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Original article

Long-lasting active lifestyle and successful cognitive aging in a healthy elderly population: The PROOF cohort☆

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ABSTRACT

Objectives. – The aim of this study was to determine whether cognitive reserve in the elderly affects the evolution of cognitive performance and what its relationship is with active lifestyles in later life.
Methods. – Cognitive performance was evaluated at baseline and 8 years later in 543 participants of the PROOF cohort, initially aged 67 years. Subjects were categorized as Cognitively Elite (CE), Cognitively Normal (CN) or Cognitively Impaired (CI) at each evaluation. At follow-up, demographic data and lifestyle, including social, intellectual and physical behaviors, were collected by questionnaires.
Results. – As much as 69% ($n = 375$) remained unchanged, while 25.5% ($n = 138$) decreased and 5.5% ($n = 30$) improved. When present, the reduction in cognitive status was most often limited to one level, but was dependent on the initial level, affecting up to 73% of the initially CN, but only 58% of the initially CE. Cognitive stability was significantly associated with the degree of social engagement at follow-up (CE: $P = 0.009$; CN: $P = 0.025$).
Conclusion. – In the healthy elderly, high cognitive ability predicts both cognitive ability and social involvement in later life. Cognitive decline by only one level may also extend the time to reach impairment, underlining the importance of the so-called cognitive reserve.

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Abbreviations: CE, Cognitively Elite; CN, Cognitively Normal; CI, Cognitively Impaired; HCI, Health Care Index; IAI, Intellectual Activity Index; MMSE, Mini-Mental State Examination; PAI, Physical Activity Index; PROOF, Prognostic Indicator of Cardiovascular and Cerebrovascular Events; QoL, Quality of Life; SAI, Social Activity Index.
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1. Introduction

Successful cognitive aging [1,2] is thought to be promoted by an active lifestyle [3–5], particularly when it includes higher levels of intellectual [6,7] and social involvement [8,9], as well as physical activities [10,11]. Many other factors contribute to the 'cognitive reserve' [12], thus delaying cognitive decline even in the presence of Alzheimer's disease [13].

However, data from the literature are controversial concerning the respective roles of lifestyle and social engagement and previous level of cognitive ability [14–17]. In the Personality & Total Health (PATH) Through Life project, where participants were assessed on three occasions, active lifestyle was related to baseline cognitive ability, but not to cognitive changes over time [16]. In contrast, the Glostrup cohort showed no such strong relationship between lifestyle activities and later cognition levels when initial cognitive levels were taken into account [17].

While remaining engaged in activities may further delay age-related cognitive decline [16–18] as well as limit the risk of developing neurodegenerative disorders [4,19], the association between initially high cognitive ability in the elderly and later lifestyle activities has rarely been assessed in a highly homogeneous cohort, such as that of the Prognostic Indicator of Cardiovascular and Cerebrovascular Events (PROOF) project [20]. Furthermore, the PROOF cohort was characterized by average levels of education (11 years of school), whereas other studies included people who more often had more years of education [3,6,14,17,21,22]. In the latter studies, the broad age span between subjects may have contributed to differences in cognitive performance and their evolution, or at least made extrapolation more difficult. The age homogeneity in the PROOF project may strengthen the analysis of interdependence between, on the one hand, baseline cognitive levels and their evolution and, on the other, later lifestyle activities. To better analyze cognitive status and its evolution in these healthy subjects, a cognitive scale [21] was used to better estimate changes in cognitive levels in relation to time and to later lifestyle activities, and to assess cognitive reserve [12,13].

2. Design and Methods

2.1. Population

Participants were subjects already enrolled in the prospective PROOF project, which was designed to assess the effects of autonomic nervous system activity on cognitive performance, and cerebrovascular and cardiovascular events. The initial population consisted of 1011 retired volunteers, all of whom were aged 65 years in 2001, the time of enrolment by random selection from the electoral list of the city of Saint-Étienne, France [20,23].

The first cognitive evaluation performed during the initial 2-year examination (2001–2003) involved 921 participants and, for the second 2-year examination (2009–2011), 631 subjects (68%). All participants completed a lifestyle questionnaire at follow-up. Ultimately, 543 participants were eligible for the present study (Fig. 1). This final group of subjects did not differ from the original sample, whereas the excluded subjects differed from the final sample by having lower Mini-Mental State Examination (MMSE) scores ($P = 0.002$).

