

## RESEARCH ARTICLE

# Correlates of institutionalization among the oldest old—Evidence from the multicenter AgeCoDe-AgeQualiDe study

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## Abstract

**Objectives:** There is a lack of studies identifying the correlates of institutionalization specifically among the oldest old. Therefore, our aim was to fill this gap in knowledge.

**Methods:** Cross-sectional data (Follow up wave 9;  $n = 633$  observations in the analytical sample) were used from the multicenter prospective cohort study “Needs, health service use, costs and health-related quality of life in a large sample of oldest-old primary care patients (85+)” Correlates of institutionalization among the oldest old—Evidence from a multicenter cohort study. The sample consists of primary care patients aged 86 years and over (mean 90.5 years, SD: 2.9 years). Sociodemographic and health-related independent variables were included in our regression model. Institutionalization was defined as living in a nursing home or an old-age home (not including assisted living facilities).

**Results:** Out of the 633 participants, 502 individuals (79.3%) did not live in an institutionalized setting, whereas 73 individuals (20.7%) lived in an institutionalized setting. Multiple logistic regressions showed that the likelihood of institutionalization increased with being divorced/widowed/single (compared to being married; OR: 5.35 [95% CI: 1.75–16.36]), the presence of social isolation (OR: 2.07 [1.20–3.59]), more depressive symptoms (OR: 1.11 [1.01–1.23]), increased cognitive impairment (OR: 1.67 [1.31–2.15]) and higher levels of frailty (OR: 1.48 [1.07–2.06]).

**Conclusion:** The study findings identified various sociodemographic and health-related factors associated with institutionalization among the oldest old. Longitudinal studies are required to gain further insights into these associations.

André Hajek and Melanie Luppá contributed equally to this work. Moreover, Steffi G. Riedel-Heller, and Hans-Helmut König contributed equally to this work.

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#### KEYWORDS

dementia, depression, frailty, institutionalization, nursing home, old age home, oldest old, social exclusion, social isolation

#### Key Points

- Based on a large multicenter prospective cohort study, the aim was to examine the correlates of institutionalization among the oldest age group
- Institutionalization was associated with being divorced/widowed/single, social isolation, more depressive symptoms, increased cognitive impairment and frailty
- Study findings identified various sociodemographic and health-related factors associated with institutionalization among the oldest old
- The implementation of flexible, tailored interventions addressing the specific circumstances of the caregiving situation to delay a transition or assure a well-timed and well-organized transition is required

## 1 | INTRODUCTION

In Germany, the number of nursing home (NH) residents in the oldest age groups almost doubled since 1999.<sup>1</sup> Twenty-nine per cent of individuals aged 85 to 89 years, and 40% of individuals aged 90 years and older were cared for in NHs, even though, most elderly people prefer to continue living in their own homes maintaining their familiar environment keeping their social relations and living habits, instead of threat of loss of autonomy and independence through institutionalization.<sup>2</sup>

In the international literature, determinants of institutionalization were investigated frequently. In the past decade, research was summarized by a number of systematic reviews focusing on determinants of the elderly population in general,<sup>3</sup> of elderly individuals with dementia,<sup>4,5</sup> on frailty as predictor of NH placement (NHP),<sup>6</sup> as well as by an umbrella review on potentially modifiable risk factors of NHP.<sup>7</sup> Key findings showed transition to a NH is mainly based on cognitive and/or functional impairment, a poor health status, a lack of social support, a higher caregivers distress or poor health status. Partly inconsistent findings were reported for gender, education, income as well as depression.<sup>3</sup>

Since the highest number of admissions can be found in the oldest age groups, factors associated with admission to a NH in this population should come stronger to the fore in research. However, so far, only one German study referred to age-specific factors of institutionalization<sup>8</sup> reporting being widowed as well as subjective cognitive impairment as predictors of NHP for the adults aged 82 years and older, while cognitive and functional impairment were the most relevant predictors for the younger age group of adults aged 75 to 81 years. The authors state that inconsistent results of risk factors of NHP in the international literature may be attributed to the lack of differentiation in different age groups. Therefore, the present study aims to examine correlates of institutionalization among the oldest age group (85+ years) of a large German primary care sample to provide information on this important but less investigated age group linked to NHP.

