CLINICAL INVESTIGATION

Centenarians' End-of-Life Thoughts and Plans: Is Their Social Network on the Same Page?

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OBJECTIVES: To explore how centenarians think about and plan for the end of life (EOL) and to what extent their primary contacts (proxy informants) are aware of these thoughts.
DESIGN: Population-based study with semistructured in-person interviews.
SETTING: Defined geographical region approximately 60 km around Heidelberg, Germany.
PARTICIPANTS: Subsample drawn from the larger study of centenarians (N = 78) with data on centenarians' EOL thoughts from the centenarian and the proxy informant.
MEASUREMENTS: Centenarians reported on their thoughts about the EOL, perception of the EOL as threatening, longing for death, engagement in any EOL planning, and type of EOL plan (will, living will, healthcare surrogate) in place. Proxy respondents answered the same set of questions based on what they thought the centenarians' perspective was.
RESULTS: In nearly half of cases, proxies misjudged whether the centenarian thought about EOL. Although only few centenarians perceived the EOL as threatening, and approximately one-quarter reported longing for death, proxies overestimated centenarians' reports on the former and underestimated the latter. Proxies reported more centenarian EOL planning than centenarians themselves.
CONCLUSION: Even though enrolled proxies were mostly persons very close to the centenarian, many of them did not seem to be well informed about the centenarians' thoughts and plans regarding the EOL, suggesting a lack of communication between centenarians and social network members in this respect. Healthcare professionals should be aware that, even for very old adults approaching the end of their lives, discussions about EOL and EOL planning may need to be actively encouraged and supported. **J Am Geriatr Soc 66:1311–1317, 2018.**

Key words: end of life; death; centenarian; very old adults; caregivers

Very old adults (aged ≥85) represent the fastest growing population in most industrialized nations.[1] This includes centenarians, the oldest old within this age segment. Worldwide, the number of centenarians is expected to increase from approximately 441,000 in 2013 to 3.4 million in 2050.[2] Due to their exceptionally high age, centenarians are per definition very close to the end of their lives. Also, most centenarians depend on help from family or professional aides in their activities of daily living.[3] Little is known about their thoughts or plans regarding the end of life (EOL), and even less is known about how this topic is handled within centenarians' networks.

Planning for high-quality, person-centered EOL care requires engaging in conversations with older adults about the EOL.[4] Systematic reviews have accumulated clear evidence of a positive effect of advance care planning on EOL quality; that is, planning was associated with fewer life-sustaining treatments and hospitalizations and greater use of hospice and palliative care.[5] Although studies of EOL discussions with older adults have considered the age segment of the oldest old (aged ≥85), samples typically included only a small percentage of very old participants (e.g., <15%) and only few, if any, centenarians.[4]

The few studies available on EOL views and preferences of very old adults suggest that they were willing to discuss the topic but rarely did and that, even though many preferred a palliative EOL approach, these preferences were often not documented.[6,7] Only one study focusing on very old participants asked directly whether they ever thought about dying, how often they thought about death, and whether they were worried about the prospect of

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dying.[8] Forty percent reported thinking about dying, and only 10% often thought and worried about death. Those who frequently thought about death were more likely to be unmarried, had less contact with their proxy, and showed more signs of depressed mood. To what extent any of these findings apply to centenarians, who face an even higher likelihood of dying, is unknown.

It is often assumed that very old adults' exceptional longevity and closer proximity to death may lead to more exchanges with their family about the EOL, yet family exchanges about EOL and knowledge about the wishes of very old adults have rarely been addressed. The one study that included a few centenarians and proxy informants[6] found that, although there was some overlap in participant and proxy accounts of participant EOL preferences, some proxies assumed the opposite of what the participant had reported, such as preference for comfort care (proxy) versus all treatments possible (participant); even more frequently the proxy admitted to not knowing participant's EOL preferences and never having talked about it.

Thus, some limited evidence suggests that, in very old age, there is insufficient EOL preparation, conversations about the EOL are limited, and social network members may not be aware of the very old person's views and preferences. This may be the case because exceptional longevity often means having bypassed common, fatal illness (e.g., cancer, stroke, coronary heart disease)[9] that would have created a need for EOL discussions and planning. To address the gap in the literature, our study aimed to capture centenarian EOL thoughts and the awareness of central social network members (proxy informants) of them, as well as how consistent network members' reporting of centenarians' EOL planning was with centenarians' own reports of planning.