The present PROOF study was approved by the local institutional review board and ethics committee (CCPRB Rhône-Alpes Loire). All subjects gave their written consent to participate.

2.2. Neuropsychological assessment

A battery of psychometric tests was administered as previously described [23,24]. Briefly, three cognitive domains were assessed:

(i) the 'information processing speed and attentional performance' domain, using the Trail Making Test (TMT) Part A [25], the Stroop Color–Word Test (Parts I and II) [26] and the Coding subtest of the Wechsler Adult Intelligence Scale, Third Edition (WAIS-III) [27];
(ii) the 'executive function' domain, using the TMT Part B [25], the Stroop Color–Word Test (Part III) [26], an alphabet fluency test using the letter 'P' [28], a category fluency test using animal names [28] and the Similarities subtest of the WAIS-III [27]; and
(iii) the 'memory' domain, using the Benton Visual Retention Test (form C) [29] and the Grober and Buschke Selective Reminding Test [30]. In addition, global intellectual efficiency was assessed by the MMSE [31].

As previously described [23], averaged Z scores were calculated for each cognitive domain. The analysis resulted in three groups: the cognitively elite (CE); the cognitively normal (CN); and the cognitively impaired (CI) [21]. CE subjects had scores above the mean for each of the three cognitive domains; CN subjects had scores between -1.5 SD and $+1.5$ SD for each domain, with at least one score below the relevant group mean; and CI subjects had at least one compound score > -1.5 SD below the group mean [32]. Subjects were then also stratified according to their evolution from baseline: (i) stable if remaining at the same level; (ii) worsened if they dropped one level or more; and (iii) improved if their cognitive status increased.

2.3. Quality of Life (QoL) questionnaire

The QoL questionnaire was designed to collect information covering the past 2 years (Table 1). It consisted of 17 items using 3- to 5-point scales for four lifestyle-activity domains: Health Care Index (HCI); Physical Activity Index (PAI); Intellectual Activity Index (IAI); and Social Activity Index (SAI). The upper-quartile raw score for each domain was used as the cut-off point to represent a high level of engagement in the activity index.

2.4. Other measures

2.4.1. Demographic data

The participants' education level was defined by the numbers of years of schooling; marital status was dichotomized as