## 2 | MATERIALS AND METHODS

### 2.1 | Sample

For our present study, data (follow-up [FU] wave 9 [year 2016/2017]) were used from the study on "needs, health service use, costs and health-related quality of life in a large sample of oldest-old primary care patients (85+)" (AgeQualiDe). We focused on this last wave to concentrate on very old individuals (mean age above 90 years, please see the "sample characteristics" section for further details). The AgeQualiDe study includes primary care patients  $\geq 85$  years at FU wave 7 (year 2014/2015). This study is an extension and continuation of the "German Study on Ageing, Cognition and Dementia in Primary Care Patients" (AgeCoDe). The AgeQualiDe study took place in six German cities (Bonn, Düsseldorf, Hamburg, Leipzig, Mannheim and Munich). Initially, the participants involved in the AgeCoDe study were recruited by means of general practitioners' (GP) offices. Inclusion criteria (baseline; year 2003/2004) were:  $\geq 75$  years, free of dementia,  $\geq 1$  contact with a GP in the preceding 12 months. If one or more of the following conditions was present, individuals were excluded: poor German language skills, GP consultation by home visits only, residence in a NH, severe illness the GP would deem fatal within 3 months, deafness, blindness, lack of ability to provide informed consent, and being an irregular patient of the participating practice. In total, 3327 individuals were included in the baseline assessment of the AgeCoDe study. Refusal and death were main reasons for drop off. Further details are given elsewhere.<sup>9</sup> Moreover, a drop-out analysis was performed (please see the results section).

In WU wave 7, 868 individuals took part (response rate: 90.1%). In FU wave 9, 639 individuals were included in total. Due to a few missing values, 633 individuals were included in our analytical sample. It should be noted that 396 interviews with relatives were performed.

Prior to participation, written informed consent was given by the individuals. The AgeCoDe and the AgeQualiDe-study have been

approved by the ethics committees of all participating study centers and comply with the ethical standards of the Declaration of Helsinki.

## 2.2 | Outcome measure: institutionalization

Institutionalization was defined as currently living in a NH or an old age home. Proxy interviews were conducted with relatives when an individual died before FU wave 9. The last residence prior to death was recorded in these interviews.

## 2.3 | Independent variables

As independent variables, we included age, sex, marital status (married; single; divorced; widowed), the level of education (based on the Comparative Analysis of Social Mobility in Industrial Nations [CASMIN]<sup>10</sup> classification, distinguishing between: low, medium and high education) and social support. To assess social support, the Lubben Social Network Scale (LSNS)<sup>11</sup> (6-item version), which was specifically developed for individuals in old age, was used. The final score ranges from 0 to 30 (which corresponds to high social support/social network). Based on previous recommendations,<sup>11</sup> it was dichotomized (presence of social isolation if LSNS-6 < 12; absence of social isolation otherwise). The LSNS-6 has good psychometric characteristics.<sup>11</sup>

Moreover, we included the Global Deterioration Scale<sup>12</sup> to assess cognitive impairment. This scale ranges from 1 to 7, with higher values reflecting more severe cognitive impairment. Furthermore, frailty was included in our regression model. It was measured using the Canadian Study of Health and Aging (CSHA) Clinical Frailty Scale (CFS),<sup>13</sup> ranging from 1 = very fit to 7 = severely frail.

The Geriatric Depression Scale (15-item version)<sup>14</sup> was used to assess depressive symptoms, ranging from 0 to 15 (with higher values corresponding to more severe depressive symptoms). The Geriatric Depression Scale (15-item version) is widely used and has good psychometric properties.<sup>15,16</sup> Furthermore, self-rated visual and hearing impairment (if required, with optical aid) were included in our regression model. Both scales were quantified on a four-point Likert scale (none; mild; severe; profound). We collapsed the last two categories (severe; profound) into one category (severe/profound) due to the low number of cases recorded in the highest category.

