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## Original Study

# Cognitive Decline After Entering a Nursing Home: A 22-Year Follow-Up Study of Institutionalized and Noninstitutionalized Elderly People



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## A B S T R A C T

## Keywords:

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**Objective:** The objective of this study is to compare cognitive decline of elderly people after entering an institution with that of elders living in the community with similar clinical conditions.

**Design:** The Personnes Agées QUID (PAQUID) cohort is a prospective population-based study which included, at baseline, 3777 community-dwelling people aged 65 years and older. Participants were followed-up for 22 years. Among those who were nondemented and living at home at baseline, 2 groups were compared: participants who entered a nursing home during study follow-up ( $n = 558$ ) and those who remained living at home ( $n = 3117$ ). Cognitive decline was assessed with Mini-Mental State Examination (MMSE), Benton visual retention test, and verbal fluency Isaacs Set Test.

**Results:** After controlling for numerous potential confounders, including baseline MMSE and instrumental activities of daily living scores, incident dementia, depressive symptoms, and chronic diseases, nursing home placement was significantly associated with a lower score on MMSE between the last visit before and after institutionalization (difference of 2.8 points,  $P < .0001$ ) and greater further cognitive decline after institutionalization (difference of 0.7 point per year,  $P < .0001$ ). Similar results were found for the Benton memory test. In a second series of analysis in which the persons who became demented over the study follow-up were excluded, the results remained unchanged.

**Conclusions:** The present study suggests that institutionalized elderly people present a greater cognitive decline than persons remaining in the community. The reasons of that decline remain unclear and may be related to physical and psychological effects of institutionalization in elderly people.

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Changes in societal and family models generate new debates in scientific but also medical areas because of their broad implications in disease management. The debate about what to do with our elders is a part of this relevant discussion and a core part of health policies in developed countries. Each country has developed its own solutions for the needs of elderly people according to socioeconomic model and resources. All of them target the integral care of the elders who cannot live independently, almost always because of the need of special medical and nursing care. Indeed, several studies have shown that the major predictors of institutionalization are to be dependent

in 3 or more basic activities of daily living (ADL) or to have cognitive impairment,<sup>1–3</sup> but also to lack economic resources or a family environment able to cope with the patient.

Residential care has considerably evolved these last decades.<sup>4</sup> Nowadays, nursing homes are comprehensive geriatric centers where innovative strategies to promote physical autonomy and cognitive stimulation, as well as internal social interactions among residents, families, and caregivers, are regularly implemented in an effort to make the residential life as comfortable and adequate as possible. The benefits are obvious for dependent elderly who cannot remain at home. However, for those who do not present cognitive impairment or major functional restrictions, negative consequences on cognitive functioning or quality of life can be expected due to the drastic and particularly abrupt change in psychosocial environment experienced when moving to a nursing home, which is known as “transfer trauma” or “relocation stress syndrome.”<sup>5,6</sup>

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Surprisingly, very few studies have objectively measured the potential effects of institutionalization on cognitive functioning. Among them, in a cross-sectional study, Winocur and Moscovitch<sup>7</sup> compared normal elders living in institutions and elders living in the community on a series of cognitive tests. They found that institutionalized people performed worse than their matched noninstitutionalized counterparts. The differences observed were not due to age, intelligence quotient level, health, or other controlled variables. It was suggested that cognitive function in the institutionalized elderly might be influenced by other factors and, possibly, by their capacities to adjust to the demands of institutional life.<sup>8</sup> The study by Scocco et al.<sup>9</sup> conducted a case series of 100 patients who were recently admitted to a nursing home and compared several health outcomes just after admission and 6 months later. They showed that the clinical condition of the residents after 6 months, in particular the females, had significantly worsened with a decrease in Mini-Mental State Examination (MMSE) score,<sup>10</sup> ADL score, and quality of life. The mortality rate was 33%.