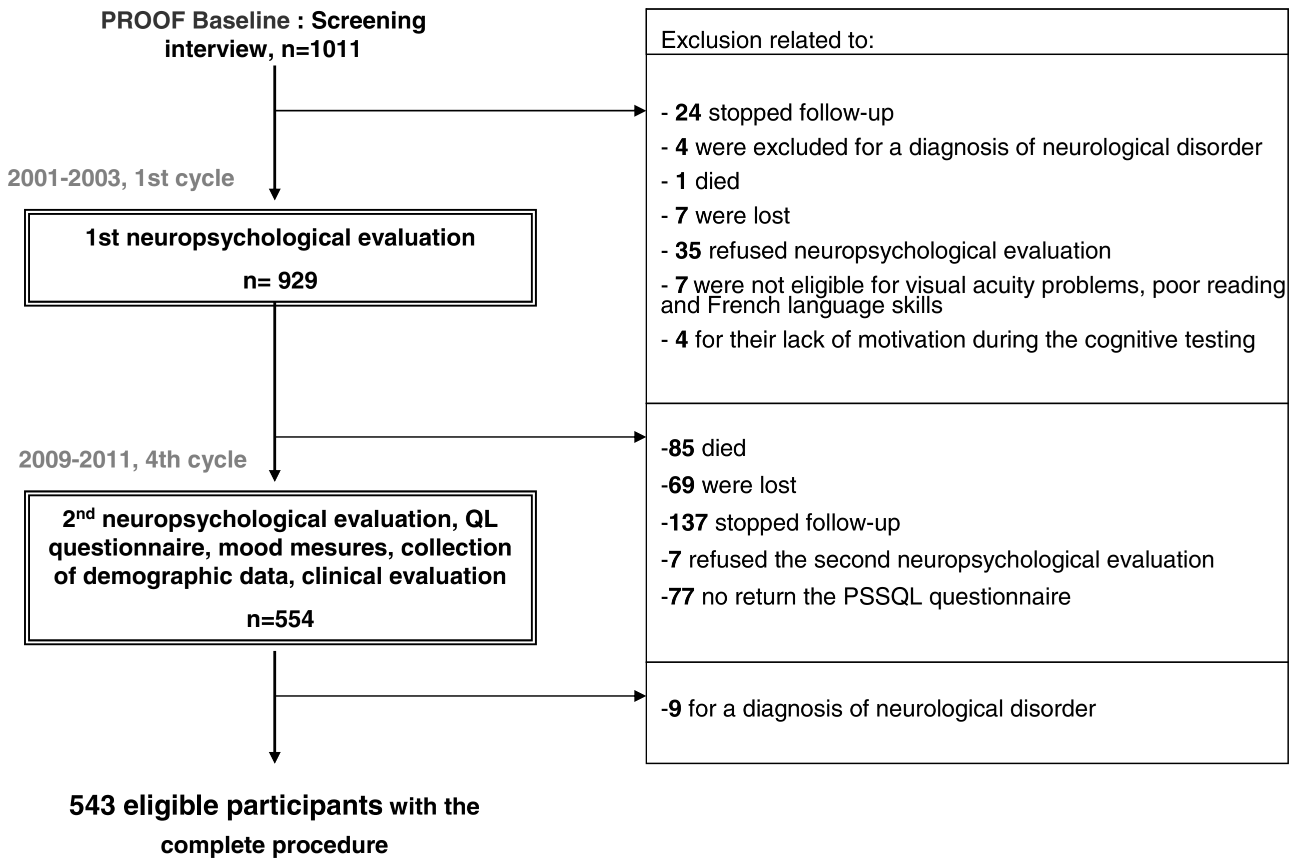

Fig. 1 – Flow chart of the participants' inclusion procedure. PROOF: Prognostic Indicator of Cardiovascular and Cerebrovascular Events; QoL: Quality of Life; PSSQL: Percentage Standard deviation of the QL.

Table 1 – Raw data from cognitive tests at baseline and 8 years later in the entire study population.

Neuropsychological measures	Baseline	Follow-up	P[a]
Attention and information-processing speed			
Trail Making Test Part A (s)	45.2 ± 13.4	48.2 ± 16.5	<0.001
Stroop Color–Word Part I (number of words)	98.9 ± 13.5	93.6 ± 12.8	<0.001
Stroop Color–Word Part II (number of colors)	71.3 ± 10.2	66.1 ± 10.5	<0.001
Code test WAIS-III (product score)	58.1 ± 12.6	52.5 ± 12.9	<0.001
Executive functioning			
Trail Making Test Part B (s)	94.6 ± 38.3	102.6 ± 40.2	<0.001
Stroop Color–Word Part III (number of colors)	35.2 ± 7.9	31.9 ± 8.0	<0.001
Letter fluency (number of words)	19.7 ± 6.6	19.9 ± 6.6	0.51
Category fluency (number of words)	30.9 ± 8.1	29.6 ± 7.4	<0.001
Similarity test WAIS-III [product score: 0–33]	17.7 ± 5.2	17.5 ± 5.5	0.31
Memory			
Visuospatial working memory			
Benton Visual Retention Test [correct answers: 0–15]	12.6 ± 1.7	12.6 ± 1.5	0.50
Verbal episodic memory			
FCSRT immediate recall [correct answers: 0–16]	15.4 ± 0.9	15.3 ± 1.0	0.12
FCRST sum of free recall trials 1–3 [correct answers: 0–48]	32.0 ± 5.1	29.2 ± 6.3	<0.001
FCRST sum of total recall trials 1–3 [correct answers: 0-48]	46.2 ± 2.6	46.1 ± 3.6	0.50
FCRST free delay recall [correct answers: 0–16]	12.4 ± 2.1	11.7 ± 2.5	<0.001
FCRST total delay recall [correct answers: 0–16]	15.6 ± 0.8	15.6 ± 1.1	0.70
FCRST recognition score [correct answers: 0–16]	15.9 ± 0.5	15.9 ± 0.3	0.50

WAIS-III: Wechsler Adult Intelligence Scale, Third Edition; FCSRT: Free and Cued Selective Reminding Test.
[a] Paired-samples *t* test.

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single or not; and occupational status, based on the last job held before retirement, was classified according to previously published data [14]: no occupation; unskilled manual workers; operatives; sales, clerical staff and craftsmen; and professional, technical and managerial.