In sensitivity analysis, depressive symptoms were added as an explanatory variable since the Geriatric Depression Scale was solely assessed when the Mini Mental State Exam (MMSE) was  $\geq 19$ . In further sensitivity analysis, the Global Deterioration Scale was replaced by the MMSE<sup>17</sup> to check the robustness of our results (ranging from 0 to 30; with higher values indicating less cognitive impairment). Furthermore, in another sensitivity analysis, the number of chronic conditions (based on a list of 35 chronic conditions like chronic obstructive pulmonary disease (COPD) or Parkinson's disease) was added to our regression model. The presence of these chronic conditions were recorded by the GPs and a sum score

covering the number of chronic conditions was created. Since the GP-questionnaire was only filled out in 587 cases (e.g., because the GPs already retired), the number of chronic conditions was only used in sensitivity analysis.

## 2.4 | Statistical analysis

First, sample characteristics for our analytical sample were displayed stratified by institutionalization (no; yes). Chi-squared or independent t-tests were used, as appropriate. Subsequently, multiple logistic regressions were used to identify the correlates of institutionalization. The statistical significance was defined as  $p$  value of  $\leq 0.05$ . Statistical analyses were performed using Stata 16.0 (Stata Corp., College Station, Texas).

## 3 | RESULTS

### 3.1 | Sample characteristics

Sample characteristics for our analytical sample at FU wave 9 are displayed in Table 1. In the total sample, the mean age equaled 90.5 years (SD: 2.9 years; 86 to 101 years). In sum, 69.8% of the participants were female and most of the participants had a low level of education (56.6%). Out of the 633 participants, 502 individuals (79.3%) did not live in an institutionalized setting, whereas 73 individuals (20.7%) lived in an institutionalized setting.

Among the non-institutionalized individuals, 438 individuals (87.3%) had no dementia (Global Deterioration Scale  $\leq 3$ ), whereas 64 individuals (12.7%) had dementia (Global Deterioration Scale  $> 3$ ). Among the institutionalized individuals, 57 individuals (43.5%) had no dementia, whereas 74 individuals had dementia (56.5%). Bivariate analysis revealed that individuals living in institutionalized settings differ from non-institutionalized individuals in terms of age, sex, marital status, social isolation and all health-related factors (i.e., visual impairment, hearing impairment, cognitive impairment, depressive symptoms, level of frailty and the number of chronic illnesses). To put it differently: These two groups do not differ significantly only in terms of educational level.

### 3.2 | Regression analysis

Findings of multiple logistic regression analysis are displayed in Table 2. The Pseudo  $R^2$  was 0.33 (main model). Regressions revealed that the likelihood of institutionalization increased with being divorced/widowed/single (compared to being married) (OR: 6.46 [95% CI: 2.57–16.24]), the presence of social isolation (OR: 2.32 [1.42–3.78]), increased cognitive impairment (OR: 1.60 [1.31–1.95]) and higher levels of frailty (OR: 1.72 [1.23–2.39]). The findings of logistic regressions with depressive symptoms as explanatory variable remained very similar and are also shown in Table 2 (last

TABLE 1 Sample characteristics for the analytical sample ( $n = 633$ )