METHODS

Sample

The study sample was drawn from the population-based Second Heidelberg Centenarian Study.[10] The institutional review board of the Faculty of Behavioral and Cultural Studies at Heidelberg University approved the study. For the purpose of the present article, we selected participants (N = 78) for whom data on centenarian EOL thoughts from the centenarian and a proxy informant were available.

The population-based recruitment strategy in the larger study involved requesting contact information of all individuals born in 1911/12 living in and up to 60 km around Heidelberg, Germany, from the city registries. All 485 individuals identified using this approach were invited to participate in the study (no exclusion criteria applied). Of these, 298 had died between initial identification and first contact, refused to participate, or could not be contacted. For another 80 centenarians, only basic information was collected over the telephone, mostly from their proxies. Reasons for declining full study participation were cognitive restrictions or dementia (43%), concern the interview would be too tiring (28%), no interest (16%), poor physical health (9%), and other reasons (4%). One hundred seven centenarians from the original pool and five additional centenarians who nominated themselves after having heard of the study participated in the full in-person interview conducted at their residence. Of these 112 centenarians, 87 answered questions about their thoughts on EOL. The final sample consisted of the 78 cases for whom proxy data on centenarian EOL thoughts were also available. Comparisons of those included in the analyses with those who did not respond to the EOL questions or did not have an enrolled proxy indicated that participants were more likely to be female, better educated, have higher functional ability and better cognitive functioning, and less likely to live in a care facility. (all $P < .05$).

MEASURES

EOL Thoughts and Planning

Centenarians answered yes or no to 8 questions. Proxies were asked to answer the same set of questions from the centenarians' perspective (what they thought the centenarians' EOL thoughts and planning would be). EOL thoughts: "Do you think about the end of life?" "Do you perceive the end of life as threatening?" "Do you long for death?" "Do you believe in an afterlife?" EOL planning: "Have you prepared or made arrangements for the case of your death?" "Do you have a will?" "Do you have a healthcare surrogate?" "Do you have a living will?"

Sociodemographic Characteristics

We included age, sex, education, and perceived income adequacy. Education was measured by asking about years of formal education and completion of degrees (0 = no formal education, 1 = elementary school, 2 = up to grade 6, 3 = up to grade 10, 4 = up to grade 12, 5 = high school degree, 6 = some undergraduate, 7 = completed undergraduate degree, 8 = doctorate). Perceived income adequacy was assessed by asking whether their income was sufficient for their needs (0 = can't make ends meet to 3 = money is not a problem).

Social Network Characteristics

A series of questions were asked to assess marital status, number of living children, and whether the centenarian saw family as often as desired. For living arrangements, the kind of residence centenarians lived in was asked about, and answers were subsequently grouped into living alone in own household (1 = yes, 0 = no) or living in an elder care facility (e.g., assisted living or nursing home; 1 = yes, 0 = no). The centenarian-proxy relationship was assessed by asking 2 questions: "Overall, how would you rate your relationship with [...] at the moment on a scale of 1 to 10? (1 = very poor to 10 = very good)" "How significant is your relationship with [...] in your life? (0 = not at all to 4 = very much)."

Physical and Mental Health

Centenarians' cognitive functioning, functional ability, and depression were assessed. The interviewer evaluated cognitive impairment according to the Global Deterioration Scale[11] (range 1 (no cognitive decline) to 7 (very severe cognitive decline)). Functional ability was assessed using a modified version of the Older Americans Resources and Services Multidimensional Functional Assessment Questionnaire, which included activities of daily living (ADLs; 7 items) and instrumental activities of daily living (IADLs; 7 items).[12] Participants responded on a 3-point scale (0 = dependent/no longer possible to 2 = can do without help/no difficulty), and items were summed to generate a total score (α = .77 for ADLs; α = .84 for IADLs). For depressive symptoms, 10 items were selected from the 30-item Geriatric Depression Scale[13]; responses were coded 1 for yes and 0 for no, and the count of 10 items was calculated (α = .67). Higher scores reflected higher levels of depressive symptomatology.