In another cohort study of 432 patients suffering from Alzheimer's disease, Wilson et al.<sup>11</sup> showed that nursing home placement is associated with accelerated short-term cognitive decline. This finding could suggest that the transition from the community to a nursing home is cognitively deleterious especially for patients with Alzheimer's disease. Moreover, in an interesting review by Volkers and Scherder,<sup>12</sup> the authors found that cognitive performances worsened when people moved into an institution because of the environment.

As may be seen, little is known about how institutionalization induces cognitive changes in the elderly without apparent memory impairment when entering a nursing home. The purpose of this study is to compare cognitive decline in patients moving from a community to an institution with noninstitutionalized counterparts with comparable clinical conditions. The analysis was conducted in the *Personnes Agées QUID* (PAQUID) cohort, a prospective population-based study that followed participants for 22 years.

## Methods

### General Study Design

The data was gathered from the PAQUID cohort, a prospective population-based study; the methodology has been described elsewhere.<sup>13</sup> Briefly, the study has included at baseline 3777 community-dwelling people aged 65 and older, in 2 areas of the southwest of France. The study has received the approval of the Ethics Committee of the Bordeaux University Hospital, and all participants gave their written informed consent to participate in this study. Standard questionnaires and cognitive tests were administered by trained psychologists who interviewed participants at home at baseline visit and after 1, 3, 5, 8, 10, 13, 15, 17, 20, and 22 years. The information collected related to sociodemographic characteristics, functional status in instrumental activities of daily living (Lawton IADL scale),<sup>14</sup> depressive symptoms (Center for Epidemiologic Studies Depression [CES-D] scale),<sup>15</sup> subjective and objective physical health, and self-reported medication consumption and diseases. Three tests were used to evaluate cognitive status: MMSE<sup>10</sup> for global cognitive functioning, the multiple choice recognition form of the Benton Visual Retention Test (BVRT)<sup>16</sup> assessing visual memory (scores range from 0 to 15), and the Isaacs Set Test (IST)<sup>17</sup> assessing verbal fluency consisting in generating lists of words in 4 semantic categories (colors, animals, fruits, and cities) in a 15-second interval (scores range from 0 to 40). Participants who entered a nursing home remained in the study. They were visited and were administered questionnaires and cognitive tests. After the interview, the psychologists completed a standardized questionnaire designed to assign the Diagnostic and

Statistical Manual of Mental Disorders-3rd edition-Revised criteria for dementia.<sup>18</sup> Individuals who met these criteria were seen by a neurologist or a geriatrician who confirmed or rejected the diagnosis. The diagnosis was reviewed by a panel of specialized neurologists who applied the following criteria for each etiological category: National Institute of Neurological and Communicative Disorders and Stroke and Alzheimer's Disease and Related Disorders Association (NINCDS-ADRDA) criteria for Alzheimer's disease, National Institute of Neurological Disorders and Stroke and Association Internationale pour la Recherche et l'Enseignement en Neurosciences (NINDS-AIREN) criteria for vascular dementia, standardized clinical criteria for frontotemporal dementia, Lewy body disease, and a history of Parkinson's disease for Parkinson dementia.

### Sample Selection

Participants who were demented at the baseline visit were excluded from the study. Among those who were nondemented (and living at home) at baseline, 2 groups were compared: participants who entered a nursing home during study follow-up and those who were living at home.