|                                                                                                                        |                                    | Total sample<br>( $n = 633$ )<br>Mean (SD)/<br>Number (percent) | Not<br>institutionalized<br>( $n = 502$ )<br>Mean (SD)/Number<br>(percent) | Institutionalized<br>( $n = 131$ )<br>Mean (SD)/<br>Number (percent) | $p$ -value* |
|------------------------------------------------------------------------------------------------------------------------|------------------------------------|-----------------------------------------------------------------|----------------------------------------------------------------------------|----------------------------------------------------------------------|-------------|
| Age                                                                                                                    |                                    | 90.5 (2.9)                                                      | 90.3 (2.8)                                                                 | 91.4 (3.1)                                                           | $p < 0.001$ |
| Sex                                                                                                                    | Female                             | 442 (69.8%)                                                     | 331 (65.9%)                                                                | 111 (84.7%)                                                          | $p < 0.001$ |
|                                                                                                                        | Male                               | 191 (30.2%)                                                     | 171 (33.1%)                                                                | 20 (15.3%)                                                           |             |
| Educational level (CASMIN classification)                                                                              | Low                                | 358 (56.6%)                                                     | 286 (57.0%)                                                                | 72 (55.0%)                                                           | $p = 0.11$  |
|                                                                                                                        | Medium                             | 189 (29.8%)                                                     | 142 (28.3%)                                                                | 47 (35.9%)                                                           |             |
|                                                                                                                        | High                               | 86 (13.6%)                                                      | 74 (14.7%)                                                                 | 12 (9.1%)                                                            |             |
| Marital status                                                                                                         | Married                            | 141 (22.3%)                                                     | 134 (26.7%)                                                                | 7 (5.3%)                                                             | $p < 0.001$ |
|                                                                                                                        | Single/Divorced/<br>Widowed        | 492 (77.7%)                                                     | 368 (73.3%)                                                                | 124 (94.7%)                                                          |             |
| Social isolation (Lubben Social Network Scale < 12)                                                                    | Absence of social<br>isolation     | 366 (57.8%)                                                     | 330 (65.7%)                                                                | 36 (27.5%)                                                           | $p < 0.001$ |
|                                                                                                                        | Presence of<br>social<br>isolation | 267 (42.2%)                                                     | 172 (34.3%)                                                                | 95 (72.5%)                                                           |             |
| Visual impairment                                                                                                      | None                               | 393 (62.1%)                                                     | 334 (66.5%)                                                                | 59 (45.0%)                                                           | $p < 0.001$ |
|                                                                                                                        | Mild                               | 150 (23.7%)                                                     | 106 (21.1%)                                                                | 44 (33.6%)                                                           |             |
|                                                                                                                        | Severe/profound                    | 90 (14.2%)                                                      | 62 (12.4%)                                                                 | 28 (21.4%)                                                           |             |
| Hearing impairment                                                                                                     | None                               | 215 (34.0%)                                                     | 176 (35.0%)                                                                | 39 (29.8%)                                                           | $p < 0.001$ |
|                                                                                                                        | Mild                               | 356 (56.2%)                                                     | 291 (58.0%)                                                                | 65 (49.6%)                                                           |             |
|                                                                                                                        | Severe/profound                    | 62 (9.8%)                                                       | 35 (7.0%)                                                                  | 27 (20.6%)                                                           |             |
| Cognitive impairment (Global Deterioration Scale; from 1 = no cognitive impairment to 7 = severe cognitive impairment) |                                    | 2.6 (1.5)                                                       | 2.2 (1.2)                                                                  | 4.0 (1.8)                                                            | $p < 0.001$ |
| Depressive Symptoms (Geriatric Depression Scale; from 0 = no depressive symptoms to 15 = severe depressive symptoms)   |                                    | 3.1 (2.7)                                                       | 2.8 (2.5)                                                                  | 4.7 (3.6)                                                            | $p < 0.001$ |
| Level of frailty (CSHA-CFS; from 1 = very fit to 7 = severely frail)                                                   |                                    | 4.5 (1.6)                                                       | 4.2 (1.5)                                                                  | 5.8 (1.3)                                                            | $p < 0.001$ |
| Number of chronic illnesses                                                                                            |                                    | 6.9 (3.5)                                                       | 6.7 (3.3)                                                                  | 8.4 (4.3)                                                            | $p < 0.001$ |

Abbreviation: SD, standard deviation.

\*  $p$ -values based on Chi<sup>2</sup> tests or independent  $t$ -tests, as appropriate. Four hundred and two individuals had data on the number of chronic illnesses.

column). It should be noted that the likelihood of institutionalization increased with depressive symptoms (OR: 1.11 [1.01–1.23]).

In another sensitivity analysis, the Global Deterioration Scale was replaced by the MMSE (worth repeating: with higher values indicating less cognitive impairment). Again, regressions showed that the likelihood of institutionalization increased with increased cognitive impairment (OR: 0.87 [0.79–0.95]). Apart from that, findings remained almost the same in terms of effect sizes and significance (with one exception: the association between depressive symptoms and institutionalization disappeared: OR: 1.09 [0.98–1.22]).

In a further sensitivity analysis, we added the number of chronic conditions to our main model. However, the number of chronic

conditions was not significantly associated with our outcome measure (OR: 1.04 [0.95–1.15]). Again, the other findings remained nearly the same. However, the association between depressive symptoms and institutionalization disappeared.