Statistical Analysis

Initial analyses involved descriptive statistics of responses from centenarians and their proxies. McNemar tests were used to examine bivariate differences in the percentage of centenarians and proxies who answered yes to each EOL thoughts item.[14]

To examine dyadic correspondence on centenarian EOL thoughts and planning, we considered the proportion of concordant and discordant dyads based on the responses of centenarians and their respective proxies. Thus, concordant dyads included cases in which centenarian and proxy answered yes or no to each EOL item (yes–yes or no–no); discordant dyads included cases in which the centenarian answered yes but their proxy no (yes–no), or the centenarian answered no but their proxy yes (no–yes).

Finally, centenarian characteristics (demographic, social network, physical and mental health) were investigated with respect to the dyadic concordance status on centenarian EOL thoughts and planning using a series of t-tests and chi-square tests (e.g., concordant dyads vs discordant dyads for each EOL item). Statistical analysis was performed using SPSS Statistics 24 (IBM Corp., Armonk, NY).

RESULTS

Sociodemographic and Social Network Characteristics

Centenarians had an average age of 100.5±0.5, and 85% were female (Table 1). Proxy informants had an average aged of 68.0±7.8 (range 48–85), and 62% were female. They were mostly close family members; 69% were daughters or sons (-in-law), 2% spouses, 16% other relatives, and 13% nonfamily network members. On average, they evaluated the quality of their relationship as high (on a scale from 1–10, 8.7 centenarians, 8.4 proxies). All centenarians and 76% of proxies evaluated the significance of their relationship as quite or very significant.

Table 1. Summary of Sample Characteristics (N = 78)

Characteristic	Value
Demographic	
Age, mean ± SD (range)	100.46 ± 0.54 (99.16–103.34)
Female, %	84.6
Education, mean ± SD (range)[a]	2.92 ± 1.64 (1–8)
Perceived income adequacy, mean ± SD (range)[b]	1.54 ± 0.92 (0–3)
Social network characteristics	
Marital status, %	
Married	5.1
Widowed	83.3
Divorced	2.6
Never married	9.0
Has living child, %	74.4
Number of living children, mean ± SD (range)	1.33 ± 1.08 (0–4)
Living arrangement, %	
Lives alone in own household	32.1
Lives in care facility	35.9
Sees family as often as desired, %	39.7
Centenarian-proxy relationship quality, mean ± SD (range)[c]	8.73 ± 1.92 (1–10)
Centenarian-proxy relationship significance, %[d]	100
Physical and mental health, mean ± SD (range)	
Cognitive impairment[e]	2.57 ± 1.50 (1–6)
Activities of daily living[f]	9.56 ± 3.07 (3–14)
Instrumental activities of daily living[f]	5.73 ± 3.76 (0–14)
Depression[g]	2.06 ± 2.31 (0–9)

[a]0 = no formal education, 1 = elementary school, 2 = up to grade 6, 3 = up to grade 10, 4 = up to grade 12, 5 = high school degree, 6 = some undergraduate, 7 = graduate (non-doctoral) degree, 8 = doctorate.
[b]0 = can't make ends meet to 3 = money is not a problem.
[c]1 = very poor to 10 = very good.
[d]1 = very significant, 0 = else.
[e]1 = no cognitive decline to 7 = very severe cognitive decline.
[f]Sum of 7 items; 0 = dependent/no longer possible to 2 = can do without help/no difficulty.
[g]Count of 10 items; 1 = yes and 0 = no.
SD = standard deviation.

Reports of EOL Thoughts and Planning

Only about half of the centenarians reported thinking about EOL and believing in an afterlife (Table 2). Slightly more proxies assumed that their centenarian thought about EOL (P = .70) or believed in an afterlife (P = .23). Response patterns of centenarians and proxies showed more differences with respect to the remaining EOL questions; 1 centenarian reported perceiving the EOL as threatening, and approximately 10% of proxies assumed that their centenarian viewed the EOL as threatening (P = .07), and 24% of centenarians reported longing for death, whereas only approximately 10% of proxies reported this for the centenarian (P = .03). Even though having made arrangements for death was the most highly endorsed item of all, a significantly higher percentage of proxies reported that the centenarians had made arrangements for their death (81%) than of centenarians' own reports (59%) (P = .008). Similar discrepancies emerged for specific types of arrangements (will, healthcare surrogate, living

Table 2. Centenarian End-of-Life (EOL) Thoughts and Proxy Assessment of Centenarian EOL Thoughts