### Statistical Analysis

The  $\chi^2$  and *t* tests were used for demographic and neuropsychological variables at baseline comparisons between the 2 groups. Linear mixed-effects regression models<sup>19</sup> were used to assess the effect of institutionalization on tests scores and further cognitive decline over the 22-year follow-up period. The mixed model procedure accounts for the correlations that are due to the repeated measurements of cognitive scores over time within the same subject. In our implementation of the mixed model, the intercept and the slope regression coefficient for the follow-up time (visit) were treated as random effects. Our model controlled the potentially confounding effects of the following variables: baseline MMSE score, age, sex, educational level, comorbidities (high blood pressure, diabetes, stroke, angor, dyspnea), dementia, depressive symptoms, and dependency in IADL. Institutionalization was taken as a time-dependent variable. The effect of institutionalization on cognitive functioning was measured by 2 components. One element describes the acute effect on tests scores between the last visit before and after the change point (ie, the time of institutionalization). It is modeled by an indicator variable that equals one for all follow-up observations after a participant was placed into a nursing home and zero otherwise. The other element designates the effect of nursing home placement on change in test scores. It is modeled by terms for time since placement for each follow-up observation after a participant was placed into a nursing home and zero otherwise. This procedure consisting in analyzing nursing home placement as a time-dependent variable allows reducing the bias of causality between cognitive decline and nursing home placement.

To ensure that the results could not be explained by different rates of dementia incidence in the group of institutionalized and noninstitutionalized participants, we computed a second analysis excluding all the participants who became demented over the study follow-up. This analysis relied on the same statistical model (ie, a linear mixed-effects regression model assessing the effect of nursing home placement analyzed as a time-dependent variable on test scores and cognitive decline controlling for baseline MMSE score, age, sex, educational level, comorbidities, depressive symptoms, and dependency in IADL). Statistical significance was set at *P* = .05. All analyses were conducted using PROC MIXED of SAS (v. 9.3) software (SAS Institute Inc., Cary, NC).

## Results

### Participants

Among the 3777 participants at baseline, we excluded persons with a diagnosis of dementia at the baseline visit of the PAQUID study ( $n = 102$ ). The study population consisted of 3675 participants. Of these, 558 entered a nursing home during the 22-year period of study follow-up. The proportion of institutionalized population increases with aging, reaching rates of almost 24% at the last visit (Table 1). For modeling cognitive decline after institutionalization, at least 1 follow-up visit after entering nursing home was required. Therefore, 274 (48%) participants contributed to model cognitive decline after their institutionalization.

Table 2 displays the baseline differences between the noninstitutionalized and the future-institutionalized groups. In comparison with those living at home, participants who will enter nursing homes were significantly older ( $P = .0002$ ) and had a lower level of education ( $P = .0128$ ). In the same vein, community-dwelling participants were less depressed ( $P = .0003$ ), less dependent for IADL ( $P = .0332$ ), and had a higher MMSE score ( $P = .0130$ ) than institutionalized persons. There were no differences between the 2 subgroups regarding comorbidities ( $P = .7539$ ).

### Effects of Institutionalization on Cognitive Decline

Three cognitive tests were considered to examine the effect of nursing home placement on cognitive decline: MMSE, BVRT, and IST. Table 3 shows results for each cognitive test. Nursing home placement was significantly associated with an estimated drop on the MMSE score of 2.8 points ( $P < .0001$ ) between the last visit before and the first visit after the placement, and greater further cognitive decline after institutionalization (a difference of 0.2 point per year,  $P < .0001$ ). Regarding the IST, nursing home placement was associated with an estimated drop between the last visit before and the first one after the placement of 2.8 points ( $P < .0001$ ) but not with further decline. For the BVRT, nursing home placement was significantly associated with an estimated drop of 0.7 points between the last visit before and after the placement ( $P = .0003$ ) and greater further decline (difference of 0.15 point per year,  $P = .0197$ ). Figure 1 shows the predicted change in MMSE score for 2 representative participants (one entering a nursing home at 70 years old and one remaining in the community).