2.4.2. *Clinical measurements*

Clinical evaluation included lifestyle habits, such as smoking history and current alcohol consumption (moderate alcohol drinking was defined as ≤ 7 drinks/week for women and ≤ 14 drinks/week for men) [5]. Depressive symptomatology was measured using the Pichot 10-item self-questionnaire (QD2A), where a score > 7 is indicative of depressive symptoms [33], whereas anxiety was assessed using the 9-item Goldberg Anxiety and Depression Scale [34], where a score ≥ 5 is indicative of anxiety.

2.5. *Statistical analyses*

Our subjects' characteristics were summarized as means $\pm$ SD for continuous variables, and as frequencies and percentages for categorical variables. Also, differences between subgroups were considered as 'stable' vs 'worsened' for the whole population, and for each initial level in the CE and CN groups and, finally, as 'stable' for the CE, CN and CI groups. The 'improved' condition was excluded because of the number of subjects was too small. Based on the normality of distribution, a comparative analysis was conducted using parametric [t test and/or univariate analysis of variance (ANOVA)] or non-parametric (Mann-Whitney U or Kruskal-Wallis k) tests. Categorical variables were analyzed by chi-square tests. Multiple logistic regression models were used to assess the contributions of demographic or lifestyle factors on cognitive status. Means and 95% confidence intervals (CI) were calculated.

Two-tailed P values < 0.05 were considered statistically significant. Statistical analyses were done using SPSS version 17.0 software (SPSS Inc., Chicago, IL, USA).

3. Results

3.1. *Demographic and clinical data*

The 543 participants, aged 66.9 ± 0.9 years at the first assessment and 74.7 ± 0.9 at follow-up, were followed for 7.8 ± 0.9 years. A total of 58.7% were female and 31.1% lived alone. Mean education level was 11.1 ± 2.2 years and, before retirement, 16.5% had been unskilled manual workers, 36.9% were operatives, 30.9% were craftsmen and 11.5% had a managerial occupation. Overall, at follow-up, smoking and current alcohol consumption was found in 33.5% and 46% of subjects, respectively, and anxiety and depression in 34.4% and 5.3%, respectively.

3.2. *Lifestyle activities data*

At follow-up, HCI, PAI, IAI and SAI scores were 14.2 ± 1.2, 5.7 ± 1.2, 9.7 ± 2.3 and 7.6 ± 1.9, respectively. There were no gender differences, except that the PAI score was lower in

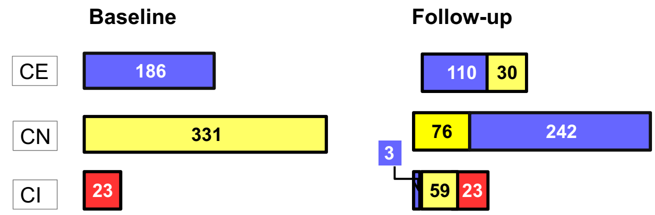

Fig. 2 – Classification of participants (n) into cognitively elite (CE), cognitively normal (CN) and cognitively impaired (CI) at baseline and at follow-up.

women ($P < 0.001$). Education level did not correlate with either HCI ($r = 0.03$, $P > 0.05$) or PAI ($r = 0.08$, $P > 0.05$), but was associated with SAI ($r = 0.18$, $P < 0.01$) and IAI ($r = 0.30$, $P < 0.01$). Occupational status was not associated with HCI ($P = 0.13$), PAI ($P = 0.25$) or SAI ($P = 0.07$), but did correlate with IAI ($P < 0.001$).

3.3. *Cognitive data*

MMSE scores did not vary from baseline to follow-up: 28.7 ± 1.5 and 28.4 ± 1.5, respectively. At baseline, the compound Z score for each domain was 0 ± 1. At follow-up, the mean $\pm$ SD of the attentional, executive and memory Z scores were -0.38 ± 0.82, -0.14 ± 0.75 and -0.18 ± 0.80, respectively. Over time, cognitive status remained stable in 375 subjects (69%), worsened in 138 (25.5%) and improved in 30 (5.5%; Fig. 2).

On the whole, there was a tendency towards a decrease in cognition ($P < 0.001$), with 76 of the 186 CE (41.2%) group dropping towards normal, and 59 of the 323 CN (18.3%) subjects falling towards the impaired level. The cognitive status decrease was generally by only one level, but the decreases more frequently involved the CE than CN group ($P < 0.001$, by chi-square). Only a small proportion of the CE group (0.5%) decreased abruptly to the impaired level.