	Between-Dyad Comparison				Within-Dyad Comparison		
EOL Thoughts Items	Centenarian, Yes (%)	Proxy, Yes (%)	McNemar Test	P-Value	Discordant Dyads (%)	Yes–No[a]	No–Yes[b]
Think about EOL	50.8	55.7	0.33	.70	44.3	19.7	24.6
Perceive EOL as threatening	1.5	10.6	4.50	.07	12.1	1.5	10.6
Long for death	24.2	10.6	5.40	.035	22.7	18.2	4.5
Believe in an afterlife	50.0	58.9	2.27	.23	19.6	5.4	14.3
Made arrangements for EOL	58.5	81.1	8.00	.008	34.0	5.7	28.3
Have a will	33.3	43.3	2.57	.18	23.3	6.7	16.7
Have a healthcare surrogate	38.3	55.0	4.17	.06	40.0	11.7	28.3
Have a living will	28.3	43.3	3.86	.08	35.0	10.0	25.0

[a]Centenarian answered yes; proxy answered no (%).
[b]Centenarian answered no; proxy answered yes (%).

will), but these differences were not significant (P = .06 to .18; Table 2).

Concordance and Discordance within Dyads

The greatest discordance emerged for the item "thinking about EOL" (44%). Almost half or proxies misjudged whether their centenarian thought about EOL, and the direction of the discordance was nearly split in half (proxy "yes" 25% vs centenarian "yes" 20%). Although the item "perceiving the EOL as threatening" had the lowest discordance (12%), proxies overestimated centenarians' endorsement (proxy 11% vs centenarian 2%), and in the one case in which the centenarian perceived the EOL as threatening, the proxy was not aware of it. The item "belief in an afterlife" showed slightly higher dyadic discordance in the same direction (proxy 14% vs centenarian 5%). "Longing for death" also had a slightly higher discordance rate but in the opposite direction; proxies underestimated centenarians' longing for death (proxy 5% vs centenarian 18%) (Table 2).

Dyadic discordance was substantial for the questions on EOL planning, with 3 of 4 items—made arrangements for EOL, have a healthcare surrogate, have a living will—reflecting the second-highest discrepancy after "thinking about EOL" (34–40%). The direction of the discordance was such that proxies were more likely to report planning than centenarians for the general questions about having made arrangements (proxy 28% vs centenarian 6%) and the 3 specific arrangement types (percentage more than twice as high for all). The greatest discrepancy was for whether the centenarian had assigned a healthcare surrogate (40%).

Centenarians' Characteristics Related to the Dyadic Concordance or Discordance

Comparing concordant and discordant dyads for the 4 EOL thought questions with respect to centenarian characteristics (Table 3) led to only one significant result: Discordant responses were significantly more likely when the centenarian lived alone.

More significant differences were found for EOL planning (Table 4). Concordant responses to the general EOL planning item were more likely when centenarians lived alone and had greater income adequacy, better functional health, and lower cognitive functioning. For having a healthcare surrogate, concordance was more likely with better functional ability and lower cognitive impairment. Concordance for having a living will was more likely when centenarians reported seeing family as often as desired. No significant differences emerged for dyadic correspondence in responses to having a will.

DISCUSSION

This study is the first to shed light on centenarian thinking about and planning for EOL and the extent to which close social network members (proxy informants) may be aware of these thoughts and planning steps. Despite evidence that relationships between enrolled proxies and centenarians were close, many of the proxies did not seem to know the centenarians' thoughts about EOL. This was more likely to be the case when the centenarian lived alone, suggesting that greater independence of the centenarian meant less EOL-related exchange. The limited awareness of proxies for what centenarians were thinking with regard to EOL may be problematic because it suggests a general lack of communication about EOL, which could result in centenarians being left alone with EOL-related thoughts. Furthermore, proxies tended to underestimate centenarian reports of longing for death and overestimate centenarians' perception of EOL as threatening. Underestimating centenarians' longing for death may result in failure to recognize and address critical care needs pertaining to mental health. Proxies overestimating perceptions of EOL as threatening may lead them to avoid bringing up the topic out of fear that it would cause distress, whereas the centenarian may want to talk about it. The small body of research documenting that very old adults were willing to discuss the topic but had little opportunity to do so supports this concern.[6,7] Because promoting conversations with older adults about EOL has been recognized as critical for ensuring high-quality EOL care,[3] it seems vital to identify barriers that hinder understanding of centenarians' EOL views and perceptions.