### 3.3 | Drop-out analysis

In Table 3, it was examined whether there are significant differences at FU wave 7 between patients who completed the study (FU wave 9) and those who dropped out from FU wave 7 to FU wave 9 (1. for health reasons/refusal; 2. death). In terms of most of the

**TABLE 2** Correlates of institutionalization (0: not institutionalized; 1: institutionalized). Findings of multiple logistic regression analysis

| Independent variables                                                                             | Institutionalization | Institutionalization (with depressive symptoms as independent variable) |
|---------------------------------------------------------------------------------------------------|----------------------|-------------------------------------------------------------------------|
| Age (in years)                                                                                    | 0.98 (0.90–1.07)     | 0.95 (0.86–1.06)                                                        |
| Sex: Male (Reference category: Female)                                                            | 0.71 (0.35–1.44)     | 0.67 (0.30–1.49)                                                        |
| Educational level (CASMIN classification): - Medium education (Reference category: Low education) | 1.77* (1.04–3.01)    | 1.62 (0.86–3.03)                                                        |
| - High education                                                                                  | 1.23 (0.48–3.15)     | 1.66 (0.62–4.42)                                                        |
| Marital status: Single/Divorced/Widowed (Reference category: Married)                             | 6.46*** (2.57–16.24) | 5.35** (1.75–16.36)                                                     |
| Presence of social isolation (LSNS < 12) (Reference category: Absence of social isolation)        | 2.32*** (1.42–3.78)  | 2.07** (1.20–3.59)                                                      |
| Visual impairment: - Mild (Reference category: None)                                              | 0.98 (0.57–1.67)     | 0.83 (0.41–1.67)                                                        |
| - Severe/profound                                                                                 | 1.45 (0.75–2.81)     | 1.78 (0.88–3.61)                                                        |
| Hearing impairment: - Mild (Reference category: None)                                             | 0.87 (0.52–1.46)     | 0.70 (0.38–1.31)                                                        |
| - Severe/profound                                                                                 | 1.09 (0.48–2.50)     | 1.27 (0.46–3.53)                                                        |
| Depressive symptoms (Geriatric Depression Scale)                                                  |                      | 1.11* (1.01–1.23)                                                       |
| Cognitive impairment (Global Deterioration Scale)                                                 | 1.60*** (1.31–1.95)  | 1.67*** (1.31–2.15)                                                     |
| Frailty (CSHA-CFS)                                                                                | 1.72** (1.23–2.39)   | 1.48* (1.07–2.06)                                                       |
| Constant                                                                                          | 0.00+ (0.00–2.87)    | 0.08 (0.00–617.95)                                                      |
| Observations                                                                                      | 633                  | 536                                                                     |
| Pseudo R <sup>2</sup>                                                                             | 0.33                 | 0.24                                                                    |

Notes: Odds ratios are displayed; 95% confidence intervals in parentheses;

\*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$ , +  $p < 0.10$ .

sociodemographic factors, there were not differences between the groups (except for age and social isolation). However, according to the health-related factors, the latter groups were more severely impaired.

## 4 | DISCUSSION

The aim of the study was to determine factors affecting the risk of institutionalization among the oldest age group of 85 years and older, which is reported to be the most rising population segment and an important however less investigated age group related to NHP.

One in eight participants lived in a NH at the time of the assessment. Excluding depression as explanatory variable, the proportion increased to 21%. These proportions seem to be rather low, since for Germany 29% for the 85 to 89 years olds, and 40% of the 90 + olds were reported.<sup>1</sup> When a study participant moved to a NH data often cannot be longer obtained, because of organizational difficulties such as making the appointment for the examination or obtaining informal consent from the participant and/or the legal guardian thus may have led to underestimation in the present study. The assumption is supported by the higher proportion of participants with a dementia diagnosis living in NHs.