3.4. *Cognitive and lifestyle activities data taken together*

3.4.1. *Stable vs worsened condition for all subjects*

Considering all subjects together, cognitive stability was associated with less smoking ($P = 0.04$) and higher SAI scores ($P = 0.01$; Table 2). After adjusting for demographic characteristics and HCI, the multiple logistic regression model indicated that cognitive stability was found in those participants engaged at a high level in social activities, and such participants were also 2.39 times more likely to remain stable rather than worsening [odds ratio (OR): 2.39, 95% CI: 1.26–4.52; $P = 0.007$], with smoking habits having no influence.

3.4.2. *Stable CE vs worsened CE*

Even when considering only those participants with the highest cognitive ability at baseline (Table 3), those who remained stable were more likely to have a history of smoking ($P = 0.02$) and a higher SAI at follow-up ($P < 0.001$). Multiple logistic regression analysis showed that stable CE subjects were 2.43 times more likely to be later engaged in a high level

Table 2 – Demographic, lifestyle and Quality of Life (QoL) questionnaire raw data for the total sample, and cognitively stable and cognitively worsened subgroups.

	Total sample *n* = 543)	Stable (*n* = 375)	Worsened (*n* = 138)	P[a]
Demographic data				
Age, years	74.7 ± 0.9	74.8 ± 0.8	74.7 ± 0.9	0.22
Women, %	58.7	59.7	55.2	0.67
Education level, years	11.1 ± 2.2	11.1 ± 2.8	11.4 ± 3.0	0.22
Marital status, single %	31.1	32.5	30.1	
Participants' occupations				
No occupation, %	4.2	4.5	3.5	
Unskilled manual workers, %	16.5	16.6	16.7	
Operatives, %	36.9	36.8	35.9	
Sales, clerical, craftsmen, %	30.9	30.8	32.5	
Professional, technical, managerial, %	11.5	11.3	11.4	0.32
Lifestyle and QoL data				
Smoking (%)	33.5	30.4	42.5	0.04
Alcohol consumption (%)	36	35.2	37.9	0.96
Health Care Score [0–19]	14.2 ± 1.7	14.2 ± 1.8	14.1 ± 1.5	0.53
Physical Activity Score [0–9]	5.7 ± 1.2	5.8 ± 1.9	5.5 ± 1.9	0.15
Intellectual Activity Score [0–14]	9.7 ± 2.3	9.7 ± 2.5	9.7 ± 1.2	0.83
Social Activity Score [0–19]	7.6 ± 1.9	7.7 ± 1.9	7.0 ± 1.9	0.01
Thymic measures				
Anxiety (%)	34.4	34.2	32.8	0.35
Depression (%)	5.3	4.8	6.7	0.25

Data are means ± SD or percentages.
[a] Stable vs worsened by Mann-Whitney or chi-square test.

Table 3 – Demographic, habitual lifestyle and Quality of Life (QoL) questionnaire raw data for the two Cognitively Elite (CE) subgroups at baseline according to their evolution.

	Stable CE (*n* = 110)	Worsened CE (*n* = 76)	P[a]
Demographic data			
Age at baseline, years	74.8 ± 1.0	74.7 ± 0.9	0.22
Gender, female %	64	41.7	0.40
Education level, years	11.5 ± 2.3	11.4 ± 2.7	0.80
Marital status, single %	32.3	33.2	0.85
Lifestyle and QoL data			
Alcohol consumption, %	29.6	37.3	0.21
History of smoking, %	27.4	43.2	0.02
Health Care Score [0–19]	14.5 ± 2.0	14.2 ± 1.6	0.07
Physical Activity Score [0–9]	5.9 ± 1.8	5.5 ± 1.8	0.10
Intellectual Activity Score [0–14]	10.6 ± 1.9	10.1 ± 2.3	0.13
Social Activity Score [0–19]	8.5 ± 1.9	7.4 ± 1.8	<0.001
Thymic measures			
Anxiety, %	30	35.6	0.21
Depression, %	5.4	2.7	0.49

Data are means ± SD or percentages.
[a] Between groups by Mann–Whitney or chi-square test, or ANOVA.

of social activities (OR: 2.43, 95% CI: 1.25–4.75; *P* = 0.009) compared with the CE who worsened, with a smaller contribution for not smoking (OR: 1.96, 95% CI: 1.05–4.75; P = 0.06).