Discordance also emerged for EOL planning, although in this case, the lack of awareness may be more on the

Table 3. Centenarian Characteristic Differences According to Dyadic Concordance Patterns of End-of-Life (EOL) Thoughts

Characteristic	Think About EOL				Perceive EOL as Threatening				Long for Death				Believe in an Afterlife			
	Concordant (55.7%)	Discordant (44.3%)	t/Chi-Square	P-Value	Concordant (87.9%)	Discordant (12.1%)	t/Chi-Square	P-Value	Concordant (77.3%)	Discordant (22.7%)	t/Chi-Square	P-Value	Concordant (80.4%)	Discordant (19.6%)	t/Chi-Square	P-Value
Demographic																
Female, %	85.3	85.2	0.00	1.00	84.5	75.0	0.46	.61	82.4	86.7	0.16	1.00	82.2	90.9	0.50	.67
Education, mean ± SD	3.00 ± 1.71	2.44 ± 0.97	1.51	.14	2.95 ± 1.66	2.88 ± 1.81	0.12	.91	2.94 ± 1.68	2.60 ± 0.83	0.76	.45	2.96 ± 1.64	3.00 ± 1.84	−0.08	.94
Perceived income adequacy, mean ± SD	1.62 ± 0.92	1.60 ± 0.82	0.08	.94	1.51 ± 0.87	2.13 ± 0.99	−1.85	.07	1.58 ± 0.91	1.50 ± 0.86	0.30	.77	1.53 ± 0.94	1.55 ± 0.93	−0.03	.97
Social network																
Has a living child, %	79.4	66.7	1.26	.38	74.1	62.5	0.48	.67	74.5	73.3	0.01	1.00	77.8	63.6	0.94	.44
Lives alone, %	17.6	48.1	6.53	.011	27.6	37.5	0.34	.68	33.3	33.3	0.00	1.00	26.7	18.2	0.34	.71
Sees family often, %	48.0	57.1	0.38	.57	59.5	25.0	3.22	.12	59.0	50.0	0.22	.71	51.4	80.0	1.46	.36
Centenarian-proxy relationship quality, mean ± SD	9.16 ± 1.25	8.75 ± 1.88	0.84	.41	8.74 ± 2.01	9.33 ± 1.03	−0.71	.48	8.71 ± 2.02	8.78 ± 2.17	−0.09	.93	8.76 ± 1.72	9.20 ± 1.10	−0.55	.59
Physical and mental health, mean ± SD																
Cognitive impairment	2.53 ± 1.58	2.58 ± 1.41	−0.13	.89	2.61 ± 1.53	2.29 ± 1.11	0.54	.59	2.53 ± 1.53	2.79 ± 1.19	−0.58	.57	2.28 ± 1.28	3.60 ± 2.17	−1.85	.09
Activities of daily living	9.79 ± 3.28	9.59 ± 2.90	0.25	.80	9.79 ± 3.07	9.50 ± 3.07	0.25	.80	9.51 ± 3.06	9.93 ± 2.52	−0.49	.63	9.44 ± 3.09	8.09 ± 3.30	1.28	.20
Instrumental activities of daily living	6.12 ± 3.80	5.96 ± 3.56	0.16	.87	5.78 ± 3.67	6.63 ± 4.50	−0.60	.55	5.67 ± 3.84	5.07 ± 2.37	0.74	.47	5.71 ± 3.49	4.64 ± 3.64	0.91	.37
Depressive symptoms	2.15 ± 2.25	2.33 ± 2.75	−0.26	.79	1.91 ± 2.20	2.63 ± 2.56	−0.83	.41	1.93 ± 2.26	3.00 ± 2.59	−1.41	.17	2.57 ± 2.51	1.33 ± 1.51	1.17	.25

SD = standard deviation.

part of the centenarian than the proxy. At least in cases of centenarians with poorer cognitive and functional ability, the finding of greater discordance for having a healthcare surrogate suggests that more plans were in place than the centenarians were aware of or remembered in the moment, although the level of cognitive limitations of centenarians who answered the EOL items indicated only mild, early signs of memory problems (scores of 2–3 on a scale from 1–7). It could also be that a deceased spouse had handled plans (e.g., legal documents), and the surviving spouse had little involvement. Thus, rather than just reflecting memory loss, it is possible that plans were made a long time ago and were simply no longer on centenarians' minds. In this light, exceptional longevity may have a "side effect," in which the steps taken at some point toward EOL preparation move out of sight the closer the very old person gets to the EOL.