Eighty-five percent of the institutionalized participants were female while among the non-institutionalized only 66% of women were found. Consistently, a systematic review of gender-specific predictors of NHP showed higher transition rates for women compared to men (1.4–1.6 to 1), which was explained by the higher living expectation of women and the higher rate of remarriage of men.<sup>18</sup> However, in the multivariate regression model female gender was not found to be a significant predictor of NHP. Instead marital status—that is, being single, divorced or widowed leads to 5 to 6 time greater odds of being institutionalized. Only 6% of married participants lived in NHs. These findings are confirmed by the study of Luppá et al.<sup>8</sup> showing marital status to be the major discriminator between the younger and the advanced elderly age group; being unmarried showed a higher effect size in the advanced elderly population compared to younger ages for the risk of institutionalization. Similar results have been shown for elderly individuals with a dementia diagnosis.<sup>19–21</sup>

Presence of social isolation was more often likely in these individuals living in a NH, which can be attributed to the loss of the familial surrounding and the relationships highlighting one negative outcome of NHP. Since social isolation is strongly related to depressive symptoms, this factor marks another potential negative outcome and has also been shown to be a risk factor of transition to a NH. A systematic review showed for social isolation moderate and

TABLE 3 Comparison—complete data and drop-outs

|                                                                                                                        |                                 | Patients who completed the study (FU wave 9) | Patients who dropped out from FU wave 7 to FU wave 9 (health reasons/refusal) | Patients who dropped out from FU wave 7 to FU wave 9 (death) | p value <sup>a</sup> |
|------------------------------------------------------------------------------------------------------------------------|---------------------------------|----------------------------------------------|-------------------------------------------------------------------------------|--------------------------------------------------------------|----------------------|
| Age                                                                                                                    |                                 | 88.7 (2.9)                                   | 88.5 (2.8)                                                                    | 89.8 (3.1)                                                   | <0.001               |
| Sex                                                                                                                    | Female                          | 443 (69.8%)                                  | 39 (69.6%)                                                                    | 110 (66.7%)                                                  | 0.74                 |
|                                                                                                                        | Male                            | 192 (30.2%)                                  | 17 (30.4)                                                                     | 55 (33.3)                                                    |                      |
| Educational level (CASMIN classification)                                                                              | Low                             | 359 (56.5%)                                  | 35 (62.5%)                                                                    | 93 (56.4%)                                                   | 0.74                 |
|                                                                                                                        | Medium                          | 188 (29.6%)                                  | 16 (28.6%)                                                                    | 53 (32.1%)                                                   |                      |
|                                                                                                                        | High                            | 88 (13.9%)                                   | 5 (8.9%)                                                                      | 19 (11.5%)                                                   |                      |
| Marital status                                                                                                         | Married                         | 153 (24.2%)                                  | 19 (33.9%)                                                                    | 32 (19.5%)                                                   | 0.09                 |
|                                                                                                                        | Single/<br>Divorced<br>/Widowed | 480 (75.8%)                                  | 37 (66.1%)                                                                    | 132 (80.5%)                                                  |                      |
| Social isolation (Lubben Social Network Scale < 12)                                                                    | Absence of social isolation     | 421 (66.9%)                                  | 32 (58.2%)                                                                    | 72 (44.4%)                                                   | 0.001                |
|                                                                                                                        | Presence of social isolation    | 208 (33.1%)                                  | 23 (41.8%)                                                                    | 90 (55.6%)                                                   |                      |
| Visual impairment                                                                                                      | None                            | 446 (70.2%)                                  | 36 (64.3%)                                                                    | 99 (60.4%)                                                   | 0.12                 |
|                                                                                                                        | Mild                            | 126 (19.9%)                                  | 11 (19.6%)                                                                    | 43 (26.2%)                                                   |                      |
|                                                                                                                        | Severe/<br>profound             | 63 (9.9%)                                    | 9 (16.1%)                                                                     | 22 (13.4%)                                                   |                      |
| Hearing impairment                                                                                                     | None                            | 265 (41.7%)                                  | 26 (46.4%)                                                                    | 67 (40.8%)                                                   | 0.03                 |
|                                                                                                                        | Mild                            | 338 (53.2%)                                  | 28 (50.0%)                                                                    | 78 (47.6%)                                                   |                      |
|                                                                                                                        | Severe/<br>profound             | 32 (5.1%)                                    | 2 (3.6%)                                                                      | 19 (11.6%)                                                   |                      |
| Cognitive impairment (Global Deterioration Scale; from 1 = no cognitive impairment to 7 = severe cognitive impairment) |                                 | 2.2 (1.3)                                    | 2.3 (1.3)                                                                     | 3.2 (1.8)                                                    | <0.001               |
| Depressive Symptoms (Geriatric Depression Scale; from 0 = no depressive symptoms to 15 = severe depressive symptoms)   |                                 | 2.6 (2.7)                                    | 3.5 (2.8)                                                                     | 3.6 (2.5)                                                    | <0.001               |
| Level of frailty (CSHA-CFS; from 1 = very fit to 7 = severely frail)                                                   |                                 | 3.9 (1.5)                                    | 4.4 (1.6)                                                                     | 5.1                                                          | <0.001               |
| Number of chronic illnesses                                                                                            |                                 | 6.1 (3.0)                                    | 6.9 (3.4)                                                                     | 7.4 (3.5)                                                    | <0.001               |