The second analysis was computed to minimize a possible reverse causality effect. It consisted of re-running the same statistical model, but this time, excluding persons who became demented during the study follow-up ( $n = 862$ ). The results remained roughly unchanged

**Table 1**  
Number of Institutionalized Participants at Each Follow-up Visit of the PAQUID Study

| Follow-up | Participants Interviewed at Visit | Participants Institutionalized at Visit | %    |
|-----------|-----------------------------------|-----------------------------------------|------|
| T0        | 3777                              | 0                                       | 0.0  |
| T1        | 1813                              | 8                                       | 0.4  |
| T3        | 2277                              | 78                                      | 3.3  |
| T5        | 2061                              | 108                                     | 5.2  |
| T8        | 1561                              | 104                                     | 6.7  |
| T10       | 1455                              | 137                                     | 9.4  |
| T13       | 1037                              | 126                                     | 12.2 |
| T15       | 831                               | 111                                     | 13.4 |
| T17       | 682                               | 125                                     | 18.4 |
| T20       | 505                               | 96                                      | 19.0 |
| T22       | 364                               | 87                                      | 23.9 |

PAQUID, Personnes Agées QUID.

**Table 2**

Baseline Characteristics of the Future-Institutionalized and Noninstitutionalized Participants

| Variable                       | Future-Institutionalized Participants ( $n = 558$ ) | Noninstitutionalized Participants ( $n = 3117$ ) | P Value (2-way)* |
|--------------------------------|-----------------------------------------------------|--------------------------------------------------|------------------|
| Age (years): mean (SD)         | 76.0 (6.6)                                          | 74.8 (6.6)                                       | .0002            |
| Sex (women): n (%)             | 436 (78.1%)                                         | 1697 (54.4%)                                     | <.0001           |
| Education: n (%)               |                                                     |                                                  | .0128            |
| No formal education            | 220 (39.4%)                                         | 1059 (34.0%)                                     |                  |
| School certificate or higher   | 338 (60.6%)                                         | 2058 (66.0%)                                     |                  |
| Depressive symptoms: n (%)     | 100 (18.3%)                                         | 383 (12.6%)                                      | .0003            |
| Baseline MMSE score: mean (SD) | 25.5 (3.4)                                          | 25.9 (3.4)                                       | .0130            |
| Comorbidities n (%)            | 230 (41.7%)                                         | 1313 (42.4%)                                     | .7539            |
| IADL dependency n (%)          | 181 (32.5%)                                         | 873 (28.0%)                                      | .0332            |

IADL, instrumental activities of daily living; MMSE, Mini-Mental State Examination; SD, standard deviation.

\*Probability values are determined using the  $\chi^2$  test or by  $t$  test as appropriate.

(Table 3). The association between institutionalization and cognitive scores was statistically significant both for MMSE ( $P = .0038$ ) and IST ( $P = .0034$ ). Nursing home placement was also significantly associated with greater decline both on MMSE ( $P = .0118$ ) and BVRT ( $P = .0290$ ).

## Discussion

Taking advantage of the population-based design of the PAQUID cohort in which elderly participants, living at home or in nursing homes, are followed-up along a particularly long follow-up period reaching 22 years, this study raised important results regarding cognitive decline of elderly people living in residential/nursing homes. We found that elderly participants who entered nursing homes exhibited a greater cognitive decline after their admission than those who remained at home. After controlling for numerous potential confounders, greater cognitive decline was observed in MMSE but also in a more specific test of visual memory. The main question is if it would be possible to establish a direct link between institution and further cognitive decline. Obviously, it is very difficult to address a causal relationship because cognitive decline depends on several factors and could not be attributed to a single one. Therefore, some biases could contribute to the statistically significant decline in cognitive performances evidenced in this study.

The main potential bias is the reverse causality effect. As it is well established, having a mild cognitive impairment is a strong risk factor for institutionalization.<sup>20</sup> Therefore, the greater cognitive decline evidenced in institutionalized elderly could be explained by the fact that those who entered nursing homes already presented cognitive impairment, and therefore, were more prone to decline. However, 2 characteristics of our study design should be highlighted. First, in addition to conventional confounders such as age, sex, and education, statistical analyses have controlled for baseline MMSE and IADL scores, incident dementia, depressive symptoms as well as chronic diseases. Second, the second statistical analysis in which the participants who developed dementia during the follow-up were excluded provided that the results were unchanged. Therefore, even though we cannot definitively rule out that those who entered institutions had significantly worse health-related outcomes, the methodological design we used should have minimized such differences, making the 2 compared groups of institutionalized and noninstitutionalized participants as homogeneous as possible.

