shows how a younger subjective age at baseline results in improved social popularity over a 1-year follow-up. The intense nature of the ADCC, which allows older adults to meet for several hours each day, several times per week, stresses the importance of ADCC-based intimate relations. Hence, the present findings point to the important role of having a younger subjective age in one's social life in the ADCC. This finding could potentially account for some of the variability found in past research concerning older adults' adjustment to long-term care settings (Ayalon & Greed, 2015).

In reviewing the findings, the relatively small sample size and the nonrepresentative nature of the sample should be acknowledged. Yet, the loss to follow-up and the sample size are consistent with past research in the field of social networks of older adults (Ayalon & Levkovich, 2018). To date, only a handful of studies has considered ADCC participants. This is unfortunate given ongoing efforts at the national and global levels to develop formal alternatives to alleviate loneliness among older adults and assist older adults in developing and elaborating their social networks.

In interpreting the findings, it is important to note that ADCC consumers represent a select group of older adults, who at least in Israel require assistance in activities of daily living. In addition, this study only examined the number of ties within the ADCC and their possible reciprocal associations with subjective age. As the quantity of ties provides only one aspect of the construct of social ties, further research will benefit from examining the quality of ties as well. Moreover, in this study, the sociocentric network was limited to the ADCC, which represents only one outlet for social ties of older ADCC participants, examining relationships in other social settings may be beneficial. We also did not examine the potential effect of personality characteristics, such as extraversion and openness to experiences, which are known to affect both subjective age (Hubley & Hultsch, 1994; Stephan et al., 2012) and social relations (Feiler & Kleinbaum, 2015; Muscanell & Guadagno, 2012). Finally, it is important to note that our findings can point to the temporal order of events, but we cannot infer cause and effect, given the nonexperimental nature of the study.

Our findings point to the important role a younger subjective age identity potentially plays in one's popularity in the ADCC. This clearly attests to the importance of subjective age as a potential construct which accounts for some of the variability in the social network of ADCC participants. Following the linked-lives perspective (Elder Jr, 1994), this study delineates the potential role of subjective age in the social lives of older adults. The study suggests that a younger subjective age might serve as a desired social quality, which attracts others to form a relationship within the ADCC setting.

ORCID iD

Liat Ayalon 🄳 https://orcid.org/0000-0003-3339-7879

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