3.4.3. *Stable CN vs worsened CN*

Considering the CN participants at baseline (Table 4), those who remained stable were less likely to have a history of smoking (*P* = 0.05), and had lower anxiety index scores (*P* = 0.04) and higher SAI scores (*P* = 0.04) than the CN whose status worsened at follow-up. Multiple logistic regression analysis indicated that stable CN elderly were 2.27 times more likely to be highly engaged in social activities (OR: 2.27, 95% CI: 1.11–4.67; *P* = 0.025) than the worsening CN group, with contributions from both smoking and anxiety (smoking OR: 1.24, 95% CI: 0.55–2.80; P = 0.17, and anxiety OR: 0.95, 95% CI: 0.42–2.17; P = 0.90).

3.4.4. *Demographic and lifestyle differences among all stable subjects*

Stable CE subjects had higher levels of education and HCI, SAI and IAI scores, and were less anxious and depressive than those in the stable CN and CI groups. Similar findings were found for the CN group, who had lower levels of social and intellectual activities compared with the CE group. The stable CI subjects had lower levels of education and HCI, SAI and

Table 4 – Demographic, lifestyle and Quality of Life (QoL) questionnaire raw data for the two Cognitively Normal (CN) subgroups at baseline according to their evolution.

	Stable CN (n = 242)	Worsened CN (n = 59)	P[a]
Demographic data			
Age at baseline (years)	74.8 ± 1.0	74.8 ± 0.9	0.62
Gender, female (%)	62.5	56.3	0.10
Education level (years)	11.1 ± 2.9	11.6 ± 3.6	0.16
Marital status, single (%)	33.3	32.1	0.35
Lifestyle and QoL data			
Alcohol consumption (%)	37.4	27.6	0.23
History of smoking (%)	31.2	41	0.04
Health Care Score [0–19]	14.2 ± 1.4	14.0 ± 1.4	0.63
Physical Activity Score [0–9]	5.8 ± 1.8	5.6 ± 2.1	0.77
Intellectual Activity Score [0–14]	9.4 ± 2.3	9.0 ± 2.7	0.15
Social Activity Score [0–19]	7.6 ± 1.9	6.8 ± 2.1	0.04
Thymic measures			
Anxiety (%)	35.6	51.2	0.05
Depression (%)	5.4	6.6	0.22

Data are means ± SD or percentages.
[a] Between groups by Mann–Whitney or chi-square test, or ANOVA.

Table 5 – Demographic, lifestyle and Quality of Life (QoL) questionnaire raw data for stable Cognitively Elite (CE), Cognitively Normal (CN) and Cognitively Impaired (CI) subgroups according to their profiles.

	Stable CE (n = 110)	Stable CN (n = 242)	Stable CI (n = 23)	P[a]
Demographic data				
Age, years	74.8 ± 1.0	74.7 ± 0.9	74.8 ± 0.9	0.22
Women, %	64	41.7	47.8	0.40
Education level, years	11.5 ± 2.3	11.1 ± 2.9	9.0 ± 2.8**	<0.001
Marital status, single %	31.3	33.2	30.5	0.32
Participants' occupations				
No occupation, %	5.4	3.8	4.3	
Unskilled manual workers, %	9.1	18.2	21.7	
Operatives, %	39	37	21.7	
Sales, clerical, craftsmen, %	32.7	30	30.4	
Professional, technical, managerial, %	13.6	11	8.6	0.32
Lifestyle and QoL data				
History of smoking (%)	27.4	31.2	34.7	0.68
Alcohol consumption (%)	29.6	37.3	36.8	0.96
Health Care Score [0–19]	14.5 ± 2.0	14.1 ± 2.7	13.2 ± 2.0**	0.01
Physical Activity Score [0–9]	5.9 ± 1.8	5.8 ± 1.8	5.4 ± 2.9	0.75
Intellectual Activity Score [0–14]	10.6 ± 1.9	9.4 ± 2.3***	8.0 ± 1.8***	<0.001
Social Activity Score [0–19]	8.4 ± 1.9	7.5 ± 1.9***	6.1 ± 2.1***	<0.001
Thymic measures				
Anxiety (%)	30	35.6	46.5	0.05
Depression (%)	5.4	2.7	26	0.001

Data are means ± SD or percentages *$P < 0.05$. CE: cognitively elite; CN: cognitively normal; CI: cognitively impaired; QoL: quality of life questionnaire.
[a] Between groups by Kruskal-Wallis or chi-square test, or ANOVA
** $P < 0.01$
*** $P < 0.001$, post-hoc test with stable CE as reference, Bonferroni or Tamhane test for equality of variances (whether assumed or not).