**Table 3**

Relation Between Institutionalization, Cognitive Scores, and Change in Cognitive Scores Over the 22 Years of the PAQUID Study Follow-Up

| Test         | Variables            | Total Sample<br>N = 3675 |       |         | After Exclusion of Future Demented Participants<br>N = 2813 |       |         |
|--------------|----------------------|--------------------------|-------|---------|-------------------------------------------------------------|-------|---------|
|              |                      | Estimate*                | SE    | P Value | Estimate*                                                   | SE    | P Value |
| MMSE         | Time                 | −0.020                   | 0.006 | <.0001  | −0.008                                                      | 0.005 | .1147   |
|              | Institutionalization | −2.820                   | 0.137 | <.0001  | −0.480                                                      | 0.166 | .0038   |
|              | Institution time     | −0.218                   | 0.044 | <.0001  | −0.131                                                      | 0.052 | .0118   |
| IST (15 sec) | Time                 | −0.267                   | 0.015 | <.0001  | −0.250                                                      | 0.016 | <.0001  |
|              | Institutionalization | −2.794                   | 0.333 | <.0001  | −1.480                                                      | 0.506 | .0034   |
|              | Institution time     | −0.025                   | 0.104 | .8117   | −0.160                                                      | 0.156 | .3063   |
| Benton test  | Time                 | −0.023                   | 0.006 | .0004   | −0.012                                                      | 0.007 | .0734   |
|              | Institutionalization | −0.691                   | 0.192 | .0003   | −0.170                                                      | 0.254 | .5041   |
|              | Institution time     | −0.147                   | 0.063 | .0197   | −0.180                                                      | 0.082 | .0290   |

IST, Isaacs Set Test; MMSE, Mini-Mental State Examination; PAQUID, Personnes Agées QUID; SE, standard error.

\*Estimated from mixed effects models adjusted for age, gender, educational level, MMSE score at baseline visit of the PAQUID study, comorbidities, dementia, depressive symptoms, and dependency for IADL.

Regarding age, in the present study, institutionalized participants were slightly older than community-dwelling ones, a difference that could have influenced the rate of cognitive decline. However, age was controlled for in statistical analysis. In addition, in a recent study by Ravona et al<sup>21</sup> conducted in 687 residents including 353 non-demented elderly, the authors showed that there was no significant association between chronological age of residents and the rate of cognitive decline.

The difference in cognitive decline could not be neither explained by the sudden decline of cognitive performances immediately before or after institutionalization because our statistical model included 2 components: a term taking into account the acute effect on tests scores between the last visit before and the first visit after the change point because we did not have cognitive scores at the exact moment of institutionalization and a term considering the average decline in cognitive tests after institutionalization. Therefore, the statistical model allows comparing cognitive decline all during study follow-up taking into account tests scores measured after institutionalization.

Several reasons can explain the greater cognitive decline exhibited by elderly people living in institutions. It is well established that institutionalization can induce negative physical and psychological effects on patients.<sup>22</sup> This phenomenon, known as “relocation stress” or “transfer trauma,” is very heterogeneous according to patients. It depends on a lot of factors related to the patient him/herself (his/her vision of being institutionalized, personality, degree of capacity to cope with new situations...), the characteristics of the placement (the hurry of the institutionalization, the information provided to the

patient, capacity to decide about his/her own placement) and, of course, the reasons that have determined the placement, specially social and family environment. One of the most important consequences of such experience is helplessness and depressive symptoms, affecting 30% to 40% of nursing home residents.<sup>23</sup> A study showed that more than one-half of residents did not feel at home in long-term care after 2 to 7 years.<sup>24</sup>