<sup>a</sup>based on oneway ANOVA or chi2 test, as appropriate.

for depressive symptoms inconclusive evidence according to the number as well as methodical quality of included studies.<sup>3</sup>

The strongest correlates besides marital status and gender were cognitive impairment and frailty. Participants living in NHs showed a mean of 4.7 on the Global Deterioration Scale indicating a mild to moderate level of dementia. 56% of the participants of the study living in NHs had a dementia diagnosis. In previous research, dementia were reported as the main cause for institutionalization in the

elderly population.<sup>21,22</sup> It can be assumed that the symptoms of dementia (e.g. cognitive impairment, higher dependencies, and behavioral problems) in combination with the increasing and complex care requirements<sup>23</sup> cause the increased risk of institutionalization.

In our study, the mean level of frailty was reported with 5.2 pointing out mild frailty indicating a need of help only regarding complex IADLs needing more complex planning and thinking such as preparing meals, taking medications and managing finances. A recent

review and meta-analysis on frailty as predictor of NH placement for older adults<sup>6</sup> reported a pooled odds ratio of 5.6 for frailty (95% CI 2.9-10.6). Physical exercise was shown to potentially prevent or reverse frailty, and exercise programs in clinical trials had a high adherence and very seldomly caused adverse events.<sup>24-26</sup>

Some strengths and limitations are worth noting. Data of the present study stem from the largest German multi-center longitudinal study of the older and oldest age conducted in primary care with a high methodical quality using a standardized assessment battery including well-established instruments to operationalize the independent variables. Recruitment in primary care offers the possibility to retrieve further health data of the participants from the GP.

A number of factors may have influenced our results and should be considered when interpreting the findings: depressive symptoms were measured using the Geriatric Depression Scale and not by using clinical criteria. However, the Geriatric Depression Scale is a widely used instrument with good psychometric properties. Although a number of factors were included other potential correlates/confounder (e.g., nutrition intake, ethnicity or income) were omitted due to data availability. Also, the assessment of depressive symptoms was solely reliable when the MMSE was  $\geq 19$ , leading to missing information about depressive symptoms in individuals with more severe cognitive impairment, because the Geriatric Depression scale is a self-rated assessment scale which cannot be administered by proxy. Moreover, there is some attrition bias present in the AgeQualiDe study. Thus, generalizing our findings may be restricted.

## 5 | CONCLUSION

The movement of an individual to a NH frequently is the result of a long, complex and multifactorially caused reasoned decision process. The present study identified various sociodemographic and health-related factors associated with institutionalization among the oldest old gaining a first insight and providing valuable reference points for further investigation of this research issue. In a next step, longitudinal studies are required for a better understanding of the multifactorial process of movement to a NH. On this basis, the implementation of flexible, tailored interventions addressing the specific circumstances of the caregiving situation to delay a transition or assure a well-timed and well-organized transition should be a long-term goal of health politics. Effective strategies exist with intervention programs such as case management, caregiver support and preventive home visits as shown by a recent review of Duan-Porter et al.<sup>7</sup>

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## CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to declare.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

## ETHICS STATEMENT

Written informed consent was given prior to participation by individuals. The AgeCoDe and the AgeQualiDe-study have been approved by the ethics committees of all participating study centers and comply with the ethical standards of the Declaration of Helsinki.

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