IAI scores, and were more anxious and depressive than the stable CN and CE subjects (Table 5). Multiple logistic regression models of the three stable cognitive groups revealed that, for the CE, high levels of social ($P = 0.007$) and intellectual ($P = 0.017$) activities played key roles, with no contribution of demographic data. The stable CI group was characterized by low education levels ($P = 0.004$), the presence of depression ($P = 0.0006$) and reduced levels of social activity ($P = 0.025$).

4. Discussion

Our main finding was that 70% of an elderly cohort homogeneous in age remained cognitively stable for 8 years after their 67th birthday, regardless of their *baseline cognitive status*. In those whose cognitive status decreased, the reduction was most frequently limited to one level: 40.2% of the elite group declined into the normal group, while 17.8% of the normal subjects declined to the impaired level. Our results also underline the strong correlation between cognitive function stability and staying socially engaged at the time of later evaluation. Moreover, the one-step decline in the CE and CN subjects extended the time to reach an impaired level of cognitive function, highlighting the importance of the so-called cognitive reserve.

Despite our study sample having an overall lower level of education compared with those examined in previous studies [3,6,14,17,21,22], around 70% of our study participants achieved successful cognitive aging. Indeed, the prevalence of cognitive stability in our subjects was similar to that of another study, which found stability in 73% of 570 subjects aged 68 years. This cohort, however, was less homogeneous in age than our present cohort, and their follow-up was limited to only 3 years [21].

Whether baseline cognitive function contributes or not to greater participation in social activities is still a matter of debate. The higher levels of social and intellectual activity in our CE group suggest that having greater cognitive function may contribute to the decision to participate in social activities.

However, the fact that the degree of social engagement might be influenced by a general mid-life association cannot be totally excluded [16,17]. In addition, our present study has established that participation in social activities was greater in older individuals with higher baseline cognition, and that the changes in cognition over time also appear to be associated with social activities later in life. However, regardless of the initial cognitive status, the stability of cognitive ability was associated with a high level of social activities compared with levels in those who declined. Thus, our data suggest that cognitive stability, a sign of successful aging, may be dependent on the interplay between individual cognitive reserve and a socially engaged lifestyle.

Thus, in agreement with previous studies [35,36], our present study has found that, even though education level may affect baseline cognitive status, changes over time may not be affected only by this parameter, but also by the degree of social engagement in spite of advancing age.

These findings support the dynamic cognitive-reserve hypothesis, in which cognitive stability during aging depends more on maintaining lifestyle activities and social interactions throughout life rather than on a higher level of education [3,37–39].

The major strength of our study lies in the fact that our participants were recruited from a healthy community-dwelling population extracted from an electoral list, and all were the same in terms of age (67 years) and education (11 years) at the time of enrollment [20]. Also, to assess their individual cognitive differences at baseline, a published method [21] was applied that allowed stratification of baseline cognitive levels into elite, normal or impaired groups, thereby standardizing changes over time to better assess whether subjects had achieved *successful cognitive* aging. Using such a method in epidemiological settings may help to better classify the degree of cognitive change.

One study limitation may lie in the fact that our examined community-based population was one in which strict inclusion criteria had been applied, which may have resulted in differences from the general population. However, the representativeness of our cohort was analyzed at the time of inclusion, and was considered representative of the French population [20,23]. More importantly, the questionnaire was used only at follow-up, and it has already been shown that the average 60-year-old subjects do not significantly change their activity habits over the subsequent 8 years [16].

Overall, in healthy elderly subjects, a high prevalence of cognitive stability was found, with only moderate cognitive changes at the 8-year longitudinal assessment. While individual baseline cognitive levels may influence successful cognitive aging, the stability of cognitive function was significantly associated to the degree of engagement in social activities in later life.

Disclosure of interest

The authors declare that they have no competing interest.

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