In an institution, sedentary lifestyle is the norm because of environmental factors (lack of space which is not adapted for exercise in elderly people) but also probably because of the lack of awareness for the necessity and benefits of making adapting physical exercise in older ages. In fact, institutions promote physical recovery programs for patients with special needs, such as stroke or hip fracture. Physical training for healthy people is more limited and not always adapted in intensity or time requirements to be useful in elderly people, even if benefits of physical adapted exercise regarding cognitive health are demonstrated.<sup>25</sup> The strongest effects on cognitive functions, especially executive functions, were reported in a meta-analysis for combined aerobic exercise and strength training.<sup>26</sup> On the other hand, the decrease in duration or intensity of physical activity results in a stronger cognitive decline than maintaining previous activity,<sup>27</sup> but in residence facilities, the possibility of walking is reduced, and it is not common to find specially adapted machines safe for physical training. Moreover, as people tend to be less physically active and tend to participate in less intense forms of activities, the cognitive changes predicted by physical activity might become more pronounced over the years.<sup>28</sup> In the same vein, it has been shown that the time spent in bed at a nursing home is too long and not always justified by the real needs of the resident.<sup>29</sup>

Another possible source of cognitive decline in institution may be the lack of cognitively stimulating activities. Cognitive inactivity has been associated with reduced performances,<sup>26,30</sup> whereas persons with cognitively stimulating occupations maintain higher cognitive functioning with aging.<sup>31–34</sup> Even though activities such as playing cards or watching television are very common in nursing homes, several studies showed that such leisure activities<sup>35–37</sup> are not sufficient to maintain cognitive health.

Finally, numerous studies have shown that social integration, family engagements, and participation in social activities provide protective effects on cognition in elderly people,<sup>38,39</sup> whereas reduction of social and family network is a frequent phenomenon in nursing homes.<sup>40</sup>

## Conclusions

Despite limitations that may not allow drawing definitive conclusions, the present results suggest that institutionalized elderly

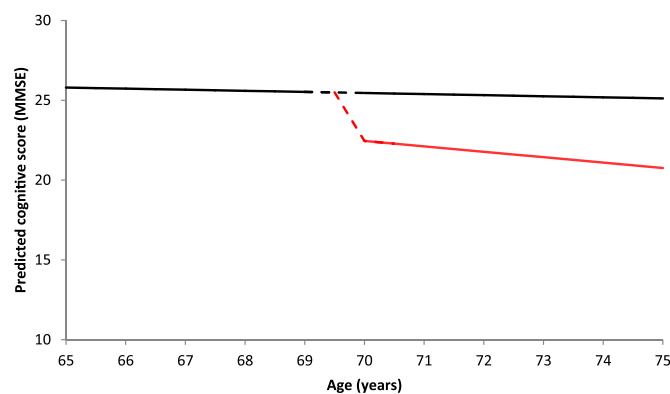


**Figure 1.** Predicted change in MMSE score for a participant placed in a nursing home at 70 years old (red line)<sup>1</sup> and a participant living in the community (black line)<sup>1</sup>.

<sup>1</sup>The dashed line represents the time between the last visit before and the first visit after the placement. Please see the online version of this article for this figure in color.

people present a greater cognitive decline than individuals remaining in community. Our study has the advantage of relying on a population-based design in which institutionalized and noninstitutionalized elderly participants are followed for a particularly long follow-up period of 22 years. It also has the advantage to rely on data collected in elderly living in various establishments devoted to continuous care avoiding the bias of generalizing results from a single nursing home. The reasons for that decline are not clear and opens a door to perform clinical research in residential homes, which is largely neglected at this time. Paying more attention to factors such as physical activities, cognitively stimulating activities, and social relationships should be seriously considered to contribute to lessening of cognitive decline when entering nursing homes.

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