Following this line of thought, it may be particularly important for very old adults to revisit existing plans with their family. Healthcare professionals may need to be particularly alert to this issue in the oldest-old adults. Because evidence indicated discrepancies between expressed EOL care preferences of very old adults and proxy informants' assessments of these preferences,[6] revisiting existing plans also seems critical because social network members may not always be good judges of the older adult's preferences.[15]

Several limitations deserve mention. First, our analytical sample was a subsample of the Second Heidelberg Centenarian Study. Although they were invited based on city registry information because of their age, study participants volunteered to participate in an in-person interview and completed the full interview including the questions on EOL thoughts and planning. Thus, our sample represents those who were in better health and is not representative of the study cohort. Second, analyses and abilities to detect any statistical significance may be limited because of the small sample size. For example, based on the concordance status of EOL thoughts between centenarians and proxies, we compared only the two groups (concordant vs discordant), but distinguishing 2 different discordant patterns (yes–no vs no–yes) would be particularly interesting to increase understanding of characteristics related to different patterns of discordance. Third, given that the care of older adults can be distributed across different network members, it could be informative to consider multiple network members' perspectives. For example, it is possible that some of the centenarians in our sample had talked with another network member about the EOL, although centenarians tend to have outlived most of their network. They are much less likely than a younger person to have an old colleague, friend, or another relative they can talk to, which is why communication in particular with network members of the next generation (e.g., children) becomes so important. Fourth, we measured EOL thoughts and plans as binary (yes–no) and did not have detailed information on EOL thoughts. Fifth, regarding discordance observed in EOL arrangements, we were not able to confirm whose reports reflected actual EOL arrangements. Future studies designed to address these issues would be helpful.

Table 4. Centenarian Characteristic Differences According to Dyadic Concordance Patterns of End–of–Life (EOL) Planning

Characteristic	EOL Arrangements				Have a Will				Have a Healthcare Surrogate				Have a Living Will			
	Concordant (66.0%)	Discordant (43.0%)	t/Chi-Square	P-Value	Concordant (76.7%)	Discordant (23.3%)	t/Chi-Square	P-Value	Concordant (60.0%)	Discordant (40.0%)	t/Chi-Square	P-Value	Concordant (65.0%)	Discordant (35.0%)	t/Chi-Square	P-Value
Demographic																
Female, %	88.6	72.2	2.25	.25	84.8	92.9	0.61	.67	94.4	75.0	4.71	.05	89.7	81.0	0.91	.43
Education, mean ± SD	3.23 ± 1.96	2.61 ± 1.33	1.20	.24	2.78 ± 1.41	3.79 ± 2.29	–1.55	.14	2.67 ± 1.07	3.54 ± 2.27	–1.77	.09	2.97 ± 1.69	3.10 ± 1.73	–0.26	.79
Perceived income adequacy, mean ± SD	1.69 ± 0.93	1.11 ± 0.76	2.41	.020	1.50 ± 1.01	1.57 ± 0.85	–0.24	.81	1.61 ± 0.93	1.38 ± 1.01	0.93	.36	1.56 ± 0.94	1.43 ± 1.03	0.52	.61
Social network																
Has a living child, %	80.0	72.2	0.41	.73	78.3	64.3	1.12	.31	69.4	83.3	1.48	.36	74.4	76.2	0.02	1.00
Lives alone, %	48.6	11.1	7.25	.008	30.4	35.7	0.14	.75	36.1	25.0	0.82	.41	38.5	19.0	2.38	.15
Sees family often, %	58.6	40.0	1.04	.47	48.5	66.7	0.94	.46	51.9	53.3	0.01	1.00	64.5	18.2	6.99	.013
Centenarian-proxy relationship quality, mean ± SD	8.62 ± 2.19	9.30 ± 1.64	–0.89	.38	9.06 ± 1.57	8.13 ± 3.23	0.80	.45	9.20 ± 1.47	8.29 ± 2.67	1.38	.18	8.80 ± 2.11	9.11 ± 1.69	–0.40	.69
Physical and mental health, mean ± SD																
Cognitive impairment	2.12 ± 1.24	3.47 ± 1.77	–2.80	.010	2.52 ± 1.79	3.29 ± 1.54	–1.44	.16	2.29 ± 1.53	3.35 ± 1.90	–2.35	.022	2.49 ± 1.54	3.10 ± 2.05	–1.28	.21
Activities of daily living	10.31 ± 2.49	7.78 ± 2.86	3.34	.002	9.26 ± 3.30	9.07 ± 3.03	0.19	.85	9.83 ± 3.13	8.29 ± 3.17	1.86	.07	9.51 ± 2.78	8.67 ± 3.90	0.97	.33
Instrumental activities of daily living	6.40 ± 3.57	3.11 ± 2.14	4.18	.000	5.50 ± 3.43	3.79 ± 3.91	1.59	.12	6.14 ± 3.76	3.54 ± 2.70	2.92	.005	5.21 ± 3.59	4.90 ± 3.66	0.31	.76
Depressive symptoms	2.28 ± 2.25	2.33 ± 2.50	–0.07	.95	2.50 ± 2.37	1.20 ± 1.81	1.61	.11	2.42 ± 2.49	1.88 ± 1.97	0.77	.45	1.94 ± 1.95	2.87 ± 2.92	–1.30	.20

SD = standard deviation.

These findings highlight the importance of communication about EOL between centenarians and their close social network members. Healthcare professionals can take a critical role in encouraging EOL conversations. In particular, healthcare professionals should be aware that, even in very old adults who are approaching the EOL, discussions about EOL and EOL planning may need to be more actively encouraged and supported. Finally, EOL arrangements made earlier in life may need to be revived or revisited to be useful and relevant to a centenarian's current life situation and prospective challenges.

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REFERENCES

1. Vaupel JW. Biodemography of human ageing. Nature 2010;464:536–542.
2. World Population Ageing 2013. New York: United Nations; 2013.
3. Richmond RL, Law J, Kay-Lambkin F. Physical, mental, and cognitive function in a convenience sample of centenarians in Australia. J Am Geriatr Soc 2011;59:1080–1086.
4. Kale MS, Ornstein KA, Smith CB, et al. End-of-life discussions with older adults. J Am Geriatr Soc 2016;64:1962–1967.
5. Brinkman-Stoppelenburg A, Rietjens JA, van der Heide A. The effects of advance care planning on end-of-life care: A systematic review. Palliat Med 2014;28:1000–1025.
6. Fleming J, Farquhar M, Brayne C, et al. Death and the oldest old: Attitudes and preferences for end-of-life care-qualitative research within a population-based cohort study. PLoS One 2016;11:e0150686.
7. Lloyd-Williams M, Kennedy V, Sixsmith A, et al. The end of life: A qualitative study of the perceptions of people over the age of 80 on issues surrounding death and dying. J Pain Symptom Manage 2007;34:60–66.
8. Rao R, Dening T, Brayne C, et al. Attitudes toward death: A community study of octogenarians and nonagenarians. Int Psychogeriatr 1997;9: 213–221.
9. Hazra NC, Dregan A, Jackson A, et al. Differences in health at age 100 according to sex: Population-based cohort study of centenarians using electronic health records. J Am Geriatr Soc 2015;63:1331–1337.
10. Jopp DS, Boerner K, Rott C. Health and disease at age 100: Findings from the Second Heidelberg Centenarian Study. Dtsch Arztebl Int 2016;113: 203–210.
11. Reisberg B, Ferris SH, de Leon MJ, et al. The Global Deterioration Scale for assessment of primary degenerative dementia. Am J Psychiatry 1982; 139:1136–1139.
12. Fillenbaum G. Multidimensional Functional Assessment: The Duke Older Americans Resources and Services Procedure. Hillsdale, NJ: Erlbaum; 1988.
13. Yesavage JA, Brink TL, Rose TL, et al. Development and validation of a geriatric depression screening scale: A preliminary report. J Psychiatr Res 1983;17:37–49.
14. Kenny DA, Kashy DA, Cook WL. Dyadic Data Analysis. New York: The Guilford Press; 2006.
15. Moorman SM, Carr D. Spouses' effectiveness as end-of-life health care surrogates: Accuracy, uncertainty, and errors of overtreatment or undertreatment. Gerontologist 2008;48:811–819.